

BATTLETECH™

STRATEGIC OPERATIONS

ADVANCED AEROSPACE RULES



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ADVANCED SOLAR SYSTEM CONQUEST RULES

FORCES IN SOLAR SYSTEM!



Liftoff planet and conquer an entire solar system! Deploy kilometer-long WarShips as escorts, first for JumpShips bridging the gulf between stars, then for detaching DropShips that burn in system to drop troops onto any battlefield. New aerospace tactics will allow you to gain air supremacy to match your grasp of ground tactics. Yet the war for a star system is more than a single battle and a commander that utilizes his supplies and personnel with skill will survive the numerous battles to come.

Strategic Operations is the one-source rulebook for advanced rules aerospace assets that open the entire conquest of a solar system. It includes new aerospace movement, combat and advanced aerospace unit construction rules.

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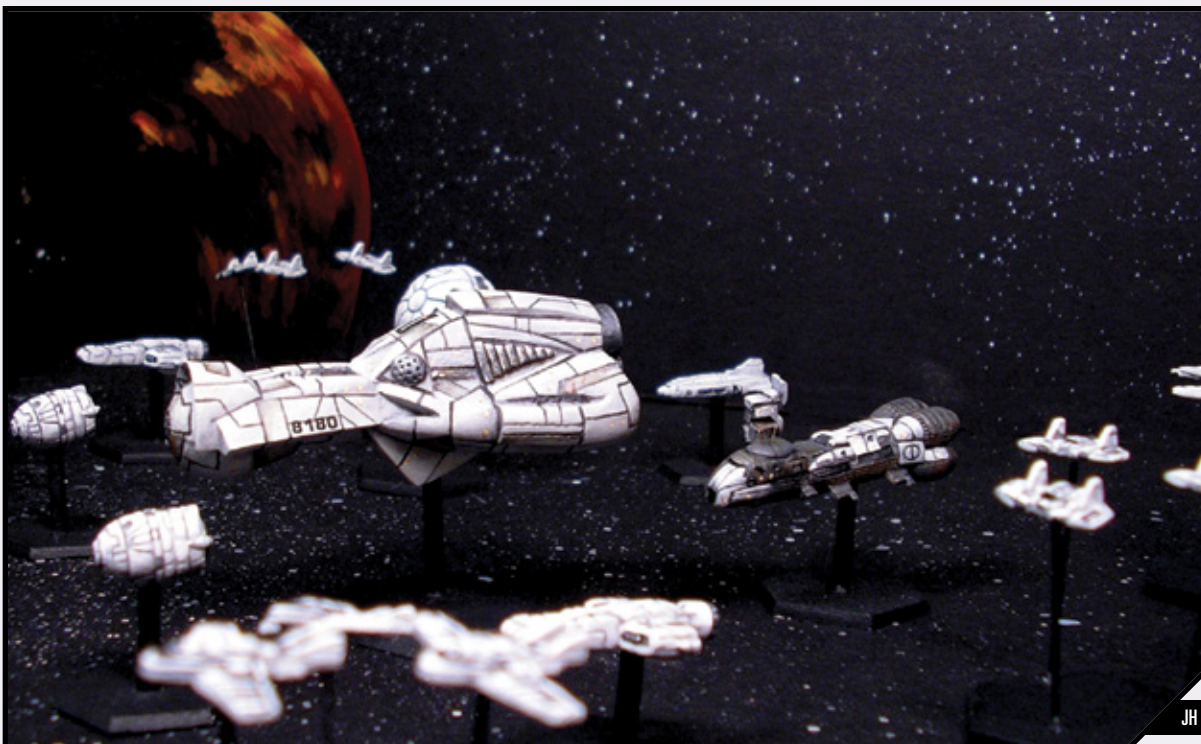
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STRATEGIC OPERATIONS

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A Word of Blake fleet, lead by the Black Lion-class Rays of Enlightenment, moves to protect one of its Hidden Worlds: the Ruins of Gabriel.

JH

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A pair of Word of Blake Vengeance DropShips patrol the Ruins of Gabriel.

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Dedication

As this book is really volume two of *Tactical Operations*, I must again dedicate this book to my fantastic, all-too-forgiving wife. Again, please give Tara a giant round of thanks if you like these core rulebooks, as they wouldn't exist without her support.

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INTRODUCTION

GENERAL RULES

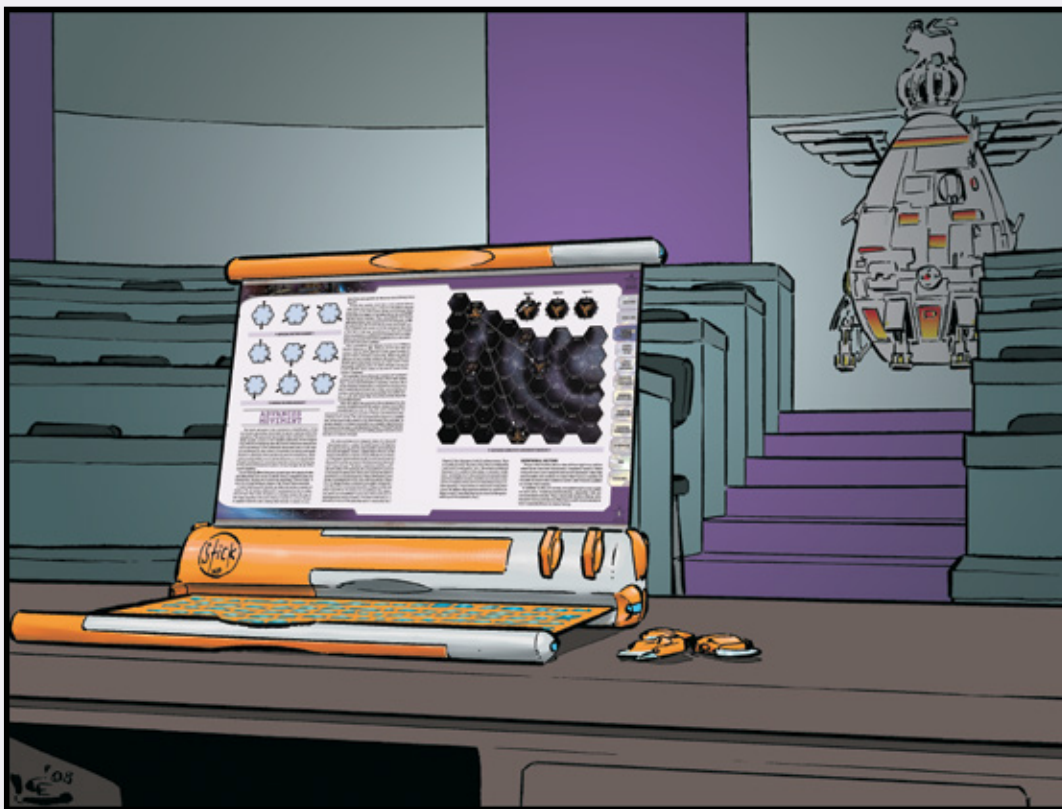
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RECORD SHEETS



The *Total Warfare (TW)* and *TechManual (TM)* rulebooks present the core game and construction rules for *BattleTech (BT)*, otherwise referred to as the standard rules. These two volumes encompass eight core unit types—several of which contain numerous subunit types—and a host of weapons and rules, as well as covering many different game situations. However, despite the breadth of play covered, many game situations still fall outside those rules, not to mention a plethora of more advanced equipment, as well as a few advanced units.

ABSTRACT RULES

Beyond the standard rules, a legion of advanced rules exists, allowing players to expand their games in any direction they desire. In an effort to bring these rules to players in the most logical form possible, the advanced rules are contained in five core rulebooks, each one staging up and building off of the previous rules set. Additionally, each one focuses on a particular “in-universe time frame” that will allow players to easily grasp where a given rulebook will “plug into” their existing game play.

TACTICAL OPERATIONS (2 VOLUMES)

SitRep:

Forces on-world.

Conflict expected to last mere hours to achieve object.

ADVANCED RULES

Tactical Operations: Advanced Rules (TO: AR) is the first in the “staging” Advanced Rulebooks. Its focus is during game play, and applies directly to a game as it unfolds on a world in the *BattleTech* universe; its rules represent hours in-universe, the time frame it takes for a single, moderate-sized battle to play out on a gaming table.

Building on *Total Warfare*, *TO: AR* conveys numerous advanced rules for movement and combat across various units, while expanding core rules such as those for buildings, and implementing a host of advanced terrain and weather rules.

ADVANCED UNITS AND EQUIPMENT

Building on *TechManual*, *Tactical Operations: Advanced Units and Equipment (TO: AUE)* presents rules for the construction and use of advanced Support Vehicles, as well as advanced and prototype construction options and weapons for use by almost every unit.

STRATEGIC OPERATIONS

SitRep:

Forces in solar system.

Beginning burn to planet.

Conflict expected to last weeks to achieve object.

Strategic Operations (SO) is the rulebook you are holding in your hands, and is the next “staging” Advanced Rulebook. It stages a player up to the next logical area of play, focusing on “in a solar system;” its rules represent weeks within the *BattleTech* universe, the time frame needed for several battles to conquer an entire solar system.



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RECORD SHEETS

Strategic Operations contains advanced movement and combat operations emphasizing the importance of aerospace units, while extensive rules cover combat drops of numerous troop types into any situation. Complete game play and construction rules for advanced aerospace units are also included.

These books contains a number of rules changes from previous editions. We feel confident that these are the most complete, clear and concise advanced rules for *BattleTech* ever presented.

These rules supersede all previously published rules, including the *BattleTech Manual*, *BattleTech Compendium*, *BattleTech Compendium: The Rules of Warfare*, *BattleTech Master Rules* (standard and revised editions), *Combat Equipment*, *Tactical Handbook*, *Maximum Tech* (standard and revised editions) and *Unbound*.

To use the construction rules, designers will need paper and pencils, as well as copies of the Blank Record Sheets found at the back of this book. Due to the complexities involved with the construction of the Advanced Aerospace Units, a calculator will be handy as well.

INTERSTELLAR OPERATIONS

SitRep:

Forces marshaled.

Flotillas assigned to target solar systems.

Conflict expected to last months to achieve objects.

Interstellar Operations (IO) is the third and final “staging” Advanced Rulebook. Players are staged up to the final level of play, where they can assume the roles of a House Lord or Clan Khan and dominate the galaxy; *IO* rules represent months in the *BattleTech* universe, the time frame for conquering numerous star systems.

Interstellar Operations contains complete rules for generating and running any type or size of force. Additionally, a comprehensive rules set governs the running of an entire faction’s military as a player tries to conquer (or defend) numerous solar systems. More importantly, the system contains rules that allow players to stage any portion of a given conflict back through the various rule sets, as they desire—from the simple, easy-to-use rules of conflict at the largest scale, all the way back down to a standard *BattleTech* game as presented in *Total Warfare* and *Tactical Operations*. Players have complete flexibility for any type of conflict in which they wish to engage.

CAMPAIGN OPERATIONS

SitRep:

Prepare forces.

Assign objectives, targets, and plans of attack across a world or a swath of interstellar space.

Wage war to achieve your final objective.

Campaign Operations (CO) is the foundational book to prepare players for campaigns that can encompass all of the three “staging” Advanced Rulebooks. Incorporating elements from all of the previous rulebooks, as well as *Alpha Strike Commander’s Edition*, *CO* represents an entire campaign, scenario, or story arc within the *BattleTech* universe. Players can assume the roles of any unit within the universe or create their own iconic force.

Campaign Operations contains rules for the construction and detailing of solar systems, building an opposing force to put in conflict with the players, crafting specialized scenario and campaign arcs, and constructing a stylized *Chaos Campaign* that fits a group’s play style. Players and gamemasters can use these rules with *Total Warfare* (and subsequent Advanced Rulebooks), *A Time of War RPG*, and the *Alpha Strike* system.

CHOOSE WHAT YOU LIKE

As previously noted, *Strategic Operations* encapsulates a myriad of advanced rules. In effect, all the rules and weapons/equipment in this volume are optional. This means you can use as many or as few of the rules in this book as you want. (In fact, this book contains so many new rules that we recommend you try them out a few at a time, rather than attempting to use them all at once.) Furthermore, most of the new rules and equipment here can be added individually to a standard game. You can add rules and pieces of equipment to your game one at a time—most of the rules do not rely on other rules in this book to work in existing *BattleTech* games. This allows you to tailor your *BattleTech* game to your taste by including only those rules that you find make the game more interesting or fun. Use whatever new rules and equipment you want and disregard the rest. Given the scope of the rules and the fact that they are optional, all players in a group should read through and agree to the use of any of these rules and weapons/equipment.

PLAYER ADJUDICATION

An advanced-rules book for any game is, almost by definition, more complex. In a game system with such a long and rich heritage as *BattleTech*—this rulebook alone draws from dozens of different sources across a large number of years—that complexity is even greater. Developers and writers have gone to great effort to make these rules as comprehensive as possible—not only from one section to the next in this book, but in how such advanced weapons and rules interact with the core game and construction rules as presented in *Total Warfare* and *TechManual*. However, the sheer scope of *Strategic Operations* (as with *Tactical Operation*) and the plethora of options provided means that it is not possible to cover all potential situations. Once this product reaches the players’ hands, they’ll envision scenarios and create situations on a game board that never crossed the minds of the developers or the legion of authors and playtesters that thoroughly worked over this product.

With that in mind, when players encounter situations not covered in the rules as they integrate the contents of *Strategic Operations* into their playing group, they are encouraged to adjudicate each situation appropriately; make up the rules that work for you. If in the process a playing group runs into an argument, feel free to let a die roll resolve any disputes so you can return to playing the game and having fun.

Finally, the forums on bg.battletech.com are an excellent resource. Players can tap into a strong and vibrant online community, tapping a wide selection of players for different ideas on how best to adjudicate a particular situation.



FICTION

As described in *Total Warfare* and *TechManual*, fiction plays a pivotal role in bringing the *BattleTech* universe to life. Whether “story fiction” that places readers inside the heads of the characters in that universe, or “sourcebook fiction” that places the reader in the universe as though living among those characters, both work hand-in-hand to immerse players in this vibrant milieu.

Total Warfare concentrated on story fiction, while *TechManual* concentrated on sourcebook fiction. *Strategic Operations* covers something of a middle ground, with various story and sourcebook fiction sections found throughout the book.

FICTION VS. RULES

It is important to remember that regardless of the critical role fiction plays in immersing players in the *BattleTech* universe, such fiction should never be construed as rules. As with *Total Warfare*, *TechManual* and *Tactical Operations*, to eliminate confusion about which sections are fiction and which are rules, the fiction sections have a unique look, compared to the uniform presentation of the various rules sections. All fiction sections are italicized in the table of contents.

FICTION VS. ART

Strategic Operations follows the graphic design format established by *Total Warfare*, *TechManual* and *Tactical Operations*, wedding art to the book’s visual presentation in order to enhance the players’ experience. In this case, the graphic presentation represents a computer from House Marik’s Lloyd Marik-Stanley Aerospace School, one of the Inner Sphere’s largest and most advanced universities for the teaching of all aspects of aerospace travel, piloting and combat.

As with fiction, while art plays an important role in bringing the *BattleTech* universe to life, it should never be construed as rules.

COMPONENTS

Page 26 of *Total Warfare* (as well as p. 13 of *TM*) discusses several units that exist in the *BattleTech* universe, but fall outside the purview of the standard-rules game and construction rulebooks. Those units are discussed here.

JUMPSHIPS

JumpShips provide the only means of transportation between the far-flung star systems of the Inner Sphere, the Periphery and beyond. These vessels make interstellar leaps of 30 light-years at a time by harnessing the radiant energy of the stars with their huge solar-energy sails and Kearny-Fuchida hyperdrive technology. JumpShips

are primarily used to transport DropShips between star systems.

WARSHIPS

Heavily armored, massively armed and highly mobile, the military JumpShips known as WarShips generally have the firepower to destroy even an assault DropShip with a single volley. They usually need only fear another WarShip.

As with DropShips, their myriad sizes and designs create two types of categories, both based on size, though their intended role comes into play in the second type of categorization. The first category type is simple demarcation between small and large, as explained below. The second type of classification combines size and role, though the wild variations in size and use of WarShips means that some vessels fall outside the categories shown below:

Raider: 100,000 to 150,000 tons

Corvette: 150,000 to 250,000 tons

Destroyer: 250,000 to 550,000 tons

Frigate: 500,000 to 750,000 tons

Light Cruiser: 600,000 to 725,000 tons

Cruiser: 700,000, to 800,000 tons

Heavy Cruiser: 800,000 to 1,000,000 tons

Battle Cruiser: 750,000 to 1,400,000 tons

Battleship: 1,000,000 to 2,500,000 tons

Surveillance, Transport and Carriers: No weight restrictions

Small WarShips

Small WarShips weigh less than 750,000 tons. These armed and armored JumpShips normally serve as escorts, providing protection for JumpShips and DropShip fleets. Many commanders also employ them as strategic assets, allowing them to accompany DropShips all the way to the destination planet. Upon arrival, they establish a geosynchronous orbit that allows them to react either to enemy troop movement on the ground with tactical orbital bombardments or to the threat of incoming reinforcements.

Large WarShips

Large WarShips range in weight from 750,000 to a mammoth 2,500,000 tons. Employed almost exclusively as protection for JumpShip fleets, a large WarShip rarely uses its massive destructive firepower against ground targets. Because of their sheer size and firepower, most large WarShips need only fear another large WarShip.

SPACE STATIONS

Numerous orbital facilities, colloquially known as Space Stations, serve multiple functions throughout the Inner Sphere. From factories to habitats, shipyards to system-defense stations, all of these facilities fall into one of three broad groups: low-orbit, geosynchronous or stable-point stations.



JumpShip



Small WarShip



Large WarShip



Space Station

RECORD SHEETS

Players use the following record sheets to track various types of information while playing *BattleTech*. Each type of unit (JumpShips, WarShips, and Space Stations) uses a unique record sheet. Blank Record Sheets are provided at the back of this rulebook for all unit types. How they work, and which record sheets should be used for each unit type featured in this book, are outlined below.

Construction

As noted in *TechManual*, at the end of the design process for any construction rules presented in this volume, each designer must translate his or her unit from its raw statistics to an appropriate record sheet in order to use it properly in a game of *BattleTech*.

AEROSPACE RECORD SHEETS

Based on unit type, the three aerospace unit record sheets have a different appearance, but use the same overall layout and core components. These record sheets are: JumpShip, WarShip, and Space Station.

Advanced Aerospace Movement Sheet: The Advanced Aerospace Movement Sheet is not a specific unit record sheet, but instead can be used in conjunction with any other aerospace record sheet either from this rulebook or *TechManual*, allowing players to easily track advanced vector movement rules (see *Advanced Movement*, p. 52).

BATTLETECH

ADVANCED AEROSPACE MOVEMENT SHEET

Advanced Movement Compass



VELOCITY RECORD

Unit:	Thrust	Facing	A	B	C	D	E	F	Fuel
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

ADVANCED MOVEMENT

A vector is active if thrust is applied while the unit is facing that heading. A vector is inactive if the unit spends no thrust to move through that heading.

Each time a unit spends thrust, note down that number on the record sheet in the appropriate vector (the vector of the unit's facing). Next, determine the effect of spending thrust by consolidating the active vectors.

First, consolidate any active opposing vectors (see Opposing Vectors diagram) by subtracting the lowest thrust value from both vectors, reducing one vector to 0.

Next, consolidate the oblique vectors (see Oblique Vectors diagram). When any pair of oblique vectors is active, subtract the lowest of the two thrust values from both vectors (or from both if they are equal), reducing one (or both) oblique vectors to 0, and add the same value to the thrust value of the vector in between.

After consolidating all vectors, a unit should have no more than two active vectors.

OPPOSING VECTORS
If both vectors marked with arrows are active, subtract an equal amount from both until only one of them is active.

OBLIQUE VECTORS
If both vector markers are active, subtract an equal amount from both and add that amount to vector X.

CATALYST

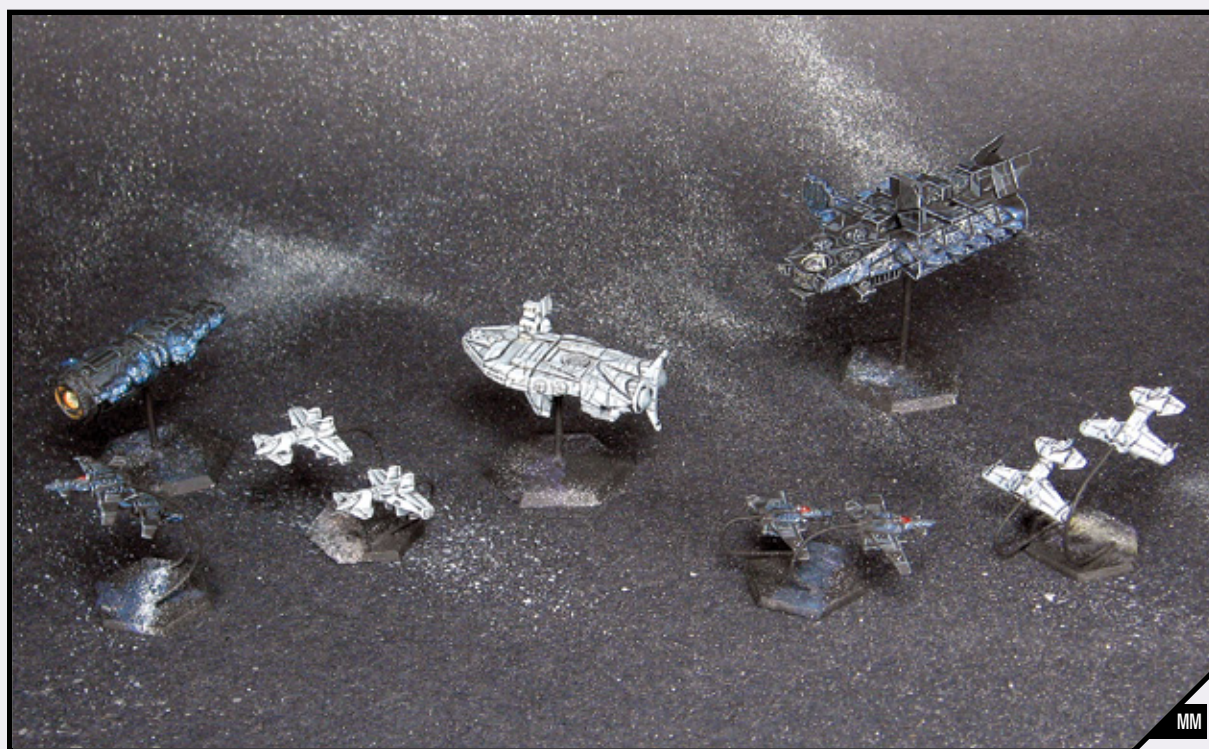
VELOCITY RECORD

Unit:	Thrust	Facing	A	B	C	D	E	F	Fuel
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

VELOCITY RECORD

Unit:	Thrust	Facing	A	B	C	D	E	F	Fuel
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

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Clan Ghost Bear and Clan Nova Cat engage in a fierce naval battle in the Alshain system.

INTRODUCTION

GENERAL RULES

ADVANCED AEROSPACE MOVEMENT

ADVANCED AEROSPACE COMBAT

ADVANCED AEROSPACE CONSTRUCTION

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RECORD SHEETS

Fighter Squadron Record Sheet: The Fighter Squadron Record Sheet doesn't represent a new unit type so much as a new unit formation and a way to track those details. However, most of the information on that sheet follows the same data blocks as outlined below (for more information, see *Fighter Squadrons*, p. 25).

Unit Data

The Unit Data block for aerospace units varies by name with the unit type (JumpShip Data for JumpShips, WarShip Data for WarShips and so forth). Located in the upper left corner, this section of the record sheet lists the unit's most important statistics, including its model (Type), weight (Tonnage), Thrust Points (Safe, Max or Station Keeping), Weapons Inventory, Cost and Battle Value. JumpShips, WarShips and Space Stations, which can possess fighter and other unit bays, may note their complement of such units, followed by the number of functioning doors on the vessel capable of releasing these units during game play.

In the Weapons Inventory, weapons of identical types and location may be combined on a single line to conserve space. Unlike 'Mechs and vehicles, however, multiple weapons in the same firing arc (or the same bay, for DropShips) must note their total combined heat and Damage Values at each range bracket, as these units generally fire their weapons by arc or bay. Unlike other units, aerospace units do not list weapon ranges in hexes, but rather list the damage their weapons can deliver at each range bracket (with a value of 0 or a dash for any bracket beyond the weapon's range). Ammunition is noted on a separate line; designers can track such munitions there or in the Notes block.

Aerospace units that have access to capital missile weapons should list damage in standard- and capital-scale. To translate standard-scale damage into capital-scale damage, divide the Damage Value for the weapon in standard scale by 10 and round normally. When listing Damage Values, the appropriate format is to list the capital value first, followed by the standard damage in parentheses.

Pilot/Crew Data

This block lists the name, skills and condition of the unit's pilot or crew.

Critical Damage

All aerospace units include a block for tracking possible effects of critical damage. The equivalent of a Critical Hits Table, this section is pre-generated, and varies only slightly by unit type.

Armor Diagram

The Armor Diagram for aerospace units fills most of the right-hand side of the unit's record sheet. It outlines each of the main body locations found on the unit, and surrounds a single area shaded in gray that represents the unit's structural integrity.

When finalizing the design of an aerospace unit, the designer must black out all excess armor and structural integrity circles/squares by location.

Capital-Scale: JumpShips, WarShips, and Space Stations track armor and structural integrity using capital scale (10 x standard-scale). To help differentiate capital-scale from standard-scale, these record sheets use squares for each armor and structural integrity point, instead of circles.

BATTLETECH  **SQUADRON RECORD SHEET**

SQUADRON DATA Name: _____ Gunnery Skill: _____ Piloting Skill: _____ Safe Thrust: _____ Max Thrust: _____

Weapon Bay: _____ Loc: _____ Ht: _____ Rf/Range: _____ Sensors: _____ FCS: _____ Life Support: _____

Tech Base: Inner Sphere ☐ Clan ☐ Total Heat Capacity (Current): _____ Total Fuel: _____

FIGHTER DATA

For #1: Total Armor/Fatal Threshold: _____ Weapons and Equipment: _____ Loc: _____ Ht: _____ Rf/Range: _____ Sensors: _____ FCS: _____ Life Support: _____

For #2: Total Armor/Fatal Threshold: _____ Weapons and Equipment: _____ Loc: _____ Ht: _____ Rf/Range: _____ Sensors: _____ FCS: _____ Life Support: _____

For #3: Total Armor/Fatal Threshold: _____ Weapons and Equipment: _____ Loc: _____ Ht: _____ Rf/Range: _____ Sensors: _____ FCS: _____ Life Support: _____

For #4: Total Armor/Fatal Threshold: _____ Weapons and Equipment: _____ Loc: _____ Ht: _____ Rf/Range: _____ Sensors: _____ FCS: _____ Life Support: _____

For #5: Total Armor/Fatal Threshold: _____ Weapons and Equipment: _____ Loc: _____ Ht: _____ Rf/Range: _____ Sensors: _____ FCS: _____ Life Support: _____

VELOCITY RECORD

Turn # _____ Thrust _____ Velocity _____ Effective Velocity _____

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BATTLETECH  **JUMPSHIP RECORD SHEET**

JUMPSHIP DATA Name: _____ Tonnage: _____ Thrust: _____ Tech Base: _____ DropShip Capacity: _____ Launch Rate: _____

Weapons & Equipment Inventory (1-10) (11-20) (21-30) (31-40) (41-50) (51-60) (61-70) (71-80) (81-90) (91-100)

Weapon Bay: _____ Loc: _____ Ht: _____ Rf/Range: _____ Sensors: _____ FCS: _____ Life Support: _____

CREW DATA Gunnery Skill: _____ Piloting Skill: _____ Ht: _____ Rf/Range: _____ Sensors: _____ FCS: _____ Life Support: _____

CRITICAL DAMAGE Avionics: _____ CIC: _____ Sensors: _____ Thrusters: _____ Engine: _____

HEAT DATA Heat Sink: _____ Heat Generation Per Arc: _____ Single: _____ Double: _____

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THE NAVAL FACTOR

Often overlooked today, despite their rising prominence in the strategic sense, are the aerospace and space-naval forces of the Inner Sphere. Since the debut of the airplane in the twentieth century, air power—and, eventually, space power—have become an intrinsic and vital part of any military command. The rise of the BattleMech, that wondrous engine of warfare, may have managed to capture humankind's imagination with its power and anthropomorphic design, but even in the glory days of the first Star League, no war could be won without the power of aerospace fighters, DropShips, JumpShips and WarShips.

At the height of the original Star League, national aerospace forces operated on the scale of armies, assigned not only as DropShip escorts and air-to-ground support for 'Mech forces, but also as the first line of defense for the mighty WarShips. WarShips themselves were common, with each member state claiming hundreds of these massive dreadnaughts that acted as combat vessels and a key element in strategic supply chains.

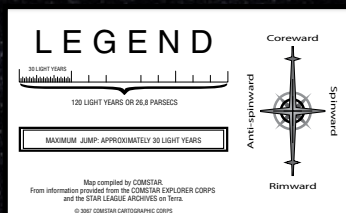
The fall of the Star League, Kerensky's Exodus, and the immediate aftermath saw the rapid decline and eventual extinction of the WarShip in the Inner Sphere. BattleMech forces took center stage once more, while DropShips and fighters found themselves stretched ever thinner to cover the duties of transport, logistics, escort and close-air support. Only the recovery of technologies in the last forty years—and the imperative for new ships presented by the returning Clans' fleets—made the birth of new WarShips possible.

Yet even now—more than twenty years later—the Inner Sphere's fleets and aerospace arms remain anemic, endangered. Prior to the Jihad, official numbers counted only ComStar and the Free Worlds League among the Inner Sphere realms who could boast a true "fleet" of operational WarShips, while the other Great Houses and the Word of Blake each possessed a few task forces at best. The FedCom Civil War and the Jihad have put these great ships to the test, while driving home the value of the aerospace fighter in an age where even a single pilot can deliver a tactical weapon capable of instantly devastating a BattleMech force.

Ironically enough, while the last few years have seen a peak in naval and aerospace fighting unparalleled in recent history, there are signs that the end of the WarShip age may again be upon us. As if in response to their return and their implied dominance of the space lanes, shipyards across the Inner Sphere have once more become the focus of military assaults, while nuclear attacks and massed fighter strikes are gradually whittling away at the ships themselves. The new "Pocket WarShips"—DropShips designed to carry capital and sub-capital weapons—have become the latest bane of modern WarShips.

What eventual form and place aerospace warfare may take in the future remains in flux, but one thing remains certain: Only a fool can overlook the potential of naval power.

—Logan DeMarco,
INN Military Industrial Analyst, Arc-Royal,
21 November 3075



CLAN WOLF

HEAVY AEROSPACE INDUSTRY (3067)		Unknown		CLAN
MOST RECENT NAVAL/ AEROSPACE INNOVATIONS (3075)		None		
MAJOR NAVAL ACADEMIES		Clan Sibko System		
ACTIVE WARSHIPS (3067)	13	FIRST AEROSPACE FIGHTER	Avar (2878)	
		FIRST WARSHIP	Molniya (2951)	

HOUSE STEINER (LYRAN ALLIANCE)

HEAVY AEROSPACE INDUSTRY (3067)		Bowie Industries, Ioto Galactic Enterprises, N&D Shipyards		GREAT HOUSE
MOST RECENT NAVAL/ AEROSPACE INNOVATIONS (3075)		Anti-Ship Electronic Warfare Missiles (3067*)		
MAJOR NAVAL ACADEMIES		Alarion Naval Academy		
ACTIVE WARSHIPS (3067)	4	FIRST AEROSPACE FIGHTER	Hurricane (2360)	
		FIRST WARSHIP	Commonwealth (2375)	

HOUSE MARIK (FREE WORLDS LEAGUE)

HEAVY AEROSPACE INDUSTRY (3067)		Imstar AeroSpace, Illium Naval Engineering, SelaSys Incorporated, Technicon Engineering		GREAT HOUSE
MOST RECENT NAVAL/ AEROSPACE INNOVATIONS (3075)		Light Air-to-Air Missiles (3072)		
MAJOR NAVAL ACADEMIES		Lloyd Marik-Stanley Aerospace School		
ACTIVE WARSHIPS (3067)	38	FIRST AEROSPACE FIGHTER	Eagle (2324)	
		FIRST WARSHIP	League (2368)	

GHOST BEAR DOMINION

HEAVY AEROSPACE INDUSTRY (3067)		Alshain Shipyards		CLAN
MOST RECENT NAVAL/ AEROSPACE INNOVATIONS (3075)		None		
MAJOR NAVAL ACADEMIES		Clan Sibko System		
ACTIVE WARSHIPS (3067)	6	FIRST AEROSPACE FIGHTER	Kirghiz (2874)	
		FIRST WARSHIP	Leviathan (3055)	

CLAN JADE FALCON

HEAVY AEROSPACE INDUSTRY (3067)		Unknown		CLAN
MOST RECENT NAVAL/ AEROSPACE INNOVATIONS (3075)		None		
MAJOR NAVAL ACADEMIES		Clan Sibko System		
ACTIVE WARSHIPS (3067)	20	FIRST AEROSPACE FIGHTER	Visigoth (2948)	
		FIRST WARSHIP	Peregrine (2969)	

HOUSE KURITA (DRACONIS COMBINE)

HEAVY AEROSPACE INDUSTRY (3067)		Dharma Hyperspace, Kurita Combine Munitions Corporation, Midway WarShip Yard, New Samarkand WarShip Yard, Stellar Trek, Terada WarShip Yard, Togura WarShip Yard, Tomori Trans Industrial		GREAT HOUSE
MOST RECENT NAVAL/ AEROSPACE INNOVATIONS (3075)		Screen Launcher (3055), Naval C3 (3065*)		
MAJOR NAVAL ACADEMIES		Aerospace and Interstellar Institute		
ACTIVE WARSHIPS (3067)	14	FIRST AEROSPACE FIGHTER	Sabre (2314)	
		FIRST WARSHIP	Narukami (2380)	

HOUSE DAVION (FEDERATED SUNS)

HEAVY AEROSPACE INDUSTRY (3067)		Challenge Systems, Federated-Boeing Interstellar, Kathil Shipworks, New Syrtis Shipyards, Universal Air		GREATHOUSE
MOST RECENT NAVAL/ AEROSPACE INNOVATIONS (3075)		Anti-Ship Missiles (3071)		
MAJOR NAVAL ACADEMIES		Armstrong Flight Academy		
ACTIVE WARSHIPS (3067)	14	FIRST AEROSPACE FIGHTER	Centurion (2430)	
		FIRST WARSHIP	Defender (2360)	

HOUSE LIAO (CAPELLAN CONFEDERATION)

HEAVY AEROSPACE INDUSTRY (3067)		Rashpur-Owens Inc., Necromo Shipyards		GREAT HOUSE
MOST RECENT NAVAL/ AEROSPACE INNOVATIONS (3075)		None		
MAJOR NAVAL ACADEMIES		None		
ACTIVE WARSHIPS (3067)	8	FIRST AEROSPACE FIGHTER	Firebird (2390)	
		FIRST WARSHIP	Du Shi Wang (2380)	

*These innovations are still classified as prototypical and have yet to reach full production.

CLAN DIAMOND SHARK

HEAVY AEROSPACE INDUSTRY (3067)		Unknown		CLAN
MOST RECENT NAVAL/ AEROSPACE INNOVATIONS (3075)		None		
MAJOR NAVAL ACADEMIES		Clan Sibko System		
ACTIVE WARSHIPS (3067)	18	FIRST AEROSPACE FIGHTER	Ogotai (2874)	
		FIRST WARSHIP	Carrack (2950)	

CLAN WOLF (IN-EXILE)

HEAVY AEROSPACE INDUSTRY (3067)		None		CLAN
MOST RECENT NAVAL/ AEROSPACE INNOVATIONS (3075)		Air-to-Air Arrow Missiles (3072)		
MAJOR NAVAL ACADEMIES		Clan Sibko System		
ACTIVE WARSHIPS (3067)	8	FIRST AEROSPACE FIGHTER	None	
		FIRST WARSHIP	None	

CLAN NOVA CAT

HEAVY AEROSPACE INDUSTRY (3067)		None		CLAN
MOST RECENT NAVAL/ AEROSPACE INNOVATIONS (3075)		None		
MAJOR NAVAL ACADEMIES		Clan Sibko System		
ACTIVE WARSHIPS (3067)	19	FIRST AEROSPACE FIGHTER	Qasar (2905)	
		FIRST WARSHIP	Carrack (2950)	

COMSTAR

HEAVY AEROSPACE INDUSTRY (3067)		None		MINOR POWER
MOST RECENT NAVAL/ AEROSPACE INNOVATIONS (3075)		Tele-Operated Capital Missiles (3056)		
MAJOR NAVAL ACADEMIES		Focht War College		
ACTIVE WARSHIPS (3067)	34	FIRST AEROSPACE FIGHTER	Zero (2791)	
		FIRST WARSHIP	Faslane (2882)	

MARIAN HEGEMONY

HEAVY AEROSPACE INDUSTRY (3067)		None		PERIPHERY STATE
MOST RECENT NAVAL/ AEROSPACE INNOVATIONS (3075)		Rocket Launcher Hardpoint (3064)		
MAJOR NAVAL ACADEMIES		Alphard Air Academy		
ACTIVE WARSHIPS (3067)	0	FIRST AEROSPACE FIGHTER	None	
		FIRST WARSHIP	None	

MAGISTRACY OF CANOPUS

HEAVY AEROSPACE INDUSTRY (3067)		None		PERIPHERY STATE
MOST RECENT NAVAL/ AEROSPACE INNOVATIONS (3075)		None		
MAJOR NAVAL ACADEMIES		None		
ACTIVE WARSHIPS (3067)	0	FIRST AEROSPACE FIGHTER	Eagle (2564)	
		FIRST WARSHIP	Athena (2569)	

LEGEND



Map compiled by COMSTAR.
From information provided from the COMSTAR EXPLORER CORPS
and the STAR LEAGUE ARCHIVES on Terra.
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FREE RASALHAGUE REPUBLIC			
HEAVY AEROSPACE INDUSTRY (3067)	None		
MOST RECENT NAVAL/ AEROSPACE INNOVATIONS (3075)	None		
MAJOR NAVAL ACADEMIES	Tyra Miraborg Memorial Academy		
ACTIVE WARSHIPS (3067)	0	FIRST AEROSPACE FIGHTER	Huscarl (3064)
		FIRST WARSHIP	None

MINOR POWER

CLAN SNOW RAVEN			
HEAVY AEROSPACE INDUSTRY (3067)	Lum Shipyards		
MOST RECENT NAVAL/ AEROSPACE INNOVATIONS (3075)	None		
MAJOR NAVAL ACADEMIES	Clan Sibko System		
ACTIVE WARSHIPS (3067)	40	FIRST AEROSPACE FIGHTER	Issus (2842)
		FIRST WARSHIP	Corone (2915)

CLAN

WORD OF BLAKE			
HEAVY AEROSPACE INDUSTRY (3067)	O'Neil Yards, Titan Yards		
MOST RECENT NAVAL/ AEROSPACE INNOVATIONS (3075)	Small Aerospace Cockpit (3070), Sub-Capital Weapons (3073)		
MAJOR NAVAL ACADEMIES	Military Academy of Aphros		
ACTIVE WARSHIPS (3067)	5	FIRST AEROSPACE FIGHTER	Shiva (3060)
		FIRST WARSHIP	Impavido (3058)

MINOR POWER

OUTWORLDS ALLIANCE			
HEAVY AEROSPACE INDUSTRY (3067)	None		
MOST RECENT NAVAL/ AEROSPACE INNOVATIONS (3075)	None		
MAJOR NAVAL ACADEMIES	Columbia Academy		
ACTIVE WARSHIPS (3067)	0	FIRST AEROSPACE FIGHTER	Centurion (2557)
		FIRST WARSHIP	None

PERIPHERY STATE

TAURIAN CONCORDAT			
HEAVY AEROSPACE INDUSTRY (3067)	None		
MOST RECENT NAVAL/ AEROSPACE INNOVATIONS (3075)	None		
MAJOR NAVAL ACADEMIES	Concordat Aerospace Flight School, Naval Institute		
ACTIVE WARSHIPS (3067)	0	FIRST AEROSPACE FIGHTER	Lightning (2489)
		FIRST WARSHIP	Winchester (2364)

PERIPHERY STATE

*These innovations are still classified as prototypical and have yet to reach full production.



A pair of Outworlds Alliance Stukas patrol over the ruins of a Periphery city scarred by battle.

The following rules cover a wide variety of advanced options for game play.

ABSTRACT AEROSPACE SYSTEM

Aerospace support of ground troops is part of many games, though often peripheral to the ground engagement. The full-blown rules provided in *Low-Altitude Operations* (see pp. 241-249, *TW*), however, might bog down the game too much for players who prefer the action to center on the ground campaign. The following rules present a simplified version of the atmospheric mechanics for quick-and-easy use of aircraft in a ground-centered game. The Radar Map offers an abstract representation of the air-space around the battlefield for use in place of low-altitude maps.

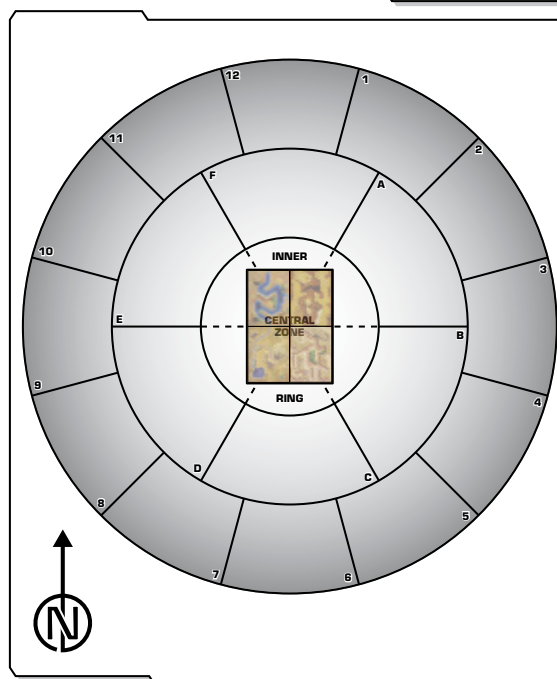
THE RADAR MAP

The Radar Map sheet at the back of the book represents the airspace around a playing area. It is divided into a series of concentric rings, each ring representing increasing distances from the ground battle. Each ring is further divided into one or more zones to regulate movement. To use the Radar Map, first photocopy it. The radar map should be placed on the table near the ground battle playing area so that units can move easily between maps.

The Central Zone corresponds to the ground playing area and represents the air directly above the battlefield, with "north" as indicated on the radar map oriented to one hexside; this should be determined and agreed upon by all players before play begins (see the Radar Map and Ground Playing Area Diagram, at right).

BATTLETECH™

RADAR MAP



• RADAR MAP AND GROUND PLAYING AREA DIAGRAM •



The Inner Ring represents the airspace near the ground playing area but out of the immediate reach of ground units. Aerospace units in this area can quickly react to events on the ground battlefield. The Inner Ring is divided by dotted lines into six parts to help players record each unit's direction of approach to the Central Zone, though unlike the middle and outer rings it is still a single game zone.

The Middle Ring represents an intermediate distance from the ground playing area. Aerospace units in this ring are a considerable distance from the battlefield, but fast units can still react to events on the ground. This ring is divided into six zones, lettered A through F.

The Outer Ring represents the farthest distance from the ground playing area at which aerospace units are still considered to be involved in the fight. This ring is divided into twelve zones, numbered 1 to 12 and corresponding to the face of a clock.

DEPLOYING FORCES

A scenario may call for units to be deployed in specific zones. If a scenario does not specify a zone, aerospace forces should set up in the Outer Ring, directly opposite each other and on the sides that best correspond to their deployment on the ground playing area.

In the Radar Map Diagram (see p. 18), if Player A is deploying his ground forces to enter along the "south" edge of the ground playing area, his aerospace forces would start in Zone 6. His opponent, Player B, would then deploy his ground forces to enter along the "north" edge of the ground playing area; Player B's aerospace forces would start in Zone 12. And so on.

ABSTRACT GROUND SUPPORT

Initiative

In Abstract Ground Support rules, aerospace units (including fighter squadrons) use the standard rules for Initiative and movement order. During an Initiative Phase, aerospace units are simply part of a player's force and so the controlling player may decide when and how to move each aerospace unit, alongside his ground units.

Movement

Each region on the Radar Map represents a large, abstract area. This allows units on the Radar Map to move between regions according to their Safe Thrust values (rather than standard movement rules). Units with a current Safe Thrust of less than 10 may move one zone per turn. Units with a current Safe Thrust of 10 or higher can move two zones per turn. Players should pick a starting Altitude for units on the Radar map when they enter play. Units moving to the central zone to engage ground units can use an available zone movement point to raise or lower that Altitude by 1. For example, a light fighter that can move two zones in a turn can use one to move to the center zone and one to drop one Altitude.

A unit must move at least one zone per turn and each move must be between adjacent zones (unless engaged in combat; see *Abstract Air-to-Air Combat*, p. 19). The Inner Ring is adjacent to all Middle Ring zones. An unlimited number of fighters may occupy each zone and hex facing is not tracked.

Units ending movement in the Central Zone are assumed

to be making a ground attack against targets on the ground playing area.

Aerospace units leaving the ground playing area are placed in the Central Zone of the Radar Map. Units moving outward from the Outer Ring are removed from play and cannot reenter the game for the remainder of the scenario.

An aerospace unit using abstract movement never suffers random movement. If they would do so and are not already out of control, they go out of control instead.

Attacks

Units making ground attacks must be assigned a flight line, which is a line of hexes over the ground playing area (see *Air-to-Ground Fire*, pp. 242-247, TW). The first hex of this flight line must be on the playing area edge corresponding to the direction from which the unit approached the Central Zone from the Inner Ring. Aerospace units may make a single pass over the battlefield, returning to the Inner Ring of the Radar Map at the end of the Combat Phase, provided they survive any anti-aircraft fire.

Provided all players agree, at any time during the game the players also may use the *Aerospace Units on Ground Mapsheets* rules (see p. 91, TW) and leave the fighters on the maps.

On the Radar Map Diagram, p. 18, two fighters join each side of a ground BattleTech game (a lance of 4 ground units on either side) to add an extra challenge to the scenario, though neither player wishes to use the full aerospace rules. Instead, they decide to use the Abstract Aerospace System rules and so copy the radar map and place it next to the ground playing area.

Jim places his Jengiz (which has 5 Safe Thrust and so can move one zone per turn) and his Vandal (which has 14 Safe Thrust and so can move two zones per turn) in Zone 12; this corresponds to his home edge on the "north" side of the playing area. Sabine places her Eagle (6 Safe Thrust, so it can move one zone per turn) and Sholagar (10 Safe Thrust, and so it can move two zones per turn) in Zone 6; this corresponds to her home edge on the "south" side of the playing area.

In Turn 1 (represented by red arrows in the diagram), Sabine wins the Initiative. During the Movement Phase of Turn 1, Jim first moves a ground unit, after which Sabine moves a ground unit. Then Jim decides to move his Jengiz (marked A on the diagram) from Zone 12 into the adjacent Zone F. Sabine then chooses to move a ground unit again. Jim then moves his Vandal (marked B on the diagram) into first Zone F and then the adjacent Zone A. Sabine then chooses to move her Eagle (marked C on the diagram) from Zone 6 into Zone C, after which Jim moves another ground unit. Sabine moves a ground unit, after which Jim moves a ground unit. Sabine follows that with her final ground unit, after which Jim moves his final unit. Finally, having won the Initiative, Sabine moves the final unit in the Movement Phase, her Sholagar (marked D on the diagram), into Zone C and then the Inner Ring.

In Turn 2 (represented by green arrows in the diagram), Sabine wins the Initiative once more. During the Movement Phase, Jim once again moves a ground unit, after which Sabine moves a ground unit. Jim moves another ground unit, hoping Sabine will move a fighter, but she opts to again

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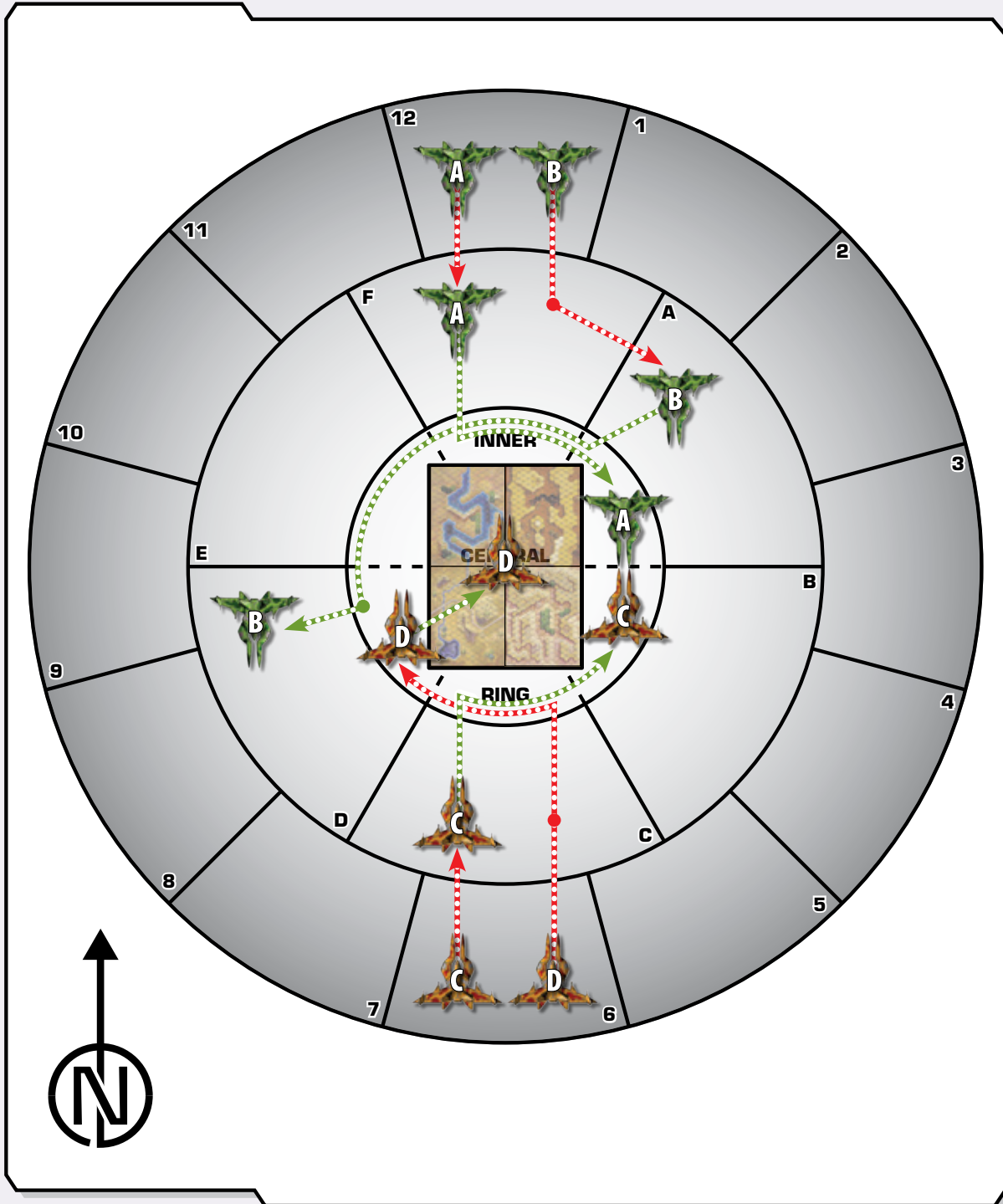
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move a ground unit. Jim finally decides to move the Jengiz into the Inner Ring, after which Sabine moves her Eagle into the Inner Ring as well, knowing she'll have a chance to get into a dogfight with the Jengiz (see Abstract Air-To-Air Combat, below). Jim then moves another ground unit, and Sabine moves a ground unit as well. Jim then moves the Vandal first into the Inner Ring and then into Zone D, after which Sabine moves another ground unit. Jim moves his final ground unit, leaving Sabine to move her Sholagar into the Central Zone and commence a ground attack, which they'll play out using the standard Air-To-Ground Attacks rules (see pp. 242-249, TW).

ABSTRACT AIR-TO-AIR COMBAT

Two aerospace units ending a turn in the same region on the Radar Map may engage in combat if one or both choose. Both pilots make a Control Roll. Add half of a unit's current Safe Thrust (round down) to the dice roll result for a successful Control Roll; add a quarter of a unit's current Safe Thrust (round down) to the dice roll result for a failed Control Roll.

The player with the higher modified die roll result determines the range of the combat (if neither succeeds at their Control Rolls, the combat takes place at long range). If the modified die roll results of the fighters are the same, the fighter with the highest unmodified MoS decides the range. If the modified die roll results are the same and both unmodified MoS are the same, the combat takes place at medium range.

If both players or neither made a successful Control Roll, each unit may use wing- and nose-mounted weapons, with hits on their opponent rolled on the Nose column of the Aerospace Hit Location Table (see p. 237, TW).

If one pilot succeeds and the other fails, the winner is tailing the other unit—the winner's unit has managed to maneuver into the enemy unit's rear arc. The tailing unit may use wing- and nose-mounted weapons, with hits on the opponent rolled on the Aft column of the Aerospace Hit Location Table (see p. 237, TW). The tailed unit is restricted to firing aft weapons and must roll for hits on the Nose column of the Aerospace Hit Location Table (see p. 237, TW).

During the End Phase of a turn, the players can choose to continue or break off the engagement. If both choose to continue the battle, the units remain in the same region and begin by making Control Rolls to determine position (as described above). If both choose to end the engagement, their units are free to move according to the standard rules in the next turn. If one player chooses to continue the engagement and the other wishes to end it, both players make another Control Roll, reducing the target number by 2 for the tailing unit and increasing it by 2 for the tailed unit; as noted above, add half or quarter of the unit's current Safe Thrust to the die roll result based upon whether the Control Roll is a success or failure. The pilot with the higher modified die roll result decides if the engagement continues. In the case of a tie, the unit with the higher unmodified MoS decides if the engagement continues. If the unmodified MoS is a tie, the decision lies with the fighter that has the higher current Safe Thrust (if that too is tied, randomly determine a winner). If both sides fail, the engagement automatically breaks off.

Movement: If a dogfight continues from one turn to the next, neither fighter will move out of the zone it occupies—an exception to the rule that a fighter must move at least one zone every turn, as noted under Movement (see p. 17).

Multiple Fighter Engagements

Where an abstract aerospace engagement involves numerous fighters, players may wish to use the procedures outlined above, with the following modifications:

- Group all fighters on each side into as many squadron formations as possible (see the Recommended Fighter Squadron Formation Table, p. 28); when a player determines to move an aerospace unit, he moves an entire formation (as opposed to a single fighter, as described above). For example, Player A is fielding a Free Rasalhague Republic force consisting of 9 fighters. As that faction fields 4 fighters to a squadron, Player A would field three formations, two of 4 fighters each and one of 1 fighter.
- Fighter formations fighting each other are dogfighting, and should use the rules above.
- Make all Control Rolls using the best Piloting Skill Rating of a formation's fighters, but adding 1 point to the rating per every two fighters after the first two. For example, in a fighter squadron of 6, the commander has a Piloting Skill Rating of 3. This is raised to 5 for the four additional fighters (1 point for each pair of fighters) beyond the first two.
- All, some or none of the fighters in a formation may fire in any attack.
- Where the enemy target is a formation of two or more fighters, use the fighter squadron rules (see p. 25).
- Fighters not involved in a dogfight but in the same zone may fire into combat as if at long range. Determine the target of such attacks randomly from all the fighters involved in the dogfight (friend and foe).

In the Radar Map Diagram on page 18, Sabine and Jim's fighters are in the Inner Ring and commence a dogfight. Jim's Jengiz has a current Safe Thrust of 5 and Piloting Skill Rating of 3, while Sabine's Eagle has a current Safe Thrust of 6 and a Piloting Skill Rating of 5.

In the first turn Sabine rolls a 6, a success, and so adds 3 (half current Safe Thrust) for a total of 9, while Jim rolls an 8, again a success, and so adds 2 (half current Safe Thrust, rounded down) for a total of 10. As Jim's modified die roll result is higher he chooses the range for the combat.

Both pilots opt to continue the dogfight and remain in the Inner Ring the following turn. Jim rolls a 3 and so again adds 2 for a total of 5. Sabine, however, rolls a 4, a failure, and so only adds a quarter of her Eagle's Safe Thrust, for a total of 5. As both modified die roll results are the same, they compare unmodified MoS; since Jim had a MoS and Sabine a MoF, Jim automatically chooses the range of combat. Additionally, as Sabine failed the Control Roll, Jim's Jengiz is in a tailing position now.

The dogfight continues into a third turn, both players determined to win. This time, however, the difficulty of Jim's Control Roll is reduced by 2 (because he was in the tailing position last round) and Sabine's is increased by 2. Jim rolls an 8, modified to 10, while Sabine rolls a 7 (just succeeding at the Control Roll), for a final result of 10. Again, the modified die roll results are equal, but Jim has an unmodified MoS of 6, while Sabine's is 0, so Jim determines range (because both fighters succeeded at their MoS, they're nose to nose once more).

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DROPPING TROOPS

BattleMechs, ProtoMechs, vehicles, infantry and battle armor can exit an aerospace unit under four conditions: on the ground, in the atmosphere, in space (cocooned for an orbital insertion) for combat drops (also known as assault drops) or free-floating in space for zero-G operations.

Ground units departing a landed aerospace unit use the Dismounting rules (see p. 91, *TW*). The following rules describe the dropping of troops under the other three conditions.

ATMOSPHERIC DROPS

Mechs, ProtoMechs, battle armor, WiGE Vehicles and vehicles with Jumping MP may make atmospheric drops. If a unit that can mount jump jets does not mount jump jets, it may either mount disposable jump jets (which automatically jettison upon touchdown; see *'Mech Jump Pack/'Mech Drop Pack*, p. 105, *TO:AUE*) or a Vehicular/Battle Armor Dropchute; the specific rules for how to use a Vehicular/Battle Armor Dropchute are found in the *Advanced Weapons and Equipment* section of *Tactical Operations* (see pp. 160-161, *TO:AUE*). Combat and Support Vehicles can also use the dropchute to make atmospheric drops. Conventional infantry can make atmospheric drops if they have Jumping MP, are paratroopers (see p. 153, *TO:AUE*), or are Mechanized VTOL Infantry (see p. 136, *TO:AUE*; see VTOL Movement below).

A carrying aerospace unit can drop a number of units each turn equal to its operational door capacity (though if a door is damaged, either through a critical hit or through dropping a unit, no units can use that door for the remainder of the scenario). Doors noted as pure cargo bay doors, or fighter/Small Craft bay doors, cannot be used; the number of 'Mech/ProtoMech/vehicle bay doors a unit has will be noted in either the unit's technical read-out or record sheet game statistics. A carrying aerospace unit can drop any number of infantry units.

Every time a non-infantry unit drops, roll 2D6. On a result of 2, though the unit successfully drops from the aerospace unit, the door is damaged and cannot be used for the rest of the scenario (it is considered to have been critically hit; see *Critical Hit Effects*, p. 239, *TW*).

Ground units that exit an aerospace unit on the space/atmosphere interface, atmospheric row or ground row hexes of the High-Altitude Map fall 1 hex per turn, starting during the Movement Phase (Aerospace) on the turn following the turn they exit. If there are two equal hexes to fall into, randomly determine which hex the unit enters. If players are using Low-Altitude Movement, ground units fall 3 Altitudes each turn.

Infantry: Infantry cannot exit a carrying aerospace unit in a space/atmosphere interface hex.

Initiative: Though dropping units cannot move in the standard sense, they still count for Initiative purposes at the start of the turn following their drop from the carrying aerospace unit; when a player nominates a dropping unit to move, it falls the appropriate number of hexes/altitudes as described above during the Movement Phase (Aerospace).

VTOL Movement: Any units with VTOL MP use the VTOL Infantry dismounting rules when making an atmospheric drop (see *Dismounting From Aerospace Carriers*, p. 225, *TW*). Such units cannot expend VTOL MP on the High-Altitude Map; only once such a unit has reached Altitude 10 of the Low-Altitude Map can it expend VTOL MP.

Atmospheric Pressure: Modify the fall rates for units as follows when using Low-Altitude Movement for different types of Atmospheric Planetary Conditions (see p. 54, *TO:AR*).

- Trace: 8 altitudes per turn
- Thin: 5 altitudes per turn
- Standard: 3 altitudes per turn (as shown above)
- Heavy: 2 altitudes per turn
- Very Heavy: 1 altitude per turn

Attacks Against Dropping Units

Other units can attack a dropping ground unit; distance to the target is determined by the unit's current atmospheric row (or altitude, if using Low-Altitude Movement). All standard combat rules apply; see Vehicular DropChute/Battle Armor DropChute and Paratroops in the *Advanced Weapons and Equipment* section of *Tactical Operations: AUE* for additional combat rules (see pp. 160 and 153, respectively). Against non-infantry units, divide any inflicted damage into 5-point Damage Value groupings (if 5 or greater; if less than 5, do not group) and apply it using the standard rules, determining the location randomly. Roll 1D6. On a result of 1–2, the attack is against the front. On a 3, it is against the left side, while a 4 means the attack is against the right side. A result of 5–6 indicates the rear.

This means that the damage from a single attack, such as a large laser, may strike several different locations—an effect of the extreme situation of a combat drop.

Conventional Infantry: Because they are spread out during a dropping maneuver to avoid colliding with one another, do not double the damage against dropping conventional infantry (i.e., they are not considered "in clear terrain" while dropping).

Attacks by Dropping Units

Dropping units can make attacks against airborne aerospace units and ground targets. In the case of airborne aerospace units when using Low-Altitude Movement, treat the ground unit as though it is on a ground map with an altitude equal to its current altitude. In all instances, apply an additional +2 to-hit modifier, in addition to all other standard modifiers (including the +3 jumping modifier, which is applied to all units even if they are using a parachute). If attacking aerospace units, remember to apply the appropriate angle of attack modifiers.

Landing Roll

Once a dropping ground unit reaches the ground hex row on a High-Altitude Map (or Altitude 1 (NOE) if using Low-Altitude Movement), at the start of that turn, its controlling player should secretly nominate a hex (this can be done by writing the information on a piece of paper and turning it face down on the table) anywhere on the playing area in which the unit will land (separate hexes spread across the entire playing area can be assigned to different units, even if they dropped simultaneously from the same aerospace unit). If a unit is prohibited from entering a specific hex type, that hex cannot be chosen as the target, with one notable exception: a player can intentionally try to violate *Stacking* rules (see *Stacking*, p. 21).

At the end of the Movement Phase, after all non-dropping troops have moved, Landing Rolls are made for each dropping unit in order of their Initiative, revealing the nominated hexes before each roll (if both opponents have troops making Landing Rolls in the same turn, alternate turns as per standard movement).



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For any unit with a Piloting/Driving Skill, make a Piloting/Driving Skill Roll, modified as normal for damage. For units without a Piloting/Driving Skill, roll 2D6 against a target number of 5, also modified as appropriate. In both instances, a successful roll result indicates the unit lands in the target hex at the end of the Movement Phase with any facing desired.

As stated previously, all units that land in a turn do so at the end of the Movement Phase after all other non-dropping troops have moved, in the order of their Initiative (if both sides have dropping troops landing in the same turn). If a unit fails its landing roll, completely resolve that situation before moving on to the next unit.

A dropping unit may not move or make attacks in the turn that it landed; dropping units may move and attack normally on the following turn. Attacks made against such units apply a +3 modifier for target movement.

WiGE Vehicle: Provided a WiGE Vehicle has 5 MP available, after the Landing Roll is resolved, the controlling player may announce he is spending 5 MP to keep the unit airborne, in which case it may move normally on the following turn; if the 5 MP is not spent, the unit is considered landed.

Planetary Conditions: Any planetary condition modifiers (such as weather; see the Weather portion of the Expanded Movement Costs and Planetary Conditions tables, p. 34, *TO:AR*) that apply to Piloting Skill Rolls are applied to the Piloting Skill Roll above. If a unit cannot be displaced (for example, all the adjacent hexes are prohibited terrain), the unit is destroyed.

Minefields: If the target hex for a landing contains a minefield, treat the dropping unit as though it entered the hex along the ground; treat dropping units as jumping units when determining if a vibrobomb minefield is detonated after a landing (see *Jumping Units*, p. 177, *TO:AR*).

Stacking: If a unit violates the Stacking rules when it lands, use the Unit Displacement rules to determine the effects (see p. 151, *TW*); randomly determine the direction to displace any units (if there are multiple units, randomly determine the displacement direction for each unit). This is not considered an accidental fall from above.

Double Blind Rules: Treat dropping units as jumping units when determining if a seismic sensor can detect them (see *Seismic Sensors*, p. 190, *TO:AR*).

Failed Landing Damage

A unit that fails its landing roll takes damage as though it had fallen a number of levels equal to the number of points by which the roll failed (see *Falling*, p. 68, *TW*, for 'Mechs or *Unit Displacement*, p. 151, *TW*, for non-'Mech units). For example, if a 'Mech with a modified Piloting Skill target number of 6 or higher rolled a 3, the unit would suffer damage as from a fall of 3 levels. A Piloting Skill Roll for landing that fails by more than 7 means the unit is automatically destroyed.

Regardless of whether a unit violates Stacking rules for entering a hex, a failed landing roll automatically is treated as an accidental fall from above (see p. 152, *TW*).

Failed Landing Location

On a failed landing, the unit also scatters 1D6 hexes for every point by which the result falls below the Piloting Skill Roll target number. Use the Dive Bombing Scatter Diagram (see p. 245, *TW*), to determine the direction of the scatter.

If players are using multiple maps, the unit may scatter onto a different map. If the unit completely misses the playing area, it is considered destroyed for purposes of determining victory in the current scenario. This rule is only for use if the players are playing an ongoing campaign. In this instance, and if players are tracking damage and using repair rules (see pp. 188-210, *CO*), then a random map should be generated to show exactly where the unit landed (players can use the *Rolling Maps* rules, p. 182, *TO:AR*) and damage assigned.

Stacking: If a unit violates the Stacking rules when it scatters and enters a hex after a failed landing roll, use the Unit Displacement rules to determine the effects (see p. 151, *TW*); in this case, use the direction from the original target hex to determine the direction of movement for any displacement that might occur. As noted, this is automatically treated as an accidental fall from above (see p. 152, *TW*). If a unit cannot be displaced (for example, all the adjacent hexes are prohibited terrain), the unit is destroyed.

SPACE DROPS FOR ORBITAL INSERTION

For a space drop, ground units are encased in ceramic cocoons to protect them during re-entry (an entire Point/squad of battle armor is contained in a single cocoon, whereas 'Mechs, vehicles and ProtoMechs have individual cocoons). Conventional infantry cannot make a space drop for orbital insertion.

Ground units making space drops for orbital insertion use all the rules for Atmospheric Drops given above, with the following additions.

To be considered a space drop for orbital insertion, a ground unit must exit a carrying aerospace unit in a space hex affected by gravity (see *High-Altitude Map*, p. 75, *TW*). A ground unit that exits an aerospace unit on a space hex falls 1 hex per space turn, starting during the Movement Phase (Aerospace) on the turn following the turn they exit; if there are two equal hexes to fall into, randomly determine which hex the unit enters.

Attacks Against Cocoons

A cocoon is considered to have a single location and can sustain 100 standard-scale points of damage before being destroyed. If the cocoon is destroyed and excess damage remains, apply the remaining damage to the unit using the *Attacks Against Dropping Units* rules (see p. 20).

If the cocoon suffers damage but is not destroyed before entering a space/atmosphere interface hex (see above), modify the re-entry roll by +1 for every full 10 points of damage it sustains. If the cocoon is completely destroyed before re-entry, the enclosed units are automatically destroyed if they enter an atmosphere/interface hex. However, such units may be able to maneuver away from such a fate using zero-G operations (see *Space Drops For Ground Units in Zero-G Operations*, p. 22).

Drop Cocoon Hit Location: In all instances, a drop cocoon is considered to have a single hit location; no roll is made for a location.

Space/Atmosphere Interface

When a ground unit enters the space/atmosphere interface hex (see *Space/Atmosphere Interface*, p. 78, *TW*), the player must make a Control Roll (use a base target number of 4 for units without Piloting/Driving Skill rolls) with a +1 modifier to reflect the cocoon's limited maneuvering capability.



A failed re-entry roll does not mean the unit failed to enter the hex, but failed to enter the hex without damaging itself. The unit does enter the hex, but the move automatically inflicts 120 points of damage to the cocoon, plus 10 points per MoF. Damage is first applied to the cocoon until it is destroyed. Then any remaining damage is applied in 5-point Damage Value groupings to a randomly determined location, using the Front column of the appropriate hit location table (provided the unit has hit locations); in the case of infantry, this damage is applied as though it were an area-effect weapon. Taking damage in this fashion applies a +1 modifier to the landing roll for each 20 points of damage taken by the unit, not the cocoon (see *Landing Roll*, p. 20).

If it survives reentry, the unit falls toward the planet's surface as described above. Beginning at Atmospheric Row 3, the controlling player can determine when to jettison the cocoon, which is done during the End Phase. If a cocoon is not jettisoned by the time the unit enters the ground hex (or Altitude 1 (NOE) if using Low-Altitude Movement), the unit is automatically destroyed.

SPACE DROPS FOR GROUND UNITS IN ZERO-G OPERATIONS

The following rules describe the movement of ground units, as well as the rules for converting those units for such movement, in zero-G operations. Rules for combat surrounding such units appear in detail in *Zero-G Ground Unit Combat* (see p. 107).

Ground units making space drops for zero-G operations use all the rules for exiting a carrying aerospace unit as given under *Atmospheric Drops*, p. 25. In addition, if a unit enters a space hex affected by gravity, whether directly from a carrying aerospace unit or due to its own movement (see High-Altitude Map, p. 75, *TW*), it must adhere to the effects of gravity as described under *Space Drops for Orbital Insertion*, above (at the end of the Movement Phase (Aerospace), all such ground units move toward the planet by 1 hex).

Prohibited Units: Four-legged 'Mechs, IndustrialMechs (unless it mounts a fuel cell, fission or fusion plant, and mounts the Environmental Sealing Chassis modification, and mounts jump jets), vehicles, four-legged battle armor and conventional infantry (except for xenoplanetary condition-trained troops; see p. 163, *TO:AUE*) cannot be space dropped for zero-G operations.

Converting Ground Units for Use in Zero-G Operations

Ground units are not designed for movement in zero-G and suffer severe limitations, and so to use ground units in this environment requires converting them to the equivalent of fighters. The Conversion of Ground Units to Fighters Table describes how this conversion occurs (rounding fractions up). Use the appropriate unit's record sheet and simply mark the appropriate changes for such conditions.

Movement Sub-Phases

Ground units in zero-G operations move before JumpShips in the sequence (see p. 50). When using Advanced Initiative (see p. 51), such ground units suffer a -6 Initiative modifier.

Unless otherwise noted, treat such units as fighters. Such units always operate as individual units and can never be combined into squadrons.

Movement

Ground units that exit a carrying aerospace unit, or voluntarily move off an aerospace unit's hull, have the same heading and

CONVERSION OF GROUND UNITS TO FIGHTERS TABLE

BattleMechs/ProtoMechs

Thrust Rating: Jumping MP ÷ 3 (round down)

Fuel: Jumping MP x 2

Offensive Systems: Use the weapon Damage Values as presented on pp. 303-305 of *TW* and pp. 216-228 of *TO:AUE*. Note that these weapons have significantly reduced ranges in aerospace engagements (see Aerospace Weapon Range Table, p. 235, *TW*). Standard ground unit arcs apply. Melee weapons may not be used, with certain exceptions (see *Zero-G Ground Unit Combat*, p. 107).

Armor: A 'Mech's armor remains in the standard locations

Battle Armor (BA squads/Points are treated as single units.)

Thrust Rating: Jumping MP ÷ 3 (round down)

Fuel: Jumping MP x 6 + any fuel tanks

Offensive Systems: Use the weapon Damage Values as presented on pp. 303-305 of *TW* and pp. 216-228 of *TO:AUE*, allocating all to a hypothetical Nose arc.

Armor: Total the Armor Points (excluding the 00 box for the soldier) for all the troopers in the battle armor formation. If a unit is not equipped with Space Operations Adaptations (see p. 269, *TM*), divide this total by 2.

Conventional Infantry (Marines)

Thrust Rating: Jump Rating ÷ 3 (round down)

Fuel: Jump Rating x 2

Offensive Systems: Per weapons load-out

Armor: Conventional infantry troops normally do not mount armor (each point of damage normally eliminates a single trooper); even when they do wear armor, it is treated differently (see *Infantry Armor*, p. 129, *TO:AUE*).

velocity as the carrying unit. For example, if a 'Mech drops from a DropShip heading along Vector A at a Velocity of 10, the 'Mech also heads along Vector A at a Velocity of 10.

In place of directly exiting a carrying aerospace unit, a ground unit may choose to move onto the carrying unit's hull; randomly determine the location where the unit ends up, ignoring the aft and nose locations. Doing so does not expend thrust and so does not require a Control Roll.

Whenever a ground unit expends thrust to move in space (meaning it is not on the hull of an aerospace unit), the controlling player must make a Control Roll (Piloting Skill Roll) with a +2 modifier. Assume a target number of 6 for battle armor units with Space Operations Adaptations and 8 for those without. For conventional infantry (marine) platoons, use a target number 7. If the unit fails, it becomes an out-of-control unit (see *Out-of-Control Effects*, p. 92, *TW*).

Fuel: Every time a unit uses a Thrust Point, that unit also expends 1 point of fuel. These units are designed to operate in atmosphere, but in space they must use reserve reaction mass, which is limited, and when this "fuel" runs out, they may no longer



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expend thrust. Battle armor may be built with extra fuel tanks (see p. 255, *TM*). If a 'Mech mounts a transport bay capable of carrying liquid (see p. 239, *TM*), the player can designate before a game that the 'Mech is carrying fuel. Each ton/critical slot of fuel provides 40 fuel points. Treat a critical hit against a transport bay slot carrying fuel as an aerospace fuel critical hit (see p. 240, *TW*), with the exception that the unit is not automatically destroyed; if the controlling player rolls 10 or more, it is treated as an ammunition explosion, with the damage equal to the amount of fuel remaining in the slot. Such transport slots can be refueled using the *Fuel Consumption* rules (see pp. 32-33).

Ejecting: BattleMech pilots may eject in space—the rules assume they are wearing some form of spacesuit while operating in space, as they would die immediately if not—but doing so is extremely dangerous. When ejecting in space, 'Mech pilots automatically take 1D6 points of damage in addition to any damage they may sustain as a result of a failed ejection roll (see *Ejection and Abandoning Units*, p. 164, *TO:AR*).

Ejected 'Mech pilots may be recovered in the same manner as fighter pilots (see *Search and Rescue*, p. 223, *CO*). However, they are only equipped with lightweight spacesuits that have limited oxygen supplies. This supply will last 30 space turns (30 minutes). Starting with the End Phase of the 31st space turn, the MechWarrior must make a Consciousness Roll in every space turn after ejecting or suffer an additional box of damage.

An ejected pilot still must conform to the effects of gravity if located in an affected hex (see *Space Drops for Orbital Insertion*, p. 21). If a pilot enters a space/atmosphere interface hex, he is eliminated.

A MechWarrior in a 'Mech cannot be equipped with a Personal Re-Entry Unit (see p. 24).

ProtoMechs: ProtoMech pilots may not eject.

BattleMech Full-Head Ejection System: Treat a BattleMech Full-Head Ejection System (see p. 122, *TO:AUE*) as a lifeboat (see *Large Craft*, p. 25).

Ramming: Ground units may make ramming attacks like aerospace units. All the standard rules for ramming attacks are used, with the following changes (see *Collisions and Ramming*, p. 241, *TW*).

When applying "Target is" modifiers from the Ramming Attacks Table, use the following: +5 for BattleMechs, +6 for ProtoMechs, +7 for infantry.

When applying "Attacker is" modifiers from the Ramming Attacks Table, use the following: +0 for infantry, +1 for ProtoMechs, +2 for BattleMechs.

When determining damage, use the Advanced Battle Armor Weights Table (see p. 155, *TO:AR*) for battle armor. If the calculation for any damage is 0 or less, no damage is applied. For example, if the calculation for a battle armor unit's damage to a target it rammed is 0 or less, then no damage is assigned to the target (though depending on the target, damage would still be assigned to the infantry unit).

Conventional Infantry cannot damage a target in this type of ramming.

Landing on a Hull

The most common use of ground units in space is in boarding actions, where the main objective is to get the unit onto

the hull of a target aerospace unit. Any 'Mech, battle armor, ProtoMech or infantry starting the turn in the same hex as an enemy Large Craft may attempt to land on that unit's hull. To do so, the controlling player must make a Control Roll, adding the appropriate modifiers from the Hull Landing Modifiers Table (below). If the roll is successful, the 'Mech, battle armor, ProtoMech or infantry lands on the hull. Otherwise, cross-reference the Margin of Failure with the appropriate effect on the Failed Hull Landing Table (below). The base landing damage of any failed landing is the velocity difference between the landing unit and its target (minimum of 1). In the case of a failed landing, apply damage to both units using the Ramming rules, see above.

Calculating the relative velocity of two units is a tricky process and varies between standard and advanced movement rules.

HULL LANDING MODIFIERS TABLE

Situation	Modifier
No fuel remaining	+2
Relative velocity	See <i>Landing on a Hull</i> , at left
Target is Out of Control	+3
'Mechs	
All armor on a location destroyed	+1 per location
Has Hatchet/Sword	-1
Has Claws or Talons	-1
Has Claws and Talons	-2
Battle Armor	
Space Operations Adaptations	-1
Has Claws and/or Magnets	-1
Has Heavy Battle Claw	-1
No manipulators	+1

FAILED HULL LANDING TABLE

Margin of Failure	Effect*
1	Hard landing. Unit takes 1D6 x Base Landing Damage.
2	Hard landing. Unit takes 2D6 x Base Landing Damage.
3	Collision. Unit bounces off the hull, taking 2D6 x Base Landing Damage, and fails to land.
4	Collision. Unit bounces off the hull, taking 2D6 x Base Landing Damage, and fails to land.
5	Collision. Unit bounces off the hull, taking 3D6 x Base Landing Damage, and fails to land.
6+	Unit misses target. May not make any other movement this turn.

*All damage is standard-scale. In all cases, the target takes a quarter of the damage applied to the landing unit (round down).

When using standard rules, three situations arise. The two units may have the same heading, in which case the relative velocity is the slower velocity subtracted from the higher velocity; they may have opposing headings (have approached each other nose-to-nose), in which case add the two velocities; or they may be "crossing" (the target unit flying across the path of the landing unit), in which case the relative velocity is the velocity of the landing unit plus half the velocity of the target (round up).

When using advanced movement, the relative velocity is the total difference in vectors between the two units.

A 'Mech with a Velocity of 5 attempts to board a DropShip with a Velocity of 7 (on the same heading) as they start the turn in the same hex. The 'Mech suffers a +2 modifier to its boarding attempt (reflecting the 2-point difference in the two units' velocities) and likewise has a Base Damage of 2 for any damage sustained in landing.

A battle armor unit with Space Operations Adaptations and a Claw traveling at Velocity 5 attempts to land on a WarShip, also at Velocity 5 but which is "crossing." The battle armor unit has a net difficulty modifier of +6 (-1 for the Space Operations Adaptation, -1 for the Claw, but +8 for the relative velocity). Despite this, its Base Landing Damage is 1 because both the battle armor unit and the target aerospace unit are traveling at the same velocity.

Using advanced movement rules, a 'Mech with vectors A2 and B1 attempts to land on a WarShip with vectors A1 and E2. The relative velocity of the two units is 4 (a 1-point difference in the A vector, the 1-point B vector of the 'Mech and the 2-point E vector of the WarShip).

EJECTION AND ABANDONING SHIP

A number of conditions may require a pilot or crew to abandon their units. Most units have systems to aid this: ejector seats in fighters, escape pods and lifeboats in larger units. Small Craft fall between these two systems, too small to mount escape pods and lifeboats yet rarely equipped with ejection systems, and so are forced to rely on manual means.

SAR: A Search and Rescue unit (usually a Small Craft, though any DropShip or WarShip can attempt a pickup) may attempt to rescue ejected pilots during a battle (see *Search and Rescue*, p. 223, CO).

Initiative: Ejected pilots/lifeboats/escape pods always move last after all other aerospace units have moved, including dropping troops (see p. 20).

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Aerospace fighters are also equipped with an auto ejection mechanism, that operates identically to that of a 'Mech, and can be disabled in the same way as a 'Mech (see *Ejection and Abandoning Units*, p. 164, TO:AR), except as noted below.

A pilot may escape from his fighter in the Movement Phase by activating his ejection system in lieu of any other action. The escape takes place automatically after the mechanism is triggered, but the pilot may sustain damage in the maneuver and must make a Control Roll. If the roll succeeds, the pilot avoids damage; otherwise, cross off one box of pilot damage per point of MoF,

which may lead to the pilot's death if the pilot is already injured or the roll is very bad. If the pilot sustains damage, he also must make a Consciousness Roll.

Whether the pilot takes damage or not, place a marker indicating the pilot in the fighter's hex. In a space hex, this marker has the same heading and velocity as the fighter; if the pilot enters a Space/Atmosphere Interface hex, the pilot is killed, unless the pilot ejected with a Personal Re-entry Unit at right. In atmosphere, the marker has a Velocity of 0 and the pilot falls toward the ground, supported by his parachute, using the same rules as for dropping troops (see *Atmospheric Drops*, p. 20). If the pilot has no parachute, when it is time to make a landing roll, the pilot is killed.

When a pilot ejects, there's a chance that the ejection seat (which is ejected with the pilot, just as a MechWarrior's ejection seat is ejected during an auto-eject) is damaged to the point it will no longer function. How much air a pilot has is based upon whether he's got a functioning ejection seat or not. If the pilot ejects with a MoS 2 or greater, his ejection seat is intact and can be used; if the pilot ejects with a MoS of 1 or less, the ejection seat is damaged beyond repair and cannot be used.

An ejected pilot without a ejection seat will survive 480 space turns (480 minutes), minus 80 space turns for every box of damage the pilot has taken (either before or during ejection). At the end of the 480 space turns, if the pilot is still in a space hex (a vacuum environment), a box of damage is marked off during the End Phase. An additional box of damage is marked off during the End Phase of every subsequent space turn until the pilot is rescued or dies.

An ejected pilot with a ejection seat will survive 24 hours (1,140 space turns). All the other rules as noted above apply.

Attacks Against an Ejected Pilot: Pilots may also be targeted by enemy fire: a +5 to-hit modifier applies to all such attacks (in addition to all other standard modifiers). Any successful attack against the pilot kills him.

Safe Ejection: The rules above cover ejecting under emergency conditions. A pilot may choose to abandon his unit at any time, taking additional time to do so. In this instance, a player declares a safe ejection during the End Phase of any turn. The pilot then takes two complete turns to safely exit his unit with all available survival gear; the pilot is considered "ejected" during the End Phase two turns following the declaration. No roll for ejection is made.

Personal Re-Entry Unit: Derived from sport space-diving, a Personal Re-Entry Unit (PRU) is a small foamed, inflatable ablative shield that provides a semi-controlled re-entry for a single pilot. At the start of a scenario, all players must designate which aerospace units are equipped with PRUs; this usually is only for fighters and Small Craft, though at the players' discretion they can nominate any number and/or type of units, except 'Mechs (when assigning PRUs to any aerospace unit beyond a fighter, each PRU weighs .25 tons; fighters ignore this weight restriction).

If the pilot of a fighter ejects with a PRU, apply a +1 modifier to the Control Roll to avoid damage during the ejection. A pilot exiting a Small Craft or Large Craft with a PRU is considered two people for purposes of how many people can exit in a turn (see *Large Craft*, p. 25).

If a pilot with a PRU is unconscious when he or she enters a Space/Atmosphere Interface hex, that pilot is automatically killed.

A conscious pilot with a PRU who enters a Space/Atmosphere Interface hex must make a Control Roll. Apply a +1 modifier for

each box of damage the person has taken. Additionally, for fighter pilots, apply a +2 modifier; for any other person, apply a +4 modifier.

If the roll is successful, the pilot enters the atmosphere. The marker for the pilot has a Velocity of 0 and the pilot falls toward the ground, supported by his parachute, using the same rules as for dropping troops (see *Atmospheric Drops*, p. 20). If the pilot has no parachute, when it is time to make a landing roll, the pilot is killed.

If the roll fails, the pilot is killed.

LARGE CRAFT

In the Movement Phase, some or all of a unit's crew may be ordered to abandon ship. When abandoning ship, make a Control Roll for the unit. A success indicates that for every full 100,000 tons of a unit, 1 + MoS lifeboats or escape pods may launch safely. Additional lifeboats or escape pods may launch in the same turn, but each must make a Piloting Skill Roll at a +2 modifier (+5 in the case of a lifeboat being employed by a unit in an atmospheric row or space/atmosphere interface hex), suffering a point of standard-scale damage for each point of the MoF (standard life boats and escape pods have an SI of 1 and an Armor Value of 4). When abandoning a Large Craft, place a marker for each pod or boat on the map. In a space hex, each starts with the heading and velocity of its parent unit. It should be noted that lifeboats, though better able to support their occupants for longer periods than escape pods, cannot maneuver, nor can they survive re-entry and are automatically destroyed if they move into a Space/Atmosphere interface hex.

In atmosphere, escape pods also begin with the same heading and velocity as their parent unit but fall under the influence of gravity (see p. 80, *TW*) if their velocity drops below 2. Lifeboats employed in atmosphere have a Velocity of 0 and automatically fall under the influence of gravity, sustaining a point of damage per atmospheric hex fallen (or 3 altitude levels if using Low-Altitude Movement, including falling into the ground hex). Parachutes allow lifeboats and escape pods to land if they enter a ground hex with at least 1 point of standard-scale armor remaining.

Crewmen can put on spacesuits and exit any Large (or Small) Craft. At the start of a space turn, the player announces how many crewmen will be exiting in this fashion (up to 50 per turn). For that space turn, those crewmen are considered wounded for purposes of Piloting and Gunnery Skill Rolls; use the *Crew Losses and Crew Hits* rules (see p. 174, *TO:AR*); round normally. During the End Phase of that space turn, the crewmen designated by the player are ejected; treat all such crewmen as ejected fighter pilots (see above).

A Feng Huang WarShip has taken crippling damage and its controlling player wants to protect as many crewmen as possible. During the next turn's Movement Phase, he makes a Control Roll with an MoS of 2. Checking the tonnage on his Feng Huang, he sees it is 970,000 tons. He quickly figures that he can eject 27 escape pods or lifeboats safely this turn $[1 \text{ (base number)} + 2 \text{ (MoS)} = 3 \times 9 \text{ (1 per each full 100,000 tons)} = 27]$. The controlling player ejects all 24 lifeboats and then 3 more escape pods; he determines this is all crew and not any battle armor troopers or pilots/technicians.

*Next turn the player attempts one final weapons attack. He ejected 162 crewmen the previous turn $[144 \text{ (24 life boats} \times 6) + 18 \text{ (3 escape pods} \times 6) = 162]$. The Feng Huang has a total crew of 1,044 (again, not counting battle armor troopers, or pilots and technicians). Dividing the 162 by 1,044 shows that 15.5 percent (rounded to 16 percent) of the crew is no longer on board. Checking the *Crew Casualties Table* on page 174 of *Tactical Operations: AR* equates to a single crew hit the controlling player must take into consideration when making his weapon attacks this turn.*

FIGHTER SQUADRONS

Though many battles involve only a handful of fighters, battles involving DropShips and WarShips can include hundreds of these smaller units. It would be impractical to manage such large numbers of individual fighters using the standard rules, so the following abstract rules provide an alternative system. The goal of these rules is to group the fighters into units and then maneuver and fight with these formations rather than individual fighters. All fighters in a squadron need not be the same type, though they often are.

Terminology: For these rules, the term "squadron" is used for any formation involving 2 or more fighters.

Maximum Squadron Size: For formations larger than 6, divide the formation into two squadrons. For example, "in universe," the Clans field aerospace Stars (equivalent to a squadron) of 10 fighters each, but in game terms that would be represented by 2 squadrons of 6 fighters and 4 fighters each, with players using two Squadron Record Sheets to track the 10 fighters.

CREATING A FIGHTER SQUADRON

Determine the statistics of a fighter squadron as follows; it is beneficial to have a copy of the Squadron Record Sheet at hand to fill out at each stage of the process.

Choose Fighters

If the player does not have a pre-existing fighter squadron, he or she should choose the fighters for one. A host of different fighters appear in *Technical Readout: 3039*, *Technical Readout: 3050 Upgrade*, *Technical Readout: 3055 Upgrade*, *Technical Readout: 3067* and *Technical Readout: 3075*. Players can also find record sheets for those fighters for sale in various Record Sheet PDFs at <https://store.catalystgamelabs.com>.

Using the Recommended Fighter Squadron Formation Table (see p. 26), players can match the proper squadron size with their desired faction. Then they can simply pick and choose which fighters they wish to field or which are appropriate. Players can also use the Random Aerospace Assignment Tables found starting on page 271 of *Total Warfare* or page 37 of this book to quickly generate an appropriate squadron of fighters. As noted above, all the fighters in a squadron need not be the same type (though it is easier to pick fighters for a squadron that way), but each pair of fighters within the squadron must be the same type (though not necessarily the same variant/configuration).

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Capital Fighters

Fighters converted to squadron stats are called Capital Fighters to distinguish them from those using Standard Rules, *Total Warfare* stats. Although Capital Fighters are normally deployed in squadrons according to the Recommended Fighter Squadron Formation Table (at right), they may be deployed individually; in effect, becoming single-fighter squadrons. A single Capital Fighter acts as a one fighter squadron and follows all the standard fighter squadron rules.

Armor

Total the individual armor values of each fighter in the squadron by adding the armor on each facing of every fighter (Technical Readouts will already have this totaled as the Armor Factor). For each fighter, then convert that armor value to capital-scale; divide the total by 10, rounding to the nearest whole number (with a minimum value of 1). Enter this data on the record sheet under the corresponding fighter's Total Armor entry, then cross off any excess armor squares under that value.

Fatal Threshold: Fatal Threshold determines when a fighter must roll for destruction (see *Fighter Squadron Critical Hits and Fatal Threshold Damage*, p. 30). To determine this value, divide the total capital-scale armor by 4 and round up to the nearest whole number with a minimum value of 2; enter this data on the record sheet next to the Total Armor entry for each fighter.

After glancing through Technical Readout: 3075, Joel decides to build a Word of Blake squadron to play in one of the tracks from a Jihad Hot Spots sourcebook. The squadron contains a pair of S-HA-OA Shades, a pair of S-RSL-O Rusalkas and pair of S-STR-OE Strigas.

With a blank Squadron Record Sheet at hand, he notes down the names of the fighters, and then because he has the Technical Readout at hand, he looks at each entry to find the Armor Factor, which is the total armor value of all facings. This gives him the following values: 116 for each Shade, 215 for each Rusalka and 322 for each Striga. Joel then generates capital-scale damage values, resulting in the following for each fighter type: 12 [116 (Shades' total armor value) ÷ 10 = 11.6, rounding to 12], 22 [215 (Rusalkas' total armor value) ÷ 10 = 21.5, rounding to 22] and 32 [322 (Strigas' total armor value) ÷ 10 = 32.2, rounding to 32]. Looking at the record sheet, Joel notes that information in the correct spot and then crosses off the excess armor squares unused by each fighter.

Determining the Fatal Threshold for each fighter, Joel finds the Shades have a Fatal Threshold of 3, the Rusalkas 6 and the Strigas 8, all of which he notes next to each Total Armor value.

Weapons

Like battle armor, fighter squadrons use the Cluster Hits Table for each weapon bay of the same weapon type to determine the total amount of damage actually applied to the target after a successful attack (see *Fighter Squadron Attacks*, p. 28). As such, each fighter groups its weapons into three types of weapon bay arcs: Nose (all Nose-mounted weapons), Wing (all forward firing Wing-mounted weapons) and Aft (all Aft and Aft-mounted Wing weapons). Then total the Heat values for each type of weapon bay and add the AV and Range for a single weapon (see record sheet example, p. 28). Once all such details are known, note them, along with the location and range of the weapon bay, under the corresponding fighter's entry on the record sheet (noting ammo in brackets).

RECOMMENDED FIGHTER SQUADRON FORMATION TABLE

Affiliation	Force Size (Fighters per Squadron)
Clan Star (All)	10 (Split 5/5 or 6/4 in two squadrons)
Inner Sphere	
Generic/Mercenary	6
Capellan Confederation	6
Draconis Combine	6
Federated Suns	6
Free Rasalhague Republic	4
Free Worlds League	6
Lyrans Alliance	6
ComStar/Word of Blake	6
Periphery (General)*	6
Marian Hegemony	10 (Split 5/5 or 6/4 in two squadrons)
Taurian Concordat	4
Calderon Protectorate	4
Additional Formations	Force Size (# of Fighters)
Clan Aerospace Point	2
Inner Sphere Flight	2
Capellan Flight	3

*Includes Circinus Federation, Magistracy of Canopus, Niops Association, Outworlds Alliance, Nueva Castile, Hanseatic League, and pirates

If any squadron members are carrying external stores, group all like types of external stores in the same fashion as weapons in the other arcs. External Stores is labeled as Bomb under the "Arc" column. If carrying external stores, be sure to put the modified Safe Thrust in parentheses after the Safe Thrust and Maximum Thrust entries. To be able to launch external stores in combat, a squadron must be carrying identical stores. They may carry more than one type of stores, but each fighter must carry the same type and number.

As detailed under Weapons, under Fighter Squadron Critical Hit Effects (see p. 30), if a fighter takes a Nose or Aft weapon bay critical hit, all weapons in that location are destroyed. However, if a fighter takes a Wing weapon bay critical hit, the first critical halves the damage of the weapon bay and the second critical hit destroys all Wing-mounted weapons on that fighter. As such, when noting weapon bays for Wings, the players should note the one half of the weapon count after the total number and note the "half" Heat value in parentheses (to be used once a first Wing weapon critical hit occurs), so such information is readily available without having to do math on the fly during the game.

Once each individual fighter's information has been determined, fill out the Squadron Data section on the record sheet with the summary information for each unique weapon bay type. For example a squadron with 10 wing-mounted medium lasers, 6 wing-mounted small lasers, 12 wing-mounted SRM 6s and 12 nose-mounted medium lasers will have four bays in the Squadron Data section, one for each unique weapon type/location.



Maximum Damage Threshold: Squadrons, due to their dispersion of fire, inflict damage as solitary fighters for purposes of determining whether a squadron's attack exceeds a target's Damage Threshold (see p. 239, TW). Thus, only the Attack Value of a single fighter's weapon bay is compared to the target's Damage Threshold regardless of how many functional fighters are in the squadron. This Attack Value is noted in the MDT column of each weapon bay in the Squadron Data section of the record sheet.

Looking at his six fighters, Joel first determines the specific weapon bays for each individual fighter. For both Shades, he comes up with the following: a Nose bay with an LRM-15 w/Artemis, and a Wing 4(2) ER medium laser bay; he remembers to enter the single wing weapon count for ease of record keeping. For both Rusalkas, he determines the following: an ER PPC Nose bay, a Nose LRM-15 w/Artemis bay, a Wing 4 (2) ER medium laser bay, a 2(1) medium pulse laser Wing bay and an ER small laser Aft bay. Finally, for both Strigas, he gets the following bays: a Nose 3 light Gauss rifle bay and a Wing 4(2) ER medium laser bay. He writes down the specific weapon bay, ammo and location information for each of the fighters in the squadron, under the Weapons and Equipment and Loc columns.

Joel then determines the heat for each weapon bay and writes that down under each corresponding fighter, in the Ht column. For both Shades' weapon bays, he writes down 5 for the Nose LRM-15 w/Artemis bay and 20 for the Wing ER medium laser bay. Joel remembers that a Wing bay can take two critical hits before being destroyed and so changes the 20 value to read "20 (10)" in the Ht column. For both Rusalkas' weapon bays, he writes 15 for the Nose ER PPC bay, 5 for the Nose LRM 15 w/Artemis bay, 20 (10) for the Wing ER medium laser bay, 8 (4) for the Wing medium pulse laser bay and 2 for the Aft ER small laser bay. Finally, for both Strigas' weapon bays, he writes 3 for the Nose light Gauss rifle bay and 20 (10) for the Wing ER medium laser bay.

Next, he figures the Attack Value and range generated for each weapon type, which he writes down under each fighter in the AV/Range column. For both Shades' weapon bays: 12/Long for the Nose LRM-15 w/Artemis and 5/Medium for the Wing ER medium laser bay. For the Rusalkas' weapon bays: 10/Long for the Nose ER PPC bay, 12/Long columns for the Nose LRM-15 w/Artemis bay, 5/Medium for the Wing ER medium laser bay, 6/Short for the Wing medium pulse laser bay and 3/Short for the Aft ER small laser bay. For the Strigas' weapon bays: 24/Extreme for the Nose light Gauss rifle bay and 5/Medium for the Wing ER medium laser bay.

In addition to each fighter's weapons, Joel has decided to outfit his fighters with external stores. The rules require him to use all the same stores for each fighter. Looking at his fighters he sees that the Shades have the smallest bomb potential (see pg. 245, TW), each shade can carry the equivalent of seven bombs. He decides to equip each fighter with a single Anti-Ship Missile (equal to 5 bomb slots) and 1 HE Bomb.

With all the appropriate information now filled out for each fighter, he then sums up the stats for each weapon bay to write in the Squadron Data section. For the Nose

section: 4 LRM-15 w/Artemis, 2ER PPC and 6 Light Gauss Rifle. For the Wing section: 24 ER Medium Laser and 4 Medium Pulse Laser. For the Aft section: 2 ER Small Laser. Finally, for Bombs: 1 AS Missile and 1 HE Bomb.

Finally, Joel mentally notes that the Maximum Damage Threshold of each bay is equal to the Attack Value for each weapon bay. He then fills in the AV Each column with these values for ease of reference: 12 for the Nose LRM-15 w/Artemis bay, 10 for the Nose ER PPC bay, 8 for the Nose light Gauss rifle bay, 5 for the Wing ER medium laser bay, 6 for the Wing medium pulse laser bay, 3 for the Aft ER small laser bay, 30 for the AS Missiles and 10 for the HE Bombs.

Heat Sinks

Fighter squadrons use the same heat rules as Large Craft (see p. 161, TW), except heat is calculated by weapon bay, not arc. Fighter squadrons that lack sufficient heat sinks to fire all weapon bays may still overheat. If the player chooses to fire more bays than the fighter squadron's heat sinks can dissipate, the fighter squadron will overheat by the difference and the player must make an immediate Control Roll, applying a +1 modifier for every 15 points (or fractions thereof) by which it overheated. This overheat effect is cumulative, and any remaining heat will carry over into the next turn. Overheat is tracked on the Velocity Record on the record sheet.

When heat sinks on a fighter are destroyed—or when a fighter is destroyed—the heat sinks are recalculated based on the remaining heat sinks/fighters. Record heat sink information in the squadron summary section of the record sheet and on each fighter's stat block.

Joel adds all the heat sinks of his six fighters to find the total value for his squadron and comes up with 84 heat sinks (11 doubles for each Shade, 18 doubles for each Rusalka and 13 doubles for each Striga). He writes that value down on the record sheet, in the Squadron Data section, as well as the fighter squadron's total heat capacity, which is 168, and then checks the double heat sinks box. If any of the fighters mounted single heat sinks, Joel would have needed to track the double and single heat sinks separately for purposes of damage and heat dissipation.

Gunnery and Piloting Skills

The Gunnery and Piloting Skills of a squadron are the average of all Gunnery and Piloting Skills of the pilots that make up the squadron. If the Piloting and Gunnery Skills of each pilot are not yet determined, those values should be determined now. Players can either assign values, or they can use the Random Experience Rating Table and Random Skills Table (Expanded) (see p. 273, TW) to generate those values. Once the values are determined, add the Gunnery and Piloting Skills separately, dividing by the number of fighters in the squadron (rounding down to the nearest whole number) to determine the average skills of the squadron.

Joel decides to randomly roll on the Veteran column of the Random Skills Table (Expanded) and comes up with the following Gunnery and Piloting Skills: 3/4, 2/4, 3/2, 1/3, 3/5 and 2/3. He first adds the Gunnery Skills to arrive at 2 [3 + 2 + 3 + 1 + 3 + 2 = 14 / 6 = 2.3, rounding down to 2]. Then

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[illegible]

Joel adds the Piloting Skills to arrive at 3 $[4 + 4 + 2 + 3 + 5 + 3 = 21 / 6 = 3.5$, rounding down to 3].

Joel writes 2 and 3 on the Gunnery Skill and Piloting Skill lines in the Squadron Data section of the record sheet.

Finishing the Record Sheet

Fighter squadrons use the Safe and Maximum Thrust values of the slowest fighter. Determine which is the slowest and note that detail on the record sheet. If using the optional fuel rules (see p. 32), the fuel capacity of the fighter with the least amount of fuel available applies. Finally, if the squadron is carrying external stores, notate the adjusted Safe Thrust in parentheses after the entry for Safe Thrust; calculate the modified Maximum Thrust and notate that in parentheses after the Maximum Thrust entry.

The squadron's Structural Integrity (SI) is equal to the lowest SI of any fighter; note that detail on the record sheet.

Finally, the player should check whether the squadron has a Clan or Inner Sphere technology base, as well as naming the squadron (if the player so desires).

Joel determines that the Striga has a Safe Thrust of 6 and a Maximum Thrust of 9. As those are the lowest values of his six fighters, he writes that down on the record sheet. He then checks for the SI: the Shade has a 9, while the Rusalka has a 7 and the Striga has an 8; the Rusalka's is the lowest, so he writes that value down on the record sheet.

Each fighter has seven bomb slots filled, this reduces their Safe Thrust by 2, giving a final value of 6 (4) for the Striga, 7 (5) for the Ruskala and 9 (7) for the Shade, with each fighters Maximum Thrust recalculated accordingly. The Striga is still the slowest fighter, so the Squadron Data is filled in with 6 (4) for Safe Thrust.

Joel notes down the fuel points for each fighter; as all fighters have the same value, that is the value used under the Squadron Data (in this case 400).

Finally he checks the Inner Sphere technology box and names his squadron: *Ghostriders*.

USING A FIGHTER SQUADRON

Use the following rules for movement and combat involving fighter squadrons.

Movement

Fighter squadrons use all the same movement rules as standard fighters, except that a squadron is considered a single unit for Initiative and movement. When a player nominates a unit to move and chooses a fighter squadron, the entire unit is moved as one.

Per standard rules, a Control Roll is made for any thrust spent in excess of the fighter squadron's SI, as determined under *Finishing the Record Sheet* (at left).

Launching/Recovering Fighters: When launching or recovering fighters, if a squadron cannot be launched or recovered in its entirety, the remaining fighters are not counted in the squadron for movement and attack purposes. For example, if a Large Craft can only launch 4 of the 6 fighters of a squadron in a single turn, the squadron only contains 4 fighters until the remaining 2 fighters are launched.

Fighter Squadron Attacks

Unless stated otherwise, fighter squadrons follow all the standard applicable rules for weapons fire, to-hit procedures and so on as standard fighters.

A fighter squadron has two firing arcs: front and aft. Looking at the Aerodyne Firing Arcs Diagram on page 236 of *Total Warfare*, the “Nose & Left Wing,” “Nose & Right Wing & Left Wing” and “Nose & Right Wing” arcs are all combined into a single front arc. Likewise, the “Aft & Left Wing (A),” Aft & Right Wing (A) & Left Wing (A)” and “Aft & Right Wing (A)” arcs are all combined into a single aft arc. Both the Nose and Wing weapon bays fire into the entire front firing arc. Missile external stores may fire into the Front arc. Bombs may be deployed per Space Bombing (see p. 104), except as noted below.

When deploying missile external stores, the player fires them in salvos equal to one store per active fighters still equipped with that store. So a six fighter squadron with 18 High Explosive Bombs could fire three salvos of six bombs each, while a four fighter squadrons carrying AAA missiles would fire a salvo of four, and the same squadron where one fighter had taken a bomb critical on its AAA missile bay, would only fire a salvo of three missiles. Expended stores are marked off on the Fighter Data block and Squadron Data block.

When the controlling player of an attacking fighter squadron unit announces a weapon attack, he chooses a weapon bay to fire; that is, all fighters in the squadron fire the same type of weapon bays at the same target. This can easily be tracked in the Squadron Data section of the record sheet. The number of weapon attacks a fighter squadron unit can make depends on how many squadron weapon bays are available in the firing arc in which the target is located, as well as the range to the target. The controlling player makes a separate to-hit roll for each squadron weapon bay that he chooses to fire.



When a fighter squadron hits with a weapon bay, consult each fighter's entry and total up the number of active weapons in the bay. Using the total number of weapons, roll 2D6 and consult the appropriate column of the Cluster Hits Table corresponding to the number of active weapons in the bay to determine how much of the squadron's fire actually struck the target. Missiles that miss their target detonate harmlessly.

Once that number is determined, the attacker rolls to determine the location for that damage, which is applied as a single block of damage to that location. External stores salvos strike a single location the same as other squadron attacks.

Fighter Squadrons conducting Air-to-Ground Attacks are treated as individual Standard Rules fighters each making a separate identical attack (Bombing, Striking, Strafing) on the target or hex. Damage from a successful Strike or Strafe attack is divided into 5-point Damage Value groupings; bomb attacks follow standard bombing rules (see p. 245, TW). In addition, because the squadron is flying in formation and in a predictable pattern, any Ground-to-Air attacks against a fighter squadron receive a -1 to hit modifier, in addition to any other standard modifiers for such an attack.

Maximum Damage Threshold: As noted under Weapons (see p. 26), the ability of a fighter squadron to inflict a potential critical hit through exceeding a target's Damage Threshold (see p. 239, TW) is based on the maximum Attack Value of a single weapon in the firing bay, this is the AV value for each bay, as noted in the Squadron Data section of the record sheet. When a player makes an attack against a target whose Damage Threshold in the struck location is higher than the Maximum Damage Threshold of that weapon bay, then no potential critical hit is inflicted through exceeding a Damage Threshold, regardless of how much damage the target takes.

If using the *Variable Damage Thresholds* rules (see p. 105), when a player makes an attack against a target whose current Damage Threshold is greater than the Maximum Damage Threshold of the fighter squadron weapon bay making the attack, regardless of how much damage is done to the target, no potential critical hit is inflicted through exceeding a Damage Threshold. If the current Damage Threshold in the struck location has a value equal to or less than the Maximum Damage Threshold of the fighter squadron weapon bay making the attack, then if the total damage of the attack exceeds the current Damage Threshold, a potential critical hit for surpassing Damage Threshold is achieved. If the damage grants an automatic critical hit chances—such as an Anti-Ship Missile—roll for these chances normally, for each missile that hits the target.

Targeting Computers: Fighter squadrons only gain the benefit of targeting computers (-1 to-hit modifier on appropriate weapons) if at least half (round up) the active members have a targeting computer.

Joel is in the thick of a battle and his fighter squadron is targeting an enemy Achilles DropShip that has just entered the fray during Turn 3. He's already lost one fighter (the Shade in Slot 2) and so his squadron of six has become a squadron of five. He already launched all his external stores, so those are not available to him. Additionally, the Shade in Slot 1 has taken two armor hits, three heat sink hits and a Wing weapon critical hit, so the ER medium laser bay on that Fighter generates only 10 heat and 10 damage (as

opposed to the standard 20 heat and 20 damage).

The DropShip is at medium range and in the fighter squadron's front arc, and so Joel opens up with as many weapon bays as he can without overheating. With damage, the 84 starting double heat sinks are now 70 double heat sinks, giving him a total heat capacity of 140. After playing with numbers quickly, Joel decides not to fire the ER PPC bay, and the medium pulse laser bay is out of range, leaving him with the LRM-15 w/Artemis, ER medium laser and light Gauss rifle bays, which will add up to 111 heat (remembering that the Shade in Slot 1 is only generating 10 heat for its ER medium laser bay); this is inside the 140 maximum heat the fighter squadron can generate per turn.

He makes an attack with all three weapon bays; he misses with the LRM 15 w/ Artemis, but both the other two bays strike the target! Looking at his fighter squadron sheet, Joel notes that the ERML Wing bay has 18 lasers still active. As such, Joel rolls 2D6 on the 18 column of the Cluster Hits Table, with a result of 9, meaning 14 of the 18 ER medium lasers strike the target. Adding the Attack Values for the fourteen ER medium lasers that did strike the target creates a final Attack Value of 70 (14 x 5 AV = 70). Joel then rolls for a hit location on the appropriate column of the Aerospace Units Hit Location Table and comes up with a result of 9: Left Side, which translates into a Left Wing for an Aerodyne DropShip. The controlling player of the Achilles DropShip assigns 70 points of standard-scale damage as a single hit to that location, reducing the damaged armor from 250 down to 180. The Damage Threshold of the armor in that location on the Achilles was 26; since the Maximum Damage Threshold of the ER Medium Laser bay is only 5, there is no potential for a critical hit due to exceeding that location's Damage Threshold.

Joel then fires the bay of 6 light Gauss rifles and so he rolls on the 6 column of the Cluster Hits Table. He gets a result of 5. He consults the 6 column of the Cluster Hits Table (number of active light Gauss rifles) and sees that only three rifles (one fighters worth) struck the target. Multiplying the AV Each value of 8 by 3 he gets a total Attack Value of 24. Joel rolls a 10 for hit location, resulting in 24 points of damage being assigned to the Left Wing again, reducing the armor from 180 to 156. Even though they are playing with Variable Damage Thresholds, the current Threshold of that location is 18, which is well below the MDT of 8 for a light Gauss rifle bay, and so there is no potential for a critical hit for damage exceeding that location's Damage Threshold.

During Turn 4, Joel's fighter squadron remains in the same condition from last turn and once again he sets his sights on the Achilles DropShip. The DropShip is in the fighter squadron's front arc and this time the direction of attack is on the already damaged Left Side, but the range is long, meaning that the powerful ER medium laser bay is out of range. Joel fires the ER PPC bay this time, along with the LRM-15 w/Artemis and the light Gauss rifle bays. The total heat is 51, well within the squadron's 140 heat capacity. The ER PPC bay fails to hit, but Joel strikes the DropShip with the LRM-15 w/Artemis and light Gauss rifle bays.

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Joel decides to determine the light Gauss rifle bay first; he already knows to roll 2D6 on the 6 column of the Cluster Hits Table. He gets a result of 11; all six rifles strike the target! He then rolls a 7 on the Hit Location Table, and the controlling player of the DropShip applies the 48 Attack Value of the six rifles (AV Each of 8 times 6 light Gauss rifles) as a single block against the Left Wing, taking its 156 armor down to 108. As before, the 8 Maximum Damage Threshold of the light Gauss rifle bay means it cannot potentially cause a critical hit through exceeding the Damage Threshold of that location.

Joel then looks at the squadron record sheet to determine that there are three active fighters with an LRM-15 w/Artemis bay (in slots 1, 3 and 4). He rolls 2D6 with a result of 7, and consults the 3 column of the Cluster Hits Table; two fighters struck the target. He then adds the Attack Value of the LRM-15 w/Artemis from the fighters in slots 1 and 3, providing a left Attack Value of 24. Joel rolls for location and gets a 6: the Left Wing again! The controlling player reduces that location's 108 armor to 84. This time, however, the current Damage Threshold of the DropShip's Left Wing at the time the LRM-15 w/Artemis bay's Attack Value is assigned is 12 $[108 \text{ (current Armor Value)} \div 10 = 11]$. As 12 is the Maximum Damage Threshold of the LRM-15 w/Artemis bay, and that value exceeds the current Damage Threshold, Joel has a chance to cause a critical hit by exceeding the Damage Threshold of that location!

Attacks Against Fighter Squadrons

When a unit attacks a fighter squadron, the attack targets the squadron as a whole, though individual fighters take the damage. A single fighter in the squadron cannot be the target of an attack; the fighter damaged by a successful attack is determined randomly. Use all standard modifiers.

On a successful attack against a fighter squadron, roll 1D6 for each Damage Value grouping to determine which fighters are hit. Each grouping strikes a different, randomly determined fighter. Re-roll if the squadron does not have that number of fighters or if the result indicates a fighter destroyed in the current or a previous phase. Any excess damage from a single damage grouping is wasted. A fighter is considered destroyed for the scenario after its last box of armor is marked off.

The following additional rules apply to attacks made against fighter squadrons.

- Each fighter armor box is at capital-scale; cross off one box for every 10 full points of standard-scale damage. Total all the attacks to a single fighter by a single attacker, then divide by 10 and round normally (.5 rounded up). If a single attack is less than 5 points, no damage is applied. For example, a laser bay of three small lasers would inflict 1 point of damage $[9 \text{ (standard-scale damage)} \div 10 = .9, \text{ rounding up to } 1]$, while a small laser fired by itself would not inflict any damage $[3 \text{ (standard-scale damage)} \div 10 = .3, \text{ rounding down to } 0]$.
- The Aerospace Attack Direction Diagram (see p. 238, TW) has no effect on the damage applied to a fighter squadron, but does determine the location of possible critical and Fatal Threshold damage. See *Fighter Squadron Critical Hit Effects and Fatal Threshold Damage*, at right for more specific details on critical hits.
- Squadrons receive the +5 to-hit modifier when being attacked by capital-scale weapons and +3 when attacked by sub-capital weapons.

- Squadrons do not make Consciousness Rolls in the event of pilot hits.
- Squadrons do not take SI damage (though they do have an SI rating).
- Fighters in a squadron hit by heat-generating weaponry suffer damage instead of increased heat (for example, a fighter in a fighter squadron hit by a plasma cannon/plasma rifle suffers 1D6 points of damage rather than extra heat).

Fighter Squadron Critical Hits and Fatal Threshold Damage

Fighter squadron critical hits have a few unique effects, as described below. Additionally, fighters in squadrons are also subject to a Fatal Threshold (see *Fatal Threshold*, below).

Standard critical hits against a fighter squadron may occur in the following two ways:

- Any single attack that destroys 2 points of a fighter's armor (at least 15 points of standard-scale damage).
- A natural 12 result on the dice roll.

In both instances, determine possible critical hits using standard rules (see *Critical Hits*, p. 238, TW). As usual, all critical hits are determined and assigned immediately.

Fatal Threshold: The Fatal Threshold represents an individual fighter taking enough damage in a round to have lost all armor and SI from one facing, destroying the fighter. Fatal Threshold is determined after each individual attacking unit has finished its attack on a fighter squadron. Total the damage done to each fighter by the attacking unit. If the total damage is equal to or higher than the fighter's Fatal Threshold, the controlling player immediately rolls 2D6, adding a +1 for every full 2 points over the Fatal Threshold. On a result of 10+, the fighter is considered destroyed for the remainder of the scenario; when splitting a fighter squadron (see p. 32), for any fighter destroyed by a Fatal Threshold, roll 1D6 to randomly determine a facing and mark off all armor on that facing, reduce the fighters SI by half and assign 3 Engine hits.

Fighter Squadron Critical Hit Effects

A hit that inflicts critical damage has the following effects per the hit location roll made for the attack (see Hit Location Table, p. 237, TW). Squadron critical hits are against the individual fighter and may affect the fighter, the squadron or both.

Avionics: The flight computer of the fighter hit is damaged. This effect forces an immediate Control Roll for the squadron, applying all existing modifiers from the squadron, as well as +1 for every fighter that suffered a Control, Engine or Avionics critical hit in the same turn. If the roll fails, the squadron goes Out-of-Control (see p. 93, TW).

Bomb: A bomb hit destroys a randomly determined "Bomb" bay on that fighter's entry on the record sheet, rendering all bombs in that bay unusable.

Cargo: Same effects as *Total Warfare* (see p. 239, TW).

Control: The squadron must make an immediate Control Roll, applying all existing modifiers from the squadron, as well as +1 for every fighter that suffered a Control, Engine or Avionics critical in the same turn. If the roll fails, the squadron goes Out-of-Control (see p. 93, TW).

Crew: If a crew location takes a critical hit, cross off one pilot/crew status box. Each unit can sustain five Pilot/Crew hits; a sixth hit kills the pilot. If a pilot is killed, remove that fighter from the squadron; it is considered destroyed for the scenario.



Engine: Against a fighter, each engine hit reduces the unit's Safe Thrust by 2 (meaning that the controlling player must also recalculate the Maximum Thrust, multiplying the new Safe Thrust by 1.5 and rounding up). If the Safe Thrust of the fighter is lower than the current Safe Thrust of the squadron, this becomes the new Safe Thrust for the squadron. Each engine hit also generates 2 points of heat, reducing the total heat sinks available to the squadron. If the Safe Thrust value is reduced to 0, the unit cannot spend thrust and the heat penalty remains in effect. Three engine critical hits destroy the fighter's engine, permanently shutting down the unit (see *Shutdown Effects*, p. 161, *TW*).

A fighter with no thrust or a destroyed engine may be detached from the squadron using the Splitting a Fighter Squadron rules (see p. 32).

FCS: The fire-control system is damaged. For every FCS hit to the squadron, apply a -1 modifier on the Cluster Hits Table roll for weapon attacks. This reflects the damage done to individual fighters that affects their aim. If an individual fighter in the squadron takes 3 or more FCS hits, it may no longer fire; the fighter is not considered when determining how many active weapons are available for a roll on the Cluster Hits Table for an attack of any kind.

A fighter with no FCS may be detached from the squadron using the *Splitting a Fighter Squadron* rules (see p. 32).

Fuel: Roll 2D6. On a result of 10 or more, the fuel tank explodes and that unit is destroyed.

Gear: The landing gear is damaged. This critical hit has no effect on the squadron, but will affect the individual fighter when it attempts to land after the squadron is broken up.

Heat Sink: For a standard-scale attack, this critical hit destroys a heat sink, reducing the amount of heat the craft can dissipate by 1 (or by 2 if the unit mounts double heat sinks). This critical hit destroys 10 heat sinks if the attacker uses a capital-scale weapon.

Sensors: The unit's sensors are damaged. For every sensor hit to the squadron, apply a -1 modifier on the Cluster Hits Table roll for weapon attacks. This reflects the damage done to individual fighters that affects their aim. An individual fighter can only take a total of three sensor hits; re-roll any subsequent sensor hit.

Thruster: The attitude control thrusters on the indicated side are damaged. No effect on a fighter in a squadron. Full effects apply to a fighter that is removed from the squadron.

Weapon: If a Nose or Aft weapon bay is hit, all weapons in this arc cease functioning. The first hit on a Wing weapon bay halves all weapon bay Attack Values from the Wing arc. The second time the arc is hit, all Wing weapon bays cease functioning. For example, in Joel's squadron, a *Rusalka* takes a weapon critical hit to the Nose and one to the Right Wing. The Nose ER PPC and LRM w/Artemis bays are destroyed, while the ER medium laser and medium pulse laser bays have their numbers halved, from 4 and 2 to 2 and 1 respectively. If the *Rusalka* takes another weapon critical hit to either wing, then its Wing weapon bays will be destroyed.

With only five fighters left in his squadron, Joel finally takes the punishment for tangling with an Achilles-class DropShip, whose controlling player just rolled a great set of hits against his unit; Joel looks at his sheet to remind

himself that the Shade in Slot 1 has taken 8 points of capital-scale damage in previous turns.

The Achilles hit Joel's fighter squadron with a 2 ER PPC bay, 2 ER large laser bay, a single ER PPC bay (a natural 12 to-hit roll result), an AC/20/Gauss rifle bay, a 2 LRM-20 w/Artemis bay (another natural 12 to-hit roll result), and 2 medium pulse lasers. Though it won't matter for damage purposes, all the attacks struck the fighter squadron's right side.

The controlling player of the Achilles starts rolling locations. For the 2 ER PPC bay (with a capital-scale Attack Value of 2), he rolls a 1, and Joel assigns 2 points of the damage to the Shade in Slot 1 (the fighter was already down 8 armor squares). He marks off 2 points of capital-scale armor, and so his opponent immediately rolls for a critical hit, but barely gets one with a result of 8. He then rolls 2D6 again for a result of 7, comparing it to the Side Table of the Fighters portion of the Aerospace Units Hit Location Table, and comes up with Avionics; Joel checks off an Avionics hit in the Critical Damage portion of his fighter squadron record sheet.

The opponent rolls for the 2 LRM-20 w/Artemis bay (capital-scale Attack Value 3) with a result of 4; Joel marks off 3 armor points on that Rusalka. The opponent rolls 2D6 for a possible critical hit, but with a result of 3 doesn't get one.

Next, the opponent rolls for the 2 ER large laser bay (capital-scale Attack Value 2) with a result of 3; Joel marks off 2 armor points on that Rusalka. The opponent rolls 2D6 for a possible critical hit, but with a result of 5 doesn't get one.

For the single ER PPC bay (capital-scale Attack Value 2), the dice roll for fighter location is 4, so Joel marks off 2 points of damage on that Rusalka. The Achilles player gets two critical hit rolls (one for 2 points of damage and for natural 12). Luckily for Joel, the next dice roll result of 7 and 5 means no critical.

For the AC/20/Gauss rifle bay (capital-scale Attack Value 4), the opponent rolls a 4. Joel marks off 4 damage points on the Rusalka in that location. Once again, because that was more than 2 points of armor, the opponent rolls a possible critical hit, but with a 6 result comes up short. The Medium Pulse bay also hits the Rusalka in slot 4 for one point.

For the final hit of the 2 LRM-20 w/Artemis bay (capital-scale Attack Value 3), the opponent rolls a 1. Joel marks off the 2 remaining armor points of damage, but the Shade is destroyed, so the remaining point of damage from the 2 LRM-20w/Artemis bay is lost.

Finally, now that all damage from a single attacker has been resolved, Joel determines if any Fatal Thresholds have been exceeded. Both of the Rusalkas took damage but were not destroyed outright, and so Joel compares the damage inflicted against the Fatal Threshold of each fighter. The 2 damage points assigned to the Rusalka in Slot 3 doesn't equal or exceed its Fatal Threshold. However, the 10 damage points assigned to the Rusalka in Slot 4 exceed its Fatal Threshold of 6, and so Joel immediately makes a 2D6 roll and gets a result of 9. Since the damage to the Rusalka is a full 3 points more than the Fatal Threshold, that applies a +2 modifier to the die roll, making it an 11. The fighter is destroyed!

Despite the destruction of the Shade, the squadron still must make a Control Roll for the Avionics hit.

Wounded and down to three fighters, Joel's squadron still has some kick left in for a few more turns.

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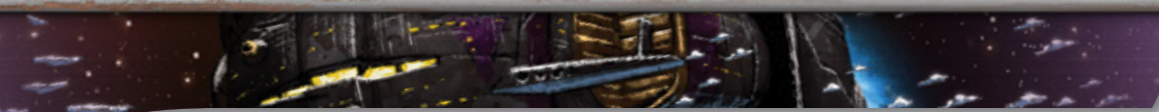
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SPLITTING A FIGHTER SQUADRON

The player controlling a fighter squadron can choose to break it into its constituent fighters and use the standard aerospace rules during the End Phase of any turn (provided all players agree), or at the end of a game. When the fighters are broken off from the squadron, or the squadron separates, each fighter operates as a Capital Fighter. To engage ground forces, the fighter must be converted to *Total Warfare* stats, and any critical damage takes effect per those rules at that time.

Alternatively, a single fighter can be removed from the squadron without breaking up the squadron. This is useful when one fighter is no longer operable.

FUEL CONSUMPTION (AEROSPACE UNITS)

In standard play, fuel is not taken into consideration for simplicity. However, the fuel reserves of aerospace units are often a critical factor in battle. Players can choose to account for fuel consumption in advanced-rules games with the following rules.

Tactical fuel efficiency is used during a scenario, while strategic fuel efficiency is used at all other times (in between scenarios). Both values are calculated at the start of a game.

The number of Fuel Points/Strategic Fuel Efficiency available to each unit depends on its type. The game statistics for aerospace fighters in the various Technical Readouts usually show the total fuel points available for a scenario. However, the Technical Readout game statistics for most aerospace units only show the tonnage devoted to fuel, not the corresponding fuel points/efficiency. Players therefore will need to use the appropriate construction rules to determine both the tactical and strategic fuel efficiencies. The Aerospace Fuel Table on page 186 of *TechManual* covers standard-rules aerospace units, while the Advanced Rules Aerospace Units Fuel Table (see p. 135) covers aerospace units detailed in this volume.

Fuel Critical Hits: A critical hit to the fuel tank does not result in an explosion if the unit is out of fuel.

Running Out of Fuel: In tactical fuel efficiency, running out of fuel does not destroy the fighter, but removes the fighter from the scenario (the fighter is removed during the End Phase of the turn in which it spent its last fuel point). Refueling (see p. 33) to stay in the scenario must occur while the fighter still has fuel points. In strategic fuel efficiency, it is up to the players to determine the exact details of what happens when a Small or Large Craft runs out of fuel. Normally a captain would never allow such a situation to arise, as it almost assures the death of the entire ship (and ships are designed for extensive distance travel, with plenty of fuel reserves). However, such a situation may occur in a larger campaign setting.

TACTICAL FUEL EFFICIENCY

Each Thrust Point up to a unit's Safe Thrust rating used during a scenario consumes 1 point of fuel. For each Thrust Point used between the Safe Thrust Rating and the Maximum Thrust Rating, 2 points of fuel are consumed.

Conventional Fighters: Conventional fighters mounting ICE engines operating in an atmospheric hex reduce fuel costs to 0.5 (per Safe Thrust point; do not round fractions) and 1 (per point of

thrust over Safe Thrust), representing the efficiency of their "air-breathing" engines.

Fusion-powered conventional fighters may, at the players' discretion, also benefit from increased fuel efficiency at low speeds (0.5 fuel points per point of thrust at or below Safe Thrust) but must still pay the full fuel cost for Thrust Points between the Safe Thrust Rating and the Maximum Thrust Rating.

Piloting Skill

The difference between a competent pilot and a good one is the ability to coax that little bit extra from his aerospace unit. Mostly this means being able to control the unit in difficult maneuvers, but it extends to more mundane—though no less significant—matters such as the consumption of fuel. A skilled pilot can eke out his fuel reserves, making efficient use of reaction mass to maneuver the unit.

At the start of each turn, the player may make a Control Roll for each unit he controls. Reduce the total fuel expenditure of the unit for the turn by the MoS (but not below more than half the normal fuel point cost, rounding up, and not below a single fuel point). Any fuel-consumption reductions not used in a turn are not carried over into future turns. If the Control Roll fails, add the MoF to the number of fuel points spent in that turn if the unit spent thrust.

A unit that does not spend thrust does not suffer this fuel-use "surcharge."

The controlling player of a fighter attempts to eke out some extra performance and makes a Control Roll, with a result of 7, which gives an MoS of 2. He may reduce the fuel point cost of any maneuvers the fighter makes by 2 points that turn. He spends 6 Thrust Points and would ordinarily have to expend fuel points, but his Piloting Skill reduces this to 4 points. Had he spent only 3 Thrust Points, the fuel cost would have been 2 points despite the 2-point reduction, as the fuel cost cannot be reduced below half the normal amount. Had he spent a single Thrust Point, the fighter would still need to expend 1 fuel point, as the amount of fuel used cannot be reduced below 1 point.

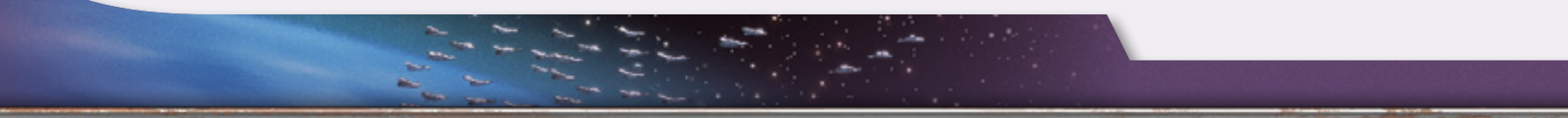
STRATEGIC FUEL EFFICIENCY

Large Craft crossing a planetary system (not in a combat situation in a scenario) use fuel more efficiently than when they are in combat. Fighters are not designed for travel through a planetary system and thus lack a strategic fuel use value. Small Craft are, however, equipped for such transits and thus have a strategic fuel use value.

The amount of fuel used in traveling is expressed in burn days. One burn day is equal to the number of tons of fuel used per day if traveling at 1G of acceleration. To determine the amount of fuel used during transit, multiply the burn day value by the number of days of travel and the G-rating. For example, a unit with a burn day value of 1.84 spends three days crossing a system at 2 Gs. This uses up 11.04 tons of fuel ($1.84 \times 3 \times 2$).

REFUELING

Units may refuel by landing on a friendly carrier and being refueled by the crews. This requires them to dock (and subsequently launch) according to the standard rules (see *Launching/Recovering Fighters/Small Craft*, p. 84, TW). The refueling action takes 1 space turn per ton of fuel loaded onto the fighter.





In-Space Refueling

Aerospace fighters may also carry out “in-space” refueling by docking with external fuel drogues, a faster and more efficient (but riskier) process. To do this, the fighter must match velocity and heading with a friendly carrier DropShip (any with fighter or Small Craft bays) and must be in the same hex. During the next turn, neither the fighter nor the DropShip may expend thrust or fire weapons. If either is forced to spend Thrust Points or make a Control Roll during the refueling process, the refueling fails automatically and the units must each make a test for collision per the Out-of-Control rules (see p. 92, *TW*). The pilot of the fighter must make a Control Roll during this turn. If the roll succeeds, the fighter may load a number of tons of fuel equal to 1+ the Margin of Success (but may not exceed its maximum fuel load). If the refueling Control Roll fails, no fuel is transferred between the DropShip and the fighter.

A Large Craft may simultaneously refuel one fighter for every six fighter/Small Craft cubicles it carries, to a maximum of six at any one time. Any attacks made against the Large Craft or fighter(s) during the refueling process may also cause damage to the other unit(s). Roll 1D6 for each successful attack. On a result of 1–5, it strikes the intended target. On a 6, it hits another target (determined randomly from the other fueling/tanker units in the hex) rather than the original target. For example, two weapons hit a DropShip that is refueling two fighters. The attacker rolls 1D6 for each attack, getting a 3 and a 6. The first attack hits the intended target (the DropShip), while the second hits one of the fighters, determined randomly.

Air-to-Air Refueling

Support units equipped with refueling drogues (see p. 247, *TM*) may also refuel fighters (one per drogue) in an atmospheric hex. To do this, each fighter must match velocity and heading with the tanker and must end the turn in the same hex, and must stay that way for a total of six ground turns; that is, both the tanker and the refueling aircraft must spend the same amount of thrust and end the turn in the same hex for six turns. During the End Phase of the sixth turn, the fighter pilot must make a Control Roll. If the roll succeeds, the fighter may load a number of tons of fuel equal to 1 + every 2 Margin of Success points (but may not exceed its maximum fuel load). If the refueling roll fails, no fuel is transferred between the tanker and the fighter; the two aerospace units are still “lined up,” however, and provided both units continue to spend the same thrust and end the turn in the same hex, they may continue to refuel. If the refueling roll failed by an MoF of 3 or greater, the six-turn count is lost; the fighter and tanker must spend another six turns lining up before the fighter can attempt to load any fuel.

Any attacks made against either unit during the refueling process may also cause damage to the other unit. Roll 1D6 for each successful attack. On a result of 1–3, it strikes the intended target. On a 4–6, it hits the other refueling target.

External Fuel Tanks

Fighters may carry fuel pods in lieu of bombs, with each tank holding 0.5 tons of fuel. Fuel from these pods is consumed before any fuel from internal tanks. If a fighter carrying external tanks sustains bomb critical damage, determine the

damaged bomb randomly, including any external fuel tanks. If the damaged bomb is an under-wing fuel pod, the fuel contained in that external tank is lost.

External fuel tanks may be dropped using the rules for *Dumping Bombs* (see p. 247, *TW*) in the case of emergency bomb dumps, or *Dumping Ammunition* (see p. 104, *TW*), in non-emergencies. Dumped fuel tanks—whether full or empty—do not inflict any damage when they land.

FUEL CONSUMPTION (ALL UNITS)

Players can choose to track fuel consumption of units not powered by fission, fusion or solar arrays. WarShips, DropShips, Small Craft, conventional fighters, aerospace fighters, Fixed-Wing Support Vehicles and Airships consume the fuel required to generate the thrust points used during a battle. JumpShips, Space Stations and Satellites consume fuel at a fixed rate, as described in their Technical Readout write-ups.

Other Support Vehicles participating in a battle or search and rescue operations (see *Search and Rescue*, p. 223, *CO*) are assumed to use fuel sufficient to travel 500 km. Those not involved in combat during the current Maintenance/Repair Cycle (see *Time*, p. 188, *CO*) will also consume fuel sufficient to travel 50 km. Once these units run out of fuel, they cannot participate in operations until refueled. Equipment on Support Vehicles (such as a Mobile Field Base or operating theater) cannot be used during a Maintenance/Repair Cycle if the vehicle has no fuel. If a Support Vehicle has insufficient fuel to travel this distance, then the fuel tank will be emptied and the vehicle cannot participate in operations until after the next scenario and Maintenance/Repair Cycle (see p. 188, *CO*). All fuel consumption rates are for Cruising movement rates; the rate of consumption is double at Flanking speed).

Combat Vehicles that require fuel consume an amount equal to 2 percent of their engine mass per scenario or search and rescue operation (see *Search and Rescue*, p. 223, *CO*), or 1 percent if not involved in combat during the current Maintenance/Repair Cycle. Their fuel tank capacity is 10 percent of the engine mass. Like Support Vehicles, Combat Vehicles will not be available for duty if they run out of fuel. Motorized and mechanized conventional infantry units burn up .25 tons of fuel per Maintenance/Repair Cycle (see *Time*, p. 188, *CO*)—which must be replenished for the next battle or they are relegated to operating as foot infantry.

Refueling requires 1 minute per 100 kg of fuel. It can be performed by the personnel assigned to the unit and does not require a Skill Check.

In-Flight Refueling: See above for space and atmospheric in-flight refueling.

Fuel Reserves: Players start a campaign with no fuel reserves apart from what is carried as cargo aboard the units that make up their battle group. Additional fuel can be acquired during play along with other supplies (see *Fuel (Optional)*, p. 202, *CO*).

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HARJEL

Discovered by Clan Diamond Shark on the planet Strato Domingo, the jellylike substance called HarJel possesses a number of remarkable properties. When properly refined, HarJel retains a liquid state until exposed to vacuum conditions or an electric current of a specific amplitude. The Clans first used HarJel to create self-sealing bulkheads on spacecraft, but quickly adapted it for use in battle armor.

The following rules apply to all Clan DropShips, JumpShips, WarShips and Space Stations. Like Clan CASE, HarJel does not take up any tonnage or space (or cost), but is automatically included with any such aerospace unit.

- Ignore the first two Crew critical hits.
- When a Cargo critical hit occurs, double the unit's SI when determining the amount of cargo damaged (see p. 239, *TW*).
- When a Fuel critical hit occurs, the unit only explodes on a 2D6 result of 12.

GRAVITATIONAL EFFECTS

Aerospace fighters, as well as other aerospace units, can sometimes generate enormous acceleration and tolerate the results better than their fragile crews. High G-forces can impede the performance of aerospace crews and even cause them to pass out. The following rules simulate those effects.

Protected and Unprotected: By default, civilian aerospace unit crew are considered to be "unprotected"; that is, they are not equipped with suitable seating, "G-suits," and other protective equipment to help them endure high G-forces. Crews of military aerospace units with Safe Thrust ratings of 4 or less are also considered unprotected. Fighter pilots always have G-force protective equipment, as do crews of military aerospace units with Safe Thrust ratings of 5 or higher.

Clan Aerospace Phenotype: For a Clan Aerospace Phenotype pilot, add 2 to all Secondary and Primary Threshold numbers.

THRESHOLDS

Two levels of effects are provided below. The Secondary Threshold is the point at which crew performance becomes impeded, with penalties to Piloting and Gunnery target numbers. The Primary Threshold is when a crewman blacks out (or multi-person crews black out in sufficient numbers to similarly paralyze crew operations).

Secondary Threshold: When the Secondary Threshold is met or exceeded during a unit's Movement Phase, the crew suffers a +1 modifier to all Piloting and Gunnery target numbers that turn (effective as soon as the Second Threshold is met). For every 3 additional turns spent beyond the Secondary Threshold, increase the target number modifier by a cumulative +1.

For protected crewmembers, the Secondary Threshold is 12 thrust points per turn (6 Gs). For unprotected crewmembers, the Secondary Threshold is 6 thrust points per turn (3 Gs).

Primary Threshold: When the Primary Threshold is met or exceeded during a unit's movement phase, the crew (or a sufficient

number of crewmembers) blacks out until the End Phase of the following game turn. While the crew is unconscious, the unit continues on the same heading and velocity at which it was moving when the crew blacked out.

For protected crewmembers, the Primary Threshold is 22 thrust points per turn (11Gs), while for unprotected crewmembers the Primary Threshold is 12 thrust points per turn (6 Gs).

INFANTRY VS. INFANTRY ACTIONS (EXPANDED)

The following rules modify the standard *Infantry Vs. Infantry Actions* rules (see p. 167, *TO:AR*) as they pertain to JumpShips, WarShips and Space Stations.

Docking and Grappling Aerospace units

When randomly rolling a location for where a docking occurs, the roll applies regardless of the defending unit type; docking never occurs on the "broad side" of a WarShip, as captains are never suicidal enough to try to maneuver themselves in front of that many guns.

Attacks From Attacking and Defending Aerospace Units

When determining size classifications, JumpShips, WarShips and Space Stations are considered the same classification, and all are a bigger classification than DropShips.

Attacking a Docked/Grappled Unit

If the aerospace unit in question is two classifications smaller (a Small Craft to a JumpShip/WarShip/Space Station), on a result of 6 the attack strikes that other aerospace unit; on a 1–5 result, it strikes the intended target.

Multiple Docking/Grappling

A WarShip/Space Station can only be docked/grappled by four attacking units at one time, but none in the same arc; re-roll the random arc location for the defending unit if that location is already occupied by another unit. In all instances, if an attacking unit breaks the dock/grapple, a new attacking unit can attempt to dock/grapple in a subsequent turn.

Standard Docking

A friendly aerospace unit can attempt to dock (see *Docking*, p. 54) to a friendly ship that is docked/grappled to another aerospace unit as part of a boarding action, but must apply a +2 modifier in addition to all the standard modifiers. In this case, the multiple docking/grappling limits above do not apply; a friendly aerospace unit can attempt to dock as many other friendly units as it has docking collars (as noted on the record sheet or Technical Readout write-up). If such a docking is successful, during the End Phase of the following turn the controlling player can add any additional personnel he chooses to the boarding action (as always, a new Marine Points Score will need to be generated; see *Marine Points Score*, p. 169, *TO:AR*).



BOARDING FOR DAMAGE INFANTRY VS. INFANTRY ACTION TABLE

2D6 Roll	Attacker to Defender Odds Ratio								
	1 to 3<	1 to 3	1 to 2	2 to 3	1 to 1	3 to 2	2 to 1	3 to 1	>3 to 1
2	E/0% (R)	55%/0% (R)	50%/0% (R)	40%/0% (R)	45%/0% (R)	40%/2% (R)	35%/3% (R)	30%/5% (R)	25%/20% (R)
3	55%/0% (R)	50%/0% (R)	45%/0% (R)	35%/0% (R)	40%/2% (R)	35%/3% (R)	30%/5%	25%/10%	20%/25%
4	50%/0% (R)	45%/0% (R)	40%/0% (R)	35%/2%	35%/3%	30%/5%	25%/10%	20%/15%	15%/30%
5	45%/0% (R)	40%/0%	35%/2%	30%/3%	30%/5%	25%/10%	20%/15%	15%/20%	10%/35%
6	40%/2%	35%/2%	30%/3%	25%/5%	25%/10%	20%/15%	15%/20%	10%/25%	10%/40%
7	35%/3%	30%/3%	25%/5%	25%/10%	20%/15%	15%/20%	10%/25%	10%/30%	5%/45%
8	35%/5%	30%/5%	25%/10%	20%/15%	15%/20%	10%/25%	10%/30%	5%/35%	5%/50%
9	30%/10%	25%/10%	20%/15%	15%/20%	10%/25%	10%/30%	5%/35%	5%/40% (1)	5%/55% (1)
10	25%/15%	20%/15%	15%/20%	10%/25%	10%/30%	5%/35% (1)	5%/40% (1)	5%/45% (1)	3%/60% (2)
11	20%/20%	15%/20%	10%/25% (1)	10%/30% (1)	5%/35% (1)	5%/40% (1)	5%/45% (2)	3%/50% (2)	2%/65% (3)
12	15%/20% (1)	10%/25% (1)	5%/30% (1)	5%/35% (2)	5%/40% (2)	5%/45% (2)	3%/50% (2)	2%/55% (3)	1%/70% (3)

Dropping Troops

If using the *Dropping Troops* rules (see p. 20), and ground forces are on the surface of an aerospace unit in the same location as an enemy docked/grappled aerospace unit, the troops and the enemy unit may make weapon attacks against each other (see p. 108). Enemy infantry may also swarm such an aerospace unit, using the *Swarm Attacks* rules (see p. 220, *TW*).

Friendly ground forces in the same location as a docked/grappled aerospace unit may mount (or dismount) using the *Carrying Units* rules (see p. 89, *TW*).

Finally, any infantry that have successfully landed on an aerospace unit may be added to the appropriate Marine Points Score in the following space turn (a new Marine Points Score and ratio will then need to be determined; see *Marine Points Score*, p. 169, *TO:AR*).

Size of Defending Aerospace Unit Modifier

Like buildings (see *Building Modifier*, p. 171, *TO:AR*), aerospace units cover a vast range of sizes, from 100-ton Small Craft to 15,000-ton DropShips to million-ton WarShips and Space Stations. In reality, clearing out a million-ton, kilometer-and-a-half-long space station—where the defenders know every access hatch and crawl space—could take days, if not weeks. To reflect a defender's intimate knowledge of such large aerospace units while keeping these events within a time frame that allows them to play out on a game table with other aerospace actions, the following rule equates "time" to a defender's bonus for ease of play.

After determining the defender Marine Point Score—as noted above—multiply that value by the following: a .1 modifier for every 100,000 tons after the first 100,000 tons of the defending unit. Round all fractions up.

Military Vs. Civilian: Military aerospace units are designed to hamper boarding actions. As such, regardless of its size, a military aerospace unit provides a .1 defending modifier applied to the ratio, before rounding. The unit's record sheet (or Technical Readout write-up) should include an indicator of whether a unit is a civilian or military craft; if it is ambiguous, the playing group should determine the unit's status (even if through a die roll) before play begins.

Structural Integrity Damage

After every Boarding Action Roll, another 2D6 roll should be made. On a result of 12, the unit takes damage. For JumpShips and Space Stations, in place of SI damage, apply the damage as a single 10-point Damage Value grouping to a randomly determined facing, rolling 1D6 and using the Random Facing Table (see p. 86), then 2D6 to determine the specific location damaged (per the Aerospace Hit Location Table, p. 237, *TW*).

BOARDING FOR DAMAGE (OPTIONAL)

When a hostile force boards an enemy unit, it is not always with the purpose of capturing the unit (the assumption of the rules as presented in *Tactical Operations*). Many times a smaller force will board with the express purpose of disabling the enemy unit. A boarding for damage assault is focused on damaging critical components of the boarded unit, with the assault team attempting to avoid an upfront confrontation with the defending crew.

Once both sides have declared their initial Marine Point Score (see p. 169, *TO:AR*), the attacking player must immediately declare he is boarding with intent to damage. He then triples his Marine Point Score solely for the purpose of determining which column of the Boarding For Damage Infantry Vs. Infantry Action Table (see above) to roll on. The Infantry Vs. Infantry Action Roll (see p. 172, *TO:AR*) is conducted normally, with the standard rules for outside reinforcements, withdrawal and structural damage. Results of the die roll, however, are compared to the Boarding For Damage Infantry Vs. Infantry Action Table (see above). Damage to attacker and defender is determined the same as a standard infantry vs. infantry action. However, instead of a possible special result of (P) for Partial Control, the attacker can potentially get a special result of (1), (2) or (3), which indicates how many critical hit rolls they can make. These critical hit rolls only apply if the infantry action successfully inflicts a critical hit per the standard rules for the type of unit in question.

If the attacker is attempting to damage a specific component (Engines, CIC and so on), then he only multiplies his actual Marine Points Score by 2 instead of 3. However, if the attacker receives a chance for a critical hit roll and then rolls a

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critical hit, the targeted component is damaged per normal critical hit rules.

Note: While most commonly seen in space combat, boarding for damage is applicable with all other boardable units, as described in *Infantry Vs Infantry Actions* (see p. 167, *TO:AR*). If using these rules in a building, each successful critical hit does 10 percent of the base CF in damage to Standard buildings, 5 percent to Hardened buildings and 1 percent to Castles Brian. A single hex can be targeted for collapse if the attacker gets 2 critical hits in one turn for a Standard building, 4 critical hits in one turn for a Hardened building and 8 critical hits in one turn for a Castle Brian.

Bill sends a marine strike team to board his opponent Hank's Vengeance-class DropShip; he wants to make sure Hank's fighters can't get away. Determining his Marine Point Scores using the Infantry vs Infantry rules in Tactical Operations, Bill has an MPS of 16 from his 8 marines in medium Inner Sphere battle armor and Hank has pulled all his aerospace technicians and added ten marines for a total MPS of 20.

With the MPS revealed for both sides, Bill now declares he will be Boarding for Damage with a target of the engines of the Vengeance. Because he is trying for a specific target he only multiplies his MPS by 2 for a total of 36 MPS. Comparing the values, Bill gets a 1.8 which means he will roll on the 3 to 2 column. Rolling a 10, Bill just ekes out a critical hit roll. A die roll of 8 gives him one critical. Because this was a targeted attack, the critical is automatically assigned to the engine. In the next turn, Bill can try for another critical or withdraw.

If Bill had chosen to just inflict random damage, his MPS would have been multiplied by 3 for a total of 48, and he would've rolled on the 2 to 1 column instead of the 3 to 2.

ORBITAL OBSTACLES

While space is vast, orbital battlefields—like their ground equivalents—often take place in areas of difficult terrain, either for tactical reasons or because of the amount of wreckage strewn across the battlefield.

ASTEROIDS

Some battles take place in or near asteroid fields. The following rules allow for a dramatic version to be included in games (though in reality, asteroids are so widely spaced they'd scarcely pose a navigational threat, let alone provide a tactical battlefield). These rocks, massing from a few grams to hundreds or even thousands of tons, can be a boon or a curse in space combat. Most DropShips and JumpShips carry a series of small guns (usually lasers or PPCs) used to destroy small pieces of debris a few centimeters across, and of course WarShip armaments cover this concept. However, all units, even the most heavily armored WarShips, must steer around large obstacles or else risk damage.

To add an asteroid field to the game, place asteroid counters on the map before play begins (players can use any type of token to represent asteroids). Players should agree on a system for placing the asteroid counters and determine the number of counters to be placed, if that number is not specified in the scenario set-up rules. For purposes of determining the amount of damage an

asteroid can withstand (see below), each asteroid should be designated as small, medium or large.

Asteroids may be stationary or mobile. Mobile asteroids may all move in the same direction at the same velocity, or each asteroid can move at a unique heading and velocity. To give each asteroid a unique movement, roll 1D6 for velocity and 1D6 for direction using the Dive-Bombing Scatter Diagram (see p. 245, *TW*). If an asteroid moves off the edge of the playing area or enters a space/atmosphere interface hex, remove it from play. If the players want to keep the playing area crowded with asteroids, each one that moves off the map can be replaced by a new asteroid (with the same heading and velocity as the exiting one) that enters the map from the opposite edge at the start of the following turn. If using *Advanced Initiative* (see p. 51), make a single Initiative roll for the entire field, applying a -6 penalty. If using regular Initiative, move mobile asteroids at the start of the Movement Phase (Aerospace) before any other units.

A unit may enter or end its movement in a hex occupied by an asteroid, but risks colliding with the asteroid. When a unit enters an asteroid hex or an asteroid enters the same hex as a unit, make a Control Roll with a +1 modifier for fighters and Small Craft and a +2 modifier for Large Craft (and any modifiers for critical damage or thrust). A successful roll means the unit and asteroid miss each other.

On a failed roll, the unit and the asteroid collide. The unit sustains a number of points of capital-scale damage equal to 1D6 x MoF. Regardless of whether the unit moved into the asteroid hex or the asteroid moved into the unit's hex, apply the damage to the facing of the unit corresponding to the hexside through which the unit or asteroid entered the target hex.

Asteroids suffer 1 point of damage for every 10,000 tons of the colliding unit's mass (round down). For example, if an *Aegis*-class cruiser collides with an asteroid, the asteroid sustains 74 points of damage (745,000 tons ÷ 10,000, rounded down). Capital-scale weapon fire can also damage or destroy an asteroid. Standard-scale weapons can damage asteroids if fired en masse (in bays), but individual standard-scale weapons are ineffective at damaging asteroids and only cause 1 point of damage on a 2D6 roll that is less than the weapon's Damage Value (5 for a medium laser, 10 for a PPC, 15 for a Gauss rifle and so on).

Each general size category of asteroid can sustain different amounts of damage before being destroyed. The players should agree on the number of capital-scale points each size asteroid can withstand in the current game, but we suggest that small asteroids may sustain no more than 200 points of damage; medium-sized asteroids, 600 points of damage; and large asteroids, 1,200 points of damage before being destroyed.

If two or more asteroids end their movement in the same hex, they may collide (roll 1D6; on a result of 6, a collision occurs). Where an asteroid collision occurs, if one is smaller than the other (or has more damage points), the smaller asteroid is destroyed. If the asteroids are the same size, determine the survivor randomly. Surviving asteroids take no damage and continue moving in the same direction and heading as before the impact.

A hex occupied by an asteroid blocks line of sight.

DEBRIS

With the following exception, combat debris—the shells of destroyed Large Craft—uses the asteroid rules. Treat debris from DropShips as a small asteroid, and debris from JumpShips,

WarShips and Space Stations as a medium asteroid. Fighters, Small Craft and Satellites never leave debris when they are destroyed.

When a DropShip, JumpShip or WarShip is destroyed, replace the unit with a debris counter. The debris has the same velocity and heading as the destroyed unit did before its demise. For attacks that trace line of sight through a hex containing a debris counter, modify the to-hit number by +1 for a small debris counter and +2 for a large debris counter. Apply these modifiers for each debris counter through which line of sight passes. These modifiers are cumulative (the more debris in a hex, the higher the modifier).

MOVEMENT AND WEAPON RESOLUTION DICE

As with the Movement and Weapon Resolution Dice Tips and Suggestions from *Tactical Operations* (see pp. 25 and 107, TO:AR, respectively), dice can help speed up and simplify game play for aerospace movement and combat. While the suggestions for using Weapon Resolution Dice from *Tactical Operations* applies to aerospace combat as written for ground combat, the differences in movement for aerospace units means a slightly different set of suggestions when using movement dice with aerospace movement.

Once a player has finished moving an aerospace unit, place a movement die along the appropriate hexside to indicate its heading; if using Advanced Aerospace Movement (see p. 52), place the die along the appropriate hexside to indicate the vector with the highest velocity.

Additionally, players can use the numerical value on their dice to indicate what type of movement was used: Safe Thrust = 1, Maximum Thrust = 2, Evading using Safe Thrust = 3, Evading using Maximum Thrust = 4, ECHO using Safe Thrust = 5 and ECHO using Maximum thrust = 6 (see *Emergency Combat Heading Operation (DropShips and WarShips Only)*, p. 101).

Finally, players should use two different colored dice and rotate those colors every turn. For example Turn 1 would be blue dice, Turn 2 red dice, Turn 3 blue dice once again, and so on. Unlike ground movement, where all dice are removed from the playing area during the End Phase, aerospace units retain their velocity from turn to turn and so the dice remain on the table heading into the following turn. Using different colors in alternating turns will make it easier for players to see which units have or have not yet moved at any given moment during the Movement Phase (Aerospace).



RANDOM AEROSPACE ASSIGNMENT TABLES

Unlike the 'Mech tables, the random aerospace assignment tables in *TW* are generic. The following tables provide faction-specific aerospace units to work hand-in-hand when quickly generating scenarios.

The following annotations are in addition to those mentioned on page 266 of *TW*: (3039) is *Technical Readout: 3039*; (3075) is *Technical Readout: 3075*.

Unlike the *Total Warfare* tables, which only display the base configuration of a design as shown in a Technical Readout, many of the aerospace units listed below are variants of a given chassis. For ease of use (and because many of these designs are not the stock designs presented in a Technical Readout), the tables have been annotated to show which record sheet books (instead of Technical Readouts) contain which units: (3039) is *Record Sheets: 3039*; (3050U) is either *Record Sheets: 3050 Upgrade, Star League and Clan* or *Record Sheets: 3050 Upgrade, Inner Sphere*; (3055U) is *Record Sheets: 3055 Upgrade*; (3057) is *Record Sheets 3057, Revised*; (3058U) is *Record Sheets: 3058 Upgrade*; (3060) is *Record Sheets: 3060*; (3067) is *Record Sheets: 3067*; (3085-PP) is *Record Sheets: 3085 Project Phoenix*; (3075) is *Record Sheets: 3075*. All these record sheet books can be purchased in PDF format for ease of printing from <https://store.catalystgamelabs.com>.



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RANDOM AEROSPACE ASSIGNMENT TABLE: INNER SPHERE 1

Light Aerospace Fighters				
2D6	House Kurita	House Davion	House Liao	House Marik
2	S-7 Sai [40] (3039)	TR-7 Thrush [25] (3039)	SB-27 Sabre [25] (3075)	SYD-Z1 Seydlitz [20] (3039)
3	THK-63 Tomahawk [40] (3050U)	DARO-1B Dagger [45] (3067)	F-11-RR Cheetah [25] (3039)	CNT-1D Centurion [30] (3075)
4	SYD-Z1 Seydlitz [20] (3039)	SYD-Z1 Seydlitz [20] (3039)	SPR-H5 Sparrowhawk [30] (3039)	F-11-R Cheetah [25] (3039)
5	SB-27 Sabre [25] (3075)	SYD-Z2A Seydlitz [20] (3039)	F-11-R Cheetah [25] (3039)	TR-7 Thrush [25] (3039)
6	SL-21 Sholagar [35] (3039)	SPR-6D Sparrowhawk [30] (3039)	TR-7 Thrush [25] (3039)	F-12-S Cheetah [25] (3039)
7	SL-21 Sholagar [35] (3039)	SPR-H5 Sparrowhawk [30] (3039)	TR-7 Thrush [25] (3039)	F-11-RR Cheetah [25] (3039)
8	SPR-SHK Sparrowhawk [30] (3039)	CNT-1D Centurion [30] (3075)	TR-8 Thrush [25] (3039)	F-14-S Cheetah [25] (3039)
9	SL-21L Sholagar [35] (3039)	DARO-1 Dagger [45] (3067)*	F-10 Cheetah [25] (3039)	F-12-S Cheetah [25] (3039)
10	F-10 Cheetah [25] (3039)	DARO-1A Dagger [45] (3067)*	SPR-H5 Sparrowhawk [30] (3039)	F-10 Cheetah [25] (3039)
11	S-4 Sai [40] (3039)	SB-27 Sabre [25] (3075)	CNT-1D Centurion [30] (3075)	F-10 Cheetah [25] (3039)
12	S-7 Sai [40] (3039)	SL-21L Sholagar [35] (3039)	F-11-RR Cheetah [25] (3039)	SB-27 Sabre [25] (3075)

Medium Aerospace Fighters				
2D6	House Kurita	House Davion	House Liao	House Marik
2	SL-17R Shilone [65] (3039)	CSR-V14 Corsair [50] (3039)	LTN-G15 Lightning [50] (3075)	CSR-V12M Corsair [50] (3039)
3	LTN-G15 Lightning [50] (3075)	TR-10 Transit [50] (3039)	CSR-V12 Corsair [50] (3039)	GTHA-500 Gotha [60] (3050U)
4	LTN-G15 Lightning [50] (3075)	CSR-V20 Corsair [50] (3039)	CMT-3T Troika [65] (3067)	F-92 Stingray [60] (3039)
5	LCF-R16KR Lucifer II [65] (3039)	F-90 Stingray [60] (3039)	F-92 Stingray [60] (3039)	F-92 Stingray [60] (3039)
6	LCF-R16K Lucifer II [65] (3039)	LTN-G15 Lightning [50] (3075)	TR-11 Transit [50] (3039)	F-90 Stingray [60] (3039)
7	SL-17 Shilone [65] (3039)	CSR-V12 Corsair [50] (3039)	TR-10 Transit [50] (3039)	F-94 Stingray [60] (3039)
8	SL-17R Shilone [65] (3039)	F-92 Stingray [60] (3039)	TR-11 Transit [50] (3039)	F-94 Stingray [60] (3039)
9	MIK-O Tatsu [70] (3067)*	HCT-213 Hellcat [60] (3075)	F-94 Stingray [60] (3039)	IRN-SD1 Ironsides [65] (3050U)
10	CSR-V12 Corsair [50] (3039)	LCF-R15 Lucifer [65] (3039)	DFC-O Defiance [55] (3067)*	LTN-G15 Lightning [50] (3075)
11	SL-17AC Shilone [65] (3039)	LCF-R20 Lucifer [65] (3039)	DFC-O Defiance [55] (3067)*	GTHA-500 Gotha [60] (3050U)
12	ON-1 Oni [55] (3067)	HCT-212 Hellcat II [50] (3050U)	LTN-16L Lightning [50] (3075)	TR-10 Transit [50] (3039)

Heavy Aerospace Fighters				
2D6	House Kurita	House Davion	House Liao	House Marik
2	HMR-HD Hammerhead [75] (3050U)	SL-15R Slayer [80] (3039)	TRB-D36 Thunderbird [100] (3075)	TRB-D36 Thunderbird [100] (3075)
3	HMR-HD Hammerhead [75] (3050U)	CHP-W7 Chippewa [90] (3039)	CHP-W5 Chippewa [90] (3039)	CHP-W5 Chippewa [90] (3039)
4	STU-K5 Stuka [100] (3039)	CHP-W10 Chippewa [90] (3039)	EGL-R6 Eagle [75] (3075)	HMR-HD Hammerhead [75] (3050U)
5	F-100b Riever [100] (3039)	TRB-D36 Thunderbird [100] (3075)	TR-13A Transgressor [75] (3039)	AHB-443 Ahab [90] (3050U)
6	EGL-R6 Eagle [75] (3075)	EGL-R6 Eagle [75] (3075)	TR-13 Transgressor [75] (3039)	EGL-R5 Eagle [75] (3039)
7	SL-15 Slayer [80] (3039)	STU-K5 Stuka [100] (3039)	TR-13 Transgressor [75] (3039)	F-100a Riever [100] (3039)
8	SL-15R Slayer [80] (3039)	STU-D6 Stuka [100] (3039)	TR-16 Transgressor [75] (3039)	F-700a Riever [100] (3039)
9	F-700b Riever [100] (3039)	TR-13 Transgressor [75] (3039)	F-100a Riever [100] (3039)	F-700a Riever [100] (3039)
10	SL-15R Slayer [80] (3039)	EGL-R6 Eagle [75] (3075)	TR-16 Transgressor [75] (3039)	TR-13A Transgressor [75] (3039)
11	TRB-D5 Thunderbird [100] (3039)	TRB-D36 Thunderbird [100] (3075)	F-100a Riever [100] (3039)	F-100b Riever [100] (3039)
12	SL-15K Slayer [80] (3039)	STU-D7 Stuka [100] (3039)	F-100a Riever [100] (3039)	SHV-O Shiva [85] (3067)*

DropShips				
2D6	House Kurita	House Davion	House Liao	House Marik
2	Nagumo (3057) ^A	Overlord-A3 (3067) ^S	Achilles (3057) ^A	Kuan Ti (3057) ^A
3	Condor (3057) ^A	Vengeance (3057) ^A	Avenger (3057) ^A	Intruder (3057) ^S
4	Intruder (3057) ^S	Conquistador (3067) ^A	Leopard CV (3057) ^A	Hamilcar (3057) ^A
5	Leopard CV (3057) ^A	Avenger (3057) ^A	Overlord (3057) ^S	Fury (3057) ^A
6	Excalibur (3057) ^S	Union (3057) ^S	Triumph (3057) ^A	Leopard (3057) ^A
7	Union (3057) ^S	Overlord (3057) ^S	Union (3057) ^S	Union (3057) ^S
8	Leopard (3057) ^A	Triumph (3057) ^A	Leopard (3057) ^A	Leopard CV (3057) ^A
9	Overlord (3057) ^S	Leopard (3057) ^A	Lung Wang (3057) ^S	Condor (3057) ^A
10	Triumph (3057) ^A	Leopard CV (3057) ^A	Excalibur (3057) ^S	Gazelle (3057) ^A
11	Okinawa (3057) ^S	Fortress (3057) ^S	Kuan Ti (3057) ^A	Merlin (3067) ^S
12	Nekohono'o (3067) ^S	Hercules (3057) ^S	Kuan Ti (3057) ^A	Hannibal (3057) ^A

*OmniFighter, ^AAerodyne, ^SSpheroid



RANDOM AEROSPACE ASSIGNMENT TABLE: INNER SPHERE 2

Light Aerospace Fighters				
2D6	House Steiner	ComStar	Word of Blake	Periphery
2	SYD-Z1 Seydlitz [20] (3039)	ZRO-115 Zero [35] (3050U)	RGU-133F Rogue [40] (3050U)	SPR-6D Sparrowhawk [30] (3039)
3	SB-27 Sabre [25] (3075)	ZRO-114 Zero [35] (3050U)	S-HA-OA Shade [35] (3075)*	SB-27 Sabre [25] (3075)
4	SYD-Z3a Seydlitz [20] (3039)	SB-27 Sabre [25] (3075)	ZRO-114 Zero [35] (3050U)	SPR-H5 Sparrowhawk [30] (3039)
5	SB-27 Sabre [25] (3075)	SPD-502 Spad [30] (3050U)	SPD-502 Spad [30] (3050U)	F-10 Cheetah [25] (3039)
6	SYD-Z3 Seydlitz [20] (3039)	SWF-606 Swift [25] (3050U)	SW-606 Swift [25] (3050U)	SB-27 Sabre [25] (3075)
7	SYD-Z2 Seydlitz [20] (3039)	TRN-3T Trident [20] (3050U)	TRN-3T Trident [20] (3050U)	CNT-1D Centurion [30] (3075)
8	CNT-1D Centurion [30] (3075)	TRN-3T Trident [20] (3050U)	THK-63 Tomahawk [45] (3050U)	SYD-21 Seydlitz [20] (3039)
9	SYD-Z2a Seydlitz [20] (3039)	THK-63 Tomahawk [45] (3050U)	F-12-S Cheetah [25] (3039)	TR-7 Thrush [25] (3039)
10	SPR-5H Sparrowhawk [30] (3039)	THK-63 Tomahawk [45] (3050U)	S-HA-O Shade [35] (3075)*	SB-27 Sabre [25] (3075)
11	SYD-Z4 Seydlitz [20] (3039)	RGU-133F Rogue [40] (3050U)	RGU-133E Rogue [40] (3050U)	CNT-1D Centurion [30] (3075)
12	F-10 Cheetah [25] (3039)	ZRO-114 Zero [35] (3050U)	THK-63 Tomahawk [45] (3050U)	SYD-22 Seydlitz [20] (3039)

Medium Aerospace Fighters				
2D6	House Steiner	ComStar	Word of Blake	Periphery
2	F-90S Stingray [60] (3039)	IRN-SD1 Ironsides [65] (3050U)	F-92 Stingray [60] (3039)	SL-17 Shilone [65] (3039)
3	HCT-212 Hellcat II [50] (3050U)	HCT-215 Hellcat II [50] (3050U)	IRN-SD3 Ironsides [65] (3050U)	CSR-V12M Corsair [50] (3039)
4	HCT-213 Hellcat [60] (3075)	F-92 Stingray [60] (3039)	S-RSL-O Rusalka [65] (3075)*	CMT-3T Troika [65] (3067)
5	F-92 Stingray [60] (3039)	IRN-SD1 Ironsides [65] (3050U)	DFC-O Defiance [55] (3067)*	LTN-G15 Lightning [50] (3075)
6	LCF-R16 Lucifer [65] (3039)	IRN-SD1 Ironsides [65] (3050U)	HCT-213B Hellcat II [50] (3050U)	CSR-V12 Corsair [50] (3039)
7	LCF-R15 Lucifer [65] (3039)	HCT-213B Hellcat II [50] (3050U)	HCT-214 Hellcat II [50] (3050U)	HCT-213 Hellcat [60] (3075)
8	CSR-V-20 Corsair [50] (3039)	GTHA-500 Gotha [60] (3050U)	GTHA-500 Gotha [60] (3050U)	LCF-R15 Lucifer [65] (3039)
9	LCF-R20 Lucifer [65] (3039)	GTHA-500 Gotha [60] (3050U)	F-94 Stingray [60] (3039)	LTN-G15 Lightning [50] (3075)
10	CSR-V-12 Corsair [50] (3039)	HCT-214 Hellcat II [50] (3050U)	S-RSL-OA Rusalka [65] (3075)*	F-90 Stingray [60] (3039)
11	LTN-G15 Lightning [50] (3075)	LTN-G15 Lightning [50] (3075)	LTN-G15 Lightning [50] (3075)	TR-10 Transit [50] (3039)
12	SL-27 Samurai [50] (3039)	F-94 Stingray [60] (3039)	LX-2 Lancer [50] (3039)	HCT-213 Hellcat [60] (3075)

Heavy Aerospace Fighters				
2D6	House Steiner	ComStar	Word of Blake	Periphery
2	EGL-R6 Eagle [75] (3075)	HSCL-1-O Huscarl [75] (3067)*	SHV-O Shiva [85] (3067)*	STU-K15 Stuka [100] (3039)
3	F-100 Riever [100] (3039)	HMR-HD Hammerhead [75] (3050U)	S-STR-OA Striga [85] (3075)*	CHP-10 Chippewa [90] (3039)
4	CHP-W5 Chippewa [90] (3039)	RPR-101 Rapier [85] (3050U)	AHB-643 Ahab [90] (3050U)	F-100 Riever [100] (3039)
5	STU-D6 Stuka [100] (3039)	HMR-HE Hammerhead [75] (3050U)	RPR-100 Rapier [85] (3050U)	CHP-W5 Chippewa [90] (3039)
6	CHP-W5 Chippewa [90] (3039)	AHB-443 Ahab [90] (3050U)	RPR-100 Rapier [85] (3050U)	TRB-D36 Thunderbird [100] (3075)
7	CHP-W7 Chippewa [90] (3039)	HMR-HE Hammerhead [75] (3050U)	HMR-HF Hammerhead [75] (3050U)	EGL-R6 Eagle [75] (3075)
8	EST-O Eisensturm [95] (3067)*	EGL-R6 Eagle [75] (3075)	AHB-443 Ahab [90] (3050U)	TRB-D36 Thunderbird [100] (3075)
9	STU-K5 Stuka [100] (3039)	AHB-443 Ahab [90] (3050U)	AHB-443 Ahab [90] (3050U)	EGL-R6 Eagle [75] (3075)
10	RPR-102 Rapier [85] (3050U)	EGL-R6 Eagle [75] (3075)	S-STR-O Striga [85] (3075)*	STU-K5 Stuka [100] (3039)
11	EST-O Eisensturm [95] (3067)*	RPR-100 Rapier [85] (3050U)	F-700 Riever [100] (3039)	SL-15 Slayer [80] (3039)
12	TRB-D36 Thunderbird [100] (3075)	AHB-443 Ahab [90] (3050U)	F-700a Riever [100] (3039)	TR-13 Transgressor [75] (3039)

DropShips				
2D6	House Steiner	ComStar	Word of Blake	Periphery
2	Claymore (3057) ^A	Vengeance (3057) ^A	Hamilcar (3057) ^A	Seeker (3057) ^S
3	Avenger (3057) ^A	Condor (3057) ^A	Overlord (3057) ^S	Leopard CV (3057) ^A
4	Excalibur (3057) ^S	Union (3057) ^S	Overlord (3057) ^S	Seeker (3057) ^S
5	Hercules (3057) ^S	Overlord (3057) ^S	Assault Triumph (3067) ^A	Mule (3057) ^S
6	Leopard CV (3057) ^A	Leopard CV (3057) ^A	Leopard CV (3057) ^A	Leopard (3057) ^A
7	Union (3057) ^S	Union (3057) ^S	Union (3057) ^S	Union (3057) ^S
8	Leopard (3057) ^A	Leopard (3057) ^A	Leopard (3057) ^A	Condor (3057) ^A
9	Overlord (3057) ^S	Model 96 'Elephant' (3075) ^S	Assault Triumph (3067) ^A	Triumph (3057) ^A
10	Intruder (3057) ^S	Triumph (3057) ^A	Fury (3057) ^A	Overlord (3057) ^S
11	Union-X (3067) ^S	Gazelle (3057) ^A	Merlin (3067) ^S	Fury (3057) ^A
12	Fortress (3057) ^S	Fortress (3057) ^S	Hannibal (3057) ^A	Intruder (3057) ^S

*OmniFighter, ^AAerodyne, ^SSpheroid

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2D6	Outworlds Alliance	Free Rasalhague Republic	Magistracy of Canopus	Marian Hegemony
2	Chaeronea [25] (3067)	SB-29 Sabre [25] (3075)	SPR-6D Sparrowhawk [30] (3039)	SB-27 Sabre [25] (3075)
3	TRN-T3 Trident [20] (3050U)	SYD-Z3A Seydlitz [20] (3039)	SB-27 Sabre [25] (3075)	SYD-22 Seydlitz [20] (3039)
4	SYD-Z2A Seydlitz [20] (3039)	SYD-Z4 Seydlitz [20] (3039)	SPR-H5 Sparrowhawk [30] (3039)	TR-7 Thrush [25] (3039)
5	CNT-1D Centurion [30] (3075)	SB-27 Sabre [25] (3075)	F-10 Cheetah [25] (3039)	SYD-21 Seydlitz [20] (3039)
6	SB-27 Sabre [25] (3075)	SL-21L Sholagar [35] (3039)	SB-27 Sabre [25] (3075)	F-10 Cheetah [25] (3039)
7	SYD-Z4 Seydlitz [20] (3039)	SL-21L Sholagar [35] (3039)	CNT-1D Centurion [30] (3075)	SB-27 Sabre [25] (3075)
8	SPR-H5 Sparrowhawk [30] (3039)	CNT-1D Centurion [30] (3057)	SYD-21 Seydlitz [20] (3039)	CNT-1D Centurion [30] (3075)
9	SL-21 Sholagar [35] (3039)	SL-22 Sholagar [35] (3039)	TR-7 Thrush [25] (3039)	SPR-H5 Sparrowhawk [30] (3039)
10	CRX-O Corax [30] (3067)*	F-11 Cheetah [25] (3039)	SL-21 Sholagar [35] (3039)	SL-21 Sholagar [35] (3039)
11	SPD-502 Spad [30] (3050U)	SYD-Z4 Seydlitz [20] (3039)	CNT-1D Centurion [30] (3075)	CNT-1D Centurion [30] (3075)
12	Bashkir Prime [20] (3055U)*	S-4 Sai [40] (3039)	SYD-22 Seydlitz [20] (3039)	SPR-6D Sparrowhawk [30] (3039)

Medium Aerospace Fighters				
2D6	Outworlds Alliance	Free Rasalhague Republic	Magistracy of Canopus	Marian Hegemony
2	IRN-SD1 Ironsides [65] (3050U)	SL-17AC Shilone [65] (3039)	DFC-O Defiance [55] (3067)*	LTN-G15 Lightning [50] (3075)
3	Turk Prime [50] (3055U)*	SL-25 Samurai [50] (3039)	CSR-V12M Corsair [50] (3039)	TR-10 Transit [50] (3039)
4	LCF-R15 Lucifer [65] (3039)	SL-17R Shilone [65] (3039)	LTN-G15 Lightning [50] (3075)	HCT-213 Hellcat [60] (3075)
5	SL-17R Shilone [65] (3039)	LCF-R16K Lucifer II [65] (3039)	CMT-3U Troika [65] (3067)	LTN-G15 Lightning [50] (3075)
6	SL-17R Shilone [65] (3039)	LCF-R16KR Lucifer II [65] (3039)	CMT-3T Troika [65] (3067)	CSR-V12 Corsair [50] (3039)
7	LTN-16O Lightning [50] (3075)	SL-17R Shilone [65] (3039)	HCT-213 Hellcat [60] (3075)	LCF-R15 Lucifer [65] (3039)
8	HCT-313 Hellcat [60] (3075)	SL-17 Shilone [65] (3039)	LCF-415 Lucifer [65] (3039)	HCT-213 Hellcat [60] (3075)
9	CSR-V12 Corsair [50] (3039)	LTN-G15 Lightning [50] (3039)	F-90 Stingray [60] (3039)	F-90 Stingray [60] (3039)
10	F-90 Stingray [60] (3039)	CSR-V14 Corsair [50] (3039)	TR-10 Transit [50] (3039)	LTN-G15 Lightning [50] (3075)
11	SL-25 Samurai [50] (3039)	Oni ON-1 [55] (3067)	LTN-16L Lightning [50] (3075)	CSR-V20 Corsair [50] (3039)
12	SL-17 Shilone [65] (3039)	LCF-R15 Lucifer [65] (3039)	CSR-V20 Corsair [50] (3039)	SL-17 Shilone [65] (3039)

Heavy Aerospace Fighters				
2D6	Outworlds Alliance	Free Rasalhague Republic	Magistracy of Canopus	Marian Hegemony
2	Sabutai Prime [75] (3055U)*	F-100b Riever [100] (3039)	STU-K15 Stuka [100] (3039)	EGL-R6 Eagle [75] (3075)
3	STU-K10 Stuka [100] (3039)	TRB-D36 Thunderbird [100] (3075)	CHP-W10 Chippewa [90] (3039)	TR-13 Transgressor [75] (3039)
4	F-100 Riever [100] (3039)	SL-15K Slayer [80] (3039)	F-100 Riever [100] (3039)	STU-K5 Stuka [100] (3039)
5	TRB-D36 Thunderbird [100] (3075)	EGL-R6 Eagle [75] (3075)	CHP-W5 Chippewa [90] (3039)	TRB-D36 Thunderbird [100] (3075)
6	SL-15 Slayer [80] (3039)	SL-15R Slayer [80] (3039)	TRB-D36 Thunderbird [100] (3075)	EGL-R6 Eagle [75] (3075)
7	STU-K5 Stuka [100] (3039)	HSCL-1-O Huscarl [75] (3067)*	EGL-R6 Eagle [75] (3075)	TRB-D36 Thunderbird [100] (3075)
8	SL-15R Slayer [80] (3039)	SL-15 Slayer [80] (3039)	TRB-D36 Thunderbird [100] (3075)	EGL-R6 Eagle [75] (3075)
9	EGL-R6 Eagle [75] (3075)	F-100 Riever [100] (3039)	EGL-R6 Eagle [75] (3075)	CHP-W10 Chippewa [90] (3039)
10	CHP-W5 Chippewa [90] (3039)	STU-K5 Stuka [100] (3039)	STU-K5 Stuka [100] (3039)	F-100 Riever [100] (3039)
11	STU-K10 Stuka [100] (3039)	TRB-D46 Thunderbird [100] (3075)	TR-13 Transgressor [75] (3039)	CHP-W10 Chippewa [90] (3039)
12	RPR-100 Rapier [85] (3050U)	HSCL-1-OA Huscarl [75] (3067)*	TRB-D46 Thunderbird [100] (3075)	STU-K15 Stuka [100] (3039)

DropShips				
2D6	Outworlds Alliance	Free Rasalhague Republic	Magistracy of Canopus	Marian Hegemony
2	Overlord (3057) ^s	Overlord (3057) ^s	Dictator (3075) ^s	Seeker (3057) ^s
3	Gazelle (3057) ^a	Gazelle (3057) ^a	Leopard CV (3057) ^a	Leopard CV (3057) ^a
4	Triumph (3057) ^a	Triumph (3057) ^a	Overlord (3057) ^s	Seeker (3057) ^s
5	Leopard CV (3057) ^a	Leopard CV (3057) ^a	Triumph (3057) ^a	Mule (3057) ^s
6	Union (3057) ^s	Union (3057) ^s	Union (3057) ^s	Leopard (3057) ^a
7	Leopard (3057) ^a	Leopard (3057) ^a	Leopard (3057) ^a	Union (3057) ^s
8	Gazelle (3057) ^a	Gazelle (3057) ^a	Condor (3057) ^a	Condor (3057) ^a
9	Leopard (3057) ^a	Union (3057) ^s	Mule (3057) ^s	Triumph (3057) ^a
10	Union (3057) ^s	Triumph (3057) ^a	Seeker (3057) ^s	Overlord (3057) ^s
11	Triumph (3057) ^a	Overlord (3057) ^s	Fury (3057) ^a	Fury (3057) ^a
12	Overlord (3057) ^s	Vengeance (3057) ^a	Seeker (3057) ^s	Intruder (3057) ^s

*OmniFighter, ^aAerodyne, ^sSpheroid



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Light Aerospace Fighters				
2D6	Mercenary	Second Star League	Pirates	Taurian Concordat
2	SB-28 Sabre [25] (3075)	THK-63 Tomahawk [45] (3050U)	SPR-6D Sparrowhawk [30] (3039)	SPR-6D Sparrowhawk [30] (3039)
3	SL-21 Sholagar [35] (3039)	SPR-6D Sparrowhawk [30] (3039U)	SB-27 Sabre [25] (3075)	SB-27 Sabre [25] (3075)
4	TR-7 Thrush [25] (3039)	DARO-1 Dagger [45] (3067)*	SPR-H5 Sparrowhawk [30] (3039)	SPR-H5 Sparrowhawk [30] (3039)
5	F-11 Cheetah [25] (3039)	F-14-S Cheetah [25] (3039U)	F-10 Cheetah [25] (3039)	F-10 Cheetah [25] (3039)
6	SB-27 Sabre [25] (3075)	SYD Z4 Seydlitz [20] (3039U)	SB-27 Sabre [25] (3075)	SB-27 Sabre [25] (3075)
7	CNT-1D Centurion [30] (3075)	SPD-502 Spad [30] (3050U)	CNT-1D Centurion [30] (3075)	CNT-1D Centurion [30] (3075)
8	SYD-Z4 Seydlitz [20] (3075)	SPR-6D Sparrowhawk [30] (3039U)	SYD-21 Seydlitz [20] (3039)	SYD-21 Seydlitz [20] (3039)
9	SPR-6D Sparrowhawk [30] (3039)	DARO-1 Dagger A [45] (3067)*	TR-7 Thrush [25] (3039)	TR-7 Thrush [25] (3039)
10	SYD-Z2A Seydlitz [20] (3039)	S-7 SAI [40] (3039U)	SL-21 Sholagar [35] (3039)	SL-21 Sholagar [35] (3039)
11	SPR-7D Sparrowhawk [30] (3039)	SYD Z3A Seydlitz [20] (3039U)	CNT-1D Centurion [30] (3075)	CNT-1D Centurion [30] (3075)
12	SYD-Z3A Seydlitz [20] (3039)	Chaeronea [25] (3067)	SYD-22 Seydlitz [20] (3039)	SYD-22 Seydlitz [20] (3039)

Medium Aerospace Fighters				
2D6	Mercenary	Second Star League	Pirates	Taurian Concordat
2	F-94 Stingray [60] (3039)	Tyre [55] (3067)	SL-17 Shilone [65] (3039)	SL-17 Shilone [65] (3039)
3	LCF-16KR Lucifer II [65] (3039)	ON-1 Oni [55] (3067)*	CSR-V12M Corsair [50] (3039)	CSR-V12 Corsair [50] (3039)
4	CSR-V12 Corsair [50] (3039)	MIK-O Tatsu A [70] (3067)*	HCT-213 Hellcat [60] (3075)	CMT-3U Troika [65] (3067)
5	LCF-R16 Lucifer [65] (3039)	HCT-213B Hellcat II [50] (3050U)	LTN-G15 Lightning [50] (3075)	HCT-213 Hellcat [60] (3075)
6	CSR-V14 Corsair [50] (3039)	SL-17R Shilone [65] (3039U)	CSR-V12 Corsair [50] (3039)	LTN-G15 Lightning [50] (3075)
7	LTN-G15 Lightning [50] (3075)	LCF-16 Lucifer [65] (3039U)	HCT-213 Hellcat [60] (3075)	CMT-3T Troika [65] (3067)
8	HCT-213 Hellcat [60] (3075)	CSR-V12 Corsair [50] (3039U)	LCF-415 Lucifer [65] (3039)	LTN-16T Lightning [50] (3075)
9	F-92 Stingray [60] (3039)	LCF-16KR Lucifer II [65] (3039U)	F-90 Stingray [60] (3039)	TR-10 Transit [50] (3039)
10	TR-10 Transit [50] (3039)	MIK-O Tatsu [70] (3067)*	LTN-G15 Lightning [50] (3075)	CSR-V20 Corsair [50] (3039)
11	SL-17R Shilone [65] (3039)	F-92 Stingray [60] (3039U)	TR-10 Transit [50] (3039)	F-90 Stingray [60] (3039)
12	F-90 Stingray [60] (3039)	Visigoth A [60] (3055U)*	CSR-V20 Corsair [50] (3039)	LCF-R15 Lucifer [65] (3039)

Heavy Aerospace Fighters				
2D6	Mercenary	Second Star League	Pirates	Taurian Concordat
2	VLC-5N Vulcan [80] (3075)	RPR-100 Rapier [85] (3050U)	STU-K15 Stuka [100] (3039)	VLC-5N Vulcan [80] (3075)
3	TRB-D46 Thunderbird [100] (3075)	SL-15R Slayer [80] (3039U)	F-100 Riever [100] (3039)	CHP-W5 Chippewa [90] (3039)
4	TR-16 Transgressor [75] (3039)	F-700 Riever [100] (3039U)	CHP-W10 Chippewa [90] (3039)	F-100 Riever [100] (3039)
5	CHP-W7 Chippewa [90] (3039)	CHP-7W Chippewa [90] (3039U)	TRB-D36 Thunderbird [100] (3075)	CHP-W7T Chippewa [90] (3039)
6	STU-D6 Stuka [100] (3039)	HSCL-1 Huscarl A [75] (3067)*	CHP-W5 Chippewa [90] (3039)	TRB-D36 Thunderbird [100] (3075)
7	EGL-R6 Eagle [75] (3075)	STU-D6 Stuka [100] (3039U)	EGL-R6 Eagle [75] (3075)	EGL-R6 Eagle [75] (3075)
8	SL-15R Slayer [80] (3039)	EST-O Eisensturm [100] (3067)*	TRB-D36 Thunderbird [100] (3075)	SL-15 Slayer [80] (3039)
9	F-700a Riever [100] (3039)	HMR-HD Hammerhead [75] (3050U)	EGL-R6 Eagle [75] (3075)	TR-13A Transgressor [75] (3039)
10	TR-13A Transgressor [75] (3039)	HSCL-1 Huscarl C [75] (3067)*	STU-K5 Stuka [100] (3039)	STU-K5 Stuka [100] (3039)
11	TRB-D36 Thunderbird (3039)	EST-O Eisensturm B [100] (3067)*	TRB-D36 Thunderbird [100] (3075)	SL-15R Slayer [80] (3039)
12	VLC-8N Vulcan [80] (3075)	Sabutai Prime [75] (3055U)*	TR-13 Transgressor [75] (3039)	TRB-D50 Thunderbird [100] (3075)

DropShips				
2D6	Mercenary	Second Star League	Pirates	Taurian Concordat
2	Excalibur (3057) ^S	Overlord-A3 (3057) ^S	Intruder (3057) ^S	Seeker (3057) ^S
3	Intruder (3057) ^S	Gazelle (Upgrade) (3057) ^A	Seeker (3057) ^S	Leopard CV (3057) ^A
4	Mule (3057) ^S	Conquistador (3067) ^A	Leopard CV (3057) ^A	Seeker (3057) ^S
5	Triumph (3057) ^A	Leopard CV (Upgrade) (3057) ^A	Triumph (3057) ^A	Mule (3057) ^S
6	Leopard (3057) ^A	Intruder (Upgrade) (3057) ^S	Union (3057) ^S	Leopard (3057) ^A
7	Union (3057) ^S	Overlord (Upgrade) (3057) ^S	Condor (3057) ^A	Union (3057) ^S
8	Seeker (3057) ^S	Union (Upgrade) (3057) ^S	Leopard (3057) ^A	Condor (3057) ^A
9	Overlord (3057) ^S	Leopard (Upgrade) (3057) ^A	Mule (3057) ^S	Triumph (3057) ^A
10	Condor (3057) ^A	Triumph (3057) ^A	Overlord (3057) ^S	Overlord (3057) ^S
11	Gazelle (3057) ^A	Okinawa (3057) ^S	Seeker (3057) ^S	Fury (3057) ^A
12	Avenger (3057) ^A	Nekohono'o (3067) ^S	Fury (3057) ^A	Intruder (3057) ^S

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Light Aerospace Fighters				
2D6	Blood Spirit	Cloud Cobra	Coyote	Diamond Shark
2	Chaeronea [†] [25] (3067)	Batu C [40] (3055U)	Vandal Prime [30] (3055U)	Avar Prime [35] (3055U)
3	Sulla Prime [45] (3055U)	Avar B [35] (3055U)	Sulla B [45] (3055U)	Vandal A [30] (3055U)
4	Issus [†] [40] (3067)	Vandal Prime [30] (3055U)	Bashkir Prime [20] (3055U)	Batu Prime [40] (3055U)
5	Chaeronea 2 [†] [25] (3067)	Sulla A [45] (3055U)	Bashkir C [20] (3055U)	Bashkir C [20] (3055U)
6	Vandal A [30] (3055U)	Sulla Prime [45] (3055U)	Avar C [35] (3055U)	Batu Prime [40] (3055U)
7	Batu B [40] (3055U)	Batu Prime [40] (3055U)	Sulla Prime [45] (3055U)	Sulla A [45] (3055U)
8	Bashkir C [20] (3055U)	Batu B [40] (3055U)	Avar Prime [35] (3055U)	Bashkir C [20] (3055U)
9	Chaeronea [†] [25] (3067)	Bashkir C [20] (3055U)	Sulla C [45] (3055U)	Sulla Prime [45] (3055U)
10	Sulla C [45] (3055U)	Vandal C [30] (3055U)	Bashkir A [20] (3055U)	Bashkir C [20] (3055U)
11	Issus [†] [40] (3067)	Avar B [35] (3055U)	Batu C [40] (3055U)	Vandal C [30] (3055U)
12	Vandal C [30] (3055U)	Sulla C [45] (3055U)	Batu A [40] (3055U)	Avar Prime [35] (3055U)

Medium Aerospace Fighters				
2D6	Blood Spirit	Cloud Cobra	Coyote	Diamond Shark
2	Visigoth B [60] (3055U)	Turk A [50] (3055U)	Jagatai C [70] (3055U)	Jagatai Prime [70] (3055U)
3	Tyre 2 [†] [55] (3067)	Visigoth A [60] (3055U)	Turk A [50] (3055U)	Ammon [†] [65] (3067)
4	Tyre [†] [55] (3067)	Jagatai B [70] (3055U)	Turk A [50] (3055U)	Visigoth A [60] (3055U)
5	Turk Prime [50] (3055U)	Turk C [50] (3055U)	Visigoth Prime [60] (3055U)	Ammon [†] [60]
6	Jagatai Prime [70] (3055U)	Turk B [50] (3055U)	Turk Prime [50] (3055U)	Visigoth Prime [60] (3055U)
7	Turk Prime [50] (3055U)	Visigoth C [60] (3055U)	Jagatai Prime [70] (3055U)	Turk A [50] (3055U)
8	Jagatai Prime [70] (3055U)	Jagatai A [70] (3055U)	Jagatai Prime [70] (3055U)	Visigoth B [60] (3055U)
9	Tyre [†] [55] (3067)	Jagatai C [70] (3055U)	Visigoth B [60] (3055U)	Turk B [50] (3055U)
10	Turk C [50] (3055U)	Visigoth B [60] (3055U)	Tyre [†] [55] (3067)	Visigoth C [60] (3055U)
11	Tyre [†] [55] (3067)	Visigoth C [60] (3055U)	Jagatai A [70] (3055U)	Jagatai Prime [70] (3055U)
12	Tyre 2 [†] [55] (3067)	Jagatai A [70] (3055U)	Jagatai C [70] (3055U)	Tyre [†] [55] (3067)

Heavy Aerospace Fighters				
2D6	Blood Spirit	Cloud Cobra	Coyote	Diamond Shark
2	Kirghiz C [100] (3055U)	Scythia B [90] (3055U)	Scythia Prime [90] (3055U)	Xerxes [†] [85] (3067)
3	Sabutai C [75] (3055U)	Kirghiz Prime [100] (3055U)	Sabutai C [75] (3055U)	Jengiz Prime [80] (3055U)
4	Kirghiz C [100] (3055U)	Kirghiz C [100] (3055U)	Sabutai C [75] (3055U)	Scythia Prime [90] (3055U)
5	Hydaspes [†] [95] (3067)	Jengiz A [80] (3055U)	Xerxes [†] [85] (3067)	Kirghiz Prime [100] (3055U)
6	Sabutai C [75] (3055U)	Kirghiz B [100] (3055U)	Sabutai A [75] (3055U)	Jengiz A [80] (3055U)
7	Hydaspes [†] [95] (3067)	Scythia B [90] (3055U)	Scythia Prime [90] (3055U)	Scythia B [90] (3055U)
8	Hydaspes [†] [95] (3067)	Jengiz B [80] (3055U)	Kirghiz C [100] (3055U)	Kirghiz A [100] (3055U)
9	Sabutai C [75] (3055U)	Scythia C [90] (3055U)	Kirghiz A [100] (3055U)	Scythia A [90] (3055U)
10	Hydaspes [†] [95] (3067)	Scythia A [90] (3055U)	Sabutai Prime [75] (3055U)	Scythia C [90] (3055U)
11	Sabutai C [75] (3055U)	Sabutai B [75] (3055U)	Kirghiz C [100] (3055U)	Hydaspes [†] [95] (3067)
12	Kirghiz C [100] (3055U)	Jengiz C [80] (3055U)	Hydaspes [†] [95] (3067)	Sabutai Prime [75] (3055U)

DropShips				
2D6	Blood Spirit	Cloud Cobra	Coyote	Diamond Shark
2	Fortress (3057) [§]	Carrier (3057) [^]	Outpost (3067) [§]	Broadsword (3057) [^]
3	Confederate (3057) [§]	Carrier (3057) [^]	Overlord-C (3057) [§]	Titan-C (3057) [^]
4	Arcadia (3067) [^]	Lion (3057) [§]	Union-C (3057) [§]	Broadsword (3057) [§]
5	Broadsword (3057) [^]	Noruff (3057) [^]	Sassanid (3057) [§]	Overlord-C (3057) [§]
6	Union-C (3057) [§]	Overlord-C (3057) [§]	Broadsword (3057) [^]	Union-C (3057) [§]
7	Union-C (3057) [§]	Union-C (3057) [§]	Union-C (3057) [§]	Union-C (3057) [§]
8	Overlord-C (3057) [§]	Titan (3057) [^]	Lion (3057) [§]	Broadsword (3057) [^]
9	Arcadia (3067) [^]	Miraborg (3057) [§]	Overlord-C (3057) [§]	Overlord (3057) [§]
10	Broadsword (3057) [^]	Lion (3057) [§]	Confederate (3057) [§]	Titan (3057) [^]
11	Carrier (3057) [^]	Confederate (3057) [§]	Carrier (3057) [^]	Overlord-C (3057) [§]
12	Arcadia (3067) [^]	Noruff (3057) [^]	Fortress (3057) [§]	Noruff (3057) [^]

[†]Non-Omnifighter, [^]Aerodyne, [§]Spheroid



RANDOM AEROSPACE ASSIGNMENT TABLE: CLAN 2

Light Aerospace Fighters				
2D6	Fire Mandrill	Ghost Bear	Goliath Scorpion	Hell's Horses
2	Avar B [35] (3055U)	Avar A [35] (3055U)	Avar C [35] (3055U)	Avar Prime [35] (3055U)
3	Vandal Prime [30] (3055U)	Vandal Prime [30] (3055U)	Vandal B [30] (3055U)	Vandal B [30] (3055U)
4	Batu Prime [40] (3055U)	Batu B [40] (3055U)	Batu Prime [40] (3055U)	Batu B [40] (3055U)
5	Bashkir A [20] (3055U)	Bashkir Prime [20] (3055U)	Avar Prime [35] (3055U)	Bashkir Prime [20] (3055U)
6	Batu A [40] (3055U)	Batu Prime [40] (3055U)	Sulla Prime [45] (3055U)	Batu C [40] (3055U)
7	Sulla A [45] (3055U)	Sulla Prime [45] (3055U)	Sulla C [45] (3055U)	Sulla A [45] (3055U)
8	Batu C [40] (3055U)	Bashkir A [20] (3055U)	Bashkir Prime [20] (3055U)	Bashkir B [20] (3055U)
9	Sulla Prime [45] (3055U)	Sulla A [45] (3055U)	Batu C [40] (3055U)	Avar C [35] (3055U)
10	Batu B [40] (3055U)	Bashkir C [20] (3055U)	Bashkir A [20] (3055U)	Bashkir C [20] (3055U)
11	Vandal B [30] (3055U)	Vandal C [30] (3055U)	Vandal Prime [30] (3055U)	Vandal C [30] (3055U)
12	Avar Prime [35] (3055U)	Avar B [35] (3055U)	Avar B [35] (3055U)	Avar B [35] (3055U)

Medium Aerospace Fighters				
2D6	Fire Mandrill	Ghost Bear	Goliath Scorpion	Hell's Horses
2	Jagatai A [70] (3055U)	Jagatai C [70] (3055U)	Jagatai A [70] (3055U)	Jagatai A [70] (3055U)
3	Ammon [†] [65] (3067)	Ammon [†] [65] (3067)	Turk B [50] (3055U)	Turk B [50] (3055U)
4	Jagatai B [70] (3055U)	Visigoth A [60] (3055U)	Visigoth C [60] (3055U)	Visigoth A [60] (3055U)
5	Visigoth A [60] (3055U)	Visigoth Prime [60] (3055U)	Turk Prime [50] (3055U)	Turk C [50] (3055U)
6	Jagatai B [70] (3055U)	Visigoth B [60] (3055U)	Visigoth B [60] (3055U)	Visigoth C [60] (3055U)
7	Turk A [50] (3055U)	Turk Prime [50] (3055U)	Visigoth Prime [60] (3055U)	Jagatai Prime [70] (3055U)
8	Visigoth Prime [60] (3055U)	Visigoth C [60] (3055U)	Jagatai Prime [70] (3055U)	Visigoth Prime [60] (3055U)
9	Jagatai Prime [70] (3055U)	Turk C [50] (3055U)	Turk A [50] (3055U)	Turk Prime [50] (3055U)
10	Visigoth A [60] (3055U)	Visigoth Prime [60] (3055U)	Visigoth A [60] (3055U)	Visigoth B [60] (3055U)
11	Jagatai C [70] (3055U)	Jagatai B [70] (3055U)	Turk C [50] (3055U)	Turk A [50] (3055U)
12	Tyre [‡] [55] (3067)	Tyre [‡] [55] (3067)	Jagatai C [70] (3055U)	Jagatai B [70] (3055U)

Heavy Aerospace Fighters				
2D6	Fire Mandrill	Ghost Bear	Goliath Scorpion	Hell's Horses
2	Xerxes [†] [85] (3067)	Xerxes [†] [85] (3067)	Sabutai Prime [75] (3055U)	Sabutai C [75] (3055U)
3	Jengiz A [80] (3055U)	Jengiz Prime [80] (3055U)	Jengiz C [80] (3055U)	Jengiz A [80] (3055U)
4	Scytha C [90] (3055U)	Scytha A [90] (3055U)	Scytha A [90] (3055U)	Scytha Prime [90] (3055U)
5	Kirghiz A [100] (3055U)	Kirghiz B [100] (3055U)	Kirghiz A [100] (3055U)	Kirghiz B [100] (3055U)
6	Jengiz B [80] (3055U)	Jengiz A [80] (3055U)	Jengiz Prime [80] (3055U)	Jengiz C [80] (3055U)
7	Scytha B [90] (3055U)	Scytha B [90] (3055U)	Scytha B [90] (3055U)	Kirghiz A [100] (3055U)
8	Kirghiz B [100] (3055U)	Kirghiz C [100] (3055U)	Scytha C [90] (3055U)	Scytha B [90] (3055U)
9	Scytha A [90] (3055U)	Scytha Prime [90] (3055U)	Kirghiz Prime [100] (3055U)	Kirghiz C [100] (3055U)
10	Scytha Prime [90] (3055U)	Scytha C [90] (3055U)	Scytha Prime [90] (3055U)	Scytha A [90] (3055U)
11	Hydaspes [‡] [95] (3067)	Hydaspes [‡] [95] (3067)	Jengiz A [80] (3055U)	Jengiz B [80] (3055U)
12	Kirghiz Prime [100] (3055U)	Sabutai Prime [75] (3055U)	Sabutai C [75] (3055U)	Sabutai B [75] (3055U)

DropShips				
2D6	Fire Mandrill	Ghost Bear	Goliath Scorpion	Hell's Horses
2	Outpost (3067) [§]	Titan (3057) [^]	Titan (3057) [^]	Titan (3057) [^]
3	Titan-C (3057) [^]	Condor (3057) [^]	Condor (3057) [^]	Condor (3057) [^]
4	Union-C (3057) [§]	Miraborg (3057) [§]	Sassanid (3057) [§]	Noruff (3057) [^]
5	Overlord-C (3057) [§]	Overlord-C (3057) [§]	Overlord-C (3057) [§]	Overlord-C (3057) [§]
6	Union-C (3057) [§]	Confederate (3057) [§]	Broadsword (3057) [^]	Sassanid (3057) [^]
7	Union-C (3057) [§]	Union-C (3057) [§]	Union-C (3057) [§]	Union-C (3057) [§]
8	Broadsword (3057) [^]	Broadsword (3057) [^]	Broadsword (3057) [^]	Broadsword (3057) [^]
9	Overlord-C (3057) [§]	Sassanid (3057) [§]	Noruff (3057) [^]	Outpost (3067) [§]
10	Titan (3057) [^]	Noruff (3057) [^]	Triumph (3057) [^]	Triumph (3057) [^]
11	Overlord-C (3057) [§]	Gazelle (3057) [^]	Gazelle (3057) [^]	Gazelle (3057) [^]
12	Mercer (3067) [§]	Lion (3057) [§]	Lion (3057) [§]	Fortress (3057) [§]

[†]Non-OmniFighter, [^]Aerodyne, [§]Spheroid

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RANDOM AEROSPACE ASSIGNMENT TABLE: CLAN 3

Light Aerospace Fighters				
2D6	Ice Hellion	Jade Falcon	Nova Cat	Smoke Jaguar
2	Vandal B [30] (3055U)	Batu C [40] (3055U)	Avar Prime [35] (3055U)	Batu B [40] (3055U)
3	Avar Prime [35] (3055U)	Vandal C [30] (3055U)	Vandal A [30] (3055U)	Vandal Prime [30] (3055U)
4	Batu Prime [40] (3055U)	Avar B [35] (3055U)	Batu Prime [40] (3055U)	Avar Prime [35] (3055U)
5	Vandal [30] (3055U)	Bashkir Prime [20] (3055U)	Bashkir A [20] (3055U)	Avar C [35] (3055U)
6	Avar B [35] (3055U)	Chaeronea [†] [25] (3067)	Batu A [40] (3055U)	Bashkir A [20] (3055U)
7	Vandal C [30] (3055U)	Sulla B [45] (3055U)	Sulla Prime [45] (3055U)	Sulla A [45] (3055U)
8	Bashkir C [20] (3055U)	Vandal Prime [30] (3055U)	Bashkir Prime [20] (3055U)	Bashkir A [20] (3055U)
9	Batu B [40] (3055U)	Batu Prime [40] (3055U)	Sulla A [45] (3055U)	Batu Prime [40] (3055U)
10	Avar C [35] (3055U)	Avar Prime [35] (3055U)	Bashkir B [20] (3055U)	Avar Prime [35] (3055U)
11	Batu C [40] (3055U)	Bashkir C [20] (3055U)	Vandal B [30] (3055U)	Bashkir A [20] (3055U)
12	Avar B [35] (3055U)	Issus [†] [40] (3067)	Avar Prime [35] (3055U)	Vandal B [30] (3055U)

Medium Aerospace Fighters				
2D6	Ice Hellion	Jade Falcon	Nova Cat	Smoke Jaguar
2	Turk C [50] (3055U)	Visigoth B [60] (3055U)	Jagatai B [70]	Visigoth B [60] (3055U)
3	Visigoth Prime [60] (3055U)	Tyre 2 [†] [55] (3067)	Ammon [†] [65] (3067)	Jagatai A [70] (3055U)
4	Turk A [50] (3055U)	Visigoth C [60] (3055U)	Visigoth C [60] (3055U)	Turk Prime [50] (3055U)
5	Turk B [50] (3055U)	Visigoth Prime [60] (3055U)	Visigoth B [60] (3055U)	Visigoth Prime [60] (3055U)
6	Visigoth Prime [60] (3055U)	Jagatai Prime [65] (3055U)	Visigoth A [60] (3055U)	Visigoth Prime [60] (3055U)
7	Turk Prime [50] (3055U)	Visigoth Prime [60] (3055U)	Turk Prime [50] (3055U)	Visigoth Prime [60] (3055U)
8	Visigoth C [60] (3055U)	Visigoth A [60] (3055U)	Visigoth A [60] (3055U)	Visigoth A [60] (3055U)
9	Jagatai A [70] (3055U)	Jagatai B [65] (3055U)	Turk A [50] (3055U)	Turk Prime [50] (3055U)
10	Jagatai C [70] (3055U)	Tyre [†] [55] (3067)	Visigoth Prime [60] (3055U)	Visigoth B [60] (3055U)
11	Turk Prime [50] (3055U)	Jagatai A [65] (3055U)	Jagatai A [70] (3055U)	Jagatai A [70] (3055U)
12	Jagatai B [70] (3055U)	Jagatai C [65] (3055U)	Tyre [†] [55] (3067)	Jagatai B [70] (3055U)

Heavy Aerospace Fighters				
2D6	Ice Hellion	Jade Falcon	Nova Cat	Smoke Jaguar
2	Jengiz C [80] (3055U)	Sabutai A [75] (3055U)	Xerxes [†] [85] (3067)	Kirghiz Prime [100] (3055U)
3	Kirghiz A [100] (3055U)	Sabutai B [75] (3055U)	Jengiz Prime [80] (3055U)	Kirghiz A [100] (3055U)
4	Scythia Prime [90] (3055U)	Scythia B [90] (3055U)	Scythia A [90] (3055U)	Jengiz A [80] (3055U)
5	Scythia B [90] (3055U)	Kirghiz Prime [100] (3055U)	Kirghiz A [100] (3055U)	Jengiz [80] (3055U)
6	Sabutai A [75] (3055U)	Jengiz [80] (3055U)	Jengiz Prime [80] (3055U)	Kirghiz C [100] (3055U)
7	Scythia Prime [90] (3055U)	Scythia Prime [90] (3055U)	Scythia A [90] (3055U)	Jengiz [80] (3055U)
8	Sabutai C [75] (3055U)	Scythia A [90] (3055U)	Kirghiz B [100] (3055U)	Jengiz A [80] (3055U)
9	Sabutai B [75] (3055U)	Kirghiz A [100] (3055U)	Scythia Prime [90] (3055U)	Kirghiz Prime [100] (3055U)
10	Scythia A [90] (3055U)	Scythia C [90] (3055U)	Scythia B [90] (3055U)	Jengiz B [80] (3055U)
11	Kirghiz C [100] (3055U)	Sabutai Prime [75] (3055U)	Hydaspes [†] [95] (3067)	Sabutai Prime [75] (3055U)
12	Jengiz A [80] (3055U)	Hydaspes [†] [95] (3067)	Sabutai Prime [75] (3055U)	Sabutai B [75] (3055U)

DropShips				
2D6	Ice Hellion	Jade Falcon	Nova Cat	Smoke Jaguar
2	Sassanid (3057) ^A	Confederate (3057) ^S	Broadsword (3057) ^A	Noruff (3057) ^A
3	Carrier (3057) ^A	Sassanid (3057) ^S	Overlord-C (3057) ^S	Titan (3057) ^A
4	Broadsword (3057) ^A	Broadsword (3057) ^A	Nekohono'o (3067) ^S	Lion (3057) ^S
5	Titan (3057) ^A	Carrier (3057) ^A	Overlord-C (3057) ^S	Overlord-C (3057) ^S
6	Noruff (3057) ^A	Union-C (3057) ^S	Union-C (3057) ^S	Union-C (3057) ^S
7	Union-C (3057) ^S	Union-C (3057) ^S	Union-C (3057) ^S	Union-C (3057) ^S
8	Miraborg (3057) ^S	Overlord-C (3057) ^S	Broadsword (3057) ^A	Overlord-C (3057) ^S
9	Overlord-C (3057) ^S	Miraborg (3057) ^S	Nekohono'o (3067) ^S	Sassanid (3057) ^A
10	Union-C (3057) ^S	Overlord-C (3057) ^S	Confederate (3057) ^S	Leopard CV (3057) ^A
11	Lion (3057) ^S	Lion (3057) ^S	Gazelle (3057) ^A	Broadsword (3057) ^A
12	Leopard CV (3057) ^A	Titan (3057) ^A	Noruff (3057) ^A	Sassanid (3057) ^A

[†]Non-Omnifighter, ^AAerodyne, ^SSpheroid



RANDOM AEROSPACE ASSIGNMENT TABLE: CLAN 4

Light Aerospace Fighters				
2D6	Snow Raven	Star Adder	Steel Viper	Wolf
2	Sulla A [45] (3055U)	Batu A [40] (3055U)	Sulla C [45] (3055U)	Avar A [35] (3055U)
3	Issus 2 [†] [40] (3067)	Bashkir C [20] (3055U)	Avar Prime [35] (3055U)	Vandal C [30] (3055U)
4	Vandal B [30] (3055U)	Sulla B [45] (3055U)	Batu A [40] (3055U)	Batu A [40] (3055U)
5	Sulla C [45] (3055U)	Sulla Prime [45] (3055U)	Bashkir C [20] (3055U)	Bashkir C [20] (3055U)
6	Bashkir Prime [20] (3055U)	Avar B [35] (3055U)	Avar C [35] (3055U)	Batu Prime [40] (3055U)
7	Bashkir C [20] (3055U)	Batu C [40] (3055U)	Sulla Prime [45] (3055U)	Sulla Prime [45] (3055U)
8	Chaeronea 3 [†] [25] (3067)	Sulla C [45] (3055U)	Bashkir B [20] (3055U)	Batu B [40] (3055U)
9	Sulla C [45] (3055U)	Batu B [40] (3055U)	Batu Prime [40] (3055U)	Sulla C [45] (3055U)
10	Sulla A [45] (3055U)	Avar A [35] (3055U)	Bashkir Prime [20] (3055U)	Batu C [40] (3055U)
11	Issus [†] [40] (3067)	Vandal C [30] (3055U)	Issus [†] [40] (3067)	Vandal A [30] (3055U)
12	Corax [30] (3067)	Avar C [35] (3055U)	Vandal C [30] (3055U)	Avar B [35] (3055U)

Medium Aerospace Fighters				
2D6	Snow Raven	Star Adder	Steel Viper	Wolf
2	Visigoth B [60] (3055U)	Turk Prime [50] (3055U)	Visigoth A [60] (3055U)	Jagatai Prime [70] (3055U)
3	Turk A [50] (3055U)	Jagatai Prime [70] (3055U)	Jagatai C [65] (3055U)	Ammon [†] [65] (3067)
4	Turk Prime [50] (3055U)	Turk A [50] (3055U)	Jagatai B [65] (3055U)	Jagatai A [70] (3055U)
5	Visigoth Prime [60] (3055U)	Turk C [50] (3055U)	Visigoth Prime [60] (3055U)	Visigoth A [60] (3055U)
6	Turk B [50] (3055U)	Jagatai A [70] (3055U)	Tyre [†] [55] (3067)	Jagatai B [70] (3055U)
7	Jagatai Prime [65] (3055U)	Visigoth C [60] (3055U)	Jagatai Prime [65] (3055U)	Turk Prime [50] (3055U)
8	Visigoth A [60] (3055U)	Jagatai B [70] (3055U)	Visigoth C [60] (3055U)	Visigoth Prime [60] (3055U)
9	Visigoth C [60] (3055U)	Visigoth B [60] (3055U)	Visigoth B [60] (3055U)	Jagatai C [70] (3055U)
10	Tyre [†] [55] (3067)	Visigoth A [60] (3055U)	Visigoth Prime [60] (3055U)	Visigoth C [60] (3055U)
11	Tyre 2 [†] [55] (3067)	Jagatai C [70] (3055U)	Jagatai A [65] (3055U)	Jagatai A [70] (3055U)
12	Jagatai C [65] (3055U)	Jagatai Prime [70] (3055U)	Tyre [†] [55] (3067)	Tyre [†] [55] (3067)

Heavy Aerospace Fighters				
2D6	Snow Raven	Star Adder	Steel Viper	Wolf
2	Hydaspes 2 [95] (3067)	Jengiz Prime [80] (3055U)	Hyspades [†] [95] (3067)	Xerxes [†] [85] (3067)
3	Sabutai A [90] (3055U)	Scythia B [90] (3055U)	Kirghiz A [100] (3055U)	Jengiz Prime [80] (3055U)
4	Hydaspes [†] [95] (3067)	Kirghiz C [100] (3055U)	Sabutai C [90] (3055U)	Scythia Prime [90] (3055U)
5	Kirghiz A [100] (3055U)	Scythia B [90] (3055U)	Kirghiz Prime [80] (3055U)	Kirghiz Prime [100] (3055U)
6	Sabutai Prime [75] (3055U)	Sabutai C [75] (3055U)	Kirghiz C [80] (3055U)	Jengiz A [80] (3055U)
7	Sabutai C [75] (3055U)	Scythia C [90] (3055U)	Sabutai Prime [75] (3055U)	Jengiz B [80] (3055U)
8	Kirghiz Prime [100] (3055U)	Sabutai A [75] (3055U)	Sabutai A [90] (3055U)	Kirghiz A [100] (3055U)
9	Kirghiz B [100] (3055U)	Kirghiz B [100] (3055U)	Hyspades [†] [95] (3067)	Scythia B [90] (3055U)
10	Kirghiz A [100] (3055U)	Scythia A [90] (3055U)	Kirghiz B [90] (3055U)	Scythia C [90] (3055U)
11	Sabutai A [75] (3055U)	Sabutai B [75] (3055U)	Sabutai B [75] (3055U)	Hydaspes [†] [95] (3067)
12	Sabutai B [75] (3055U)	Jengiz B [80] (3055U)	Hydaspes 2 [†] [95] (3067)	Kirghiz C [100] (3055U)

DropShips				
2D6	Snow Raven	Star Adder	Steel Viper	Wolf
2	Lion (3057) [§]	Miraborg (3057) [§]	Broadsword (3057) [^]	Outpost (3067) [§]
3	Sassanid (3057) [§]	Noruff (3057) [^]	Broadsword (3057) [^]	Titan (3057) [^]
4	Union-C (3057) [§]	Union-C (3057) [§]	Sassanid (3057) [§]	Union-C (3057) [§]
5	Broadsword (3057) [^]	Titan (3057) [§]	Miraborg (3057) [§]	Overlord-C (3057) [§]
6	Carrier (3057) [^]	Lion (3057) [§]	Noruff (3057) [^]	Union-C (3057) [§]
7	Union-C (3057) [§]	Overlord-C (3057) [§]	Union-C (3057) [§]	Union-C (3057) [§]
8	Titan (3057) [^]	Union-C (3057) [§]	Overlord-C (3057) [§]	Broadsword (3057) [^]
9	Miraborg (3057) [§]	Overlord-C (3057) [§]	Mercer (3067) [§]	Overlord-C (3057) [§]
10	Overlord-C (3057) [§]	Triumph (3057) [^]	Carrier (3057) [^]	Titan (3057) [^]
11	Overlord-C (3057) [§]	Sassanid (3057) [^]	Lion (3057) [§]	Overlord-C (3057) [§]
12	Confederate (3057) [§]	Fortress (3057) [§]	Titan (3057) [^]	Mercer (3067) [§]

[†]Non-OmniFighter, [^]Aerodyne, [§]Spheroid

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DESPERATE

ALRill

STEVEN MOHAN, JR.



**THE SKIES OVER BREADBASKET, GREENVELDT
CORAINES, OUTWORLDS ALLIANCE
6 AUGUST 3064**

The *Leopard* fell out of the black sky, body flat, nose angled up slightly as she bled velocity, her squat aerodyne shape aglow from the heat of her recent atmospheric entry. Her fuselage was painted a mottled green and gold, her belly a plain white.

She'd be carrying 'Mechs.

Supervisor Joshua Hill of the Coraines Militia absently touched the medallion tucked beneath his olive drab flight suit, reading the shape of a stalk of wheat with his fingers. He thought of it as his Omnis medallion. It kept him close to life: even here, strapped into his cockpit where he would face life's antithesis.

BattleMechs.

His hand tightened on the stick of his STU-K5 *Stuka*.

Hill's radio crackled. "Hey, is that a *Union*, three o'clock high?" asked his wingman, Defender Charles "Snakebite" McKay.

Hill glanced up and saw the pale dot of a spheroid DropShip, its engines flaring molten orange against the midnight blue of high atmosphere.

"Negative," said Hill. "Coraines isn't important enough to attack with more than one lance. I make her a cargo ship, probable *Mule*."

"Oh," said Snakebite, "sure."

He sounded disappointed. Hill shook his head. The kid was fresh out of flight school, but he was good. Already he had a single red star painted on his fuselage just beneath the cockpit, and he was eager for more.

In contrast, Hill had seven confirmed kills. None of them were painted on his aircraft.

"We gonna take her out, Skipper?" asked Guardian Shelley "Top Hat" Kinta. Kinta piloted number three of four birds. Two *Stukas* and two *Shilones*, that was all they had to defend a world.

"That DropShip can't hurt our people. What she's carrying, can. We want what's inside."

"So we're not going to take her out?" asked Defender Thomas "Big Red" Krajewska.

Hill sighed. "Listen up," he said. "Three and Four, you stand off and hit her port side with your autocannons. Two, cover the *Shilones*. I'm going to start my run."

"Gonna take all the glory," said Snakebite bitterly.

There is no glory here, Hill wanted to say, it's a dirty and dangerous job and I'm better equipped to do it than you. But he didn't have time for that, so instead he said, "You have your orders, *Defender*."

Then he rolled right and nosed down, dropping into a U-shaped turn that brought him right back up again, standing on his tail, his *Stuka* an arrow pointed at the DropShip's soft belly.

He spared a glance back, saw the two Boomerangs split up, the *Shilones* juking toward the DropShip, their twin ACs smashing armor on the dropper's port side. Snakebite rolled left, pulling fire away from the smaller *Shilones*.

Hill pushed his throttle forward, nursing every last newton of thrust out of his GM 300, screaming toward the *Leopard*.

The DropShip opened up with her nose weapons, azure lightning slicing centimeters past his left wing, emerald fire gouging divots in his nose armor.

He juked right-left-up-right, trying to throw off the gunners' solution, then shoved his throttle hard over, arcing out of the steep climb and sending his fighter racing away from the dropper.

Hill pulled up into a tight loop, rolling at the same time, and suddenly he was racing toward the *Leopard*, his nose centered on the right rear 'Mech bay door.

Only then did he open up with his weapons.

He loosed a flight of SRMs and then he was juking again, spraying laser fire along the *Leopard's* starboard quarter as his missiles ran straight and true.

He just had time to see the SRMs blossom into a molten orange fireball and then he nosed down, pushing his *Stuka* into a steep dive as he raced the *Leopard's* gunners to the deck.

"Boomerangs, come around and put some fire into that new hole."

"Roger, Skipper."

Hill cleared the effective range of the dropper's gunners and pushed his *Stuka* into a lazy loop, climbing again. Ahead of him he saw Top Hat and Big Red pouring the last of their autocannon rounds into the 'Mech bay that he'd opened to sky.

Hill broke low, coming up for another pass at the *Leopard's* right side, juking through glowing streaks of death, every hit melting irreplaceable composite off his airframe.

He clenched his jaw and held course. Just . . . a little . . . longer.

He popped over the *Leopard's* right wing, letting loose with a flight of LRMs and then riding his four Exostars all the way in to the shattered door, until he was close enough to pop loose a second flight of SRMs and then skip away.

This time he shot straight up and rolled over.

So his cockpit was turned toward the *Leopard* when his last flight of missiles hit. The roll-up door had been torn to shreds and he saw flashes of incandescent light inside, heard the echo of a massive concussion even over the low growl of air rushing past his cockpit.

Then he saw the 'Mech tumble out the smashed door. It was a *Bandersnatch*, solid turquoise with a blood red battleaxe painted over its left torso, though the paint job had been badly damaged by the same explosions that had ripped the machine free of its restraints. Its left arm was missing, but the machine made an attempt to hook the door frame with its right.

For a second it held.

And then the tortured metal of the frame tore away.

The 'Mech tumbled into the sky, still entangled with a five-meter strip of laminated steel. Behind the *Bandersnatch*, Hill saw the cotton wisps of clouds and the gold and green patchwork of farmland. The 'Mech was on its back, looking up at the sky that had been its undoing.



Hill watched it fall, arm and legs flailing helplessly, desperately trying to grab hold in a world suddenly without purchase.

A whoop went up over the general channel as his flight saw the falling 'Mech.

"Lock it down," snarled Hill.

It wasn't that he felt any pity for the *Bandersnatch's* pilot. The SOB was a stone killer, and worse, he or she piloted a walking obscenity.

But this wasn't a game. People were going to die today.

Maybe a large number of people if he and his flight failed to stop the pirates.

"Let's hit her again," said Snakebite.

"That's a negative," said Hill. "She's too close to the deck. There's no room to maneuver."

He flattened into a low orbit, his pilots following his lead, cutting circles in the sky as they watched the *Leopard* touch down through in long field of winter wheat, tearing up a furrow and scorching the golden crop black. A towering column of black smoke to the east marked where the *Bandersnatch* had come down.

Hill thought about that. Snatches carried three Holly racks, and LRMs weren't a bad way to go if you were being harassed from above. What else was in that *Leopard*?

He glanced up at the *Mule* coming down. If he were the pirates he'd anchor the LZ with the *Leopard*, bring down the cargo ship to cover the debarkation point with another set of guns, and then he'd unload his 'Mechs.

Hill shook his head. No. Right now the pirates were only facing planetary militia. They couldn't take the chance that AAA regular forces would jump into a pirate point and ruin their whole day. First Wing's Second Regiment was only a jump away at Jordan Wais. So the pirates had to move fast.

Which meant they had to get their 'Mechs off and their cargo dropper down in parallel. That gave Hill a small window of opportunity.

Small and dangerous.

"We'll pick off the 'Mechs as they debark. I'll take lead."

"Big surprise," muttered Snakebite.

Hill gritted his teeth, but didn't answer the barb. He didn't have time to debate the kid; his people needed to know what they were facing. "This has to be a grocery run. They're here to load up the *Mule* with food. They need 'Mechs to punch through militia infantry. Good news is, if we can hurt 'em bad enough, they'll pull out."

"What do you figure that means, Skipper?" asked Top Hat. "One, two 'Mechs?"

"Let's say two," said Hill.

"Bad news?" asked Big Red.

"Bad news, is we're going to have to go through the *Leopard* to get the 'Mechs and we're going to have to do it fast."

Something below caught Hill's eyes—one of the doors sliding open. As he watched, a 'Mech walked down the right forward ramp. It was a turquoise HMR-3M *Hammer*. He watched a second *Hammer* and an ARC-4M *Archer* emerge from the other side. All machines loaded out with LRMs tied to Artemis IV fire control.

Snakebite whistled appreciatively. "That's not all the bad news, Skipper."

"What about the *Archer*?" asked the boy.

"We only need to bloody their nose. No reason to throw ourselves at the big boy if we don't have to."

Snakebite snorted, but said nothing.

"Just follow my lead, Snakebite. Top Hat, you have lead on the starboard *Hammer*. You need to be jukin' and jivin', boys and girls. Wingmen, remember this is not a convoy. You need to come in behind, but on your own vectors. After first pass, we'll come up and do BDA before swinging around for the next pass. Any questions?"

For once, mercifully, no one had anything to say.

"Good," said Hill. "Let's go."

He pushed his *Stuka* into a power dive, dropping almost straight down, giving the *Leopard* as little target aspect as possible. Hill juked through the streams of fire that rose up toward him from the planet's surface. But there was a basic problem with this set-up.

The pirates knew where they had to end up.

He leveled out, running straight at the turquoise *Hammer*, pouring laser fire into the machine.

The warble of a jump tone filled his cockpit, telling him the *Hammer* had locked on. No matter how he dodged or shimmied, he could not break that shrill call.

Hill flashed on the *Hammer*, an ugly brute with broad shoulders that sported two Coventry five-tubes on either side of the monster's round head.

He saw the bright flash of a missile launch. Double flight.

He dropped his nose, swooped down, arced up, all in one fluid motion.

The first flight of LRMs failed to make the tight turn and intersected with the ground, digging craters in the earth. The second flight caught him along the left wing, shattering armor and tearing into the pair of Exostars there.

His eyes flickered down to his board in time to see the laser status lights blink red.

He pulled back on his stick, climbing away from the little monster, pulling his aircraft over so he could watch Snakebite's attack run.

What he saw sent a shiver of dread wriggling down his spine. Snakebite wasn't lined up on the *Hammer*.

He was going after the *Archer*.

"Snakebite," Hill called out. There wasn't time to say anything else.

The young defender punched a barrage into the heavy, but the pirate MechWarrior just stood there and took it.

And then answered back.

The *Archer* loosed a double flight of Doombuds, followed by a salvo of lasers. All targeted on the same place.

Snakebite's cockpit.

The boy's *Stuka* jerked up, and all at once Hill realized Snakebite had lost the bubble. It happened to young pilots sometimes; they found themselves in a bad situation, panicked, and if something interfered with their visibility they lost track of up and down.

Snakebite's fighter flashed past the *Archer*, but the heavy's pilot turned and followed with another double flight of LRMs.

The *Stuka* jerked left and then arrowed into the earth, sending a bright orange fireball rising into the sky.

"We got the *Hammer*," said Big Red, but not before it got Top Hat. Lucky hits."

Two dead, thought Hill. He'd lost two pilots. If Snakebite had

"All right, *Stukas* left and Boomerangs right," said Hill. "Snakebite, primary target is the *Hammer*."

listened, they might've taken apart the second *Hammer* and this would all be over now. Instead there were two dead and likely more to come. Hill touched the medallion under his flight suit. Such a high price to pay.

He swallowed hard, forcing himself back to the here and now. "What's the status of your armor?"

He could hear the hesitation in Big Red's voice. "Skipper, if I take another pass, I'm afraid that *Leopard's* gonna go Moses on me."

Go Moses. Part the Red Sea.

So Big Red was torn up.

The truth was, he wasn't in much better shape. Hill's forward armor was an ugly patchwork of yellows and reds, he'd lost half his large lasers in the last attack, and he was facing a pair of missile boats with be-yoo-tiful fire control.

The smart move would have been to withdraw.

But he had taken two of their 'Mechs and damaged their DropShip. The pirates had to be enraged. If he let them go, they would do more than steal Breadbasket's harvest. They would brutalize the innocent people of this world. His mouth tasted dry.

He couldn't let that happen.

"Big Red, I want you to start an attack run on the *Leopard's* starboard side."

"Yes sir," said the boy stiffly.

"Listen," said Hill. "I don't want you to *actually* attack. Just draw the attention of the dropper's gunners. I'll do the rest."

"Yes, sir," answered Big Red. And then softly, "Godspeed, Skipper."

"Just don't get yourself killed," growled Hill.

Then he put his fighter into a dive.

Hill came in fast along the *Leopard's* port quarter, running a mere five meters above the deck, so low he could almost *feel* the wheat tickling his butt.

Aimed right at the *Hammer*.

The *Hammer* pilot had guts. He set himself and lighted Hill up with his fire control radar.

A jump tone sounded in Hill's ear.

He gritted his teeth and kept on coming.

The *Hammer* fired two flights of missiles.

Hill answered with his own missiles right before he popped up and flashed past the *Hammer's* LRMs.

The 'Mech's missiles looped around and locked on again. Which was too bad, because there was no way Hill could outrun them and with his damaged armor he wasn't going to survive another hit.

But what the hell. He pumped a flight of SRMs into the *Hammer* right before he passed three, four meters above the machine's head.

And dove for the ground.

He leveled out so low that this time he really *could* feel the wheat tickling his butt.

Just a few centimeters higher than Snakebite's fatal dive.

The shrill jump tone told him the missiles were still locked on his *Stuka*. But the *Hammer* was between him and them.

They hit the pirate 'Mech right in the same place where his missiles had gone in. Both flights. It was enough to do the trick. Suddenly the *Hammer* was swallowed by the fiery explosion of an internal ammunition detonation and Hill stood his fighter up and fled for the sky.

But not before he saw the *Archer* racing back to the DropShip.

LEVI AIR BASE, BREADBASKET, GREENVELDT

After showering and changing into jeans and a well-patched denim work shirt, Hill turned around to find Director Richard Kilaka, the commander of all militia forces on Coraines, standing behind him. Kilaka was a tall, thin man with skin the color of rich, black soil. Quiet and enigmatic, he never spoke unless he had something to say. He was also one of the very few people Hill knew who scared the hell out of him.

Kilaka tossed a vidclip down on the low locker room bench between them. "This is the BattleROM readout from Krajewski's *Shilone*. He caught your engagement with the *Hammer*."

Hill said nothing.

"This is some of the most incredible flying I have ever seen," said Kilaka, a note of awe in his voice.

Hill shook his head. "I don't think so, sir."

"Sure," said Kilaka. "I just said it because I live to blow sunshine up your skirt."

"Look—" said Hill.

"Son, most pilots have to wait to get into the Flying Nightmares." He jabbed his finger at the bench. "I could get you in just with that clip."

"No you couldn't, sir," said Hill. "I'm just a farmer."

He offered Kilaka a respectful nod and then stepped past him, not sparing a single glance for the vidclip or the future it promised.

When Hill stepped outside, he found that Old Tuck had pulled Candle out of the stable and hitched her to Hill's wagon. The old man took better care of his horse than he did. Hill shook his head. He'd have to have Tuck out to the house for one of Molly's home-cooked meals as thanks.

He ran his hand along Candle's neck, gentling the horse, breathing in her musky smell. Then he climbed atop the clapboard wagon and took the reins, setting Candle in an easy trot, his hooves clapping against the ferrocrete roadway.

On the horizon he saw a column of black smoke marking the blue sky, smelled the stink of burnt metal and spent explosives on the wind. Suddenly Hill hated combat, the terrible destruction, the loss of life, especially the desperate thrill of it that made it like a drug for some men.

He closed his eyes.

How easy it would be to get hooked.

He was always so careful, holding himself apart from the glory of battle, lest he be caught up in it. He touched the Omnis medallion under his shirt for strength. He had done his time in the militia. He should turn in his resignation, just walk away.

But even as the thought passed through his mind, he knew he never would. No matter what he told himself now, he'd be back up in the sky the next time there was a raid.

He sighed deeply, wondering what Molly had made for dinner tonight.

22 July 3064

To whom it may concern:

The purpose of this letter is to submit my formal
in this decision taken



The Aegis-class SLS Promise proudly displays its Star League Nova Cat insignia.

The Aerospace Movement section of *Total Warfare* covers the basics of movement, in space and in atmosphere, for most aerospace units. However, some additional rules apply to the movement of those aerospace units presented in this book. A host of additional advanced movement options are also contained in this section, increasing the realism of aerospace unit movement along with the potential enjoyment of a game as players maneuver their forces.

Fighter Squadrons: As the Fighter Squadron rules deal both with movement and combat, as well as how to assemble such units, those rules are found in the *General Rules* section (see p. 25).

ADVANCED UNITS

The following rules apply to the movement of JumpShips, WarShips, Space Stations and Satellites. Unless otherwise stated, the advanced units below follow all the standard movement rules for aerospace as outlined in the *Aerospace Movement* section of *Total Warfare*.

MOVEMENT SUB-PHASES

The addition of advanced units expands the movement sub-phases of the Movement Phase (Aerospace; see p. 76, *TW*). The expanded sequence is:

1. Space Stations
2. Ground Units
3. JumpShips
4. WarShips
5. Escape Pods/Lifeboats
6. DropShips
7. Small Craft
8. Fighters

JUMPSHIPS

Intended for traveling between star systems, jumping through space by means of their massive Kearny-Fuchida drives, JumpShips are essentially static in most games. Their fusion drives, while designed merely to allow the unit to maintain station, can nonetheless generate sufficient thrust to move in a conventional manner, albeit somewhat more slowly than other aerospace units.

JumpShips may expend thrust points over multiple turns, using the accumulated thrust to change velocity per the same rules that apply to other aerospace units. Any accumulated thrust not used by the maneuver counts toward the next maneuver. JumpShips do not have Safe and Maximum Thrust values; all movement by JumpShips is assumed to be Maximum Thrust.

Additionally, JumpShips mount attitude jets that allow them to change their facing by one hexside per turn; this movement does not count toward the accumulated thrust for the change of



velocity, as noted above. Furthermore, a JumpShip cannot use its attitude jets (that is, make a facing change) in the same turn that it changes its velocity, nor can it expend thrust in that turn. However, the previously accumulated thrust still exists and can be added to by additional thrust on a turn or turns after a hexside change is made.

JumpShips can only operate in space; if they enter an atmosphere or space/atmosphere interface hex, they are immediately destroyed.

An Invader-class JumpShip with a station-keeping Thrust of 0.1 G has the equivalent of .2 thrust points. On turns 1, 2 and 3, the Invader expends .2 thrust points, for an accumulated .6 thrust points. On Turn 4, the controlling player decides to use the attitude jets to change the JumpShip's facing by 1 hexside; he cannot expend any thrust that turn, and so at the end of Turn 4 still only has a cumulative thrust of .6. On Turn 5, the player expends another thrust point, bringing the total to .8, so that during the Movement Phase (Aerospace) of Turn 6, he will be able to change the Invader's velocity by 1 because he will then have an accumulated Thrust of 1 point to spend.

WARSHIPS

Despite weighing hundreds of thousands or even millions of tons and being hundreds of meters long, combat JumpShips—WarShips to most people—maneuver little differently from DropShips thanks to their huge drives. Their combination of maneuverability, firepower and armor make them a force to be reckoned with in space combat.

WarShips can only operate in space, lacking the streamlining (if not the raw thrust) to function in atmospheric or space-atmosphere interface hexes. If a WarShip enters a space/atmosphere interface hex, apply a +10 modifier to the Control Roll (see p. 78, TW). A WarShip that successfully makes the roll (avoiding damage and entering the space/atmosphere interface hex) can return to space in the following turn if it can spend 4 thrust points. Otherwise it will fall one Atmospheric Row per space turn until it reaches the ground hex row, where it automatically crashes (see p. 81, TW).

The effect of a crashing WarShip is based on its size. First, the players must determine which mapsheet of the playing area (if there are multiple mapsheets) is the primary location of the crash site. Next, the damage is determined: for every 100,000 tons, 10 capital-scale damage points, multiplied by the current velocity of the unit when it entered the ground hex row, are applied to every hex of the primary mapsheet as though the crash were an orbit-to-surface attack (see p. 91). Finally, if a WarShip is larger than 1,000,000 tons, that damage is applied not only to the target mapsheet, but to all adjacent mapsheets.

SPACE STATIONS

Space Stations, like JumpShips, are essentially static in aerospace combat. Unlike JumpShips, however, a Space Station's station-keeping drive lacks the power to provide even rudimentary changes in velocity within the context of a game; any repositioning of a station requires hours if not days to achieve, the drive generating only around 0.1 G.

Space Stations mount attitude jets like JumpShips. However, because a Space Station is designed to sit in an orbit

and generally not move—it is not designed for even the mild movement a JumpShip might encounter—its attitude jets are weaker. A Space Station's attitude jets provide .2 thrust; just as with a JumpShip making velocity changes, a Space Station can accumulate thrust across several turns to make a facing change. Once a Space Station has accumulated 1 thrust point using its attitude jets, it must make a facing change.

Military Space Stations mount more robust attitude jets and can change 1 hexside per turn.

ADVANCED INITIATIVE

The Advanced Initiative rules determine Initiative on a unit-by-unit basis using Control Rolls (all applicable modifiers to a Control Roll apply). This system takes longer than rolling Initiative once for each side, but it gives better quality crews (and smaller aerospace units) an advantage. The unit with the lowest Initiative moves first, followed by the unit with the second lowest, and progressing to the highest Initiative. For ties, units with the lowest MoS move first. If both units possess the same MoS, re-roll the Control Roll. This system eliminates the use of movement sub-phases.

Dropping Troops: Even when using Advanced Initiative, dropping troops (see p. 20) always move after all other aerospace units have moved (including ground units in zero-g operations). The exception are ejected pilots/lifeboats/escape pods (see p. 24), which always move last after all other aerospace units have moved, including dropping troops.

John's fighter pilot has a Piloting Skill of 4. He rolls 2D6 with a result of 6—an MoS of 2. Adding the +3 fighter modifier, the fighter has an Initiative of 5. Simon's DropShip crew also has a Piloting Skill of 4. His 2D6 roll results in a 9, an MoS of 5. For a DropShip, the modifier is 0. The two units tie. However, because the fighter's MoS was lower than the MoS of the DropShip, John must move first.

ADVANCED INITIATIVE TABLE

Initiative = Control Roll MoS/MoF + Class Modifier

Class	Modifiers
Fighter	+3*
Small Craft	+0
DropShip	+0
Support Vehicle (aircraft)	-1
WarShip	-3
Airship	-4
JumpShip	-5
Space Station	-5
Ground Unit in Zero-G Ops	-6
Satellite	-7

*Including squadrons

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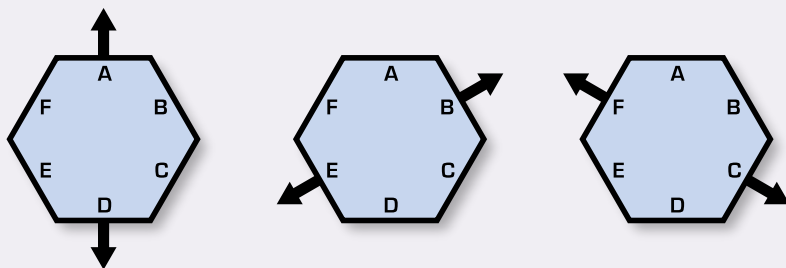
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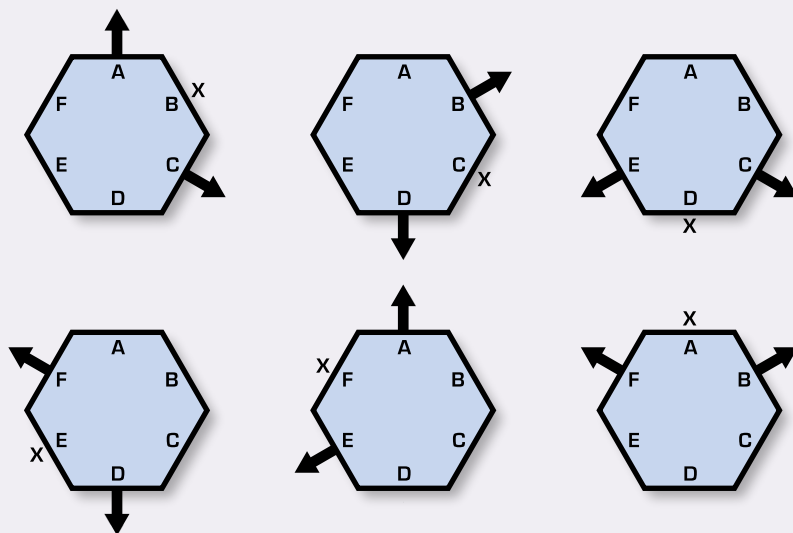
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ADVANCED MOVEMENT

The basic aerospace rules represent a simplification of the mechanics governing movement in space, trading realism for playability. The advanced movement rules simulate a more realistic version, where a unit's heading (direction of movement) may differ from its facing (the direction in which the nose of the unit is pointing). In the advanced movement rules a unit may not decelerate; to slow down, it must alter its facing and apply thrust in a direction that counters its current movement. These rules accommodate a unit flying sideways or even backward, though tracking such maneuvers requires extra record-keeping. In the advanced movement system, facing changes do not affect a unit's heading.

A unit's facing affects firing arcs according to the standard rules and determines the vector to which thrust is applied. Units can change their facing one hexside by spending 1 Thrust Point. A unit can change facing as long as it has Thrust Points available.

A unit's heading and velocity are determined by a system of vectors. The six vectors, labeled A-F, correspond to the six sides of each hex. The A side of each hex is always toward the top of the map, regardless of a unit's facing. A vector is active if thrust is applied while the unit is facing that hexside. A vector is inactive if the unit spends no thrust to move through that hexside.

To use this system, each time a unit spends thrust, note down that number on the record sheet in the appropriate vector (the vector of the unit's facing). Next, determine the effect of spending thrust by consolidating the active vectors. First, consolidate any active opposing vectors (see Opposing Vectors diagram, at left) by subtracting the lowest thrust value from both vectors, reducing one vector to 0. Per standard rules (see p. 76, *TW*), a unit may spend thrust at the start or end of its movement; in advanced movement this is either before any vectors have been applied to the unit or after all vectors have been applied.

Next, consolidate the oblique vectors (see Oblique Vectors diagram, at left). Oblique vectors are pairs of vectors that are both adjacent to the same hexside (F and B, A and C, B and D, and so on). When any pair of oblique vectors is active, subtract the lowest of the two thrust values from both vectors (or from both if they are equal), reducing one (or both) oblique vectors to 0, and add the same value to the thrust value of the vector in between.

For example, if a unit has an A vector of 4 and an C vector of 2, its player would subtract 2 from both values. The C vector would become 0 and thus inactive; the A vector would be reduced to 2, and the B vector between them would be increased by 2. After consolidating all vectors, a unit should have no more than two active vectors. A unit with more than two active vectors must be consolidated again.

After the player has spent the thrust planned for the current movement and the active vectors have been consolidated to one or two, the unit completes its movement by moving the number of hexes and direction indicated by each vector. The unit is assumed to move in a straight line: if the exact path needs to be determined (for example, to decide whether a collision occurred), lay a straight edge between the center of the origin and destination hexes. If the path passes directly between two hexes, the controlling player chooses which hex the unit moves through.

The Advanced Movement diagram, on page 53, shows the advanced movement system in action. The fighter's nose indicates its facing (in Hex A this corresponds with the hex number 0209), and the small numbers surrounding its hex show the fighter's vectors. A fighter begins the turn in Hex A with a Velocity of 5 in Vector D and a Velocity of 3 in Vector C. If the player spent no thrust at all, his unit would move to the position and facing shown in Hex B by moving 5 hexes aft and 3 hexes aft-right. The fighter would not check for a collision with either of the asteroids; the actual path of movement is shown by the dotted line. Rather than leaving the fighter's movement as is, the player spends 3 Thrust Points at its current facing, increasing Vector A from 0 to 3. He then spends 1 Thrust Point to change facing one hexside to the right, and spends 1 more Thrust Point increasing Vector B to 1 (Figure 1). After the thrust expenditure, the vectors are consolidated. First, opposing vectors are consolidated. In this case, there is one pair of opposing active vectors: A and D. The lesser of the two, A, is reduced by 3 to 0, and the opposing vector is reduced by 3 to 2 (Figure 2). Next, the player checks for oblique vectors. There is one pair, D and B. The lesser



• ADVANCED AEROSPACE MOVEMENT DIAGRAM •

of the two, B, is reduced by 1 to 0, and D is reduced by 1 to 1. The amount subtracted from each (1) is added to the vector in between, in this case C, increasing it to 4. Because there are no more active opposing or oblique vectors, and there are only two active vectors, the fighter's final vectors are now known (Figure 3). After spending 5 Thrust Points on movement as described above, the fighter's final position and facing would be as shown in Hex C. Note that there is no chance of the fighter colliding with the asteroid in Hex E.

ROTATIONAL VECTORS

Players who find the above rules still too rigid may add another factor into their maneuvers—rotational vectors. When using this rule, units using the advanced movement rules that turn hexsides will continue to rotate their facing a number of hexsides to match the rotational vector until thrust is applied to counter the rotation.

In addition to the A-F vectors, two additional vectors apply to such units: clockwise/anticlockwise, opposites that are consolidated normally. These rotational vectors change only the unit's facing and do not affect how a unit moves except in how it expends thrust to chance facing.

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Pitch up/pitch down and flip left/roll right may also be considered as rotational vectors, but in the case of these vectors the unit flips end-over only when 2 points of velocity have accumulated in the given direction; 2 Thrust Points are required to stop such a move.

A WarShip facing Hexside A spends 2 Thrust Points to turn clockwise. After doing so, it has a clockwise rotational vector of 2 and rotates its facing two hexsides clockwise to face Hexside C. If it does not spend thrust to counter this rotation, it will continue to change facing next turn, pointing next toward Hexside E (and the turn after that Hexside A and so on). As it happens, the WarShip spends a single Thrust Point counter-clockwise at the start of the next turn. Consolidating the rotational vectors, the counter-clockwise vector is subtracted from the clockwise one, reducing it to 1 and so the WarShip's facing change slows (but does not stop) and it ends the turn facing Hexside D.

A DropShip applies a point of thrust to a left roll vector. In the first turn nothing happens (as there is effectively only 1 point of accumulated velocity), but in the second turn it makes a left roll, reversing its sides, as the accumulator vector matches the two needed to roll the unit. Had 2 points of thrust been put into the roll vector, the DropShip would roll every turn.

RANDOM MOVEMENT

When using Advanced Movement, use the following Random Movement Table for random movement.

RANDOM MOVEMENT (ADVANCED VECTORS) TABLE

1D6	Effect
1	Turn 2 hexsides left
2	Turn 1 hexside left
3	Increase vector corresponding to current facing by 1
4	Increase vector corresponding to current facing by 2
5	Turn 1 hexside right
6	Turn 2 hexsides right

LATERAL AND DECELERATION MOVEMENT

Under these advanced movement rules, a unit can use its maneuvering thrusters to perform lateral or sideslip maneuvers as well as use these thrusters to reduce their "forward" velocity. Once per turn a unit may apply one point of thrust to any facing (except aft), changing their vectors. The cost of this vector change is identical to a facing change.

Damage to a unit's thrusters will increase the MP cost for lateral movement as per Thruster critical hits (see p. 240, *TW*). If the unit is applying vector change directly to its nose, for every two boxes (rounded down) of thruster damage, apply an additional 1 MP to the cost for nose vector change. For example, a DropShip with 2 Thruster boxes marked off on the left side and one Thruster box marked off on the right would pay 2 MP to change nose vector. A WarShip with a destroyed thruster on the left side would pay 2 MP to change the Nose vector, and would be unable to change its left forward or rear vector.

ANGLES OF ATTACK

When using these advanced movement rules, Angle of Attack to-hit modifiers (see p. 237, *TW*) are calculated from the units' thrust vectors, not their relative facings.

SPECIAL MANEUVERS

While combat acrobatics are largely the realm of fighters, Large Craft have their own range of special maneuvers in and out of combat.



YAWING AND END-OVERS

When using *Advanced Movement* rules (see p. 52), a "barrel roll" (see p. 85, *TW*) maneuver may be used to swap a unit's nose and aft facings, in effect changing their facing 180 degrees. This move may take one of two forms: a yaw (which preserves left and right relative to the nose of the unit on the map) or an "end-over," which reverses fore and aft and swaps left- and right-side arcs. Unlike a regular barrel roll, yawing and end-overs cost 2 Thrust Points to execute.

Rotational vectors (see p. 53) can be used with this rule. Note that this rule can be used by any aerospace unit.

A WarShip facing toward Hexside A opts to carry out an end-over during its Movement Phase. Spending 2 Thrust Points, the unit reverses its front and rear facings (and so now faces Hexside D), and also swaps its left and right sides. If it chose to turn 1 hexside right, it would in fact turn 1 hexside left because of the reversed sides (potentially significant if the unit has damaged maneuvering thrusters). Had the WarShip chosen to yaw, it would have swapped front and rear facings in the same manner but retained its left and right orientation.

DOCKING

Two Large Craft can attempt to dock, linking airlocks (such as bay doors) or docking adapters. A docking attempt normally takes about 30 minutes (30 turns). This time can be increased as a result of docking collar damage, or voluntarily to improve the likelihood of a safe docking. A unit can dock in less time, to a minimum of 5 minutes, but such reductions increase the difficulty per the Docking Modifiers Table. These rules represent friendly units; enemy units attempting to dock/grapple a unit use the *Infantry Vs. Infantry Actions* rules (see p. 167, *TO:AR*), or the *Infantry Vs. Infantry Actions (Expanded)* rules from this volume (see p. 34), as appropriate.

Units attempting to dock must be in the same space hex and moving at the same heading and velocity for the length of the maneuver. During the End Phase of the turn, once the time allocated for the docking maneuver has expired, make a Control Roll with the modifiers shown on the Docking Modifiers Table (see p. 56). A successful result indicates a successful docking. Failure

indicates a mishap. The Docking Damage Table (see p. 56) lists the effects of the mishap based on the Margin of Failure (MoF).

Out-of-control units may not be the target of docking attempts (unless the docking units has a Naval Tug Adaptor; see p. 147, *TO:AUE*), nor may any hostile unit capable of expending thrust.

Docking Collar Locations: In most instances, exactly where an aerospace unit docks to another aerospace unit (the location of docking collars) can be left vague. However, certain rules exist (such as determining what arcs might not be able to fire when docked to another ship, or *Zero-G Ground Unit Combat*; see p. 107) that require a specific location for any docked units. In any scenario where the players think they will likely need to know the specific location of an aerospace unit's docking collar or bay doors, they can simply choose any location (except docking collars may not be placed on the aft side of JumpShips and WarShips).

If a KF drive unit has multiple docking collars, they should be spread as equally as possible around the unit. While players may wish to use a unit's Technical Readout illustration as a reference, they ultimately can place the docking collars wherever they choose, within the rules as described. For example, the *Star Lord*-class JumpShip mounts six docking collars. Looking at the illustration in *Technical Readout: 3057, Revised*, no docking collars are apparent, so that doesn't provide any help. A player might therefore simply assign one docking collar to each of the four available locations: Fore-Right, Fore-Left, Aft-Left and Aft-Right, leaving two docking collars to place in two different locations as he sees fit. The bay doors of units, particularly DropShips, tend to be located on the sides of units, and should be specified in the same fashion as docking collars.

If a scenario begins with aerospace units docked to a parent aerospace unit, the parent unit's controlling player decides which docking collars or bay doors those units occupy. At any point during the game, if a unit is attempting to dock with another aerospace unit, the second unit's controlling player determines which docking collar or door is occupied if the docking is successful.



MM

Clan Nova Cat Aegis and Carrack WarShips prepare to dock in order to transfer supplies.

A friendly Large Craft will always dock where a docking collar is located, as determined above, in preference to bay doors. In the case of a DropShip docking with a JumpShip or WarShip, the DropShip may dock with its aft location or nose location wedded to the parent unit's docking collar, at the discretion of the controlling player. In the case of a JumpShip or WarShip docking with either a JumpShip or WarShip, both units assume an identical orientation and heading side by side (an umbilical tube is stretched between the two aerospace units' docking collars or bay doors). Any unit docking with a Space Station may use a docking collar or bay door of its choice. DropShips docking with DropShips may use their bay doors or docking collars as preferred after specifying their location as noted above.

Attacks From Docked Units: Neither docked unit can make any attacks using weapons in the same arc where the docking occurred (as determined above). The only exceptions are when different unit classifications are involved: specifically, DropShips to JumpShips/WarShips/Space Stations (JumpShips, Warships and Space Stations are considered the same classification for this rule). If a unit in a smaller classification is docked to a unit in a larger classification, the smaller unit still cannot use the weapons in the arc where the docking occurred, but the larger unit can use weapons in its arc. For example, a DropShip docked aft first to a JumpShip, WarShip or Space Station would be unable to fire its aft weapons, but the JumpShip/WarShip/Space Station would be able to fire all weapons in that arc. However, if WarShip A is docked along its right broadside and WarShip B is docked along its left broadside (same orientation and heading), neither would be able to use those broadsides, even though WarShip A would still be able to use its fore and aft right side arcs, while WarShip B would be able to use its fore and aft left side arcs.

Attacking a Docked Unit: See *Attacking a Docked/Grappled Unit* (see pp. 167, *TO:AR*, and 34 of this volume, as appropriate) for rules on how to attack docked units.

Fighters and Small Craft: Fighters and Small Craft do not dock with their carrier units; instead, they use the launch/recovery rules presented on pages 84-86 of *Total Warfare*.

Undocking: Undocking requires no special rolls or rules and occurs during the End Phase of any turn when the player declares the unit is undocking; the unit can move normally on the following turn. However, a unit undocking from an out-of-control unit must make a Control Roll to avoid going out-of-control itself.

Expendng Thrust: If any thrust is expended by a unit that has units docked to it, all such docked units must make a standard Control Roll, apply a +1 modifier for each point of thrust expended. A success means the ships remain docked, while a failure automatically undocks that unit, and destroys the docking collars on both units; as though both docking collars received critical hits.

Space Stations: Space Stations with KF Booms occupy one JumpShip collar per 50,000 tons (rounded up). They take 1 hour to dock and to undock for every 1,000 tons of the station's mass (rounded up). In campaign play, round hours up to the nearest whole day. The JumpShip need only be present for the last half (round up) of the docking time or first half of the undocking time. During docking, a Space Station may not expend thrust, fire weapons or launch/recover other units.

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DOCKING MODIFIERS TABLE

Condition	Modifier
Unit has critical damage to thruster	+1/box
Docking conducted during combat*	+2
Docking unit is JumpShip	+4
Docking unit is WarShip	+3
Docking unit is DropShip over 20,000 tons	+2
Docking unit is DropShip under 5,000 tons	-1
Per 15 minutes added to docking time	-1
Per 5 minutes subtracted from docking time	+1
Sensor damage**	+1/box
Avionics damage**	+1/box
Towing Adaptor on docking unit	-2
Target unit is Out of Control	+5***
Docking collar damaged	Double docking time

*This modifier applies to any docking attempts made within 10 hexes of units firing or being fired upon during the docking procedure.

**On either the docking unit or the target.

*** Impossible unless docking unit has Naval Tug Adaptor (see p. 147, *TO:AUE*)

During a battle, an Achilles-class DropShip attempts to dock with its crippled twin to rescue the crew. The docking DropShip rushes the maneuver, opting to do it in 15 minutes rather than the usual 30 (and receiving a +3 modifier for doing so). After maneuvering into the same space hex with the same orientation, the docking unit's controlling player decides to align the DropShips; the docking DropShip (the one attempting the dock) is on the right, using its fore-left docking collar and the dockee DropShip (the one receiving the docking attempt) is on the left, using its fore-right docking collar.

The target DropShip has damaged avionics (another +1 penalty) and combat is taking place within 10 hexes (another +2 modifier). In the unit's favor is its small size; massing 4,500 tons, the Achilles qualifies for a -1 modifier. This gives a net modifier of +5 for the docking attempt, still a difficult proposition.

With a base Piloting Skill of 5, the Modified Target Number for the roll is 10. The dice roll result is a 9, a Margin of Failure of 1. The Docking Damage Table shows that this results in a successful docking between the two units, though each suffers 1 box of docking collar damage. If either aerospace unit had taken damage points, the damage would have been applied to the fore-left of the docking DropShip and the fore-right of the dockee DropShip.

DOCKING DAMAGE TABLE

Margin of Failure	Effect
0	Docking successful
1	Docking successful. Both docking collars take 1 box of damage.
2	Docking unsuccessful. The craft miss each other, but the pilot can attempt another docking after 10 turns.
3	Docking unsuccessful. Both docking collars suffer damage; cross off 1 box. The pilot can attempt another docking after a delay of 10 turns.
4+	Docking unsuccessful. Apply standard-scale damage equal to (MoF - 3) x 10 to the location of both units where the docking collars chosen for the docking attempt are located. The pilot can attempt another docking after 10 turns.

FLIGHT AND TRANSIT TIMES

The following rules provide guidelines that players can use to determine actual flight times around a planet, or between the planets within a solar system, while also offering expanded flight speed rules. While such information usually isn't needed outside of battle, when attempting to ferry reinforcements into a hot battle zone, timing could mean everything.

ATMOSPHERIC FLIGHT TIMES

Fixed Wing Support Vehicles and aerodyne aerospace units are capable of flight at high speeds using the *High-Altitude Movement* rules (see p. 79, *TW*). At that scale, Mach 1 is approximately one hex per turn. Aerospace units can climb above the atmosphere and reach extremely high speeds (see *Suborbital Flight Times*, p. 57), but atmospheric flight has its advantages—and is sometimes the only option, such as for conventional fighters and flight-capable support vehicles.

Non-propeller Fixed Wing Support Vehicles are limited to the Ground Row (approximately Mach 2 top speed; two hexes per turn) and Atmospheric Row 1 (approximately Mach 3 top speed; three hexes per turn) of the High-Altitude Map (see p. 79, *TW*). Non-propeller Fixed Wing Support Vehicles burn 2 fuel points per turn at their top speed at either altitude.

Long-range flights at such speeds are readily calculated once players (or gamemaster, if one is involved) establish the distance of the flight. The following table presents some examples of long range flight in atmospheres of standard Terran pressure (density). These assume travel at 2 hexes per turn (Ground Row) or 3 hexes per turn (Atmospheric Row 1) on the High-Altitude Map, and that the unit does not need to refuel during the flight (see p. 32). The longest distances provided are larger than a great circle flight around half of Terra's circumference, allowing for extended routes



and planets larger than Terra. These assume military flight profiles, where takeoff and landing times can be compressed to a few minutes (5 is assumed below) as the phenomenal acceleration of modern aircraft can be harnessed with little concern for passenger comfort.

Players should refer to page 52 of *Tactical Operations: AR* in the case of atmospheres of alternate pressures (density) to determine the maximum speed at that altitude, and whether their aircraft can operate at that Altitude row.

While the atmosphere extends above Atmospheric Row 1 (35 km) for atmospheres of standard pressure (density), and higher speeds are possible at those altitudes for the aerospace units that can reach them, the units that can operate at those altitudes and speeds are also capable of reaching orbit, which is a milder environment than hypersonic, high altitude atmospheric flight. Therefore, these flight times only address relatively low altitude (35 km or less) supersonic flight.

Players wishing to calculate their own flight times can approximate 1 hex per turn on the High-Altitude map as 1000 kilometers per hour. Players should refer to the *High-Altitude Movement* rules (see p. 79, *TW*) to determine the required thrust and thus fuel consumption at those altitudes.

ATMOSPHERIC FLIGHT TIMES TABLE

Distance in Kilometers	Flight Times (by Altitude)*	
	Ground Row	Atmospheric Row 1
500	18.9 minutes	14.3 minutes
1,000	32.8 minutes	23.5 minutes
2,000	60.6 minutes	42.0 minutes
5,000	2.4 hours	1.6 hours
10,000	4.7 hours	3.2 hours
20,000	9.3 hours	6.3 hours
30,000	14 hours	9.3 hours
40,000	18.6 hours	12.4 hours

* Takeoff and Landing are a military profile of 5 minutes.

SUBORBITAL FLIGHT TIMES

Aerospace units can make much more rapid long distance transits around planets by climbing above the atmosphere. The higher velocities call for longer acceleration and braking (aerobraking or rocket braking) than atmospheric flights, meaning that suborbital flights, at least those that do not end in vigorous and deconstructive lithobraking, are only worthwhile at longer ranges (several thousand kilometers or more).

Of course, spheroid Small Craft and DropShips, which cannot perform supersonic level atmospheric flight, generally must resort to this sort of flight for any journey longer than a few dozen kilometers.

The Suborbital and Orbital Flight Tables Table (at top right) present rough approximations of flight times. It assumes brief, powered ascents, followed by ballistic coasting and powered or aerodynamic braking to a normal landing. Constantly powered flights are very possible with the fusion-powered spacecraft of *BattleTech*, but such flights are a trickier matter to calculate.

While these rules do not address such flights, players are encouraged to independently investigate the rewarding and interesting problem of suborbital and orbital flights at supra-orbital velocities under constantly varying acceleration vectors. The longer flights (over approximately 10,000 km) assume that the unit enters a low orbit over a Terra-sized planet until actively braking from orbit. Larger and smaller worlds than Terra may have longer orbital periods than Terra's low orbit, so this table is only appropriate for planets relatively close to Terra in size. Players can use the table as a guideline for generating flight times for planets significantly smaller or larger than Terra.

SUBORBITAL AND ORBITAL FLIGHT TIMES TABLE

Distance in Kilometers	Flight Time
1,500	15 minutes
2,000	18 minutes
2,500	20 minutes
5,000	30 minutes
10,000	50 minutes
20,000	90 minutes
30,000	120 minutes
40,000	140 minutes

INTERPLANETARY FLIGHT TIMES

The Interplanetary Flight Times Table (see p. 58) is a list of examples of interplanetary (even borderline interstellar) flights using the conventional continuous acceleration method (1G of acceleration to the midpoint of the journey, then 1G of braking to the destination). Generally, launch and landing in these flight profiles do not contribute significantly and so are not included on the table. Also, increased acceleration has negligible effects as well (see *System Transit*, p. 166), and flight paths are virtually straight lines except at the slowest beginning and end portions of the flights (or the shortest of the flights, those of a few thousand kilometers).

Players may wish to use the Terran System Navigation: A Closer Look graphic (see pp. 120–121) when reviewing this table to better understand the distances involved. While some of the information presented here is found on the Transit Times Table on that graphic, a much wider selection of distances is provided. Players can use the Interplanetary Flight Times Table (see p. 58) as a guideline for generating flight times for non-Terran solar systems—whether the planets are packed in tightly, or widely spaced—either based off of the sourcebook fiction for an already established system, or for players to make up from whole cloth.

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INTERPLANETARY FLIGHT TIMES TABLE

1G TRANSIT TIMES

Distance in Kilometers	Astronomical Unit (AU)	Flight Time	Examples (Approximate)*
10,000	0.00007	0.6 hours	
20,000	0.00013	0.8 hours	Mars to Deimos
50,000	0.00033	1.3 hours	
100,000	0.00067	1.8 hours	
200,000	0.0013	2.5 hours	
500,000	0.0033	4.0 hours	Terra to Luna (400,000 km)
1,000,000	0.0067	5.6 hours	
2,000,000	0.013	8.0 hours	
5,000,000	0.033	12.6 hours	
10,000,000	0.067	17.8 hours	
20,000,000	0.13	1.0 days	
38,200,000	0.25	1.45 days	Terra to Venus (closest approach)
50,000,000	0.33	1.7 days	
56,000,000	0.37	1.75 days	Terra to Mars (closest approach)
100,000,000	0.67	2.3 days	
109,780,635	0.73	2.5 days	M5V Class-star Zenith/Nadir-to-Planet Transit
150,000,000	1.00	2.9 days	Terra to Mars (typical separation)
180,323,723	1.20	3.2 days	M0V Class-star Zenith/Nadir-to-Planet Transit
300,000,000	2.00	4.0 days	Terra to asteroid belt
310,447,382	2.07	4.1 days	K5V Class-star Zenith/Nadir-to-Planet Transit
549,230,550	3.66	5.5 days	K0V Class-star Zenith/Nadir-to-Planet Transit
750,000,000	5.00	6.4 days	Terra to Jupiter (average separation)

Distance in Kilometers	Astronomical Unit (AU)	Flight Time	Examples (Approximate)*
1,020,551,142	6.80	7.5 days	G5V Class-star Zenith/Nadir-to-Planet Transit
1,500,000,000	10.00	9.1 days	Terra to Sol's Standard Jump Points
1,989,583,571	13.26	10.4 days	G0V Class-star Zenith/Nadir-to-Planet Transit
3,000,000,000	20.00	12.8 days	Terra to Uranus (average separation)
4,082,204,567	27.21	15.0 days	F5V Class-star Zenith/Nadir-to-Planet Transit
7,500,000,000	50.00	20.3 days	Terra to Kuiper Belt
8,803,732,048	58.69	21.0 days	F0V Class-star Zenith/Nadir-to-Planet Transit
15,000,000,000	100.00	28.6 days	
20,061,999,976	133.75	33.1 days	A5V Class-star Zenith/Nadir-to-Planet Transit
30,000,000,000	200.00	40.5 days	
48,582,783,961	323.89	51.6 days	A0V Class-star Zenith/Nadir-to-Planet Transit
75,000,000,000	500.00	64.0 days	
125,569,286,703	837.13	82.9 days	B5V Class-star Zenith/Nadir-to-Planet Transit
150,000,000,000	1,000.00	90.6 days	
300,000,000,000	2,000.00	128.0 days	
347,844,456,294	2,318.96	137.9 days	B0V Class-star Zenith/Nadir-to-Planet Transit
948,600,000,000	6,324.00	227.7 days	0.1 light-year, Inner Ter-ran Oort Cloud

*Zenith/Nadir-to-Planet Transit assumes planet is located in the middle of the habitable zone; players can adjust flight times for planets further or closer away to a given star, using the rest of the information on the table as a guide (more information is found in the *Solar System Generation* rules in *Campaign Operations*, pp. 98-133).

LANDING AND LIFTOFF (EXPANDED)

The following expands upon the Standard Rules for landing and liftoff of aerospace units (see p. 87, *TW*).

SYSTEMS STATUS

Standard rules assume aerospace units can instantly liftoff as soon as the controlling player desires. However, reality is different, depending upon the readiness of the aerospace unit in question.

Two things govern how quickly aerospace units can liftoff: Preflight Check List and Engine Status.

Launching Fighters/Small Craft: If players are using these System Status rules, they also apply to launching fighters and Small Craft (see *Launching/Recovering Fighters/Small Craft*, p. 84, *TW*).

Preflight Check List

A Preflight Check List allows the pilot/crew to verify that all systems are in a flight-ready status. A Preflight Check List must occur before the engine status can be changed in anyway (see *Engine Status*, p. 59).

The time a Preflight Check List takes is based upon the size of the unit:

- **200 tons and under:** 45 ground turns (7.5 minutes)
- **201 tons to 5,000 tons:** 90 ground turns (15 minutes)
- **5,001 tons to 10,000 tons:** 180 ground turns (30 minutes)
- **10,000 tons and higher:** 270 ground turns (45 minutes)

The controlling player can attempt to liftoff earlier, but must make an automatic Control Roll. For each full 30 ground turns (5 minutes) under the time noted above, the controlling player must add a cumulative +1 modifier to the Control Roll. A success means the aerospace unit lifted off and no mishaps will occur due to short-changing the Preflight Check List.



FAILED PREFLIGHT CHECKLIST TABLE

2D6 Die	Effect*
2-5	No Effect
6-7	+1 modifier to all Control Rolls
8-9	+2 modifier to all Control Rolls, +1 modifier to all Weapon Attack Rolls
10-11	Randomly determine a column and location on the appropriate aerospace Hit Location Table, and apply that critical damage
12	Randomly determine a column and location twice on the appropriate aerospace unit Hit Location Table, and apply both critical damages

*If an effect occurs, cargo is damaged as well (if there is cargo; Transport Bays are considered cargo in this instance). Roll 1D6, adding the final die roll result from the roll on the Failed Preflight Check List Table to determine the number of tons damaged; use the Cargo rules on page 239 of *Total Warfare* to determine the final outcome of that damage.

A failure means that aerospace unit still lifted off successfully, but that something might occur during liftoff that will affect the unit's operations; this could be a shifting of cargo that upsets flight balance, a critical systems failure and so on. After the failed Control Roll, roll 2D6 and compare the result with the Failed Preflight Check List Table (at left), adding a cumulative +1 modifier to the die roll result for each point of MoF from the Control Roll.

These effects are permanent until the aerospace unit lands and completes a new, successful Preflight Check List (for example the +1 modifier to all Control Rolls), or until the critical damage is repaired.

Delayed Liftoff: Once a Preflight Check List Control Roll has been made (and the engine status has reached Hot; see p. 60), the controlling player does not need to immediately liftoff the aerospace unit, designating the pilot/crew as "on standby". At any later time the aerospace unit may liftoff immediately. In this instance, if the Preflight Check List Control Roll was a failure, a roll on the Failed Preflight Check List Table is not made until the aerospace unit actually lifts off.

However, for every two hours (720 ground turns or 120 space turns) that a non-Large Craft (Large Craft have enough excess engineers, technicians and so on to maintain a steady standby) has not lifted off, apply a cumulative +1 modifier to all Control Rolls and Weapon Attacks for the pilot/crew. To reverse these effects, the player must designate the pilot/crew as 'resting,' meaning they cannot participate in any actions and to liftoff the aerospace unit a new Preflight Check List must occur. One hour (360 ground turns) must pass to eliminate each +1 modifier. For example if the controlling player has an aerospace pilot on "standby" after a Preflight Check List for three hours (creating a +3 modifier to all Control Rolls and Weapon Attacks), the aerospace pilot would need to be resting for three hours to eliminate all 3 modifiers.

Pilot/Crew On Standby: If an aerospace unit has kept a Hot Engine Status (see p. 60) since it landed and the player designates the pilot/crew as "on standby" at the time of landing, it can liftoff without a Preflight Check List and no Control Roll is required. However, for each hour (360 ground turns)

that the pilot/crew is on standby on a non-Large Craft, apply the cumulative Control Roll and Weapon Attack modifiers as described under Delayed Liftoff, above.

Alternating Crews: In both the *Delayed Liftoff* and *Pilot/Crew On Standby* rules above, it is assumed that only a single pilot/crew is being used. If the controlling player has access to multiple pilot/crews, then he can rotate said crews and ignore any modifiers; effectively leaving the aerospace unit in standby indefinitely.

Maintenance: A failed Preflight Check List Control Roll applies a cumulative +1 modifier for each point of MoF to the next Maintenance Check made for that aerospace unit (see *Maintenance*, p. 191, CO). The next successful Maintenance Check, however, will clear any non-critical effects resulting from a failed Preflight Check List Control Roll—just as if the aerospace unit had landed and performed a new successful Preflight Check as described above—even if the Maintenance Check is made in flight.

Moving Cargo: An aerospace unit cannot begin its preflight check until all cargo has been loaded or unloaded (see *Moving Cargo*, p. 220, CO). If the aerospace unit is in the middle of loading or unloading and abruptly wishes to begin a Preflight Check List, the player simply stops the loading or unloading. If there is an item(s) that requires multiple turns (minutes) to load/unload and the controlling player is in the process of loading/unloading such an item(s), it must finish before the controlling player can designate that the loading/unloading process is done and the preflight check can begin.

Engine Status

A grounded aerospace unit mounting a fusion (or fission) engine can have its engines in three levels of readiness: Cold, Warm and Hot.

At the start of a scenario, the controlling player of any aerospace units should write down the Engine Status of the units in question. The players should agree on a formula for determining the engine status of each aerospace unit they control, based upon the type of scenario being played (if combat is expected, then engines might be Warm or even Hot, but if combat is not expected and the unit has been grounded for some time, it should likely be Cold). Players can also simply randomly determine the Engine Status for any aerospace units they control.

If an Engine Status is Cold or Warm, the Preflight Check List (see p. 58) must be completed before time can be spent, as noted below, to change the Engine Status. To use weapons, a unit's Engine Status must be Hot.

- **Cold:** A Cold Status engine is completely shutdown, idling on auxiliary power or power drawn from the local DropPort (if grounded at such a location). To reach the point of liftoff from a Cold Status takes 90 ground turns (15 minutes) for a Large Craft, or 45 ground turns (7.5 minutes) for a Fighter or Small Craft. The controlling player can attempt to liftoff earlier, but must make an automatic Control Roll. For each full 6 turns (1 minute) under the 90 turns (15 minutes) for Large Craft and 45 turns (7.5 minutes) for fighters and Small Craft, the controlling player must add a cumulative +1 modifier to the Control Roll. A success means the aerospace unit ignited the engine without any mishap. A failure means the engine has been damaged. For each two points of MoF, the engine takes one box of critical damage; this means a single MoF does not damage the engine.

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- **Warm:** A Warm Status engine has portions of its systems kept hot, allowing for the engines to be more quickly brought on-line. To reach the point of liftoff from a Warm Status takes 30 ground turns (5 minutes) for Large Craft or 15 ground turns (2.5 minutes) for fighters and Small Craft. As with a Cold Status, the controlling player may attempt to liftoff sooner, but must make a Control Roll under the same limitations noted above, and with the same results. Keeping an engine in Warm Status consumes 1/100th burn-day of fuel per day (or 1 point of fuel per day).
- **Hot:** A Hot Status engine has been kept idling and hot, meaning the unit can liftoff instantly, at the controlling player's discretion. However, keeping an engine in Hot Status consumes 1/20th burn-day of fuel per day (or 2 points of fuel per day).
- **Maintenance:** A failed Control Roll applies a cumulative +1 modifier for each point of MoF to the next Maintenance Check made for that aerospace unit (see *Maintenance*, p. 191, CO).

Kristian has finished loading the cargo on his Colossus-class DropShip. Now it's time for the Preflight Check List (he's been on the ground for some time and he didn't prep and so the crew is not on stand by). At 20,000 tons, it'll take 45 minutes for the Preflight Check List.

However, he doesn't have that kind of time. He's just been notified by his spies that the bad guys finally know where his DropShip is at and an enemy DropShip just lifted off to intercept. He knows they're around 10,000 kilometers distant, and so checking the Suborbital and Orbital Flight Times Table (see p. 57), he knows he's got 50 minutes to get airborne before his opponent is going to start dropping ground troops on him and strafing him with aerospace fighter support. However, he was trying to horde fuel and so allowed his engine to reach a Cold Status. If he takes the safest route, that's 45 minutes for the Preflight Check List and 15 minutes for the Engine Status to move from Cold to Hot...10 minutes too late. He's not too keen on potentially damaging his engines, and so he decides to short change the Preflight Check List.

He wants to shave off 15 minutes, which will give him a 5 minute window to potentially escape. This incurs a +3 modifier to the Control Roll. With a Piloting Skill Rating of 4 for his crew, he's got to roll a 7 or better [4 (Piloting Skill Rating) +3 (+1 for each 5 minutes under the 45 minute mark = +3) = 7]. After the 30 minutes have transpired, he makes a Control Roll with a result of 4, giving him a MoF of 3. Ouch!

However, he doesn't make the roll on the Failed Preflight Check List Table yet as he's not lifted off. He's got to wait the 15 minutes for his Engine Status to go from Warm to Hot. As soon as he hits the 45 minute mark (a total of 78.6 minutes since Kristian began loading the DropShip in the first place), he immediately lifts off. Now that he's airborne, he rolls on the Failed Preflight Check List Table to determine if short changing preflight will do him any harm. He rolls 2D6 with a result of 5, applying the 3 MoF, giving him a final result of 8. Looking on the table he has to apply a +2 modifier to all Control Rolls and +1 modifier to all Weapon Attack Rolls; brutal if he the bad guys managed to catch up to him. Additionally, has to roll 1D6, adding that to the final die roll result of 8, giving him the amount of tons of cargo destroyed; he'll have to roll to determine if that's cargo or Transport Bays.

On his next Maintenance Check he'll have to also apply the 3 MoF, but hopefully it'll be a success and he'll be able to eliminate those effects.

space fighter or small craft expends no fuel or thrust for the launch process, having been ejected from the carrier with a speed and heading equal to that of the carrier. As noted in *Total Warfare*, all of the launched vehicle's thrust is available for use on the turn of launch. This also applies to any large craft undocking maneuvers (see p. 54) and the use of flight decks on a support vehicle.

When recovering to transport bays (see p. 86, *TW*), an aerospace fighter or small craft expends no thrust or fuel points for the recovery process other than the thrust points required to match the heading and speed of the carrier (including any thrust points spent by the carrier during the 5 turns of the recovery process.) This also applies to any large craft docking maneuvers (see p. 54).

When landing on a ground map using a horizontal, rolling landing (see p. 87, *TW*), an aerospace fighter, conventional fighter, aerodyne small craft, or aerodyne DropShip expends no extra thrust or fuel points other than those required to reach the altitude and speed required for landing. This also applies to conventional fighters with VSTOL making a shortened landing run.

When landing on a ground map vertically, any vehicle expends 1 thrust point and fuel point per 0.5Gs of local gravity, rounded up (see p. 53, *TO:AR*). These thrust points are not available for other maneuvers in that turn. This also applies to vehicles landing on a flight deck of a support vehicle, which is generally performed at high thrust levels in case of a failed landing, and to aerodyne DropShips and small craft attempting to shorten their landing run (see p. 87, *TW*).

When taking off from a ground map using a horizontal, rolling liftoff (see p. 88, *TW*), an aerospace fighter, conventional fighter, aerodyne small craft, or aerodyne DropShip expends 1 thrust point and fuel point to put the vehicle on the appropriate hex of the atmospheric map moving at 1 hex per turn. The vehicle may not expend additional thrust that turn, representing the low-and-slow nature of aircraft at the moment of takeoff.

When taking off from a ground map using a vertical liftoff (see p. 88, *TW*), any vehicle expends 1 thrust point and fuel point per 0.5Gs of local gravity, rounded up, and is placed on the appropriate hex of the atmospheric map in a hover (0 hexes per turn). The vehicle may not expend additional thrust that turn, representing thrust being constrained to avoid damaging the vehicle with backblast from the ground during launch.

VERTICAL LANDING AND LIFTOFF

Under standard rules, aerodyne DropShips may not conduct vertical landing maneuvers in any type of atmosphere; such units can move in a vacuum in this fashion (see *Vacuum*, p. 52, *TO:AR*). Aerodyne units are not designed to shunt away the backwash of their belly mounted transit drives, and can suffer catastrophic damage to their hulls and components if they attempt to land vertically in an atmosphere.

Under these advanced rules, aerodyne DropShips may conduct a vertical landing (and the liftoff rules are modified accordingly), as a spheroid, in any atmospheric conditions (see *Atmospheric Pressure*, p. 52, *TO:AR*) using all the standard rules for spheroids making such a maneuver (see p. 87, *TW*), with the following additional rules.

- In addition to all standard modifiers for a spheroid landing, apply an additional +1 for aerodyne DropShips and +2 for aerodyne Small Craft to the landing Control Roll
- A second Control Roll after the standard landing Control Roll is made (for maneuvering the unit through its own backwash), applying all the appropriate spheroid modifiers from the Landing Modifiers Table (see p. 86, *TW*) or Vertical Liftoff Modifiers Table (see p. 88, *TW*) as appropriate, and an additional +2 modifier. For every point of Margin of Failure,

FUEL USE FOR LANDING AND TAKEOFF

When launching from transport bays (per p. 86, *TW*), an aero-



SIZE CLASS DAMAGE TABLE (ALL DAMAGE IN CAPITAL SCALE)

Unit Tonnage	Damage*
Zero to 500 tons	8 + 1D6
501 to 5,000 tons	14 + 2D6
5,001 to 10,000 tons	18 + 3D6
10,001 to 20,000 tons	24 + 4D6
20,001 to 35,000 tons	30 + 5D6

*Add 1D6 damage if the unit is conducting a vertical landing.

ATMOSPHERIC CONDITIONS TABLE

Atmospheric Pressure	Modifier
Vacuum	No Damage
Trace	Multiply Damage by .5
Thin	Multiply Damage by .75
Standard	No Modifier
High	No Modifier
Very High	Multiply Damage by 1.25
Water Take Off	Multiply Damage by 1.25

add 1D6 points of capital-scale damage to the final liftoff/landing damage. If the Control Roll succeeds, subtract 6 capital-scale damage from the final Takeoff Damage for every point of MoS.

- The unit suffers automatic damage based on its tonnage (see Size Class Damage Table, above). Modify this damage by the MoS or MoF of the Control Roll and then apply any Atmospheric Conditions modifiers to the final damage. Damage is split evenly between the Nose and Aft armor. If damage exceeds the damage threshold for that arc, roll for a critical hit as normal.
- For a liftoff, if the unit's landing gear is deployed it is destroyed during liftoff as though it took a critical hit; check off the Gear box on the record sheet.
- For a landing, the unit's landing gear is not deployed during the landing. If the unit survives the landing, it may not move under its own power (see *Taxiing*, p. 88, TW).

A heavily damaged Conquistador is forced to land in a small cleared area of Avalon City. With insufficient runway space, it is forced to try a vertical landing. First it must make a standard spheroid landing Control Roll. The Conquistador is moving at a 2 velocity, so applies a +1 modifier for vertical landing at greater than 1 velocity. It has no damage to thrusters or landing gear so does not need to apply these modifiers. Because it is landing as a Spheroid, it does not apply the +2 modifier for destroyed nose armor or insufficient runway space. It still has thrust, but if it did not, it would apply a +8 modifier for landing as a Spheroid with no thrust. Finally as an Aerodyne DropShip, conducting a vertical landing, it applies a +1 modifier. Adding the modifiers to a base Piloting Skill Rating of 5, provides a final Modified Target Number of 7 [5 (Piloting Skill Rating) +1 (velocity over 1), +1 (Aerodyne DropShip)] = 7.

The controlling player makes a first successful Control Roll for the landing. However, the pilot must now determine how much damage the craft takes during landing. Once again the craft applies a +1 modifier for landing with a velocity of more than 1. It then applies the +2 Aerodyne DropShip modifier, for a final Modified Target Number of 8 [5 (Piloting Skill Rating) +1 (velocity over 1) +2 (Aerodyne DropShip) = 8]. Rolling a 6 provides a Margin of Failure of 2, so the DropShip will take an additional +2D6 damage on the Size Class Damage Table.

WATER LANDING AND LIFTOFF

For ease of play, in Standard Rules if an aerospace unit occupies a Depth 1 or deeper hex after landing it is considered automatically destroyed. However, units designed for the depths of space are able to deal with the effects of water with minimal lasting damage.

Any DropShip or Small Craft may land, ending its movement, in a water hex of Depth 1 or more (all hexes occupied by the landed DropShip must be water hexes of Depth 1 or more for these rules to be applicable). Fighters may not make such landings, unless equipped for an amphibious landing (see *Flotation Hull*, p. 114, TO:AUE).

Horizontal Landing

An aerodyne unit conducting a horizontal landing in which more than one quarter (round down) of the hexes of its landing strip are water hexes is considered to have crashed. Follow all standard rules for crashing (see p. 81, TW) with final damage multiplied by 10. This reflects the unit hitting the water and cart wheeling. Finally roll 1D6; on a result of 1-3 the unit ends movement right side up, on result of 3-6 the unit is upside down. If the unit ends its movement upside down, it is considered destroyed for game play purposes. It must be salvaged before it can be used again.

Horizontal Liftoff

(Conventional Fighter with Flotation Hull Only)

Only a conventional fighter equipped with an amphibious hull may attempt a horizontal liftoff. Such units follow all standard rules for liftoff (see p. 87, TW) and amphibious hulls (see p. 114, TO:AUE).

Vertical Landing

Spheroid and aerodyne units can land vertically with the following conditions and modifiers (effectively the unit hovers over the water and then cuts its drive when two elevations up, dropping the remaining distance to avoid plasma backwash):

- Make a Control Roll, as a spheroid, for landing using the standard rules (see p. 86, TW); aerodyne DropShips add an additional +1 modifier, while aerodyne Small Craft add an additional +2 modifier. If the Control Roll fails, add an additional 1D6 capital-scale damage for every point of Margin of Failure. If the Control Roll succeeds, subtract 6 Capital-scale damage from the final Takeoff Damage for every point of MoS.
- Damage uses the standard rules for crashing (see p. 81, TW), with the unit considered to have a velocity of 2.
- Aerodyne units are considered to have their landing gear retracted. A spheroid's gear is deployed to assist in stability after landing.

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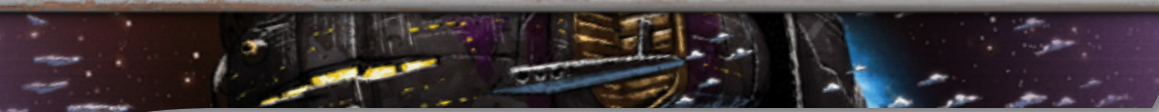
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Vertical Liftoff

Spheroid and aerodyne units can attempt to liftoff vertically with the following conditions and modifiers (this operation is more complex, as the drives are submerged and must counter the water pressing in on it).

- Make a Control Roll for Liftoff, per the standard Vertical Liftoff rules (see p. 88, *TW*), with an additional +1 modifier for aerodyne DropShips and an additional +2 modifier for aerodyne Small Craft.
- After applying the Size Class Damage and Atmospheric modifiers (see Size Class Damage and Atmospheric Conditions Tables, p. 61), apply the Water Landing Damage modifier for landing.
- The unit suffers automatic damage based on the size of the unit (see the Size Class Damage Table, p. 61). Modify this damage by the MoS or MoF of the Control Roll and then apply the Atmospheric Conditions modifier to the final rolled damage. Damage is split evenly between the Nose and Aft armor. If damage exceeds the damage threshold for that Arc, roll for a critical hit as normal.

Floating DropShips in Combat

A DropShip that is still operational after landing in water (it cannot move except to take off again) may participate in combat normally, with the following additional rules.

- Multiply their heat sinks by 1.1 for heat dissipation purposes, rounding down to the nearest whole point.
- Floating DropShips do not receive the -2 to-hit modifier for a grounded DropShip (as the DropShip will be bobbing in the water).
- Any critical hits rolled on a spheroid's Aft or an aerodyne's Nose and Aft received a +1 modifier to the die roll result (this reflects potential water damage when the armor is breached).
- If the Water Flow Planetary Condition is in use (see p. 50, *TO:AR*), a floating or submerged DropShip will automatically be displaced as though it is a Naval Vehicle not expending MP to "hold position".

Partially Submerged Spheroid DropShips

During combat, a spheroid DropShip can choose to flood its cargo bays, lowering the hull 3 depths, so that it rises 7 levels above the surface of the water and is 3 depths below the surface of the water (this means that all hexes occupied by the DropShip must be a minimum of Depth 4). This operation must be declared in the End Phase of a turn. During the End Phase of the third turn after this declaration, the ship is considered flooded; it cannot move except to take off again. A flooded DropShip may not take off, first having to reverse the flooding process; the player makes the announcement during the End Phase and then at the End Phase of the third turn after the declaration, the ship is empty of water.

In addition, the following rules apply.

- Due to the hasty nature of the flooding (as opposed to outside of combat, where the crew would be able to ensure everything in the cargo hold is properly sealed), roll 2D6 during the End Phase when the DropShip's cargo bays are considered fully submerged. On a result of 8+, some cargo is destroyed. For every point of MoF, roll 1D6. On a result of 1-3, general cargo suffers damage (if present; if no cargo is present, no damage is done). On a result of 4-6, units in bays (if present) are effected. First determine any units that are

damaged. If any unit that is destroyed by submersion is present in the cargo hold, it is automatically destroyed. If there is more than one, randomly determine which is destroyed. Once all unit destruction has been determined, roll 2D6 for any remaining MoF and add that together to determine the tons of cargo destroyed. For example, if a player rolled an 11, resulting in a MoF of 3 and then rolled a unit in a bay and 2 cargo, he would then determine which unit was destroyed and then roll 2D6 twice, adding both rolls together and marking that much tonnage off as destroyed.

- Weapon attacks from non-submerged units re-roll all aft hits on the DropShip while it is flooded.
- Any friendly units with UMU MPs may mount or dismount through doors into flooded cargo bays of a DropShip. Use all the applicable rules for Mounting and Dismounting (see pp. 89-91, *TW*), but apply an additional +1 modifier to all Piloting Skill Rolls.
- An enemy unit with UMU MPs may attempt to mount or dismount through doors into a flooded cargo bay of a DropShip. Use all the applicable rules from *Boarding Actions (Non-Infantry)*; see p. 156, *TO:AR*, but apply an additional +2 modifier to all Piloting Skill Rolls.
- As with standard underwater combat, if units are firing weapons inside a submerged cargo bay, only energy weapons or torpedoes can be fired.
- A fire can never occur in a submerged bay.

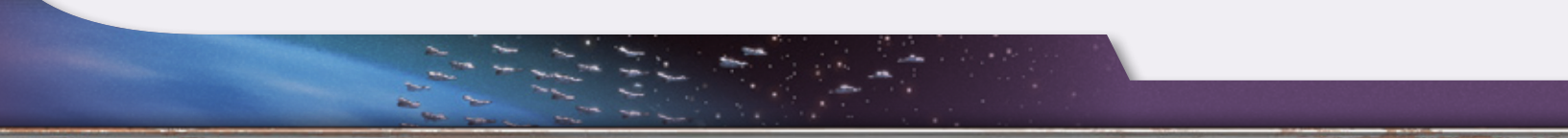
HIGH SPEED CLOSING ENGAGEMENTS

All the Standard and Advanced Aerospace Movement and Combat Rules assume low relative velocities, where both sides typically start the scenario under 20 velocity and do not move greatly faster than this. However, the distances of solar system travel and the almost limitless velocity of aerospace units means that engagements can occur where an eye blink could cover the entire span of a battle.

The *High Speed Closing Engagement* rules represent combat where the opposing forces are operating at high velocities, typically found when transiting with in a system—such as to and from the system's jump point. The minimum speed for "High Speed" engagements is arbitrarily set as a relative speed that would take a unit through the maximum gun range of a target in 1 turn—about 101 hexes per turn with standard capital-scale weapons. These high speed closing engagements are a fast and usually brutal flurry of action and reaction, which can often leave one Force an exploding cloud of debris and the other spinning out of control. The unforgiving and often inconclusive nature of these engagements is one of the reasons most combat occurs near a fixed location in the system—planetary orbit, jump points and so on.

Note: Even though these rules have been abstracted for ease of use, there is still a level of complexity, creating what some may consider significant math (particularly when trying to determine distances). Players should read these rules completely and understand the math requirements before deciding on their use.

At the same time, the lack of maps, even the need for miniatures and many of the more time-consuming standard rules, can





make High Speed Closing Engagements a fast and fun 'pick up' game.

Terminology: High Speed Closing Engagements use the following definitions: a Unit represents multiple Elements and an Element indicates a single ship, fighter or fighter squadron.

TYPES OF CLOSING ENGAGEMENTS

As an abstract combat system, High Speed Closing Engagements fall into two categories: Head On and Crossing.

Head On

Head On Engagements are the most common and involve the opposing Forces closing relatively directly at one another. Typically this will involve the attacker burning into the system, while the defender moves from the planet to engage in deep space, or may occur if the invader nearly reaches orbit before the defender responds with a head-on launch. These engagements also cover the case where a particularly fast Unit overtakes another from astern—the defenders generally have time to flip to face the attack from astern. Head On Engagements can also be used to simulate a 'drive by' encounter, where the attacker moves past a relatively stationary defender such as a recharging or orbital space station.

Crossing

Crossing Engagements represent one Force crossing the other when velocity vectors have more than 60 degrees of difference. This is most typically represented by a patrolling system defender moving to intercept an inbound attacker, who is burning to or from the planet. It may also occur in orbit when one group changes orbits to intercept another.

SET-UP

Closing Engagements are standalone aerospace scenarios. They do not require maps to play. Instead, players use the High Speed Closing Engagements Sheet (see the record sheets at the end of this book) and the individual record sheets for each Unit involved in the engagement.

Aerodyne Facing

For ease of game play, it is assumed any aerodyne DropShip or Small Craft in the engagement is maneuvering in 'Combat Mode' via their aft transit drive and not their belly mounted transit drive.

Decide Attacker and Defender

In many cases this will be self-explanatory. When this is not, players should randomly decide who is the Attacker and who is the Defender, for the purposes of playing the scenario.

Identify: Flotillas, Squadrons and Individual Ships

Closing Engagements allow players to maneuver entire fleets as single Units, or handle each ship and fighter individually, or combinations thereof. The difference is in the amount of record keeping, which is handled by the High Speed Closing Engagements Sheet. Each Unit (whether it is a flotilla, squadron or individual ship) that the players want to track is given a separate row on the record sheet. Players should clearly identify the Elements in each Unit.

Note that once declared at the start of a closing engagement, Units will only have one opportunity to rearrange into different groupings, which occurs during the Detection Phase. This is important because Maneuvers (see below) are declared for an entire Unit, and it may not be optimum, for example, to tie troop transports to the same maneuvers as their escorts.

Also note that fighters are not declared before the start of combat. They do not have the endurance for interplanetary transits and high-speed engagements on their own, and thus are carried by larger Elements until the Detection Phase. Small Craft may travel independently or wait to be launched during the Detection Phase. Any fighters or Small Craft carried by larger Elements must be specifically noted on the larger Element's Record Sheet. This is to prevent confusion later in the game as to which ship was carrying what.

Andrea and Bob are using these rules for the first time. Andrea is commanding a Force of 2 Fox-class WarShips, 4 Achilles-class DropShips, and 3 Stuka fighter squadrons that are intercepting an invading Word of Blake fleet. (Two fighter squadrons are carried by the first Fox, while the third squadron is mounted on the second Fox, at the beginning of battle.) Andrea is feeling a bit lazy and decides to group her main Force of WarShips and 2 Achilles into "Flotilla 1." She then groups the two other Achilles into a quick-reaction Unit, which she decides to call a "Heavy Squadron." She has plans for her fighters, but it not time to declare them yet. She scribbles in the details on her High Speed Closing Engagements Sheet, as shown below.

Meanwhile, Andrea's opponent Bob is commanding a Word of Blake task Force with an Agamemnon-class WarShip "donated" by his Free Worlds allies, three

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PLAYER Bob

Engagement Speed:		Angle of Attack:				
Unit	Ship/Squadron/ Mines/Debris	Detection Phase	Capital Missile Phase		Meeting Engagement Phase	
		Maneuver	Maneuver	Target(s)	Maneuver	Target(s)
1	The Hit Squad (everything)					
2						

• HIGH SPEED CLOSING ENGAGEMENTS RECORD SHEET SAMPLE 1 (BOB) •

Overlord-class DropShips carrying his assault Elements, and is waiting to deploy his four Striga fighter squadrons (noted on the record sheet as three squadrons on the Agamemnon, and one squadron on the first Overlord). Bob wants to keep his Elements together, mistakenly thinking it will help, and is feeling very lazy, so he puts them into a single Unit, which he jokingly names "The Hit Squad." Bob fills out his High Speed Closing Engagements Sheet as shown above.

Determining Engagement Speed

At the start of play, players must determine the closing speeds of the opposing sides. This can be determined by mutual agreement according to the scenario or using the Random Engagement Speed Table below.

Engagement Speeds are split into three classes: Slow, Medium and Fast.

"Slow" engagements are typical of conflicts near planets, where both sides, because they are either braking to a halt in preparation to land on or orbit the planet or are starting from a near-stop to intercept the invaders.

"Fast" engagements are very difficult to arrange because they are representative of jump point-to-planet transit velocities, where detection ranges of current sensor systems have a difficult time spotting other Units at adequate distances.

Finally, "Medium" speed engagements are "in between" velocities typical of long-range ambushes or short interplanetary intercepts.

In game terms, these three speeds are:

- Speed Class 1 (Slow): Approximate velocity of 101-1,000 hexes per turn.
- Speed Class 2 (Medium): Approximate velocity of 1,001-5,000 hexes per turn.
- Speed Class 3 (Fast): Approximate velocity of 5,001+ hexes per turn.

Andrea and Bob have already agreed that this interception will be occurring several hours from an unnamed Federated Suns planet, representing a surprise intercept of the Word of Blake fleet by a lurking AFFS aerospace Force, so they don't roll on the Random Speed Table. They've decided that Bob's fleet has several hours of braking left from his transit at 1 G (2 thrust points per turn, 60 turns per hour), which means his fleet will be moving at 360 hexes per turn when they meet. (At the end of the braking maneuver, his fleet would be almost motionless

RANDOM ENGAGEMENT SPEED TABLE

2D6 Roll	Speed Class
2	Fast
3	Medium
4	Medium
5	Slow
6	Slow
7	Slow
8	Slow
9	Slow
10	Medium
11	Medium
12	Fast

relative to the planet.) Andrea wants her fleet to have been burning at 2.5 Gs (5 thrust points) flat out to intercept the Blakists as far from Davion soil as possible, which means her fleet will be moving at 900 hexes per turn when it cross Bob's fleet. The total speed is 1,260 hexes per turn, which squeaks them into the "Medium" engagement speed class.

Determine Angle of Attack

Next, players should determine which of the two types of Closing Engagements they will use for the scenario. They can choose by mutual agreement, or alternately roll on the Angle of Attack Table below.

Andrea and Bob have decided their scenario calls for a Head On Engagement, rather than rolling randomly. Bob's fleet is, after all, heading straight for the planet, and Andrea's fleet is departing straight away from the planet.

At this point, Bob and Andrea take a moment to update their Closing Engagements Record Sheets by filling in the Engagement Speed and Angle of Attack boxes in the top row with (because Andrea's feeling clever) "378km/s" and (because Bob wants to hurry to the ground combat) "Medium", and both mark "Head On."



ANGLE OF ATTACK TABLE

2D6 Roll	Angle of Attack (AoA)
2	Crossing
3	Crossing
4	Crossing
5	Head On
6	Head On
7	Head On
8	Head On
9	Head On
10	Head On
11	Crossing
12	Crossing

SEQUENCE OF PLAY

The Sequence of Play of High Speed Closing Engagements is different from Standard or Advanced Aerospace Rules. A Closing Engagement consists of five phases. Not all phases—or their sub-phases—will be used in a given Closing Engagement scenario, but the order of play remains unchanged.

Note: All phases are considered an abstract time frame, which can represent milliseconds to hours. In Class 1 (Slow) and Class 2 (Medium) speed Engagements, the detection and tracking periods may occur over hours (because detection ranges are so large compared to the velocity), while combat in Class 3 (Fast) speed Engagements may be a matter of millisecond, computer-controlled weapons fire (the proverbial “eye blink” and you missed it).

1. Detection and Initial Maneuver Phase
 - Determine Detection
 - Launch and Redeploy Units
 - Detection Maneuvering
2. Capital Missile Phase
 - Capital Missile Maneuvers
 - Capital Missile Attacks
3. Meeting Engagement Phase
 - Meeting Engagement Maneuvers
 - Meeting Engagement Weapons Fire
 - Mine/Debris/Collisions
 - Chaser Weapons Fire
4. End Phase
 - Recover Detached Units

DETECTION AND INITIAL MANEUVER PHASE

The following steps occur, in the following order, during the Detection and Initial Maneuver Phase.

Determine Detection

In Class 1 (Slow) and Class 2 (Medium) speed Engagements, detection ranges (see *Advanced Sensors*, p. 105) are usually sufficient to give hours of warning and thus open all options for maneuver and engagements. Hard calculations of detection time generally entail a bit of basic physics of motions and are thus handled abstractly. Suffice to say that Class 1 (Slow) and

Class 2 (Medium) speed Engagements do provide plenty of warning time.

For those players interested in calculating when a side is detected based on the detection ranges, note that one hex is 18km and one turn is 1 minute.

In Class 3 (Fast) speed Engagements, detection times can be much shorter. That is handled differently by limiting some options in fast encounters (as described later in these rules).

In Andrea's and Bob's scenario, they agreed that the normal observation satellites around their still-unnamed world had drive plume detectors and that the multitudes of satellites would guarantee detection at 3 million kilometers range. Working backward from the distance and Bob's acceleration (1G), they use the Transit Time calculations (see p. 166) to calculate that Bob would cross this distance in not quite 7 hours—Bob's fleet was thus detected 7 hours from the planet. (If they had not wanted to bother with this math, they could use an approximation of several hours given under “Determine Detection.”) Andrea wanted to calculate closing speed based on a 7-hour response time, but Bob argued that it would take time to muster and launch all of Andrea's Forces, so she should only have a 1-hour response time. They split the difference with a 3-hour response time.

Launch And Redeploy Units

This is the last chance for fleets to re-arrange into Units, and the time to launch fighters. Later phases will occur so rapidly that there is no time to split-up and regroup Units.

Andrea is happy with her current Unit groupings, but Bob suddenly realizes that he has an opportunity to keep his ground troops out of harm's way. He regroups his Units into the Hit Squad Unit (the Agamemnon, carrying 3 fighter squadrons) and The Troops Unit (the three Overlords, and 1 fighter squadrons).

In Class 1 (Slow) and Class 2 (Medium) speed Engagements, there is always sufficient time to launch any fighters and/or Small Craft carried by larger Units. The short duration of these engagements mean that the fighters have sufficient fuel to maneuver independently when launched within about a half-hour of the combat.

In Class 3 (Fast) speed Engagements, detection ranges are not sufficient to guarantee enough warning time to launch fighters. The “attacker” (if one has been designated) is assumed to have had enough foreknowledge of the location of the defender to be able to deploy all their fighters even before entering detection range, but the “defender” has too little time. To represent this situation, the defender rolls on the Fighter and Small Craft Deployment Table (see p. 66) to determine how many fighters and Small Craft (as a percentage of all available to the defender) could be launched before the shooting starts.

At this step, if fighter squadrons are deployed, they must be noted onto their High Speed Closing Engagements Sheets.

In Bob's and Andrea's game, the Class 2 (medium) speed Engagement means both have a chance to launch all their fighters before combat. Since both do not want to see their

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FIGHTER AND SMALL CRAFT DEPLOYMENT TABLE

1D6 Roll	Percentage of Units Deployed*
1	15%
2	30%
3	45%
4	60%
5	75%
6	90%

*In all cases, round down to the nearest whole fighter and small craft.

fighters lost sitting in their hangars, both launch all fighters available. Andrea adds 1 squadron to "Flotilla-1" and deploys the other two squadrons' individual Elements she names "Light Squadrons 1 and 2." Bob adds one squadron to his new "Troops" Unit and the other 3 squadrons to his "Hit Squad."

Detection Maneuvering

Over the course of the Detection Phase, both sides will likely be maneuvering to either avoid or seek engagement. In game terms, there are 2 maneuvers in this phase: Intercept or Break Contact.

Each side determines whether each of their Units (each row on their High Speed Closing Engagements Sheet) will be making an Intercept or Break Contact maneuvers, and marks the maneuver on the record sheet. One Unit may only execute one maneuver in this phase.

If both sides are seeking conflict (both execute the Intercept maneuver), then this phase is ignored: move to the Capital Missile Phase (see p. 67). If both sides are seeking to avoid combat (both execute the Break Contact maneuver), then the entire combat scenario is over; no further phases are resolved.

In the case where one side executes the Break Contact maneuver and the other executes an Intercept maneuver, Control Rolls are made as described below. The side with the highest Margin of Success (MoS) successfully executes their maneuver. Ties go to the Unit executing an Intercept Maneuver.

Order is important when conducting these contested Maneuvers. Resolve Initiative normally with each side declaring Maneuvers in turn (as movement would be resolved normally in Standard or Advanced Aerospace Rules; see p. 75, *TW*, or p. 52). When declaring Maneuvers for Units, a player must declare Maneuvers for Units with WarShips first, then Units with DropShips second, and finally Units with only fighters and Small Craft.

Break Contact: A player executing this maneuver for a Unit is trying to have the Unit avoid combat. Success indicates that the Unit will *probably* avoid the combat phases. However, because later Maneuvers (in Class 1 (Slow) and Class 2 (Medium) speed Engagements) can give an attacker an opportunity to catch the fleeing Unit, this Maneuver should be recorded, and marked whether it was successfully executed or not. When making the Control Roll for this Maneuver, add a bonus equal to the Safe Thrust of the Element in the Unit with the lowest Safe Thrust. If this maneuver is successful in a Class 3 (Fast) speed Engagement, the Unit avoids all further combat with

the avoided Units and does not need to go through combat with them.

Intercept: A player executing this maneuver for a Unit is trying to seek combat with another Unit. In addition to marking down the Intercept Maneuver on the record sheet, the Unit must indicate which Unit/Element it is attempting to Intercept. This will determine who can be engaged in combat later. Both sides make opposed Control Rolls, adding half of each Unit's Safe Thrust (round down) to the dice roll's Margin of Success (or subtract it from the Margin of Failure, to a minimum of 1). For Units with more than one thrust rating, use the lowest Element's thrust rating. A successful Intercept Maneuver indicates that the Unit has been able to enter combat range with the target.

Realizing what a couple of WarShips could do to his troop transports and invasion, Bob is now less sanguine about doing combat. Because Bob and Andrea have differing intentions, they roll Initiative. Andrea gets an Initiative of 10 and Bob rolls a 9. Bob declares his WarShip-containing Unit first, stating the Hit Squad will be Intercepting Andrea's Unit 1 "Flotilla-1." Andrea moves next, predictably declaring her WarShip-containing Flotilla-1 will be Intercepting the Bob's Unit 2, the Overlords. Bob declares his Troops (Unit 2) will be Breaking Contact. Finally, Andrea looks over the situation and decides the whole Word of Blake invasion hinges on its ground troops, so she sets Unit 2, Heavy Squadron and then both Light Squadrons (Element 3 and 4) will be Intercepting the Overlords (Bob's Unit 2).

With Maneuvers declared, it's time to see if the Maneuvers are successful. First, Bob's Hit Squad automatically Intercepts Andrea's Flotilla-1 since Flotilla-1 was not Breaking Contact. Bob notes the success on his record sheet for Hit Squad.

Next, Bob and Andrea roll to see if the Troops Break Contact with Flotilla-1. Despite the nimble fighters in the Troops Unit, Bob only gets a +1 for the Overlords' Safe Thrust. With his Regular crews and the modifier, he rolls a 6, for a MoS of 2 [6 (die roll result) +1 (Overlords' Safe Thrust) = 7 - 5 (Piloting Skill Rating) = 2 (MoS)]. Flotilla-1 similarly gets a +1 for the sluggish Foxes, and with a Regular crew as well, Andrea is rolling against an identical Target Number, with an identical modifier. She rolls a 4, for a MoS of only 0 [4 (die roll result) +1 (Foxes' Safe Thrust) = 5 - 5 (Piloting Skill Rating) = 0 (MoS)]. The Troops Unit have avoided—for now—the Davion WarShips.

Bob and Andrea roll again to see if her Heavy Squadron intercepts Bob's Troops (Unit 2). Bob has the same +1 modifier for the Overlords' Safe Thrust and rolls a solid 8, for a MoS of 4 [8 (die roll result) +1 (Overlords' Safe Thrust) = 9 - 5 (Piloting Skill Rating) = 4 (MoS)]. However, the Achilles of the Heavy Squadron have an enormous +4 modifier for its 8 Safe Thrust and Andrea easily gets a 12 on the Control Roll after a die roll result of 8, for a MoS of 7 [8 (die roll result) +4 (Achilles' Safe Thrust) = 12 - 5 (Piloting Skill Rating) = 7 (MoS)]. The Overlords have been intercepted by the Achilles. Finally, Andrea and Bob roll for the Light Squadrons: 10 and 10, and then 9 and 14. With the tie, the nimble Light Squadron-1 is able to intercept the Troops, while Light Squadron-2 handily intercepts the Overlords.

Their record sheets now look like the following at the end of the Detection Phase (see p. 67):



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PLAYER AndreaEngagement Speed: **378km/s (Med)**Angle of Attack: **Head-On**

Unit	Ship/Squadron/ Mines/Debris	Detection Phase	Capital Missile Phase		Meeting Engagement Phase	
		Maneuver	Maneuver	Target(s)	Maneuver	Target(s)
1	Flotilla-1(2 Fox, 2 Achilles,	Intercept 1,				
	1 Stuka Squadron)	failed				
2	Heavy Squadron	Intercept 2,				
	(2 Achilles)	Success				
3	Light Squadron-1	Intercept 2,				
	(6 Stukas)	Success				
4	Light Squadron-2	Intercept 2,				
	(6 Stukas)	Success				

• HIGH SPEED CLOSING ENGAGEMENTS RECORD SHEET SAMPLE 2 (ANDREA) •

PLAYER BobEngagement Speed: **Medium**Angle of Attack: **Head-On**

Unit	Ship/Squadron/ Mines/Debris	Detection Phase	Capital Missile Phase		Meeting Engagement Phase	
		Maneuver	Maneuver	Target(s)	Maneuver	Target(s)
1	The Hit Squad (Aggie,	Intercept 1,				
	3 ftr Squadrons)	Success				
2	The Troops (3 Overlords,	Break Contact				
	1 ftr sqs.)					
3						

• HIGH SPEED CLOSING ENGAGEMENTS RECORD SHEET SAMPLE 2 (BOB) •

CAPITAL MISSILE PHASE

During this phase, players make attacks with the only weapons that have a substantial chance of hitting very distant targets in these high speed conditions: capital missiles. The missiles are released ahead of the fleet and use their unique independent maneuvering capabilities to execute bearings launch attacks on their foes. This is also the last chance to intercept a target that successfully Broke Contact in the Detection Phase.

Class 3 (Fast) Speed Engagements: In Class 3 (Fast) Speed Engagements, skip this phase and go directly to the Meeting Engagement (see p. 69).

Capital Missile Maneuvering

There are 4 Maneuvers you can select in this phase: Late Intercept, Turn Aside, Evasion, and Hold Steady. These are resolved in the same fashion as Maneuvers in the Detection Phase: roll Initiative, declare Maneuvers as before (WarShips first, fighters last), determine success by Opposed Control Rolls, with a limit of one Maneuver per Unit.

Late Intercept: This last ditch maneuver to intercept a fleeing target has one of three effects. It will either intercept a

target that Broke Contact in the Detection Phase, cancel a Turn Aside Maneuver made in this phase, or give the Unit a new target. A Late Intercept is successful if the Control Roll has a MoS that equals or exceeds the Control Roll for the target Unit.

When intercepting a target that successfully Broke Contact in the Detection Phase, the Late Interception Maneuver faces a potentially stiff penalty. If the target declares that it is making an Evasion or Hold Steady Maneuver, the Late Interception receives a +1 modifier on its opposed Control Roll against the Broke Contact Unit. If the fleeing Unit makes a Turn Aside Maneuver, then it and the Late Interceptor Unit make opposed Control Rolls, but with the Late Interceptor receiving only a quarter of the lowest Element Safe Thrust (round down).

When intercepting a target that did not previously Break Contact but is making a Turn Aside Maneuver this phase, the Late Interception Maneuver allows a Unit to cancel the benefits of the Turn Aside Maneuver. In this case, the Late Interception Maneuver is made with a modifier equal to half Safe Thrust (round down) of the Element with the lowest Safe Thrust in the Unit. If the Turn Aside Unit is successful, then it has broken contact and can only be attacked by Capital Missiles but will avoid the Meeting Engagement Phase.



Finally, the Late Interception Maneuver can allow the Late Interceptor to move to a new target. If that target is Turning Aside this turn, resolve as above. If the target instead makes a Late Intercept of its own, then the interception is automatically successful.

Turn Aside: This Maneuver is either used to represent continued retreat by a Unit that successfully Broke Contact in the Detection Phase or to try and avoid the worst of direct combat in the Meeting Engagement Phase.

A Unit that is defending a successful Break Contact Maneuver by Turning Aside in this phase makes an opposed Control Roll with any of the Late Interceptors. The Unit Turning Aside makes a Control Roll with a modifier equal to half the Safe Thrust (round down) of the Element with the lowest Safe Thrust in the Unit, resolved as discussed under Late Interception (see above). If the Late Interceptor does not have a very large advantage in Safe Thrust, the Unit Turning Aside will generally be successful. If successful, the Unit Turning Aside will completely avoid Capital Missile combat and the later Meeting Engagement combat.

A Unit that did not successfully Break Contact in the Detection Phase makes an opposed Control Roll with any of the Late Interceptors. The Unit Turning Aside makes a Control Roll with a modifier equal to half the Safe Thrust (round down) of the Element with the lowest Safe Thrust in the Unit, resolved as discussed under Late Intercept (see above). If successful, the Unit Turning Aside will be harder to hit in the Meeting Engagement combat.

Hold Steady: The Unit does not contest Interception or Break Contact efforts, but instead holds steady to give its weapons a good shot on their target.

Evasion: Rather than trying to avoid combat completely, the Unit goes through evasive maneuvers while engaged in combat. The advantage is that the ship is harder to hit by capital missiles, but impairs the accuracy of its own missiles. Of course, if the Unit does not have any capital missiles but seeks combat in the Meeting Engagement Phase, then Evasion is an excellent Maneuver. Otherwise, the results are as noted under Hold Steady.

Launch Capital Missiles

Normal bearings-only capital missile launches are made, with the following details. Tele-operated and other modes of capital missile launches may not be used.

Facing: Depending upon the type of Maneuver, a Unit may need to declare a facing.

- A Unit that is Evading or Holding Steady may declare which arc it is presenting to Interceptors.
- A Unit that is making a Late Intercept Maneuver will have its nose arc aimed at its target, and thus will receive fire from its target on its nose arc.
- A Unit making a Late Intercept Maneuver on one Unit will be attacked from its side arc by another Unit intercepting it (Roll 1D6: 1-3 = right side, 4-6 = left side; then 1-3 = front side, 4-6 = aft side). Owing to the possibility of ships rolling around their thrust axis, Elements in the same Unit may be attacked on different sides by the same interceptor.
- A Unit that is continuing a successful Break Contact Maneuver but was caught by a Late Intercept Maneuver presents its stern arc to the Late Interceptor.
- A Unit that did not successfully Break Contact but made a successful Turn Aside Maneuver presents its stern sides to its attackers (Roll 1D6: 1-3 Aft Left, 4-6 Aft Right).
- In all cases, attacking Elements may fire from their primary

facing arc and one adjacent arc. So a WarShip making a Late Intercept Maneuver may fire from its Nose and either of its Fore-side Arcs.

Attack Modifiers: Attack rolls are made with the following modifiers.

- +2 to-hit if the target successfully Broke Contact in the Detection Phase, but the attacker made a successful Late Intercept in the Capital Missile Phase
- Target cannot be attacked if it successfully Broke Contact and Turned Aside
- Normal angle of attack modifiers apply
- Normal Evasion maneuver modifiers apply

Attacks are made normally for bearings-only capital missile launches, selecting specific squadrons or Large Craft within Units.

Record Damage: Attacks are now resolved normally for bearings-only launches, applying damage to their declared targets. Unlike the upcoming phase, there is no debris generation to worry about—there is enough time to avoid debris generated from the Capital Missile Phase.

Andrea and Bob's Forces enter capital missile range. Bob realizes that his Forces are really poorly selected for this sort of warfare, because he has no capital missiles to launch. Andrea, however, has 16 Barracudas to launch. Additionally both players realize they need to maneuver for the upcoming Meeting Engagement Phase. They roll Initiative and this time Andrea rolls poorly, getting only a 5, while Bob gets a 9.

Going first, Andrea must move a WarShip-containing Unit before others. She declares Flotilla-1 will be making a Late Intercept on Bob's Overlord Unit. It is Bob's turn, so he declares the fighter-and-WarShip Hit Squad will continue the Intercept of Flotilla-1, which is automatically successful. Andrea cuts to the chase by saying that the rest of her Units will still be making Late Intercepts on the Overlords, and Bob has his "Troops" make a Turn Aside maneuver to hopefully completely avoid the Davion WarShips and minimize contact with the other Davion Units.

Bob and Andrea roll to see if her Unit 1, containing her WarShips, intercepts The Troops (Bob's Unit 2). With no thrust bonus this time, Andrea rolls a 7 on her Control Roll, for a final MoS of 2. Bob rolls a 7, but since he has a +1 bonus from his Safe Thrust he has a final result of 8 and MoS of 1. Bob's Overlords manage to avoid capital missile fire and will avoid the Meeting Engagement with Andrea's WarShips.

Bob is not so lucky elsewhere. Andrea's Heavy Squadron rolls a final result of 14 and her Light Squadrons roll final results of 11 and 13 for their Late Intercepts of The Troops Unit. Bob rolls final results of 8, 10, and 10 for his Turn Aside Maneuver—failing every time! The Troops are now committed to the capital missile engagement with Andrea's fighter and DropShip squadrons (fortunately, they have no capital missiles) and the upcoming Meeting Engagement.

If Bob's Overlords had been caught by the Foxes, their capital missiles would have hit with unusual force due to the high speed nature of the engagement (see p. 73). On the other hand, they would have suffered a +2 to-hit modifier because of the successful Break Contact Maneuver last phase. Had both Units been able to fire missiles, the fleeing Overlords would've been taking "up the skirt" (rear arc) shots from the Foxes, while the Overlords would've been firing on the noses of the Foxes. Andrea instead fires her Capital Missiles at the incoming



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PLAYER Andrea

Engagement Speed: 378km/s (Med)		Angle of Attack: Head-On				
Unit	Ship/Squadron/ Mines/Debris	Detection Phase	Capital Missile Phase		Meeting Engagement Phase	
		Maneuver	Maneuver	Target(s)	Maneuver	Target(s)
1	Flotilla-1(2 Fox, 2 Achilles,	Intercept 1,	Intercept 2,	Intercepting 1		
	1 Stuka Squadron)	failed	failed			
2	Heavy Squadron	Intercept 2,	Intercept 2,	No cap missiles		
	(2 Achilles)	Success	Success	to fire		
3	Light Squadron-1	Intercept 2,	Intercept 2,	No cap missiles		
	(6 Stukas)	Success	Success	to fire		
4	Light Squadron-2	Intercept 2,	Intercept 2,	No cap missiles		
	(6 Stukas)	Success	Success	to fire		

• HIGH SPEED CLOSING ENGAGEMENTS RECORD SHEET SAMPLE 3 (ANDREA) •

PLAYER Bob

Engagement Speed: Medium		Angle of Attack: Head-On				
Unit	Ship/Squadron/ Mines/Debris	Detection Phase	Capital Missile Phase		Meeting Engagement Phase	
		Maneuver	Maneuver	Target(s)	Maneuver	Target(s)
1	The Hit Squad (Aggie,	Intercept 1,	Intercept 1,	No cap missiles		
	3 ftr Squadrons)	Success	Success	to fire		
2	The Troops (3 Overlords,	Break Contact	Turn Asside	No cap missiles		
	1 ftr sqs.)			to fire		
3						

• HIGH SPEED CLOSING ENGAGEMENTS RECORD SHEET SAMPLE 3 (BOB) •

Blakist Agamemnon, but in a stunning series of bad rolls, manages to miss with all her missile bays.

Bob's and Andrea's Game Sheets now look like the following at the end of the Capital Missile Phase (see above).

MEETING ENGAGEMENT PHASE

In this third Phase, the fleets reach gun range and pass each other. Generally, shots are withheld until range reaches a minimum to improve accuracy. This results in a low default Target Number modified by certain factors.

Meeting Engagement Maneuvering

Maneuvers are fundamentally different in this phase. Escape is no longer an option because time is so short; any Unit that was going to escape conflict did so in prior phases. (Note that it may be possible for a fleeing Unit to avoid Meeting Engagements with some foes but not others.) Instead, Maneuvers represent last-instant "tactical" moves to make attacks easier or more difficult. There are four Maneuvers available in this phase: Accelerating, Decelerating, Evasion, and Hold Steady.

Again, roll Initiative for the phase and declare Maneuvers as in the Detection Phase (see p. 65).

Accelerating: One way to avoid conflict is to shorten the opportunity for foes to target a ship. In this case, the Unit accelerates toward one declared enemy Unit, worsening that enemy's accuracy at the expense of its own accuracy. The Accelerating Unit may expend thrust points up to the Maximum Thrust of the Element with the lowest Maximum Thrust in the Unit. For every 3 full thrust points expended, the Accelerating Unit is harder to hit by a +1 to-hit modifier by the target enemy Unit, while it has a +1 to-hit modifier per 3 full thrust points to hit any enemy Unit.

Decelerating: The Unit burns hard to extend the engagement window with a selected enemy. Though this can help accuracy against that enemy significantly, it also means the Unit is flying butt-first toward the enemy with engines exposed to enemy fire and is easier to hit. The Decelerating Unit may expend thrust points up to the Maximum Thrust of the Element with the lowest Maximum Thrust in the Unit. For every 3 full thrust points expended, the Decelerating Unit has a -1 to-hit modifier against the targeted enemy Unit, but is easier to hit by a -1 to-hit modifier per 3 full thrust points by any enemy Unit.

Accelerating and Decelerating may cancel each other out or add together if two Units are Accelerating or Decelerating toward each other. After Accelerating or Decelerating modifiers are calculated, add them together. Modifiers for non-targeted Units do not change.

Hold Steady: The Unit takes no action to interfere with its accuracy and may pick the facing of its choosing. WarShips, for example, tend to turn broadside at moments like these to take an enemy under the combined firepower of its side and broadside arcs.

Evasion: The Unit begins maneuvering erratically. This makes it harder to hit, but will impair its own accuracy.

Andrea failed initiative again, rolling a 4 to Bob's 12. Since she has to declare her WarShip-containing Unit first and the Overlords are out of its range, she accepts combat with the Agamemnon (which successfully Intercepted her in the last phase) and will Hold Steady. Bob declares his Agamemnon will Decelerate toward Flotilla-1, expending 6 thrust to gain a -2 to-hit modifier. Seeing an interesting opportunity for aerospace superiority, in a gamble, Andrea throws away two phases of dogged pursuit of the three tough Overlords and moves her Heavy Squadron and Light Squadrons to engage Bob's Hit Squad by Holding Steady—they never attempted to flee the Hit Squad, and thus may engage during the Meeting Engagement. Bob could have his Troops Unit Hold Steady to engage the Heavy Squadron or Light Squadrons, but thinks his Hit Squad will be able handle them alone, or at least survive the experience. He has his Troops Unit Evade, just to be sure. There are no Control Rolls to make in this Maneuvering Phase.

Meeting Engagement Weapons Fire

Meeting engagement weapons fire is resolved using all the standard rules for combat (see pp. 234-251, *TW*, and pp. 50-77 of this book, as appropriate), with the following modifications:

Avoided Combat: In Class 1 (Slow) and Class 2 (Medium) speed Engagements, a Unit that successfully Broke Contact in the Detection Phase and Turned Aside in the Capital Missile Phase avoids Meeting Engagement Weapons Fire. This may apply to some Units and not others. (For example, Andrea's Unit 2, Heavy Squadron could engage Bob's Unit 2, Troops in the Meeting Engagement Phase, but Andrea's Flotilla-1 could not.) In Class 3 (Fast) speed Engagements, a Unit that successfully Broke Contact in the Detection Phase avoids the Meeting Engagement phase entirely.

Range: By default, a blanket range penalty of +4 is applied to both standard and capital-scale weapons, representing the random variations in range that may occur as ships fire their guns at slightly different instants. Variations to range are modeled with other abstract modifiers given below.

Capital Missiles: Standard capital missiles may be fired normally even if they were also fired in the Capital Missile Phase. Tele-operated missiles, which are limited by the reflexes of their human users, may not be used during Meeting Engagements.

Facing: Facing is usually declared at this point, but prior Maneuvers or the original Angle of Attack for the scenario may force another facing to be engaged.

- In Crossing Engagements, Accelerating or Decelerating Units will be presenting their sides (Roll 1D6: 1-3 = Right, 4-6 = Left) to hostile units. Roll once to determine which arc is presented to all opponents.

- In Head On engagements, Accelerating or Decelerating Units will be presenting their nose (Accelerating) or Stern (Decelerating) toward the target of the Maneuver. The Accelerating or Decelerating Unit will be able to select their nose/aft and one front side/aft side arc on the target of their Maneuver. Other hostile Units will hit the Accelerating/Decelerating Unit from the front sides (Accelerating [Roll 1D6]: 1-2 = Right, 3-4 = Nose, 5-6 = Left) or rear sides (Decelerating [Roll 1D6]: 1-2 = Right, 3-4 = Aft, 5-6 = Left). Roll separately to determine facing with respect to each hostile Unit.
- Units that successfully Turned Aside in the Capital Missile Phase but did not Break Contact in the Detection Phase present their aft sides to hostile Units (Roll 1D6): 1-2 = Right, 3-4 = Rear, 5-6 = Left. Roll separately for each hostile Unit.
- Units that chose to Hold Steady may declare any facing.
- Aerospace fighters, thanks to their extreme maneuverability, can bring their nose around to meet their target, in all conditions.

This facing is also important for the upcoming Chasing Weapons Exchange step, as there is no opportunity to change facing after the Meeting Engagement Weapons Fire subphase. A Meeting Engagement will be over in fractions of a second.

Attack Modifiers: In addition to appropriate standard combat modifiers, the following apply:

- +2 to-hit if the target Turned Aside in the Capital Missile Phase, but did not Break Contact in the Detection Phase
- Normal Modifiers for Evading
- +1 to-hit modifier per 3 full thrust points the target spends if the target is Accelerating toward the attacker
- +1 to-hit modifier per 3 full thrust points the attacker spends if the attacker is Accelerating toward the target
- -1 to-hit modifier per 3 full thrust points the target spends if the attacker is Decelerating toward the target
- -1 to-hit modifier per 3 full thrust points the target spends if the target is Decelerating
- -2 to-hit modifier with Capital-scale weapons that have Long or Extreme Range because their longer range gives them a better chance of catching the targets
- +1 to-hit modifier for Class 2 (Medium) speed Engagements
- +2 to-hit modifier for Class 3 (Fast) speed Engagements

Damage: Again, note the multiplication of damage from kinetic weapons based on speed class (*High Speed Damage*, see p. 73).

Mine Deployment: Mine fields (either standard mines or standard bombs released by fighter squadrons) and screen launchers may be deliberately targeted in High Speed Closing Engagements because the targets do not have a normal chance to avoid these threats. Minefields and screen launchers only be targeted at units when the attacker is making an Accelerating or Decelerating Maneuver toward the target, and the target is not Evading.

Attack Declaration: At this time, the Units take turns declaring attacks in the same order as they Maneuvered in this Phase. Minefield attacks, which are resolved in the next subphase, are also declared now.

Andrea speeds things along by declaring all her facing and shots first: everything on the Agamemnon. If she kills that, the Hit Squad Unit's 3 squadrons of fighters might barely have 3 hours of fuel to reach orbit after this passing engagement, and it will be much easier to kill the fighters' last support ships—the Overlords—once the Agamemnon is gone. The Foxes, Holding



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PLAYER Andrea

Engagement Speed: <u>378km/s (Med)</u>			Angle of Attack: <u>Head-On</u>			
Unit	Ship/Squadron/ Mines/Debris	Detection Phase	Capital Missile Phase		Meeting Engagement Phase	
		Maneuver	Maneuver	Target(s)	Maneuver	Target(s)
1	Flotilla-1(2 Fox, 2 Achilles,	Intercept 1,	Intercept 2,	Intercepting 1	Hold Steady	Unit 1: Agamemnon
	1 Stuka Squadron)	failed	failed			Fox 1 - RBS Fox 2 - RBS Other - Nose
2	Heavy Squadron	Intercept 2,	Intercept 2,	No cap missiles	Hold Steady	Unit 1: Agamemnon
	(2 Achilles)	Success	Success	to fire		Nose
3	Light Squadron-1	Intercept 2,	Intercept 2,	No cap missiles	Hold Steady	Unit 1: Agamemnon
	(6 Stukas)	Success	Success	to fire		Nose
4	Light Squadron-2	Intercept 2,	Intercept 2,	No cap missiles	Hold Steady	Unit 1: Agamemnon
	(6 Stukas)	Success	Success	to fire		Nose

• HIGH SPEED CLOSING ENGAGEMENTS RECORD SHEET SAMPLE 4 (ANDREA) •

PLAYER Bob

Engagement Speed: <u>Medium</u>			Angle of Attack: <u>Head-On</u>			
Unit	Ship/Squadron/ Mines/Debris	Detection Phase	Capital Missile Phase		Meeting Engagement Phase	
		Maneuver	Maneuver	Target(s)	Maneuver	Target(s)
1	The Hit Squad (Aggie,	Intercept 1,	Intercept 1,	No cap missiles	Decelerate	Agg - Fox1, Fox2
	3 ftr Squadrons)	Success	Success	to fire		Aft Sq 1 - f1 Nose S2/3 - f2 Nose
2	The Troops (3 Overlords,	Break Contact	Turn Asside	No cap missiles	Evasion	N/A
	1 ftr sqs.)			to fire		
3						

• HIGH SPEED CLOSING ENGAGEMENTS RECORD SHEET SAMPLE 4 (BOB) •

Steady, will swing to present their overlapping broadside bays (Andrea picks the starboard side—right to you land-lubbers) at the Agamemnon while her other Units will face the heavy cruiser nose first. Andrea rolls to see from which angle her lighter Units are approaching Bob's Hit Squad Unit and gets a 1, 3, and 6: Aft Right, Aft, and Aft Left for the Heavy Squadron, Light Squadron-1, and Light Squadron-2, respectively. (How they managed to spread out around the stern of the Hit Squad when they were all off chasing one group of DropShips isn't clear to Andrea, but she chalks it up to the abstract nature of High Speed Engagements.)

Bob, figuring he can deal with Andrea's DropShips and fighters later if he can get rid of the Foxes, splits his Agamemnon's firepower between the two Foxes. Because he decelerated his Hit Squad for a to-hit modifier the Agamemnon can only bring her Aft and one Aft-Side arc to bear, which Bob declares will fire its Aft and Aft Right weapons on the Foxes. All three squadrons of Strigas spin about at the last moment to fire their Nose mounted pulse lasers.

They update their record sheets as shown above.

In the following exchange of fire, Andrea's Elements (all Holding Steady) have no modifiers for their own maneuvers. However, Bob's own Decelerating Maneuver has worked against him, giving all of Andrea's ships a -2 to-hit modifier. Unit 2, The Troops, is out of range for all of Andrea's ships and thus needn't have modifiers calculated against them. Bob's Unit 1 Agamemnon is showing its rear to Andrea's Unit 1 WarShips and Unit 3, Light Squadron-1, so they have a +0 to-hit modifier for "attacks against aft." Heavy Squadron and Light Squadron-2 have a +2 to hit modifier for "attacks against side." The range modifier is +4; all of the available Foxes' capital weapons will have a -2 to-hit modifier because of their Long or Extreme ranges; their Barracudas will have another -2 to-hit modifier; their large pulse lasers will have a straight -2 to-hit modifier. Andrea's 3 squadrons of STU-D7 Stukas do not have any particular weapon-related bonuses, but their massed missiles and autocannons will have a nice damage amplification from their velocity. And because this is a Class 2 (Medium) speed Engagement with a brief chance to shoot, all her Units apply a +1 to-hit modifier.

Bob's WarShip Unit has its two targets facing broadside to his, so he gets a +2 to-hit modifier for "attacks against side." He also got a useful -2 to-hit modifier by Decelerating. Many—but not all—of the Agamemnon's aft and aft right capital-scale weapons have a -2 to-hit modifier for their range. And, like Andrea, he has a +4 to-hit modifier for the range and +1 to-hit modifier for Class 2 (Medium) speed. His fighters gain their own -2 to-hit modifier for their pulse lasers but have all the other modifiers that Bob's WarShip does.

Neither player has any mines to deploy, though Bob reflects his fighters might've accomplished something if he'd loaded them with conventional bombs.

In the following exchange of fire, Bob is thrilled to see how a bay of NAC/20s can increase in damage from 60 points of capital-scale damage to 120. However, his capital-scale weapons do not finish off the Foxes—he has too few in his aft and aft right arc and the miss with the single NAC/40 costs him his chance to kill Fox #1 (though, to be sure, it only survived because of its huge SI and lucky critical hit rolls). His fighter squadrons do a mix of damage, with two rolling poorly on their cluster hits. Added to his Capital Lasers not getting a damage bonus from speed, Bob is unable to finish either Fox (though they are both missing all armor on their Fore-sides). Bob notes that in the future, he should try a Hold Steady Maneuver and a broadside engagement, since he was unable to use most of his capital weaponry.

Andrea is equally thrilled that she has two semi-functional Foxes, but is more stoic about the predicted effects of concentrating firepower on the thin-skinned Agamemnon. Six Barracudas and 6 NAC/10s don't all hit, but at target numbers 3 (Barracudas) and 5 (NACs), only 2 NAC/10s missed for total of 112 damage. At similarly low numbers, the Foxes' Capital Lasers (without damage amplification) contribute to the demise of a ship over twice their mass. Andrea notes that for the future, she should use her screen launchers when target numbers are that low. They would've spared her ships some damage.

The contribution of Andrea's fighters and DropShips are unneeded in this subphase; their declared target is dead.

Mine/Debris/Ramming Attacks

In High Speed Engagements, the risk of debris from the target you're approaching is much worse. Mines and even the "smoke" from screen launchers can be a threat. This step resolves the results of mines and debris passing through the enemy Formation.

Mine/Bomb/Screen Attacks: Mines and Screens may only hit targets if they were targeted in the Meeting Engagement Phase (see above for declaring a Mine attack). The Unit that deployed the mines makes a Control Roll with +6 modifier, modified by the to-hit penalty/bonus for the Accelerating, Decelerating or Evasion Maneuver that the attacking or target Unit generated during the Meeting Engagement Maneuvering subphase. A successful roll indicates that the attack hits.

Damage for Bombs are resolved per the standard rules (see p. 245, TW, or pp. 169, 172, TO:AUE), while Screen Launchers base damage is half their normal damage as covered in the standard rules (see p. 251, TW). Rules for Space Mines can be found on page 178 of *Tactical Operations: AUE*.

In all cases, multiply damage as discussed on page 73.

Debris/Out of Control Collisions: If a Unit that was destroyed in the Meeting Engagement Weapons Fire subphase made an

Accelerating or Decelerating Maneuver against a target that Held Steady or Accelerated/Decelerated toward the destroyed Unit, then there is a chance its debris will collide with the target. The target makes a Control Roll for each Large Craft or Squadron in the target Unit; if the die roll result is a 2, there is a collision. Damage is based on deliberate ramming (see p. 241, TW), but divide the tonnage by 10 (slow engagements), 5 (medium engagements), or 2 (fast engagements) to represent dispersion of the debris.

A Element that went out of control may collide under the same circumstances as a Debris collision, but it will only strike one target. When the target Unit is making Control Rolls, stop making the rolls if a 2 is rolled and apply damage to that Unit; if no 2 is rolled the collision was avoided. Start making the rolls with the Element in the opposing Unit with the highest tonnage and proceed down to the lightest. Damage is resolved as described in ramming (see below).

In both cases, if the target is a Fighter Squadron, there is a chance the fighters will evade the impact. On a successful Control Roll with a +4 modifier, the fighters 'thread the needle', and avoid all damage.

Ramming: Only deliberate ramming is a risk and is resolved (see p. 241, TW). Damage is multiplied as discussed on page 73, under High Speed Damage.

Andrea is elated she still has two WarShips and the rest of her aerospace Units, which she plans to use to hunt down the Blakist troop ships. Bob, however, points out that the High Speed Closing Engagement is not over. He had a Unit Decelerating toward Andrea's Flotilla-1, which was Holding Steady, and his Agamemnon was destroyed, so there's a chance for debris collision with each Element and squadron in Flotilla-1. Andrea rolls for her Foxes and fighter squadron: 7, 2. Against all odds (about 1 in 1,300), the debris cloud of the Agamemnon expanded enough to sweep through the space occupied by Andrea's Fox-2 and one of her Stuka Squadrons, blotting them from the sky in collisions with the force of nuclear explosions. Bob gleefully offers to calculate the damage, but at more than 1,200 hexes per turn and 820,000 tons of debris, Andrea doesn't need to apply points to know the Agamemnon has annihilated her Fox and 6 Stukas.

Chaser Weapons Fire

The instant after passing a target, a ship may fire weapons aimed in reverse toward its passing foes. The heading declared in Meeting Engagement Weapons Fire subphase is important now, because the arcs that can be fired now are the exact opposite arc of those fired in the Meeting Engagement Weapons Fire subphase. The same to-hit modifiers apply as in the Meeting Engagement Weapons Fire subphase, except that the to-hit number for firing on a different arc of the target may apply. (For example, previously facing a +0 to-hit modifier for firing into the Agamemnon's stern, Andrea's surviving Flotilla-1 Elements would face a +2 to-hit modifier for firing on its nose.)

Kinetic weapons fired as chaser weapons suffer a damage penalty, and may not be useful at all, when fired as chasers (see p. 72).

Chaser Weapons fire is resolved with the same Initiative, Maneuvers, and targets that applied to the Meeting Engagement Weapons Fire. Units may not change targets from what was declared in the Meeting Engagement Weapons Fire subphase because there is no time to accomplish a retargeting.



Bob wonders again about his choice of Meeting Engagement Maneuvers. His Striga A fighter squadrons are armed primarily with ballistic and missile weapons in their forward arcs, and no weapons in their Aft arcs, which happen to be the arcs able to fire on the passing Flotilla-1. Even had his fighters been facing the opposite direction at Class 2 (Medium) speeds, the Strigas' fighters are unable to catch the Flotilla-1 ships (specifically, Fox-1 and the deceased Fox-2) with their ballistic and missile weapons, leaving only the light-speed Heavy PPCs to flail at the passing Unit. The effect on the undamaged side armor of the Fox-1 is trivial. Since Andrea did not target the Striga squadrons, she cannot fire on them, but doesn't particularly care—with 1 Fox, 4 Achilles, and 2 Stuka Squadrons, the Blakist's DropShips are all hers.

Heat and High Speed Engagements

For purposes of determining total heat, all weapons fire from the Meeting Engagement Weapons Fire and Chaser Weapons Fire are considered to have fired in the same turn. DropShips and WarShips may not exceed their total heat capacity with this combined fire (unless using the *Advanced Heat* rules; see p. 82).

END PHASE

Because the prior phases and subphases address damage resolution, the only significant actions left to players is to reclaim deployed fighters and consider if there is going to be another high-speed pass in their near future.

Reclaim Fighters

This is a relatively simple operation if the deployed fighters can still expect to return home to their original carrier Elements, or if their side still has enough empty fighter bays to "trap" all the fighters. However, if there is a shortage of bays, then excess fighters will have to be abandoned. The controlling player selects which fighters to save and which fighters from which only the pilots will be saved.

Close Encounters of the Second Kind

It is left as an exercise in players' physics knowledge of thrust ratings, distance, and time if they want to arrange a second High Speed Closing Engagement. While the first encounter might be arranged with random dice rolls, arranging the second is determined by the outcome of the first and the willingness of the players to bring their Forces back together again for battle.

Andrea is very interested in hunting down the dregs of Bob's Blakist Force, but Bob is more interested in landing his troops on the ground. The downside to a High Speed Closing Engagement is also obvious: after spending 3 hours accelerating at 2.5Gs, it will take Andrea 3 hours to halt (at least as a cohesive fleet; her Achilles could stop sooner at 6Gs if she wanted to risk injuring or killing her crews), and more hours to return along the path they came. On the other hand, in 3 hours Bob's Overlords can continue braking 1G to drop their troops

from a near-hover over the Davion planet. It is unlikely a second encounter could be arranged before the troops are deployed but, on the other hand, it is unlikely Bob's ground troops will have their DropShips for much longer after they deploy their troops.

HIGH SPEED DAMAGE

For simplicity, Standard and even most Advanced Aerospace Rules combat ignores the influence of velocity on damage inflicted by non-energy weapons. However, High Speed Closing Engagements address this in part, recognizing the influence on damage for ballistic and missile weapons. Energy weapons (plasma, laser, PPC) are not affected by closing velocity. Damage is affected as follows:

- In Class 1 (Slow) speed Engagements, the damage by missile, autocannon, and Gauss weaponry is multiplied by 1.5 (round up).
- In Class 2 (Medium) speed Engagements, the damage by missile, autocannon, and Gauss weaponry is doubled.
- In Class 3 (Fast) speed Engagements, the damage by missile, autocannon, and Gauss weaponry is quadrupled.
- In Class 1 (Slow) speed Chasing Weapons Fire, only autocannons and Gauss rifles can hit the passing targets and then only at half damage; missiles cannot hit.
- In Class 2 (Medium) and Class 3 (Fast) speed Chasing Weapons Fire, non-energy weapons cannot hit the passing targets.

Realistically, the damage might be increased by a great deal more than quadrupling (especially if anyone starts citing kinetic energy equations), but since it would be awkward for a battleship to be destroyed by a machine gun, a simple linear increase was selected for playability.

Players who want more realism from Units crossing each other at substantial percentages of light-speed (as might happen mid-transit in systems with large stars) are encouraged to resolve combat by dropping record sheets into cross-cut shredders simultaneously. The record sheet that is shredded the slowest wins the engagement though, obviously, it is destroyed in the process.



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HYPERSPACE TRAVEL

JumpShips and WarShips can travel through hyperspace by means of the Kearny-Fuchida jump drive. Such drives allow these units to cross up to thirty light years almost instantaneously, but they require massive amounts of energy.

The time involved in moving to an appropriate location for making a jump, as well as charging the KF drive and calculating a jump generally fall outside of the scope of a standard scenario, often requiring hours, days or even weeks. As such, most of these rules fall outside of the scope of a standard scenario. Each of the headers below include a parenthetical noting whether the rules general apply outside or during a standard scenario game play. However, it is important to note that these are only guidelines. Depending upon the type and size of scenarios being played, players may find the lines blurred between what can and cannot occur during a scenario.

JUMP POINTS (OUTSIDE OF GAME PLAY)

To perform a jump safely, a jump-capable unit must be in an area free of significant gravitational influences (see p. 122). Such areas are known as either Proximity Points or Jump Points. The two most commonly used jump points are at the zenith and nadir of the gravity well, along the line that passes through the system's gravitational center and is perpendicular to the plane of the star system (generally above and below the poles of the star). These two points lie at the minimum safe jump distance from the main star and simplify navigational calculations. The jumping unit need not be stationary though calculating jump points for a moving

unit is both more time consuming and difficult, as described under *Jump Calculations (During Game Play)* (see p. 76).

The zenith and nadir are the most commonly used points, especially for civilian traffic, but are not the only options. A jump-capable unit can travel to any point in a star system that is at least as far away from the star as the distance listed on the Proximity Point Distance Table (see below). These jump points form a sphere around the star, although the gravitational fields of large planets might distort this.

A skillful navigator can use detailed information regarding a planetary system to calculate a jump point much closer to the intended destination than the zenith or nadir. This can drastically reduce transit times and fuel consumption, and will give defenders less time to react. Additional points, known as transient points and Lagrange points, may exist within a system where gravitational forces cancel each other out, such as points between a planet and a moon. These points are often used by raiders and smugglers, and are sometimes referred to as pirate points (see *Jump Points*, p. 122).

Transient points can be anywhere in a system and can come and go in seconds, though they are generally a sub-class of Lagrange points. This makes them difficult to use without significant advance planning. Some systems simply do not have useful transient points. Because of the very nature of transient points, they are not covered by the following rules. Players may wish to use transient points in certain scenarios; however, in such cases, the players sets transit distances and times.

Sol is a G2 star. To determine the distance from the star, cross-index the G row with the 2 column on the table. The result

PROXIMITY POINT DISTANCE TABLE

Star Type	Star Subtype									
	0	1	2	3	4	5	6	7	8	9
B	347.84	282.07	229.40	187.12	153.06	125.56	103.29	85.20	70.47	58.44
A	48.56	40.51	33.85	28.36	23.82	20.06	19.63	14.32	12.15	10.32
F	8.80	7.51	6.43	5.51	4.74	4.08	3.52	3.04	2.64	2.29
G	1.99	1.74	1.52	1.33	1.16	1.02	.90	.79	.70	.62
K	.55	.49	.43	.39	.34	.31	.28	.25	.22	.20
M	.18	.16	.15	.13	.12	.11	.10	.09	.08	.07

DISTANCE TO ZENITH/NADIR JUMP POINT TABLE

In days, assuming 1G acceleration and mid-point turnover

Star Type	Star Subtype									
	0	1	2	3	4	5	6	7	8	9
B	137.91	124.19	112.00	101.15	91.48	82.86	75.15	68.25	62.07	56.53
A	51.51	47.06	43.02	39.38	36.09	33.12	32.76	27.98	25.77	23.75
F	21.94	20.26	18.75	17.36	16.10	14.94	13.87	12.89	12.01	11.19
G	10.43	9.75	9.12	8.53	7.96	7.47	7.01	6.57	6.19	5.82
K	5.48	5.18	4.85	4.62	4.31	4.12	3.91	3.70	3.47	3.31
M	3.14	2.96	2.86	2.67	2.56	2.45	2.34	2.22	2.09	1.96

All distances given are in billions of kilometers.



JUMP SAIL RECHARGING TABLE

Results in hours

Star Type	Star Subtype									
	0	1	2	3	4	5	6	7	8	9
M	201	202	203	204	205	206	207	208	209	210
K	191	192	193	194	195	196	197	198	199	200
G	181	182	183	184	185	186	187	188	189	190
F	171	172	173	174	175	176	177	178	179	180
A	161	162	163	164	165	166	167	168	169	170
B	151	152	153	154	155	156	157	158	159	160

is 1.52. Because the figures given are in billions of kilometers, the distance from the star to the minimum standard jump point is 1.52 billion kilometers. A standard transit at 1G would take 9.12 days.

CHARGING THE DRIVE (OUTSIDE OF GAME PLAY)

Normally a JumpShip recharges its K-F drive with energy gathered via the massive collector sail, commonly known as the jump sail. The sail is fragile and great care is taken when deploying it. The controlling player should make a Control Roll. Success indicates the operation is successful, while failure causes damage to the Sail Integrity equal to the MoF.

Deployment of the sail normally takes 80 minutes, while furling requires twice that. For every 10 minutes (or fraction thereof) subtracted from this time, apply a +1 modifier to the Control Roll for the operation. Conversely, for every 10 minutes added to the furling or deployment, apply a -1 modifier to the Control Roll (to a minimum of 2; a result of 2 on the Control Roll is always a failure). For example, a furling operation would normally take 160 minutes. A crew decides to reduce this to 120 minutes. As this is 40 minutes less than normal, a +4 modifier is applied to the Crew Piloting Skill Rating for the Control Roll. Had the same crew opted to increase the time taken for the furling operation to 200 minutes, a -4 modifier would be applied to the Crew Piloting Skill Rating for the Control Roll, to a minimum of 2.

The time required for recharging the Kearny-Fuchida drive is governed by the star type of the current system. To determine the time, compare the star's type with its sub-type. This time is the minimum required and is increased by 10 percent for each point of Sail Integrity damage suffered by the jump sail.

Alternatively, JumpShips and WarShips can use their power plants to recharge the drive, or JumpShips and WarShips may also recharge their KF drives (and LF batteries) with energy stored in a recharge station's batteries, either beamed via microwave into the unit's sails or via a direct cable connection when docked.

Any attempts to recharge the K-F drive faster than 175 hours may result in drive damage. To determine if damage occurs, the controlling player should make a Control Roll, applying a modifier as indicated on the Quick-Charge Table (at right) at the end of the elapsed time. If the roll is successful, the drive is fully charged. If the roll fails, roll 2D6, adding the

QUICK-CHARGE FAILURE TABLE

Die Roll (2D6 + MoF)	Result
2	40% charge lost
3	60% charge lost
4	80% charge lost
5	80% charge lost
6	100% charge lost
7	100% charge lost
8	100% charge lost; reduce K-F Drive Integrity by 1
9	100% charge lost; reduce K-F Drive Integrity by 2
10	100% charge lost; reduce K-F Drive Integrity by 3
11	100% charge lost; reduce K-F Drive Integrity by 4
12	100% charge lost; reduce K-F Drive Integrity by 5
13+	100% charge lost; K-F Drive destroyed

QUICK-CHARGE TABLE

Time Spent (Hours)	Control Roll Modifier
175+	No failure
150-174	+0
125-149	+1
100-124	+2
75-99	+3
25-74	+4
22-24	+5
20-21	+6
19	+7
18	+8
17	+9
16	+10
15	N/A

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MoF as a modifier to the roll, and consult the Quick-Charge Failure Table (see p. 75).

Each power plant-based charging attempt of the drive requires 10 burn-days of fuel (in addition to any fuel required for station keeping). At the end of the charging period (irrespective of success or failure) the controlling player makes another Control Roll applying a modifier as for the charging attempt (applying a +0 modifier for charging periods of 175 hours). For each point of MoS, reduce this fuel requirement by 0.5 burn-days (to a minimum of 4 burn days of fuel). For each point of MoF, increase the fuel consumed by 0.5 burn-days (with no upper limit).

Recharging from a space station occurs per the power-plant charging rules above (including the chance of failure) but does not cost the JumpShip or WarShip any fuel. Additionally, a direct cable connection (available only when docked) shortcuts a number of the fragile KF drive systems and thus the difficulty of any quick-charge attempts by such docked units applies a -2 modifier to the Control Roll, treating a final Modified Target Number of 2 or less as having no chance of failure. When docked to a space station the direct connection can only feed the energy from a single energy storage battery at a time.

It is impossible to charge a jump drive using more than one power source (sail, power plant, energy storage battery) at a time.

Lithium Fusion Batteries

Though expensive, lithium fusion batteries (see p. 135, *TO:AUE*) have become increasingly common since 3050. The system serves as an energy store, allowing the unit to make a second hyperspace jump. Charging the lithium fusion battery is handled like charging the K-F drive as described in *Charging The Drive* (see p. 75), and both can be charged simultaneously.

A unit with an LF battery in addition to its K-F core may use its jump sail to charge one device, and its power plant (or a direct cable connection to a recharge station) the other. If using its sail to charge from the local star, the unit may not use a microwave link to an energy storage battery at the same time (or vice versa), nor may it use one power source (sail, power plant, or direct connection to a station battery) to charge multiple drive systems. The exception to this is a station battery, where one charge can be sent via microwaves through the jump sail and a second charge via a direct cable connection.

If a failed quick-charge of an LF battery indicates a reduction in K-F Drive Integrity, the battery is destroyed instead.

The Invader-class Athena arrives in a F7-class star system. Cross-referencing Star Type F with Subtype 7 indicates that it will take the Athena 178 hours to recharge its KF drive via its jump sail. If the unit's controlling player were in a hurry he could shave almost 28 hours off this recharge time by using his power plant in lieu of the sail with minimal risk to the drive (and more if he is prepared to gamble on taking damage), albeit at the expense of fuel.

The controlling player chooses to gamble, aiming to complete his recharging in 4 days (96 hours), applying a +3 modifier to the Control Roll for a final Modified Target Number of 7 (4 (Crew Piloting Skill Rating) + 3 (quick-charging in 96 hours)) = 7. The player rolls a 9—a success—and completes his recharging operation. However, he must make a second roll to determine his fuel consumption (also against with a +3 modifier). This

time he rolls a 10 (an MoS of 3), reducing his fuel consumption by 1.5 burn-days to 8.5 burn-days.

If there was a recharge station in the system, the Athena's controlling player could purchase a charge from the orbital facility. If he did so and recharged via the sail, the standard power plant rules apply save for fuel expenditure (i.e. if he charged in 96 hours, a Control Roll with a +3 modifier). However, had the controlling player docked to the station and used a direct cable connection for a 96-hour charge, the modifier would've only been a +1.

JUMP CALCULATIONS (DURING GAME PLAY)

Once a jump-capable unit is at a jump point and has a fully charged drive, its crew may calculate an appropriate path between the current position and the destination, which must both be valid jump points (see pp. 121–122).

In aerospace engagements, jump-capable units are assumed to *not* have a jump route calculated unless the scenario instructions state otherwise. To calculate a jump route, make a Control Roll with a +2 modifier, adding the modifiers from the Hyperspace Navigation Table. Compare the MoS to the relevant row in the Jump Calculation Table to determine the amount of time needed to calculate the jump.

If the roll succeeds, a jump point is calculated. If the roll fails, the time elapses without a point being calculated.

HYPERSPACE NAVIGATION TABLE

Situation	Modifier
Calculations made without navigation computer*	+2
Aerospace unit is moving predictably	+1
Aerospace unit is moving out-of-control	+3
Destination is nadir or zenith point	+0
Destination is non-standard point*	+4
Destination is transient point**	+4
Origin point is at nadir or zenith	0
Origin is non-standard (Lagrange) point	+2
Origin is transient point	+2

*Non-standard points cannot be calculated if a navigation computer is unavailable.

**Transient points require detailed charts of the destination system.

JUMP CALCULATION TABLE

Target is zenith or nadir
With computer: $(2D6 - MoS) \times 10$ minutes
Without computer: $(2D6 - MoS)$ hours
Target is non-standard jump point
With computer: $(2D6 - MoS) \times 30$ minutes
Without computer: Impossible
Other
Unit is moving: Base time $\times 1.1$



JUMP PROCESS (OUTSIDE OF GAME PLAY)

Once calculations are made, the coordinates are programmed into the K-F drive. The precise amount of time this requires depends on the crew's skill and random factors. Roll 2D6 to determine the base number of minutes. Then make a standard Control Roll, applying each MoF as one additional minute, or each MoS as one less minute (to a minimum of one minute).

Routes plotted to or from other non-standard and transient points are only valid for 20 minutes. Those calculated for a moving unit must be for a pre-determined position on its route. After that time, orbital movement makes the calculations useless and the process must begin again.

Once a unit is committed to a jump, it takes 10 minutes for the program to initialize. At this point warning klaxons sound to alert the crew, followed by additional warnings at 5 minutes, 1 minute, 30 seconds and 10 seconds before the jump.

At this point the jump occurs, taking the K-F drive-equipped unit along with any successfully docked external vessels (provided they have a K-F Boom and used a Docking Collar). K-F Booms only work when connected directly to the unit with the K-F Drive; otherwise, treat the vessel as if it's a ground unit landed on the hull, as per below.

The jump seems instantaneous, but it actually can take several minutes. The time varies depending on the distance traveled and the size of the JumpShip. The elapsed time in seconds is:

$$[\text{light years traveled} \div 2] \times \text{maximum number of DropShips the JumpShip can carry.}$$

JumpShips always arrive stationary relative to the destination jump point.

Upon "arriving" at the intended destination, the navigator makes a second Control Roll. Apply the MoS from the original coordinate calculation as a bonus to the roll. Additionally, apply a +2 modifier for every point of damage sustained by the ship's K-F drive. Success indicates a "clean" jump, while failure indicates a miscalculation or erroneous data, causing damage or possibly destroying the ship. If the roll fails (i.e. a mis-jump occurs), apply (1D6 x 2 x MoF) points of capital-scale damage to each armor facing of the JumpShip and any DropShips carried. In addition, reduce the JumpShip's K-F Drive Integrity by the MoF. If the Drive Integrity is reduced to zero or lower, the K-F drive and the unit are destroyed, along with all DropShips carried.

MAKING A JUMP (DURING GAME PLAY)

In the Initiative Phase, JumpShips or WarShips that have coordinates plotted and have not expended thrust (changed velocity or facing) since plotting the jump can declare they are making a hyperspace jump; this means that a jump-capable aerospace unit with a Velocity greater than 0 can jump. However, regardless of the velocity of the jumping unit, it will always arrive at its destination hex with 0 Velocity with respect to the destination jump point; if needed, the player may determine the facing of the arriving JumpShip/WarShip.

The unit jumps in the End Phase of the following turn. The jump-capable unit is then removed from the mapsheet and cannot re-enter the scenario (see *Minimum Distance Jumps*, at right, for the exception).

Damage to Nearby Units

Opening a hole into hyperspace places great stress on nearby objects, potentially causing considerable damage to units close

to the jumping unit. Additionally, attempting a jump while in close proximity to another K-F equipped aerospace unit is problematic because the two drive cores can interfere with each other fatally.

If two operational, jump-capable aerospace units occupy the same space hex or are in adjacent space hexes when one jumps, safety circuits will attempt to abort the jump (make a Control Roll; a success indicates an abort). If the jump does not abort, it still fails and the aerospace unit remains in place, but the jumping unit (and all other K-F equipped units in the same or adjacent hexes) loses a number of SI points equal to (MoF x 12D6). Additionally, each unit loses a number of points of K-F drive integrity equal to the MoF. It is not possible to abort an arriving jump-capable unit, and so if a JumpShip or WarShip appears in a hex containing another K-F equipped aerospace unit or a hex immediately adjacent to one, no Control Roll is made. Instead, any jump-capable aerospace units automatically take 7 points of damage to their K-F drive integrity and 7 x 2D6 damage to their Structural Integrity.

An aerospace unit that has had its K-F drive integrity reduced to 0 does not interfere with the jump process; you cannot shut down a K-F drive, so unless it or the aerospace unit where it is mounted is destroyed, it will always interfere in the jump process of a nearby unit.

All aerospace units in the same hex as a jumping unit (arriving or departing) or in an adjacent hex must make a Control Roll, except for any aerospace units docked to the jumping aerospace unit. A successful result means the unit avoids damage. Failure indicates it suffers (MoF x 2D6) points of capital-scale damage to each armor facing. Other than this, the jump proceeds normally and the jumping aerospace unit departs (or arrives).

Ground Units in Zero-G Operations: Any ground units landed on an aerospace unit that makes such a Control Roll must also roll to stay attached to the aerospace unit (see p. 120). If any ground units fail to stay attached to the aerospace unit, they automatically take the damage from the emergence wave (the MoF is their missed Control Roll to stay on the unit), translated into standard scale and applied in 5-point Damage Value groupings; treat it as an area effect weapon against infantry. If any ground units stay attached to the aerospace unit and the aerospace unit fails, the full damage applied to each facing of the ship is also applied to all attached ground units.

Minimum Distance Jumps: There is no minimum distance that a JumpShip/WarShip need jump; it can jump into the exact same hex from which it departed. However, if the destination hex is the origin hex or a hex adjacent to the origin hex, the result is almost certainly self-destruction. The jumping aerospace unit is subject to double the normal damage of a jump-capable unit within the effect of an arriving aerospace unit as it effectively "catches itself coming and going" with its own jump effects.

As previously noted, regardless of the velocity of the departing ship, it arrives with a Velocity of 0 with respect to the local jump point (the playing area). If the jump places the aerospace unit back onto the playing area, the controlling player determines facing.

For extremely short jumps (under 0.1 light-years), the duration of the jump is such that a jumping unit arrives in the same End Phase in which it is removed from the map for the jump.

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PUNITIVE STRIKE

KEVIN KILLIANY



**KABAH
SMOKE JAGUAR
OCCUPATION ZONE
01 AUGUST 3057**

Point Commander Lindz felt the familiar drag as her *Avar*'s down-swept wings bit into the thickening atmosphere. She tested her control surfaces reflexively, the minute movements barely affecting the thirty-five ton fighter's trajectory.

Chronometer check, position check: optimal.

Somewhere in the airless black above her, the *Drummond's Pride* began its braking burn. The Nova Cats were known to rely on their trusted hover drop. The Smoke Jaguars would be expecting the *Union-C* DropShip to descend within range of their weapons, then pause—a stationary target on its pillar of plasma as the Tertiary of Fifteenth Garrison Cluster OmniMechs jumped free. The Smoke Jaguars were in for a surprise.

But it was a dangerous and fragile surprise. Her trothkin would be counting on Lindz to see them safely down.

Ahead of her the world's blue-white primary rose with preternatural speed as she overtook it. The unlimited sea beneath her wings lit from gunmetal grey to aquamarine as she arrowed out of the predawn darkness. An ocean, dotted with islands, and a table-flat continent beyond. Topography would not be a factor in the upcoming battle.

A glance through the canopy to her right confirmed Bicker was in position.

Strung out to her left—too far for her to confirm with naked eyes—were the other three Points of the abbreviated Star the Fifteenth Garrison Cluster had bid: two more *Avars*, and a Point each of *Turks* and *Batus*. More than enough firepower to teach the Smoke Jaguars respect.



DROPSHIP DRUMMOND'S PRIDE

The racked row of pale dun eggs was not inspiring. Savil preferred the dignity of a hover drop deployment; the sense of control over one's destiny. In a hover drop a Warrior stood at the brink of an abyss, in the open door of a DropShip's bay and awaited the command to attack. When the order came, the Warrior stepped forward of his own will into the maelstrom of turbulence — keeping his OmniMech aligned as the thermal wash of the giant engines buffeted the war machine like a leaf in a gale — then chose when to fire his jump jets.

With the orbital drop, his beloved *Huntsman* would fall blindly from orbit in a thermal cocoon until air density sensors triggered explosive bolts to shatter the protecting egg. Then, then, he would fire his jump jets and his OmniMech would transform itself from helpless passenger to deadly machine of war. But Savil felt its glory was somehow lessened, its honor tainted by its ignominious delivery to the battlefield.

Raising one arm above his head to fit his broad shoulders through the narrow ingress, Savil lowered himself through the opening at the very top of the ceramic cocoon that enshrouded his *Huntsman*.

The sound of the technicians sealing the cocoon's final plug were

carried faintly through his OmniMech's metal frame as he made final preparations. The cockpit's interior lights illuminated the ablative ceramic, creating the illusion of a pale yellow fog bank, silhouetting the knife point hanging from the slender chain above his view port. There was nothing remarkable about the seven centimeters of civilian-grade steel slightly twisted where it had snapped free of the blade—but it was a potent reminder.

Five years before, the 214th Jaguar Dragoons had abandoned Chupadero, leaving weeks before the Fifteenth Garrison Cluster's arrival without acknowledging Star Colonel Attwater's original *batchall*. Declaring by action that the Nova Cats were unworthy of honorable combat.

Not so the remnants of the Chupadero Armored Legion. They had met the Nova Cats with an unreasoning fury as ferocious as it was futile.

Savil had felt a moment's fear when the unarmored infantryman appeared at the *Huntsman's* canopy, clinging impossibly in the midst of battle. He'd expected an adhesive charge slapped against the ferroglass. Instead, the man had jammed his knife into a framing seam, evidently bent on prying his way into the cockpit. The blade had snapped in his hand. Without a sound the soldier had tumbled from view.

The incident had lasted less than a breath, but to Savil it symbolized the entire Chupadero campaign.

It wasn't until the Fifteenth had secured the planet that they were able to assess the level of abuse the Smoke Jaguars had visited on the agrarian world during their occupation. The Nova Cat response, after the initial nausea, had been twofold: Their engineering caste had stepped in to facilitate rebuilding the ravaged world and their warriors had sought every opportunity to punish the Jaguars.

Ostensibly this raid against the 214th's supply depot was about acquiring needed munitions and tech. But there wasn't a warrior on either side who did not understand this was a matter of honor.

The angle of descent changed. The shift was subtle, but enough to swing the knife point against the canopy with a sharp click. As though it were eager to be free, ready to seek its vengeance in Jaguar blood.



With contact still minutes away, Lindz brought her weapons online. On this mission all four *Avars* were arrayed for strafing ground targets: two large pulse lasers mounted in the nose, supported by two extended-range medium lasers in the wings. Star Colonel Attwater had been explicit: Avoid native assets and do as much damage to the Smoke Jaguars as possible.

A fiery point appeared at the top edge of the tactical display. Checking vectors, Lindz boosted her throttle a notch. She didn't bother telling Bicker to do the same. Her wingman could read numbers as well as she—or failing that, would notice her *Avar* pulling ahead. The assault plan demanded that fighter cover arrive at the



drop point just as the OmniMechs shed their shells for the final, most vulnerable stage of their descent.

Four blue sparks rose from an island ahead and to the north.

Lindz knew the Smoke Jaguars had bid six aerospace fighters to defend, choosing predictably to rely on BattleMechs. She watched for a long second, but no other craft rose to meet them.

"Lindz, lead Points three and four, suppress ground fire." Star Commander Suze's voice was crisp and unhurried in her headphones. "Points one and two, form on me. Engage fighters."

"Two fighters are missing," Lindz pointed out.

"Watch the sky."

Lindz nodded. Standard tactic would have a Point of *Kirghizes* or other heavy fighters lying doggo in low orbit, ready to pounce once the Nova Cat force was committed. It was possible they were already on a ballistic drop—engines cold as they fell toward the Nova Cats. No doubt the *Turks* and *Batus* would engage the stooping fighters long before they reached the *Avars'* level, but Lindz could hope one would fall low enough to engage. It would be little more than counting coup, there was little her small fighter could do against an opponent three times its mass, but to strike a *Kirghiz*—or even a *Scythia*—with her *Avar* would add honor to her name.

Lights streaked down through the sky ahead. Fifteen falling stars in close formation, their fiery trails pointing the way to their target. The ground beneath remained dark as the chronometer counted down the seconds to contact.

A data window popped into existence below the tactical display.

Based on apparent mass and flight characteristics, her targeting computer had decided the rising defenders were a Point each of *Sabutais* and *Sullas*. Specific weapons configurations would remain a mystery until battle was joined, but Lindz felt confident the unimaginative Jaguars had configured the medium-weight *Sullas* for air-to-air combat, intending them to cover the *Sabutais*. The heavy fighters were no doubt primed to attack a DropShip. Indeed, for long seconds they pulled up, climbing for altitude until, like dogs chasing a ground car, they realized the *Drummond's Pride* was forever beyond their grasp. Turning their climb into a long arc, the enemy altered vector to engage the Nova Cat aerospace fighters.

Focused on protecting her falling trothkin against threats from the ground, Lindz ignored the formidable Smoke Jaguar flight. The *Sabutais* and *Sullas* had little chance against Star Commander Suze and the *Batus* and *Turks* flying high guard.

"Fire up," Lindz urged the Smoke Jaguar MechWarriors holding the landing zone. "Give me a target."

Lindz told herself there was nothing dishonorable in standing with reactors banked and letting your enemy come to you, but the Smoke Jaguars' patience *felt* like *dezgra* deceit. If her computer could not find hard targets, she would have to rake the ground with random fire, relying on luck for hits.

Unless ...

"Throttle back."

She didn't insult the intelligence of her pilots by explaining the command. They would arrive seconds late. Their MechWarriors would spill from their shells above a ready and undamaged enemy—enemy warriors who would have to choose between revealing themselves to the *Avars* or allowing the Nova Cat force to land unmolested.

Lindz hoped the Jaguars made the wrong choice.



The knife point swung on its chain, ticking gently against the ferroglass view screen. Savil kept his interior lights on, preferring

the ersatz fog bank to the darkness. Savil knew the outside of his ablative cocoon was glowing with white-hot heat as it streaked toward the ground, but inside his cockpit was cool.

A single tone in warning.

Savil gripped his yoke and joystick as the egg shattered. Eyes on the gauges, he directed his *Huntsman's* legs toward the ground and he stomped the control pedals. Hands and neurohelmet conspired to direct the blast of his jump jets against the deadly pull of gravity.

To his right Star Commander Proe's *Ebon Jaguar* fell, its powerful legs spread to accommodate the thick collars of disposable landing jets.

The *Huntsman's* active probe came alive, the targeting computer identifying a half dozen OmniMechs below as the defenders brought their fusion reactors up to full power. *Stormcrows*, of course, but also a brace of *Warhawks* and an *Ebon Jaguar* to match his Star commander's.

With a few quick keystrokes, Savil sent his superior array's data to Proe, acknowledging his leader's right to first choice of targets.

Evidently not trusting the single-use jump packs to hold his OmniMech steady against the recoil of the massive ultra AC/20, Proe lashed out with all five lasers at extreme range, targeting the closest *Warhawk*.

Savil targeted the lone *Ebon Jaguar* and unleashed his own extended-range large lasers. A storage shed disappeared in a ball of flame as whatever it had held exploded, but the second beam gouged a deep gash along the length his target's autocannon housing.

The Smoke Jaguar MechWarrior answered with his own extended-range large lasers. Both beams boiled through empty air, their targeting systems scrambled by the *Huntsman's* electronic countermeasures.

Savil lined all four extended-range medium lasers on his opponent. Three seconds to optimum range. Two—

Silver flashed in the noonday sun. Savil's startled mind registered a winged shape streaking between him and the ground. Then he was thrown against his harness, fighting for control as the OmniMech's gyro failed against the fighter's turbulence.



Blue-white flash.

Stomping her left pedal, Lindz wrenched the yoke over, throwing her fighter into a tight roll.

An orange flare filled her cockpit, disappearing instantly.

Focused on the Jaguar BattleMechs coming alive across her targeting array, it took Lindz a startled second to process the images. The bolt of a particle projection cannon and the remains of Bicker's *Avar* a fading fireball behind her.

Weapons alarms hooted.

A fighter directly ahead. Her targeting array gave good tone, but Lindz didn't dare fire. There were fifteen Nova Cat MechWarriors suspended in the air beyond the oncoming enemy.

Knowing only the PPC's recycle time had saved her thus far, Lindz shoved the yoke forward. Giving up air was the wrong thing to do in a dogfight, but stupid was her only option.

The bolt of eye-searing blue savaged the air where she should have been; then the fighter was past her.

Ignoring an enemy that would take long seconds to circle back, Lindz chose a Smoke Jaguar *Warhawk* and narrowed her sensors' focus but stayed her trigger finger. Air support was not melee; she could not violate the code of *zellbrigen* by strafing an opponent actively engaged in a duel. A heartbeat later, her sensors reported the MechWarrior was still scanning wide, with no adversary

selected. Satisfied, she unleashed all four lasers. The *Warhawk's* long range launcher disappeared in a fireball of exploding missiles.

Distracted from the jumping Nova Cats, the eighty-five-ton OmniMech pivoted to meet the unexpected assault. Or tried to—the machine was much too ponderous to respond to an enemy flickering past at six hundred kilometers an hour.

Lindz climbed, ignoring the return fire flaring harmlessly through where she had been.

High above, a single Jaguar *Sabutai* and the pair of *Sullas* fought futilely to escape the Nova Cat *Batus* and *Turks*. Beneath her, twelve of the fifteen OmniMechs had reached the ground and were engaging a roughly equal number of defenders. At her level ...

An aerospace fighter was arrowing toward her from the south-southeast at seven hundred kilometers per hour. The Smoke Jaguar signaled intent with a focused double pulse of his targeting array. With her charges safely grounded, Lindz was free to accept the duel. Grinning she brought her *Avar* around to engage.

A data window popped open at the edge of her heads-up display. She was facing a *Chaeronea*. Ten tons lighter than her *Avar*, it was practically unarmored. But it was faster—and armed with an extended-range particle projection cannon that could deliver devastating damage from beyond the reach of her pulse lasers.

"Lindz..."

"Go, Daran."

"I am engaging second Smoke Jaguar," the Point Four wingman reported. "Vost lost his engine but landed safely. There is a strip west of the depot."

Lindz nodded. A simple strip—that was where the hyper-fast *Chaeroneas* had waited until the Nova Cat pilots were committed before attacking from the one direction they would not be watching. Through the OmniMechs they were protecting.

"He will be remembered," she said aloud.

"Remembered hell, I will be picked up," Vost broke in. "I can taxi and shoot until extracted."

Lindz doubted that, but said nothing. Twelve seconds from contact, she swung her fighter in a random series of shallow arcs, teasing her opponent into responding; assessing his skill.

"They are made of paper," Daran said. "One solid hit and they come apart."

Lindz did not acknowledge the useless advice.

Kicking to full thrust, she attacked.



Savil forgave the Jaguar piloting the wounded *Dire Wolf* as explosions cascaded up the side of his *Huntsman*. He'd landed far from the *Ebon Jaguar* and there was nothing to indicate he was already engaged in a duel.

Savil shuffled left, then jumped right, using his *Huntsman's* greater agility to avoid a killing blow. His speed and the Jaguar's lack of imagination were working to his advantage, allowing him to close.

The *Dire Wolf's* pilot was evidently used to standing foursquare and pounding his enemies to scrap—he hadn't so much as shifted his leg position since opening fire. Instead he methodically alternated between his twin autocannons and his four ER large lasers, using neither with particular accuracy.

Firing both ER large lasers, Savil dashed forward, aiming his fifty-ton *Huntsman* like a battering ram. As expected, the Jaguar froze—momentarily confused by the suicidal tactic—and was a heartbeat late firing the hundred-ton OmniMech's massive mix of lasers and cannon.

One hundred and twenty meters in front of his enemy, Savil

stomped his jump pedals. The *Huntsman* leapt into the air—cleanly over the deadly barrage of the Smoke Jaguar's belated alpha strike.

Angling the jets, Savil rotated as he passed over his opponent's head. The legs of his damaged machine nearly buckled as he came down behind the *Dire Wolf*, but he managed to stay upright. Ignoring the damage alarms, Savil unleashed his own alpha strike. Heat sucked the air from his lungs as all seven lasers poured destruction into the thinly armored back of his enemy at near-contact range.

The huge machine pivoted—too slowly. Savil dashed right, keeping behind the behemoth. A second alpha strike would force his *Huntsman* into thermal shutdown, but there might be enough margin—

Four extended-range medium lasers tore through the gaping armor. Savil expected an explosion of stored missiles—instead the *Dire Wolf* staggered, nearly toppling as its pilot threw a leg wide in a desperate attempt to keep it upright.

Savil shuffled right, staying away from the unstable Jaguar's guns as his OmniMech cooled. His enemy had not yet fallen, but with the gyro failing it was only a matter of time.



In space the Smoke Jaguar could have rotated his *Chaeronea* on a short axis—keeping the extended-range particle projection cannon focused on Lindz as she flared up and wide. But the thick soup of air limited his options. If he wanted to keep his straight-ahead weapon bearing, he had to turn, pulling up as she rose.

Lindz jiggered her yoke right, again, then left—complicating the firing solution without affecting her overall arc.

As long as air flowed across wings, physics dictated the Jaguar had to give up speed to stay inside her arc. If he let her turn in, she'd have a clear shot at his unarmored hide. True, he could break off and outrun her—but at this range he'd be under her guns for long seconds before he pulled away, and all the *Avar* needed was one clean hit to bring him down.

Of course, a clean hit from the massive ER-PPC could bring her down, if he placed it well enough. Worth remembering.

Lindz flattened her arc, turning her wide flare into a climb. A stupid move, but she'd proven once today that stupidity worked against this Jaguar pilot.

Shedding velocity, the *Chaeronea* followed her upward. Lindz rocked her craft, doing her best impression of a pilot in panic as she lured the Jaguar closer.

Target lock.

Pulling the yoke to her gut, Lindz stood her *Avar* in its tail. Lock tone faded as the craft shuddered, and dropped. Hands off the throttle, she let gravity pull her fighter down. She jacked the ailerons and kicked the rudder hard. Nose up, the fighter fluttered as it fell.

Unable to lock on the random motion, the Jaguar fired manually. The blinding blue bolt of the ER-PPC crackled uselessly through empty air.

Lindz released the yoke as the *Chaeronea* flashed past—bringing elevators and ailerons true—and shoved the throttle forward.

The Jaguar pilot boosted to maximum acceleration, easily pulling away from the *Avar*. He was out of range of her medium lasers by the time Lindz regained control. But still within reach of her pulse lasers.

The fireball was invisible from the ground below.



JH/DK

The Black Lion-class Rays of Enlightenment WarShip maneuvers past an asteroid to rejoin the battle.

Combat involving advanced aerospace units follows the rules presented in the *Aerospace Units* section of *Total Warfare* (TW) closely—only a few additional rules apply to advanced aerospace units with regard to firing arcs and hit locations. Most of the rules presented here are intended to increase the range of options available in aerospace combat and the level of detail and realism that may be achieved.

ADVANCED AEROSPACE UNITS COMBAT

The following rules are in addition to the rules presented in the *Aerospace Units* section of *Total Warfare*. Unless specifically stated otherwise, these units follow all those rules.

FIRING ARCS

The following firing arcs apply to advanced-rules aerospace units:

JumpShips and Space Stations: JumpShips and Space Stations use the Spheroid Firing Arcs Diagram (see p. 235, TW).

WarShips: WarShips use the WarShip Firing Arcs Diagram (see p. 83).

Satellites: Satellites use the Spheroid Firing Arcs Diagram (see p. 235, TW)

HIT LOCATION

While advanced-rules aerospace units assign damage in the same way as standard aerospace units, they use their own Hit Location Table.

Satellites: Satellites use the Fighters section of the Aerospace Units Hit Location Table (see p. 237, TW) to determine hit locations.

CRITICAL HIT EFFECTS

The following critical hit effects are in addition to those starting on page 239 of *Total Warfare*.

Grav Deck: A randomly determined grav deck is rendered inoperative. This has no tactical game effect.

K-F Drive: Part of the JumpShip's or WarShip's K-F drive is damaged. Reduce the K-F Drive Integrity by 1 point per critical hit. If the Drive Integrity is reduced to 0, the unit cannot jump.

COLLISIONS AND RAMMING

The Ramming Attacks Table (see p. 89) is taken from page 241 of *Total Warfare* and expanded to include appropriate modifiers for advanced aerospace units as well as allowing for the ramming of ground targets.

Squadrons may not make (or be the target of) ramming attacks.

GENERAL RULES

The following rules provide additional options for aerospace combat. Some offer new tactical options while others enhance the detail and realism of aerospace combat, albeit at the expense of speed of play. All of these rules are optional and the participants should agree in advance to their inclusion in a game.

ADVANCED HEAT

As a means of simplifying aerospace combat, *Total Warfare* requires that all Large Craft operate on a zero net heat principle and apply the full heat of a firing arc's weapons even if only some of them fire. The advanced heat rules still require such units to generate only as much heat as they can dissipate, but rather than being limited by a whole arc's heat, the heat to be dissipated is only that of the bays (or individual weapons, if using the *Individual Weapons* rules on p. 107) that are fired. When using this detailed heat system, units may not exceed their heat dissipation capabilities, superseding the rules on page 161 of *Total Warfare*.



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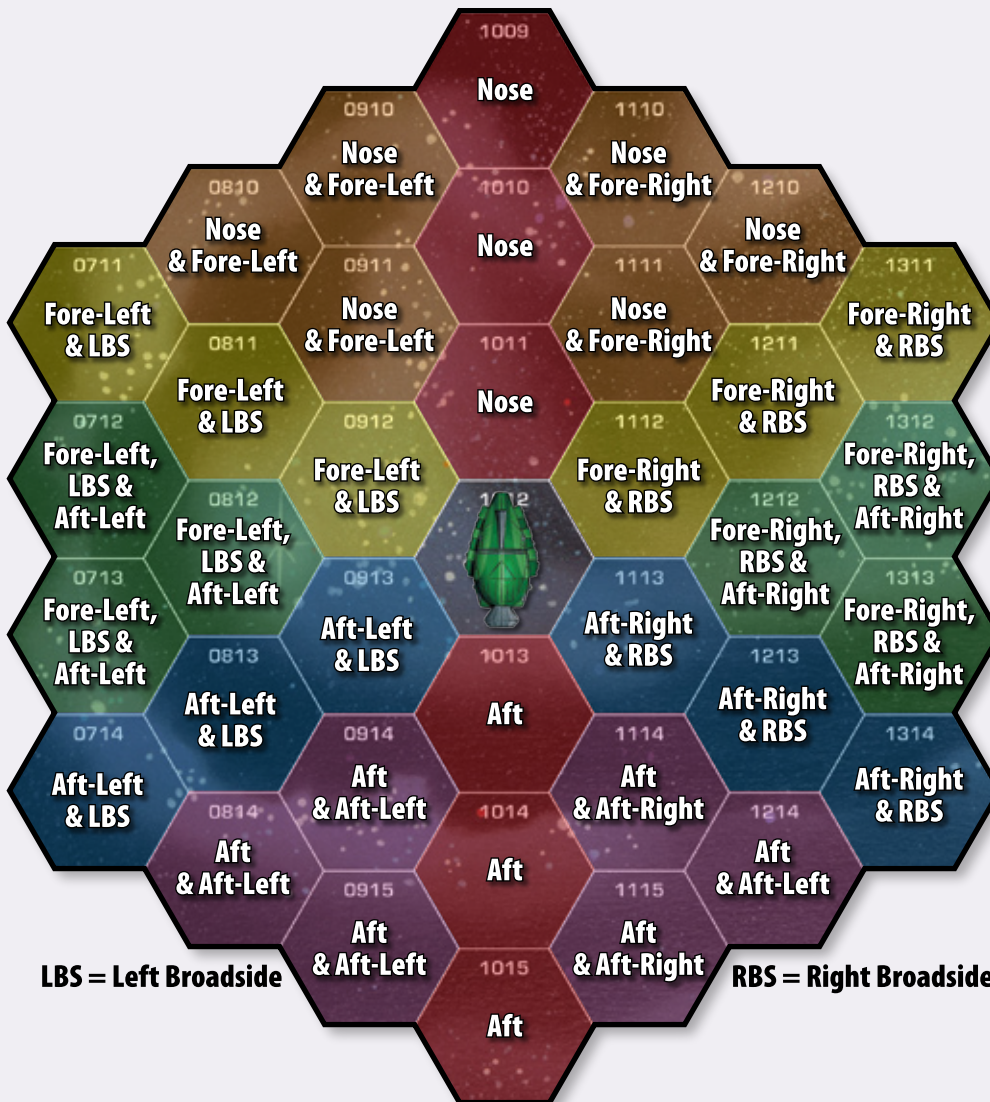
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JUMPSHIP/WARSHIP/SPACE STATION HIT LOCATION TABLE

2D6 Roll	Nose	Aft	Side
2	Nose/Life Support	Aft/Fuel	Nose/Avionics
3	Nose/Control	Aft/Avionics	Front Side/Sensors
4	Fore-Right/Weapon	Aft-Right/Weapon	Front Side/Front Side Weapon
5	Fore-Right/Thruster	Aft-Right/Thruster	Front Side/Docking Collar
6	Nose/CIC	Aft/Engine	Front Side/K-F Drive
7	Nose/Weapon	Aft/Weapon	Aft-Side/Broadside Weapon
8	Nose/Sensors	Aft/Engine	Aft-Side/Grav Deck
9	Fore-Left/Thruster	Aft-Left/Thruster	Aft-Side/Door
10	Fore-Left/Weapon	Aft-Left/Weapon	Aft-Side/Aft-Side Weapon
11	Nose/Crew	Aft/Control	Aft/Cargo
12	Nose/K-F Drive	Aft/K-F Drive	Aft/Engine



RAMMING ATTACKS TABLE (EXPANDED)

Base To-Hit Number: 6 + (target Piloting Skill – attacker Piloting Skill)

Modifiers	
<i>Attacker existing damage:</i>	
Sensor damage	+1
Avionics damage	+1 per box
<i>Target is (in space):</i>	
Fighter or Small Craft	+4*
DropShip	+2
JumpShip	+0
WarShip	+1
Space Station	-1
Satellite	-2
Cannot spend thrust	-2
Evading	Variable**
<i>Target is (in atmosphere):</i>	
Grounded DropShip hex	-2††
Building hex	-2††
Grounded fighter or Small Craft	+4††
Ground Unit‡	+4
Large Support Vehicle	+2
Large Naval Vessel Support Vehicle	Variable‡‡
Small or Medium Airships§	-1
Large Airships§	-2
Mobile Structures	Variable§§
Airborne Air Mobile Structure	+0
Infantry	Not Possible§§§
<i>Attacker is:</i>	
Fighter or Small Craft	-2
DropShip	-1
WarShip	+1
In atmosphere	+2

*Fighter squadrons may not make (or be the target of) ramming attacks

**See page 77, TW.

†If the attack misses, make a Control Roll with +4 modifier, -1 per level above 1 (Max of 0). If the Control Roll fails, the attacker crashes into the ground in the hex behind the target. (Control Roll does not apply if the target was airborne.)

††Target's Piloting Skill Rating is considered equal to attacker.

‡Includes 'Mechs, ProtoMechs, Combat Vehicles, Support Vehicles.

‡‡Apply the following modifier based upon template size: Type A = +1; Type B = +0 Type C = -1, Type D = -2; Type E = -3.

§Grounded or airborne.

§§Start with a +0 modifier, then apply a cumulative -2 modifier for every 10 hexes of size, or fractions thereof, above 10; i.e. a 31 hex Mobile Structure would apply a -6 modifier.

§§§Hexes containing infantry can be targeted; apply the standard -4 to-hit modifier and treat as a standard crash (see *Avoiding or Taking Damage*, p. 82, TW) for effects on infantry in the hex.

Under the standard aerospace rules, a Sovetskii Soyuz firing the NPPCs in its left broadside would be required to dissipate 440 heat points (135 heat for each NPPC and 60 for each NAC). Under the advanced rules, the aerospace unit would only need to dissipate 270 heat points if firing just the NPPC bay.

ADVANCED POINT DEFENSE WEAPONS

Many aerospace units carry weapons that are too small to use offensively against other Large Craft. Weapons such as machine guns, anti-missile systems, flamers and small lasers can, however, function defensively to target incoming enemy missiles (but not autocannon or Gauss rifle shells; they are too small and inert for targeting computers to track effectively). Weapons capable of functioning in this way are labeled as Point Defense Weapons in the Aerospace Weapon Classes Table on page 352 of *TechManual*. Weapons can switch between normal operation and point defense mode in the End Phase. Weapons or bays in point defense mode cannot be used offensively. Weapons (or bays) in normal mode cannot be used defensively.

A weapon in point defense mode has a range of 1 hex—the weapon defends the first hex in its firing arc (or hexes, in the case of the Broadside arc), and the hex containing the point defense weapons for attacks coming from that firing arc. It reduces the effect of enemy missile attacks (SRM, MRM, LRM, NLRM, ELRM, MML, ATM, Streaks—both SRM and LRM—and rocket launchers) aimed at or passing through defended hexes by an amount equal to half (round up) the point-defense weapon/bay's capital-scale Attack Value. For the Thunderbolt (which is a single missile), use the standard AMS rule for a single missile (see p. 129, TW).

The unit using its point defense need not be the target of the attack—any attack passing through hexes protected by a unit's point-defense systems may be engaged by all applicable point defense weapons, which means that multiple arcs may have a chance of engaging a missile. To determine the exact arcs that can target a missile attack (if there are multiple arcs), note the hexsides where the attack entered and then exited the hex containing the unit mounting point defense weapons. The arcs that cover those two hexsides are the only two arcs that can potentially fire on the missile attack. If a missile attack passes along the line between two arcs, the defending player may choose to use the point-defense weapons in one or both arcs. (Unlike a missile attack targeted at the unit, the flight of a missile attack passing through the hex is not bearing directly at the target, and so only the point defense weapons in the arcs through which the missile attack passes may fire.)

A missile attack reduced to an Attack Value of 0 or lower causes no damage to the target.

Point defense bays can only be used once each turn. The player must declare that he will use point-defense weapons before the to-hit roll is made for the missile attack. No to-hit roll is required for the point defense weapons.

For fighter squadrons (see p. 25), total all point defense weapons in the squadron before determining damage and heat.

AMS: Each AMS in a bay inflicts 3 points of damage. Do not halve the damage of AMS bays, as described above for point defense weapon bays; AMS bays apply their full damage. AMS may fire multiple times in a turn, but only once per missile attack. The firing player must declare that he will use AMS before the to-hit roll is made for the missile attack. No to-hit roll is required for the AMS. (For this rule, treat Small Craft as Large Craft.)



Large Craft AMS bays in these advanced rules ignore the “firing by arcs” rules (see *Large Craft Weapon Bays*, p. 234, TW). Instead, even if the rest of the arc cannot fire (or has already fired, or will not fire), the AMS bay can fire. However, each use of an AMS generates heat for that bay. For example, an AMS bay composed of 4 AMS that are each fired 3 times in a turn would result in 12 points of heat. An AMS bay may not fire if doing so would cause the unit’s total heat to exceed its dissipation capacity. Fighter AMS may only be used once per turn.

Large Craft AMS bays may be used against every attack that passes through the hex(s) that AMS bay defends. For example, an AMS bay in the Left Broadside of a WarShip could defend against any attack entering either of the two left broadside adjacent hexes, or against an attack entering the WarShip’s hex from the direction of either left broadside hexsides. An AMS bay may fire multiple times per turn, expending ammunition for each missile attack they engage. The Large Craft need not be the target of the attack. The controlling player may choose to defend against *any* attack that passed through an AMS defended hex, even if the target is another unit in the same hex or a different hex (as described above).

For fighter squadrons (see p. 25), total all AMS in the squadron before determining damage and heat.

Capital Missiles: Only point-defense weapon bays (2 or more weapons) can affect capital missiles; a single PDW has no effect. When firing at missiles, convert the damage from a PDW bay to capital-scale damage. If this damage is insufficient to destroy a targeted missile (which occurs when a missile takes capital-scale damage equal to its Attack Value), the missile suffers a +1 to-hit penalty for each point of capital-scale damage it sustained from PDW bays.

Capital Missile Bays: For the purposes of PDW fire, treat all missiles fired from a single bay as a single combined missile (i.e. PDW fire damages and inflicts to-hit penalties on the entire group, not against individual missiles). Similarly, the damage value of the missile flight is not reduced unless the entire flight is destroyed by PDW fire.

Arrow IV Missiles: Treat these as capital missiles, except that in place of capital-scale damage, use standard-scale damage, giving an Arrow IV missile 20 points of standard-scale armor.

John controls a Dante-class WarShip. He switches the appropriate systems into point-defense mode in the End Phase of the current turn. In the following turn, a 50-point LRM attack is aimed at the frigate. Before the attacker makes his to-hit roll, John declares that he will use the point defense weapons. The LRM attack passes through the front hex of the WarShip, which contains a 30-point point-defense bay. The point-defense bay reduces the LRM attack by 15 points (30 ÷ 2).

A Killer Whale capital missile passes through another hex protected by point defense. The point-defense bay inflicts 3 points of capital-scale damage and so the Killer Whale missile suffers a +3 to-hit modifier when making its attack.

An AMS bay in the nose and aft of an Avalon-class WarShip fires at two capital missiles passing through its hex, nose to aft, on their way to another target (since

the attacks pass through the front and rear hexsides of the Avalon’s hex, the unit’s nose and aft arcs can target the missiles; no other arcs may target them). For the nose arc, both missiles are engaged, generating 6 heat points (3 per firing) and 18 points of standard-scale anti-missile defense. For the aft arc, once again the player chooses to engage both missiles, generating 8 heat points (4 per firing) and 24 points of standard-scale anti-missile defense.

ADVANCED ATMOSPHERIC CONTROL ROLLS

Total Warfare’s standard aerospace rules require any unit to make a Control Roll in the End Phase of a turn in which it is damaged while in atmosphere. Under the advanced rules, such rolls are still needed. However, rather than for every turn in which it takes damage, Control Rolls are made in every turn where a unit takes an Avionics or Control critical hit (per standard rules) or where a unit sustains a hit that exceeds its Damage Threshold. If a threshold-exceeding hit occurs that also causes critical damage, two Control Rolls are made. The +1 modifier for 20 points of damage does not apply when using advanced atmospheric Control Rolls.

A Sabutai aerospace fighter, operating at Altitude 6 is hit by an Inner Sphere medium laser on its nose for 5 points of standard-scale damage. With nose armor of 62 points (and thus a Damage Threshold of 7; 10 percent of 62, rounded up), this hit does not prompt a Control Roll (unless Variable Damage Thresholds are used; see p. 105). The same hit to the aft of the fighter (which has an Armor Value of 40 and thus a Damage Threshold of 4) would require a Control Roll.

AMMUNITION

Standard aerospace rules ignore ammunition considerations in combat, with regard to the ability to inflict damage and the impact of damage to weapons and ammunition supplies, in favor of ease of play. The following rules take such details into account.

Ammunition Expenditure

All units carry a limited amount of ammunition for their ballistic and missile weapons, and players, in an effort to increase the realism of aerospace unit combat, may choose to track ammunition expenditure. The standard ammunition load (available shots) for an ammunition-based weapon is listed in the unit’s description (if looking at a Technical Readout) or on the record sheet. As in *BattleTech* ground unit game play, a single “shot” represents one use of the weapon, not a single shell or missile. For example, a ton of LRM-20 ammunition contains six shots—120 individual missiles.

When a player fires a weapon that requires ammunition, he should place a tally mark next to the ammunition line for that weapon. When the ammo bay is empty, the weapon cannot be fired for the remainder of the game unless reloaded (at right).

Ultra AC: Ultra AC weapons use two shots of ammunition every time they are fired. If only one shot remains for an Ultra AC, it is treated as though it were out of ammo. Players using the optional *Individual Weapons* rules (see p. 102) may opt to fire an Ultra AC at less than its maximum rate with commensurate reductions in the ammo consumed.

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Rotary AC: By default, rotary autocannons (RACs) use six shots of ammunition every time they fire. If less than six shots remain for a RAC, it is treated as though it were out of ammo. Players using the optional *Individual Weapons* rules (see p. 102) may opt to fire a RAC at less than its maximum rate with commensurate reductions in ammo consumed and damage done.

AMS: Each individual firing of an AMS bay uses a shot, so an AMS bay that fires 3 times in a turn uses three shots.

Single-Shot: One-shot (OS) weapons may be fired once, after which they are considered out of ammo and may not be used.

Ammunition Explosions

Roll 2D6 whenever a weapons critical hit occurs on an ammunition-fed weapon to determine whether the damage is to the ammunition rather than the weapon itself. On a result of 10 or greater, the ammunition suffers damage; otherwise, only the weapon is destroyed. If the ammunition is explosive (any other than Gauss or Plasma ammo), an Ammunition critical hit causes damage equal to the weapon's Damage Value (not its Attack Value) multiplied by the number of shots remaining of the ammunition associated with that weapon/bay. If the ammunition is shared by weapons in multiple arcs (or if the weapon simply carries multiple tons of ammunition), roll 1D6 to determine the number of tons of ammunition involved (for weapons with ammunition weighing more than one ton per shot, round tonnage up to the nearest whole shot).

Apply this damage in a single block to the armor of the same facing as the weapon struck, even if the ammo is shared (for example, if the critical hit struck a Nose/Weapon location, apply the damage to the nose armor; Right Side/Weapon damage results in damage to the right side, and so on). Fighters equipped with CASE suffer damage equal to a single attack's Damage Value (not its Attack Value) rather than the full ammunition associated with the weapon.

Per standard ground unit rules, players may wish Gauss rifles to explode and cause damage when they sustain damage. In such cases, when a Gauss weapon critical hit occurs, the location also suffers the effects of an ammunition explosion (the Gauss weapon explodes for the same amount of standard-scale damage as noted for ground-mounted weapons; see pp. 135-136, *TW*). Naval Gauss weapons do not explode if they suffer critical damage.

An LRM-20 with 1 ton of unused ammo suffers an ammo critical hit. A roll is made to see if an ammunition explosion occurs. The result is an 11, an explosion, and so the aerospace unit suffers 120 points of armor damage [20 (LRM-20 Damage Value, not Attack Value) x 6 (number of shots per ton)] on the same facing as the weapon. If the damaged unit had been a fighter whose ammo was protected by CASE, it would suffer

only 20 points of damage (the Damage Value of a single attack). This is different than a heat-related explosion, which only inflicts damage on the unit's SI, with no additional damage applied or possible critical hits rolled.

Rearming (Expanded)

The following rules build on those found on page 181 of *Tactical Operations: AR*, covering those units presented in *Strategic Operations*, while providing some additional diversity to rearming.

Ammunition Explosion: Like fighters, Small Craft and DropShips, for WarShips, total this damage and then divide the result by 100 (rounding up).

JumpShips and Space Stations do not suffer SI damage. Instead, apply the damage in 20-point Damage Value groupings to a randomly determined facing, rolling 1D6 and using the Random Facing Table, see above), then roll 2D6 to determine the specific location damaged (per the Aerospace Hit Location Table, p. 237, *TW*).

Capital Missiles: A die roll is made for each capital missile, applying a +1 modifier to the roll result for every 50 tons.

DropShips: For every full 5,000 tons, apply an additional -1 modifier to all die roll results; a -4 modifier is the maximum modifier that can be achieved through tonnage.

Failed Ammo Loading: If ammunition fails to load, apply a -2 modifier to the die roll result to load that ammunition during another rearming attempt, provided no additional tonnage is allocated to the amount previously stated. For example, if a player attempts to load 4 tons of Ultra AC/10 ammunition and fails, a -2 modifier is applied on the next attempt (provided no additional tonnage is designated beyond the 4 tons).

Remember that capital missiles are treated as separate ammo types, so no matter how many additional capital missiles a player attempts to load, a failed load of a capital missile will always apply a -2 modifier.

These modifiers are not cumulative; only a -2 modifier is ever applied, regardless of how many rearming attempts are made.

Military Units: Military units automatically apply a -1 modifier to all die roll results.

Crew Hits: For each Crew Hit on the Large Craft rearming, apply a +1 modifier to the die roll result (representing fewer crewmen available to do the job appropriately).

WarShip: WarShips, regardless of size, automatically apply a -1 modifier to all die roll results. Additionally, for every full 500,000 tons, apply an additional -1 modifier to all die roll results; a -4 modifier is the maximum modifier that can be achieved through tonnage.

During a long chase, a Nekohono'o-class DropShip exhausts the ammunition for all 3 Kraken-T launchers in its nose, as well as the Gauss rifles in both the Fore-Left and Fore-Right locations and the 2 LRM-20s in the Fore-Left location. At the start of the Movement Phase (Aerospace), the controlling player announces a rearming action.

He decides if he doesn't get serious ammo loaded he's going to be dead meat for his pursuer and so goes for broke, loading three tons of Gauss ammo, four tons of LRM ammo and 2 Kraken-T capital missiles.

First, he determines what the overall modifier will be to all die rolls for the various types of ammunition and comes up with +3 (three different types of ammo beyond the first; each capital missile is considered a different type of ammo).

RANDOM FACING TABLE

1D6 Roll	Facing
1	Nose
2	Fore-Right/Right
3	Fore-Left/Left
4	Aft-Right/Right
5	Aft-Left/Left
6	Aft



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He then determines the rolls for each ammo type and comes up with a +4 modifier for each Kraken-T [+3 (different types of ammunition) + 2 (100-ton capital missile) -1 (military unit) = +4]. He rolls twice with a result of 4 (for a total of 8) and 3 (for a total of 7). One missile is loaded; the other is not, but it can be reloaded at a later time (he notes down that he'll be able to apply a -2 modifier to that subsequent rearming attempt).

Next, he determines his Gauss ammunition and comes up with a +4 modifier [+3 (different types of ammunition) + 2 (2 tons beyond first ton) -1 (military unit) = +4]. A die roll result of 3 results in a success. He decides to slot two of the tons into his fore-left arc and the other ton into his fore-right arc.

Finally, he determines the LRM ammo and comes up with a +5 modifier [+3 (different types of ammunition) + 3 (3 tons beyond first ton) -1 (military unit) = +5]. A die roll result of a 9 gives a final result of 14! An accident has occurred. The Nekohono'o suffers 480 points of damage $[20 \text{ (LRM Damage Value)} \times 6 \text{ (number of shots per ton)} \times 4 \text{ (number of tons moved)}]$, which is divided by 100 for a 5-point (4.8, rounded up) reduction in the Nekohono'o's SI.

Had the unit been a JumpShip, it would have taken armor damage rather than SI loss, the 480 points being applied in 20-point Damage Value groupings to random facings and locations.

Finally, ten space turns (10 minutes) must pass before that ammunition is available; during the Weapon Attack Phase of the eleventh turn after the die roll result was made, the ammo can be used.

ANTI-AEROSPACE CAPITAL LASER TARGETING MODE

Capital and sub-capital lasers are normally optimized for targeting Large Craft. They can, however, be placed in an AAA firing mode that uses the laser's main targeting mirrors to rapidly adjust their aim, allowing for easier hits against small targets.

During the End Phase of any turn, a player may announce that he is switching any capital and sub-capital lasers into or out of the AAA targeting mode; they remain in the selected mode until changed in a subsequent End Phase. While in AAA mode, the to-hit modifier for capital lasers is +3 (in place of the standard +5) against any non-Large Craft (this includes fighter squadrons); against the same targets, the to-hit modifier for sub-capital lasers is +1 (in place of the standard +3). However, targeting Large Craft becomes more difficult and all shots against such targets apply a +1 to-hit modifier, while in AAA mode.

Bracketing Fire Mode and Called Shots Mode: A weapon bay using Anti-Aerospace Capital Laser Targeting Mode in a turn cannot use *Bracketing Fire Mode* (at right) or *Called Shots Mode* (see p. 88).

ATTACKING THE JUMP SAIL

The bloody fighting of the early Succession Wars took a terrible toll on the JumpShip fleets of the Inner Sphere. As the wars progressed, the Successor States came to an unspoken agreement that placed JumpShips off-limits for attacks. In most cases, JumpShip crews surrendered their ships rather

than risk damage. For those who chose to resist or flee, the most efficient way to stop them was to attack their massive energy-collecting sail, hampering their ability to recharge the Kearny-Fuchida drive while avoiding a direct attack on these valuable aerospace units.

If an attacker fires at a deployed sail (attached to a JumpShip or WarShip, or "detached" and left in orbit while its parent unit maneuvers), apply a -4 to-hit modifier to reflect the vast surface area of the sail. The material of the sail is ultra-thin and extremely fragile, so even the most powerful attacks simply tear a small hole in it. As a result, each successful hit on the sail reduces its integrity by 1 point, regardless of the weapon's Attack Value.

BRACKETING FIRE MODE (CAPITAL AND SUB-CAPITAL WEAPONS ONLY)

A skill lost during the Star League (along with the top-secret algorithms that made it practical to employ) and only recently rediscovered, bracketing fire is the art of dispersing fire in a carefully selected pattern to increase the chance of a hit.

Only capital and sub-capital weapons can use Bracketing Fire Mode (mass drivers, capital missiles and non-capital weapons cannot use Bracketing Fire Mode).

When using Bracketing Fire Mode, a player may lower the Damage Value of a weapon bay in order to increase the chance of a hit. Before a player rolls to see if a weapon bay strikes the target, he may announce he is using Bracketing Fire Mode. At the time the player announces he is using Bracketing Fire Mode, he also announces which to-hit modifier he is choosing from the Bracketing Fire Mode Table (see below); as noted under the Minimum Number of Weapons in Firing Bay column, the to-hit modifier selected for a weapon bay can only be selected if that bay contains the appropriate number of weapons. If the attack strikes the target, the player adjusts the damage as shown on the table.

If the players agree to the use of Bracketing Fire Mode, they're encouraged to figure out the Damage Value for various to-hit modifier reductions for each Weapon Bay under their control prior to game play to minimize disruptions during the game.

Minimum Range: Bracketing Fire Mode cannot be used against non-Large Craft (including fighter squadrons) at short range.

Anti-Aerospace Capital Laser Targeting Mode and Called Shots Mode: A weapon bay using Bracketing Fire Mode in a turn cannot use Anti-Aerospace Capital Laser Targeting Mode (at left) or Called Shots Mode (see p. 88).

BRACKETING FIRE MODE TABLE

Weapon Bay Damage Value Reduction*	To-Hit Modifier	Minimum Number of Weapons in Firing Bay
80%	-1	2
60%	-2	3
40%	-3	4

*Round all fractions down



Capital Weapons Fire in Atmosphere: Bracketing Fire Mode cannot be used with *Capital Weapons Fire in Atmosphere* (see p. 90).

A player with a modified Aegis-class WarShip is being swarmed by several aerospace fighter squadrons and assault DropShips. Having already taken considerable damage, the controlling player really needs to start knocking some enemy targets down. During his weapon declaration, the player announces that he'll be firing an NAC/35, an NL55 and an NAC/10 weapon bay in the left-broadside arc using Bracketing Fire Mode, all against an Achilles DropShip.

For the NAC/35 weapon bay, he announces a -1 to-hit modifier (the highest he can designate, since there are only two weapons in that bay). For the NL55, he announces a -2 to-hit modifier (again, the highest he can designate for that bay, as it only contains 3 weapons). Finally, for the NAC/10 bay, he's able to announce the highest to-hit modifier of -3, as that bay contains 5 weapons.

All three to-hit rolls succeed! The player then consults the Bracketing Fire Table. For the NAC/35 weapon bay, the 70 Damage Value is reduced by 20 percent for a final Damage Value of 56 [70 (original Damage Value) x .8 (-1 to-hit modifier reduction) = 56]. For the NL55 weapon bay, the 17 Damage Value is reduced by 40 percent for a final Damage Value of 10 [17 (original Damage Value) x .6 (-2 to-hit modifier reduction) = 10.2 (rounding down to 10)]. Finally, for the NAC/10 weapon bay, the Damage Value of 50 is reduced by 60 percent for a final Damage Value of 20 [50 (original Damage Value) x .4 (-3 to-hit modifier reduction) = 20].

CALLED SHOTS MODE

The size of many aerospace units and their components leaves them open to precisely targeted attacks by their opponents. Players may aim at specific locations on Large Craft, though such attacks are subject to the following restrictions:

- The target unit must be a Large Craft (see p. 74, *TW*).
- Capital-scale weapons may only make Called Shots against targets massing 50,000 tons or more (this will be noted in either the unit's Technical Readout entry or on its record sheet).
- Apply a +4 to-hit modifier. If the modified to-hit target number is greater than 12, the attack automatically fails.
- The attacker must nominate a valid hit location (as listed on the Aerospace Units Hit Location Table, p. 237, *TW*, or JumpShip/WarShip/Space Station Hit Location Table, p. 83, appropriate to the attack direction) before making the to-hit roll.
- If the attack succeeds, the damage is applied to the designated location.
- If the attack roll fails, the shot misses the target.
- Targeting Computers use the above rules instead of the Aimed Shots rules (see p. 110, *TW*); they still apply their standard -1 to-hit modifier.

Anti-Aerospace Capital Laser Targeting Mode and Bracketing Fire Mode: A weapon bay using Called Shots Mode in a turn cannot use Anti-Aerospace Capital Laser Targeting Mode (see p. 87) or Bracketing Fire Mode (see p. 87).

Capital Weapons Fire in Atmosphere: Called Shots Mode cannot be used with *Capital Weapons Fire in Atmosphere* (see p. 90).

A fighter attacking an enemy DropShip attempts to target a specific location on the hostile unit, namely the FCS system mounted in its nose. The pilot has a Gunnery Skill Rating of 4 and the attack is at Medium Range (+2) against the nose of the enemy (+1), for a base to-hit number of 7. Applying the +4 to-hit modifier for a Called Shot, the modified to-hit number increases to 11. If the attack roll succeeds, the Attack Value is applied to the specified location (in this case, Location 6 on the nose).

CAPITAL MISSILE BEARINGS-ONLY LAUNCH

Under standard rules, once launched, a capital missile automatically uses its active radar to home in on its assigned target. The firing unit must be able to detect the specific target before the missile is launched and the missile will home in on that target exclusively. (In game terms, this is a normal attack as described in *Total Warfare* on p. 235, or p. 251 for tele-operated capital missiles.)

In a bearings-only missile launch, a missile can be fired "blind" without a predetermined target and instead sent to a predetermined location before it goes active, seeking out the nearest valid target from that point. Bearings-only missile launch rules can be used in three different styles of game play: standard (players are using mapsheets), bearings-only launches not directly on the playing area, and *High Speed Closing Engagement* (see p. 62).

Regardless of the style of game play, a bearings-only missile launch is resolved in four steps: Designation Phase, Movement Phase, Detection Phase and Attack Phase, described starting on the following page. Specific considerations given for each style of game play are discussed in each section.

Designation Phase

In order to fire a missile under a bearings-only launch, the missile must be preprogrammed the turn prior to launch. During the Indirect Artillery Attack Phase (see p. 147, *TO:AR*) in the turn prior to a bearings-only missile launch, the controlling player of the firing unit must designate and mark down three details about the missiles being fired:

- **Detection Range (Default is Long Range):** The missile Detection Range is the range at which a bearings-only launched capital missile will detect targets, thus determines the maximum Base To-Hit Number. Shorter ranges can be designated, but make it much more difficult for a bearings-only missile to find its target, owing to the smaller area it scans.
- **Launch Velocity:** A standard capital missile has a Launch Velocity of 50 hexes per turn, while a tele-operated missile has a Launch Velocity set by the player that must follow all standard tele-operated rules (see p. 251, *TW*). Additionally, for standard play, if the missile is fired in any forward arc, add the velocity of the launching unit; if fired in any aft arc, subtract the velocity of the launching unit. If using advanced vector movement (see p. 52), the missile starts with the same vector values as the launching unit and then adds the appropriate Launch Velocity (50 for a standard missile, or the value set by the player for a tele-operated missile) to the facing the missile will first pass through as it exits the launching unit's hex. This step is not required for high-speed closing engagements.



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- **Activation Hex:** The Activation Hex (which a player notes secretly) is where the capital missile will activate (become active) and begin searching for a target. This step is not required for High Speed Closing Engagements.

In a large standard-play space combat scenario, during the Indirect Artillery Attack Phase of Turn 1, Terrence decides to launch a standard capital missile in a bearings-only launch situation. He decides to go for a Medium Detection Range (as opposed to the default Long Detection Range). He also notes that with a bearings-only launch, the missile has an automatic Launch Velocity of 50 (+5, since the launching unit has a Velocity of 5, so a total Launch Velocity of 55) and he determines the Activation Hex. Looking at the map, he hopes he's figured out where his opponent is going to place some units in the coming turns, and so he secretly notes an Activation Hex 115 hexes away.

Movement Phase

How a capital missile moves under a bearings-only launch depends on the style of game play used, as described below.

Standard Play: Bearings-only launched missiles are launched during the Indirect Artillery Attack Phase (see p. 147, *TO:AR*), the turn after they executed a Designation Phase preprogramming. For a standard missile, if the Activation Hex (designated during the Indirect Artillery Attack Phase of the turn prior) is located 50 hexes (plus or minus the launching unit's velocity) or less from the launching unit, place the bearings-only launched missile in the Activation Hex at the start of the Weapon Attack Phase of the turn in which the missiles were launched. For a tele-operated missile, it is only placed in the Activation Hex at the start of the Weapon Attack Phase of the turn in which the missile was launched if the Activation Hex is equal to or less than the Launch Velocity (plus or minus the launching unit's velocity) set by the player. In both instances, the missile will actively seek a target per the rules in the Detection Phase (at left).

If the Activation Hex is located more than 50 hexes away from the launching unit (for a tele-operated missile, if the Activation Hex is located more hexes away than the Launch Velocity), then the missiles will not go active, but instead will travel 50 hexes (plus or minus the launching unit's velocity) on a direct course to the Activation Hex (for a tele-operated missile, they travel a number of hexes equal to the Launch Velocity set by the player); the launching player should indicate that the missile is not yet active. Each turn after the turn in which a missile was launched, during the Indirect Artillery Attack Phase, the missile will travel another 50 hexes (for a tele-operated missile, it will travel a number of hexes equal to its Launch Velocity). During any Indirect Artillery Attack Phase, if the missile will reach the Activation Hex within the 50 hexes it travels that turn (for a tele-operated missile, within the number of hexes equal to its Launch Velocity), the launching player must indicate that the missile is going active at the start of that turn's Weapon Attack Phase. In all instances, the facing of the missile is based on a straight line from the launching unit to the Activation Hex.

Bearings-Only Launches Not Directly on the Playing Area: Bearings-only launched missiles may be treated as artil-

lery not directly on the playing area (see p. 147, *TO:AR*), with the following changes:

- As with standard play, note the Detection Range and Activation Hex.
- The launching player must designate the entry hex from which the missile will enter the map. This hex must be on the player's home edge.
- Bearings-only launched standard missiles travel three mapsheets per turn (51 hexes, at 17 hexes per mapsheet; for ease of play it's rounded to 50) and enter the playing area with a Velocity of 50.
- Bearings-only launched tele-operated missiles travel a number of mapsheets per turn equal to their Launch Velocity divided by 17 (for ease of play, rounding up).
- On the turn they enter the playing area, regardless of how many mapsheets they traveled prior to entering, the missiles automatically travel 50 hexes.
- Once the missile enters the playing area, use the standard rules above to determine how far it moves and when it goes active.

Tele-operated missiles fired from off the playing area may not use the optional waypoint rules (see *Capital Missiles Preprogrammed Waypoint Launches*, p. 90).

The "mapsheets" reference above assumes the use of mapsheets the size of standard ground maps; adjust flight times appropriately for mapsheets of different sizes. If players agree, they may use the *Artillery and Rolling Maps* rules (see p. 147, *TO:AR*), to allow for pursuit and attack of missile-only launching units outside the playing area.

In both standard play and bearings-only launches not directly on the playing area, if using the rules for attacks on capital missiles (see *Targeting Capital Missiles*, p. 105), the missile may only be attacked in the turn it activates and any turn thereafter, including the turn of impact against the target, as long as it is on the playing area.

High Speed Closing Engagement: There is no Movement Phase in High Speed Closing Engagements; proceed directly to the Detection Phase (see below).

During the Indirect Artillery Attack Phase of Turn 2, Terrence places a penny on the playing area to indicate a missile—tails up, indicating it is inactive—and the missile moves 55 hexes (its Launch Velocity). During the Indirect Artillery Attack Phase of Turn 3, the missile again moves 55 hexes, for a total of 110 hexes. In Turn 4, during the Indirect Artillery Attack Phase, the missile travels another 55 hexes. It will reach its Activation Hex in this turn; the Activation Hex was 115 hexes from the launching unit, and so Terrence turns the penny over to face heads-up at the start of Turn 3's Weapon Attack Phase. This shows that the missile has gone active in the Activation Hex.

Detection Phase

Once the missile has reached its pre-determined Activation Hex and activates, it then enters its Detection Phase. How a missile acts during the Detection Phase depends on the style of game play used, as described below.

Standard Play: For standard play, the missile automatically detects all targets in its nose firing arc out to a distance equal to its Detection Range (the range the controlling player des-

ignated before the missile launched). The missile will then attack the nearest detected enemy Large Craft. If two or more targets are equidistant, the missile will attack the target with the higher tonnage. If the targets are the same tonnage, determine the target randomly. If no valid Large Craft is detected, the missile will repeat this process for any valid Small Craft targets in the nose arc. A bearing-only launched capital missile cannot target anything smaller than a Small Craft.

If no valid targets are detected, the missile will remain active and in the following turn will continue to travel in a straight line at its launch velocity. If the missile is still on the playing area in the following turn, it will repeat the Detection Phase at the start of the following turn's Weapon Attack Phase. If it exits the playing area, it is removed from play.

As previously noted, the default Detection Range is Long (per standard weapon range bands; see p. 235, *TW*), but may be set for Short, Medium or Extreme. Shorter ranges make it less likely the missile will spot a target, but lower the target number in the Attack Phase, while the opposite applies for Extreme detection ranges.

A tele-operated missile operates exactly like a standard missile in this situation, except the operator can select which detected target to attack within the Detection Range.

Bearings-Only Launches Not Directly on the Playing Area: Once a bearings-only launched missile arrives on the playing area, it is treated exactly like a missile under standard play, as described above; this applies to the Detection Phase as well as the Attack Phase (see below).

High Speed Closing Engagement: The Detection Phase occurs at the start of the Capital Missile Attacks sub-phase, where the missile is automatically considered active. The capital missile makes a single Detection Check as though it was a Small Craft with active radar (see *Radar*, p. 107), using a Piloting Skill Rating of 5 against all Elements in the targeted Unit. A Short Detection Range imposes a +2 modifier on the Detection Check, while a Medium Detection Range imposes a +1 modifier; a -1 modifier applies for Extreme Detection Range.

If a missile fails to detect any target, it is removed from play.

A tele-operated missile operates exactly like a standard missile in this situation, except the operator can select which detected Element within a Unit to attack.

Now that his missile is active, Terrence looks at the playing area and realizes his guess was right; there are two enemy Large Craft within 12 hexes (the Medium Detection Range he designated) and his missile automatically detects both the DropShip and the WarShip. As both enemy units are exactly 10 hexes away, the missile will attack the larger target, the WarShip.

Attack Phase

A bearings-only launched capital missile makes a to-hit roll on its selected target with a Gunnery Skill Rating of 4, no matter the Gunnery Skill Rating of the launching aerospace unit; no to-hit modifiers that apply to the launching unit apply to the missile. The exact mechanics for the attack depend on which style of game play is in use, as described below.

Standard Play: Range is determined per normal weapon attacks. All other modifiers apply as for a standard attack, including ECM and Angle of Attack. If the target is at a range different from the set Detection Range—for example a missile is set to long range detection and the target is at short range—apply an ad-

ditional +1 modifier to hit (this represents the difficulty of the missile in adjusting its vector radically).

High Speed Closing Engagements: Range to the target is equal to the Detection Range set for the missile prior to launch. All other modifiers apply as for a standard attack, including ECM and Angle of Attack. To determine the missile's angle of attack, use the Facing After Fall Table (see p. 68, *TW*), with a result of 1 representing a shot against the target's nose.

Terrence figures his numbers (he remembers to add the ECM, as they're playing with the Electronic Warfare rules; see p. 98) and comes up with a final modified to-hit number of 10 [4 (Gunnery Skill Rating of a bearings-only launch) +1 (Angle of Attack; he's coming in at the WarShip's nose) + 3 (3 hexes of enemy ECM, including the target's hex) +2 (Medium Range) = 10]. He rolls 2D6 and comes up with a 10; he hit the ship!

CAPITAL MISSILE PREPROGRAMMED WAYPOINT LAUNCHES

A standard missile—whether fired normally or under the bearings-only launch rules (see p. 88)—may execute a single pre-plotted course correction of up to one hexside, but may do so only in the first three hexes after being fired from the launching unit (i.e. before it has sprinted to full speed and would need to spend much more fuel on the course correction). This option is most commonly used by WarShips to fire their side-mounted missiles into the forward or rear arcs. This maneuver does not affect the range of the missile, but does impose a +1 to-hit modifier.

Tele-operated missiles fired under bearings-only launch rules (see p. 88) may also be programmed to move to a pre-determined hex (or a number of hexes) prior to activation: these hex(s) are designated as waypoints. The entire intended course should be noted down prior to the missile being launched and must adhere to all standard tele-operated maneuvering and fuel usage (see p. 251, *TW*).

CAPITAL WEAPONS FIRE IN ATMOSPHERE

Capital and sub-capital weapons can be fired through a Space/Atmosphere Interface and Atmospheric Row hexes (see High-Altitude Map, p. 75, *TW*); non-capital weapons cannot be fired using any of these rules. However, the specific rules for how such attacks occur depend on where the attacker and target are located.

The following bullet points list which rules to use in this section, based on attacker and target locations. If a situation is not listed below, then the attack cannot be made using capital or sub-capital weapons; for example, an airborne-to-airborne attack cannot be made.

- **Orbit-to-Surface Fire:** Attacker is located in a space hex, targeting a hex on a ground mapsheet.
- **Airborne-to-Surface Fire:** Attacker is located in an Atmospheric Row hex (see High-Altitude Map, p. 75, *TW*) or using Low-Altitude Movement, targeting a hex on a ground mapsheet.
- **Surface-to-Orbit Fire:** Attacker is located on a ground mapsheet (including landed aerospace units) and is targeting a unit in a space hex.
- **Airborne-to-Orbit Fire:** Attacker is located in an Atmospheric Row hex (see High-Altitude Map, p. 75, *TW*) or using Low-Altitude Movement, targeting a unit in a space hex.
- **Surface-to-Surface Fire:** Attacker is located on a ground



mapsheet (including landed aerospace units) and is targeting a hex on a ground mapsheet.

Game Turns: One space turn is 60 seconds while a ground turn is 10 seconds. Therefore, the following time limits are involved when making such attacks.

- **Orbit-to-Surface Fire:** While this attack can be made every space turn, the resolution of such attacks on ground mapsheets takes place only every six ground turns.
- **Airborne-to-Surface Fire:** All attacks are tracked using standard ground turns.
- **Surface-to-Orbit Fire:** This attack can only be made once every six ground turns (one space turn).
- **Airborne-to-Orbit Fire:** This attack can only be made once every six ground turns (one space turn).
- **Surface-to-Surface Fire:** All attacks are tracked using standard ground turns.

Construction: Capital-scale weapons (and sub-capital scale weapons; see p. 155, *TO:AUE*), depending on the type, can be mounted in ground buildings or units, and used to attack units in orbit. Both situations are rare; ground facilities are known as SDS (Space Defense System) bases, while the mounting of such weapons on mobile units is exceedingly rare. See *Advanced Buildings*, page 129 in *Tactical Operations: AR*, to determine which capital/sub-capital scale weapons can be mounted in a building; see *Naval Autocannons*, p. 143; *Naval Gauss*, p. 145; *Naval Laser*, p. 145; *Naval PPC*, p. 145; and *Sub-Capital Weapons*, p. 155 in *Tactical Operations: AUE* to determine which units might mount which type of capital/sub-capital weapons.

Bomb Munitions: Under standard conditions, bomb munitions cannot cross the Space/Atmosphere Interface. Using these rules, however, the Air-to-Air Arrow (AAA) missile (see p. 169, *TO:AUE*), Anti-Ship (AS) missile (see p. 170, *TO:AUE*) and Anti-Ship Electronic Warfare (ASEW) missile (see p. 170, *TO:AUE*) can cross the Space/Atmosphere Interface. Treat those specific bomb munitions as standard capital missiles in all situations, but apply an additional +1 to-hit modifier.

Orbit-to-Surface Fire

A unit can fire its capital/sub-capital weapons at ground targets (commonly referred to as orbital bombardment or naval fire support), but may not make any other type of weapon attack in the same turn (though it may use point-defense and AMS).

The target ground hex on the High-Altitude Map (see p. 75, *TW*) must be within the firing arc of the bay used and must be in range (taking into account range modifications for firing through atmosphere hexes; see p. 236, *TW*). The attacker nominates a hex (30 meters) on the ground mapsheet as the target for each weapon and/or weapon bay attack. The attack from each bay is targeted and resolved separately (or from each weapon, if a unit only mounts a single weapon or the players are using the Individual Weapons rules; see p. 102).

Each orbit-to-surface attack is resolved using the Artillery rules (see p. 147, *TO:AR*) with the following additions and exceptions.

- An orbit-to-surface attack can only target a hex.
- The base Damage Value of each attack is the Attack Value of each bay.

- Apply standard range modifiers for CIC or sensor damage to the base to-hit number.
- Apply standard to-hit modifiers for firing through atmospheric hexes (this means a capital-scale weapon must have at least a long range to be used in an orbit-to-surface attack).
- TAG may be used to designate the target hex (see p. 142, *TW*), and if successful applies a -2 to-hit modifier.
- The target hex is immobile and so must apply the standard -4 to-hit modifier.
- If the attack misses, the distance scattered is equal to the MoF x 2 hexes.
- Direct-Fire Energy Weapon attacks arrive on the ground mapsheet in the same turn they were fired.
- Direct-Fire Ballistic Weapon attacks arrive on the ground mapsheet during the Indirect Artillery Attack Phase, the turn after they were fired.
- Capital Missile Weapon attacks arrive on the ground mapsheet during the Ground Indirect Artillery Attack Phase 1D6 ground turns after they were fired (the controlling player makes the roll in secret, without announcing when it will arrive; the controlling player should write the turn number when the attack will arrive on a piece of paper and place it face down next to the playing area). Such guided weapons apply a -2 to-hit modifier (-3 for Barrucas only; -1 for any tele-operated missiles) and scatter only half (round up) the usual distance.
- Orbit-to-surface attacks cannot be pre-plotted.
- Like standard artillery, each subsequent orbit-to-surface attack against the same target hex receives a -1 to-hit modifier if there is a friendly unit with LOS to the target hex.

In many cases the modified to-hit number may be higher than 12, but an attack roll should still be made, as the orbit-to-surface attack will still hit *somewhere* (though not at the intended point) and damage targets over a large area even if the attack misses its intended target hex.

In the target hex, the damage inflicted is equal to the bay's (or weapon's) Attack Value multiplied by 10 (i.e. converted to standard scale). For each hex away from the target hex, reduce the multiplier by 2; adjacent hexes suffer Attack Value x 8, and so on. Units more than 4 hexes away from the target hex suffer no damage. All damage is divided into 5-point Damage Value groupings and assigned randomly; 'Mechs in target hex use the Shots From Above portion of the special 'Mech Hit Location Table (see p. 175, *TW*). Determine attack direction for any units outside the target hex as if the attack originated in the target hex.

This damage is also applied vertically into the elevations above the various hexes (meaning an airborne VTOL in a target hex that is at the correct elevation may still be damaged). In the target hex, for each subsequent elevation above the level of the underlying struck hex, divide the Attack Value by 2 (round down) and apply that damage to the next elevation. This is repeated for four additional elevations, dividing each new Attack Value by 2 each time. No additional damage from the orbit-to-surface attack is assigned to the fifth elevation (or beyond). This same procedure is repeated for each adjacent hex, starting with the damage assigned to each hex, dividing by 2 (round down) for each elevation; for the second ring, the damage only rises three elevations, for the third ring the

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damage only rises two elevations, while the fourth ring damage only rises one elevation. Note that all such damage is in relation to the target hex, not adjacent hexes, as their levels may be higher; if lower, then the standard number of elevations is used. If a unit falls into multiple elevations due to its height, damage is not applied twice; simply apply the most severe damage. Finally, this type of vertical damage does not apply to buildings or Mobile Structures, which follow their own rules (see p. 93).

Airborne Units: If an aerospace unit (including an Air Mobile Structure) is using the Low-Altitude Movement rules and occupies the same hex corresponding to the mapsheet where the orbit-to-surface strike occurs, the controlling player of that unit rolls 2D6. On a result of 12, the orbit-to-surface attack strikes the airborne aerospace unit. Resolve damage normally. If there is any damage remaining, that damage becomes the Damage Value used for the target hex; subsequent damage applied to the adjacent hexes uses the new Damage Value.

If an aerospace unit is using the Aerospace Units on Ground Mapsheets rules and occupies the target hex where the orbit-to-surface attack strikes (or if a non-aerospace airborne unit occupies that same target hex), the controlling player of that unit rolls 1D6. On a result of 6, the orbit-to-surface attack strikes the airborne unit; resolve as described above.

Area-Effect Weapon: Orbit-to-surface attacks are area-effect weapons, and so all rules that apply to such weapons also apply to orbit-to-surface attacks (for the exception, see *Castles Brian*, at right).

Atmospheric Pressure: If using the Atmospheric Pressure Planetary Conditions rules (see p. 52, *TO:AR*), modify the orbit-to-surface attack as follows:

- **Vacuum:** No to-hit modifiers for atmosphere, ground or space/atmosphere hexes are applied.
- **Trace:** No to-hit modifiers for space/atmosphere hexes are

applied; treat each atmosphere and ground hex as 2 hexes of range.

- **Thin:** No to-hit modifiers for space/atmosphere hexes are applied; treat each atmosphere and ground hex as 4 hexes of range.
- **High:** Treat each space/atmosphere hex as 4 hexes and each atmosphere or ground hex as 8 hexes of range.
- **Very High:** Treat each space/atmosphere hex as 6 hexes and each atmosphere or ground hex as 10 hexes of range.

Buildings: If a unit occupies a non-Fortress or -Castle Brian building hex, or a non-Hardened building hex for any other classification (see *Advanced Building Classifications*, p. 112, *TO:AR*), in a hex damaged by an orbit-to-surface attack, full damage is applied to the unit as well as the building hex.

Castles Brian: Castles Brian Construction Factors (see *Advanced Building Classifications*, p. 112, *TO:AR*) are in capital-scale, so there is no "times 10" scale conversion when applying damage. For each Castle Brian hex beyond the target hex, simply determine the damage as described above and then divide by 10 (round up).

Construction Factor (Expanded): When using the expanded Construction Factor rules (see p. 119, *TO:AR*), the full damage from an orbit-to-surface attack is still assigned to every level within a building hex (as well as every level in every hex that takes damage in a multi-hex building) regardless of how many levels there are. The only exception is a Castle Brian hex(s), which is specifically designed to withstand an orbit-to-surface attack. In the case of a Castle Brian and the use of the expanded Construction Factor rules, damage is assigned in the following manner (the following applies to an attack that strikes the roof of a multi-hex Castle Brian, but the rules can be extrapolated to determine how damage would be assigned if the blast wave hit the side of a multi-hex/multi-level Castle Brian building):

- **Target Hex:** The roof level of the building in the target hex is assigned the full capital-scale damage. For each level below the roof, divide the Attack Value by 2 (round down) and apply that damage to the next level. This is repeated for four additional levels, dividing each new Attack Value by 2 each time. No additional damage from the orbit-to-surface attack is assigned to the fifth level (or beyond) below the roof level.
- **First Ring of Hexes:** The damage assigned to the roof level of the first ring of hexes adjacent to the target hex is the same as described above under *Castles Brian*. For each level below the roof, divide that Attack Value by 2 (round down) and apply that damage to the next level. This is repeated for three additional levels. No additional damage from the orbit-to-surface attack is assigned to the fourth level (or beyond) below the roof level.
- **Second Ring of Hexes:** The damage assigned to the roof level of the second ring of hexes adjacent to the target hex is the same as described above under *Castles Brian*. For each level below the roof, divide that Attack Value by 2 (round down) and apply that damage to the next level. This is repeated for two additional levels. No additional damage from the orbit-to-surface attack is assigned to the third level (or beyond) below the roof level.
- **Third Ring of Hexes:** The damage assigned to the roof level of the third ring of hexes adjacent to the target hex is the same as described above under *Castles Brian*. For each level below the roof, divide that Attack Value by 2 (round down) and apply that damage to the next level. No additional dam-



A Potemkin-class WarShip prepares for an orbit-to-surface attack.



A pirate Hunchback scavenges through the devastation wrought on a city after a terrifying orbital bombardment by a WarShip.

age from the orbit-to-surface attack is assigned to the second level (or beyond) below the roof level.

- **Fourth Ring of Hexes:** The damage assigned to the roof level of the fourth and final ring of hexes adjacent to the target hex is the same as described above under *Castles Brian*. No additional damage from the orbit-to-surface attack is assigned to any levels below the first level.

Mobile Structures: Mobile Structures use the Building rules when determining damage from an orbit-to-surface attack (see *Buildings*, p. 92).

Naval C³: A DropShip mounting a Naval C³ (see p. 144, *TO:AUE*) may reduce the to-hit range modifier for an orbit-to-surface attack by one range band under any of the following three conditions:

- If the DropShip is on the Low-Altitude Map and flying at Altitude 6 or less and is in a hex corresponding to the ground mapsheet where the target hex for the orbit-to-surface attack is located.
- If the DropShip is using Aerospace Units on Ground Mapsheets rules, it must be on the playing area (regardless of how large the area is).
- If the DropShip is grounded, it must be on the playing area (regardless of how large the area is); LOS from the DropShip to the target hex need not exist.

For example, if an orbit-to-surface attack by a Heavy NPPC bay has a link to a Naval C³ as described above, the +2 Medium Range to-hit modifier would be used in place of the +4 Long-Range to-hit modifier.

The orbit-to-surface firing unit must still be able to

reach the target with its attacking weapons (Long or Extreme Range weapons only).

Levels (Hills), Grounded DropShips, Buildings and Mobile Structures: If any of these units/terrain features are higher than both the underlying level of the target hex and a unit/building occupying a hex that would be damaged by an artillery attack, and these units/terrain features lie along the LOS between the target hex and the hex occupied by the unit, use the rules for artillery when determining this outcome of an orbit-to-surface attack (see p. 152, *TO:AR*).

Terrain Factor: If *Terrain Factor Rules* (see p. 63, *TO:AR*) are in use, an orbit-to-surface attack simultaneously damages the hex itself and any terrain in the hex. Full damage is assigned to both. In the case of very large Attack Values for an orbit-to-surface attack, this will likely lead to the creation of a large crater across the area damaged by the attack. The only exceptions are multi-hex buildings and multi-hex Mobile Structures (see p. 33, *TO:AUE*) that are completely surrounded by adjacent building hexes from the same building, or adjacent Mobile Structure hexes, where the building or Mobile Structure hex is not destroyed by the attack. If such a building/Mobile Structure hex is destroyed, full damage is applied to the hex itself. If a ground unit is located in a hex that loses a level, it automatically falls (see *Unit Displacement*, p. 151, *TW*); the exception is Mobile Structures, which do not fall unless all hexes that the unit occupies are reduced in level. If a building is located in a hex that loses a level, apply an additional 10 points of damage per level lost to that building hex (if using the expanded Construction Factor rules on p. 119, *TO:AR*, the 10 standard-scale points of damage are applied

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to every level within that building hex). Finally, the same rules that apply to blocking damage to a target as described under *Buildings and Levels* above also apply to damage for the hex itself when using Terrain Factor rules.

Water: If the target hex is a water hex, this damage is also applied vertically into the depths below the various hexes. In the target hex, for each subsequent depth below the surface of the struck water hex, divide the Attack Value by 2 (round down) and apply that damage to the next depth. This is repeated for four additional depths, dividing each new Attack Value by 2 each time. No additional damage from the orbit-to-surface attack is assigned to the fifth depth (or beyond). This same procedure is repeated for any adjacent water hexes, starting with the damage assigned to each hex, dividing by 2 (round down) for each depth; for the second ring, the damage lowers three depths, for the third ring the damage lowers two depths, while the fourth ring damage only lowers one depth. Note that all such damage is in relation to the target hex, not adjacent hexes, as their levels may be higher; if lower, then the standard number of elevations/depths is used. If a unit falls into multiple elevations/depths due to its height, damage is not applied twice; simply apply the most severe damage. Finally, this type of vertical damage does not apply to buildings or Mobile Structures, which follow their own rules (see above).

If the target hex is not a water hex and an adjacent hex is a water hex, no damage is applied to completely submerged targets in that adjacent hex.

If a water hex or series of water hexes are completely surrounded by non-water hexes, and all the water hexes and the accompanying adjacent non-water hexes are within the blast radius, reduce the surface level of the water by 1; in this instance, all Depth 1 hexes are converted into Sublevel 1 mud (see p. 48, TO:AR).

Woods: Woods hexes provide no protection against damage from orbit-to-surface attacks.

Minefields: An orbit-to-surface attack (as well as a airborne-to-surface and surface-to-surface attacks; see pp. 96 and 98, respectively) automatically clears a minefield hex if damage from the attack is applied in the mined hex at the level of the underlying terrain (see *Clearing Minefields*, p. 178, TO:AR).

In the Orbit-to-Surface Attack Diagram on page 95, a Sovetskii Soyuz-class WarShip orbiting 1 hex above the space/atmosphere interface hex row makes an orbit-to-surface attack with its broadside NPPCs at a ground target hex on the Military Base #1 map. The aerospace unit's CIC and sensors are undamaged and so the final modified to-hit number is 12 [4 (Gunnery Skill) + 4 (long range: 4 atmospheric hexes = 24 hexes; + the ground hex = 6 hexes; + 3 hexes for the space/atmosphere interface hex = 33 hexes) + 8 (four atmospheric hexes) - 4 (immobile target) = 12]. The controlling player is attempting to strike Hex A, which contains a grounded DropShip, and rolls 2D6 with a result of 9; the Margin of Failure is 3 and so the attack scatters (3 MoF x 2 hexes) 6 hexes. The controlling player first rolls 1D6 to determine the direction of the scatter, with a result of 3—two hexsides to the right of the numbered hexside. The orbit-to-surface attack scatters 6 hexes to Hex B.

The base Attack Value of two NPPCs is 18 points of capital-scale damage and so 180 points of standard-scale damage [18 (capital-scale damage) x 10 = 180] is applied to the target Hex B. The damage is then applied to adjacent hexes: 144 points of standard-scale damage are applied to every Hex 1

[18 (capital-scale damage) x 8 = 144]; 108 points of standard-scale damage are applied to every Hex 2 [18 (capital-scale damage) x 6 = 108]; 72 points of standard-scale damage are applied to every Hex 3 [18 (capital-scale damage) x 4 = 72]; 36 points of standard-scale damage are applied to every Hex 4 [18 (capital-scale damage) x 2 = 36]. No damage is assigned to hexes 5 or more away from the target hex. In all instances, the damage is divided into 5-point Damage Value groupings and assigned randomly.

Note that the Hardened buildings on Base Map #1 use Total Warfare classifications and the players are using the advanced rules building classifications from Tactical Operations: AR, which don't allow a "standard" building to be Hardened. As such, before play began, the players determined that since this is a military base, any Hardened building hex would be a Construction Factor 120 Hardened Fortress, while the "wall" of fortress building hexes around the base on top of the revetment would be Construction Factor 100 Hardened Fortresses.

In the diagram, a Gallowglas occupies the target Hex B. Not only will 180 points of damage be assigned to the 'Mech, but the Special 'Mech Hit Location Table (see p. 175, TW) is used, almost guaranteeing the 'Mech will be destroyed.

In Hex C, a Grenadier battle armor squad is located on the ground floor of the Construction Factor 15, Light, Level 2 building hex. As the building is neither a Fortress nor a Castle Brian, nor Hardened, it does not provide any protection and the full 144 points of damage are applied to the building and every trooper in the squad (the damage is multiplied by 2, as the orbit-to-surface attack is an area-effect weapon, for a horrific overkill of 288 points of damage). The building and the battle armor unit are completely destroyed; the hex is reduced to rubble.

In Hex D, a building hex lies along the LOS between the target hex and the Archer in Hex D, and the building hex is higher than both the target hex and the height of the Archer. However, the building does not block damage to the 'Mech because the orbit-to-surface attack reduces the building hex to rubble [108 (Damage Value applied to Ring 2 hexes from the target hex) x 2 (area-effect weapon) ÷ 2 (Fortress Classification) = 108; applied against the Construction Factor 100 Hardened Fortress destroys the building]. However, the two Level 2 hills intervening in the LOS do block the damage and so the Archer does not receive any. Even if the Terrain Factor Rules (see p. 63, TO:AR) are in effect, damage to the Archer would still be blocked; neither the 144 points nor the 108 points of damage assigned to the first-ring Level 2 hex or second-ring Level 2 hex are enough to reduce either hex's 200 Terrain Factor to 0, instead reducing their levels by 1. If both Level 2 hills had received enough previous damage to reduce their Terrain Factor to 0 once the respective orbit-to-surface attack damage values had been assigned, thus reducing both Level 2s to Level 1s, then 72 points of damage would be assigned to the Archer.

The Atlas in Hex E is inside a Hardened Fortress, and so a portion of the damage that would normally be assigned to the 'Mech is absorbed by the building. After looking at the Buildings Classification and Type Table from Tactical Operations (see p. 113, TO:AR), the players determine that the damage applied to such a building hex is divided by 2 (rounded down). The damage ultimately applied to the building is 72 [72 (Damage Value applied to Ring 3 hexes from the target hex) x 2 (area-effect weapon against building hexes) ÷ 2 (Fortress Classification) =



• ORBIT-TO-SURFACE ATTACK DIAGRAM •

72]. More importantly, the damage applied to the Atlas is only 30 [72 (Damage Value applied to Ring 3 hexes from the target hex) - 12 (current CF 120 ÷ 10) ÷ 2 (Fortress Classification) = 30]. As the damage is entering the Atlas' left-side arc, it is applied in 5-point Damage Value groupings to the Left Side of the 'Mech Hit Location Table. Unless the player is extremely unlucky, the Atlas will easily survive.

If the building in Hex E had been a 120 CF Castle Brian hex, the damage applied to the building would be 8 [72 (standard-scale damage applied to Ring 3 hexes from the target hex) ÷ 10 = 8 (7.2, rounding up to 8)]; the area-effect status of an orbit-to-surface attack doesn't apply to Castles Brian, and so the final damage is not doubled. The player then determines that the Castle Brian's current Damage Threshold is 12 [120 (current CF) ÷ 10 = 12]. As the capital-scale Damage Value 8 of the hit doesn't equal or exceed the

Damage Threshold, a 10-point standard-scale attack is not delivered to the Atlas.

The VTOL in Hex F at Elevation 3 will still be damaged, as damage rises three elevations in Ring 2. The controlling player divides the 108 points of standard-scale damage applied to every Hex 2 to determine how much damage is applied to the VTOL. He comes up with 13 points of damage [108 (Ring 2 damage) ÷ 2 (Elevation 1) = 54 ÷ 2 (Elevation 2) = 27 ÷ 2 (Elevation 3) = 13.5 (rounded down to 13)].

The VTOL in Hex G is also at Elevation 3. However, since damage only rises two elevations in Ring 3, that VTOL will escape damage.

Finishing off the rest of the damage from the orbit-to-surface attack, the controlling player finds the following:

Because the building in Hex E was not reduced to rubble by the damage, and is higher than the target hex and the

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two adjacent building hexes in the Ring 4 hexes, no damage is assigned to those hexes.

The Construction Factor 15 of the Light Buildings in the second and third ring of hexes is well below the damage being applied; those buildings are immediately reduced to rubble.

The Terrain Factor of 50 for the Light Woods in the Ring 2 and 3 hexes is below the Damage Values of 108 and 72 respectively (even before multiplying those Damage Values by 2 because the orbit-to-surface attack is an area-effect weapon; see Clearing Woods, p. 112, TW), and so they are reduced to rough hexes.

The Hardened Fortress buildings making up the "wall" on the revetment (each with CF 100) in the Ring 2, 3 and 4 hexes receive damage of 108, 72 and 36 respectively. Like the other Hardened Fortress building in Hex E, because the orbit-to-surface attack is an area-effect weapon, those damages are doubled to 216, 144 and 72 respectively, but are then divided by 2 because of the buildings' Fortress classification, bringing the numbers back to their original values. Subsequently, all Ring 2 Hardened Fortress buildings are reduced to rubble, while any Hardened Fortress buildings in the fourth ring of hexes receive 36 points of damage.

The player notes with wry amusement that despite the 6 hexes of scatter, he just missed damaging the DropShip; even if he'd rolled a 5, the sheer scale of the orbit-to-surface attack would have enabled him to apply the Ring 4 damage to the DropShip.

If the Sovetskii Soyuz fired a NAC/20 bay in a surface-to-orbit attack, striking the exact same hex, and the Terrain Factor Rules are in use (see p. 63, TO:AR), the following would occur (the example assumes no damage has yet been applied to any terrain).

The base Attack Value of the NAC/20 bay is 60 points of capital-scale damage, and so 600 points of standard-scale damage $[60 \text{ (capital-scale damage)} \times 10 = 600]$ is applied to the target Hex B. The damage is then applied to adjacent hexes: 480 points of standard-scale damage are applied to every Hex 1 $[60 \text{ (capital-scale damage)} \times 8 = 480]$; 360 points of standard-scale damage are applied to every Hex 2 $[60 \text{ (capital-scale damage)} \times 6 = 360]$; 240 points of standard-scale damage are applied to every Hex 3 $[60 \text{ (capital-scale damage)} \times 4 = 240]$; 120 points of standard-scale damage are applied to every Hex 4 $[60 \text{ (capital-scale damage)} \times 2 = 120]$. No damage is assigned to hexes 5 or more away from the target hex.

Because a hex level is reduced by 1 for every 200 points of damage, the target Hex B (which began as a Level 1) will be reduced to a rough, Sublevel 2 hex. Each Ring 1 hex that began as a Level 0 hex will be converted into a rough, Sublevel 2 hex, while the Level 1 and Level 2 hexes in the first ring will be converted into rough, Sublevel 1 and Level 0 hexes respectively. Each Ring 2 hex that began as a Level 0 hex will be converted into rough, Sublevel 1 hexes, while the Level 1 and Level 2 hexes in that ring will be converted into rough, Level 0 and Level 1 hexes respectively. Each Ring 3 hex that began as a Level 0 hex will be converted into rough, Sublevel 1 hexes, while the Level 1 and Level 2 third-ring hexes will be converted into rough, Level 0 and Level 1 hexes respectively. Finally, each Ring 4 hex will not be reduced in level, as the 120 points of damage does not exceed each hex's 200 Terrain Factor.

Because the 360 points of damage (for Ring 2) and 240 points of damage (for Ring 3) applied to the buildings in the "wall" hexes automatically destroyed those buildings, they do not block any damage. Furthermore, because the target hex's underlying terrain began as Level 1, and the Level 2 hexes of Ring 2 and Ring 3 in the fortress "wall" have been reduced to Level 1 (meaning they are no longer higher than both the underlying level of the target hex and the hexes to be damaged), damage is now applied to those additional hexes beyond the fortress wall.

If any buildings in any damaged hex managed to survive, 10 standard-scale points would then be applied to each building hex for each level reduction.

Airborne-to-Surface Fire

Airborne-to-surface fire follows all the standard rules for orbit-to-surface fire (see p. 91), with the following modifications.

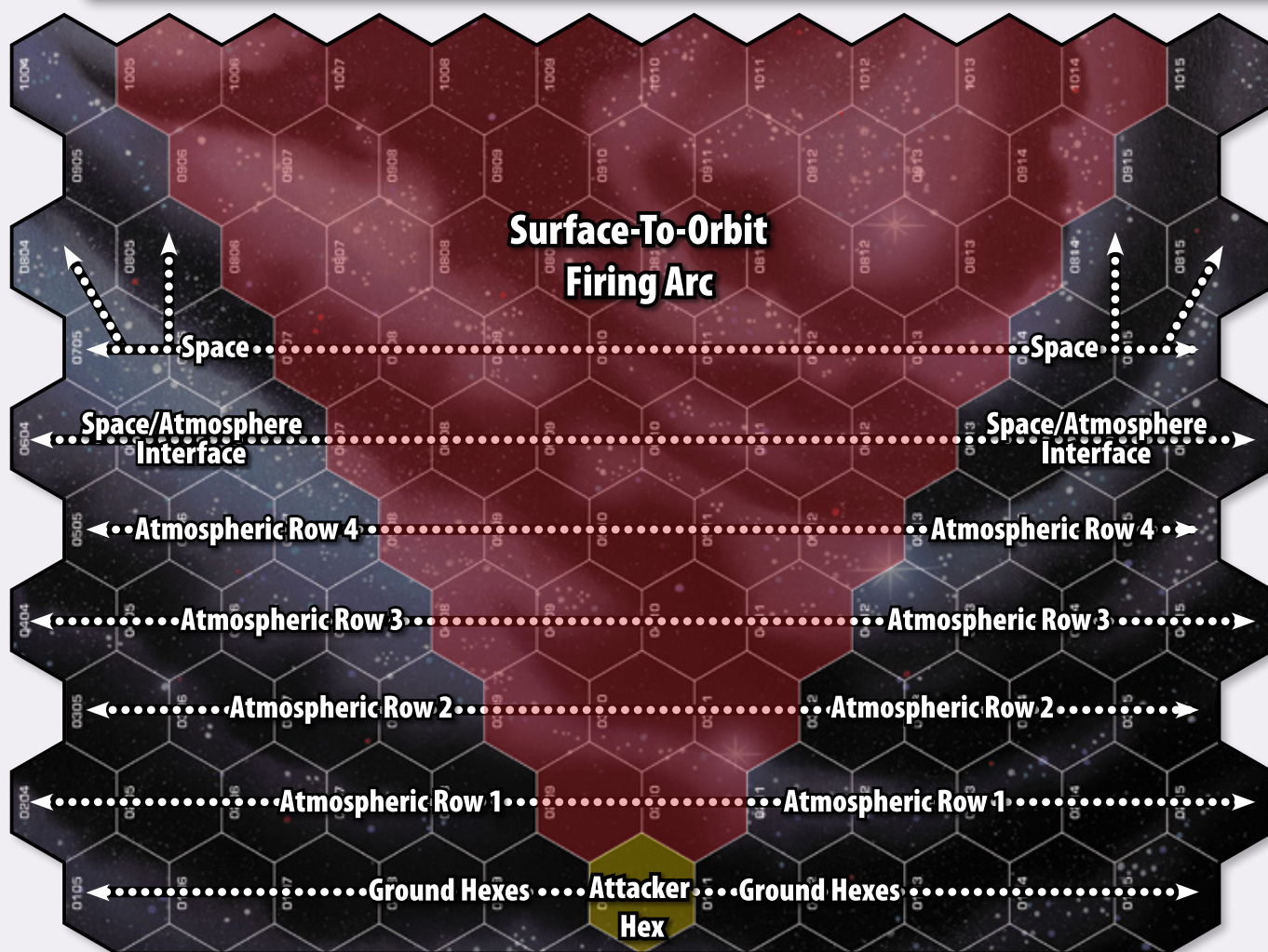
Apply to-hit modifiers for firing through atmospheric hexes, based on the altitude of the attacker (the attack does not pass through a Space/Atmosphere Interface Hex, so that modifier is not applied).

- Apply a +1 to-hit modifier for every point of velocity change by the attacker in the turn in which it makes the attack.
- Direct-Fire Ballistic Weapon attacks fired from Atmospheric Rows 4 or 3 arrive on the ground mapsheet during the Indirect Artillery Attack Phase the turn after they were fired. Direct-Fire Ballistic Weapon attacks fired from Atmospheric Rows 2 or 1, or from a Ground Hex, arrive on the ground mapsheet in the same turn they were fired.
- Missile attacks arrive on the ground mapsheet during the Indirect Artillery Attack Phase 1D6 turns after they were fired, -1 for each Atmospheric Row below the Space/Atmosphere Interface to a minimum of 0 (the controlling player makes the roll in secret, without announcing when the attack will arrive, and should write the turn number on a piece of paper and place it face down next to the playing area). If the die roll result is 0 (due to modifiers applied for the Atmospheric Row from which the attack was made), the attack arrives on the ground mapsheet in the same turn it was fired.
- Spheroid units can only launch an airborne-to-surface attack from weapons mounted in the Aft, Aft Left and Aft Right locations.
- Aerodyne units can only launch an airborne-to-surface attack from weapons mounted in the Nose, Left Wing and Right Wing locations.

Surface-to-Orbit Fire

Surface-to-orbit attacks follow all the standard rules for orbit-to-surface fire (see p. 91) with the following modifications.

- Attacks can only be made against a target in the surface-to-orbit firing arc (see the Surface-to-Orbit Firing Arc Diagram, above) and the weapon in question must be able to attack the target.
- To-hit modifiers for firing through atmospheric hexes do not apply for surface-to-orbit attacks (unlike WarShips, which are not designed for orbit-to-surface fire—though they can be used in such attacks—surface-to-orbit weapons systems are optimized for local atmospheric conditions).
- Direct-Fire Energy Weapon attacks arrive on the space mapsheet in the same turn they were fired.



• SURFACE-TO-ORBIT FIRING ARC DIAGRAM •

- Direct-Fire Ballistic Weapon attacks arrive on the space mapsheet during the Indirect Artillery Attack Phase of the turn after they were fired; if the target has moved out of range since the attack was made, the attack automatically misses.
- For Direct-Fire Weapons only, apply a +1 to-hit modifier for every point of velocity change by the target, both in the turn the surface-to-orbit attack is made and in the turn when the attack arrives on the space mapsheet (other than for evasive action, which applies its own modifier; see p. 77, TW).
- Missile attacks arrive on the space mapsheet during the Indirect Artillery Attack Phase 1D6 turns after they were fired (the controlling player makes the roll in secret, without announcing when the attack will arrive, and should write the turn number on a piece of paper and place it face down next to the playing area). If the target has moved out of range since the attack was made, the attack automatically misses.
- Only Large Craft can be the target of a surface-to-orbit attack.
- Tele-operated missiles used in surface-to-orbit attacks begin maneuvering in the Movement Phase (Aerospace)

once they arrive on the mapsheet; they are placed on the first space hex immediately above the Space/Atmosphere Interface. Tele-operated missiles do not expend any fuel in the launch phase; they do so only once they begin to maneuver after being placed on the space map.

- Only a missile weapon may be launched from underwater. For every two full depths below the surface, apply a +1 modifier to the 1D6 die roll result to determine how many turns it takes to reach the space map, while also applying an additional +3 to-hit modifier.
- For a unit mounting a capital/sub-capital weapon that is making a surface-to-orbit attack, apply standard attacker movement modifiers.
- Landed spheroid aerospace units can only launch a surface-to-orbit attack from weapons mounted in the Nose, Fore-Left and Fore-Right locations.
- Landed aerodyne aerospace units cannot make surface-to-orbit attacks.

The controlling player of a Terran SDS base lofts a Barracuda missile at an orbiting DropShip (the DropShip is large enough for the missile to attack). The missile's Extreme

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range means it can travel up to 50 hexes, but each atmospheric hex fired through counts as 6 hexes and the Space/Atmospheric Interface hex counts as 3 hexes. Therefore, the first 27 hexes of the weapon's range are lost to the atmosphere, but this still allows the missile to travel another 23 space hexes. The player secretly rolls 1D6 with a result of 3; he writes that number down on a piece of paper and places it face down next to the playing area. During the Indirect Artillery Attack Phase of the turn when the missile arrives, the player turns the paper over to indicate the result, and then determines if he can hit the target. Despite the elapse of three turns, the target DropShip remains in the base's firing arc and is 5 hexes above the atmospheric interface. In effect, this means the target is 32 hexes from the launch site (27 for the atmosphere and 5 for space), placing it in the Long range bracket. This provides a final modified to-hit number of 6 [4 (Gunnery Skill Rating) + 4 (Long Range) - 2 (missile modifier) = 6].

Airborne-to-Orbit Fire

Airborne-to-orbit fire follows all the standard rules for surface-to-orbit fire (see p. 91), with the following modifications.

- Apply to-hit modifiers for firing through atmospheric hexes, based on the altitude of the attacker.
- Apply a +1 to-hit modifier for every point of velocity change by the attacker in the turn in which it makes the attack.
- Direct-Fire Ballistic Weapon attacks fired from the Ground Row, or Atmospheric Rows 1 or 2, arrive on the space mapsheet during the Indirect Artillery Attack Phase the turn after they were fired; if the target has moved out of range since the attack was made, the attack automatically misses. Direct-Fire Ballistic Weapon attacks fired from the Atmospheric Rows 3 or 4 or the Space/Atmosphere Interface hex arrive on the space mapsheet in the same turn they were fired.
- Missile attacks arrive on the space mapsheet during the Indirect Artillery Attack Phase 1D6 turns after they were fired, -1 for each Atmospheric Row above the Ground Row to a minimum of 0 (the controlling player makes the roll in secret, without announcing when the attack will arrive, and should write the turn number on a piece of paper and place it face down next to the playing area). If the target has moved out of range since the attack was made, the attack automatically misses. If the die roll result is 0 (due to modifiers applied for the Atmospheric Row from which the attack was made), the attack arrives on the space mapsheet in the same turn it was fired.
- Spheroid aerospace units can only launch an airborne-to-orbit attack from weapons mounted in the Nose, Fore-Left and Fore-Right locations.
- Aerodyne aerospace units can only launch an airborne-to-orbit attack from weapons mounted in the Nose, Left Wing and Right Wing locations.

Surface-to-Surface Fire

Surface-to-surface attacks by capital/sub-capital weapons are horribly inaccurate and generally deemed terribly wasteful of these rare weapons, leaving the instances of such attacks very few and far between.

All the same rules that apply to an artillery attack (see *Artillery*, p. 147, *TO:AR*) also apply to a surface-to-surface attack, with the following exceptions and additional rules.

- Only capital/sub-capital missiles may be used when making a surface-to-surface attack.

- The range in mapsheets of capital/sub-capital missiles is equal to their Maximum Range (see the Aerospace Weapon Range Table, p. 235, *TW*), plus 10 additional mapsheets for each Atmospheric Row they occupy above the Ground Row. For example, in the Ground Row, a Barracuda would have a maximum range of 50 mapsheets. However, if the unit mounting the Barracuda were at Atmospheric Row 4, the range would be 90 mapsheets [50 mapsheets (standard range) + 40 mapsheets (10 mapsheets per Atmospheric Row above Ground Row) = 90 mapsheets].
- Apply a +2 to-hit modifier.
- For a unit mounting a capital/sub-capital missile weapon that is making a surface-to-surface attack, apply a +1 to-hit modifier if the unit expended Cruising/Safe Thrust MP, or a +2 to-hit modifier if the unit expended Flanking/Maximum Thrust MP in the turn in which the attack is made.
- A surface-to-surface missile attack launched from underwater increases the artillery flight times (see Indirect Artillery Flight Times Table, p. 149, *TO:AR*) by 1 turn and applies an additional +3 to-hit modifier.

ELECTRONIC WARFARE

Standard aerospace combat assumes that electronic combat measures between the participants—sensor probes, jamming and the like—cancel each other out. Players may wish, however, to incorporate this invisible warfare into their games to enhance the detail, albeit at the expense of complexity and speed of play. These additions only apply to space combat on a space map, not to atmospheric engagements or landed aerospace units.



JH

Test simulations prove a massive Ghost Bear Leviathan WarShip can see defeat.



Feng Huang-class Elias Jung (House Liao)

Construction: Military Small Craft and Large Craft ECM gear is an integral part of the structure of military aerospace units, not a design component. Civilian craft do not possess significant ECM gear.

Anti-Ship Electronic Warfare Missiles: If an ASEW missile (see p. 170, *TO:AUE*) successfully strikes an aerospace target, the unit loses its Electronic Warfare capability until the End Phase of the turn following the attack (multiple hits are not cumulative in any fashion).

Note: These ECM rules do not have any of the effects of any ground-based ECM system, and so do not affect any weapons and/or equipment in the same way as ground-based ECM systems.

Electronic Countermeasures (ECM)

All military aerospace units larger than a fighter have some form of electronic countermeasures to foil enemy targeting systems, though the ECM of larger units extend their influence over a greater volume of space and are less likely to be countered.

For every valid ECM hex (including that of the target and the attacker, if close enough) through which an enemy traces LOS in an attack, add a +1 to-hit modifier (to a maximum +4 modifier).

Fighters and Small Craft: Fighters only have an ECM field when they actually mount an ECM suite (for *Guardian ECM*, see p. 213, *TM*; for *Watchdog ECM*, see p. 90, *TO:AUE*; for *Angel ECM*, see p. 91, *TO:AUE*; for *Electronic Warfare Equipment*, see p. 122, *TO:AUE*). If a fighter mounts an ECM suite, it extends its ECM field over the fighter's own hex only.

Like Large Craft, a military Small Craft automatically generates an ECM field, but it only extends to the craft's own hex; a civilian Small Craft that mounts an ECM as described above for a fighter will generate an ECM field that covers its own hex. If a military Small Craft mounts an ECM suite as described above for a fighter, that equipment meshes with its automatically generated ECM field and will extend it to adjacent hexes.

Fighter/Small Craft ECM (regardless of whether or not the Small Craft mounts an ECM suite) only applies to other fighters and Small Craft, and is ignored by Large Craft.

When using the *Fighter Squadron* rules (see p. 25), if a single fighter within a squadron mounts an ECM suite, the entire squadron has an ECM field.

Large Craft: Military JumpShips and DropShips have an ECM field that extends into adjacent hexes, while WarShips and military Space Stations have an ECM field that extends 2 hexes from their location. A Large Craft's ECM field affects Large Craft as well as fighters and Small Craft. Civilian units cannot generate an ECM field.

Mounting an ECM suite, as described above for a fighter, on a Large Craft has no effect. Unlike a Small Craft, whose systems are compatible, the far more powerful Large Craft integral ECM systems are incompatible with any type of ECM suite; the Large Craft ECM is flat-out superior to that of smaller units and so supersedes the effects of an individual ECM suite.

Stacking and Maximum ECM Effects: No matter how many enemy ECM fields are active on the playing area, there is an upper limit to the interference they can impose. The maximum to-hit modifier generated by stacked ECM fields (regardless of Fighter/Small Craft/Large Craft ECM type, or the number of hexes) is +4. Any modifiers above +4, regardless of how many hexes of additional ECM modifiers that lie between the attacker and target, are ignored. If firing out of a hex affected by an enemy ECM field, count that hex in your to-hit modifier. Multiple ECM fields of the same class (generated by the same type of unit) in the same hex do not stack. For example, three Large Craft in a single hex only generate a +1 ECM to-hit modifier. However, a hex can have an active Fighter/Small Craft ECM and Large Craft ECM field at the same time. For example, a hex can have a +1 Fighter/Small Craft ECM field and a +1 Large Craft ECM field, both affecting fighters and Small Craft. If a fighter is attempting to shoot at a Small Craft or a Large Craft in this field, the fighter applies a +2 to-hit modifier, up to the maximum cumulative +4 to-hit modifier.

Electronic Counter-Countermeasures (ECCM)

The following rules below explain how Electronic counter-countermeasures are used in space combat.

Active Probes: Any fighter, fighter squadron or Small Craft equipped with an Active Probe (for *Beagle* and *Light*, see p. 204, *TM*; for *Bloodhound* and *Watchdog*, see p. 90, *TO:AUE*) or Electronic Warfare Equipment (see p. 122, *TO:AUE*), at the start of a scenario should designate whether the Active Probe is going to operate in the standard-scale Short Range band or Medium Range band (see Aerospace Weapon Range Table, p. 235, *TW*). If the Active Probe is operating in the Short Range band (6 hexes), the probe's effects cover all arcs out to the maximum standard-scale Short Range (6 hexes). If the Active Probe is operating in the Medium Range band, the probe's effects only cover the Nose arc of the carrying unit. During the End Phase of any turn, the play may announce a switch between the two range bands.

For any hex affected by the Active Probe, all friendly units ignore enemy ECM effects from fighters, fighter squadrons and Small Craft in those hexes. Additionally, such units can reduce the effect of Large Craft ECM by -2 (to a minimum of 0), per hex in the area of effect.

Fighters/Small Craft: A fighter with an ECM suite (as well as a military Small Craft, whether it mounts an ECM suite or not) can tune it to act as electronic counter-countermeasure (ECCM) in order to negate enemy ECM. The ECM loses its normal function when used in this way. The player must announce the switch to ECCM in the End Phase of any turn, or

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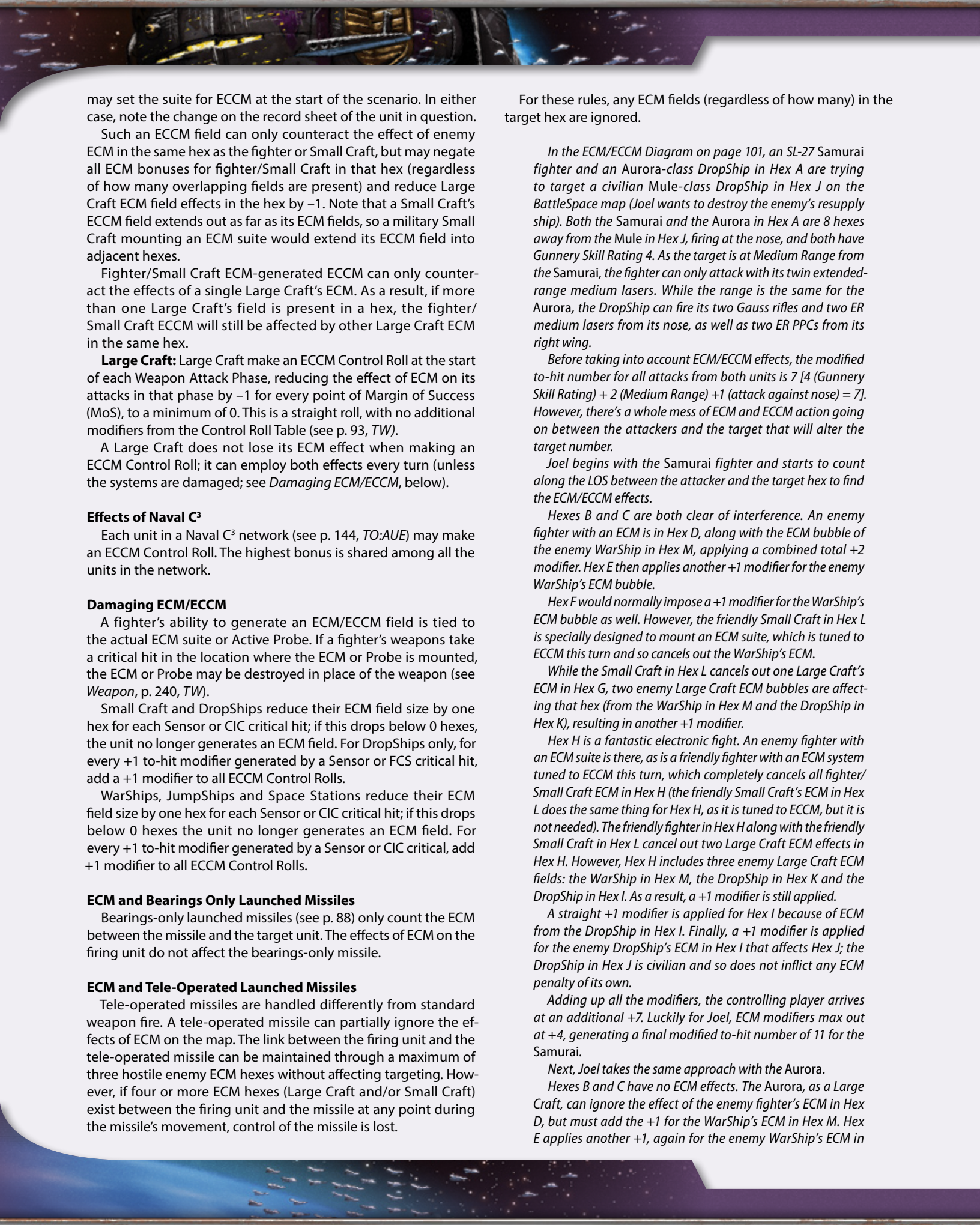
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may set the suite for ECCM at the start of the scenario. In either case, note the change on the record sheet of the unit in question.

Such an ECCM field can only counteract the effect of enemy ECM in the same hex as the fighter or Small Craft, but may negate all ECM bonuses for fighter/Small Craft in that hex (regardless of how many overlapping fields are present) and reduce Large Craft ECM field effects in the hex by -1. Note that a Small Craft's ECCM field extends out as far as its ECM fields, so a military Small Craft mounting an ECM suite would extend its ECCM field into adjacent hexes.

Fighter/Small Craft ECM-generated ECCM can only counteract the effects of a single Large Craft's ECM. As a result, if more than one Large Craft's field is present in a hex, the fighter/Small Craft ECCM will still be affected by other Large Craft ECM in the same hex.

Large Craft: Large Craft make an ECCM Control Roll at the start of each Weapon Attack Phase, reducing the effect of ECM on its attacks in that phase by -1 for every point of Margin of Success (MoS), to a minimum of 0. This is a straight roll, with no additional modifiers from the Control Roll Table (see p. 93, TW).

A Large Craft does not lose its ECM effect when making an ECCM Control Roll; it can employ both effects every turn (unless the systems are damaged; see *Damaging ECM/ECCM*, below).

Effects of Naval C³

Each unit in a Naval C³ network (see p. 144, *TO:AUE*) may make an ECCM Control Roll. The highest bonus is shared among all the units in the network.

Damaging ECM/ECCM

A fighter's ability to generate an ECM/ECCM field is tied to the actual ECM suite or Active Probe. If a fighter's weapons take a critical hit in the location where the ECM or Probe is mounted, the ECM or Probe may be destroyed in place of the weapon (see *Weapon*, p. 240, TW).

Small Craft and DropShips reduce their ECM field size by one hex for each Sensor or CIC critical hit; if this drops below 0 hexes, the unit no longer generates an ECM field. For DropShips only, for every +1 to-hit modifier generated by a Sensor or FCS critical hit, add a +1 modifier to all ECCM Control Rolls.

WarShips, JumpShips and Space Stations reduce their ECM field size by one hex for each Sensor or CIC critical hit; if this drops below 0 hexes the unit no longer generates an ECM field. For every +1 to-hit modifier generated by a Sensor or CIC critical, add +1 modifier to all ECCM Control Rolls.

ECM and Bearings Only Launched Missiles

Bearings-only launched missiles (see p. 88) only count the ECM between the missile and the target unit. The effects of ECM on the firing unit do not affect the bearings-only missile.

ECM and Tele-Operated Launched Missiles

Tele-operated missiles are handled differently from standard weapon fire. A tele-operated missile can partially ignore the effects of ECM on the map. The link between the firing unit and the tele-operated missile can be maintained through a maximum of three hostile enemy ECM hexes without affecting targeting. However, if four or more ECM hexes (Large Craft and/or Small Craft) exist between the firing unit and the missile at any point during the missile's movement, control of the missile is lost.

For these rules, any ECM fields (regardless of how many) in the target hex are ignored.

In the ECM/ECCM Diagram on page 101, an SL-27 Samurai fighter and an Aurora-class DropShip in Hex A are trying to target a civilian Mule-class DropShip in Hex J on the BattleSpace map (Joel wants to destroy the enemy's resupply ship). Both the Samurai and the Aurora in Hex A are 8 hexes away from the Mule in Hex J, firing at the nose, and both have Gunnery Skill Rating 4. As the target is at Medium Range from the Samurai, the fighter can only attack with its twin extended-range medium lasers. While the range is the same for the Aurora, the DropShip can fire its two Gauss rifles and two ER medium lasers from its nose, as well as two ER PPCs from its right wing.

Before taking into account ECM/ECCM effects, the modified to-hit number for all attacks from both units is 7 [4 (Gunnery Skill Rating) + 2 (Medium Range) + 1 (attack against nose) = 7]. However, there's a whole mess of ECM and ECCM action going on between the attackers and the target that will alter the target number.

Joel begins with the Samurai fighter and starts to count along the LOS between the attacker and the target hex to find the ECM/ECCM effects.

Hexes B and C are both clear of interference. An enemy fighter with an ECM is in Hex D, along with the ECM bubble of the enemy WarShip in Hex M, applying a combined total +2 modifier. Hex E then applies another +1 modifier for the enemy WarShip's ECM bubble.

Hex F would normally impose a +1 modifier for the WarShip's ECM bubble as well. However, the friendly Small Craft in Hex L is specially designed to mount an ECM suite, which is tuned to ECCM this turn and so cancels out the WarShip's ECM.

While the Small Craft in Hex L cancels out one Large Craft's ECM in Hex G, two enemy Large Craft ECM bubbles are affecting that hex (from the WarShip in Hex M and the DropShip in Hex K), resulting in another +1 modifier.

Hex H is a fantastic electronic fight. An enemy fighter with an ECM suite is there, as is a friendly fighter with an ECM system tuned to ECCM this turn, which completely cancels all fighter/Small Craft ECM in Hex H (the friendly Small Craft's ECM in Hex L does the same thing for Hex H, as it is tuned to ECCM, but it is not needed). The friendly fighter in Hex H along with the friendly Small Craft in Hex L cancel out two Large Craft ECM effects in Hex H. However, Hex H includes three enemy Large Craft ECM fields: the WarShip in Hex M, the DropShip in Hex K and the DropShip in Hex I. As a result, a +1 modifier is still applied.

A straight +1 modifier is applied for Hex I because of ECM from the DropShip in Hex I. Finally, a +1 modifier is applied for the enemy DropShip's ECM in Hex I that affects Hex J; the DropShip in Hex J is civilian and so does not inflict any ECM penalty of its own.

Adding up all the modifiers, the controlling player arrives at an additional +7. Luckily for Joel, ECM modifiers max out at +4, generating a final modified to-hit number of 11 for the Samurai.

Next, Joel takes the same approach with the Aurora.

Hexes B and C have no ECM effects. The Aurora, as a Large Craft, can ignore the effect of the enemy fighter's ECM in Hex D, but must add the +1 for the WarShip's ECM in Hex M. Hex E applies another +1, again for the enemy WarShip's ECM in



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Hex M. No modifier applies for Hex F, as the enemy ECM from Hex M is canceled by the friendly Small Craft's ECCM from Hex L. Hex G applies only a +1 modifier, as the friendly Small Craft's ECCM in Hex L cancels out one of the two Large Craft ECM fields in Hex G.

Once again, as a Large Craft, the Aurora ignores the enemy fighter in Hex H. As with the Samurai, the ECCM from the friendly fighter in Hex H and the friendly Small Craft in Hex L cancel out two of the three fields from the three Large Craft ECM affecting that hex, leaving a +1 modifier. Again, as with the Samurai, hexes I and J apply a +1 modifier each.

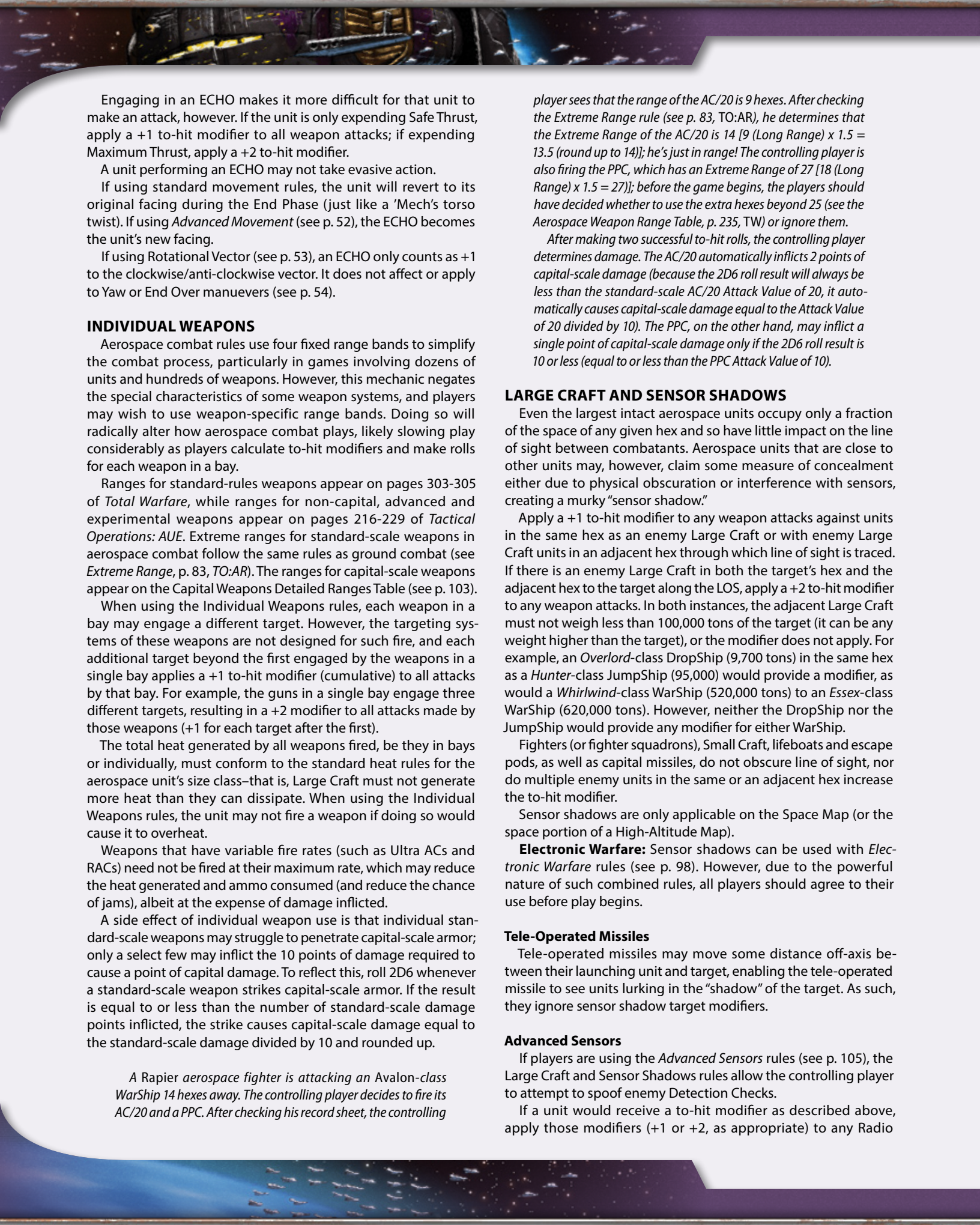
That leaves a total modifier of +6, but the maximum ECM modifier is +4. Additionally, at the start of the current turn, the controlling player of the Aurora made a successful ECCM Control Roll with a Margin of Success of 2. That generates a modified target number of 9 [4 (Gunnery Skill Rating) + 2 (Medium Range) + 1 (attack against nose) + 4 (enemy ECM) - 2 (ECCM Control Roll) = 9].

Joel realizes next turn he's got to get some more fighters and DropShips into the mix if he wants to fire at units across so many overlapping ECM fields.

EMERGENCY COMBAT HEADING OPERATION (DROPSHIPS AND WARSHIPS ONLY)

Through the emergency application of attitude and control thrusters, DropShips and WarShips can execute emergency heading changes in the thick of combat, allowing them to partially react to highly nimble smaller craft. The ECHO is akin to a BattleMech's torso twist.

At the end of the Movement Phase (Aerospace)—after fighters and Small Craft have completed movement—DropShips and WarShips may declare an ECHO (Emergency Combat Heading Operation) by expending 2 thrust points. The aerospace unit must have the required thrust points remaining for this maneuver. If the thrust points are available, the DropShip or WarShip may change its facing by one hexside in any direction.



Engaging in an ECHO makes it more difficult for that unit to make an attack, however. If the unit is only expending Safe Thrust, apply a +1 to-hit modifier to all weapon attacks; if expending Maximum Thrust, apply a +2 to-hit modifier.

A unit performing an ECHO may not take evasive action.

If using standard movement rules, the unit will revert to its original facing during the End Phase (just like a 'Mech's torso twist). If using *Advanced Movement* (see p. 52), the ECHO becomes the unit's new facing.

If using Rotational Vector (see p. 53), an ECHO only counts as +1 to the clockwise/anti-clockwise vector. It does not affect or apply to Yaw or End Over maneuvers (see p. 54).

INDIVIDUAL WEAPONS

Aerospace combat rules use four fixed range bands to simplify the combat process, particularly in games involving dozens of units and hundreds of weapons. However, this mechanic negates the special characteristics of some weapon systems, and players may wish to use weapon-specific range bands. Doing so will radically alter how aerospace combat plays, likely slowing play considerably as players calculate to-hit modifiers and make rolls for each weapon in a bay.

Ranges for standard-rules weapons appear on pages 303-305 of *Total Warfare*, while ranges for non-capital, advanced and experimental weapons appear on pages 216-229 of *Tactical Operations: AUE*. Extreme ranges for standard-scale weapons in aerospace combat follow the same rules as ground combat (see *Extreme Range*, p. 83, TO:AR). The ranges for capital-scale weapons appear on the Capital Weapons Detailed Ranges Table (see p. 103).

When using the Individual Weapons rules, each weapon in a bay may engage a different target. However, the targeting systems of these weapons are not designed for such fire, and each additional target beyond the first engaged by the weapons in a single bay applies a +1 to-hit modifier (cumulative) to all attacks by that bay. For example, the guns in a single bay engage three different targets, resulting in a +2 modifier to all attacks made by those weapons (+1 for each target after the first).

The total heat generated by all weapons fired, be they in bays or individually, must conform to the standard heat rules for the aerospace unit's size class—that is, Large Craft must not generate more heat than they can dissipate. When using the Individual Weapons rules, the unit may not fire a weapon if doing so would cause it to overheat.

Weapons that have variable fire rates (such as Ultra ACs and RACs) need not be fired at their maximum rate, which may reduce the heat generated and ammo consumed (and reduce the chance of jams), albeit at the expense of damage inflicted.

A side effect of individual weapon use is that individual standard-scale weapons may struggle to penetrate capital-scale armor; only a select few may inflict the 10 points of damage required to cause a point of capital damage. To reflect this, roll 2D6 whenever a standard-scale weapon strikes capital-scale armor. If the result is equal to or less than the number of standard-scale damage points inflicted, the strike causes capital-scale damage equal to the standard-scale damage divided by 10 and rounded up.

A Rapier aerospace fighter is attacking an Avalon-class WarShip 14 hexes away. The controlling player decides to fire its AC/20 and a PPC. After checking his record sheet, the controlling

player sees that the range of the AC/20 is 9 hexes. After checking the Extreme Range rule (see p. 83, TO:AR), he determines that the Extreme Range of the AC/20 is 14 [9 (Long Range) x 1.5 = 13.5 (round up to 14)]; he's just in range! The controlling player is also firing the PPC, which has an Extreme Range of 27 [18 (Long Range) x 1.5 = 27]]; before the game begins, the players should have decided whether to use the extra hexes beyond 25 (see the Aerospace Weapon Range Table, p. 235, TW) or ignore them.

After making two successful to-hit rolls, the controlling player determines damage. The AC/20 automatically inflicts 2 points of capital-scale damage (because the 2D6 roll result will always be less than the standard-scale AC/20 Attack Value of 20, it automatically causes capital-scale damage equal to the Attack Value of 20 divided by 10). The PPC, on the other hand, may inflict a single point of capital-scale damage only if the 2D6 roll result is 10 or less (equal to or less than the PPC Attack Value of 10).

LARGE CRAFT AND SENSOR SHADOWS

Even the largest intact aerospace units occupy only a fraction of the space of any given hex and so have little impact on the line of sight between combatants. Aerospace units that are close to other units may, however, claim some measure of concealment either due to physical obscuration or interference with sensors, creating a murky "sensor shadow."

Apply a +1 to-hit modifier to any weapon attacks against units in the same hex as an enemy Large Craft or with enemy Large Craft units in an adjacent hex through which line of sight is traced. If there is an enemy Large Craft in both the target's hex and the adjacent hex to the target along the LOS, apply a +2 to-hit modifier to any weapon attacks. In both instances, the adjacent Large Craft must not weigh less than 100,000 tons of the target (it can be any weight higher than the target), or the modifier does not apply. For example, an *Overlord*-class DropShip (9,700 tons) in the same hex as a *Hunter*-class JumpShip (95,000) would provide a modifier, as would a *Whirlwind*-class WarShip (520,000 tons) to an *Essex*-class WarShip (620,000 tons). However, neither the DropShip nor the JumpShip would provide any modifier for either WarShip.

Fighters (or fighter squadrons), Small Craft, lifeboats and escape pods, as well as capital missiles, do not obscure line of sight, nor do multiple enemy units in the same or an adjacent hex increase the to-hit modifier.

Sensor shadows are only applicable on the Space Map (or the space portion of a High-Altitude Map).

Electronic Warfare: Sensor shadows can be used with *Electronic Warfare* rules (see p. 98). However, due to the powerful nature of such combined rules, all players should agree to their use before play begins.

Tele-Operated Missiles

Tele-operated missiles may move some distance off-axis between their launching unit and target, enabling the tele-operated missile to see units lurking in the "shadow" of the target. As such, they ignore sensor shadow target modifiers.

Advanced Sensors

If players are using the *Advanced Sensors* rules (see p. 105), the Large Craft and Sensor Shadows rules allow the controlling player to attempt to spoof enemy Detection Checks.

If a unit would receive a to-hit modifier as described above, apply those modifiers (+1 or +2, as appropriate) to any Radio



CAPITAL WEAPONS DETAILED RANGES TABLE

Type	Heat	Short Range	Medium Range	Long Range	Extreme Range
<i>Direct-Fire Ballistic Weapons</i>					
Light Mass Driver	30	1-10	11-20	21-30	31-40
Medium Mass Driver	60	1-9	10-18	19-27	28-36
Heavy Mass Driver	90	1-8	9-16	17-24	25-32
NAC/10	30	1-11	12-22	23-33	34-44
NAC/20	60	1-11	12-21	22-31	32-42
NAC/25	85	1-10	11-20	21-30	31-40
NAC/30	100	1-9	10-18	19-27	28-36
NAC/35	120	1-7	8-14	15-21	22-28
NAC/40	135	1-6	7-12	13-18	19-24
Light N-Gauss	9	1-14	15-28	29-40	41-56
Medium N-Gauss	15	1-13	14-26	27-39	40-52
Heavy N-Gauss	18	1-12	13-24	25-36	37-48
Light SC-Cannon	12	1-8	9-16	17-24	25-32
Medium SC-Cannon	30	1-6	7-12	13-18	19-24
Heavy SC-Cannon	42	1-5	6-10	11-15	16-20
<i>Direct-Fire Energy Weapons</i>					
NL35	52	1-11	12-22	23-33	34-44
NL45	70	1-12	13-24	25-36	37-48
NL55	85	1-13	14-26	27-39	40-52
Light NPPC	105	1-11	12-22	23-33	34-44
Medium NPPC	135	1-12	13-24	25-36	37-48
Heavy NPPC	225	1-13	14-26	27-39	40-52
SCL1	24	1-9	10-18	19-27	28-36
SCL2	28	1-8	9-14	15-19	20-24
SCL3	32	1-7	8-13	14-18	19-22
<i>Missile Weapons</i>					
Killer Whale	20	1-12	13-24	25-36	37-48
White Shark	15	1-12	13-24	25-36	37-48
Barracuda†	10	1-20	21-30	31-40	41-50
AR10*	*	*	*	*	*
<i>Sub-Capital</i>					
Manta Ray	21	1-3	4-5	6-7	8-9
Swordfish	15	1-3	4-6	7-9	10-12
Stingray	12	1-6	7-12	13-18	19-24
Piranha	9	1-9	10-18	19-27	28-36
<i>Tele-Operated‡</i>					
Kraken-T	50	N/A	N/A	N/A	N/A
Killer Whale-T	20	N/A	N/A	N/A	N/A
White Shark-T	15	N/A	N/A	N/A	N/A
Barracuda-T	10	N/A	N/A	N/A	N/A
<i>Equipment</i>					
Screen Launcher	10	1-3	4-6	7-9	10-12

*Per missile type †If using weapon-specific ranges, Barracuda missiles do not gain a to-hit bonus. ‡Tele-operated missile (see p. 251, TW)

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Triangulation (see p. 106), Drive Plumes (see p. 107), Radar (see p. 107) or Optical/Thermal (see p. 107) Detection Checks.

A DropShip engages an enemy DropShip in the same hex. Attacks by other aerospace units from either side against the combatants suffer a +1 to-hit modifier, as both are Large Craft. A fighter squadron in an adjacent hex likewise gains a +1 to-hit modifier for any attacks against it that pass through the hex containing the two DropShips. The DropShips do not gain any protection from the fighters because those units are too small to obscure the larger vessels.

OVER-PENETRATION WEAPONS FIRE TABLE

1D6 Roll	Result
1-3	All units apply standard damage
4	JumpShips and Space Stations apply over-penetration rules*
5	JumpShips, Space Stations and DropShips apply over-penetration rules*
6	WarShips with an original SI 30 or less and any JumpShips, Space Stations or DropShips apply over-penetration rules*

*All other units apply standard damage.

OVER-PENETRATION WEAPONS FIRE

Large Craft encompass a considerable volume of “empty” space: open passages, cargo bays, self-sealing tankage (water, sewage, fuel) and so on. In combat, these spaces provide little resistance to incoming fire and can allow a powerful weapon strike to pass through a vessel nearly unimpeded.

Each time a weapon inflicts damage to a Large Craft’s SI, roll 1D6 and consult the Over-Penetration Weapons Fire Table (see above) to determine if the damage strikes through one of these “empty volume” regions. If the attack indicates it hit one of these sections, thus passing through the entire ship, then DropShips and WarShips only assign 1 point of SI damage, and no SI damage is assigned to a JumpShip or Space Station. In all instances, any remaining damage is assigned to the armor in the location opposite the incoming attack. Any damage remaining is lost.

As with standard SI damage, roll for a critical hit.

A Jade Falcon Fredasa fires with its NAC/40 on a Lyran Invader-class JumpShip. The attack hits, doing 40 points of damage. After blotting out the 7 points of armor on his fore-left facing, the Lyran player rolls 1D6. Rolling a 4, he consults the table and finds that the damage over-penetrated his fragile JumpShip. He marks off the 7 points of armor on his fore-right arc and the 7 points of armor in his aft-left arc, and then rolls a critical hit, but the Invader is still alive and ready to be shot at again next turn.

SPACE BOMBING

Single fighters (not squadrons) may be loaded with bombs while on a Large Craft with Small Craft/fighter bays, while in space,

for use against ground targets and against Large Craft in space. Rules for atmospheric bombing appear in *Low-Altitude Operations* (see p. 80, TW). To bomb a target on the space map, the following conditions must apply:

- Both the bomber and its target must occupy space hexes.
- The target must be in a hex the bomber passed through on the turn of the attack (including the hex in which it ends the turn). Resolve the attack during the Weapon Attack Phase of the turn in which the fighter passed through the target hex.
- The fighter must have its nose aligned with its direction of travel (or with its largest vector if using the Advanced Movement rules; see p. 52). Standard atmospheric bombing rules apply, except as follows:
- Fighters may only dive-bomb their targets.
- The base to-hit number is the pilot’s Gunnery Skill Rating +4.
- Apply a +1 to-hit modifier for every point of velocity change by the target in the turn in which it is attacked (other than for evasive action, which applies its own modifier; see p. 77, TW).
- Apply a +1 to-hit modifier for every point of velocity change by the attacker in the turn in which it makes the attack.
- A +1 to-hit modifier applies for every 10,000 tons (or part thereof) the target masses under 100,000 tons.
- The target of a space-bombing attack must mass at least 10,000 tons or higher.
- Apply the immobile –4 to-hit modifier if the target is a Space Station or a Large Craft that has a destroyed engine, even if it still has a velocity (i.e. is drifting).
- Missed bombs do not scatter and do not hit other targets.
- Only HE, cluster and laser-guided bombs or non-homing Arrow IV may be used. However, the three bomb types all function as HE bombs, inflicting 10 points of standard-scale (1 point of capital-scale) damage, applied in 50-point (5-point capital-scale) groups. Arrow IV inflicts 20 standard-scale points (2 capital-scale points) of damage but also has a chance of an automatic critical hit like capital missiles (Critical Hit Chance 11+; see p. 239, TW).
- Bombs only affect the targeted unit.
- TAG has no impact on space bombing.
- Called Shots Mode (see p. 88) cannot be used with space bombing.
- Fighter squadrons (see p. 25) use modified rules for bombing and external ordnance.

A fighter equipped with 8 HE bombs opts to attack a Space Station with its weapons. The controlling player changed the fighter’s velocity by 2 so that its movement takes it through the target station’s hex (a requirement of the bombing attack), giving the fighter a +2 to-hit modifier for the 2 points of velocity change. The modified to-hit number is 6 [4 (Gunnery Skill Rating) + 4 (bombing attack modifier) + 2 (attacker thrust expenditure) – 4 (Space Station) = 6]. The die roll result is an 11, a success; the damage is applied as a 50-point standard-scale (5-point capital-scale) and a 30-point standard-scale (3-point capital-scale) hit.

In the same turn, another fighter attempts to bomb a WarShip in its path. The fighter doesn’t need to change its velocity, but the WarShip changed its velocity by 3, so the modified to-hit target number is 11 [4 (Gunnery Skill Rating) + 4 (bombing attack modifier) + 3 (target thrust expenditure) = 11].



TARGETING CAPITAL MISSILES

Aerospace units may choose to forgo normal weapon fire during the Weapon Attack Phase in order to target a capital/sub-capital missile (including tele-operated missiles) that has yet to reach its target (in essence they're turning themselves into a point-defense weapon; see p. 84). The missile must have passed within six hexes of the attacking unit during the Movement Phase of the turn in which the attack will be made (even if the missile is no longer within that six-hex range). In addition to all standard modifiers, apply a +3 to-hit modifier and double all angle of attack modifiers; the range is always considered Short.

Large Craft: If a Large Craft fires any weapons in an arc at a capital missile, no other targets may be attacked by any other weapons in that arc that turn.

Aerospace Fighters and Small Craft: If aerospace fighters or Small Craft target a capital missile, they cannot make any other weapon attacks against any other targets that turn.

Atmospheric Hexes: If the target missile is located in an atmospheric hex, apply an additional +2 to-hit modifier.

TELE-OPERATED MISSILES (EXPANDED)

The following rule provides an additional option for tele-operated missiles. Unless specifically stated otherwise, all standard tele-operated rules are still in effect (see p. 251, *TW*).

A single launcher may fire and operate more than one active tele-operated missile at one time, though only a single tele-operated missile may be launched in a single turn.

At the start of any turn in which a player wishes to fire a tele-operated missile from a launcher already controlling an active tele-operated missile (or missiles), a capital bay or two standard bays must be declared "inactive" (the bay(s) can be located anywhere on the ship).

An inactive bay cannot be fired until it is activated again.

To determine when a bay can be activated again, use the following rules:

At the end of every turn, the player counts up the number of active (i.e. that have not been destroyed, used up their fuel, or left the playing area) tele-operated missiles being controlled beyond the first missile by a single launcher.

- If the number is equal to the number of inactive bays, nothing happens.
- If the number is less than the number of inactive bays, the player nominates the difference in bays he wishes to activate (either 1 capital bay or two standard bays); the "activated" bays can be fired and used normally starting on the following turn.

Point Defense Bays and Screen Launchers: Neither Point Defense Bays or Screen Launchers count towards bay totals and cannot be "subtracted" to allow for the firing of additional tele-operated missiles.

At the start of a turn, a Nekohono'o-class DropShip has 5 active tele-operate kraken missiles on the playing area, 3 operating from one launcher and 2 operating from another launcher. Since that's 3 missiles beyond the first being controlled by the same launchers, and the DropShip has no capital bays, Jacob previously made the MRM and SRM bays in the nose, and the MRM and PPC bays in the FL/FR arcs inactive (a total of 6 bays).

Jacob wants to fire three more tele-operated missiles this turn. Since one of those missiles is the first active missile controlled by the third launcher, there's no penalty. However, the other two launchers are already controlling multiple launchers, so he must nominate four more bays to make them inactive: he chooses the ER PPC bays in the FL/FR arcs, as well as the SRM bays in the AL/AR arcs, and fires during the turn, giving him 8 tele-operated missiles on the playing area.

At the end of the turn, however, 4 of the 8 missiles have either run out of fuel, left the playing area or been destroyed. He subtracts the number of active missiles beyond the first for each launcher resulting in 1 [4 (active tele-operated missiles beyond the first) – 3 (number of launchers)]. Jacob then compares that number with the number of inactive bays he has, which leaves him with a difference of 3 [4 (8 inactive standard bays / 2) – 1 (active tele-operated missiles beyond the first) = 3]. This means he may activate all but 2 of his bays; he leaves the MRM and SRM bays in the nose inactive.

VARIABLE DAMAGE THRESHOLDS

In standard aerospace combat rules, the Damage Thresholds of each unit are fixed during construction, equal to one-tenth of the starting Armor Value on the facing, and they never change. This mechanic simplifies and speeds up the game, but does not reflect the steady degradation of armor and the protection it offers as battles progress.

Players may decide to have a unit's Damage Threshold vary as it takes damage, reflecting the increased chance of critical damage as a unit is denuded of its armor. In this case, the Damage Threshold of a unit's facing is equal to one-tenth of its current Armor Value, rounding fractions up. Tracking armor degradation in this way requires additional bookkeeping, recalculating the Damage Threshold whenever a target unit takes damage, but it also increases the lethality of aerospace combat.

An Aegis-class WarShip has 101 armor points on each of its fore and aft sides and thus a starting Damage Threshold of 11 points (rounded up). After taking 1 point of damage, those facings would have their Damage Threshold reduced to 10 (100/10; another 10 points of damage would reduce the Damage Threshold to 9 (90/10).

ADVANCED SENSORS

The following rules provide a method of incorporating advanced sensor suites into aerospace combat. They assume that any military craft will not be emitting an identifying IFF signal, will be operating under EMCON (EMission CONTROL, or radio silence) orders, and will be using its integral ECM and ECCM to their best effect (see *Electronic Warfare*, p. 98). Broadcasting an IFF signal means other aerospace units can detect the unit automatically (provided those aerospace units are within range of the IFF signal; see *Radio Triangulation* (Object), p. 106).

The targets of sensor attempts fall into three categories: undetected, objects (which are visible to the sensors but

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cannot be directly attacked) and firing solution (which may be attacked directly). The header for each sensor method indicates the category of detection it produces. Only active radar can provide a firing solution to allow direct attack against a target, but an attacker may employ bearings-only capital missile attacks against any detected aerospace unit in range, relying on the missile's own sensor suite to provide the detailed targeting information (see *Capital Missile Bearings-Only Launch*, p. 88).

Detection Check: All Detection Checks are Control Rolls, using the pilot/crew's Piloting Skill Rating as the base target number, unless specifically stated otherwise in the following rules.

An unmanned unit makes a Detection Check based upon the amount of Communications Equipment (or its equivalency) it mounts (see p. 212, *TM*). The Base Target Number starts at 7. For every two tons of Communications Equipment (or its equivalency), drop the number by 1 (round down). For example, an unmanned DropShip without any additional Communication Equipment has an equivalency of 3 tons, meaning the Detection Check is made with a Modified Target Number of 6 [$7 \text{ (Base Target Number)} - 1 \text{ (3 tons of equivalent Communication Equipment / 2 = 1.5, rounded down to 1)} = 6$]. If it had mounted 3 tons of additional Communications Equipment, the Modified Target Number would be 4 [$7 \text{ (Base Target Number)} - 3 \text{ (6 tons of Communication Equipment and/or its equivalency / 2 = 3)} = 4$]. The modifiers for Active Probes and Naval Comm-Scanner Suites (see below) apply as is to unmanned Detection Checks.

Active Probes: If a unit mounts an Active Probe (for *Beagle* and *Light*, see p. 204, *TM*; for *Bloodhound* and *Watchdog*, see p. 90, *TO:AUE*) or Electronic Warfare Equipment (see p. 122, *TO:AUE*), apply a -2 modifier to any Detection Check to detect a given unit.

Large Craft and Sensor Shadows: The use of Large Craft and Sensor Shadows rules can modify the Detection Checks described below (see p. 102).

Naval Comm-Scanner Suite: Double the sensor range for a Small NCSS and apply a -1 modifier to any Detection Check to detect a given unit; triple the sensor range for a Large NCSS and apply a -2 modifier to any Detection Check to detect a given unit (see p. 145, *TO:AUE*). NCSS does not affect sensor ranges for emergence wave detection. For other detection types, either modify the maximum listed range and/or modify the range used to calculate penalties as appropriate.

Note: Many of the following rules deal with a scale well outside the standard play that might be encountered in a scenario. Additionally, to best capture the flavor of the fog of war as it applies to the vastness of space, a third neutral party may be useful to act as a gamemaster for some situations. As with all sections of this book, players should thoroughly read these rules before determining which they will use and how best to implement them in their games.

INFRARED JUMP SIGNATURE (OBJECT)

The detection of an incoming JumpShip from its IR signature depends on the length of time a unit takes to make the jump and its DropShip capacity. The formula to determine jump duration is provided on page 77, though the unit's IR signature is detectable for double the jump time prior to the unit's appearance in addition to the jump duration. If a JumpShip or WarShip carries no DropShips, assume a capacity of 1 for these calculations. This IR signature is clearly visible to any units within 50,000 kilometers that have functioning sensors, but requires a Detection Check

with a +1 modifier per 10,000 kilometers of distance between the two ships.

EMERGENCE WAVE (OBJECT)

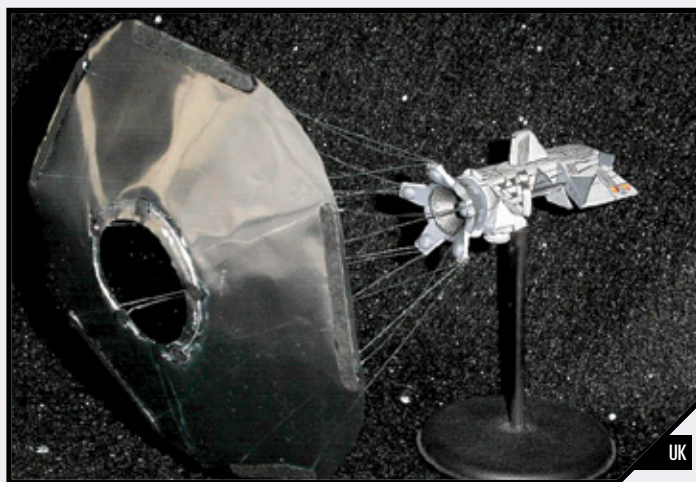
The appearance of a JumpShip/WarShip warps space and annihilates the gas and space dust at the unit's destination, triggering a burst of EM radiation known as the emergence wave. While detectable at a greater distance than the IR jump signature, this signal is harder to separate from background noise. Any military Large Craft may attempt to detect an arriving JumpShip/WarShip. The controlling player makes a Detection Check with a +2 modifier, as well as an additional modifier equal to half the distance from the arriving JumpShip/WarShip in AU (1 AU is approximately 150 million kilometers). Apply a further modifier by subtracting the incoming unit's full K-F Drive integrity + its DropShip capacity, divided by 10, to generate a final modified target number for the Detection Check. Round all fractions up at each stage. Each detecting unit may make a single Detection Check against an arriving JumpShip. Regardless of the final modified target number, it is not possible to detect any target beyond 15 AU.

Note: The electromagnetic pulse travels at the speed of light (299,800 kilometers per second) and will take approximately eight minutes to travel 1 AU.

RADIO TRIANGULATION (OBJECT)

Appropriately equipped units within range may detect radio and HPG communications. Civilian units may detect any radio transmissions within 500,000 kilometers. Military units can use their ESM to detect communications transmissions out to 10 million kilometers.

HPG transmissions use K-F hyperspace principles to send a message. After sending the message, the K-F field collapses, creating an electromagnetic pulse similar to an emergence wave, though much weaker. The HPG emergence wave rules allow triangulation of such emergence points, with the following changes: assume a +0 modifier for drive integrity and DropShip capacity, but double all range modifiers.



A McKenna-class WarShip deploys its solar sail after arriving in system, sweeping the depths of space with its sensors for hostile ships.



DRIVE PLUMES (OBJECT)

Any Large Craft may detect the drive exhaust plume of any moving unit. The plume, seen as a moving bar or point of x-rays and light, provides information on heading, velocity and distance to the target unit. The Detection Check base target number for detecting the moving unit is 5, with a modifier of +1 for every 5,000,000 kilometers of distance (or part thereof). The distance limitation does not reflect a limit on how far a unit can see, but rather the distance at which the motion of the target unit becomes apparent. Each unit may make one Detection Check against each opposing unit per hour (60 space turns).

RADAR (OBJECT)

Any Large Craft with a functioning sensor system (one not destroyed through critical damage) may attempt a Detection Check against objects within 100,000 km (5,555 space hexes). The radar systems of fighters and Small Craft are less powerful, and may only detect targets out to a range of 10,000 km (555 space hexes). When making a Detection Check, apply a modifier equal to the range/10,000 (for Large Craft) or range/1,000 (for fighters and Small Craft), rounding up. Apply any modifiers, as appropriate, for any sensor damage. Once detected, an object remains detected while within the detecting aerospace unit's sensor range. Each unit may make one Detection Check against each target per hour (60 space turns).

Battlefield Radar (Firing Solution)

The aerospace combat rules assume the combatants are using radar to detect and target their opponents. To reflect this, players may wish to determine if an aerospace unit detects a particular target. Assuming its radar is active, the aerospace unit automatically detects any targets within 1/10 of the unit's normal radar range, 10,000 km (555 space hexes) for Large Craft or 1,000 km (55 space hexes) for fighters, Small Craft and capital missiles. Beyond that range, the players must make a Detection Check, as described under *Radar (Object)* above, in each turn immediately before firing. An aerospace unit not detected in this manner may not be fired on directly, but may be targeted by capital missiles (which have their own sensors) using a bearings-only launch (see *Capital Missiles Bearings-Only Launch*, p. 88).

Electronic Support Measures (Object)

Military Large Craft automatically detect any aerospace units within 1,000,000 km that are using active radar. Civilian aerospace units, as well as military fighters and Small Craft, lack the ESM systems needed to detect the radar emissions and so may not use this detection method. ESM detection is not sufficient to allow the detecting aerospace unit to fire directly at the target, but does allow the firing of capital missiles on a bearings-only launch (see *Capital Missiles Bearings-Only Launch*, p. 88); players can use the *High Speed Closing Engagement* or *Bearings-Only Launches Not Directly on the Playing Area* rules to resolve these situations, depending on whether mapsheets are in use.

OPTICAL/THERMAL DETECTION (OBJECT)

All aerospace units are equipped with optical-based sensors, from the most basic digitally enhanced optical telescopes

to thermal-enhanced imaging and x-ray telescopes. These sensors allow the detection of drive plumes at considerable ranges. At the battlefield level, their ability is more limited. Resolving a small object such as an aerospace fighter, or even a two million-ton *McKenna*, in the vastness of space can be very difficult.

Any Large Craft with a functioning sensor system (one that has not been destroyed through critical damage) may attempt a Thermal/Optical Detection Check against objects within 25,000 km (1,388 space hexes). The telescopic systems of fighters and Small Craft are less powerful, and may only detect targets out to a range of 2,500 km (139 space hexes). The Detection Check applies a modifier equal to the range/2,500 (for Large Craft) or range/250 (for fighters and Small Craft), rounding up. Apply modifiers as appropriate for any sensor damage. Once detected, an object remains detected while within the detecting aerospace unit's sensor range. Each unit may make one Detection Check against each target per hour (60 space turns).

Optical/Thermal detection beyond 139 space hexes (for Large Craft) or 14 space hexes (for Small Craft/fighter) is not sufficient to allow the detecting aerospace unit to fire directly at the target, but does allow the firing of capital missiles on a bearings-only launch (see *Capital Missiles Bearings-Only Launch*, p. 88). Players can use the *High Speed Closing Engagements* (see p. 62) or *Bearings-Only Launches Not Directly on the Playing Area* rules (see p. 90) to resolve these situations, depending on whether mapsheets are in use.

Battlefield Thermal/Optical Detection (Firing Solution)

The aerospace combat rules assume the combatants are using radar to detect and target their opponents, but units may attempt to use thermal or optical sensors. These sensors have the advantage of passive operation, but have shorter ranges than active radar. To reflect this, players may wish to determine if an aerospace unit detects a particular target. Using thermal/optical sensors, the aerospace unit automatically detects any targets within 1/10 of the unit's normal thermal/optical range: 2,500 km (139 space hexes) for Large Craft or 250 km (14 space hexes) for fighters and Small Craft. Beyond that range, the players must make a Detection Check as described under *Optical/Thermal Detection (Object)* above, in each turn immediately before firing.

ZERO-G GROUND UNIT COMBAT

The following rules build on the *Zero-G Ground Unit Movement* rules (see p. 22), allowing such units to enter combat.

Ground units can be employed in aerospace engagements, though they make poor space combatants. Such units may only engage units in the same hex (they lack the targeting systems of aerospace units) and suffer a +4 to-hit modifier for all weapon attacks (because they treat all attacks as being at long range). Other units may attack them as if they were fighters. Battle armor may not use anti-personnel weapons in space combat, and infantry platoons reduce their damage

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to 25 percent of normal. All attacks made by ground units target their opponent's front facing. Attacks against such units by aerospace units in the same hex determine the facing randomly. Roll 1D6. On a result of 1–3, the attack is against the front. On a 4, it is against the side (randomly determine which side), and a 5 or 6 indicates the rear. Use standard ground unit rules to determine the location of the hit.

All units must adhere to the Vacuum rules when involved in zero-G combat (see p. 52, *TO:AR*). The following additional rules also apply.

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- A jump jet hit reduces available Thrust by 1. Fuel reserves remain unchanged.
- The unit ignores all Movement Point modifiers while in space (but they apply when making a landing roll).

ZERO-G GROUND UNIT COMBAT ON LARGE AEROSPACE UNITS

Ground Units on a Large Aerospace Unit Hull may engage in combat using the "Ground Scenario" rules with the following modifications:

- All units are treated as ground units, using ground combat ranges
- Only Biped units may move
- Jump-capable units have an MP of Jump –1
- Non-jump-capable units have an MP of Walk/Cruise –2
- In any turn a unit moves it must make a Piloting Skill Roll. If it fails, it comes off the hull.
- If the Aerospace unit changes heading or velocity all units on the hull must make a Piloting Skill Roll.
- Any unit that fails a Piloting Skill Roll is removed from the playing field. It has lost its hold on the hull and floats away. It must make a new landing attempt.

An exception to this rule is tracked combat units operating on Large Aerospace units that have had their hull modified to support tracked combat units operating on special on tracks. This must be declared prior to the scenario start. When the mapsheets are laid out, the player controlling the aerospace craft may place 50 track hexes on each map sheet. Track hexes must all be connected. The tracked vehicles may only move on these track-designated hexes, and only at Cruising speed.

WEAPON ATTACKS

Once a unit is landed on the enemy aerospace unit (see p. 22), the target unit's weapons may not attack the ground unit.

For targeting and damage purposes, the landed ground unit is assumed to be on the aerospace unit in the location corresponding to the hexside from which it entered. For example, a unit entering through the nose hexside is in the Nose location. If the aerospace unit moved into the ground unit's hex, determine the location randomly. During the Movement Phase (Aerospace), a landed ground unit may move to an adjacent location, but it may not make any attacks during that turn (for example, from Nose to Fore-Right on a DropShip).

The landed unit may make an attack against that location of the aerospace unit's armor, or may make a direct attack on critical systems. All weapon attacks are automatically successful (no to-hit roll required; all cluster weapons automatically deal their full At-

tack Value), but must be converted from standard- to capital-scale if the targeted unit is a JumpShip, WarShip or Space Station. Physical attacks may also be used against armor, with the following stipulations: only punch, kick and physical weapon attacks may be made, and must still adhere to their standard rules (for example, an arm carrying a physical attack weapon cannot deal damage with it if a weapon from that arm is fired in the same turn).

Targeting critical systems requires a to-hit roll (short range for 'Mechs and ProtoMechs, Anti-'Mech Skill for infantry). The target system may be any in the appropriate location (for example, if the ground unit is on the aerospace unit's nose, any hit location on the Nose, Aft or Side column of the Aerospace Units Hit Location Tables prefixed by Nose/). If the total damage caused by all the successful hits of a single ground unit (including any physical attacks) exceeds the Armor Threshold for the location, a critical hit may occur on the targeted system. Determine if critical damage occurs using the standard rules (see p. 238, *TW*). Attacks aimed at causing critical hits do not inflict armor damage, irrespective of their success or failure.

Control Rolls: If the target aerospace unit makes a Control Roll, as the result of damage or high-thrust maneuvering, the landed ground unit must do so also, applying all landing modifiers apart from No Fuel (see p. 22). Failure indicates that the ground unit has been thrown off the hull of the aerospace unit, traveling in the same direction and velocity as the aerospace unit when it was thrown. Provided the unit still has reaction mass (fuel), it may maneuver normally in the following turn (see *Movement*, p. 22).

Docked or Grappling Units: Any aerospace units either docked (see p. 54) or docked/grappled as part of a boarding action (see p. 34) to the aerospace unit where ground units have landed may target those ground units normally (and be the target of attacks by such ground units), provided they are both in the same location. In such an instance, use the *Attacks by Grounded Aerospace Units* rules (see p. 249, *TW*), with the following modifications:

- Randomly determine whether a landed ground unit is in the left side or right side arc of a friendly docked DropShip for firing arcs and attack direction. In the case of a docking/grappling aerospace unit, this may require some adjudication, depending on which location of the boarding aerospace unit is connected to the unit it is attempting to board (see *Docking and Grappling*, pp. 167, *TO:AR*; and 34). For JumpShips/WarShips/Space Stations, the arc should be readily apparent, as they maintain the same heading and orientation as the aerospace unit to which they are docking; randomly determine the location if there is any doubt. In all instances, this orientation remains the same as long as any ground units remain in the same location. For example, if two ground units are landed on a WarShip in the same location as a docked DropShip, and the random roll determined that the combat will be resolved on the left side of the DropShip, that location will be used as long as either unit is in the same location. If both ground units move to another location on the WarShip and then return, a new location (left or right side, for example) would be rolled.
- All damage to ground units is applied to the Front Hit Location Table.
- All attacks are considered to be at long range.
- Any attacks against the landed unit that miss automatically hit the aerospace unit where the ground unit is landed, causing damage normally.



Defending Troops: Ground units carried either by the aerospace unit on which the enemy ground units have landed or—in the case of larger aerospace units—any ground units carried by friendly aerospace units docked to the parent aerospace unit can exit such an aerospace unit to fight the landed enemy units on the surface of the ship. Use the *Dismounting* rules (see p. 91, *TW*), to exit such troops, with the exception that any number of infantry can exit a JumpShip/WarShip/Space Station; no door limitation applies.

In all such instances, players should lay out a standard ground mapsheet with the blank side up (representing the hull of the aerospace unit), placing the attacking landed ground units in the center of the map, without violating stacking rules. If all players agree, the map can actually be a ground map, or a randomly created urban map with all buildings being considered impassable, as the hull of a massive aerospace unit can be just as contoured and filled with obstacles as any ground map. The defending units randomly determine which edge of the playing area they should enter; if units are simultaneously arriving in the location on the hull from two different sources (for example, from a JumpShip and a docked DropShip), they should enter from different sides.

The game is then played as a standard ground combat game, with all the rules in this section for vacuum and operating in zero-G in effect. Remember that one space turn represents six ground turns, so six turns of ship surface combat between ground units would be played for each space turn involving the rest of the units in the aerospace game.

If the number of units involved is large enough, players may wish to use more than one map to play on (see *Selecting Mapsheets*, p. 264, *TW*, for guidelines on the ratio of maps to units).

A valiant Combine GHR-5J Grasshopper lands on a Snow Raven Essex-class WarShip. Having arrived through the Aft-Right hexside, it is in the Aft-Right location on the WarShip's hull. Its objective is the vessel's K-F drive, which may only be targeted in the Nose (Nose/K-F Drive), Front-Right or Front-Left (Front Side/K-F Drive), or Aft (Aft/K-F Drive) locations—pretty much anywhere except where the 'Mech landed. The Grasshopper's player spends his next Movement Phase maneuvering into the Aft location, but cannot make any attacks that turn. During the Weapon Attack Phase of the following turn, the player then attempts to attack the K-F drive core. The player fires all weapons, which automatically strike the target: ER large laser, 2 medium lasers and a Streak SRM-2, for a total Damage Value of 22. However, the controlling player of the Grasshopper knows that with an aft Armor Value of 35, the Essex has a Damage Threshold of 3.5 (35 points of standard-scale damage). He therefore throws in a kick (for an additional 14 points of damage), giving him 36 points of damage, just enough for a possible critical hit. The player rolls 2D6 to determine if he inflicts critical damage on the K-F drive, but the result is a 7, no critical. He now must hope to survive any maneuvers the Essex may use to dislodge him, so he can try again next turn.



A Wyvern and Lancelot have made the desperate gamble to board a WarShip, while the defending vessel deploys its own 'Mech forces to battle on its surface.

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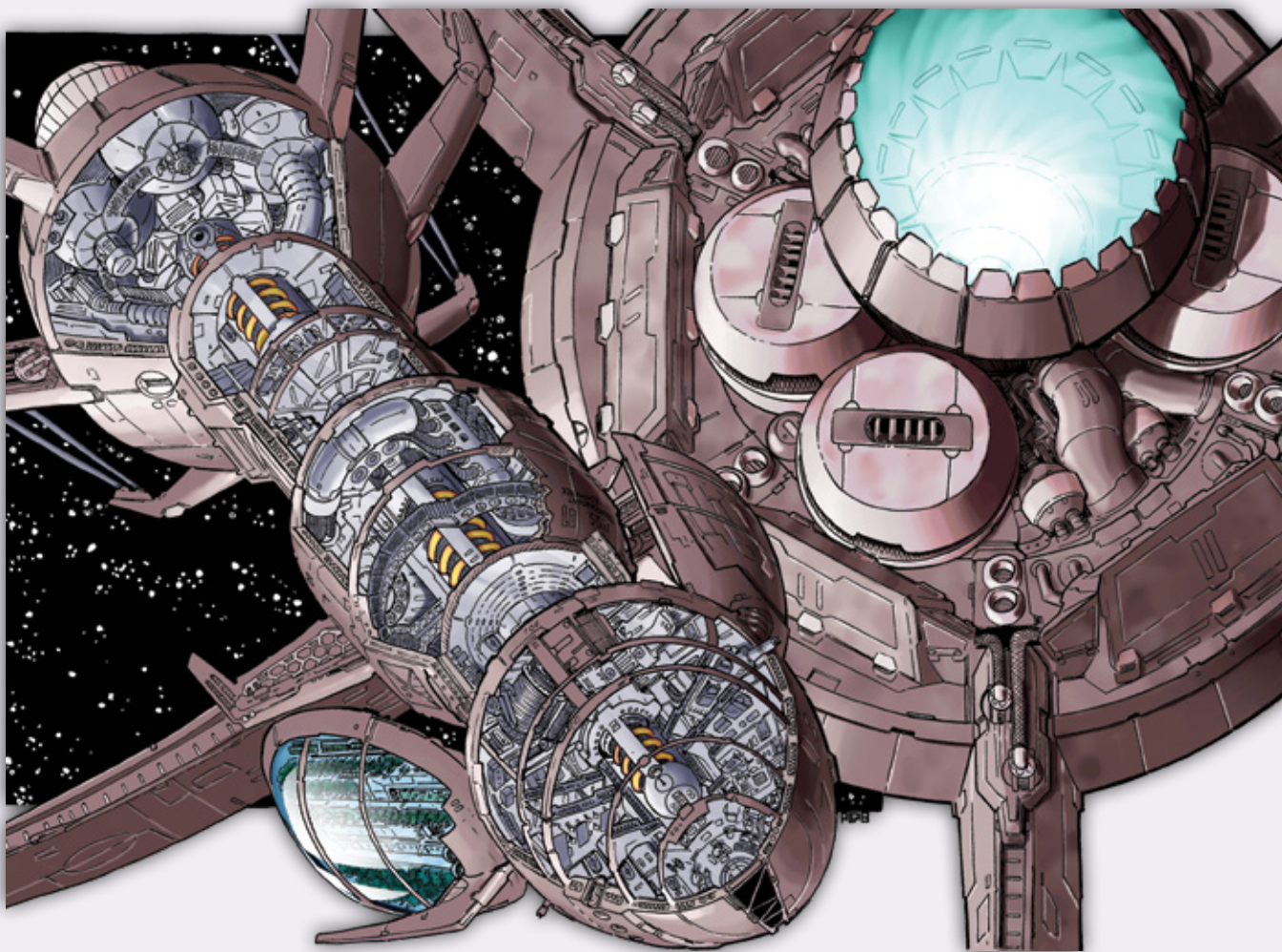
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AEROSPACE TECHNOLOGIES

—Tharkad University lecture broadcast at the Lloyd Marik-Stanley Aerospace School. Used With Permission.

Oh, interesting. More people showed up for this half of the lecture. Did your friends message you that Dr. Ready's flashy WarShip presentation was going to begin? Well, I hate to disappoint you, but I'm not Dr. Ready, and he's saving all the dramatic holos for when he returns. To the newly arrived students, I'm Assistant Professor Dietrich Mathers, and I'm stuck talking about the boring features of transportation technology. Well, I do have some colorful holos, but they're mostly of space stations and some obscure bits of JumpShip architectures. Speaking of JumpShips, let's start with those.

AEROSPACE VEHICLES

JUMPSHIPS

Without JumpShips, humankind would still be stuck in the Terran system. Or, mostly stuck there. The fusion motors developed by the Magellan program probably could've gotten humankind to the stars in a reasonable period for one-way missions. Anyway, faster-than-light starships were invented in the 22nd century when Terran Alliance scientists revisited the scorned physics postulates of Thomas Kearny and Takayoshi Fuchida, almost eight decades after those two visionaries were laughed out of the scientific commu-

nity for their ideas. Personally, I think Kearny and Fuchida should've gotten a second look because of their key contributions to workable fusion power plants, but they were challenging some very solid Einsteinian dogma of the time. I mean, we still use big chunks of Einstein's theories today.

Anyway, a JumpShip is laid out like a long, slender needle. This shape is a result of the Kearny-Fuchida drive system. The core of the drive is a meters-thick titanium-germanium core that stretches from one end of the vessel to the other and is wrapped in a liquid helium jacket to keep it at the correct operating temperatures. Usually, a proportionally small habitat and bridge are at the ship's bow while the stern houses the massive station-keeping drive.

The Kearny-Fuchida drive is what makes the JumpShip do what it does. It allows the craft to instantly “jump” between two points in space up to thirty light-years apart, hence the name JumpShip.

Though the station-keeping fusion drive of JumpShips is often substantially more massive than the drives of most DropShips, it is proportionally a smaller fraction of the JumpShip’s mass, leaving JumpShips barely able to maneuver in comparison to DropShips. Don’t let that fool you; JumpShips can putter around star systems when they need to. But in combat, they’re almost stationary targets. In fact, today only the unspoken prohibition against destroying these rare and vital spacecraft keeps them safe and interstellar travel flowing. That ban stemmed from the early Succession Wars, which were all too successful in destroying JumpShips, though with the coming of the Clans and now the Jihad that ban is starting to wane.

JumpShips have several features in common: engineering systems, weapons, control systems, grav decks and cargo areas. I’ll get to those in a moment, after I frame those systems with an obligatory historical overview that Dr. Ready wants... though, honestly, can you get through your primary and secondary schools without knowing most of the major JumpShip dates?

JumpShip History

I won’t take long with this. The Deimos Program began in 2102 and resulted in the first jump by a vessel, an unmanned probe, in 2107. The following year, Raymond Bache became the first human to travel through hyperspace when he made a similar in-system jump. The TAS *Pathfinder* made the first interstellar jump, to Tau Ceti, in the same year. Colonization plans were drawn up immediately thereafter, but it took until 2116 for the TAS *Ark* to deliver the first colonists to New Earth. The TAS *Charger*, the first military JumpShip, was built in 2122.

JumpShip technology was refined steadily throughout the 22nd century, allowing increases in range every few decades until the modern thirty-light year limit was reached in the early 23rd century. At the same time, recharge times dropped steadily as drive durability and energy storage efficiency improved, all of which cut down travel times almost to modern limits. However, those old ships were still slaves to enormous quantities of hydrogen for recharging, which led to the introduction of the “jump sail” at about the same time JumpShips were reaching their thirty-light year limit.

The next revolution involved the compact core, which appeared right around the dawn of the 24th century...my notes say 2300 C.E. on the dot. I say “revolution,” but the compact core was really an evolution of existing trends in K-F core design—early JumpShips used smaller cores than today. The standard core, which I’ll get to in a moment, was a result of cost-saving trends in JumpShip design. Anyway, despite a few attempts by civilians to harness the weight-efficient compact cores, these K-F drives are so exclusively used by militaries that any compact core vessel, armed or not, is referred to as a WarShip.

Shortly after the compact core was introduced, various JumpShip designers began pushing in another direction: stripping JumpShips down to the bare minimum K-F drive,

even externalizing cargo using extensions of the K-F core, the so-called K-F booms that reached into DropShips. Until that point, JumpShips had served as both starship and in-system transport for their payloads. They would make the jump and then the transit to planetary orbit, where large shuttles would “drop” out of vast internal bays to deliver cargo groundside. The shuttles that evolved to handle the huge payloads of early JumpShips were thus unofficially named “DropShips” by their crews. Over time, JumpShips were streamlined to remain at jump points while DropShips handled transit to planetary orbit—merchants found no sense in paying for redundant numbers of large drives. At that point, DropShips were “dropping” free of JumpShips upon arrival into a system, rather than dropping from orbit.

Naturally, the militaries of the Inner Sphere first made use of the modern JumpShip/DropShip combination. The modern docking collar had evolved by the 25th century, allowing DropShips to easily plug in and drop off from JumpShips like super-sized cargo containers, and the name “DropShip” became official. No longer did JumpShips need to be customized for different cargos—that became entirely the problem of DropShips. The result was our current system of JumpShips and DropShips.

Since the 25th century, there have been few dramatic advances in JumpShip technology, and certainly the fall of the old Star League stagnated further developments in K-F drive technology.

Engineering Systems

“The heart of the JumpShip is the Kearny-Fuchida hyperspace drive.” I think I said that already, but it’s here in my notes...Anyway, the K-F drive is composed of an alloy of titanium and germanium...I said that before, too. And I said this part about the liquid helium...Okay, here’s the new stuff. The super-cooled titanium-germanium core of the drive acts like a giant capacitor, which stores the energy needed to rip holes through space. It also serves as a big...oh, call it an antenna, to focus and tune the hyperspace field created by the initiator.

JumpShips have one of two types of cores. Most of the JumpShips out there—and I mean 99.9 percent of JumpShips today—use the so-called standard core. This cost-effective core can normally only transport about twice its mass through hyperspace (plus its own mass), so the JumpShip built around it is pared down to a minimum. A typical standard-core JumpShip is 95 percent K-F drive in terms of mass.

The remaining 0.1 percent of JumpShips, usually called WarShips even when they’re unarmed, uses a compact core about half the mass of the JumpShip. This efficient core can carry six times its own mass through hyperspace. I mean, the drive’s own mass plus five times more.

Where was I...right. The field initiator. Stuck in the stern of the JumpShip, this piece of equipment starts the jump by forming a hyperspace field. It kicks the field to the core, which then shapes and expands the field to hopefully encompass the whole JumpShip and properly docked DropShips. Everyone and everything else nearby tends to get mangled, since the drive controller isn’t aware of them. The initiator is stuck at the aft end of the JumpShip to keep it away from the life support systems and most of the crew, because the initiators of early JumpShips—those of the 22nd and 23rd centu-

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Interesting little fact. On some Star League-era models of JumpShips, famously including the *Chahar Profit*, the field initiator—or some modular, redundant components of it—were designed to be detached and perform a jump without the rest of the JumpShip, forming a distress beacon system known colloquially as a pigeon. The technology for this “free initiator jump” has been lost and I don’t think JumpShip crews or designers are particularly weeping about its passing.

Anyway, the pigeon was a complete “Hail Mary” option at the height of its use in the 26th century before common sense and HPGs squeezed it out of service. The systems rarely worked well because the field initiator didn’t have a core to properly form a field, though the Pigeons themselves could usually deliver a distress call even if they arrived as a mangled ball of garbage. But even then, removing chunks of a K-F drive didn’t leave the parent JumpShip in any shape to jump, especially after the Pigeon jumped away with parts of the parent drive. It had the compounding problems of being extremely expensive, usually driving up the cost of a K-F drive by half; often damaging the power systems of its parent ship; and taking away parts from the K-F drive that might be needed to make the drive work again.

You might start to think “But professor, a Pigeon could still mean the difference between stranding and rescue, so are those problems really so bad?” Take a moment and consider those problems, one by one. The cost impact of the Pigeon was greater than an HPG—you could have better communications for less expense in

the old Star League, which was the death knell of the Pigeon in the 27th century. The Pigeon lacked a core, which means it needed power from another source, the parent ship, and the process of diverting jump-level power to something off the ship usually damaged the JumpShip’s electrical system, blowing relays and power cells, which could worsen the JumpShip’s predicament. And the Pigeon wasn’t a standalone emergency beacon, it was part of the ship’s K-F drive. A healthy drive might spare the Pigeon’s components, but you didn’t use a Pigeon if you had a healthy drive.

Thus, even if Pigeons were still possible today the idea is less popular now than ever, because crews prefer to try to get their whole ship to jump, and modern attackers either just destroy the JumpShip or, most often, leave it alone.

An interesting little fact about this interesting little fact is that Pigeons can safely jump relatively near other ships because of their tiny hyperspace fields, and do not inhibit the formation of hyperspace fields because they lack a core to manipulate and shape such fields. So please disregard the urban legend that Pigeons were suppressed because they could somehow “interdict” jump points and thus bring interstellar travel to a halt. They died off because they were obsolete and risky. Also, take a moment to think about jump points. They are huge things. The entire outer reaches of a star system beyond the proximity limit, all the way into deep interstellar space, is a valid region for jumps. “Point” is often a misnomer. The numbers of K-F drives needed to interdict that space is effectively infinite.

ries—had trouble handing off the field to the core, so sometimes you’d see the field initiator making a jump without the rest of the ship. Though it tended to take the engineering section with it... but anyway, that made for a good reason to stick the crew in front. After all, it’s not like they’re in front because they need windows to see where they’re going.

Charging

Energy. Generating and expanding the hyperspace field takes gobs of energy. Recharging the K-F drive usually takes seven to ten days, depending on the star used, and that process often requires a near-perfect photovoltaic collector—the so-called “solar sail”—about a kilometer in diameter. In addition to sending the JumpShip into another star system, this energy input is used to adjust the JumpShip’s velocity to match the velocity of the destination jump point and to annihilate any matter at the destination.

I’m supposed to talk about the fusion drive here, but I already mentioned it...except for the fuel. If you’re curious, JumpShip fusion rockets use hydrogen for fuel and reaction mass, just like most other spacecraft. They typically carry a few hundred tons. While this engine can recharge the drive, oddly enough, not many JumpShips actually carry enough hydrogen to pull this off. If you need to quickly charge off your engine, you better hope you’re carrying some DropShips with spare hydrogen or that there’s a recharge station nearby.

Solar sails, also called jump sails: same thing. Big disks of light-collecting material just fractions of a millimeter thick, coated with photochemicals that respond to all significant electromagnetic wavelengths produced by stars. They’re soot black and hardly

reflect anything, not even radar, so it’s not unusual to hear about some small craft flying through the sail of a JumpShip, especially when the sail’s navigation beacons and reflective strips are in poor shape. Sails are only deployed when a JumpShip is parked at a jump point because any real acceleration will rip them apart. The advantage to sails is that they give JumpShips almost limitless endurance and greatly accelerated human colonization when they were introduced in the 2200s. The first sails were giant arrays up to 50 kilometers in diameter, but they have shrunk considerably to an average of about 1 kilometer. These giant foils typically take about 80 minutes to deploy and 160 minutes to retract, and each operation carries the risk of tearing the fragile sails.

At a standard jump point, jump sails dangle under the JumpShip facing the star, pulled down under by their own weight. Yes, weight. The zenith and nadir points aren’t in orbit, hence the station-keeping drives that keep JumpShips from plummeting into stars. (The fall typically takes years or even decades, but spacers love to frighten novices with the risk of stellar incineration.) Solar sails offer no propulsion to speak of—they’re not real sails, and light pressure is usually much weaker than stellar gravity at standard jump points. And before you ask, the solar wind is even weaker than light pressure. So all those flashy pictures of JumpShips with billowing sails and roaring engines? Those are just JumpShips holding station with the sails drooping under them, trying to avoid plummeting into the local star.

A few Inner Sphere JumpShips and a lot of Clan JumpShips pack a system known as a lithium-fusion battery. This reactor stores a lot of energy that can be dumped to power a second jump moments after a first. As cool as it’d be, though, it’s not feasible to

METEORITE DEFENSE

A great majority of defense against minor space debris is provided by the magnificent materials that clad modern spacecraft. A typical transit from jump point to planet will entail a peak velocity of small percentages of light speed, which means any speck of dust would be a vicious threat. And if space dust is mean, "space pebbles" and "space gravel" are very serious threats.

Natural debris in space is not made of materials as impressive as modern manmade armors. Icy specks are the norm in the outer system, bits of rock dust, or soft carbonaceous chondrites would definitely lose any normal contest against hull materials if it were not for their extreme speed. Just like lead bullets can punch through harder, stronger steel when propelled to high velocities by gunpowder, and just like the paper wadding of "blank" gun cartridge can punch through a skull at short range, fragile space debris colliding with a fast-moving spacecraft can rip through the strongest of materials.

The preferred means of dealing with space debris is to avoid it. Bigger debris—gravel-sized and larger—can be spotted by radar and avoided except by the fastest-moving spacecraft.

After avoidance comes deterrence: shooting the debris before it gets to the spacecraft. A relatively small amount of energy input from a laser will evaporate most micrometeorites and will ablate enough material from slightly larger bits to deflect them—action-reaction isn't limited to purpose-built rocket nozzles. For this reason, spacecraft tend to be dotted with low-output lasers.

Those lasers might blind an unprotected human, but otherwise they won't do more than scorch your skin or burn the paint on a spacesuit...are spacesuits painted? Anyway, space debris is, like I said, not exactly tough stuff and most of it is smaller than a fleck of paint—smaller than the fleck of paint or skin the lasers would burn off you. Owing to various arms control laws, occupational safety regulations, and paranoid governments, the standard anti-micrometeorite laser is thus not a serious threat to space-suited humans but significantly reduces the maintenance expenses of spacecraft.

Of course, the lasers and dodging aren't perfect solutions, which means armor still ends up playing the primary role in protecting ships from debris.

mount more than one lithium-fusion battery on a ship. A quick double-jump isn't good for a K-F drive, so standard practice is to space out the jumps every few days. Over the long haul, this still amounts to a doubled rate of travel.

The lithium-fusion battery is charged much like a K-F drive, and the K-F drive and lithium-fusion batteries cannot be charged simultaneously from one power source. You'll need a second power source—sail, fusion engine, or recharge station—to charge the lithium-fusion battery and K-F drive simultaneously. If you use one power plant to sequentially charge the drive and battery, you'll lose your doubled movement rate over long distances.

Quick Charging

Speaking of charging, let me clarify something here about the fusion power plant and other power sources for

JumpShips. There are basically three ways to recharge the K-F drive: using the solar sail to collect sunlight or to receive a beamed microwave transmission from a recharge station; using a direct cable connection to a recharge station; or using the JumpShip's own fusion engine. And you know what? Any of those can fry a K-F drive. It's not just a fusion engine that can damage the drive. A recharge station can quick-charge your JumpShip, but doing so can fry the drive, too. Solar sails at bright stars, or in positions closer to stars than standard jump points, can also fry the drive. You've got to watch that inverse square law about sunlight. Example: a habitable planet for a yellow star is about ten times closer to the star than the jump points. If you deploy your sail there, you can get one hundred times the power input. That'll let you charge the drive in about two hours by sail, but there won't be much drive left to use, so it'd be wise to keep the sail power converter output throttled down in a bright system—you don't have to let in every joule from the sail, after all. The flip side to this is that any power source that takes a sufficiently long time will not risk drive damage. It's just as safe to use a fusion engine as a solar sail if you take about 175 to 180 hours during charging.

Weapons Systems

Okay, I can get this one over quickly and get us back on schedule: JumpShips don't carry weapons. Oh, you'll see a couple of "anti-meteor" popguns on some ships that can scorch the armor on a fighter, but most JumpShips don't bother. That's because if they start shooting at something that can shoot back, the JumpShip usually loses. I've heard the Clans do different, but I'm not sure why they would. And, for the record, real anti-meteor defense is performed by little "weapons," laser emitters smaller than pistols that are a standard spacecraft feature and that can't puncture a combat space suit, so take the *Invader*-class JumpShip's claims to pack a pair of PPCs or lasers for "anti-meteor" purposes with a grain of salt. The *Invader's* just being silly and trying to invite a serious attack.

Control Systems

You already know that the ship's controls and crew quarters are in the nose bubble of JumpShips. The bridge is kind of interesting. In micro-G operations and even milli-G station-keeping, you can arrange control stations at all sorts of angles. A lot of JumpShip designers like the idea of clustering crew together for quick interactions rather than satisfying planet-based psychological needs of a constant "up" direction, so you'll see some crew stations on the "roof" of the bridge, over the heads of other stations. When the JumpShip fires up its station-keeping drive to a higher level of power, alternate crew stations on the "floor" need to be used.

JumpShip bridges are generally larger versions of DropShip bridges, though they do have to address hyperspace navigation. Incidentally, should the nav computer fail, it's possible to manually calculate jumps, at least from standard jump points. (I say "manually," but trust me, the navigator will be burning out a hand noteputer's battery.)

Grav Deck

Most large JumpShips (100,000+ tons) have a gravdeck that...you know, I'm running short on time. I'll address gravdecks when I get to space stations. No need to be redundant.

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Cargo Section

Standard JumpShips are too optimized to carry a lot of cargo. They'll carry a few hundred or thousand tons, but most cargo capacity is left to DropShips. The cargo that a JumpShip carries is generally for its own needs, like spare parts, food and extra fuel. It's not very efficient to store commercial cargo on a JumpShip, since you still need a DropShip to carry the goods to market. I've seen some interesting papers about compact core freighters showing good profit margins, but today that's just theoretical nonsense given the rate shipyards and WarShips are being blown up. That might've been different during the original Star League, but I'm not sure non-standard core freighters did well in the face of the all-dominating standard core/DropShip combination even then. So the way most JumpShips haul cargo is with their docking collars, in the form of DropShips.

WARSHIPS

WarShips. I bet you're hoping I'll say a lot about these awesome military leviathans, aren't you?

Unfortunately, there's not a lot more to say about WarShips that I didn't cover while talking about JumpShips. They use a more compact, efficient K-F drive that can haul a substantial amount of integral spacecraft systems in addition to the typical DropShip payload. With that carrying capacity, they mount bigger fusion drives that allow DropShip-like maneuverability, armor that can shrug off small nuclear weapons and guns as massive as DropShips that fire mammoth projectiles traveling at tens and hundreds of kilometers per second.

While a JumpShip pares itself down to a bare minimum, a WarShip has enough mass and volume to bury core systems deep in its interior. The K-F drive still runs the length of the ship, but is hidden behind layers of armor, decks and secondary systems.

Speaking of decks, I've noticed some of Kaumberg's armchair admirals have been proposing fanciful super-battleships that the Lyran Alliance should build to drive the League and Blakists out of our space. Never mind how incredibly expensive and difficult it is to set up a shipyard, and never mind the WMD-magnet Kaumberg would become if we hosted such an exercise. Remember Alarion, folks? Most of these people reveal the shortcomings of their own knowledge when they portray WarShips with long, horizontal decks, as if a WarShip is a wet navy vessel that just lifted into the sky on fusion rockets. No, sorry. You need to remember that "down" for a WarShip under thrust is in whatever direction its engines are pointing, and "up" is where the nose is pointing. WarShips are built like space-going skyscrapers, with dozens and even hundreds of decks built perpendicular to the K-F drive core.

This of course begs the question of why WarShips, when viewed from the exterior, have viewports that suggest an interior perpendicular orientation to the direction of travel, like wet-navy vessels. That, students, is a classic example of every navy across the known universe being the most hide-bound institution in existence. There are naval customs that stretch across millennia all the way back to the age of sail on Terra. Why should construction be any different? When the first WarShips took flight, the navy and its centuries of tradition insisted that the viewports remain perpendicular to the vessel itself. Now from the interior, this orientation has no bear-

ing. A viewport is a viewport, regardless of its size or shape. Only from the exterior do the un-initiated become confused over why a "skyscraper" has viewports that make it look as though its decks should be perpendicular rather than horizontal. Even as factions refitted their WarShips through various "Block I", "Block II", "Block III" upgrades, and so on, across the centuries (often resulting in a silhouette of later Blocks bearing little resemblance to the original vessels of the same name) this design philosophy remained true. An oddity more firmly entrenched in naval construction than any religious dogma.

Incidentally, this interior arrangement is why few WarShips will carry DropShips under thrust. DropShips are built to make transits from jump points to planets anyway, and depending on how they dock to a WarShip, their decks may end up at very odd angles when the WarShip is accelerating. Not to mention the risk of tearing off at the docking collar—DropShips are tough, but not all of them are meant to dangle from their docking collars.

Anyway, there are a couple of reasons for the long, somewhat narrow shape of WarShips rather than adopting a structurally efficient spheroid shape, like the experimental Fox hull form. The K-F drive is one; it still dominates WarShip shaping. The other is a matter of defensive architecture. A slender WarShip aimed head-on at its foe hides most of its critical systems behind the full depth of bow armor and tens, even hundreds, of meters of top—or front, in other words—decks. Furthermore, the narrow frontal profile maximizes the thickness of a given weight of armor. These benefits go out the door in the normal broadside engagements between WarShips, but again, WarShips aren't water-going naval vessels. Unless they have a pressing reason to use their engines in another direction, they can usually pivot to keep their bow toward a threat. It's not like a frictionless vacuum is going to force them to "sail" nose-forward.

Another advantage to a long, slender layout is that you can pack more guns along those long sides than in the bow. In fact, a majority of WarShips are optimized for broadside engagements. The *McKenna* and *Black Lion* classes are notable examples. Unlike the archaic "Age of Sail" broadside engagements that often entailed two forces moving in parallel columns to trade fire, WarShips often select a heading toward a foe to shorten range and thus improve accuracy, begin coasting, pivot to present a broadside toward a foe, then trade fire during the approach. If damage gets too heavy on one side, they can roll to present the undamaged broadside. If they pass the target before destroying it, they have the backward-aimed broadside ready to continue shooting until the captain decides to reverse heading. That sort of approach could be performed with nose and stern weaponry, too, but any flip to present a ship's stern toward the foe sharply increases the chance for engine damage.

Instead, nose and stern armaments are more often used by ships seeking a fleeing foe, or by ships trying to avoid combat by thrusting away from battle. You might note that some ships, like the *McKenna* and *Aegis*, do have more stern weaponry than bow—if they can't engage broadside, they're probably trying to run away.

What other differences from JumpShips are there? Well, WarShips tend to have much larger cargo bays than JumpShips. The Star League was truly silly about this, but its WarShips spent much less time—much, much less time—shooting other spaceships than delivering supplies to mammoth occupation forces spread across thousands of Periphery star systems. Also, the Star League came from an

era where orbital bombardment techniques were much more sophisticated than they are now. This century's WarShip crewmen are out of practice and they can't depend on having a dozen other WarShips covering other regions of a hostile planet, so they have to put their ships into handy orbits, often polar orbits, which cover most of the planet but leave only brief windows for bombardment. The Star League, though, was known to have a WarShip brake to a halt in space over a target and hover for hours on end, and it could use other ships in the fleet to cover the rest of the planet in case of simultaneous conflicts elsewhere on the planets. Bombardments from one of those hovering monsters wouldn't just level cities and armies, they

could also remodel the landscape. The Terran Alliance's Admiral James McKenna famously demonstrated this by obliterating an island to launch his very successful military coup.

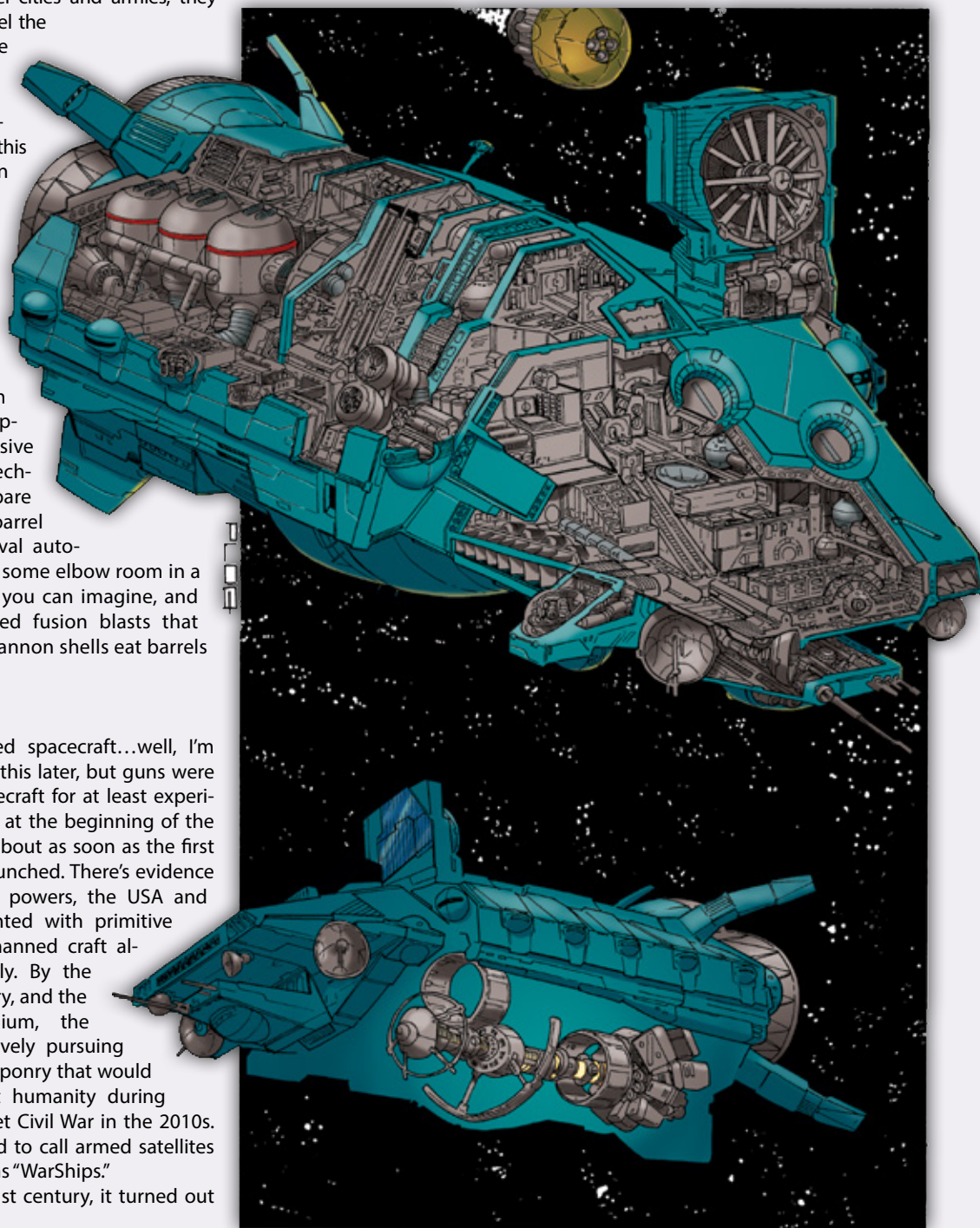
Of course, doing this sort of thing takes lots of ammunition. And spare parts, I'm told. Capital weapons are very abusive of their own mechanisms. A spare thousand-ton barrel of a class-40 naval autocannon takes up some elbow room in a ship, as I'm sure you can imagine, and the laser-triggered fusion blasts that fling naval autocannon shells eat barrels like candy.

WarShip Origins

The first armed spacecraft...well, I'm going to discuss this later, but guns were going onto spacecraft for at least experimental purposes at the beginning of the Space Age, just about as soon as the first satellites were launched. There's evidence that both major powers, the USA and USSR, experimented with primitive guns on their manned craft almost immediately. By the end of the century, and the Second Millennium, the US was aggressively pursuing space-based weaponry that would serve to protect humanity during the Second Soviet Civil War in the 2010s. However, it's hard to call armed satellites and space stations "WarShips."

Later in the 21st century, it turned out

that the fusion revolution that made spaceflight so simple also allowed spacecraft to be used in criminal acts. For example, remote facilities abandoned by their owners, sometimes with workers still in them, sought to survive when isolated. Lacking money to buy the supplies and parts they needed, they turned on their neighbors. Thus space piracy was born—and you thought pirates needed JumpShips. The Terran Alliance responded with armed spacecraft that were somewhere between a small craft and small DropShip, by modern standards, and could probably be shot apart by the guns of a merchant cargo DropShip today.



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Speaking of WarShip roles, some people might talk about different WarShip “classifications.” What are these classifications? Terms like, “cruiser,” “corvette,” “frigate,” “battleship” and many others that armchair admirals like to hang on WarShips, hinting that these WarShips play some special role. But all the volumes of pontificating on WarShip classifications bear little resemblance to reality in the 31st century. The actual applications of WarShips in the past two decades have often varied substantially from their grandiose planned roles. Escorts, multi-role cruisers, carrier-killers...all nice and well, but most WarShips have been used in the same fashion: as capital weapon platforms for aerospace superiority, as bombardment units and sometimes as troop transports. They’re apparently supposed to show up, kill everything in sight and maybe blow something up on the ground.

Modern usage of WarShips is kind of like a lance of light pirate ‘Mechs dropping on a very backward Periphery planet with only primitive tanks and infantry for defense: the ‘Mechs are used arrogantly, as if they are the kings of the battlefield, and pressed into the “kill ‘em all” role without consideration for their design specs.

A few decades later, humankind was beginning to settle the stars and the Alliance’s leadership began worrying about how it would control all those future colonies. The solution was simple: a Navy. In 2120, the Navy received funding for six military JumpShips over ten years. The first, the *TAS Charger*, was completed in 2122. The *Charger* could probably be called “an armed JumpShip,” since it lacked the modern features that define a WarShip, primarily a true compact core. Like many early JumpShips, the *Charger*’s core was smaller than those of modern standard JumpShips, but it was also a less capable drive.

The heady days of freedom from Terra lasted until April of 2128, when the colony ship *Liberator* jumped from Terra and was never heard...oh, wait, the *Liberator* was just found a few years ago, wasn’t it? But at the time, the loss of hundreds of colonists and the JumpShip was a disaster that prompted the Alliance to crack down on wild colonization efforts. All colony ships would be escorted by the new Terran Space Navy, and all colonies would receive Alliance governors. Still, this Navy was not equipped with true WarShips—yet.

That revolution came with the development of the compact K-F core around 2300 C.E., which reached a new height in K-F drive weight efficiency, if not cost efficiency. The Terran Alliance wasted no time but a lot of money combining this new technology with existing capital weaponry, the naval autocannons, and breakthroughs in weaponry like naval lasers. The first true WarShips were thus introduced in 2300 C.E. with the *TAS Dreadnought*. For those of you who don’t have your noses buried in military history books, a namesake of the *TAS Dreadnought* revolutionized oceanic battleship design almost exactly 400 years before the Alliance’s WarShip was launched, and the naming of the Alliance’s new toy was not coincidental. The first significant combat action by WarShips would be to launch McKenna’s coup and topple the Alliance government, to be replaced with McKenna’s Hegemony.

After that point, changes were a matter of evolution and technology refinement. Some of the oldest WarShips, like the *Aegis*, remained in effective service until the present day.

Now, if the ship has been called a “battleship” or some kind of cruiser, then “kill ‘em all” is not far off from its intended role. But when corvettes and destroyers are being forced into that sort of duty, then you know no one’s really paying attention to the owner’s manual. And all the folks who are using WarShips with minimal fighter and DropShip support are ignoring their tactical manuals. You don’t use WarShips alone anymore than you use tanks without infantry in an urban environment.

I won’t name names, but any nation using *Fox*-class corvettes as the primary aerospace defenders of key planets is a great example of modern WarShip usage. Or mis-usage, maybe. You can’t really fault those nations, though. It’s not like they have a lot of other WarShips they could use.

For better or worse, the only folks who have enough WarShips to use them in proper fleet actions with the ships sticking to their designed roles either aren’t doing so (Ravens and WoBblies, I’m looking at you) or have had their fleet come apart at the seams along with their nation.

Why Build WarShips?

On the face of it, this is almost a silly question. WarShips are big. WarShips are awesome. WarShips have huge guns and thick armor. WarShips, dare I say, are sexy. Why wouldn’t *everybody* build WarShips if they could?

In fact, if you notice how rapidly WarShips are being destroyed, you might start to wonder about their utility. They *can* be replaced by other units, like fighters and assault DropShips, in most applications, though sometimes WarShips’ replacements have to struggle. The largest problem, in the opinion of this armchair admiral, is that WarShips are rarely utilized properly. Indeed, the reason behind most WarShip programs of the Inner Sphere boils down to “national pride” and (especially) “because the other guys are doing it.” For example, does everyone remember Tharkad’s rhetoric about “a cruiser gap” after the Alliance seceded from the Federated Commonwealth? While the resulting battle cruisers are impressive ships by many standards, our government took a very sensible light cruiser design—sensible for reasons I’ll discuss below—and turned it into the *Atlas* of cruisers, just so there’d be no doubt who had the best cruiser. There are endless performance-based justifications for the final form of the *Mjolnirs*, but if you look at the contemporary ranting coming off of Tharkad, you’ll see that the reasons were political. The hasty upsizing of the *Mjolnir* caused some problems, too, like the goofy mix of three different autocannon calibers and unnecessary “mine’s bigger than yours” naval Gauss rifles.

Another crass offender in “national pride” and “because the other guys are doing it” is the Capellan Confederation. The Confederation threw away any coherent naval build plan just to get out some WarShips, any WarShips, and if you look at the design of the *Feng Huang*...well, look at the Capellan propaganda that calls it a “*Thera* killer.” It’s nothing of the sort. Oh, the basic engines and armor have potential, but it can’t fight its way out of a wet paper bag. It would make a decent light task force transport with the collars, sort of like a plus-sized *Fox*, but no Capellan admiral is going to admit that their *Thera*-killer is better utilized as a tougher *Star Lord*.

Now, the Federated Commonwealth, Free Worlds League and Draconis Combine all jumped into the WarShip program because “all the Clans were doing it,” and they actually had good justifications behind that excuse. They were so inexperienced with WarShips that they overlooked a premier defensive WarShip killer—aerospace fighters—and sought to build WarShips of their own. And given the fighter-deficient designs that the Clans were using, building WarShips to kill WarShips was reasonable, and opened up all the potential side applications for WarShips. The first four invading Clans had about three score WarShips between them, and it seemed almost feasible to build enough WarShips to match that threat, though that never quite happened. Certainly not as planned.

With that said, those nations give some good examples of why WarShips are built, and how grandiose plans for an epic fleet can go awry. The Federated Commonwealth’s production of...how many? almost two dozen?... *Fox*-class corvettes is a good start. The Federated Commonwealth and its successors built more than twenty of the ships. Anyway, while the Houses had been poking at the compact K-F drive data from the Helm memory core for a couple of decades, the Clans scared the Federated Commonwealth into moving on WarShips quickly. Despite the time pressure, Hanse Davion respected his engineers when they said, “You’re asking a lot, and we don’t know squat. We need a starter design,” so he let them build the *Fox*. Or the RX-78, as it was known at the time, with “X” for “experimental.”

The *Fox* was really an intelligent design from an industrial and engineering standpoint: it was small, had a small crew, a small array of light capital weapons, small engines, a spheroid-like hull and a small compact core, all of which made it easy to design and mostly within the limits of FedCom industry to produce. The RX-78’s blueprints were done in under eighteen months, which is pretty damned impressive when you consider how inexperienced the architects were, and how well the *Fox* functioned compared to its often-flawed contemporaries. Construction of the first ship was understandably slow due to shipyard inexperience, but the real delays were caused by terrorist attacks and ComStar’s little snit that held up key engine components. Subsequent ships in the class would be built quite quickly. Individually, they took about eighteen months, like civilian JumpShips of similar size, and parallel production in multiple shipyards meant better than two per year were launched in the 3060s.

Within the dates lies the catch, though: the world outside the AFFC Navy didn’t stand still. The “*Fox* as a starter ship” plan didn’t last. The anticipated *Avalon* cruisers, which would be the first “real” WarShips of the AFFC, were delayed, and delayed, and delayed some more thanks to AFFC reconstruction expenses. The *Avalons*’ escorting assault DropShip squadrons certainly never got built. The *Mjolnir* light cruisers, the intended sidekick for the *Avalons*, were hijacked for another role and lost to the other side in the civil war. (By the way, that example should make clear that the Federated Commonwealth had a good *theoretical* understanding of how to build a fleet—it’s not all about big WarShips, but their supporting elements, too.)

While the *Avalon* was floundering, the *Fox* was almost bug-free and most of its epic start-up costs were paid off. It didn’t cost much more to keep the *Fox* in production than it did to

keep all the specialized, *Fox*-related shipyards and factories idle but operational. People wonder why three militaries—the AFFC and its estranged children—built so many “popgun corvettes that cost more than a *Mjolnir*,” but that’s only the flyaway cost, the cost of the labor and materials that went into one ship. That amount is the tip of the iceberg in WarShip production costs. Getting started, building and sustaining all those specialized factories that have no other customers, designing the WarShip and researching new technologies for each new class, building the supporting fighters and DropShips...that’s where the money goes for each new design. Very few new Inner Sphere WarShip designs reached that level of mass production. Two *Mjolnirs* certainly didn’t, and the *Avalons* were only just getting there when they were largely exterminated.

That all might make sense for bean counters and industrialists, but any admiral is going to wince when he’s stuck with so many undergunned “WarShips.” And *that’s* how a decent WarShip fleet plan can go awry.

If any House got it right, it was the Mariks. Despite all the upheavals of the past two decades, they stuck to the plan to defend against a Clan invasion and built the foundation of a real fleet, one that could challenge any single Clan’s fleet. Or a couple, honestly. They built in quantity, they established shipyards for all necessary supporting ships, they set up the academies, and held the line through every parliamentary budget review. It was a fantastically expensive undertaking. Their core ships, the *Theras*, were even a quite reasonable design for fighting other WarShips. The *Impavido*, *Agamemnon* and *Eagle*...well, their hearts were in the right place as *Thera* support units, even if they could’ve taken lessons from the *Feng Huang*. If the League had gotten to 3080 uninterrupted, its Navy would’ve been scary.

Especially if it upgraded the *Thera*’s sidekicks. My pet upgrade recommendation: a coat of paint would double the armor thickness on the *Aggies* and *Eagles*, and it’s a cheap upgrade.

As an aside, it’s kind of a shame that the *Mjolnirs* never got anywhere. Even as Freudian pacifiers for politicians’ inadequacies, they had real potential. They were cheap per unit for a ship their size, and they had almost all the right features to make a serious pocket battleship. Given some *Vengeance* escorts and another ten years of production and they would’ve been the start of a good foil for the Free Worlds’ Navy, and would almost certainly overmatch the Falcons’ fleet. I think we would’ve gotten there, too, since whatever competency problems we Lyrans have with our military leadership doesn’t carry over to our industrial know-how. “Mass production” is as natural to Lyrans as breathing.

To answer my second question, some people shouldn’t bother with WarShips. The Taurians would be better off buying up fighter-carrier DropShips and expanding their fighter production than wasting fortunes on that ancient WarShip they’re trying to resurrect. The Capellans and the Combine should take a step back and consider useful applications for WarShips, rather than building ships without real tactical roles, or changing the roles after their WarShips turn out to be riddled with technical

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flaws. Even the WarShip-intensive Word of Blake kind of missed the boat on the potential of WarShips by pissing them away in dribs and drabs.

HYPERSPACE

Here's some background on something shared between JumpShips and WarShips: hyperspace.

We wouldn't be here today if Kearny and Fuchida hadn't figured out the basic idea of moving matter into, and then back out of, hyperspace. Jump travel does not involve wormholes, or somehow ripping holes between two points of the universe and stepping through, or travel through some alternate "dimension"—to use the science fiction term for another plane of existence—at faster than light speeds. Jump travel entails a transformation of the ship through hyperspace, and I mean hyperspace in the classic mathematical-topographical sense.

To borrow the classic "flatland" example: imagine that a 2-dimensional creature skittering around its flat world bumps into a wall. The only way the flat creature can conceive of passing this wall is to break through or go around it. But then Flat-Kearny and Flat-Fuchida come along and say, "We've got a better idea: stand up, into an extra dimension, this hyperspace we call 'the third dimension.' Then you can go *over* the wall much faster than going around it or through it. When you're on the other side, you can lay back down into your normal two-dimensional world." Then the Flat-Kearny and Flat-Fuchida get laughed out of their flat research jobs and are forgotten until 80 years later when other flat scientists realize they were right all along, and finally make a flying machine that can move vertically, utilizing this "hyperspace" that is the third dimension, and bypass that wall.

That's what the Kearny-Fuchida drive does for us. A JumpShip rotates into a hyperspace configuration and can then pick a new place to "rotate" back into our normal three spatial and one time-like dimensions. It generates a "hyperspace field" that encompasses a volume of space and mass, as shaped by the drive core and K-F booms reaching to any attached DropShips, and transforms this to a new location almost instantaneously.

Of course, it's much easier to call this a "jump" or imagine you're somehow making a "tunnel" through space than to deal with hypersurfaces and hypervolumes and all the other fun of hyperspatial mathematics.

The first JumpShips were limited to "jumps" of eighteen to twenty light-years, though this rapidly reached the modern thirty light-year limit imposed by exponentially increasing energy demands. During a jump, a ship accomplishes a number of feats beyond "mere" travel between points that could be kilometers or light-years apart.

K-F Drive Damage to Nearby Objects

The first feat is that the hyperspace field forms at the destination and performs an incomplete "transformation" on any matter within the destination field—it converts this matter to energy in a process that is drawn out and red-shifted into the distinct infrared glow of an arriving JumpShip. This is done because space is pretty empty, but not completely empty. Without this annihilation, ships and crews would be riddled with space dust. No, this would not produce an enormous explosion—matter is mostly empty space, so there's plenty of room to briefly overlap two objects. Electrostatic repulsion forces will shove "interpenetrated" atoms back to appropriate spacings immediately, but this effect

REPAIRING STRANDED JUMPSHIPS

Bringing replacement drive parts to a crippled JumpShip is problematic. Many components of a K-F drive are easy to deliver, like the helium tankage, K-F controllers and K-F initiators, but the problem child is the big one: the core. This behemoth component is cast at the shipyard as a single, woven, giant element. Because it will interfere with a hyperspace field whether it is powered or not—like a bar of iron in a magnetic field—the only way the core can travel between stars is under its own power. The only other way to transport a K-F core is to fragment it down to gravel and, preferably, chemically process the titanium-germanium material into something less likely to interfere with a hyperspace field. Then you need the full facilities of a shipyard, or a yardship (which are incredibly rare), to recast the core, which can require many months. Most of that's spent cooling the core without fracturing it.

Is it worth it? It's not a technologically futile exercise to transport new cores to a stranded JumpShip, not always—if you have a spare core. But it's often less expensive to buy a new JumpShip than to pay for the salvage operation. Unless, as in the Succession Wars, any JumpShip is precious. And JumpShips are designed to replace their cores if need be, though that entails ripping open one end of the ship or the other and pulling out the core. Ships are sometimes designed to remove surprisingly large sections to get at cores. For example, much of the bow section might be mounted in an easily removed module, kind of like the "tilting cabs" on large trucks. The usual means of transporting a core is to build it up to a complete drive—controller, initiator, tankage and all—and put a very lightweight transport shell around it, a sort of shipping container for K-F cores. I mean, you don't *need* the shell, but K-F drives don't like micrometeorites and the temperature extremes of space. Then the drive is delivered by a tender ship, another JumpShip that recharges this "naked" K-F drive and programs it for jumps to the destination. Obviously, the tender has to move out of the way for the replacement drive to jump, and then it follows. Finally, this new core has to be installed in the stranded ship. It's a lot of work and, prior to the Succession Wars, was primarily performed for WarShips.

JumpShip salvage tends to work the same way. You bring just enough parts to get the JumpShip hyperspace-mobile again and send it to a shipyard for repairs. Otherwise, about all you can do is shred the core for raw materials and salvage what other parts will fit in your holds.

by itself is not a serious problem. The problem is that human cells, K-F drive cores and computers can be wrecked by suddenly being laced with space dust and solar wind particles. Any explosions resulting from a JumpShip landing on top of other mass is strictly a result of the hyperspace field's annihilation process.

There is a "choke limit" to this annihilation process, since the K-F drive doesn't have infinite power to convert matter to energy. It's actually in terms of kilograms, which is far more than enough to clean out the stray atoms at even a dusty jump point, and the destruction takes place over many seconds so there isn't an enormous explosion. You likely all know the famous example of the *Mississippi Queen*, an SLDF corvette, arriving atop the *Richardson*, a transport, during the Liberation of Terra that involves a dramatic

explosion, but this illustrates the choke limits. The *Mississippi Queen* arrived with her nose inside the tail of the *Richardson*. Were matter annihilation unlimited, the entire SLDF fleet would've been wiped out by thousands of tons of matter converting to energy. The explosion actually resulted because the machinery in the stern of the *Richardson*—including an autocannon magazine and the ship's fusion reactor—did not take kindly to sharing their space with the structure of a corvette. The *Mississippi Queen* survived the explosion and was able to clear the jump point under its own power.

The real damage done by an arriving or departing JumpShip is to objects caught by the "space warping" effects of the hyperspace field. The ship is trying to "rotate" a volume of space through hyperspace, but can only do that accurately for mass that it is aware of. This is accomplished with the K-F core, which has branches that "map" the mass in the ship, and extensions through docking collars and into DropShips. Mass that the K-F drive is unaware of—such as a nearby fighter—generally gets treated as empty space, not as a complicated aerospace frame and human pilot. Sometimes nearby masses get carried with the jump, sometimes they don't, and often they are only partially carried through the jump, inflicting immense—but sometimes survivable—damage.

While a DropShip, fighter or free-floating spacer in a suit might survive a nearby jump, other K-F drive vessels are in for a very bad experience. As I said, hyperspace fields are formed in anticipation of mass that they're aware of. Also, the K-F core of a drive is meant to form, shape and manipulate hyperspace fields. So when a hyperspace field forms and a "foreign" K-F core is in it, you get a mess for both ships. It's a miracle the *Mississippi Queen* was able to maneuver at all, since its core would've been ruptured by drive interaction with the *Richardson's* core. The *Queen* certainly never jumped again.

This leads me to the story of the Ryan Ice Cartel "iceships." These were fleets of sixteen JumpShips that arranged themselves around several cubic kilometers of ice, over 5 billion tons, and jumped together. The key to the success of this operation was that the K-F drives of these ships "talked" to each other (via laser links, typically), so they knew to adjust their fields in anticipation of nearby hyperspace fields and K-F cores. Though they did not have a perfect "map" of the iceberg they were carrying, the frozen water was quite homogenous, so it was safe to use an approximation of its structure when the fields formed. The iceberg was still wrapped in netting and a sunshield because, more often than not, it was shattered by the jump, but almost all the water would make the trip in a manageably semi-intact mass. The iceships understandably used modified K-F drive controllers and unique, very complex navigation calculations, so this is not a stunt that just any JumpShip can accomplish.

Because of the risk of drive interactions, even in the vastness of standard jump points, most civilian JumpShips will maneuver slightly inside the proximity limit of a star before they begin charging. This is where jump point stations usually keep station, too.

Similarly, drive interactions mean that crippled K-F drive vehicles have to be repaired on site. There is no way to "jump" a disabled JumpShip with another K-F drive vessel—the process will destroy both. Ships that cannot be repaired in the field are generally abandoned or even dropped into the nearest star.

JumpShip Gymnastics

A jump alters more than position, it alters velocity. A JumpShip arrives stationary with respect to its destination jump point. This entails substantial changes in velocity, since stars may be moving at tens of kilometers a second with respect to each other. A JumpShip using a non-standard jump point may be circling a moon, star and planet for additional complications in velocity relative to the destination. These complications are part of the reason that it's easiest to calculate jumps to and from the "standard" jump points over a star's north and south poles—you only have to worry about the motion of the star with respect to the destination star. Excess velocity is dumped by the drive in the form of infrared radiation, which contributes to the IR signature of an arriving JumpShip.

On the other hand, you do not have to be stationary with respect to the jump point when you make the jump. WarShips can and have jumped after burning non-stop to jump points. This is possible because the ship has a good idea of its own movement and the upcoming gravitational fields where it will jump, so it can plan the moving jump accordingly.

Now, about facing...yes, question? What? No, they can't do that. All right, for those of you who didn't hear, the question was, "Since JumpShips can adjust their velocity during a jump, can they pop out of a jump point with some extra velocity?" That's a good question, but the answer is no. A forming hyperspace field is very sensitive to gravitational gradients and there's a deliberate feedback process to help the drive's controller know if the hyperspace field forming at the destination is matching the velocity of the destination jump point. If it's not, the hyperspace field will be moving through a changing gravity field, which makes it nearly impossible to form the hyperspace field correctly. And, no, contrary to what I said earlier, jumps aren't actually instantaneous; they just seem that way. There's a brief period for the drive controller to accept certain feedback, like recognizing a gravity-distorted field via the Brandt Recoil effect or damage in the core from quick-charging.

The process of translating a ship from one position to another does open one interesting option: you can re-orient the ship during the jump so that it is facing in a new direction at the destination. A JumpShip will normally retain its original orientation. If the JumpShip's nose was pointed coreward at the origin jump point, it will be pointing coreward—allowing for the trivial lateral displacement of the jump—at the destination. That's the default—if a captain wants the ship to flip around to be ready to burn clear of a jump point immediately upon arrival, then that can be worked into the calculations.

Jumps are a surprisingly accurate and precise means of traveling. Civilian ships with lazy navigators average a 5,000-meter spherical error of probability, while military ships usually manage 500 meters with their fancier navigation systems. Of course, as they say, "Garbage in, garbage out." A navigator that feeds in the destination incorrectly can cause a bad misjump by many AU—and human error is most responsible for misjumps. Misjumps of light-years have been reported, usually accompanied by notices that a ship is taking applications for a new navigator.

What other tricks are notable about jumps...ah, range. While thirty light-years seems to be a fairly hard limit, it is possible to jump much shorter ranges. The first jump with a ship—that is, something larger than atomic particles in a

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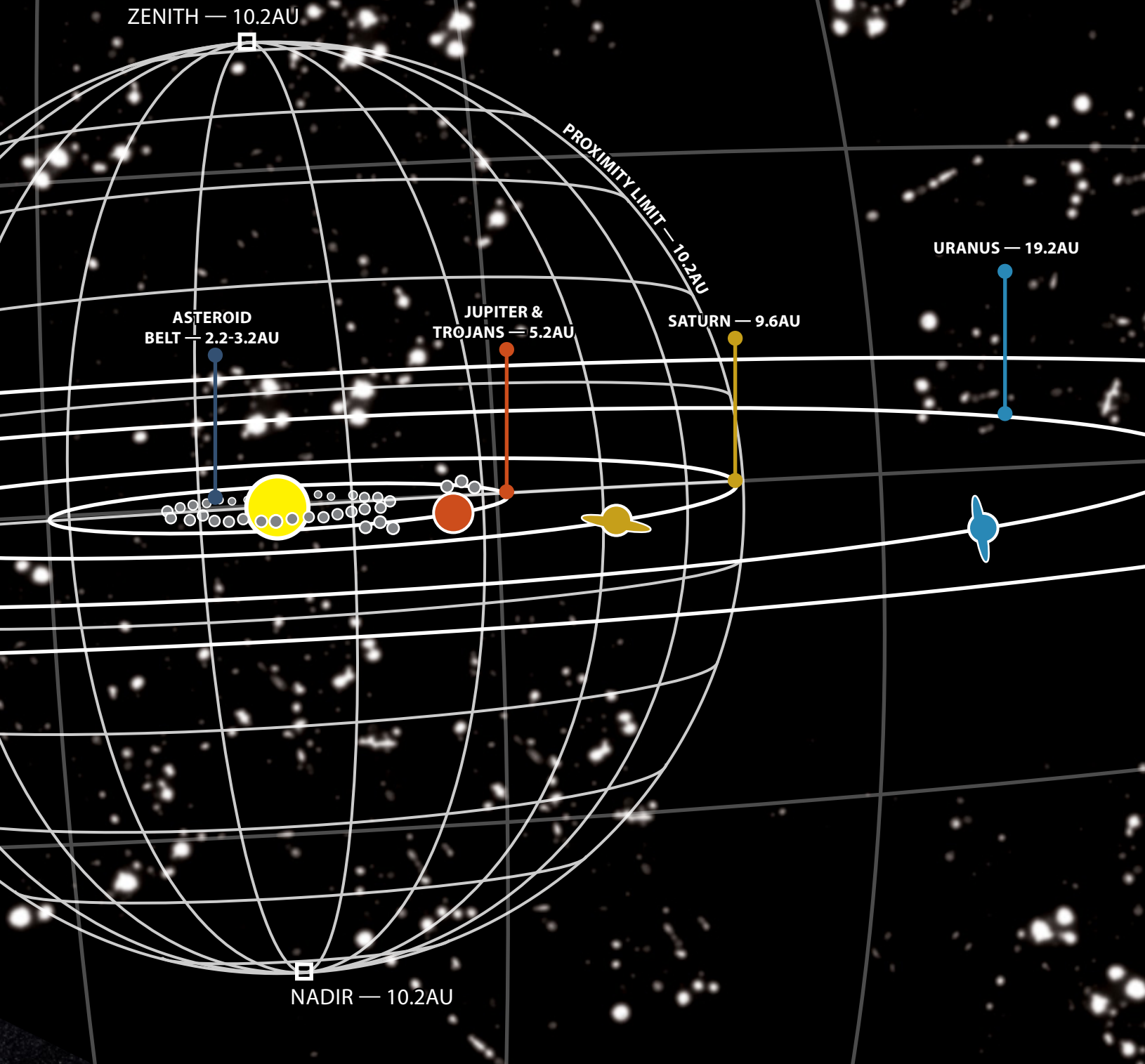
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TERRAN SYSTEM NAVIGATION

A CLOSER LOOK



TRANSIT TIMES

This image demonstrates transit times between the various planets and significant debris belts of the Terran System and valid jump points. The Transit to Zenith/Nadir Points column provides the transit time, in days and millions of kilometers, to the standard jump points of the Terran System.

The Transit to Proximity Limit column provides the transit time directly from the planet to the closest Proximity Limit. In the case of the Uranus and Neptune, this is the transit time to the Proximity Limits of those planets. In the case of the Kuiper Belt, it represents the transit time of very large Kuiper Belt objects to the Proximity Limit of those planetoids; many Kuiper Belt objects have smaller Proximity Limits.

The Transit to Sol-Planet L1 point column provides the approximate transit time from the planet to the Lagrange L1 jump point formed by the cancellation of gravity between Sol and the planet. It does not take into consideration the influence of large moons (as in Terra's case). Transit times are not given for Uranus and Neptune, since their Proximity Limit is closer. Transit times are not given for Kuiper Belt objects because the difference in distance between their Proximity Limit and L1 points is negligible.

PLANET	MEAN ORBITAL RADIUS	TRANSIT TO ZENITH/ NADIR POINT^	TRANSIT TO PROXIMITY LIMIT^	TRANSIT TO SOL- PLANET L1 POINT^
Zenith/Nadir	1513.9Mkm/10.2AU*	N/A.....	N/A.....	N/A.....
Mercury	57.9Mkm/0.39AU.....	1,515Mkm/9.10 days.....	9.8AU/8.92 days.....	0.024Mkm/0.04 days.....
Venus.....	108.2Mkm/.72AU.....	1,518Mkm/9.11 days.....	9.5AU/8.78 days.....	0.169Mkm/0.01 days.....
Terra.....	149.6Mkm/1AU.....	1,521Mkm/9.12 days.....	9.2AU/8.64 days.....	0.260Mkm/0.12 days.....
Mars.....	227.9Mkm/1.52AU.....	1,531Mkm/9.15 days.....	8.7AU/8.40 days.....	0.129Mkm/0.09 days.....
Asteroid Belt.....	~2.2-3.2AU.....	1,558Mkm/9.23 days.....	7.7AU/7.91 days.....	0.009Mkm>0.02days>
Jupiter	778.5Mkm/5.2AU.....	1,699Mkm/9.64 days.....	5.0AU/6.37 days.....	24.0Mkm/1.15 days.....
Saturn.....	1,433Mkm/9.6AU.....	2,079Mkm/10.66 days.....	0.6AU/2.21 days.....	24.3Mkm/1.15 days.....
Uranus.....	2,877Mkm/19.2AU.....	3,228Mkm/13.29 days.....	1.42Mkm**/6.69 hours.....	N/A.....
Neptune.....	4,503Mkm/30.1AU.....	4,718Mkm/16.06 days.....	1.54Mkm**/6.96 hours.....	N/A.....
Kuiper Belt.....	~39.5-48AU.....	6,850Mkm/19.35 days.....	0.01Mkm (avg)**/0.56 hours.....	N/A.....

AU = 1 Astronomical Unit

Mkm = Million Kilometers

[^] These transit times assume constant 1G acceleration half-way, then constant 1G braking to the listed distance

* This is the distance from Sol to the jump points: the points are not actually in orbit

**** This is the proximity limit of the planet or typical small body, which is beyond Sol's proximity limit**

physics lab—was by a drone ship between Sol's standard points, a distance of about 20AU. The minimum range is actually about thirty kilometers. And it's only thirty kilometers because the oddities of K-F drives allow a JumpShip to be its own interfering drive. I mean, a JumpShip that tries to jump "in place" or within a few kilometers of its current location will get to play the *Richardson* to its *Mississippi Queen*. Twenty-five kilometers just about clears this effect, but when you factor in the usual jump error radius, you might want to think about thirty or more kilometers.

Time. I just saw a fascinating load of tripe a week ago on Channel 98 from that conspiracy nut, Starling, something about JumpShips as time machines because of a misunderstanding about the "time-independence" of hyperspace equations. The equations' "independence" from time is a mathematical note meaning that time in "real space" is not a factor in the jump field equations. The jump will happen at its own pace generally determined by constants that are factored out of the equations. The independence does not mean you can relocate the ship wherever—whenever—you want in real space-time. Time only goes forward from any perspective.

Now, there is some disconnect between hyperspace and real space when it comes to time. The shipboard perception of time spent "jumping" is actually mostly in real space as the drive's field is forming, which can really distort human perceptions. The actual shipboard time spent in hyperspace is too short for shipboard humans to notice, though minutes may pass for external, real space observers. This does lead to the experimentally confirmed possibility that a flawed jump may seem to leave a ship "stuck" in hyperspace. It's an elaborate form of suspended animation, not time travel in the usual sense. And I don't know if it's actually possible with a full K-F drive, it's just something that's been done in labs with subatomic particles and HPG transmissions.

JUMP POINTS

Where can you actually use a jump drive? Everyone's heard that JumpShips have to jump from and to "jump points," but what are jump points and where are they?

Let's start with the K-F drive. As I mentioned earlier, K-F drives generate hyperspace fields that dislike shifting or very curved space—in other words, the hyperspace fields don't like gravity. They have a certain maximum tolerance, after which the drive can no longer compensate for the distortion imposed by gravity. So, where do you find places with minimal gravity?

Naturally, quite far away from objects with lots of mass like stars and planets.

Since stars generally represent 99.9 percent or more of the mass in a system, stars all but singlehandedly establish the boundaries around a star system where a JumpShip can safely arrive. The minimum distance that a ship can approach a star is called the proximity limit, which forms a sphere around the star. You can jump anywhere on or outside the proximity limit of a star. Since proximity limits are in terms of astronomical units—AU—not light-years, and often do not encompass all the planets of a star system, this should lead you to understand that all of deep space, interstellar space, is one giant, valid jump point. Any jump point right on the proximity limit sphere is called a proximity point.

If you're curious about what jump point motion a JumpShip matches in deep space, it is generally the motion of the closest star, or the average motion of several closest stars. In other words,

average galactic rotation is the default for deep space jumps.

Planets have much smaller proximity limits than stars, rarely exceeding a few million kilometers for the largest gas giants. This means planets do not significantly block off outer solar systems, and you're pretty much safe to jump where you want out there unless you manage the abysmal luck of landing right atop an uncharted deep space comet or something. Planets cannot be entirely ignored, though, and throw enough problems into calculations that navigators seek a location where planetary influences largely cancel each other out: the points on the system's proximity limit intersected by the poles of the plane of the ecliptic, which is the plane most of the planets are on. Generally, these least-troubled jump points are "over the poles of the star," since stars tend to have an equator close to the plane of the ecliptic as a result of early movement in the proto-stellar cloud that produced the system.

Even the Deimos Project scientists identified these "standard jump points" as significantly easing jump calculations and made their first test jumps from those locations. Today, we call these the zenith and nadir points. Jump calculations made at these points are generally good for months until planetary movement calls for recalculation. In fact, the zenith and nadir jump points are so preferred that all other points are called "non-standard jump points," even their fellow proximity points.

In addition to deep space jumps and proximity points, there are a couple of other sorts of valid jump points. These two types of jump points fall under the heading "pirate points" because they are rarely used by anyone but pirates or other invaders looking to be sneaky. This is because it's very hard to navigate to these points—you need a top-notch map of the system with precise timing, or you'll miss the moving jump points.

The two types of pirate points are transient points and LaGrange points, and they occur inside the proximity limit of systems. LaGrange points—not LaGrange *jump* points—are regions of space where the gravity of two bodies and centripetal force end up canceling. You can look up LaGrange points on your own; this isn't an orbital mechanics class. One of those LaGrange points, the so-called "L1 point," is a place formed by the effective cancellation of gravity between the two bodies. Relatively near that place is often an area where gravity for most influential bodies is cancelled to a level safe enough to use a K-F drive. When you subtract the influence of centripetal force, you find the point of stability is closer to the larger of the two bodies by a distance that depends on...well, the relative size of the two bodies and influence of any other substantial bodies in the system. A planet-moon L1 point often wiggles around a lot based on the input of the local star. However, if you can imagine how a planet and moon forming an L1 point are whirling around a star together, and you imagine how small a valid jump area is formed in this fashion, you can imagine how much more complicated it is to arrive at such a LaGrange point than at a standard jump point.

I mean, standard jump points can be *seen* from another star. Modern shipboard astronomical instruments usually can roughly judge the mass of a star and look for the Doppler shift in its light that indicates its rotation, allowing a navigator to get a general idea of the proximity limit and probably the standard jump point location. If the navigator's uncertain, he can always aim further away from the star. You cannot do the same for a LaGrange jump point.

Anyway...the other type of pirate point is the transient point. Transient points are often at or near LaGrange points, but they are not continuously valid jump points because the gravity of some other body, usually a moon, periodically raises gravity levels beyond that acceptable for jumps. Planets with several moons often have transient points, as do planets with large, neighboring planets.

Last item regarding these pirate points...There was a huge debate in the media recently about the need to watch all the hundreds of LaGrange points around Kaumberg's system. Just to be clear, LaGrange points are places where gravity from two bodies, typically a planet and its moon or a planet and the local star, *kind of* nullify each other and create a stable point where a spacecraft can more or less hover. The easiest point to explain is the L1 point, which is between the two bodies. Let's say those two bodies are a planet and a moon, to keep this easy to imagine. The planet's gravity pulls one way, while the moon's gravity pulls the other way. At the L1 point, the gravities roughly cancel. The actual L1 point is a bit closer to the planet than just where the gravities cancel because you need a bit more gravity from the planet to cancel the outward slinging effect of centripetal force.

The role of centripetal force is even more apparent for the L2 point, which is on the far side of the smaller body, the moon in our example. At L2, you've got two gravity fields—the planet's and the moon's—pulling in one direction. The moon and planet are both on one side of the L2 point, so why would something find stability there rather than plummeting toward the moon? Because centripetal force is high enough to match gravity.

No, I'm probably not using the terms "centripetal" and "centrifugal" correctly, but you should get the idea. Take a physics or orbital mechanics course if you want more details.

Anyway, the short of it is this: in any set of LaGrange points, only the L1 point—well, a place near it—is a valid jump point. The actual jump point will wiggle around the real L1 point due to the influence of the local star and planets. This is why the need for all those monitoring satellites is silly—you only need to watch L1 points. And in the outer system...well, the whole outer Kaumberg system is one big jump point, so there's no need to watch even L1 points there—you have to watch the whole outer system, all the way to the nearest stars, to be really thorough. And that's not practical with today's sensors.

Double Jumping

K-F drive vessels equipped with lithium-fusion batteries can "rapidly" jump again, but it's not an instant process. A multitude of issues delay "instant" jumps. The primary issue is getting the ship's navigational sensors back up, which takes a hard minimum of thirty seconds. Without those, the ship doesn't know where it is, even if the second jump is already pre-plotted. That's the next delay: plotting the second jump. If you got things straight and know exactly where you are and where you're going, then you can have a pre-planned jump waiting in the navigational system. If your jump didn't put you in the right place, or if you change your mind about the destination, then you need to recalculate the next jump from scratch. That can take minutes for a jump between standard jump points or hours if you're moving to or from non-standard jump points.

Another physical delay is the hyperspace field retraction process. Sure, your trip through hyperspace was only an instant for you, but it might take minutes for the field to form and contract. You cannot jump until the field has fully collapsed.

Some secondary issues also sneak up on quick double jumpers. Jumping tends to produce static electricity in a ship that can take a while to bleed off—JumpShips often seek degaussing at recharge stations to really put this problem to rest. But double jumping can increase static build-up to levels that shielding can't handle and warp sensor input and computer operation, and interfere with electrical systems. In addition, all the energy pumped through a jump core invariably entails some heating that the brittle core dislikes—micro-fractures are possible, and will eventually interfere with core functions as an electrical capacitor, affecting its ability to properly form a hyperspace field. The most dramatic heating effect may be helium evaporation and the associated rupture of core helium tankage seals, which will promptly cripple a drive.

For all those reasons, it is standard procedure to use lithium-fusion batteries at days-long intervals from the first jump. Near-instant jumps are reserved for rare transit into or out of critical military situations.

Command Circuits

We've established that double-jumping is rough on JumpShips, that it takes about 176 hours to safely charge a JumpShip, and you should know that it typically takes days to cross the distance between a standard jump point and a habitable planet. These facts have shaped human history since the first interstellar jump. They shape warfare, commerce and colonization.

Some people, though, would prefer to travel faster. Usually the response is, "Too bad." But for the wealthy who can afford the mammoth cost, diverting multiple JumpShips—sometimes dozens of JumpShips—and arranging them into a *circuit* makes transit much faster.

The classic "JumpShip command circuit" involves a series of JumpShips, normally placed at inhabited systems as far apart as one jump can manage. A particularly high priority DropShip catches a jump on one JumpShip, detaches and moves to the next JumpShip, which carries it through another jump, and so on. In this fashion, it is possible to cross the thousand-light year diameter of the Inner Sphere in about a day, allowing for about an hour between JumpShips.

For mere mortals, though, such a journey typically takes about 35 weeks in the best of times, and maybe several years depending on JumpShip schedules.

Hyperspace and Health

A jump rarely bothers a person with more than a bit of disorientation and physical and psychological discomfort, like the school's cafeteria before the health inspectors shut them down. Which is a shame, that greasy food all tasted so good, and I could eat as much as I wanted while the salmonella was helping me drop kilos like you wouldn't believe....

Anyway, some poor individuals experience those symptoms—I mean, from hyperspace travel, not salmonella poisoning—but to a much greater degree. It's the difference

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between a passing tension headache and an incapacitating migraine. Medication, usually a sedative, helps if the problem is known from prior experience. Unfortunately, there's no handy predictive test for this sort of vulnerability. You find out if you're vulnerable to "transit disorientation syndrome" the hard way on your first jump.

Less often, hallucinations may result from hyperspace travel. I've heard travelers report seeing atomic structures swell to visible size or planetary systems shrink to atomic size...and that there's some correlation between this and watching a navigational display during a jump. Funny how a space-warping process can make an image of a solar system swell or shrink, yes? But less funny are those individuals driven to catatonia by hallucinations involving their "personal demons." This sort of hallucinatory effect is usually unrelated to normal transit disorientation syndrome and may strike at any time, even hitting veteran spacers. Again, this is entirely unpredictable.

Finally, in very rare cases, a jump may trigger physical shock that can prove fatal. JumpShip crews are trained to treat this reaction and will have first aid kits nearby. This reaction is somewhat more likely among personnel who are in poor health or who are making their first jump, but it is otherwise unpredictable.

SPACE STATIONS

Space stations rarely figure prominently in the public mind, probably because they are not BattleMechs or WarShips and they rarely get involved in anything exciting or newsworthy. This is not surprising because space stations rarely have front-line military utility and are usually stuck in unglamorous jobs like industrial operations, freight transshipment and JumpShip recharging.

Unglamorous though space stations may be, they are important, and I think the best example is one of the first space stations. Crippen Station, designed at the end of the Second Millennium and launched early in the last millennium, was perhaps the most important space station in history.

I say that without exaggeration. Crippen Station coordinated the network of defense satellites that intercepted nuclear missiles launched during the Second Soviet Civil War (2011-2014), which could have crippled humankind for centuries. (It probably would only have been centuries if you assume that successful nuclear strikes outside the Soviet Union did not prompt a genocidal global nuclear war, which would've been a *somewhat* larger setback for humanity.)

After this incident, Crippen Station played another critical role: supporting humankind's ascent to the stars. Its zero-G industrial facilities presaged modern industrial space stations by producing exotic (for the time) materials and medicines, testbed solar power satellites, and spacecraft that would explore the Terran system. In that last role, Crippen Station served as the assembly point for spacecraft that colonized Terra's moon, the chemically fueled manned spacecraft that first reached Mars (the fourth planet of the Terran system), the first fusion-powered spacecraft and the first starships (the

slower-than-light Magellan probes). Indeed, of tasks commonly performed by space stations today, about the only thing Crippen Station did not do was serve as a recharge station for JumpShips. Crippen later served for centuries more as a famous aerospace museum. Crippen was destroyed by a debris cascade from Amaris's destruction of O'Neil Station, a cascade which wiped out many spacecraft, from factories to habitats to satellites, around Terra.

In the centuries since Crippen Station's very successful life, space stations have gone on to serve humankind across the Inner Sphere and beyond. They have generally been more specialized than their famous progenitor and fall into a handful of major classes, which I'll go over now.

FACTORY STATIONS

Factory stations were once found throughout human-inhabited space, but the ferocious economic warfare of the Succession Wars drove many factories to planetary surfaces—at least, those factories that produced goods tolerant of gravity. Others, like the special mills that produced endo-steel or the chemical facilities that produced exotic drugs, all but died out. The recovery of lostech has revived these space stations, and they are being built in greater numbers now than at any other time in the past quarter millennium as the demand for products created in freefall is soaring.

Factory stations generally mass between 2,000 and 200,000 tons, but larger and smaller facilities do exist. The largest factory station built so far is a germanium ore refinery in the Federated-Boeing Interstellar Galax Megaplex, which masses more than two megatons.

HABITAT STATIONS

Habitats are a rare role for space stations. Though the 21st century seemed to promise an endless need for habitat stations in the barren depths of the Terran system to handle humanity's swelling population, the Kearny-Fuchida drive and the discovery of countless habitable planets eliminated most need for habitat space stations. The majority of habitats built prior to the Succession Wars were exotic resorts or high-priced living space away from some detested planetary surface.

The massive, and destroyed, O'Neil Station near Terra filled both these roles—Terra's ultra-wealthy wanted a place to get away from the crowds of dirty commoners on Terra, either permanently or for vacations. O'Neil Station is noteworthy as about the largest station outside of asteroid bases, with a basic framework massing more than ten million tons and the soil, rock and water of the "park" interior adding tens of millions more tons. It was a unique structure that could only have been funded by Terra at the height of the Hegemony's glory.

Today, the Inner Sphere's largest known habitats hold anywhere from ten inhabitants to fifteen thousand, with the largest (population fifty thousand) being at Gulf Breeze in the Lyran Alliance. The Clans are thought to have some habitats with populations exceeding two hundred thousand, but information on these stations remains scarce.

The destruction of O'Neil Station—which was nuked by Rim Worlds troops too lazy to contend with a conventional battle for a space city seven kilometers long and one kilo-

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meter in diameter—presaged the destruction of many other habitats in the coming Succession Wars. Dwindling technology led to the abandonment of others. Until the Fourth Succession War, the only surviving Inner Sphere habitat stations were in the hearts of Successor States and dated to the Star League era.

Following the Fourth Succession War, the growing numbers of factory stations prompted a need for housing in space. Old stations were renovated and new ones were built to support the Inner Sphere's growing space-based industry. Beginning in the late 3050s, prosperity and recovered technology had reached such a level that a number of companies revived the idea of resort stations, with the greatest number found in the Free Worlds League. I think we had some plans here in the Lyran Alliance for resort stations, as did the Federated Suns, but that fit of genius by our noble masters known as the FedCom Civil War and the Jihad shelved those plans.

RECHARGE STATIONS

Perhaps the best known stations in the Inner Sphere during the Succession Wars and today are recharge stations, located at nadir and zenith jump points in many star systems. Actually, they're usually slightly inside the proximity limit to avoid the infinitesimal chance of a JumpShip arriving in the same location as the station. Some stations move beyond the proximity limit, but that's a rare event.

Recharge stations use solar sails, like those of JumpShips but on a grander scale, to store energy in massive batteries. The energy storage batteries can in turn deliver the energy to JumpShips either by microwave transmission to the JumpShip's solar sail or by direct hard lines to a docked JumpShip.

The advantage of recharge stations to JumpShip operators is sometimes lost on novice observers, since recharge stations do not usually allow JumpShips to recharge faster than the normal safe limit, which is 176 hours, give or take a hair. However, many stars visited by JumpShips cannot deliver a full charge in 176 hours at a standard jump point, with some dim stars requiring more than three additional days to recharge a ship. To merchants, who detest wasting even an extra six-hour shift in port and dread the accumulation of lost recharge hours over a fiscal year, the guaranteed 176-hour recharge from a recharge station's microwave transmissions can be worth the expense.

When I discussed JumpShips, I mentioned they could also recharge by a hard connection to a recharge station. This option bypasses some of the more delicate components of the K-F drive, enabling JumpShips to safely recharge in as little as 125 hours. That's more than two days faster than the normal safe minimum. The hard feed option is also convenient to merchants with a 200-year old JumpShip and a balky sail deployment mechanism, a common problem for the kilometer-wide, tissue-thin solar sails.

Recharge stations almost always have additional duties. They act as refueling platforms, cargo transshipment points, entrepôts and customs checkpoints. Recharge stations sometimes act as system defense surveillance stations due to the number of invaders that pass through zenith and nadir points, but this fact is so well known and the presence of a recharge station is such public knowledge that hostile forces will either use the other standard point—star systems rarely have two recharge stations anymore—or use a covert operation to disable the station's surveillance system. Destruction of a recharge station, despite the risk the station presents to invaders, is rare because recharge

stations are also useful to the invaders. Many recharge stations survived the Succession Wars for this reason.

SHIPYARD STATIONS

Shipyards are probably the most critical stations in human-occupied space. Without them, JumpShips—which are stuck in space from birth to breaking—could not be built. They are sources of other spacecraft too, everything from WarShips to DropShips and other space stations.

Shipyards exist amid clusters of other stations, factories and habitats that support the shipyards' operations. While shipyards were primary targets in the First and Second Succession Wars for the same reason as JumpShips, this strategy was abandoned because it was working too well for all sides. During the Third Succession War and the first half of the 31st century, shipyards were mostly protected by an unwritten prohibition against destruction of lostech. Today, this prohibition is disappearing in the latest hostilities, as everyone in Alarion Province knows well.

Anyway, shipyards essentially fall into two categories: unpressurized and pressurized. Unpressurized shipyards, of which barely a hundred exist, are the most common type of yard. They typically consist of skeletal frames shielded by light-weight walls that provide micrometeorite protection and catch parts that get loose in freefall. Because they do not need to maintain atmospheric pressure in their construction and repair slips, unpressurized shipyards can scale to almost any capacity. Currently, only a handful of Inner Sphere unpressurized shipyards can handle ships larger than 500,000 tons.

Pressurized shipyards are considerably more productive and helpful to worker morale because the workers operate in a "shirt sleeve" environment instead of being burdened with bulky spacesuits. However, establishing a single, non-compartmentalized pressure vessel able to enclose something as large as a JumpShip or WarShip is quite an engineering challenge. Climate control and pressurization/depressurization systems are also daunting and high-maintenance items. As a result, pressurized yards tend to be smaller than unpressurized yards, with most able to hold DropShips and only a few able to hold JumpShips. To my knowledge, no Inner Sphere plans for a pressurized shipyard able to hold WarShips larger than a *Monolith* were ever completed.

SYSTEM DEFENSE STATIONS

System defense stations were common during the Star League and were established along hostile borders, typically at choke points like planetary orbit or zenith and nadir jump points. At those points, one way or another, hostile forces would likely pass the near-stationary platforms so the stations could actually shoot something or catch the "bad guys" with fighters. Defense stations were, of course, primary targets in the Succession Wars and often turned out to be target practice for mobile foes like WarShips. The few that survived were found in the hearts of Successor States. The 3050s naval arms race in the Inner Sphere prompted a new surge in defense station construction, though they remain rare. And they're dwindling again.

One of the problems plaguing defense stations is lack of interstellar mobility. Stations are generally built on site from DropShip-delivered components and remain in a star system until they are scrapped or destroyed in battle. Federated-Boeing Interstellar hoped to bypass this problem with its (supposedly) JumpShip-mobile *Capitol*-class defense station, and the company modified

Periodically, some luminary gets the idea that one can step or drop into a gravdeck without the assistance of transfer cars, usually coming to this conclusion because of some misunderstanding of zero-G and centripetal "gravity." They think they can "hover" until they start running up to speed.

This is uniformly a bad idea. A small gravdeck, say three rpm and a hundred meters in diameter, has a floor speed of 56kph relative to the spacecraft around it. Big gravdecks are faster—the *Olympus's* deck spins at 275kph. Dropping or stepping onto the gravdeck from a stationary start will often result in fatal collisions with furniture, walls and other gravdeck occupants. For comparison, most pedestrian collisions with automobiles tend to be fatal above 35kph.

Sometimes people who ignore the advice about floor speeds do so under the misapprehension that if they start in zero-G, then they can drift through the gravdeck and gently come up to speed. This is true if you ignore aerodynamic drag (the air in a gravdeck moves with the gravdeck), except for the "coming up to speed" part. In an ideal, depressurized gravdeck free of obstructions, one can hover because there is no real gravity to pull you to the surface. The "gravity" is a result of being constantly spun in a circle, so if you're not

spinning, you're not experiencing "gravity." However, in practice, a floater's first contact with the surface is...bad. The experience is much like a pedestrian leaning against the side of a passing, high-speed train. No, gravity doesn't hold you against the train, but the experience is still going to be messy, and after that first collision with the gravdeck's floor, you'll be moving a bit and experiencing some "gravity," too. Which means more time colliding with the gravdeck's floor, and so on.

Those geniuses who try to sneak onto a gravdeck by slipping through the spaces between the bulkheads of a JumpShip that enclose the deck are usually the messiest examples of why non-standard gravdeck boarding procedures don't work. Clearance is minimal and the shearing effects of the stationary and moving walls on a human body are spectacular. Imagine being caught between a moving subway train and a tunnel wall with insufficient clearance. The whole zero-G effect won't save you there.

In either case, one can hope that these advanced students of physics do not kill anyone else and make a minimal mess in their demise. Seventy-five kilograms of stupid is enough to smear out over a good length of a gravdeck's exterior.

a JumpShip with the required adaptor to deliver the stations to customers. The customers never repeated the modification despite Federated-Boeing's eager offers, leaving the *Capitols* stranded in their home star systems. Other defense station manufacturers have not bothered trying to make their stations strategically mobile. Reasons varied, but the proliferation of WarShips and assault DropShips is the most common explanation. Why build a defense station when you can build a mobile, more versatile spacecraft?

CARGO SPACE STATIONS

Often quite similar to a habitat station is the cargo station, or customs platform. Many space stations—especially recharge stations—are optimized for cargo and passenger transfer, inspection, and all the other usual customs roles applied to interstellar travel. But when a system finds its recharge stations unsatisfactory for these duties, a space station is generally placed in planetary orbit to serve in these roles. These stations thus tend to resemble habitat stations, but with greatly enlarged cargo capacity.

SPACE STATION ODDITIES

An interesting question: was Federated-Boeing inspired by Wolf's Dragoons when it came to the *Capitol*? The Dragoons' famous *Hephaestus* Station is a modular space station delivered to its destinations by JumpShips—usually one large JumpShip can carry all the modules—which are then plugged together on-site. Federated-Boeing skipped the on-site assembly by keeping the *Capitol* under the 100,000-ton capacity of a JumpShip docking collar, but the aerospace community continues to speculate about the reported similarity of the K-F boom extension in the *Capitol* to the *Hephaestus*.

Though that approach to station delivery might seem

convenient, it's extremely expensive, on par with DropShips rather than conventional space stations. The usual methods of space station construction are either construction on-site by local industries, or shipping in much smaller modules by DropShip from a central facility.

Of course, making a space station that can be carried by a JumpShip leads to another group of oddball space stations: jump-capable ones. Though a number of stations have been labeled as jump-capable, they are universally just normal JumpShips or WarShips that have been given a stationary duty, sometimes overgrown with additions and expansions. Honestly, conventional JumpShips meet the definition of space stations because 99.9 percent of the time they hover at standard jump points like a recharge station and hardly maneuver on their own except to dock with another vessel. Their only significant movement is via hyperspace to another star.

SPACE STATION LOCATIONS

Space stations are most commonly located at LaGrange points. I talked about LaGrange points a few minutes ago, so I shouldn't have to repeat much of it. Anyway, space stations usually circle a LaGrange point in a "halo" orbit, which might be something you want to look up before Dr. Ready's next exam. Federated-Boeing Interstellar's Galax Megaplex is located at the L1 point between the planet Galax and its moon and includes nearly fifty space stations of various sizes that support the Megaplex's key occupants: shipyards.

Some stations are also found at zenith and nadir points, which are a trickier matter, as I discussed earlier for JumpShips and satellites. Recharge stations are almost exclusively found at standard jump points. Other stations are located in planetary orbits, most often fairly low, like four hundred to six hundred kilometers. These low orbits are not stable for more

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than a few decades (and sometimes only months, if much lower than four hundred kilometers) due to a miniscule degree of atmospheric drag close to a planet. Station-keeping fuel expenditures are periodically required, though at nowhere near the frequency of zenith/nadir point stations. Popular low orbits are generally around a planet's equator, which allows convenient interception of space stations by DropShips and shuttles launching from the planetary surface, but some, like resorts, defense stations and science platforms, sweep over the poles or at high angles to the equator.

Least frequently, space stations are found in a geosynchronous orbit around a planet, which is an equatorial orbit selected at an altitude such that the length of time needed to complete an orbit is equal to the length of time needed for the planet below to rotate. This makes the space station appear to hover over a particular spot on a planet. While these orbits are exceptionally useful to satellites, they tend to be in the middle of radiation belts trapped by a planet's magnetic field, which inhibits external operations by the station's crew.

It should be noted that space stations typically have station-keeping drives comparable to those of JumpShips, which means stations can get around a star system pretty good when they need to. They can't get around between stars very well, but attackers shouldn't get too complacent about the location of a battle station in a star system.

GRAVDECKS

I skimmed over this topic when I was talking about JumpShips and WarShips. Now it's time for the details on gravdecks.

To an extent, space stations are defined by their gravdecks, the rotating ring-shaped decks that simulate gravity through centripetal forces. Stations can mount larger, more useful, more habitable gravdecks than any other type of spacecraft. Why does size matter for gravdecks? It's not all about elbow room. After all, a JumpShip's hundred-meter diameter gravdeck is effectively a deck four to ten meters wide and about 314 meters long—enough room for one hundred to two hundred full-sized staterooms. No, the issue is the human inner ear.

Gravdecks follow a number of conventions for their use, depending on whether they are small or large. "Small" or "large" is defined by the vulnerability of the human inner ear to movement within a rotating frame of reference. The rule of thumb is that few humans will adapt to gravdeck rotational speeds above three revolutions per minute (rpm) unless they sit perfectly still—turning one's head or moving rapidly in high-spin gravdecks confuses the inner ear with the Coriolis effect and produces nausea. People can adapt to gravdecks at one to three rpm, but the key word is "adapt"—casual visitors may not have a chance to do so. At one rpm and less, few visitors and regular users of gravdecks will notice (due to their inner ear, at least) that the "gravity" keeping them on the floor is actually created by spin.

With the biology established, let's move on to a matter of physics: the "gravity" generated by a gravdeck is related to the deck's size and speed. A larger, faster gravdeck generates more gravity. Larger gravdecks can use lower speeds to generate the same gravity as smaller gravdecks. The physics approximation is that you get 1G (9.8m/s/s) from an 1,800-meter diameter gravdeck at one rpm. To get 1G from a smaller gravdeck, you need to

spin faster. Two rpm will give you 1G from a 450-meter diameter gravdeck, while three rpm allows a 200-meter 1G gravdeck. If the gravdeck has a yet lower diameter, the preference is to keep the speed at two or three rpm and accept lower gravity rather than risk turning the gravdeck into a "puke wheel," "vomit mill," "stomach pumper," or any of the other colorful names spacers reserve for fast-spinning gravdecks. Thus the small and large gravdecks are separated by whether they can generate 1G at three rpm or less (or about 200 meters), and some spacers won't even consider gravdecks "large" unless they're over a thousand meters in diameter.

Small gravdecks, particularly the forty- to one hundred-meter sorts found on JumpShips, are thus mostly useful for—excuse me—"dining and defecating," as spacers sum it up. In other words, these little gravdecks mostly serve as lounges. The low simulated gravity allows a normal meal instead of food-in-a-tube or those weird low-crumbs, high-cohesivity recipes. It also avoids the trouble of the zero-G toilet, which, after eleven centuries of development, still stinks, if you'll pardon the pun.

Now, I did say keeping the inner ear still would avoid upset stomachs, so you might think that sleepers should not be bothered by the spin. That's true, but putting crew quarters in a small gravdeck is only helpful for crew morale, not crew health. Bed rest under spin-generated gravity creates the same bone degeneration found in zero-G. Exercise facilities may also turn up on small gravdecks, though they tend to be stationary exercise machines rather than active sports facilities like a racquetball court. There is a health benefit to exercising in the limited gravity of a small gravdeck. I'm told bones are better stressed and reinforced by impact exercises under gravity, like using a treadmill.

Large gravdecks, the kind found on space stations and large WarShips, are another matter. These can readily simulate 1G without disturbing many occupants and visitors. Space stations can thus put entire habitats, shopping plazas, parks and sports facilities into their gravdecks. The *Olympus*-class recharge stations are famous for their 1,200-meters-in-diameter gravdecks, which include all those facilities and more. At these scales you realize most of the mass of the gravdeck is not in the deck's structure, but rather in the spin and balance mechanisms and the transfer mechanisms.

Space stations also have an easier time incorporating gravdecks than their more mobile aerospace siblings. A space station can be built to almost any geometry with no concern for a K-F drive core, ammunition feeds, power lines, data cables or anything else that must run through the center of a JumpShip or WarShip. Similarly, space station gravdecks rarely need to worry about high acceleration. Space station gravdecks therefore can be built with simple systems for transferring people to and from them, such as long elevator spokes to a slow-spinning hub. JumpShips and WarShips generally cannot spare the volume or passage room for such elevator spokes and must use "subway" systems of transfer cars paralleling the gravdeck's track.

FUEL

I saved this bit for last, since it's applicable to JumpShips, WarShips, and space stations. And aerospace fighters, small craft, DropShips, some satellites, and many other spacecraft. That topic is fuel, and pretty much all modern spacecraft use the same fuel: hydrogen. Plain old diatomic hydrogen, molecular mass 2, not

even one of the heavier isotopes, always stored in liquid form at very cold temperatures and a mere 71 kilograms per cubic meter. Too bad liquids are so incompressible, or aerospace fighter designers would have an easier life. Designers of large craft don't have the elbowroom restrictions of their smaller cousins.

Anyway...I've been chastised for flippantly using the term "fuel" with respect to hydrogen on spacecraft but, hah, no I was correct. Most of the time. See, a fuel is something that provides energy for an engine. That might sound obvious, but hold on until you come to this rocketry term: reaction mass. In rockets, the reaction mass is something you throw out your tailpipe to go in an equal and opposite direction. In chemical rockets, fuel and reaction mass are the same thing: you burn the fuel, which produces very hot exhaust gas that flies out the tailpipe. In large fusion rockets operating in heat-expansion mode, this is also the case. Hydrogen is the fuel that is fused to produce a very hot gas, mostly helium, which is blown out the tailpipe.

However, you can see the difference between fuel and reaction mass in jump jets and lightweight aerospace fighters. The fuel in both those cases is hydrogen, which is fused in the reactor. In jump jets, the reaction mass is an entirely separate substance, often air or sometimes some bottled hydrogen or mercury, which are heated indirectly by energy from the reactor. In fighters, a similar system heats hydrogen that never went through the reactor. As fighters get more massive, they maintain their consistent propellant consumption by increasing exhaust temperature, to the extent that the heaviest fighters are augmenting their hydrogen reaction mass with burned fuel—waste helium—from the reactor. Larger vessels in "tactical" engine operation use larger and larger fractions of burned fuel until they're using almost no additional reaction mass.

That's some hair splitting that slipped off topic...anyway, about the fuel for modern spacecraft. With the exception of some satellites and maybe the chemical reaction control systems of some fighters, the fuel of choice is hydrogen. Hydrogen is extremely plentiful in the universe, representing about three quarters of every atom in the universe. So, how does it get in spacecraft?

Very often, it's simply a matter of converting a planetary hydrogen resource—water especially—into hydrogen and filling up the fuel tanks and some spare cargo space in a DropShip. DropShips heading to JumpShips can deliver some hydrogen to the JumpShip to keep the JumpShip topped off, assuming there's no convenient space station at the jump point. Such jump point space stations will often build up tens of thousands of tons of hydrogen in their cargo bays for visiting vessels.

Those of you from water-poor worlds might be appalled to think of your water being wasted in space but very few plan-

ets are actually so deficient in water that they cannot spare a few thousand tons out of their trillions to the spacecraft that visit them annually. Like I said in the first half of this lecture, "water-poor" worlds are often "worlds deficient in easily purified water." The high-energy electrolysis of water to produce hydrogen is an expensive means of producing the millions of tons of water a city might need on a weekly basis, but it's cost effective for producing a few thousand tons of pure hydrogen for spacecraft.

Some planets are still dodgy about sharing their water supplies and not every system can spare DropShips for regular supply runs to JumpShips, so some systems turn to comets, which are stuffed with hydrogen-bearing compounds like water, ammonia, and hydrocarbons. The same processes that gave humanity the Ryan Ice Cartel's eight cubic kilometer icebergs from comets sometimes provides vast, if not cheap, amounts of hydrogen.

In a pinch, clever engineers on spacecraft can even rig a thermal still to separate out dust and other impurities from cometary ices, then run the impure water through life support equipment, which often includes some water "cracking" capacity. It'd be enough to keep the reactors running, if not provide a lot of reaction mass.

What spacecraft don't do is dip into gas giants for a quick refill. The gaseous, impure hydrogen of gas giants would need all the same processing equipment as cometary hydrogen extraction, and more: a means of collecting, compressing, and liquefying the purified hydrogen, plus all the modifications needed to send a ship slamming into the atmosphere of a gas giant. Even with the awesome hull materials used today, ships could not survive an orbital velocity passage through the upper fringes of a gas giant atmosphere—all that gravity makes orbital velocity so much higher on gas giants—so you have to brake under thrust and gently enter the atmosphere of the gas giant. Only aerodyne DropShips begin to be suited for this—Spheroids would spend hours and days hovering on thrust provided by the fuel they're trying to collect—but even so, it's much easier just to visit a comet and hack out some water ice boulders.

CONCLUSION

There you go for today, the rest of the unsung workhorses of the modern universe. Well, no, these were the more exciting ones. If I know Dr. Ready, though, he's not going to give you a research paper on McKenna-class WarShips, even though he will spend the next two lectures awing you with his collection of WarShip holos and vids. No, you're going to be covering General Motors Ultra-Super-Whatever-Maxi spaceport crawlers and FedBoeing Navigation Beacon floaters, so I hoped you took notes in the first half.

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.....
An ancient Avatar-class WarShip undergoes extensive refit and repairs at the Ruins of Gabriel.

The unit construction rules described in *TechManual* covered the range of *BattleTech*'s most common battlefield and support units, while *Tactical Operations* covered Advanced Support Vehicle construction: Satellites, Rail, Large-sized Airships and Naval Vessel Support Vehicles, as well as Mobile Structures.

The following section covers Advanced Aerospace units: JumpShips, WarShips and Space Stations. As these rules can be fairly math-intensive, designers are encouraged to do all work on scratch paper before committing the resulting unit's specifications to the appropriate blank Record Sheets.

These rules should be considered the standard rule set for advanced aerospace unit design in the same fashion as the *TechManual* rules covered the basic rules for constructing tournament-legal units. These rules do not delve into any experimental options that may be available in the equipment section of *Tactical Operations* (starting on p. 86, *TO:AUE*).

THE BASICS OF ADVANCED UNIT DESIGN

Advanced unit construction relies on three primary factors: unit type, technology base and weight. The notes below explain and expand on these factors.

Throughout these construction rules, the term "unit" refers to a single advanced unit for *Strategic Operations* game play. A unit may be a single Space Station, a single JumpShip or a single WarShip.

UNIT TYPE

The advanced units presented here come in a range of unit types that largely determine their core construction rules, maximum weight allowances, structural designs and what equipment they may mount. These features are broadly outlined below. Because so much is influenced by the unit's type—including its core construction rules and Record Sheet—this factor must be decided upon first in the design process.

Advanced Aerospace Units

Space Stations, JumpShips and WarShips represent the largest commonly seen spacecraft in the *BattleTech* universe. As their construction is largely similar to that of other aerospace units (see pp. 180-199, *TM*), the construction rules for these units are grouped together in their own section.



Space Stations: Space Stations (including recharge stations, habitats and orbital factories) are large and relatively immobile spacecraft that range from 2,000 to 2,500,000 tons in weight. These units use the Aerospace Unit construction system, may only operate in space, and rely on fusion engines for power.

JumpShips: JumpShips range from 50,000 to 500,000 tons in weight. JumpShips use the Aerospace Unit construction system. Like Space Stations, JumpShips may only operate in space and are fairly immobile, relying on fusion engines and jump sails for power.

WarShips: WarShips range from 100,000 to 2,500,000 tons in weight. WarShips use the Aerospace Unit construction system. Like Space Stations and JumpShips, they may operate only in space, and rely on fusion power and energy sails, but unlike these other units, WarShips are mobile and combat capable.

TECHNOLOGY BASE

In *BattleTech*, all units broadly fall into one of two available technology bases: Inner Sphere or Clan. (Mixed technology bases are possible, per the *Advanced Construction Options* starting on page 188 of *Tactical Operations: AUE*, but will not be covered here.) Purely Inner Sphere advanced units may only use Inner Sphere equipment, while purely Clan advanced units may only use Clan equipment. Many standard components, however, such as armor, control systems, engines and heat sinks, are considered universal and so may be available to both technology bases.

Technology Rating

In the Weapons and Equipment Tables used for creating units in *TechManual* and *Tactical Operations*, all items receive a Technology Rating in addition to a technology base. This rating (expressed as a series of letter grades that define the level of technology and its availability through the major eras of *BattleTech* history) helps to define the item's level of sophistication and may be used to help standardize the level of advancement the unit demonstrates for purposes of era-based campaigning. An item's Technology Rating typically has no direct bearing on advanced unit design.

Omni Units

Space Stations, JumpShips and WarShips cannot be built as Omni units under these rules (see *Omni Technology*, p. 19, *TM*).

WEIGHT

The advanced units described in these rules use the tonnage standard, with the weight ranges legal for game play described above under *Unit Type*.

For purposes of construction, though the term "weight" is typically used, it reflects the mass of items and components rather than a weight based on gravity.

Weight and Unit Classes

The varied nature of these advanced units creates a different range of weight and unit classes than most other unit types covered in *TechManual*. Still, depending on the unit's weight and type, many advanced designs can be classified along similar lines, though unusual specializations and such remain possible within the weight limits of any given design.

Space Stations: Classed as a Large-sized aerospace unit, Space Stations have a broad range of sizes and are commonly used as jump point recharging or refueling bases, local defense outposts, observation platforms in near orbit, habitats or factories. The size of the station rarely determines its function, and so military or civilian stations can exist in all sizes.

JumpShips: Regardless of their size, JumpShips are straight transport units, meant for the interstellar transport of DropShips and Small Craft above any and all other concerns. Larger JumpShips tend to carry more DropShips and incorporate amenities for extended space voyages, making them ideal for long pleasure cruises and military campaigns alike, while smaller ones are less expensive and more apt for raiding forces and light commercial travel. Few JumpShips are armed or heavily armored, though some military designs and exploration models have been known to carry weapons to deal with pirates and other hostile boarding parties.

WarShips: Another aerospace unit type is the WarShip. Essentially a combat JumpShip with engines for in-system transit as well as interstellar hops, WarShips bristle with armor and weapons—including powerful capital-class weapons—and can be used in a broader range of roles than JumpShips. Typical WarShip roles include corvettes for picket defense and anti-DropShip work, destroyers for interception and attack, frigates and cruisers for faster and heavier attack missions, carriers and transports for fighter and/or DropShip support, and battleships for full-on assault. The role of a WarShip typically influences its weight as well, with lighter ships falling into the corvette and destroyer roles, while heavier WarShips commonly serve as carriers, transports or battleships.

SPACE

Under these rules, an advanced unit's size and type determine its equipment capacity and weapon limits. These limits are largely based on the construction rules the unit uses.



Cameron-class Ulric Kerensky (Clan Wolf (in-Exile))

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DESIGNING ADVANCED AEROSPACE UNITS

The following basic rules cover the construction of advanced aerospace unit types (specifically, Space Stations, JumpShips and WarShips). Despite their range of types, these advanced units follow six simple steps in design, each of which is described in detail later. In brief, these steps are as follows.

Step 1: Design the Chassis—Determine the advanced aerospace unit's type, its tech base, its weight and (for select units) any Structural Integrity.

Step 2: Install Engine and Control Systems—Determine the advanced aerospace unit's acceleration, engine weight, control components, fuel and (for some units) its Structural Integrity.

Step 3: Add Armor—Determine type, amount and weight of armor (if any), and allocate armor points.

Step 4: Add Heat Sinks—Determine number and weight (if necessary) of the advanced unit's heat sinks.

Step 5: Install Weapons and Equipment—Add weapons and other equipment to the advanced unit.

Step 6: Complete the Record Sheet.

The above steps are a framework for designing an advanced aerospace unit. The actual process—particularly after the chassis, engine and control systems are determined—can involve a bit more flexibility as weapons, armor and heat sinks are balanced for their best fit in terms of tonnage and weapon slots. For instance, some designers might wish to assign armor after the weapons and heat sinks are established, to maximize firepower over protection. Others may want to add weapons before adding more heat sinks, to see if those that come free with the engine are sufficient for the unit's needs.

To assist in this effort, the designer may find it useful to make copies of an appropriate Blank Record Sheet (in the back of this book) to visually arrange the placement of weapons and equipment while tracking the use of weight on a piece of scratch paper.

Terminology: For the sake of simplicity, any reference under these rules to *advanced aerospace units* covers Space Stations, JumpShips and WarShips. Where a rule applies to a specific advanced aerospace unit type, such units will be noted.

STEP 1: DESIGN THE CHASSIS

The first step in creating an advanced aerospace unit is choosing the unit's chassis. This step establishes some of the most basic aspects of its design, determining what type of unit it is, its technology base and its weight. These choices will restrict the designer's access to certain equipment and can also influence the weight of the unit's structural integrity.

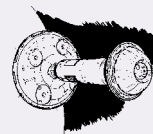
CHOOSE ADVANCED AEROSPACE UNIT TYPE

Advanced aerospace units come in three main types that can affect their design, maximum weight and engine types. Because of this, choosing the unit's type is the first key part of the chassis

design process. Even the selection of a proper Blank Record Sheet for use in unit design hinges on the choice of unit type before any other component.

The Advanced Aerospace Unit Types Table (see p. 133) provides key data that applies to advanced aerospace unit design and game play. Each of the unit types covered by these rules is listed in the Aerospace Unit Type column, along with its Weight Range in tons (beyond which units of that type may not be constructed), Weight Incremental (the increments of tons that the unit may vary in weight within its range) and Restricted Terrain (areas impassable to units of that type in *Total Warfare* game play). The Advanced Aerospace Unit Record Sheet Table, meanwhile, determines which Blank Record Sheet must be used to record the construction of a new advanced unit of a given unit type.

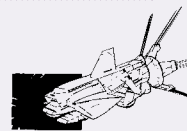
Joel is interested in building space stations capable of servicing or salvaging damaged DropShips and JumpShips. Dubbing this the Alliance class, he notes from the Advanced Units Record Sheet Table that he will need a Space Station Record Sheet.



Kate is interested in developing a JumpShip to support the movement of modest-size DropShip flotillas for the Clans. For her Odyssey-class JumpShip, she prepares a JumpShip Record Sheet.



Lynn is planning to build a battleship for deep space combat. Naming its class after the Star League's founder, Admiral James McKenna, she copies a WarShip Record Sheet to plan her McKenna-class vessel.



CHOOSE TECHNOLOGY BASE

Advanced aerospace units may be constructed using Clan or Inner Sphere technology bases. Advanced aerospace units may not be constructed as Omnis.

Joel assigns his Alliance class station an Inner Sphere tech base.



Kate plans her Odyssey-class JumpShip for Clan use, and so assigns it a Clan tech base.



Lynn wants to use her McKenna in a pre-Clan campaign, and so picks an Inner Sphere tech base.





ADVANCED AEROSPACE UNIT TYPES TABLE

Aerospace Unit Type	Weight Range (Tons)	Weight Incremental (Tons)	Restricted Terrain
Space Stations	2,000 to 2,500,000	500	Any non-Space
JumpShips	50,000 to 500,000	1,000	Any non-Space
WarShips	100,000 to 2,500,000	10,000	Any non-Space

ADVANCED AEROSPACE UNIT RECORD SHEET TABLE

Unit Type	Record Sheet	Weapon Arcs
Space Station	Space Station	Nose, Fore-Left/Right, Aft-Left/Right, Aft
JumpShip	JumpShip	Nose, Fore-Left/Right, Aft-Left/Right, Aft
WarShip	WarShip	Nose, Fore-Left/Right, Broadside Left/Right, Aft-Left/Right, Aft

CHOOSE WEIGHT

Depending on the advanced aerospace unit's type, its maximum (and minimum) weight varies greatly (as shown on the Advanced Aerospace Unit Types Table).

All advanced aerospace units described in these rules track their weight using the tonnage standard, and may be constructed as light as their lowest listed weight from the Advanced Aerospace Unit Types Table, to their maximum listed weight, increasing from the minimum in multiples of the unit's listed Weight Incremental. Because of the tonnage standard, the designer must first convert to tons any desired items with a weight listing in kilograms. To do this, divide the item's kilogram weight by 1,000.

Regardless of the advanced unit's size and type, the total weight for its engine, equipment, armor and other components must not exceed the weight chosen. Any unspent weight left after the creation process is considered cargo space if the vehicle still has equipment slots to spare, or wasted weight if it does not.

Space

Space Stations, JumpShips and WarShips track space in much the same way as DropShips and Small Craft do (see p. 183, *TM*), with a base limit in the number of weapons they may mount per arc. For JumpShips, the base limit is 12 weapons per each of the craft's 6 arcs (Nose, Fore-Left, Fore-Right, Aft-Left, Aft-Right and Aft). For Space Stations and WarShips, this limit is 20 weapons per each of the unit's 6 arcs. As with DropShips and Small Craft, these limits may be extended by the addition of expanded fire control systems.

Beyond these weapon limits, advanced aerospace units may mount any number of non-weapon items, with most counting only as weight and some counting as bays. Which items take up weapon slots and which do not is explained in the appropriate sections.

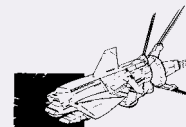
Joel opts to give his Alliance-class Space Station a total weight of 100,000 tons—a modest size for a station, but he's not looking for a fortress here. Joel also knows that it will receive a base limit of 20 weapons per firing arc.



Kate's Odyssey-class JumpShip, she decides, will weigh 345,000 tons. As a JumpShip, the Odyssey begins with a limit of 12 weapon slots per arc.



Lynn decides to place her McKenna-class battleship just below the two-million-ton mark, and settles on a weight of 1,930,000 tons. Like Joel's Alliance, this vessel receives a starting limit of 20 weapon items per firing arc.



Lola III-class Blizzard (Clan Ghost Bear)

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ADVANCED AEROSPACE UNIT STRUCTURAL INTEGRITY WEIGHT TABLE

Advanced Aerospace Unit Type	Structural Integrity Value	Weight Formula*
Space Station Structural Integrity Weight	1	Space Station Weight $\div$ 100
JumpShip Structural Integrity Weight	1	JumpShip Weight $\div$ 150
WarShip Structural Integrity Weight	See <i>Install Engines, below</i>	See <i>Install Engines and Control Systems, below.</i>

*Round up to the nearest half-ton

ALLOCATE WEIGHT FOR STRUCTURAL INTEGRITY

Space Stations and JumpShips may determine the weight of their internal structure (Structural Integrity) at this stage. Advanced aerospace units possess capital-scale Structural Integrity (SI): each point is equal to 10 points of standard-scale SI. However, WarShips—which rely on first determining their movement capabilities—may only allocate Structural Integrity weight after installing any engines.

Calculate Structural Integrity Weight

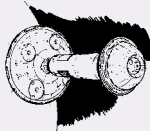
Space Stations and JumpShips are designed as stationary (station-keeping) spacecraft, so their Structural Integrity values are pre-set (at 1 point) and may not be changed (unlike DropShips and WarShips). The weight of this internal structure—which may be computed at this stage—is shown in the Advanced Aerospace Unit Structural Integrity Weight Table. The weight of a Space Station's Structural Integrity is equal to the station's mass divided by 100, while the weight of a JumpShip's Structural Integrity equals the JumpShip's total weight divided by 150. In both cases, Structural Integrity weight is rounded up to the nearest half-ton.

Structural Integrity Values are not assigned to a location on the unit's Record Sheet beyond the Structural Integrity area itself.

Tech Base/Rating: The Structural Integrity types for the advanced aerospace units in this section are equally available to vehicles of Clan or Inner Sphere tech bases. However, Structural Integrity components featured by these advanced units are incompatible with those of any different unit type. For example, a JumpShip cannot use the Space Station Structural Integrity weight formula.

Space: For all of the advanced aerospace units discussed here, the various types of Structural Integrity have no impact on the unit's equipment slot spaces.

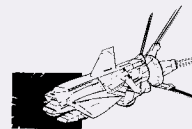
Joel's Alliance-class Space Station has a total weight of 100,000 tons. Because it is a Space Station, he can determine that the weight for its Structural Integrity will be 1,000 tons (100,000 tons $\div$ 100 = 1,000 tons). Also, as the Alliance is a Space Station, it receives a fixed Structural Integrity Value of 1.



Kate's Odyssey-class JumpShip, like Joel's Alliance, is an advanced aerospace unit, has a fixed Structural Integrity value and she can therefore compute its Structural Integrity weight at this time. Because it is a JumpShip weighing 345,000 tons, it receives a Structural Integrity weight of 2,300 tons (345,000 $\div$ 150 = 2,300 tons). It also receives a fixed Structural Integrity Value of 1.



Lynn's McKenna-class battleship is a WarShip, and so is also exempt from requiring Support Vehicle Chassis and Engine values. But unlike the Alliance or the Odyssey, this advanced aerospace unit will have more than mere station-keeping thrust, which may prompt a larger Structural Integrity Value and thus a larger SI Mass. Lynn will not know these values until she installs the McKenna's engine, and so she proceeds to do just that.



STEP 2: INSTALL ENGINES AND CONTROL SYSTEMS

The second step in advanced aerospace unit design is the installation of the unit's engines and control systems. This step establishes the key factors in the unit's mobility, including the size and performance of its engine and the weight of the control systems the crew uses during operations.

INSTALL ENGINE

Each advanced aerospace unit carries one engine to power its movement, equipment and other integral components. The weight of this engine is determined by a simple formula based on the unit type chosen (Space Station, JumpShip or WarShip), as well as its desired acceleration (in Thrust Points). Advanced aerospace units do not use the military engines employed by BattleMechs and Aerospace Fighters, and so do not have Engine Ratings as such.

The Advanced Aerospace Unit Base Engine Formulae Table (see p. 135) provides the formulas of the various engine types available to advanced aerospace units. Determining the weight of an advanced aerospace unit's engine is simply a matter of multiplying the unit's total weight by its relevant factors, including its Engine Mass Factor (a value based on the unit type) and (if the unit is a WarShip) its desired Safe Thrust.

This final engine weight (rounded up to the nearest half-ton) includes not only the unit's engine, but any integral cooling systems and shielding necessary to operate the engine.

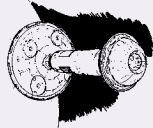
Advanced aerospace units invariably use Fusion engines.

Tech Base/Rating: The engine types presented in this section are available to advanced aerospace units made using either the Clan or Inner Sphere tech bases.



Space: The types of engines used by advanced aerospace units do not affect the unit's equipment slot space.

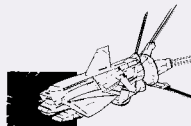
As a Space Station, Joel's Alliance receives an Engine Weight Factor of 0.012, and may not select a Safe Thrust rate (Space Stations, like Satellites and JumpShips, use station-keeping drives only). With its total weight set at 100,000 tons, this means the Alliance's station-keeping engines will weigh 1,200 tons (0.012 [Engine Weight Factor] x 100,000 tons = 1,200 tons). Given its Structural Integrity weight of 1,000 tons, this leaves 97,800 tons left over (100,000 – 1,000 [SI Weight] – 1,200 [Engine Weight] = 97,800 tons).



Kate's Odyssey-class JumpShip has spent 2,300 tons of its 345,000-ton weight on Structural Integrity, leaving 342,700 tons remaining (345,000 – 2,300 = 342,700). Like Joel's Alliance, the JumpShip receives an Engine Weight Factor of 0.012 and may not choose a Safe Thrust because its drives are for station-keeping only. This provides the Odyssey with an engine weighing 4,140 tons (0.012 x 345,000 = 4,140), and 338,560 free tons remaining (342,700 tons – 4,140 tons = 338,560).



Lynn's McKenna-class battleship is a WarShip, and so unlike the Alliance or the Odyssey, this vessel will have more than a mere station-keeping thrust. In fact, Lynn assigns a Safe Thrust of 3 for this vessel, which provides a Max Thrust of 5 (3 Safe Thrust x 1.5 = 4.5, round up to 5). As a WarShip, the McKenna receives an Engine Weight Factor of 0.06. Combined with the vessel's 1,930,000-ton mass and its desired Safe Thrust, Lynn computes that this will produce a final engine weight of 347,400 tons (0.06 [Engine Weight Factor] x 3 [Safe Thrust] x 1,930,000 tons = 347,400 tons). This leaves 1,582,600 tons remaining (1,930,000 – 347,400 = 1,582,600 tons).



DETERMINE FUEL CAPACITY

All advanced aerospace units require fuel. These units track fuel by Fuel Points or fuel tons (depending on conditions; see p. 32 for rules on tracking fuel use). The number of Fuel Points provided per ton is based primarily on the unit's weight, as shown in the Advanced Aerospace Unit Fuel Table, at right. Regardless of the advanced aerospace unit's type and weight, fuel may only be added in full or half-ton lots. Once a fuel capacity is established, an additional 2 percent of the fuel's total weight (rounded up to the nearest ton) must be applied to reflect the mass of the fuel tanks and pumps.

Also provided in the Aerospace Fuel Table is the Strategic Fuel Use Rating, which applies to all advanced aerospace units (as they employ heat expansion systems for sustained burns). This value sets how many tons of fuel the vessel consumes in a given day at a constant 1 G (2 Thrust Point) acceleration rate. This value may be multiplied by the craft's actual acceleration—in Gs—used during long-range transits as well.

ADVANCED AEROSPACE UNIT BASE ENGINE FORMULAE

Unit Type	Engine Mass Factor
Station-Keeping Drive (Space Station/JumpShips)*	0.012
Maneuvering Drive (WarShips)*	0.06

Max Thrust Value (WarShips only)**

Safe Thrust x 1.5 (Round up)

*Station-Keeping and Maneuvering Drives may not be combined on a single unit, and only WarShips may mount Maneuvering Drives. Maneuvering Drive Safe Thrust is selected in whole numbers, not fractions. Maneuvering Drives may not have a Safe Thrust of less than 1. For lower thrust than 1, a WarShip must mount a Station-Keeping Drive** instead of a Maneuvering Drive (in this instance the WarShip moves as per a JumpShip [see p. 50]).

**Station-Keeping Drives do not receive a Max Thrust (their engines provide for station-keeping only, at 0.2 Thrust).

ADVANCED AEROSPACE UNIT ENGINE WEIGHT FORMULAE

Engine Weight (Space Station/JumpShips) =
Engine Mass Factor x Total Advanced Aerospace Unit Weight

Engine Weight (WarShips) = Engine Mass Factor x
Safe Thrust x Total Advanced Aerospace Unit Weight

ADVANCED AEROSPACE UNIT FUEL TABLE

Advanced Unit Mass	Fuel Points (per ton)	Strategic Fuel Use (tons/burn day)*
2,000 to 49,999	10	2.82
50,000 to 99,999	10	9.77
100,000 to 109,999	10	19.75
110,000 to 199,999	5	19.75
200,000 to 249,000	5	39.52
Over 249,999	2.5	39.52

*Space Stations and JumpShips burn one-tenth as much fuel per day to maintain station-keeping thrust

FUEL AND FUEL PUMP WEIGHT FORMULA

Total fuel and fuel pumps weight (advanced aerospace units only) = desired fuel tonnage x 1.02 (Round up to nearest ton)

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Space Stations and JumpShips always use station-keeping drives, which have an effective Thrust of 0.1 G. These units consume only one-tenth as much fuel per burn day as the listed amount for their tonnage.

Tech Base/Rating: Fuel tanks and fuels are standardized, and equally available to advanced Support Vehicles of Clan or Inner Sphere technology bases. The fuel usage rates by all of the advanced aerospace units presented here remain the same regardless of the unit's tech base.

Space: The internal fuel tanks covered by these rules occupy no weapon or equipment slots on any advanced aerospace unit.

As an advanced aerospace unit, Joel's Alliance-class Space Station must maintain a fuel reserve for its station-keeping drives. He decides to allocate 10,000 tons of fuel (100,000 Fuel Points; 10 Fuel Points per ton x 10,000 tons = 100,000 points) to the station. This will cost a total amount of 10,200 tons (thanks to the additional 200 tons' worth of fuel pumps; $0.02 \times 10,000 \text{ tons} = 200 \text{ tons}$). In checking the Advanced Aerospace Unit Fuel Table, Joel notes that the Alliance will consume this fuel at a rate of 1.975 tons per day at station-keeping (19.75 tons per burn-day for a 100,000-ton unit, divided by 10 for Space Station or JumpShip unit types = 1.975).

After the addition of its fuel tanks and pumps, the Alliance now has 87,600 tons left over ($97,800 - 10,200 \text{ [Fuel and Pumps]} = 87,600 \text{ tons}$).

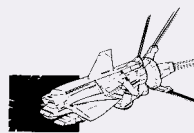
Kate's Odyssey-class JumpShip also requires fuel for its station-keeping drives. She decides that 1,000 tons (2,500 Fuel Points; 2.5 points per ton x 1,000 tons = 2,500) should be sufficient for the task.

Thus, she must spend 1,020 tons in weight for the fuel and pumps ($1,000 \text{ tons} + (0.02 \times 1,000 \text{ tons}) = 1,020 \text{ tons}$). This leaves the Odyssey with 337,540 unspent tons ($338,560 - 1,020 = 337,540 \text{ tons}$).

In checking the Advanced Aerospace Unit Fuel Table, Kate also finds that her JumpShip will burn 3.952 tons of fuel per day at station-keeping (39.52 tons per day for a 345,000-ton unit, divided by 10 for Space Stations or JumpShips = 3.952).

Lynn decides to provide her McKenna-class battleship with 1,600 tons' worth of fuel, or 4,000 Fuel Points (1,600 tons x 2.5 points per ton for a vessel 250,000 tons and over = 4,000 points). The weight of the fuel and pumps will be 1,632 tons ($1,600 \text{ tons} + [0.02 \times 1,600 \text{ tons}] = 1,632 \text{ tons}$), which will leave 1,580,968 tons unspent ($1,582,600 - 1,632 = 1,580,968 \text{ tons}$).

In reviewing the Advanced Aerospace Units Fuel Table, Lynn finds that the McKenna will burn this fuel at a rate of 39.52 tons per burn day (at 1 G).



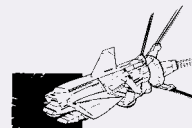
Unlike the SI of a Space Station or JumpShip, a WarShip's SI may vary at the designer's option. At the very minimum, this value must be equal to the vessel's Maximum Thrust Rating, but the designer may—at his or her discretion—increase this value to as much as 30 times the vessel's Max Thrust. Higher values provide a more resilient frame, as well as a corresponding increase in armor capacity.

A WarShip's SI value also determines the weight it must spend on Structural Integrity. To find the weight of a WarShip's Structural Integrity (SI), multiply the SI value by the vessel's total weight, divided by 1,000, and round the final result up to the nearest half-ton. For example, a 600,000-ton WarShip with an SI of 50 would spend 30,000 tons on Structural Integrity ($50 \text{ [SI]} \times 600,000 \text{ tons} \div 1,000 = 30,000 \text{ tons}$).

Space: A WarShip's Structural Integrity does not affect its allotment of internal equipment space.

For her McKenna, Lynn notes that the vessel's Max Thrust of 5 offers a possible SI value range between 5 and 150 ($30 \times 5 = 150$). Because she plans the vessel for heavy combat, but also wants to leave tonnage for weapons and cargo, Lynn decides on an SI of 95.

The 1,930,000-ton McKenna's Structural Integrity, Lynn then determines, will weigh 183,350 tons ($95 \text{ [SI]} \times 1,930,000 \text{ tons} \div 1,000 = 183,350 \text{ tons}$). This will leave the WarShip with 1,397,618 unspent tons ($1,580,968 \text{ tons} - 183,350 \text{ SI tons} = 1,397,618 \text{ tons}$).



DETERMINE K-F JUMP CAPABILITY (JUMPSHIPS AND WARSHIPS)

Only JumpShips and WarShips may incorporate a Kearny-Fuchida (K-F) jump drive. This drive system makes interstellar travel possible, and is directly tied into the vessel's total weight. JumpShips built using these rules may only make use of the Standard K-F drive, while WarShips built under these rules may only make use of a Compact K-F drive. (More advanced options, such as the experimental Sub-Compact K-F drive, are discussed in the Equipment section of *Tactical Operations: AUE*.)

The formula for finding the weight of a K-F drive is shown in the Kearny-Fuchida Drive Table below. All K-F drive weights must be rounded up to the nearest whole ton.

K-F Drive Integrity: In addition to computing the weight of a K-F drive, designers must also determine the K-F drive's Integrity, which reflects the jump system's ability to withstand damage. The formula for determining a K-F drive's Integrity is shown in the Kearny-Fuchida Drive Table below. As with the K-F drive's weight, K-F Integrity values are rounded up to the nearest whole number.

Jump Sail and Jump Sail Integrity: The final step for installing a K-F jump drive is adding a jump sail, the weight of which is derived from the vessel's weight, along with the Jump Sail Integrity, which reflects the sail's ability to withstand damage when unfurled. The formula for finding a Jump Sail's weight and its Integrity are both listed in the Kearny-Fuchida Table as well, and both values round up to the nearest whole number.

Space Stations with energy storage batteries may also carry a Jump Sail, which is used to collect energy for the batteries (rather than a jump drive). In such cases, the sail's weight and Integrity are computed like that of a sail for a JumpShip of equivalent size.

DETERMINE STRUCTURAL INTEGRITY (WARSHIPS ONLY)

Once the weight and Thrust Points for a WarShip are determined, the designer can determine this unit's Structural Integrity (SI) value. This determines the overall strength of the vessel's internal structure or spaceframe.



KEARNY-FUCHIDA DRIVE TABLE

Unit Type	K-F Drive Type	K-F Drive Weight	K-F Drive Integrity	Jump Sail Mass*
JumpShip	Standard	JumpShip weight x 0.95	$1.2 + (\text{K-F Drive weight} \div 60,000)$	$30 + (\text{JumpShip weight} \div 7,500)$
WarShip	Compact	WarShip weight x .4525	$2 + (\text{K-F Drive weight} \div 25,000)$	$30 + (\text{WarShip weight} \div 20,000)$

*Jump Sail Integrity = $1 + (\text{Jump Sail weight} \div 20)$

Round all weights and Integrity values up to the nearest whole number.

K-F Drive and Sail Limits: An advanced aerospace unit may mount only one K-F jump drive of any type, and one Jump Sail (or energy collection sail).

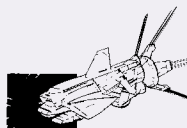
Kate's Odyssey-class JumpShip receives a Standard K-F drive unit and a Jump Sail. With the vessel's weight of 345,000 tons, Kate finds that the drive itself will weigh 327,750 tons ($345,000 \text{ tons} \times 0.95 = 327,750 \text{ tons}$). At that weight, the Odyssey's K-F drive Integrity comes to 7 ($1.2 + [327,750 \text{ K-F Drive tons} \div 60,000] = 6.663$, round up to 7).



For the Odyssey's Jump Sail, Kate determines a weight of 76 tons ($30 + [345,000 \text{ tons} \div 7,500] = 76$). This yields a Jump Sail Integrity of 5 ($1 + [76 \text{ tons} \div 20] = 4.8$, rounded up to 5). On the record sheet, Kate notes both the K-F and Sail Integrity for her JumpShip.

Subtracting the weight of the jump drive and Jump Sail from the Odyssey's remaining weight, Kate determines that she will have 9,714 tons left over ($337,540 \text{ tons} - 327,750 \text{ tons [K-F drive]} - 76 \text{ tons [Jump Sail]} = 9,714 \text{ tons}$).

For her 1,930,000-ton McKenna, Lynn must install a Compact K-F drive, which will weigh 873,325 tons ($1,930,000 \text{ tons} \times 0.4525 = 873,325 \text{ tons}$). This produces a K-F drive Integrity Value of 37 ($2 + [873,325 \text{ K-F tons} \div 25,000] = 36.933$, round up to 37).



For the McKenna's Jump Sail, Lynn finds a weight of 127 tons ($30 + [1,930,000 \text{ tons} \div 20,000] = 126.5 \text{ tons}$, rounded up to 127). This provides the WarShip with a Jump Sail Integrity of 8 ($1 + [127 \text{ Jump Sail tons} \div 20] = 7.35$, rounded up to 8).

Subtracting the weight of the K-F drive and Jump Sail will leave the McKenna with 524,166 tons left to spend ($1,397,618 \text{ tons} - 873,325 \text{ [K-F drive]} - 127 \text{ [Jump Sail]} = 524,166 \text{ tons}$).



A Lola II-class WarShip deploys for combat.

ADVANCED AEROSPACE CONTROL SYSTEMS TABLE

Advanced Aerospace Unit	Control Systems Weight
Space Station	Tonnage x 0.0010*
JumpShip/WarShip	Tonnage x 0.0025*

*Based on total unit tonnage, round up to the nearest full ton.

ADD CONTROL/CREW SYSTEMS

Advanced aerospace units must have control systems, reflecting crew stations from which the unit is operated. These control systems provide sensors and navigation that are often distributed throughout the unit and controlled from one or two command centers. The weight of such systems is shown on the Advanced Aerospace Control Systems Table above.

Crew: All advanced aerospace units require a certain amount of crew to operate them. To determine the basic crew needs for each unit type, consult the Advanced Aerospace Unit Minimum Crew Table (see p. 138). The unit's crew must be equal to (or, at the designer's option, greater than) the sum of its minimum crew requirements (including any supplemental crew such as officers and those needed to man special equipment such as weapons, communications, kitchens and MASH theaters). Bay personnel—for vehicle bays and such—are not listed (the bays themselves incorporate a limited amount of bunk space for such personnel). Additional crew needs for the specific items listed do not have to be met unless and until the items are mounted (typically after Step 5), and any officer requirements must be computed after all crew are assigned.

Gunners are necessary only for items that require a Gunnery Skill roll to use in combat, and that have a range of more than 1 hex in *Total Warfare* game play. (Automatic defensive armaments like Anti-Missile Systems, A-Pods and the like require no gunners, nor do non-weapon items listed on the Weapons and Equipment Tables, such as Active Probes and ECM gear.)

Crew Accommodations: Unlike advanced Support Vehicles, advanced aerospace units *must* allocate weight to quarters for every crewman, as such quarters represent expansions on the unit's life support apparatus. Space Stations, JumpShips and WarShips require quarters for all crew and passengers, with standard procedure providing First Class Quarters (10 tons apiece) to officers and Second Class Quarters (7 tons apiece) to enlisted/non-officer crew. Because bays

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incorporate a limited amount of bunk space into their design, bay personnel—those required for vehicle bays, 'Mech bays and so forth—need not be counted toward required accommodations.

At the designer's option, the "standard procedure" for crew and passenger quarters need not be followed precisely; so long as all non-bay crew receive quarters, the needs of unit construction are satisfied. Designers may thus opt to equip a vessel with other quarter types instead, such as Steerage and Officer/First Class quarters in place of Standard crew quarters. For example, a standard Inner Sphere military DropShip with a crew of 9, plus 2 officers, might normally devote Standard crew quarters to its 9 crewmen and Officer/First Class quarters to its 2 officers. Clan military DropShips tend to be more spartan, and so may bunk their crew—officers and all—in Standard crew quarters.

Fire Control Systems: Unlike advanced Support Vehicles, advanced aerospace units use more sophisticated sensors by necessity, and so do not need to spend additional weight on fire control at this stage. However, advanced aerospace units that mount more weapons than their standard limits will need to spend additional tonnage on expanded fire control. This tonnage (if needed) can be calculated when installing weapons and other equipment in Step 5.

Tech Base: The control systems and crew accommodations covered by these rules are equally available to advanced aerospace units built using a Clan or Inner Sphere technology base.

Space: The installation of all crew quarters and control systems covered by these rules does not affect the amount of weapon slots available to an advanced aerospace unit.

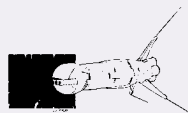
Joel's Alliance-class space station, as an advanced aerospace unit, must assign some of its weight to control systems. Upon consulting the Advanced Aerospace Units Controls Table, he finds that the weight for these systems comes to 100 tons (100,000 tons x 0.001 = 100 tons).



As a 100,000-ton Space Station, Joel calculates that his Alliance will require a minimum of 65 crewmen (45 + [100,000 tons ÷ 5,000] = 65). Of these, 1 in 6 must be officers, and so 11 of these crewmen are identified as officers (65 ÷ 6 = 10.833, round up to 11). Though gunners and additional crew may yet be required, Joel knows about these needs already, and so assigns 54 Standard crew quarters (at 7 tons each) and 11 Officers' quarters (10 tons each) to the design, for a total of 488 tons in quarters ([54 x 7] + [11 x 10] = 488 tons). As an advanced aerospace unit, the Alliance need not assign slot space to these quarters.

Between these quarters and the control systems, this will leave the Alliance Space Station with 87,006 unspent tons remaining (87,600 – 100 [Control Systems] – 488 [quarters] = 87,012).

Kate's Odyssey-class JumpShip, as an advanced aerospace unit, must spend weight on control systems. Checking the Advanced Aerospace Unit Control Systems Table, Kate finds that this weight will come to 863 tons (345,000 tons x 0.0025 = 862.5, round up to 863 tons).



In addition, the Odyssey's 345,000-ton size means it will have a minimum crew requirement of 24 (6 + [345,000 ÷ 20,000] = 23.25, round up to 24). Of these 24 crewmen, 4 must be officers

ADVANCED AEROSPACE UNIT MINIMUM CREW TABLE

Minimum Crew Formula
Minimum Crew Needs = Base Crew Minimum + Minimum Gunners

Advanced Unit Type	Base Crew Minimum
JumpShip	6 + (1 per 20,000 tons)*
WarShip/Space Stations	45 + (1 per 5,000 tons)*

*Round up

ADDITIONAL CREW

Non-Gunners	Minimum Crew Requirement
Communications Equipment (per ton, see p. 212, TM)	1
Field Kitchen (per item, see p. 217, TM)	3
MASH (per theater, see p. 228, TM)	5

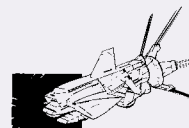
Gunners	Minimum Gunners Requirement*
Standard Weapons	1 per 6 weapons
Capital Weapons	1 per weapon

Crew	Minimum Officer Requirement
5 or more Crew	(Total Base Crew + Total Gunners) ÷ 6 (round up)

*Inclusive to the crew (thus, for every 6 crewmen assigned, 1 is an officer)

(24 crew ÷ 6 = 4). Thus, Kate decides to spend 140 tons on 20 Standard crew quarters (20 quarters x 7 tons per = 140), and 40 tons more for 4 officer quarters (4 officers x 10 tons per). Combined with the 863 tons' worth of control systems, Kate computes that her JumpShip has 8,671 tons remaining (9,714 tons – 863 [Control Systems] – 140 [Crew quarters] – 40 [Officers' quarters] = 8,671 tons). Kate notes, however, that her crew needs may increase depending on any additional equipment she may decide to mount.

Computing the weight of the McKenna's control systems, Lynn finds that these will weigh 4,825 tons (1,930,000 tons x 0.0025 = 4,825 tons).



The minimal crew—before gunners—works out to 431 (45 + [1,930,000 tons ÷ 5,000] = 431). Of these, 72 must be officers (431 crew ÷ 6 = 71.8 officers, round up to 72). The quarters for these minimal crew needs will thus weigh 2,513 tons in Standard quarters (359 crew x 7 tons per), plus 720 tons in Officers' quarters (72 officers x 10 tons per).

The combined weight of the control systems and minimal crew quarters allotted to the McKenna leaves the WarShip with 516,108 tons left over (524,166 tons – 4,825 tons [Control Systems] – 2,513 [Crew quarters] – 720 tons [Officers' quarters] = 516,108 tons).



SPECIAL ENHANCEMENTS

Some Space Stations are equipped to be carried by Jump-Ships. Such stations are limited to 100,000 tons and must be equipped with a KF Boom. They replace the Space Station cost multiplier of x1.25 (see p. 158) with x20.

STEP 3: ADD HEAT SINKS

Like all other Large Craft, in Standard Rules advanced aerospace units operate on a “zero-net-heat principle” where the number of heat sinks installed provides a hard cap on the amount of heat such units may generate from all weapons fired in one turn. This means that, while advanced aerospace units need not mount enough sinks to cover all heat the unit may potentially generate in one turn, it should mount at least enough to effectively use some of its weaponry.

Though determining an advanced aerospace unit’s heat sink needs is dependent on many factors, this stage can help provide designers with a guide toward determining how many heat sinks the unit receives initially (if any), as well as preparing the unit in advance for a desired selection of weapons. Alternatively, the designer may wish to skip this step until after all weapons and equipment are selected, in order to better allocate the unit’s remaining tonnage.

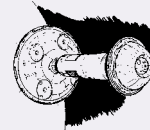
Thanks to the design of their fusion engines, advanced aerospace units receive a certain number of “weight-free” heat sinks that are considered part and parcel with their power plants. To find the number of weight-free sinks provided by a given advanced aerospace unit type, consult the Advanced Aerospace Unit Heat Sinks Table, below.

Advanced aerospace units of any type may be equipped with either standard or double heat sinks. A unit may not combine different heat sink types on the same design; if an advanced aerospace unit selects double heat sinks, then all of its free sinks are also double heat sinks.

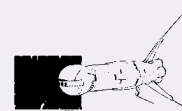
Tech Base: Standard (single) and double heat sinks are equally available to advanced aerospace units of Clan or Inner Sphere tech bases. (Though units built with an Inner Sphere tech base may use only Inner Sphere double heat sinks, and Clan-made units may use Clan double heat sinks, the distinction between them in the design of advanced aerospace units does not noticeably affect the amount of tonnage or space used.)

Space: An advanced aerospace unit’s heat sinks do not affect the amount of weapon slots available to the unit.

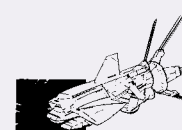
Joel knows that his Alliance-class space station will have a certain number of weight-free heat sinks (which may be standard (single) heat sinks, or double-strength sinks at his option). Applying the Weight-Free Heat Sinks formula shown in the Advanced Unit Heat Sinks Table, Joel finds that the Alliance—with its 1,200-ton engine—will receive 93 weight-free sinks ($45 + \sqrt{(1,200 \times 2)} = 93.99$, rounded down to 93). Because he sees his Alliance as using less sophisticated technologies across the board, but also sees it as a well-armed station in a pinch, Joel selects standard heat sinks, and decides to mount an additional 307 of them (at 307 tons), for a final count of 400 heat sinks (307 added sinks + 93 weight-free sinks = 400). This leaves the Alliance with 86,705 unspent tons ($87,012 - 307 = 86,705$).



For her Odyssey-class JumpShip, Kate also notes that she may receive a certain number of weight-free sinks with its engine, and that the vessel may mount either standard or double heat sinks. Applying the Weight-Free Heat Sinks formula, she finds that the Odyssey’s 4,140-ton engine will provide the vessel with 135 free sinks ($45 + \sqrt{(4,140 \times 2)} = 135.99$, round down to 135). Deciding that the JumpShip will not be that heavily armed, Kate decides that single heat sinks will be sufficient and spends only 1 ton on added sinks, for a total of 136 standard heat sinks. The Odyssey now has 8,670 unspent tons remaining ($8,671 - 1 = 8,670$ tons).



With its massive 347,400-ton engine, Lynn’s McKenna-class WarShip receives 878 free heat sinks according to the Weight-Free Heat Sinks formula ($45 + \sqrt{(347,400 \times 2)} = 878.55$, round down to 878). Because she is building a vessel meant for heavy combat, even choosing double heat sinks (which she does do) won’t measure up to the kind of heat management Lynn anticipates the ship will need. She thus elects to mount an extra 5,447 double heat sinks (at a cost of 5,447 more tons in weight), for a final heat sink count of 6,325 (5,447 added sinks + 878 weight-free sinks = 6,325 total sinks). Because these are double heat sinks, the McKenna will be able to vent 12,650 total heat points per turn ($6,325 \text{ sinks} \times 2 \text{ points per sink} = 12,650 \text{ points}$). The McKenna now has 510,661 unspent tons remaining ($516,108 \text{ tons} - 5,447 \text{ tons} = 510,661 \text{ tons}$).



ADVANCED AEROSPACE UNIT HEAT SINKS TABLE

Advanced Aerospace Unit Type	Min. Heat Sink Requirement	Weight-Free Heat Sinks
Advanced Aerospace Units (All)	None	$45 + \sqrt{(\text{Engine Tonnage} \times 2)^*}$

*Round down

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STEP 4: ADD ARMOR

Advanced aerospace units—whether built as unarmed JumpShips or as formidable WarShips—require armor to protect their internal structures and critical components against debris, routine wear and tear, and combat. The range of armor available and its effectiveness varies with the unit's weight and its technology base.

The maximum amount of armor points an advanced aerospace unit may mount is based on its weight and unit type. This value applies to Clan and Inner Sphere advanced units, regardless of the Tech Rating used, and is established in tons of armor—rather than in armor points—for advanced aerospace units.

Using the Armor Diagram on the advanced aerospace unit's appropriate Record Sheet, mark out any excess armor circles to indicate the number of armor points that protect each part of the unit's body. Armor circles for a given location appear in the appropriate unshaded parts of the diagram.

Under these rules, designers may not mix armor types on an advanced aerospace unit, and may only use armor types listed in the Advanced Aerospace Unit Armor Table (see below).

Advanced aerospace units mount armor per the same basic rules as other aerospace units, but use a different damage scale known as capital-scale. Capital-scale armor and damage is generally reserved for JumpShips, Space Stations and WarShips, to more easily track the incredible amount of armor points possible for these super-large units. Each point of capital-scale armor is equal to 10 points of standard-scale armor.

The maximum number of armor tons (*not* points) an advanced aerospace unit may receive is shown in the Maximum Armor column of the Advanced Aerospace Unit Armor Maximums Table. This value is always rounded down to the nearest half-ton.

Advanced aerospace units include a certain degree of armor within their very structure (which does not count toward the tonnage of armor that may be added), and thus do not have a minimum armor requirement. The amount of "free" capital-scale armor (per facing) an advanced aerospace unit receives is based on its Structural Integrity value. The formula for computing this free SI-provided armor is shown on the Advanced Aerospace Unit Armor Table, and rounds normally (rounding up on .5), to a minimum value of 0.

Advanced aerospace units use the Advanced Aerospace Unit Armor Weights Table to find how many capital-scale points of armor are provided per ton, based on the unit's total weight and armor type chosen. Each armor type's points-per-ton value is given as two numbers separated by a slash. For Inner Sphere-made advanced aerospace units, the number left of the slash is the number of capital-scale points provided per ton of armor; Clan-made units use the number to the right of the slash.

To find the tonnage of a given number of capital armor points *beyond* the free SI-provided armor, divide the total desired number of capital-scale armor points by the number of points per ton (based on the armor type and tech base used) and round the result up to the nearest half-ton.

Tech Base/Rating: Advanced aerospace units built with an Inner Sphere technology base may only use standard Inner Sphere armor, as well as Inner Sphere improved ferro-aluminum, ferro-carbide and Lamellor ferro-carbide armors. Advanced aerospace units built with a Clan tech base may only use the Clan equivalents of these armor types.

Space: Under these rules, no armor type available to an advanced aerospace unit reduces its equipment space.

ADVANCED AEROSPACE UNIT ARMOR TABLE

ADVANCED UNIT ARMOR MAXIMUMS		
Unit Type	Maximum Armor (tons)*	Armor Facings
JumpShip	Structural Integrity Mass ÷ 12	Nose, Fore-Left, Fore-Right, Aft-Left, Aft-Right, Aft
Space Station	Structural Integrity Mass ÷ 3 + 60	Nose, Fore-Left, Fore-Right, Aft-Left, Aft-Right, Aft
WarShip	Structural Integrity Mass ÷ 50	Nose, Fore-Left, Fore-Right, Aft-Left, Aft-Right, Aft

*Round all values down to nearest half-ton

Advanced Aerospace Unit Armor Table (Capital Scale)	
Free SI-Provided Armor Value (Points per Facing) = Unit's Structural Integrity Value ÷ 10*	

*Round normally (up on .5); Free SI-provided armor does not count against the unit's maximum armor limits

ADVANCED AEROSPACE UNIT ARMOR WEIGHTS				
Advanced Aerospace Unit Weight	Standard	Points per Ton by Armor Type [Inner Sphere/Clan]*		
		Imp. Ferro-Aluminum	Ferro-Carbide	Lamellor Ferro-Carbide
2,000 through 149,999 tons	0.8/1.0	1.0/1.2	1.2/1.4	1.4/1.6
150,000 through 249,999 tons	0.6/0.7	0.8/0.9	1.0/1.1	1.2/1.3
250,000 through 2,500,000 tons	0.4/0.5	0.6/0.7	0.8/0.9	1.0/1.1

*Round down after determining total armor tonnage

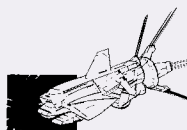
As his Alliance-class Space Station weighs in at 100,000 tons (1,000 tons of which are Structural Integrity weight) and has a Structural Integrity of 1, Joel finds that the maximum armor he can install on the unit is 393 tons (1,000 tons of Structural Integrity $\div 3 + 60 = 393.33$, round down to 393). Because its Structural Integrity value is so low, however, the station receives no free capital-scale armor for each facing (1 SI $\div 10 = 0.1$, rounded normally—down—to 0). Because he sees the Alliance as a fixture in an era of simpler technologies, Joel chooses standard Inner Sphere armor—which provides 0.8 capital-scale points per ton. Joel decides to install 7 capital-scale points of armor per each of the station's six facings, for a total Armor Factor of 42. This armor will weigh 52.5 tons in all (42 points $\div 0.8$ points per ton = 52.5 tons), well below the station's maximum potential armor limit. This will leave the Alliance with 86,652.5 unspent tons remaining (86,705 – 52.5 = 86,652.5).



Kate's Odyssey, a 345,000-ton JumpShip with a Structural Integrity value of 1 and an SI weight of 2,300 tons, may install a maximum of 191.5 tons of armor (2,300 tons for SI $\div 12 = 191.67$, rounded down to 191.5). Kate decides to install 168 tons of standard armor (which, because it is a Clan-designed JumpShip weighing more than 249,999 tons, provides 0.5 points of capital-scale armor per ton) for a total of 84 points (168 armor tons $\times 0.5$ points of armor per ton = 84 points). As with the Alliance, the Odyssey's SI of 1 provides no bonus armor, and so she assigns the armor points as follows: 15 to the Nose, 13 to the Aft and 14 to each of the four side facings. After subtracting the armor tonnage, Kate finds that her JumpShip now has 8,502 unspent tons remaining (8,670 – 168 = 8,502).



Lynn's McKenna-class WarShip is a 1,930,000-ton vessel with a Structural Integrity value of 95 and an SI weight of 183,350 tons. The vessel may thus install a maximum of 3,667 tons of armor (183,350 tons for SI $\div 50 = 3,667$). Lynn decides to install 1,603.5 tons of armor, and chooses to employ ferro-carbide armor. Because she planned her McKenna to serve in the Star League era, Lynn must choose Inner Sphere ferro-carbide, which provides 0.8 capital-scale points of armor protection per ton for a vessel this size. This yields a total of 1,282 armor points (1,603.5 tons $\times 0.8 = 1,282.8$, rounded down to 1,282). In addition, however, the McKenna's SI of 95 provides 10 extra free capital-scale points per facing (95 SI $\div 10 = 9.5$, round normally—up on .5—to 10). When assigning armor values, Lynn assigns 190 points to the McKenna's Nose, 132 to its Aft and 240 to all four side armor facings. With the bonus 10 points, this yields 200 capital-scale armor points on the vessel's Nose, 142 to the Aft and 250 on each side facing. After subtracting the armor tonnage, Lynn finds that her WarShip now has 509,057.5 unspent tons remaining (510,661 – 1,603.5 = 509,057.5).



STEP 5: ADD WEAPONS, AMMUNITION AND OTHER EQUIPMENT

The weapons, ammunition and equipment that may be mounted on advanced aerospace units are listed in the Weapons and Equipment Tables beginning on page 86 of *Tactical Operations: AUE* and page 341 of *TechManual* (see *TechManual Items*, below). In addition to any heat, damage and range statistics, these tables provide the weight these items take up on an advanced unit, how many equipment slots they occupy, what technology base (Clan or Inner Sphere) is required to use them, and any special construction rules that might apply to installing the equipment (such as location and unit type restrictions).

Remember that the total weight for a given advanced aerospace unit's structure, engine, controls, armor, heat sinks, weapons and other components must never exceed the weight established for the vehicle in Step 1. Any leftover weight that cannot be allocated to cargo space (see *Transport Bays and Doors*, p. 143) or other equipment (due to item slot constraints or other factors) is considered wasted tonnage.

Weapons and items placed on any advanced aerospace unit automatically receive a fixed firing arc in that direction (meaning a JumpShip's front-mounted weapon will have a front firing arc, while a WarShip's left-broadside mounted weapon can only fire into the left broadside arc, and so on). Advanced aerospace units may not mount turrets or pintles of any kind.

For special rules on any item, consult its entry under *Heavy Weapons and Equipment* (see pp. 201-245, TM), or *Advanced Weapons and Equipment* (see pp. 86-187, TO:AUE).

TechManual Items: The items described and listed in the Weapons and Equipment Tables in *TechManual* may all be mounted on advanced aerospace units in accordance with their standard equipment rules. Advanced aerospace units may install any item permitted on tournament-legal DropShips, in addition to any weapons and equipment featured in this book specifically permitted to such units.

Tech Base/Rating: The various Weapons and Equipment Tables note which items are available to which technology bases. Clan-made advanced aerospace units may use only items available to the Clans, while Inner Sphere-made advanced aerospace units must use only those items available to the Inner Sphere.

Space: For advanced aerospace units, only weapons have a slot space, with each weapon typically occupying 1 slot on the unit's weapon and equipment inventories. Items that require listing on this inventory are listed on the relevant Weapon and Equipment Tables with a value other than 0 for their unit types.

Weapons and Ammunition: Under these rules, all advanced aerospace units may not mount Light- or Medium-weight weapons, but they may instead mount Heavy weapons, which are represented in the Weapons and Equipment Tables starting on page 341 of *TechManual*, or page 216 of *Tactical Operations: AUE*. All ammo-dependent weapons from these lists—except for machine guns (including their

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Light and Heavy versions) and nail or rivet guns—require at least a ton of ammunition. (Machine guns, nail guns and rivet guns may carry ammo in half-ton lots instead.) Advanced aerospace units must also satisfy a minimum 10-shot requirement for all ammo-dependent weapons, rounding any excess resulting ammunition weights up to the nearest half-ton.

Advanced aerospace units include their ammo bins with the weapons they feed at no cost in slots, so the 40 rounds for a WarShip's NAC/20 will appear on the same line as the weapon itself on the ship's weapon inventory.

Remember that, depending on the number of weapons and types of fire-control systems used, the advanced unit may require additional crew (and any applicable accommodations) to handle such firepower. Advanced aerospace units require gunners for all weapons and equipment that have a damage value, with crew needs for such items identified as described under *Add Control/Crew Systems* (see p. 137).

Capital Weapons: All advanced aerospace units may mount capital-scale and sub-capital scale weapons (see pp. 143, 145, 155, *TO:AUE*).

Power Amplifiers: As they only use Fusion engines, advanced aerospace units do not require power amplifiers.

Advanced Aerospace Unit Weapon Bays and Firing Arcs: As a means of simplifying their use in combat, the weapons usable by advanced aerospace units are sorted into weapon classes in the same fashion as for DropShip units. These weapon bay classes are: Point Defense, Laser, Pulse Laser, PPC, Plasma, Autocannon, LB-X AC, ATM, LRM, MML, MRM, SRM, Rocket Launcher, Capital Missile, Capital Laser, Capital Gauss, Capital PPC, Capital AC and Screen. All weapons must be allocated to bays of the appropriate type; non-capital weapons may not be allocated to capital weapon bays, and vice versa. Note that this does not mean that all of the weapons of a given type in the same location must be condensed into one bay, though doing so would streamline the unit's game play.

The only limit to the number of weapons that can be grouped together in a single weapon bay is a maximum attack value limit—after adding up all weapon damage—of 700 standard damage points (70 capital damage points) per bay. If a combina-

tion of desired weapons exceeds this amount in a single firing arc, the vessel simply requires additional weapon bays to handle the excess weaponry, with the damage capability split as evenly as possible among all appropriate weapon bays.

Space Stations divide their weapon bays among six firing arcs: Nose, Fore-Left, Fore-Right, Aft-Left, Aft-Right and Aft. JumpShips and WarShips may divide their weapons among eight firing arcs: Nose, Fore-Left, Fore-Right, Left-Broadside, Right-Broadside, Aft-Left, Aft-Right and Aft. Side-mounted weapons must be identical on both sides of a given unit—so if a Space Station carries 2 large lasers and an SRM-6 on its Fore-Left side, it must carry 2 large lasers and an SRM-6 in its Fore-Right side as well.

Turrets/Pintles: Advanced aerospace units may not mount turrets or pintles.

Heat Sinks: Advanced aerospace units may mount any number of heat sinks desired. However, because such units operate on a zero net heat principle (meaning that they have no heat scale to track overheating), and because weapons are fired in full weapon bays, such units must at least carry enough sinks to cover the heat produced by all weapons from a single weapon bay fired from the most heat-producing weapons bay on the unit. For example, if the combined heat from the unit's most heat-intensive weapons bay comes to 300 points, the unit must mount a minimum of 300 standard heat sinks (or 150 double heat sinks).

Docking Hardpoint (Docking Collar): As noted on page 116 of *Tactical Operations: AUE*, a docking hardpoint (also known as a docking collar) is required for one unit to dock to another. For JumpShips and WarShips docking DropShips for hyperspace jumps, the maximum tonnage per docking collar is 100,000 tons.

Small Items on Advanced Aerospace Units: Advanced aerospace units rarely employ small items, as many of the craft's amenities actually cover such features by default, but if a designer opts to install small-size items on an advanced aerospace unit, use the following rules.

Several items that may be installed on advanced aerospace units have weight values presented in kilograms rather than tons. When mounting such items, the designer must keep a running total of the number of kilograms used. At the end of this



An unpressurized naval repair facility, built into an asteroid, awaits the next vessel in need of a repair or heavy upgrade.



step in the design process, divide this quantity of kilograms by 1,000 to find their total weight in tons. Always round up used weight to the nearest half-ton, so any leftover weight automatically rounds down to the nearest half-ton for cargo purposes.

Crew Quarters: Advanced aerospace units of all types receive no free crew quarters, and must therefore allocate tonnage to personnel quarters. In most cases, these quarters are installed at a standard rate of 7 tons per non-commissioned crew, gunners and second-class passengers, and 10 tons for officers and first-class passengers. Alternative quarters may be installed to save on weight, reflecting a more spartan arrangement, such as applying steerage-quality quarters to all crew and passengers.

Bay personnel—which includes personnel associated with other units being transported, such as infantry, vehicles, fighters and 'Mechs—do not need quarters, as their bays already incorporate basic amenities. Additional quarters for such personnel may be added as passenger quarters, reflecting an added level of comfort and support, but are not required.

Fire Control Systems: Advanced aerospace units have the option of exceeding their listed maximum of weapons per arc, at the designer's option, but if they do so, additional fire control systems and power distribution systems will need to be installed. To determine the weight of these systems, divide all weapons mounted in any firing arc that exceeds its weapon limits (12 for JumpShips, 20 for Space Stations and WarShips) by the limit value, and round the result down to the nearest whole number. Multiply this result by 0.1 times the total weight of *all* weapons mounted in that arc (discounting ammunition), and round the final result up to the nearest half. This is the final weight of any expanded fire control and power systems the unit requires for such weaponry.

Transport Bays and Doors: Bays for cargo and unit transport often make up all remaining tonnage on advanced units of every stripe (though the Star League era also left ample room for later refit work, such as converting a WarShip from a cruiser configuration to a carrier model). These bays can be specific cubicles for 'Mechs, fighters and other units, or they may be generic cargo bays to store supplies, spare parts or even additional ammunition and fuel stores.

How much of the generic cargo space is allocated to such needs is entirely up to the designer and can vary from mission to mission, so this issue need not be addressed during construction. During the time of the Star League, for example, it was standing doctrine to devote as much as 25 percent of a WarShip's total mass to cargo, with a minimum of 1 percent of the ship's mass (and as much as 5 percent) devoted to spare parts for routine maintenance, and to allocate tonnage for 180 to 360 days' worth of food and potable water for crew and passenger needs, including bay personnel. Additional bulk tonnage was used to carry extra ammunition for the vessel's guns (which could vary wildly), or to house troops and their supplies in transit, freeing them from the more cramped confines of their DropShips. The remainder was then left to haul supplies and personnel for more humanitarian missions, like colonial support and planetary evacuations. JumpShips and more modern WarShips often lack this much space, resulting in units that are better tailored to short-term functions and

ADVANCED AEROSPACE UNIT MAXIMUM BAY DOORS TABLE

Advanced Unit Type	Maximum Bay Doors
JumpShips	$7 + [\text{Unit Weight} \div 50,000]^*$
Space Stations	$8 + [\text{Unit Weight} \div 75,000]^*$
WarShips	$8 + [\text{Unit Weight} \div 100,000]^*$

*Round fractions up

briefier missions away from ports of call or in the absence of supporting DropShips.

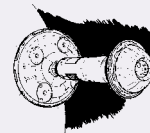
On spacecraft, 1 ton of food and water covers the needs of 200 people for 1 day if they are assigned to quarters. Bay personnel (including infantry bay personnel) who do not receive separate quarters have simpler life support and facilities, and thus use 1 ton of consumables (food, water, air, and so on) per 20 people for 1 day. Personnel transported in cargo bays use 1 ton of consumables per 5 people per day.

Designers of advanced aerospace units must assign a minimum of 1 bay door to any unit with a transport bay, to allow for entry and egress from the unit. To find the maximum total number of bay doors of all types – cargo doors, launch doors, repair bay doors, etc. – a unit can incorporate, consult the Advanced Aerospace Unit Maximum Bay Doors Table above.

A transporting unit's launch rate (per turn) for onboard fighters or other launch-capable units with appropriate cubicles (Small Craft, 'Mechs and ProtoMechs) is equal to twice the number of functioning bay doors associated with its launch-capable units. For example, a Space Station with 18 fighters in a single fighter transport bay that has 2 doors assigned to it may launch 4 of these 18 fighters per turn (2 doors x 2 fighters per door per turn = 4 fighters per turn). Meanwhile, a WarShip that has 12 BattleMechs across two bays, each of which has 2 doors, would be able to deploy 8 'Mechs per turn (2 doors per bay x 2 bays x 2 BattleMechs per door per turn = 8 BattleMechs per turn).

With 86,652.5 tons left to spend on his Alliance-class Space Station, Joel starts by installing two pressurized repair bays (see p. 146, TO:AUE), each of which he wants to be capable of servicing craft weighing up to 50,000 tons. The weight for such bays is thus 3,750 tons each (50,000 tons x 0.075 = 3,750), for a total of 7,500 tons. Joel then adds 8 Small Craft bays (200 tons each), with 1 Door, and a 420-meter grav deck for the comfort of shipboard personnel (500 tons). Because these are not weapon items and the Alliance is an advanced aerospace unit rather than a support vehicle, none of this equipment requires a location or arc except for the Small Craft bay door (which Joel assigns to the Front facing).

Moving on, Joel then decides to mount a range of weapons on his Space Station. Intended for defensive purposes only, he eschews capital-scale weapons and so



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limits his options to the standard scale. Because the Alliance lacks maneuvering capability, he decides to mount identical firepower in each of its six firing arcs (Front, Fore-Left, Fore-Right, Aft-Left, Aft-Right and Aft), and chooses the following weapons per arc: 1 PPC (7 tons), 2 LRM-15s (7 tons each), AC/5 (8 tons), 2 Large Lasers (5 tons each) and 6 Medium Lasers (1 ton each). Because this firepower is repeated in each of the unit's six arcs, the total weight for the station's weaponry comes to 270 tons (6 arcs x [1 (PPC) + 14 (2 LRM-15s) + 8 (AC/5) + 10 (2 Large Lasers) + 6 (6 Medium Lasers)] = 270). Because the number of weapons per arc does not exceed 12, no additional fire control is required for the station. The weapons, grouped into PPC, LRM, AC and Laser bays, also do not exceed 70 points of capital-scale damage and so do not need to be further divided within their arcs. Joel further installs 30 tons of ammunition to feed the LRM-15s, and 6 tons to feed the AC/5s. This ammunition is distributed evenly among the six weapon arcs, placing 5 tons of LRM ammo and 1 ton of AC/5 ammo on in each arc. Between the weapons and the additional equipment installed above, Joel has spent 11,906 tons (7,500 [2 pressurized bays] + 2,000 [2 docking collars] + 1,600 [8 Small Craft bays] + 500 [grav deck] + 270 [weapons] + 36 [ammo] = 11,906).

Looking at crew requirements, Joel sees that the Alliance now requires a minimum base crew of 65 ($45 + [100,000 \text{ tons} \div 5,000] = 65$), plus 12 gunners (72 weapons $\div 6 = 12$), for a total minimum crew of 77. This means the station also has a minimum requirement of 13 officers ($77 \text{ crew} \div 6 = 12.8$, round up to 13), who may be included among the crew counts. Joel decides to triple the amount of regular and officer crew to a final total of 210 crewmen and 20 gunners, 38 of whom will be officers ($230 \div 6 = 38.3$, round up to 39), to account for additional personnel for the repair bays and more frequent crew rotations on longer assignments. He also opts to add two platoons of marines (48 troopers) to the station's personnel, as well as space for up to 150 passengers. For this final count of 172 crew, 20 gunners, 38 officers, 48 marines and 150 passengers, he knows he has already installed 54 Crew quarters and 11 Officers' quarters, leaving 186 more quarters for the crew, gunners and marines (at 7 tons each), and 27 more Officers' quarters to (10 tons apiece) to install, plus 100 second-class quarters for passengers (7 tons apiece), and 50 first-class quarters for VIP passengers (10 tons each). The final tally for the Alliance's additional quarters thus comes to 3,132 tons ($826 [118 \text{ crew}] + 140 [20 \text{ gunners}] + 336 [48 \text{ marines}] + 270 [27 \text{ officers}] + 700 [100 \text{ second-class passengers}] + 500 [50 \text{ first-class passengers}] = 2,772$). For emergency evacuation, Joel adds 60 Life Boats at 7 tons each, for an extra 420 tons.

After subtracting the equipment, weapons, quarters and lifeboats, Joel finds that his Alliance now has 73,554.5 tons remaining ($86,652.5 \text{ tons} - 11,906 [\text{weapons and equipment}] - 2,772 [\text{quarters}] - 420 \text{ tons} [\text{lifeboats}] = 73,554.5 \text{ tons}$), which he assigns to a single cargo bay. For accessibility, he assigns two doors to this bay—one each facing the station's Fore-Left and Fore-Right sides.

Kate's Odyssey-class JumpShip has 8,502 unspent tons remaining for equipment, weapons and quarters. As her vessel is a JumpShip weighing 345,000 tons, she determines that the first priority will be docking collars, of which the Odyssey can

have up to 6 ($345,000 \text{ tons} \div 50,000 = 6.9$, round down to 6). She decides to install 4 Docking Collars (at 1,000 tons each), as well as 1 Small Craft bay (200 tons), 2 110-meter grav decks (100 tons each), and 3 Life Boats (7 tons each). For added support against boarding parties, she even adds two Battle Armor Point/Squad bays (10 tons each). As an advanced aerospace unit, none of these items require slot space, but the Small Craft and Battle Armor bays do require doors, which Kate assigns at 1 for the Small Craft (Front facing), and 2 for the Battle Armor (Aft-Left and Aft-Right, respectively). After installing this equipment, Kate decides—for an extra-special bonus—to install a Lithium-Fusion Battery on her JumpShip as well, at a cost of 3,450 tons ($345,000 \text{ JumpShip tons} \times 0.01 = 3,450 \text{ tons}$). These non-weapon items come to a total of 7,891 tons ($4,000 [4 \text{ Docking Collars}] + 200 [1 \text{ Small Craft Bay}] + 200 [2 \text{ Grav Decks}] + 21 [3 \text{ Life Boats}] + 20 [2 \text{ Battle Armor Bays}] + 3,450 [\text{LF Battery}] = 7,891$).

Even though, like Joel's Alliance, her Clan-made Odyssey will be a largely stationary target in combat, Kate decides that its weapons need not be so uniformly distributed. With leftover tonnage too low to expend on capital-scale weapons, she also goes for standard-scale weaponry. For the Front arc, she installs 2 Gauss Rifles (12 tons each) and 3 tons of Gauss ammo (for 24 shots) to an Autocannon bay, and 1 ER Large Laser (4 tons) to a Laser bay. She also adds 1 Large Pulse Laser (6 tons) and 2 Medium Pulse Lasers (2 tons each) to a Pulse Laser bay. For the Front-Side arcs (which must be identical to each other), she assigns 1 ER Large Laser to a Laser bay, 2 Medium Pulse Lasers to a Pulse Laser bay and 2 Anti-Missile Systems (0.5 tons each) with 2 tons of ammo (24 shots) to a dedicated AMS bay. For the Aft-Side arcs (which also must mirror each other), Kate mounts 1 Large Pulse Laser and 2 Medium Pulse Lasers in a Pulse Laser bay, and 2 more Anti-Missile Systems (with 2 tons of ammo; 24 shots) to a dedicated AMS bay. The Aft arc is covered by an ER Large Laser in a Laser bay, plus 1 Large Pulse and 2 Medium Pulse Lasers in a Pulse Laser bay. As no single arc exceeds 12 weapons, extended fire control is unnecessary, and no capital damage values in any single weapons bay exceed 70, requiring no further weapon bay breakdowns. This leaves the total weight of all mounted weapons at 92 tons ($38 [\text{Front Arc: 2 Gauss, 1 ER Large, 1 Large Pulse, 2 Medium Pulse}] + 18 [2 \times \text{Front-Side Arc: 1 ER Large, 2 Medium Pulse, 2 AMS}] + 22 [2 \times \text{Aft-Side Arc: 1 Large Pulse, 2 Medium Pulse, 2 AMS}] + 14 [\text{Aft Arc: 1 ER Large, 1 Large Pulse, 2 Medium Pulse}] = 92 \text{ tons}$), plus 11 tons of ammunition ($3 [\text{Gauss}] + 8 [\text{AMS; 4 Arcs} \times 2 \text{ tons each}] = 11$).

Reviewing crew needs, Kate finds that the Odyssey has a base requirement of 24 crewmen ($6 + [345,000 \div 20,000] = 23.25$, rounded up to 24) plus 5 gunners (26 weapons [AMS not counted, as it does not require a Gunnery Skill roll to fire] $\div 6 = 4.33$, round up to 5). Five of these crewmen must be officers ($29 \text{ crew} [24 \text{ base} + 5 \text{ gunners}] \div 6 = 4.833$, round up to 5). Kate assigns 7 additional crewmen to exceed the minimum needs, upping the crew and gunner total to 36; this forces her to add another officer for a total of 6 ($36 \text{ crew} + \text{gunners} \div 6 = 6$). As she has already assigned 20 Crew quarters and 4 Officers' quarters, she assigns an additional 10 standard 7-ton quarters to the remaining non-rated crew and gunners, and 2 additional



10-ton Officers' quarters, covering the needs of the 30 enlisted and 6 officers of her vessel for a total weight of 90 tons ($70 [10 \text{ crew and gunners} \times 7] + 2 [2 \text{ officers} \times 10] = 90$). Though the vessel will also have bay personnel for its Small Craft and battle armor, Kate decides that space is already at a premium for her Odyssey and decides not to spring for extra quarters for these passengers, forcing them to make do with the minimalist bunk space their bays provide.

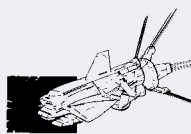
The final 418 tons ($8,502 - 7,891 [\text{non-weapon equipment}] - 92 [\text{weapons}] - 11 [\text{ammo}] - 90 [\text{quarters}] = 418$) is assigned to a standard cargo bay, which Kate provides with a single bay door (facing the front).

Lynn's McKenna-class WarShip has 509,057.5 tons left to spend on weapons, equipment and quarters. Though she mainly intends this vessel to engage and destroy other capital ships, she decides to start with the non-weapon equipment first, just to get them out of the way. First, she chooses to install docking collars, and computes that the 1,930,000-ton battleship can have up to $38 (1,930,000 \text{ tons} \div 50,000 = 38.6, \text{ round down to } 38)$. Lynn decides 38 would be excessive, however, and installs only 6 collars on the McKenna (at 1,000 tons each). She also installs launch cubicles for 50 fighters (at 150 tons each), divided into two bays (each of which is assigned 4 doors). An additional 16 Small Craft bays are added as well (at 200 tons apiece), but not assigned doors (they will simply launch through the fighter bays when needed). For crew comfort and security, Lynn also installs 3 grav decks—2 at 45-meter diameter and 1 at 75-meter diameter—at 50 tons each, plus 30 7-ton Escape Pods and 30 7-ton Life Boats. For added strategic value, Lynn also decides to add a Lithium-Fusion Battery to this WarShip, at a weight cost of 19,300 tons ($1,930,000 \text{ WarShip tons} \times 0.01 = 19,300 \text{ tons}$). These non-weapon items come to a total of 36,570 tons ($6,000 [6 \text{ collars}] + 7,500 [50 \text{ Fighter Cubicles}] + 3,200 [16 \text{ Small Craft Bays}] + 150 [3 \text{ Grav Decks}] + 210 [30 \text{ Life Boats}] + 210 [30 \text{ Escape Pods}] + 19,300 [\text{LF Battery}] = 36,570$).

For weaponry, Lynn intends to focus entirely on capital-scale armament, relying on the McKenna's fighters and other escorts to deal with lesser threats, and underscore the vessel's role as a battleship. As a WarShip, the McKenna will have 8 firing arcs available in all: Nose, Fore-Left, Fore-Right, Left Broadside, Right Broadside, Aft-Left, Aft-Right and Aft.

In the Nose arc, Lynn decides to mount 2 NAC/40s in Capital AC weapon bays and 2 NL55s in Capital Laser weapon bays. The NACs must be broken into two Capital AC bays, however, because their combined capital-scale damage values—40 per weapon—would exceed 70 points. These weapons have a combined weight of 11,200 tons ($9,000 [2 \text{ NAC/40s}] + 2,200 [2 \text{ NL55s}] = 11,200$) before ammo is added.

In the Fore-Side arcs (which, as with all aerospace units, must mirror each other), the McKenna mounts 3 more NAC/40s (split into three Capital AC weapon bays), backed up by 3 NL55s in a Capital Laser weapon bay, and 2 AR-10 launchers in a Capital Missile weapon bay. These weapons



will have a combined weight of 17,300 tons ($13,500 [3 \text{ NAC/40s}] + 3,300 [3 \text{ NL55s}] + 500 [2 \text{ AR-10s}] = 17,300$) per side, for a grand total of 34,600 tons for both Fore-Side arcs before ammo is added.

In the Broadside arcs (which, once more, must mirror each other), Lynn installs 12 Heavy NPPCs. Because each NPPC delivers a capital-scale Damage Value of 15, a maximum of 4 may be mounted in a single Capital PPC bay before it exceeds the maximum rating for a single weapon bay. Thus, the broadside weapons are broken into 3 Capital PPC weapon bays of 4 Heavy NPPCs each. At 3,000 tons per Heavy NPPC, each Broadside arc has a weapon weight of 36,000 tons, for a grand total of 72,000 tons for both Broadside arcs.

For the Aft-Side arcs, Lynn repeats the same weapon load she used in the Broadside arcs, with the same effects and final weights. Thus, the 12 Heavy NPPCs in each Aft-Side arc will weigh 36,000 tons, for a grand total of 72,000 tons for both Aft-Side arcs.

In the Aft arc, Lynn begins with 4 NAC/40s spread across 4 Capital AC weapon bays, and backs them up with 4 NL55s in a Capital Laser weapon bay, plus 2 AR-10 launchers. Before ammo is added, these weapons have a combined weight of 22,900 tons ($18,000 [4 \text{ NAC/40s}] + 4,400 [4 \text{ NL55s}] + 500 [2 \text{ AR-10s}] = 22,900$).

Because none of the McKenna's firing arcs exceeded 20 weapons, there is no need for expanded fire control systems. To feed the ammunition needs of the vessel's 12 NAC/40s, Lynn decides to install 500 shots' worth of NAC/40 ammo (at 1.2 tons per shot, that comes to 600 tons; $500 \times 1.2 = 600$), which she divides as evenly as possible among the various NAC/40s (41 shots in the Nose NAC/40s and 1 of the 3 NACs in each Fore-Side arc; 42 shots to all others). For the AR-10s, she provides 30 Barracuda Missiles (at 30 tons each), 20 White Sharks (at 40 tons each) and 20 Killer Whales (at 50 tons each)—placing 5 Barracudas in all 6 launchers, 7 each of the Sharks and Whales in the Fore-Side launchers, and 6 each of these same missiles in the Aft launchers). The total weight for all this ammo comes to 3,300 tons ($600 [500 \text{ NAC/40 shots}] + 900 [30 \text{ Barracuda Missiles}] + 800 [20 \text{ White Shark Missiles}] + 1,000 [20 \text{ Killer Whale Missiles}] = 3,300$).

Reviewing crew needs, Lynn finds that the McKenna has a base requirement of 431 crewmen ($45 + [1,930,000 \div 5,000] = 431$) and 78 gunners ($78 \text{ capital weapons} \div 1 = 78$), for a total crew of 509 ($431 + 78 = 509$). 85 of these crewmen and gunners must be officers ($509 \text{ crew} \div 6 = 84.8, \text{ round up to } 85$). Lynn determines to add another 70 crewmen to the mix, which raises the total crew count to 579, 97 of whom must now be officers ($579 \text{ crew} \div 6 = 96.5, \text{ round up to } 97$). With a final crew count of 97 officers, 404 crewmen, and 78 gunners, Lynn notes before assigning quarters that she has already installed 359 crew quarters and 72 officer quarters. She decides to assign an additional 123 standard 7-ton quarters to the remaining non-rated crew and gunners, and 25 additional 10-ton Officers' quarters, for a grand total of 97 Officers' quarters (72 previously installed + 25 added), and 482 Crew quarters (covering the needs of the 404 enlisted crew and 78 gunners of this vessel). The added quarters come to a total weight of

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ADVANCED AEROSPACE UNIT FINAL COSTS TABLE

Unit Type	Total Cost Formula
JumpShips	(Structural Costs + Weapons and Equipment Costs) x 1.25
WarShips	(Structural Costs + Weapons and Equipment Costs) x 2
Space Stations	(Structural Costs + Weapons and Equipment Costs) x 5

ADVANCED AEROSPACE UNIT STRUCTURAL COSTS AND AVAILABILITY

Component	Cost (in C-bills)	Tech Rating	Availability	Introduction
<i>Controls</i>				
Bridge	200,000 + (10 x Unit Tonnage)	C	C-C-C	ES
Computer	200,000	B	C-C-C	ES
Life Support	5,000 x (Total Passengers + Crew)	C	C-C-C	ES
Sensors	80,000	C	C-C-C	ES
Fire Control Computer	100,000	C	C-C-C	ES
Gunnery Control Systems	10,000 x (Number of Arcs with Weapons)	C	C-C-C	ES
Structure	100,000 x Structural Integrity	C	D-D-D	ES
<i>Maneuvering/Station-Keeping Drive</i>				
Drive Unit	500 x Safe Thrust x (Unit Tonnage ÷ 100)	D	C-D-C	ES
Engine	1,000 x Engine Tonnage	D	C-E-C	ES
Engine Control Unit	1,000	D	C-C-C	ES
<i>Kearny-Fuchida (K-F) Drive</i>				
Drive Coil	60,000,000 + (75,000,000 x No. of Docking Collars)	D	D-E-D	2107
Initiator	25,000,000 + (5,000,000 x No. of Docking Collars)	D	D-E-D	2107
Controller	50,000,000	D	D-E-D	2107
Tankage	50,000 x K-F Drive Integrity Value	D	D-E-D	2107
Sail	50,000 x Sail Tonnage	D	E-E-D	2220
Charging System	500,000 + (200,000 x No. of Docking Collars)	D	D-E-D	2107
Standard Core	Add all Drive Components for total cost of K-F	D	D-E-D	2300
Compact Core	Multiply all K-F Drive Components by 5	D	D-F-E	2107
Standard Core w/Lithium-Fusion Battery	Multiply all K-F Drive Components by 3	D	E-F-E	2529
Compact Core w/ Lithium-Fusion Battery	Multiply all K-F Drive Components by 15	D	E-E-E	2529
<i>K-F Drive Support Systems</i>				
JumpShip Support Systems	10,000,000 x (Unit Tonnage ÷ 10,000)	D	D-D-D	2107
WarShip Support Systems	20,000,000 x (50 + Unit Tonnage ÷ 10,000)	D	D-X-D	2300
<i>Additional Ship's Systems</i>				
Attitude Thrusters	25,000	C	C-C-C	ES
Docking Collar	100,000	B	C-C-C	2304
Fuel Tank	200 x Fuel Tonnage	B	A-A-A	PS
<i>Armor</i>				
Standard	10,000 x Armor Tonnage	D	B-B-B	2300
Improved Ferro-Aluminum	50,000 x Armor Tonnage	E	E-X-E	2350
Ferro-Carbide	75,000 x Armor Tonnage	E	E-F-E	2370
Lamellor Ferro-Carbide	100,000 x Armor Tonnage	E	E-F-E	2615
<i>Heat Sinks</i>				
Standard	2,000 x (Total Number of Heat Sinks)	D	B-B-B	ES
Double	6,000 x (Total Number of Heat Sinks)	E	C-E-D	2567

Notes: ES = Early Spaceflight (introduced between 1950 and 2200); PS = Pre-Spaceflight (introduced in or before 1950)



ADVANCED AEROSPACE UNIT COSTS TABLES

ADVANCED AEROSPACE WEAPON AND EQUIPMENT COSTS AND AVAILABILITY

Component	Cost (in C-bills)	Tech Rating	Availability	Introduction
Energy Storage Batteries	1,000,000	D	C-E-D	2131
Escape Pods	5,000	D	C-D-C	ES
Grav Deck (Under 100m diameter)	5,000,000	B	C-C-C	ES
Grav Deck (100-250m diameter)	10,000,000	B	C-C-C	ES
Grav Deck (Over 250m diameter)	40,000,000	B	C-C-C	ES
Lifeboat	5,000	C	C-C-C	ES
Naval Repair Facilities (Pressurized)	10,000 x Tonnage Capacity	C	C-E-D	ES
Naval Repair Facilities (Unpressurized)	5,000 x Tonnage Capacity	C	C-E-D	ES
Naval Tug Adaptor	100,000	C	C-C-C	ES
Transport Bays	p. 293, TM	*	*	*
Additional Weapons/Equipment				
TechManual items	pp. 290-296, TM	*	*	*
Tactical Operations items	pp. 216-223, TO:AUE	*	*	*

*See Costs column for page reference.

Notes: ES = Early Spaceflight (introduced between 1950 and 2200); PS = Pre-Spaceflight (introduced in or before 1950)

1,111 tons (250 tons [25 Officers' quarters x 10 tons per] + 861 [123 Crew quarters x 7 tons per] = 1,111). Though the vessel will also have bay personnel for its Small Craft and fighter pilots, Lynn decides that the bunk space provided in the fighter and Small Craft bays will be sufficient for such personnel. She also does not bother to add any passenger cabins; the McKenna is a battleship, not a cruise liner.

The final 255,376.5 tons (509,057.5 – 36,570 [non-weapon equipment] – 212,700 [weapons] – 3,300 [ammo] – 1,031 [quarters] = 255,376.5) is assigned to a standard cargo bay, which Lynn provides with 2 bay doors (facing the Left and Right Broadships).

STEP 6: COMPLETE THE RECORD SHEET

By the time the designer has chosen all structure, engine and controls for the advanced unit, and added armor, weapons and equipment, all items must be allocated to their proper places on the appropriate Blank Record Sheet. For a completed Record Sheet, the designer must make sure to have selected the appropriate sheet for the unit's type. The sheet must have all data filled in for the Station/JumpShip/WarShip Data block (including name, tonnage and Thrust values). All equipment

slots must be allocated on the Weapons and Equipment Inventory (including ammunition and number of shots per bin). All extraneous armor and internal structure points must be blacked out on the Armor Diagram.

In the case of advanced aerospace units, weapons are allocated in groups based on weapon classes, with both standard-scale and capital-scale weapons divided into classes. For each weapon group, advanced aerospace units must indicate the standard-scale damage inflicted by the combined weapons in that group at each range, as well as the capital-scale damage (in parentheses). Because the weapons on these units ordinarily fire as a group (unless using the *Individual Weapons* rules; see p. 114), when listing the heat and damage values of a weapons group, these values should be presented as the value for *all* weapons in that group. For example, a listing on the record sheet for 2 ER Large Lasers in a single JumpShip weapon bay would state "2 ER Large Lasers" under the Quantity and Weapon columns, and show 24 for Heat and 16 (2) for standard-scale (capital-scale) damage at the Short and Medium ranges, reflecting both weapons fired in unison.

Once all of the above is completed, the advanced unit is ready for game play.

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CALCULATING ADVANCED AEROSPACE UNIT COSTS

The following rules are additions and/or adjustments to those presented in the *TechManual* (see pp. 302-313). They allow players to determine the C-bill costs and availabilities for any advanced aerospace unit that may be created under these rules. Note that the Costs for weapons and other equipment may be found in *TechManual* (see pp. 290-296) and *Tactical Operations: AUE* (see pp. 216-223).

BASIC COST CALCULATIONS

As in *TechManual*, computing an advanced unit's C-bill cost is a simple matter of summing up the costs for all of the unit's structural components (such as engines, control systems, K-F drives, structure and armor), plus the cost of all weapons and equipment added. Final cost multipliers are then applied to the result, based on the unit's type and weight.

Component Formulas

On occasion throughout the cost calculations process, the designer may be asked to find an individual component's cost through a sub-formula, such as determining the cost of a JumpShip's K-F drive components, by adding to a flat base value a second value based on the number of docking collars mounted on the vessel. When encountering such component formulas, care should be taken to ensure that the values used are the exact ones required for the formula. Computing a WarShip's transit drive engine cost using the ship's total weight instead of its engine weight, for example, can produce a wildly different result.

Rounding

All costs computed here must not be rounded until the end of the calculations process, after applying any final cost multipliers. At that point, costs should be rounded normally to the nearest C-bill (rounding up at .50).

In the earlier stages of calculations, however, designers may either leave all values unrounded, or—for more manageable numbers—rounded normally to three significant digits after the decimal point (thus, a value of 1.4563 could be rounded to 1.456 with minimal impact on computations).

STRUCTURAL COSTS

Because the advanced aerospace units presented in these rules are broadly cross-compatible with each other (in terms of component costs), the Structural Costs Table presented in this section covers all advanced aerospace units together. To find a given unit's structural costs, simply sum up the combined values for all appropriate equipment listed under Advanced Aerospace Unit Structural Costs and Availability.

WEAPONS AND EQUIPMENT

The Weapon and Equipment Costs and Availability Table is used to find the additional cost—beyond that of the aforementioned structural components—for any armaments and other items mounted or carried by a given advanced aerospace unit.

For brevity, however, the costs for most of the weapons and items already covered by *TechManual* and *Tactical Operations* simply refer to the appropriate pages in those sources. As a general guide, when using these figures to compute a unit's final cost, it is not necessary to purchase ammunition for ammo-based weaponry. (Combat units, after all, are generally assembled with weapons and fuel tanks empty to avoid mishaps, and ammo purchases are best left up to field commanders.)

The cost of all weapons and equipment are added to the structural costs for the unit.

Special Exemption: Crew/Passenger Quarters and Infantry Bays/Compartments

For all advanced aerospace units, any and all crew/passenger quarters, infantry bays and infantry compartments are considered cost-free, regardless of the quarters or infantry bay type used on the unit (this cost is considered to be incorporated into the structural and life support costs already incurred by the vessel itself).

FINAL UNIT COSTS

Once an advanced aerospace unit's structural and equipment costs have been determined, the unit's final total cost may be computed by applying the appropriate Total Cost formula for the unit as found under the Advanced Aerospace Unit Final Costs Table. These final costs account for extra features that affect the design overall, as well as the labor, support, resource processing and other abstract minutiae that can go into a unit's design.

Once applied, the unit's final cost may be rounded as indicated under *Basic Cost Calculations* (at left).

CALCULATING ADVANCED AEROSPACE UNIT BV

The following rules add to those presented in the *TechManual* (see pp. 302-313). They allow players to calculate the Battle Value for any advanced aerospace unit that may be created under these rules. Note that the Battle Values for weapons and other equipment may be found in *TechManual* (see pp. 317-319) and *Tactical Operations: AUE* (see pp. 192-197).

Equipment Battle Values: Note that any equipment introduced in *TechManual* or *Tactical Operations*, that is not included in the Inner Sphere and Clan Equipment and BV Tables of those books is considered to have a BV of 0 for the purposes of calculating a unit's Battle Value.

CALCULATING ADVANCED AEROSPACE OFFENSIVE BATTLE RATING

Advanced Aerospace units use a different method than aerospace fighters, for determining the battle value of their weapon attacks, use the following rules in place of those on pages 312-313 of *TechManual*.

Calculate Base Weapon Rating

As with aerospace fighters the weapon battle rating is adjusted to take in account the units heat efficiency, but the exact method

varies to better reflect advanced aerospace zero overheat limitations and their usage of firing arcs.

Advanced Aerospace Heat Efficiency= Heat Sink Capacity

Heat Sink Capacity: For Advanced aerospace units, this is the same as for DropShips (see p. 312, *TM*). After finding the Advanced Aerospace Unit Heat Efficiency, notate this and proceed to Calculate BV By Arc.

Calculate BV By Arc: Advanced aerospace units calculate their weapon battle rating by their firing arcs, reflecting their firing by weapon bay and generating heat by firing arcs. First determine the total weapon only BV (do not factor ammo BV in these calculations) of each individual firing arc (Nose, Aft, Fore Left/Right, Aft Left/ Right, Broadside [for WarShips] Left/Right).

Once these values are determined, compare the battle value of the Nose, Broadside and Aft arcs (for WarShips) or all arcs (for JumpShips, Space Stations and Satellites). The arc with the greatest weapon BV becomes the "front" of the unit for calculating heat efficiency. The "front" arc is calculated at 100% of its Battle Value, even if this arc exceeds the Heat Sink Efficiency of the unit. Next, if the heat sink capacity of the unit has not been exceeded, then find the adjacent firing arc with the highest BV (if two are the same value pick one at random) and calculate this at 100% BV. If heat sink capacity would be exceeded by firing this arc, then add only 50% of the BV for this arc.

If the heat sink capacity will not be exceeded, then add the arc on the opposite side from the "nose" arc at 50% of its total BV; if heat is exceeded then add only 25% of its total BV. Finally all remaining firing arcs are then added at 25% of their BV.

Multiply Total Offensive Battle Rating by Speed Factor: Calculate the units speed factor as per the rules for aerospace (see p. 312, *TM*), using maximum thrust. See specific rules below for how to determine the maximum thrust of a Space Station or JumpShip.

SPACE STATIONS

Except as noted above, use the rules for calculating an Aerospace BV (see pp. 312-313, *TM*) to find the BV of a space station. Stations have a Vehicle Type Modifier of 0.7 when computing Defensive Battle Rating, but multiply their capital-scale armor factor by 25, rather than 2.5, and their capital-scale structural Integrity by 20, rather than 2.0.

When calculating their Offensive Battle Rating, space stations find their Speed Factor based on a Maximum Thrust of 0.

JUMPSHIPS

Except as noted above, use the rules for calculating an Aerospace BV (see pp. 312-313, *TM*) to find the BV of a JumpShip. JumpShips have a Vehicle Type Modifier of 0.75 when computing Defensive Battle Rating, but multiply their capital-scale armor factor by 25, rather than 2.5, and their capital-scale structural Integrity by 20, rather than 2.0.

When calculating their Offensive Battle Rating, JumpShips find their Speed Factor based on a Maximum Thrust of 1.

UNIT TYPE MODIFIERS TABLE (ADDENDUM)

Type	Modifier
JumpShip	0.75
WarShip	0.8
Space Station	0.7

WARSHIPS

Except as noted above, use the rules for calculating an Aerospace Unit's BV (see pp. 312-313, *TM*) to find the BV of a WarShip. WarShips have a Vehicle Type Modifier of 0.8 when computing Defensive Battle Rating, but multiply their capital-scale armor factor by 25, rather than 2.5, and their capital-scale structural Integrity by 20, rather than 2.0.

BALANCING AEROSPACE UNIT FORCES

The Battle Value system was originally designed for the tactical board game and while relatively balanced for ground based units, and even the integration of Aerospace fighter support, it is not able to fully capture the nuances of inter unit aerospace combat. Aerospace Battle Value is structured to balance out similar units and is not ideal for comparing different classes (fighter, fighter squadrons, Large Craft and so on) against one another.

For best game balance it is recommend that both sides have similar BV for each aerospace unit class, or at least similar numbers (12 fighters and 1 DropShip per side for example).

Mike is fielding a Wing of 18 fighters (in 3 six-fighter squadrons) with a total BV 25,218 and one Vengeance DropShip (BV 4,487), for a total force BV of 29,705. Dave wants to field 2 Obsolete Avengers (BV 4,320 each) and 3 Obsolete Achilles (BV 6,744 each) for a total of 28,872 BV. While appearing to be fairly close in BV, experience has told Mike and Dave, that these forces are not well balanced, as Dave lacks any fighters. Even with the use of the Emergency Combat Heading Operation rule (see p. 113), Dave is likely to have his Avengers overwhelmed quickly and his Achilles will have to work over time to keep the fighters in their fore arcs. Dave decides instead to take only 1 Achilles and fields fighters for the remainder of his force.



McFadden's Skyriders fighters protect their Leopard CV DropShip



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AEROSPACE OPERATIONS

—Tharkad University lecture broadcast at the Lloyd Marik-Stanely Aerospace School. Used With Permission.

Yep, Dr. Ready is out again and wants me to run the lecture. Unfortunately, I'm out, too, but the wonders of video recording and splicing have allowed me to pilfer bits and pieces from past semesters.

It turns out that one lecture on the dull aspects of transportation technology wasn't enough. I think Dr. Ready's figured out that he can dump the boring lectures on me so he gets the glory. But did I forecast that research paper or what? You got two lectures of first-hand vids personally made by Dr. Ready of various WarShips, and then a paper on General Electric's Electrofreight train. I hope I got you going in the right direction with my last lecture on trains.

Today, you get a lecture about life on vehicles, spacecraft specifically, and some of their operational aspects. One thousand one hundred fourteen years ago today, Yuri Gagarin became the first human to enter orbit. After thirty years of fairly regular visits, humankind settled in for a permanent residency with the later Sal-...Salyut? Am I saying that right? Anyone from Tikonov here? Yes, the last Salyut space station, Mark 8, was continuously inhabited. And Salyut-8 was soon dwarfed by its Western contemporary, the massive Crippen Station. That means humankind will mark its eleventh full century off Terra in about seventeen years, and the way things are starting to look, some of us might actually be alive to see that date.

COMBAT

Speaking of the excitement brought to the Inner Sphere by the Word of Blake, one thing humankind has been doing while it lived in space is fighting. Let me snip in something from when I had pretensions to teach military history...

We went into space using missiles originally intended to launch nuclear warheads between Terran continents, and the bulk of space travel expenditures for the first half-century of space flight were on military-related hardware. The first recorded serious fight in space was unarmed, non-lethal, and occurred on Salyut-8 in 1994. Something about a spacer from the Soviet tributary state, the Afghan SSR, objecting to the politics of his fellow spacers. Blood sport enthusiasts had to wait almost two decades for space conflict to graduate from fists to knives and see the first murder in space, in 2010 on Crippen Station...there's a first you don't usually hear about Crippen.

Crippen then raised the bar for space combat a lot higher than utility knives by waging the first real space-to-space fleet engagement in 2014: it utilized primitive energy weapons mounted on itself and a flotilla of satellites to shoot down nuclear missiles launched in the Second Soviet Civil War. Crippen's weaponry might as well have been chipped from flint and bone compared to today's weapons, but we're here today because of that engagement.

Almost eleven centuries later, space stations, satellites and ballistic missiles are rare participants in space combat. Today, the dominant participants are DropShips and aerospace fighters, with high-profile cameos by the handful of WarShips. Unlike the variations offered by terrain and atmosphere on a planet, there are not a lot of different approaches for engaging opposing forces. Weaponry makes relatively little difference but for range and firepower-per-weapon, since advantages like indirect fire or problems like minimum ranges are rarely manifest in space. Electronic warfare, on the other hand, provides some advantages and can well turn a battle.

Once the shooting starts, engagements boil down to one of two forms in space: the fast pass and the slow exchange.

The slow exchange dominates media retellings of space combat because it's more exciting to spectators. It entails the two forces ending up on roughly the same heading and speed, like the same direction in orbit or the same direction on a jump point-to-planet transit. Since the two forces are basically moving together, the conflict can last many minutes and give all the dogfighting excitement the entertainment industry has taught us to expect from space combat.

Not a lot of fancy options exist for finessing a slow exchange. Unless one side has an edge in fuel and acceleration that allows it to flee, the fight will continue until someone wins one way or another. There are no handy canyons, forests or storms to mask clever maneuvering, though good use of ECM can ruin targeting solutions during advances and retreats. Units with particularly high acceleration compared to the foe might be able to apply their firepower to a vulnerable area and amplify their damage, but generally these conflicts are slugging matches that favor the side with the most firepower and armor.

The "fast pass" encompasses any space conflict where the two sides approach each other too rapidly to linger for multiple salvos. This is typical of situations where defenders intercept invaders hours or longer from a planet, or two forces approach each other in opposing orbits. Since it would take many minutes, hours, or sometimes days to halt and have a slow exchange-style slugging match, fast passes basically amount to single salvos traded in the precise moments when the foes are in range. Or will be in range—you have to allow for flight times of shots. There's not much to finesse these sorts of combats, either. When you're in range for milliseconds, a little error in timing can cause you to miss completely, so the fine tactics are mostly a matter of maneuvering your forces to guarantee some will end up in range of the other guys at just the right time—or trying to avoid that.

Admirals can talk about clever formations, fighter screens and escorts, but in the frictionless environment of space it's far too easy to arrange a fast pass through outlying defenders to reach transports for a fast pass of your own. Foes almost have to want to stop to draw out an engagement, or be decidedly slower than the other side. And before anyone

corrects me, by "slower" I do mean "possessing lower acceleration." Even slow JumpShips can get moving very quickly, given time.

Here's a series of snippets on how to use various primary aerospace combat units.

Fighter Operations

Aerospace fighters are small, lightly armored and outgunned by virtually any other unit in space. Their strengths are their nimbleness, numbers and the aggregate firepower of massed squadrons.

Fighters can dominate space when deployed in sensible numbers—a good *Vengeance* deckload will turn just about any aerospace battle—but their problem is delivery. Aerospace fighters are not equipped with heat-expansion fusion rockets, but are limited to lower-temperature maneuvering drives that either indirectly heat hydrogen like BattleMech jump jets, or dilute reactor exhaust heavily with secondary hydrogen injections. Or a little of both. Either way, the heaviest fighters only manage an exhaust velocity of a bit over 2,000 kilometers per second, which clearly...maybe not so clearly...means that fighters inhale reaction mass. The average fighter will exhaust its five tons of reaction mass in about three hours at 1 G, while a 16,000-ton *Excalibur* will have only used about a quarter-ton of fuel in the same time when in heat-expansion mode. When you look at the days of transit time between standard jump points or in between planets, you can see the problems fighters have in getting anywhere on their own. Fighters are good for powered intercepts over—roughly—a volume occupied by an average planet and its moons, assuming they do some coasting and invest in drop tanks.

That short range dominates fighter tactics. They have to be carried to deep space battles by a carrier, usually either a DropShip or WarShip, and launching and capturing fighters takes time. They can only stray so far from ground bases on their own. If they depend on a carrier, take a good moment to think about an application of a fast-pass attack on the carrier, especially when those fighters cannot physically block fast-moving attackers the way a line of BattleMechs can obstruct foes from their base. You can indirectly kill whole wings of fighters by killing their carrier.

DropShip Operations

Assault DropShips, especially the new so-called "Pocket WarShips" (which are assault DropShips with fancier names and capital missiles), have some application in combat, but they're mostly an unhappy middle ground between fighters and WarShips. They have dramatically less firepower per ton than fighters and cost substantially more, while at the same time gaining new vulnerability to capital weapons—they're big enough to hit easily with capital guns. Really, assault DropShips are kind of like little WarShips but without the K-F drive, armor or firepower. But if you don't have WarShips, and you need interplanetary range with substantial firepower, then it's worth looking into these vehicles.

Most DropShip operations are thus dominated by DropShips acting as transports, which means they're usually busy trying to avoid being shot by fighters or the occasional WarShip. WarShips are exceptional DropShip hunters, since DropShips cannot muster the swarming durability, numbers or firepower of a large fighter unit, nor can DropShips easily avoid the big

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Let's see your best aerospace fighters or Pocket WarShips try this:

First, you plunk down some observation satellites or small craft at some jump points. Maybe they're pirate points in a system where you want to stomp out smuggling or pirate raids, or maybe it's the standard points of a system where you'd like to run some anti-shipping operations. Next, when your remote spy sees a standard JumpShip named "SS Target Practice," it burps a well-focused laser signal to you, perhaps across some relays if you happen to be hiding behind a star or planet, which may take tens of minutes or hours to get to you. But really, the delay isn't a problem because if your victim just jumped in, chances are it won't be departing for about a week.

Now, here's the fun part: using your spy's sensor data and your own precise navigational system, you plot a jump to arrive right beside the victim. Maybe you were at a pirate point yourself, or maybe you were at the other standard jump point of the system, or maybe—if your spy had an HPG—you were in another system altogether. In any case, it's a trick a fighter or DropShip would never pull off on its own.

And here's the two parts that makes this crazy, even more so

than the fairly neurotic in-system jump straight into combat. First, you're trying to jump as close as possible to the target JumpShip as you can without getting drive-on-drive interference, and military JumpShips and WarShips have a spherical error probability of five hundred meters when their navigators are at their best. A few kilometers of error isn't unknown, and can kill both vessels. Second, you're immediately going to fire up your motors and move closer to the victim, where a jump by either vessel will kill both ships.

The theory is that by the time the target's crew can think about jumping, your WarShip will only be hundreds of meters away and the target JumpShip will have to surrender, so you could capture the ship without firing a shot. The risk is that a panicked target crew might jump anyway and destroy both vessels.

This maneuver was created by Captain Jane Hargreaves of the Terran Hegemony *Aegis*-class heavy cruiser *Spark* in 2431 to harass civilian shipping within the bounds of the newly created Ares Conventions, which banned attacks on civilian targets. Captain Jane Hargreaves' potentially suicidal imposition of a K-F Drive—Crazy Jane Maneuver. Get it? Good, because it's something that only WarShips can pull off single-handedly.

guns of WarShips. Fortunately for DropShips, WarShips are rare. Unfortunately for DropShips, fighters are not.

As transports, DropShips are critical to modern interstellar warfare. And interstellar civilization, for that matter. Their combat operations reflect that. Only carrier DropShips *have* to risk themselves to bring fighters to battle. You'd think other DropShips would stay clear of battle—perhaps of the whole system—until defending fighters and WarShips were swept away, but often a shortage of aerospace forces and the long flights from jump points, which give defenders time to send reinforcements from other systems, means the transports have to move in with their escorts. Some transport DropShips can give a good accounting of themselves in a fight against moderate threats, like an *Overlord* or *Union*, but they're gambling their passengers' lives if they enter combat.

And, trust me, the quickest way to destroy a BattleMech regiment—without nukes—is to blow up their transports before the 'Mechs are dropped. It's not sporting, but it's very effective.

WarShip Operations

I actually planned to talk about this in our last lecture, but cut it for lack of time. I'll share it now, though...

So, what good are WarShips? How can you use them in combat? These might seem like dumb questions, but with WarShips dropping left and right, often in futile battles, you should give it some thought. The fact of the matter is most WarShips—and other large spacecraft—are vulnerable to a reasonable force of aerospace fighters. Aerospace fighters can be the kings of the aerospace battlefield. But they are kings with short legs that have trouble intercepting and chasing down WarShips or anything else with a heat-expansion fusion engine. That gap in the superiority of fighters is one place WarShips find use.

WarShips have high strategic mobility. Unparalleled even. Sure, fighters can run rings around most WarShips in a tactical situation,

but only for minutes at a time. Within a star system, WarShips are matched by DropShips in maneuverability, but WarShips can do most things a DropShip can, and do them better. WarShips can chase down all sorts of military transports—including fighter carriers—and kill them more quickly than any assault DropShip. They're also more likely to survive the experience if heavy fighter screens are present.

WarShips' organic jump capability also sets them apart from DropShips, which often depend on conventional JumpShips for transport. WarShips can haul themselves to threatened areas, or raid areas, much more readily than a DropShip, and obviously beat the pants off fighters in this regard. They can even use their jump capabilities for daring—or stupid—in-system jumps, giving them unique defensive and offensive options. The "Crazy Jane Maneuver" perhaps exemplifies the offensive potential of a WarShip's jump drive in a tactical situation.

In short, WarShips can be excellent anti-shipping raiders. In comparison, fighters are stuck near planets or their carriers, while DropShips are pale imitations of WarShips.

WarShips are also useful in a couple of other fashions. The artillery platform is one such application. The first real, history-making application of WarShips was to obliterate a small island...I can find the name in my notes..."Strand Rock"...on Terra, and that graphically illustrated the potential of WarShips as artillery units. And...actually, I discussed this in my last lecture, under cargo of all things. The other is task force transport, which I think I also discussed at length in my last lecture when I evaluated the *Feng Huang*. Going in circles a bit here. You can download that last lecture, so go back and review that if you have any questions.

Detection

Here's a blurb on an important aspect of aerospace conflicts: finding your targets...

ARES CONVENTIONS

I will comment on some past publications and recent media pronouncements regarding the destruction of space stations and JumpShips in the current conflicts around the Inner Sphere. There is a lot of crying about “violations of the Ares Conventions” when a civilian space station is destroyed. Well, it’s true the Ares Conventions ruled against attacking civilian targets, including space stations, but the Ares Conventions ruled against virtually every other aspect of modern warfare.

Just as an example of how much was banned under the Conventions, all the battles that obeyed the Ares Conventions between 2412 and 2575 killed fewer soldiers than the two-year Fourth Succession War, or the last fifteen years of the Third Succession War. Conflicts under the Conventions were wars of maneuver, with opponents often surrendering when “checkmated.” Pauses in battle were allowed for medics and coolant units to enter a battlefield. That’s right, there were “timeouts” under the Conventions.

The Star League cast aside the Conventions when it went to war with the Periphery and no one re-adopted it in any depth, except some lip service that mercenaries pay to the front page and some loose adherence to the provisions for prisoners of war. In the past five hundred years, none of your favorite military units have ever obeyed more than a small fraction of the Conventions in any battle they fought.

The Conventions make a symbolic, well-known document that can be used to smear the Bad Guys as Really Dirty Bad Guys when they do something naughty on the battlefield. I also think it gets confused a lot with the unwritten rules of warfare that developed in the Succession Wars, which protected near-lostech like space stations and JumpShips. But don’t expect any military force to take you seriously when you wave the Conventions at them. It will no more protect a space station or JumpShip than it will bring back battlefield “timeouts” and bloodless “checkmate” battles of maneuver that typified the late Age of War.

Compared to the vast sweeps of star systems—billions of kilometers—over which modern spacecraft operate, sensor ranges are disappointingly short. Short of the fabled and magical “neutrino scanners,” the most effective sensors of modern ships are drive plume detectors, which reliably spot the unmistakable hard x-rays of fusion engine exhausts at ranges of about 20 to 30 million kilometers. On the other hand, the ranges of modern combat are mere tens and hundreds of kilometers. That means entire fleets can sneak through systems unobserved, but it can be hard to break contact once combat is joined.

Though infrared imaging figures prominently in ground combat and at aerospace combat ranges, IR and optical sensors offer only supporting roles to radar. Their most prominent long-ranged role is detection of arriving JumpShips. A Kearny-Fuchida drive is a source of infrared radiation for several reasons, including annihilation of matter at the arrival point and shedding of relative velocity differences between destination and origin jump points. This diffuse signature can usually be spotted at distances of about 50,000 kilometers.

A more subtle effect of hyperspace travel, the emergence wave, is detected with specialized military sensors. This can spot an arriving JumpShip at distances of up to 15AU. The effect of an arriving JumpShip on local space is a spherical “ripple” that propagates at light-speed. This is a fairly distinct electromagnetic pulse caused by the collapse of the hyperspace field. The light-speed lag means that if the detector is multiple AU from the target, the JumpShip has been in the system for tens of minutes and had plenty of time to maneuver, release DropShips or otherwise hide from reaction forces. Only large military spacecraft carry this system.

Emergence wave detectors are also useful for spotting arriving HPG signals, which generate the same emergence wave phenomena as JumpShips. The signals are quite a bit weaker than JumpShip “ripples,” though, and thus detection ranges are often much shorter.

I don’t think I need to explain much about active radar. You bounce a radio signal off an object and look at the return. The fancy details of how modern military radar works are topics for an electromagnetic physics course, not transportation technology. Bigger vessels can dependably spot targets with active radar at about 100,000 kilometers in range, while fighters and small craft are limited to about 10,000 kilometers. That, again, illustrates one of the shortcomings of fighters as independent military units: they’re virtually blind.

Part of radar involves listening for the radio signals you broadcast, but you don’t need to listen just for your own transmissions. You can turn your blaring radio emitter off and listen for the Bad Guy’s signals. Large military spacecraft, which have electronic support measures (ESM), can reliably spot active radar units at about 1,000,000 kilometers in range. It’s a feature rarely found on civilian ships, while small military spacecraft do not have sufficiently sophisticated and large radar receivers to spot the low-observability tricks of modern military radar systems.

The longest-range common sensor is the drive plume detector, which is a battery of x-ray and hyperspectral imagers that seek the distinctive super-hot particle flux of fusion motor exhaust. It goes without saying that fusion rocket exhaust is hot, but take a moment to consider just how hot it is. This exhaust is vastly hotter than the surface of the STAR—it’s hotter than the core of stars, because the reactors are producing fusion reactions at much lower pressures than the core of a star. That means, if you remember your basic physics, the exhaust is so hot that it is primarily emitting in high frequency radiation. It’s got a little visible light tail, some ultra-violet light and a lot of x-rays, especially for fusion motors operating in heat-expansion mode. Of course, in an atmosphere, the surrounding air gets heated to merely stellar surface temperatures and produces a distinct visible light display that we’re all familiar with, as does excess hydrogen dumped into the exhaust during combat maneuvering. For all the energy going into the drive plume, it’s fairly hard to detect in space because the exhaust is generally collimated and there’s nothing to scatter the enormous x-ray signatures. If you happened to catch a glimpse right up the rocket nozzle, you might be able to spot the plume at billions of kilometers, but for the most part the wispy traces of x-rays and other light that get scattered in all directions are fairly hard to spot beyond fifty million kilometers. On the

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other hand, the detectors are pretty compact, so they're easy to install on every vessel.

Radio triangulation of common radio signals works fairly well at long distances, too. Civilian and small military spacecraft can usually triangulate radio signals at about half a million kilometers in range, while large military spacecraft with ESM can manage much further. Such signals rarely have the low observability of active military radar and thus are easy to detect.

The last sensor system of note is the neutrino detector, and it's only notable for its performance. Essentially, modern military commanders virtually won't have to be concerned about these until they're in the Terran system or maybe over Strana Mechty. These giant sensors were only fitted on a percentage of old Star League WarShips, the big WarShips that could spare the massive kilotonnage for the detectors, and so the Clans might have a few left. The Word of Blake and ComStar reportedly had the technology as a result of inheriting Terra, but the latest speculation in military journals is that neither took the time or money to restart production because the high-performance neutrino detectors were an industry unto themselves. So, the Word of Blake might've had a handful of mobile detectors in service at the start of their crusade, but speculation has it that the Word's WarShip losses are so high they have none left except for planetary detector units on Terra.

And what could neutrino detectors do? If the Star League-era reports are true, they could just about read the serial numbers on a fusion engine at several AU distance. The detectors took hours to calibrate to the neutrino environment generated by the local star, but then could almost sweep the system for any neutrino sources—any nuclear reactor, fission or fusion, basically. With several hours of tracking, a neutrino detector could identify the make and model of a fusion-powered vessel, and only needed several more hours to establish a unique "fingerprint" for a vessel that could be recognized at a later date. You might want to take a minute and remember the properties of neutrinos before trying to suggest some means of shielding your fusion engines. A neutrino detector can see into the heart of star; there's nothing that can hide a reactor from the detector except to the turn off the reactor.

Boarding

I did this bit a few semesters ago when people got excited about some dramatic boarding actions. I was surprised to find it was relatively feasible, more than I thought...

In an era where space combat involves shots exchanged at hundreds of kilometers' range while opponents may be moving at tens of kilometers per second—or much more—relative to each other, there still manages to be a place for getting troops onto the other guy's ships. I thought boarding only occurred on space stations or JumpShips or vehicles with crippled engines, but apparently the marines among today's militaries even plan for boarding live ships. I have to salute such folks. Even a sluggish ship like a *Behemoth*-class DropShip or *Aegis*-class WarShip can out-accelerate all but the highest-performance sports cars. To put it another way, if they were atmospheric vessels, they could go from a standing start to Mach 3 in two minutes. And when one of those giants starts twisting...yes, you start to understand the difficulty of boarding.

There are three principal assault techniques. Far and away the most popular is the shuttle assault, which delivers infantry, usually space- or battle-suited, to the target. They then have the chore

of attaching to the target, which is not easy even with their specialized grapples. But unlike free battle armor and free BattleMech assaults, which I'll discuss momentarily, assault shuttles have the thrust to match the maneuvers of most targets. In fact, dedicated assault shuttles usually have much better acceleration than their targets, like the NL-42 "Battle Taxi," which can manage 4.5 gees.

Free battle armor attacks depend on the limited space maneuvering capacity of certain battle armor suits. This is a risky form of attack best reserved for targets with crippled engines—I mean, even riskier than other boarding actions—because a minute of determined maneuvering by most DropShips and WarShips can result in the battle armor troops smacking into their target at better than a kilometer per second. Then your brave battle-armored soldiers are tinfoil-and-tomato-paste smears on the nose of the ship they were trying to board.

Free BattleMech boarding actions are a particularly bad application of BattleMechs, kind of like using infantry to ignite the engines of a DropShip by holding a match into the engine nozzles. The "free BattleMech assault" process entails releasing BattleMechs at a target ship, depending on the abysmal maneuvering capacity of their jump jets and miniscule reaction mass capacity to manage a landing, then attempting to do something constructive on the hull. Like free battle armor boarding actions, a BattleMech can quickly find itself playing the role of a quadriplegic fly facing a giant flyswatter if the target has live engines. BattleMechs have a hard time staying on a ship's hull, too. Even if they have some sort of magnetic feet or grapple—which is decidedly not standard on BattleMechs—the BattleMech has about as much chance of staying on the hull when the target's engines light up as it has of standing upright on the side of a skyscraper. Unlike skyscrapers, JumpShips and WarShips can also pivot fast enough to impose noticeable horizontal G-forces.

Darn Sir Isaac Newton for making the "down" direction on spacecraft in the same direction as their engines. If acceleration manifested perpendicular to the thrust direction, then WarShips and JumpShips would be oriented like seagoing ships and regiments of BattleMechs could stand all over them to shoot at each other and at swarming fighters, like in the children's cartoon "The Littlest Atlas."

Anyway, if a BattleMech can get loose on a ship or space station, or it gets inside the ship, then it can certainly wreak havoc. But deploying BattleMechs outside ships, let alone in boarding actions, is a move of pure desperation.

Now, once you have troops on the target ship, there's the question of what they do. Most boarding actions, as the name suggests, involve trying to get inside the target. Once inside, marines generally attempt to seize control of the vessel by attacking the bridge and engineering or other choke points, like life support. Alternately, when the ability to control the ship appears to be in doubt, attackers may prefer to cripple or destroy the boarded vessel, which also involves going after certain key sections—the K-F drive core, magazines, engine room and so on.

Contrary to what the media may tell you, marines rarely hold back on heavy weaponry because they are worried about puncturing the hull. Bulkhead and hull materials are tough enough to laugh off most individual bullet and energy shots, and those that do penetrate generally only leave small holes that cause proportionally slow leaks. The "explosive decompression" of fiction where a large section of wall suddenly blows out because of a small bullet hole is just that: fiction. Spacecraft hulls are not made of



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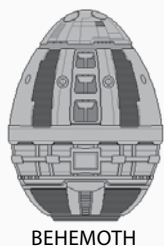


Atlas BattleMech

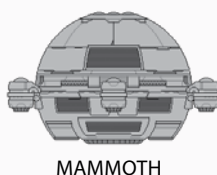
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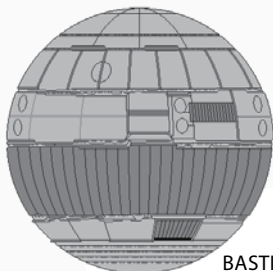
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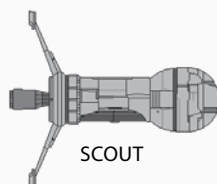
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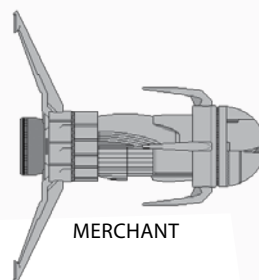
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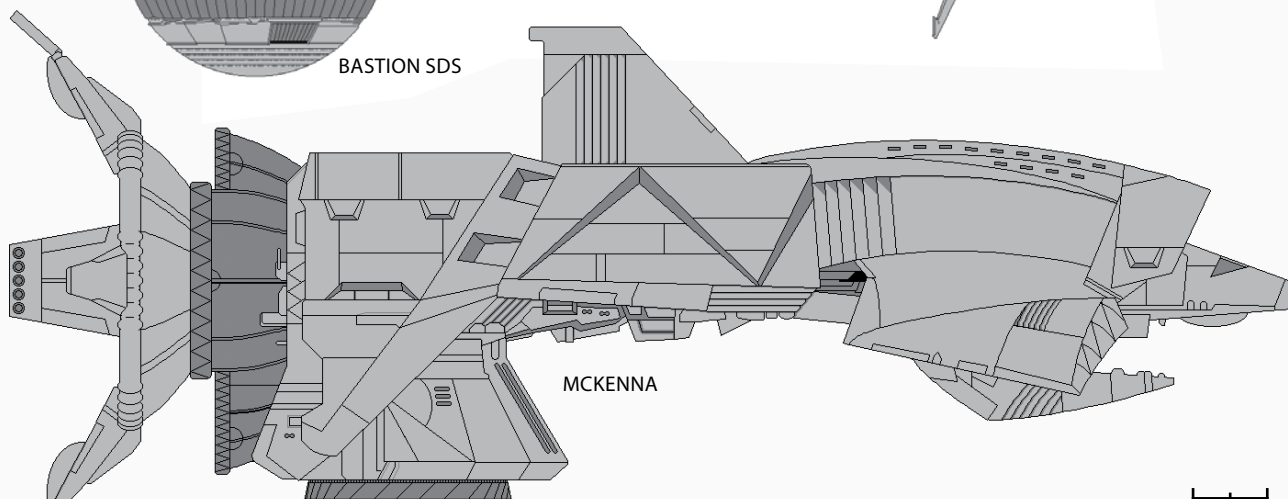
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MERCHANT



MCKENNA

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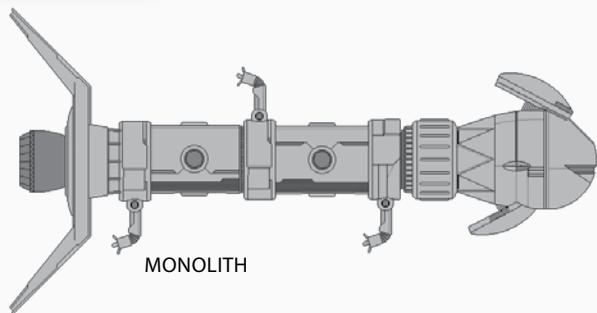
window glass. For that matter, you can generally safely plug a bullet hole with your finger. You won't be sucked out; one bar of atmospheric pressure can't force a human body through a bullet hole. The tip might bruise from the vacuum outside but...I'm getting off track.

The point is, boarders interested in capturing a vessel and crewmen interested in preserving their ship from capture use various "accelerated energy transfer" projectiles, needlers and other lightweight attacks because many key systems are not

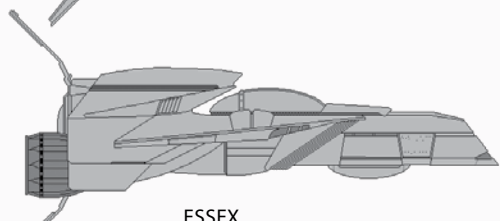
as tough as the hull material. Hosing a battle armor's heavy machine gun down a typical corridor might not blow out the hull, but you can rupture a pure oxygen line; ignite an emergency oxygen candle or spill chemicals from an emergency air scrubber; sever any of half a dozen important data lines; burst a sewage line; shatter a local computer control module; or cause a lot of other mayhem. And that's just in a simple corridor. Imagine a firefight in an engineering compartment or the computer deck of a JumpShip.

SHIP SIZING CHART

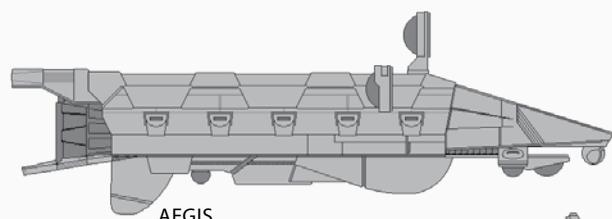
Atlas BattleMech



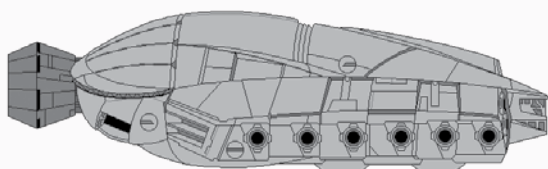
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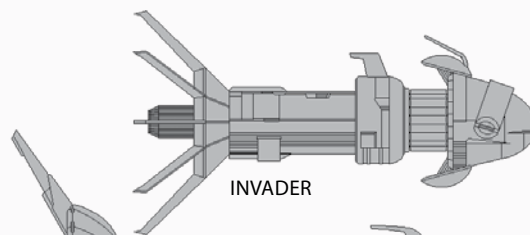
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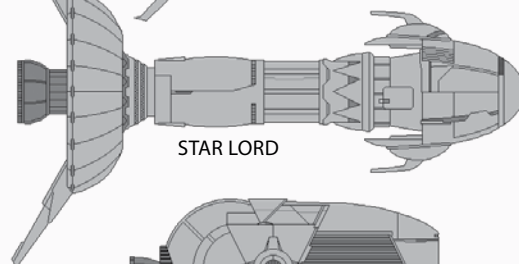
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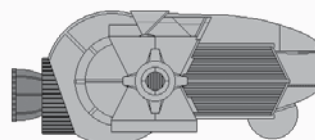
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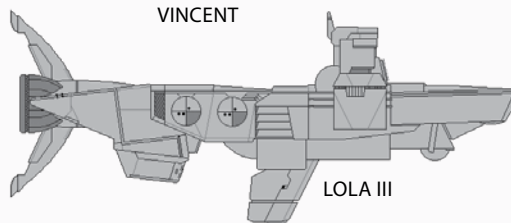
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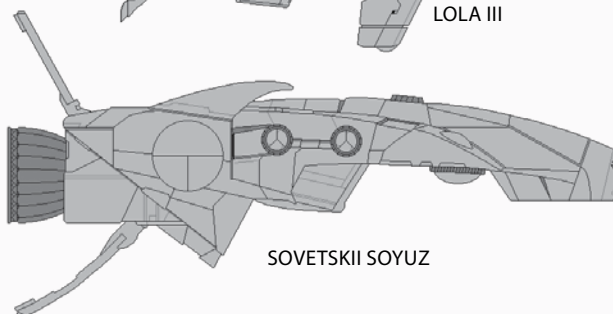
STAR LORD



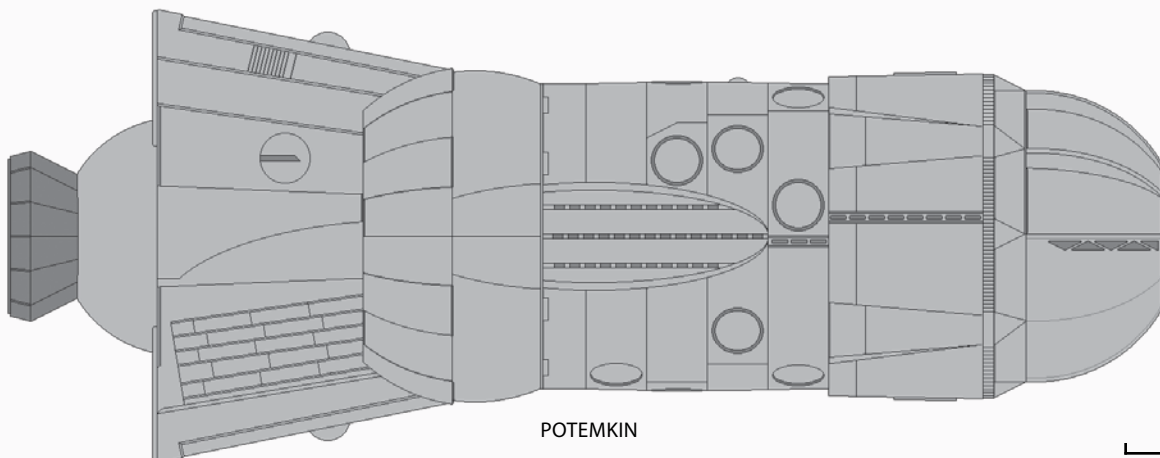
VINCENT



LOLA III



SOVETSKII SOYUZ



POTEMKIN

100 meters

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Planetary Combat Operations

Here's my intro to what should be a good few chapters on the mechanics of a planetary assault...

It is not enough to achieve victory just to show up at a planet with BattleMechs, tons of ammo and a flotilla of DropShips. You need to know the target planet ahead of time. You need to know the terrain, the climate and the microbial threats—are there any vicious local diseases? Human factors need endless study, too. Politics, primary infrastructure choke points, key industries, demographics. No, invading a planet is not as simple as showing up with enough guns and ammo.

This isn't a military history course, so I'm not going to get into the endless details of how to conduct a planetary combat operation. What matters to this course is how spacecraft and space travel figure into these operations.

Obviously, JumpShips and DropShips allow the invaders to reach a planet, and allow reinforcements to aid the defenders. The role of DropShips as troop transports doesn't stop once forces are on the ground, either. Clever commanders have often made use of DropShips to transport troops from location to location on a planet faster than any other mode of transport.

Spacecraft are eminently important for keeping off-world attackers fed, armed and fueled—an armored regiment that finds itself on a planet without readily plundered fuel supplies is going to be an immobile set of pillboxes very quickly unless it can ship in the kilotons of fuel needed by its hungry combustion engines. Reasons like this make me wonder why any military with interstellar aspirations deliberately chooses combustion engines and ammunition-dependent weapons unless industrial shortcomings force the choice. You only have to deliver a tank or 'Mech to a planet once, but you have to keep delivering ammunition and fuel.

Anyway...most spacecraft can offer support other than transport. Just about any military spacecraft carries sensor and communications suites that make them excellent orbital observers. Aerospace fighters make exceptional scouts, being able to dart around a planet in under two hours. Most large spacecraft can refuel aerospace fighters that divert to orbit between ground strikes. Military aerodyne DropShips can offer supplemental air strikes, if one doesn't mind risking such expensive hardware in that role. Other DropShips have been pressed into the role of mobile fortress.

COMMUNICATIONS

That just about wraps up combat...I suppose the next aspect of spacecraft is communications. It's less exciting than the combat-related aspects of spacecraft, but still critical and necessary. This section is actually something Dr. Ready had planned for you in a few weeks.

Internal Communications

Most communications within ships are carried by fiber optic lines to specific workstations, intercom panels and speakers; fiber optics afford a maximum of bandwidth and no chance of eavesdropping. Speakers and intercom panels dis-

tributed throughout the corridors and rooms of a ship allow passengers and crew to send messages to the entire vessel or selected areas, depending on their specific communication privileges.

Fiber optics can shuttle enormous amounts of information through a ship, but being tethered to a fiber is not convenient for all crew and passengers. Personal communicator units (in conventional belt, wrist, chest and headset forms) allow wireless freedom via low-powered repeater units in the intercom panels throughout the ship. When infrared signals are not used, radio signals of sufficiently low power not to penetrate the hull are the medium of choice. More powerful radio systems might be partly behind the myth of the Star League's *Bugeye*, which supposedly could "hack" into another ship's systems and listen to crew conversations. The *Bugeye* might've just been listening to noisy wireless intercom systems.

External Communications

For the past eleven centuries, external communications have fallen into three categories: radio, laser and HPG...wait, HPG's less than five centuries old. Anyway, radio communications are generally broadcast, which is helpful in many circumstances like talking to large groups of units, but broadcasting is less often useful for military vessels interested in stealth. Radio transmissions can tighten up their beams, but not nearly to the extent of lasers. The lower frequencies of radio transmissions also limit their bandwidth, the rate of information transfer. Radio transmissions allow any interested listener to intercept signals and, as I discussed above, radio transmissions are vulnerable to triangulation.

Still, radio signals serve many uses in modern spaceflight. Radio communications serve as a staple of Identification Friend-or-Foe (IFF) systems. Most commercial vessels used to be registered—or were supposedly registered—with the ComStar Terran Registry of Spacecraft, but people have been less willing to share with the Word of Blake since it seized Terra. Even so, I'm not sure how many commercial vessels used to register with ComStar. As recently as the 3020s, ComStar was claiming there were only 2,000 JumpShips and 25,000 DropShips in service in the Inner Sphere, but the actual number had to be higher by at least an order of magnitude (or two) to meet the observed tonnages of bulk freight in necessities like food, petrochemicals, ores and...and I'm off track again. It is worth noting that IFF can be faked despite elaborate security precautions, and with increasingly incomplete ship registry databases, it's getting easier than ever. You pretty much need to resort to visual identification or boarding to confirm a ship's identity.

Laser communications bypass most of the shortcomings of radio. Lasers are generally much more focused and have much smaller sidelobes, and being higher in frequency they have much higher bandwidths. No, don't ask. For further explanations of sidelobes, bandwidth and many other facets of electromagnetic communication, please take an electromagnetic physics course. The short description is that laser links use relatively low-powered lasers, just a few kilowatts usually, that are focused sufficiently by multi-meter mirrors (obviously smaller on small craft and fighters) to only illuminate the target vessel at distances of thousands of kilometers. To intercept a laser transmission, you virtually have to be inside the beam,

and the transmitting and receiving vessels will notice that. The only drawback to laser links is their very focus: a laser link is generally good only between two vessels. DropShips typically carry a couple of laser links, while JumpShips carry one per docking collar and up to a half dozen others. WarShips and battle stations are the exceptions to the normal paucity...hey, I used paucity in a sentence...of laser links. These units will carry dozens of laser links to communicate securely with a whole fleet, all the way down to fighters.

HPGs essentially only appear on WarShips, and not every WarShip, which means they're almost a non-issue for most considerations. But, let's face it, any hyperspace technology is worth some time in class.

HPGs famously generate an artificial jump point of microscopic scale and send a signal through, so they can even work in planetary gravity fields. This signal can be sent for up to fifty light-years, depending on the HPG in question. While the "jump" involved in sending the signal over many light-years carries with it all the usual hyperspace issues, like I was talking about with emergence wave detectors earlier, the actual signal is a conventional electromagnetic signal, generally a radio frequency burst. Think about that a second: you don't need an HPG to receive an HPG message. You need a radio. And you need the proper decryption codes—ComStar didn't survive the Succession Wars by letting anyone decrypt the messages it delivered.

Another misconception about HPGs is their transmission times. ComStar and the Word generally wait hours or days to accumulate a good packet of traffic to send between planetary HPGs, but HPGs can transmit as fast as their power plants can recharge the HPG. Since they're only sending microscopic amounts of matter—energy, really—through hyperspace, HPGs can recharge and signal quickly, though the power required for the artificial jump point of even microscopic size is fairly impressive. Entire chains of HPGs can be arranged to support real-time communications across great distances, as has been famously accomplished by Clan Khans and our former Archon.

While the radio signals from an arriving HPG burst can propagate up to 4AU from the arrival point, such long-range reception may entail considerable speed-of-light delays. This isn't a problem when signals are only arriving every few hours or days, but it is a problem for the real-time "HPG command circuits." To minimize speed-of-light delays, HPG signals in command circuits are targeted to within 1,000 meters of each relay unit. The emergence wave of an HPG burst is trivial compared to that of an arriving JumpShip—it won't shred a ship. But the electromagnetic effects can blind sensors and fire control systems, particularly when they're being received several times a second as part of an HPG command circuit.

You might think, "Wow, an HPG would make the ultimate weapon because it could blind and stun any target," but no, HPGs do not work in that fashion. HPGs are meant to target objects light-years distant for which they have exceedingly exact coordinates. Units in command circuits and various remote relay systems, like those of ComStar's Explorer Corps' DRUM network, share their exact coordinates with neighboring HPGs to improve aim. Fast-moving, maneuvering local targets are impossible for HPGs to hit.

DAILY ROUTINE

Next topic on the list...this doesn't flow well at all. From communications to daily life on ship? It's topical to transportation tech, but....

Daily routine onboard spacecraft does not necessarily follow the niceties of planetary life.

Watch Cycles and Drills

Virtually all spacecraft, except for the Capellan Confederation's Xin Sheng'd national merchant marine and Navy, use "Terran Standard Time," which is basically a renamed form of Greenwich Mean Time.

Let me interrupt that old recording to point out that GMT is fair game on Dr. Ready's exams, so look it up...

What spacecraft do on this timekeeping standard differs. Military ships tend to adhere to six-hour watch cycles that put crewmen on duty for six hours, then give them twelve hours off duty. And by "off duty," I mean, "not necessarily carrying out primary duties." There's generally a four-hour period with secondary duties and training, leaving eight hours for rest, recreation and meals. This may mean crewmen end up standing twelve hours on watch per 24-hour day. Civilian spacecraft are more lax on this matter and may prefer eight-hour watch cycles with meal breaks, allowing crewmen almost sixteen hours off-duty. Then again, they may follow the military standard.

On virtually all ships, captains take care to rotate duties to avoid complacency in the crew and often schedule training drills. These emergency response exercises keep the crew trained and ready to deal with fires, hull breaches, enemy attacks and—I'll say it again—fires. Firefighting is critical onboard sealed vessels like spacecraft. Boarding drills are often particularly entertaining due to their use of non-lethal sport equipment and the chance to "shoot and kill" obnoxious officers or crewmates who end up on the other side of the drill.

Food

Interrupting again, I think I used the term "food-in-a-tube" in my last lecture, but that's mostly—not entirely—a product of lazy or novice space programs. New transport companies or groups that are just re-establishing a domestic space travel capacity tend to re-invent "food-in-a-tube," thinking that freefall dining requires elaborate precautions to avoid crumbs, free-flying blobs, and other catastrophic mishaps...

In fact, covered pouches and some food package restraint—like a tray—are sufficient to hold fairly normal foods in place. Modern spacecraft generally have endless power and no shortage of spare volume for refrigerated food storage, so freeze-drying and other food-abusing "space food" treatments are only necessary for foods stored for long periods without refrigeration, such as in fighter emergency food lockers or lifeboats. And, of course, some fighter cockpits roomy enough for extended deployments include amenities much like BattleMech cockpits, so they can do better than "thermal stabilized, intermediate moisture meals." So even freefall food

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can be pretty good, and quite normal—it just takes a little skill to eat it.

If you're worried about crumbs, spacecraft operators have figured out that an air intake placed in the dining area will inhale most free-flying crumbs and droplets. These intakes are filtered, obviously. Actually, spacers have known since the first space stations, the first spacecraft with large open air volumes, that loose items in freefall tend to be carried by air currents to air intakes. If you drop a screw or pen, search the local air intakes.

And when you get to gravdecks, even low-gravity ones, dining is much easier. The only unusual features might be the cups and soup bowls for low-gravity gravdecks, which need extra care to prevent sloshing.

So, I said normal foods can be eaten on most spacecraft. What foods do spacers get? Generally, pretty good food. They visit a wide range of planets with different cultures and different foods. Most large spacecraft that visit different systems have continual, almost weekly opportunities to refresh their food stocks. Since large spacecraft rarely have a shortage of volume for food storage, months or years of good food can easily be stored aboard a ship or station. When refrigerated volume runs out, standard radiation treatments, thermal treatments like pasteurization and various modern preservatives keep food fresh without mangling it like freeze-drying.

An alternative to all preserved foods is fresh foods, which are almost universally grown in a hydroponics facility. The idea is to grow completely fresh food right on the ship, perhaps producing a closed-loop life support system that will indefinitely sustain the crew. The idea is widely used on the *Invader*-class JumpShip and I suspect the *Invaders* are about the only ship to make use of it because the entire system is completely automated, otherwise no one would bother. Honestly, the variety of fresh foods a JumpShip or DropShip can acquire from planets they visit dwarfs the output of these small hydroponic "farms" and modern food preservation means there is little difference between fresh-from-hydroponics vegetables and fresh-from-a-bag planetary vegetables. If you plan to traipse through the Periphery or think your K-F drive might fail and leave you in an uninhabited system, then yes, hydroponics are pretty useful. But modern spacecraft are rarely far from resupply, even on long-duration military deployments, and mechanical life support systems are more robust and easier to repair than vats of fruits, grains, veggies and algae.

Recreation and Exercise

Next bullet on the schedule: how to relax on spacecraft. I mentioned the value of exercise in my last lecture, but this hits some new points...

On larger spacecraft, many options are usually made available for recreation because crews may be stuck on the ship for months. On a cramped military DropShip, this might be a considerable collection of vids and computer games, while spacecraft with gravdecks can provide some space for sports. Sometimes even large-court sports like football (any version) or basketball will be seen on space stations' large gravdecks, but the one universal rarity is a swimming pool. A small pool of just 40,000 liters is forty tons of water. WarShips sometimes afford pools for their crews, but they are generally zero-G pools to avoid the mass needed to balance such an off-center weight on a gravdeck.

From sports we get to exercise. Exercise can be particularly important on JumpShips, which spend decades in milli-gravity con-

ditions at jump points. As I mentioned in my last lecture, it's not enough to sleep and eat on gravdecks—keeping good muscle tone and bone density generally requires a regimen of exercise on a gravdeck, with certain supplemental drugs. Even so, some long-time JumpShip crewmen can have seriously compromised physiques. DropShip and WarShip crewmen benefit from considerable periods under acceleration that simulates natural gravity without the inner ear problems of gravdecks, and thus generally have laxer exercise requirements than JumpShip crewmen.

Quarters

How do crew and passengers live on ships? It's not universally elbows-and-...er, noses. Here's a bit I did when I was a junior professor, years ago. There's a lot of donuts between that me and today, isn't there?...

Quarters vary widely. Military vessels, which often dedicate large volumes to "critical military hardware," tend to have cramped quarters. The *Union*-class of the Third Succession War is a good example. Despite being larger than this building, it crammed about thirty crewmen into a bunkroom distinctly smaller than this lecture hall. As a matter of damage control and easy maintenance in an era when photopolymer lighting seemed like lostech to the under-educated maintenance personnel, the air filtration system was kept as simple as possible. This meant it could get pretty ripe in those cramped quarters. And while ComStar famously blamed the simple air filters in their *Technical Readout: 3025* publication, the old *Unions* also had simple water filters and limited water storage, which meant very limited bathing. It got ripe on those ships pretty fast.

To compound the problem, military ships were often overloaded with additional passengers, like technicians, ground security details, command lances and so on. In such circumstances, there were not enough berths for each crewmember and passenger, so bunks were shared in rotating shifts: the "hot bunking" system, so called because your bunk was still "hot" from the last guy when you climbed into it. I just wanted to define "hot bunking" in case anyone else saw "Danger Dave and the Amazon Express" last night and had another idea about the meaning of "hot bunking" based on that over-used one-liner of his. Real hot bunking and limited basic amenities were—and are—major sources of morale problems on military vessels.

While recovered technology and the associated improvements in education mean that many modern military DropShips have improved facilities for their crews, infantry bays generally remain the domain of "old school" passenger facilities. A typical infantry bay for a foot platoon allots about 175 kilograms for each soldier, his gear and any life support and shared amenities like restrooms and recreation space. Giving each infantryman a typical 5-ton steerage-class allotment of quarters, life support and amenities is a common goal among modern military ship designers, but infantry accommodations are invariably the first thing to get cut when a new spacecraft turns out to be overweight. I mean, we all know how unimportant infantry are—just ask any MechWarrior.

Civilian ships generally give much more volume and weight for crew and passengers, especially passenger liners, and are willing to pay extra for improved air and water quality. The closest civilian ships might come to "hot bunking" is to split officer-class quarters, the so-called luxury quarters, between two passengers or crewmen, effectively reducing the quarters to steerage-class. But it'll have much nicer brass trim than your normal steerage quarters.

It is worth noting that the mass and volume of quarters are not often linked. The steerage-class quarters of a JumpShip may have as many cubic meters per crewman in personal and public spaces as the entire berthing space of a military DropShip. The mass of quarters is generally determined by life support budgets (how much water and air are given per person), quality of amenities and number of amenities. Elbow room weighs almost nothing; personal kitchenettes, exercise machines and a big water budget can add tons.

On that note, I'd observe that only a few modern spacecraft can honestly justify volumetrically cramped quarters for their crew and passengers, and those are fighters and small craft. However, you still find cramped, stinky, poorly furnished quarters throughout the JumpShip and military DropShip fleets of the Inner Sphere. Even some WarShips are notable offenders. Despite having unused volumes—for unspecified “future system expansions”—larger than this building, the quarters of the first block of *Fox*-class corvettes were notoriously cramped. Admittedly, the *Fox* had been approached as a short-lived prototype WarShip that only had to live through a few years of trials before being replaced by a fleet of *Avalons* and *Mjolnirs*, but Fed-Boeing was really just in a hurry and didn't bother. Making spacecraft human-compatible is one of the most exacting and time-consuming parts of designing a new vessel.

DOCKING AND LAUNCHING

Here's another complete topic change: docking and launching. When viewing this, please keep in mind the skyscraper layout of spacecraft I mentioned in my last lecture...

Docking spacecraft is not a trivial operation. Both vessels can move in either of three dimensions and for every action, there will be a reaction. When one vessel is much larger than the other, the problem is somewhat simpler because the larger vessel is not going to be seriously jostled by any mishandling on the part of the smaller vessel. Basic conservation of momentum. Still, when the smaller vessel masses in kilotons—as might be the case of a DropShip docking with a WarShip or space station—any mishandling can cause massive local damage.

Small Craft

Fighters and small craft have the easiest time docking because they are usually small enough that docking bays can be satisfactorily reinforced to survive a poor docking run. Also, they tend to be much, much smaller than the ships they dock with, sometimes thousands of times smaller in the case of WarShips.

The general procedure for docking entails the larger vessel coasting, effectively seeming stationary to the approaching small craft, while the small craft maneuvers closer under the power of its main drive. Within a kilometer of the carrier, the small craft will shift to maneuvering on its reaction control system (RCS) alone. Final docking is generally accomplished by coasting slowly into the bay, where various systems are used to secure the small craft and move it out of the way of other vessels.

It is feasible and a practiced maneuver for small craft to dock with a maneuvering carrier, but even with perfect coordination and simple, straight-line acceleration by the carrier, there is room for enormous damage to both vessels. A small craft or fighter trying to pace an accelerating DropShip must use its main drive until the instant of capture, and even a fighter's drive can cause massive damage to a large vessel. In an ideal situation, the carrier will have stern docking ports, like the *Vengeance* class, which allows the fighter to safely run its main engine—though the small craft will be right beside the carrier's own drive plume. For side docking bays, you can hope they have a telescoping capture arm or crane, otherwise powered docking is just begging for a mishap, such as a late cut-off of the fighter's main drive.

Launching is generally much easier. The only risk occurs when the small craft is dumped out a stern bay and the carrier is running its main drive—the small craft needs to be careful with its first post-launch maneuvers to avoid a bad case of “moth in a blowtorch” syndrome. The preferred means of launch is through side ports, which gets the small craft clear of the carrier and its drive plume. Fighter and small craft bays usually include an electromagnetic catapult to eject the small craft with some velocity so the craft gets clear without firing its own motors. In these launches, the drive plume danger is reversed—the small craft must be careful to orient its main drive before firing it to avoid damaging the carrier.

The one form of launch you only see in the cinema is bow launches, or at least bow launches under thrust. A launch out a hypothetical bow bay door on a carrier would not be much different than a side launch if the carrier was coasting. Like side launches, the small craft would have to re-orient its main drive before accelerating. This turns into a real problem when the carrier is accelerating. DropShips and WarShips are portrayed as ponderous compared to fighters, but don't be fooled by the media. A *Vengeance*-class carrier can accelerate at 3 Gs—0 to 100 kph *each second*. Name a sports car that can manage that. Even with a powerful catapult boost, a fighter would only have a fraction of a second—yes, a fraction of a second—before the carrier overtook the fighter and slammed into its rear at 3 Gs. One of the frequent users of bow doors, the *Vengeance*-class, has long docking bays that provide a lot of fighter handling room when coasting and bow doors are helpful at those times, but when under thrust those long docking bays are subdivided into dozens of tiny decks and fighters have to be ejected perpendicular to the thrust axis—out the dorsal, ventral, starboard, or port sides.

Large Craft

Large craft docking and launching operations are somewhat more complicated. While a wayward fighter in a docking bay can largely be contained, a mishandled DropShip can cripple a JumpShip docking collar at even low velocities. Because DropShips, JumpShips and WarShips do not pivot and translate as responsively as a small craft, large craft docking operations typically take about half an hour from the time two vessels rendezvous and match velocities. And the docking is always performed while coasting.

In cases where one large craft is still much smaller than the other, such as DropShips with JumpShips, WarShips and many space stations, the larger vessel simply waits passively, since

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it is likely less agile on the helm. Generally, after navigating to within centimeters of contact, final docking is accomplished by mechanisms in the docking collar or cargo bay door—dozens of hydraulic clamps, magnetic grapples or the famous giant arms of the *Monolith*-class JumpShips.

For vessels of similar size, like a WarShip and space station, they both might maneuver some, but the preference is to keep matters simple by letting one ship do the final maneuvering.

Undocking is rather simpler than docking. The smaller ship uses its RCS to back away until it can safely orient to use its main drive and that's about it—the process pretty much lacks the risk of collision that accompanies docking. Undocking is always done while coasting because large craft are not nimble enough to handle a launch under thrust. Also, orientation is often problematic for undocking under thrust. Spheroid DropShips are typically docked stern-first to the K-F drive vessel, while aerodynes tend to dock belly- or back-first to the JumpShip, which would put their decks “sideways” compared to the “engine-is-down” orientation of their JumpShip. This means that K-F drive vessels rarely accelerate with DropShips attached, so launching DropShips under thrust is almost a non-issue.

For the record, DropShips often stay attached while the JumpShip is station keeping at a jump point, but the milli- and micro-G thrust used at those times is barely noticeable even in an oddly-angled DropShip. It is, for all intents and purposes, free fall.

EMERGENCY EVACUATION SYSTEMS

Modern large craft rarely have a single “Jesus bolt” that causes the entire spacecraft to suddenly need evacuation when it fails, so ship evacuation is rare, but it happens. The method of evacuation depends on the nature of the emergency and what options are available.

The preferred method is transferring to another ship, since large spacecraft have the best ability to handle large numbers of evacuees and injured. However, if the distressed vessel is not already docked to another ship, this sort of evacuation generally involves small craft. Captains loathe docking their own large craft to a distressed spacecraft because doing so endangers both ships. Imagine a fuel explosion on a DropShip while it is docked to another DropShip, or a JumpShip. Actually, I have to wonder how fuel tank explosions occur in space, though they seem a somewhat frequent cause of combat casualties. It's not like there's enough oxygen on the ship, and certainly none around the vessel, to cause all that hydrogen to explode. But I'm getting off track again....

The next option is lifeboats and escape pods. These occasionally get confused, but to settle the matter: escape pods have some rocket-powered maneuverability and are intended to enter an atmosphere, settling to the ground under a steerable parasail. Lifeboats cannot handle atmospheric entry and are simply meant to drift in space, providing a safe haven until a rescue unit arrives. Escape pods tend to be more cramped and have less endurance in space than lifeboats, relying on battery power. Lifeboats deploy solar collecting sails for indefinite electricity, though life support and food supplies are limited. The newest trick with lifeboats is to use inflatable sections to greatly increase volume after launch, making the days or weeks in the small vessels much more tolerable.

A few vessels, including fighters, carry PRUs, personal re-entry units. These are derived from that insane sport space-diving, which entails jumping out of a perfectly good orbital platform and entering the atmosphere in almost nothing but a spacesuit and the PRU. These are usually foam or inflatable ablative shields that provide a semi-controlled re-entry. They are controlled enough to usually hit a targeted continent, but you'll need to supply your own landing gear, like a parachute. Experimental PRUs appeared at the dawn of the space age and sport units have a sufficient safety record to prevent them from being banned in most sane nations, so they're probably going to stick around for a while longer. However, they're not the best way to escape a distressed vehicle unless they're the only way.

A form of evacuation that sometimes includes a PRU is the fighter ejection seat. Ejection seats sometimes turn up on small craft and smaller DropShips, but are mostly found on fighters. You're probably fairly familiar with ejection seats, so I won't get into the details. The space-related details are that they often include a distress beacon, supplemental power and air for a pilot's spacesuit, and you do need your own spacesuit. Ejection seats have a pretty low success record when used in space without a spacesuit. Between the life support in a typical spacesuit and the ejection seat, a fighter pilot generally has about 24 hours to live after ejection.

Speaking of spacesuits, the all-time least preferable means of evacuating a distressed vessel is jumping out of the spacecraft in a spacesuit and nothing else other than a maneuvering pack, if you can find one of those in time. A typical space suit will keep you alive for 8 hours without supplemental packs, while the emergency suits found throughout most ships are only good for 30 minutes without supplemental support. Spacesuits all include distress beacons that generally will last many days longer than your life support.

GRAVITATIONAL EFFECTS

Maybe I should've talked about this earlier, along with exercise and recreation...oh, well, it won't make this lecture anymore confused to put it here. Okay, spacers encounter a wider range of G-forces than the steady 1 G of DropShips or planets. I mean, the planetary average. The notional average based on Terra. Back on track...the two notable variant gravitational experiences are microgravity and high gravity. Let me splice these in ...

High Gravity

Spacers rarely encounter high gravity, anything over 1 G, for more than a few hours at a time and usually only for minutes in combat or when launching from a planet. The reason for the limited use is that high-Gs do not cut travel times as rapidly as most of us would like—damn you again, Newton. Twice the acceleration does not halve travel time; instead, it divides travel time by the square root of two. I'll get into this more in a bit, but if you took your freshman mechanical physics, you should be able to look at the equation relating distance to acceleration and time and see the problem. So, there's not much point in punishing the crew with days of 2 G or 3 G acceleration, since you won't be getting there much faster than 1 G.

A few extra Gs are rarely a problem to any prepared individual. The problems stem from extended duration and really high gravities. Human tolerance for high gravity decreases exponentially with duration and intensity.

Duration and intensity. A healthy human might...not "might," I should say "has" and "are"...survive at 1.5 Gs for decades on the highest-gravity worlds humankind has settled. They can patently walk, talk and live in those conditions. There's a high rate of premature deaths due to heart failure and a higher rate of infant mortality, but it's tolerable. At 2 Gs, though, you see a dramatic drop in survival durations. Yes, the strong can still walk and talk at 2 Gs and more—heck, look at me. I'm nearly twice the healthy mass for my height and I get around fine. But I'm also not lifting blood against 2 Gs. Healthy people start having sudden heart failure. Apparently healthy people faint because the human heart just can't lift blood against 2 Gs, not vertically. Sure, some people could live for years in those conditions, but they're the exception. By 3 Gs, some fools can stagger around a bit, but entire crews have to be seated and preferably horizontal for the hours or days they're subjected to that, and if you push for days, you're almost certainly going to suffer some crew casualties. At further elevations in G-force, people start blacking out almost immediately.

With proper protection—like G-suits and proper seating—healthy spaceship crewmen can endure 6 Gs "indefinitely" as reckoned by combat, or tens of minutes as we might count it, though they'll rapidly fatigue. Such protected spacers only face quick blackouts above 10Gs. Unprotected crewmen are likely to black out at 5 or 6 Gs, and will rapidly fatigue at 3 Gs.

Microgravity

Zero gravity, often more accurately called microgravity due to various microscopic acceleration sources, is basically the condition where everyone's floating around because there's not enough centripetal force, linear acceleration or old-fashioned gravity. I'd even say normal jump point station-keeping thrust falls in this category, though that's really "milli-gravity," if you remember your metric prefixes. JumpShip crews spend the vast majority of their time in these conditions—at least, if they're not on gravdecks—and WarShip crews may spend significant time in these conditions as well. DropShip crews generally spend most of their time under 1 G as their ships rocket back and forth.

Long-term exposure to freefall...could you get through Lyran primary or secondary school without knowing this? Bones decalcify and most muscles atrophy. For a great many centuries before the Third Succession War, there were drugs and even genetic therapies—in places that tolerated that crap—to reduce bone decalcification, but muscle loss always had to be treated by exercise.

Moving about in freefall is interesting. For short distances, you can push yourself along with very light motions. I do mean light motions—it doesn't take much gravity-born strength to hurl someone at dangerous speeds into a bulkhead or another crewmember. Ships with longer corridors frequently use stationary handholds and footholds to guide travelers, while JumpShips and WarShips may use powered hand loops to pull crew around in a controlled fashion. The standard coloring is blue handholds are heading toward the ship's stern, red to-

ward the bow, green is counterclockwise around a deck and yellow is clockwise.

For spacers who can't find a convenient freefall handhold or foothold or other anchor, there are Velcro and magnetic shoes. These are options of last resort. While cheap vid directors like to use "magnetic shoes" as an excuse not to record their tripe in actual freefall conditions (like Danger Dave), such shoes actually offer little advantage. They're basically good for holding you in place. Trying to simulate walking in 1 G with a magnetic field around your foot verges on folly because when you walk in gravity, your moving foot does not have the weight of your body over it—you put your weight on the stationary foot. Having to lift a foot against magnetic or some other retaining force that approaches full bodyweight is unnatural. The reality is that the experience of simulating full bodyweight through such shoes or boots is like floating underwater with heavily weighted shoes. You get to float around like a waving seaweed anchored to the ocean floor. With practice, magnetic shoes can be a useful aid to movement and they certainly give a quick anchor against weapons recoil—for you prospective marines out there—but they entail an entirely new way of using your ankles and legs to keep you upright against your upper body inertia. It takes skill, and it's never as easy as normal walking—and running, which involves both your feet off the ground at the same time, is right out.

That, by the way, should give you some inkling of the problem that BattleMechs and battle armor face when trying to stay on the sides of an accelerating ship. They tend to flop over at the ankle actuators, assuming their feet manage to stick at all—it takes a good MechWarrior to maneuver a 'Mech on the surface of a non-maneuvering ship, let alone one that lights up its engines.

INTERNAL ATMOSPHERE AND ENVIRONMENT

At least this bit kind of follows the last. First, health problems, and now the machinery that keeps you alive in space. Yeah, I wasn't twice normal mass back when I gave the following lecture, was I?...

Air

I touched on this under quarters, but some other details about life support are worth regurgitating before your next quiz. Obviously, in an enclosed environment like a spacecraft, air is a serious concern. We had two workers suffocate on campus while they were working on a water tank several weeks ago, and that space even had an open manhole. The situation is potentially much worse on a spacecraft, since you don't have the convenience of gigatons of atmosphere outside.

The good news is, most spacecraft carry very large air reserves. Even without recycling, oxygen demands by an adult human are relatively light in terms of mass. If you take care to scrub the air, an adult needs only about two kilograms of oxygen per day. The many tons of air needed just to fill a typical DropShip carry enough oxygen to last a long time—a *Union* alone has more than fifty tons of oxygen in its open spaces. Without scrubbers, though, carbon dioxide levels can reach a

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toxic point long before the oxygen runs low. Fortunately, carbon dioxide scrubbing is a pretty simple technology. Some alkaline hydroxide compounds make a quick back-up for the fancier thermal or molecular traps and dioxide crackers of modern ships.

Humans exhale a lot besides carbon dioxide. Humans exhale about as much water as CO₂, kilograms of it, as a result of your metabolism—not all the byproducts of your digested food come out your rear end. Water, humidity, is easy to capture, but the trace chemicals humans emit can get annoying and complicate air processing.

Ships generally have a centralized, fancy air treatment system that cleans out unwanted chemicals, keeps the oxygen and nitrogen in balance, maintains pressure at the desired level, “cracks” water and carbon dioxide back into more useful chemicals, controls temperature and performs other complicated tricks of air processing. However, secondary systems include local emergency oxygen supplies and scrubbing packs throughout corridors and major compartments. I’ve heard some passenger liners make a point of including closed emergency life support in their luxury passenger compartments, just to sell tickets with that added measure of safety.

Fighters tend to be the exception to this rule. Mass is at a premium on aerospace fighters, so the cockpits generally only include some “canned” oxygen and a scrubber, with no real recycling—which would only be slightly heavier, given the abundance of power available from the fusion engine. The typical fighter (or ‘Mech) life support system is only meant to last about 96 hours, including oxygen and some drinking water (a small cockpit on a ‘Mech reduces this to 48 hours), though most units can install extra oxygen tanks. A few liters of liquid oxygen will last a long time when the pilot is only breathing about two kilos a day, and it’s not like fighters are short of internal space when they’re stuffed full of tons of liquid hydrogen. Though it’s feasible to put pilots in some fighters for a week or more, that sometimes takes special training or at least substantial hardship pay. Fighter cockpits are rarely as comfortable as the largest BattleMech cockpits.

Despite the many redundant systems and robust hulls of their spacecraft, spacers—especially engineers and technicians—wear uniforms that can double as spacesuits in a pinch. The wiser and trimmer spacers wear “skinsuits,” perhaps under general duty overalls, that maintain satisfactory pressure with the elastic material of the suit, which allows pretty good mobility in a vacuum. The alternative for decent mobility in an emergency is full suits with “constant volume joints.” Simply inflated spacesuits would bend unevenly at joints, meaning the spacer would fight against the internal pressurization of the suit to bend a limb, perhaps requiring more than a thousand Newtons of force, so spacesuits are designed with articulated joints that keep the joint volumes constant. As an emergency feature, most large spacecraft carry plentiful emergency spacesuits. These lightweight garments have awful vacuum mobility because they lack proper constant-volume joints—they inflate like star-shaped balloons in a hard vacuum—and only give about 30 minutes of air without external aid, but that should be enough to reach a lifeboat or pressurized compartment.

On that note, most large spacecraft are heavily compartmentalized. Modern construction materials allow most walls and doors to hold pressure, even little crew cabins. They aren’t proper airlocks, but the many airtight compartments allow excellent damage containment, and most of it is automated to some degree.

Generally, alarms will sound when slow leaks are detected, giving local compartment occupants time to evacuate or plug the leak. In sudden decompressions, such as those due to battle damage, damage control computers snap shut doors automatically. Assuming the doors weren’t already shut for battle.

Ships generally do not depressurize for battle, though some captains may do so deliberately. While air pressure can transmit shocks and support fires, it also allows the ship to act as a “space-suit” for the crew. Compartments that decompress before crew inside them can react are generally compartments filled with dead crew, so keeping the ship pressurized is an extra measure of safety—particularly if damage that got through the hull holed spacesuits. Damage control computers can always depressurize volumes with fires or boarders or chemical spills; you don’t have to proactively vent the whole ship for problems that are likely to be localized. And while captains may keep ships pressurized, they generally demand their crews suit up anyway, with helmets and gloves tethered if not worn.

While I’m on the topic, firefighting is important in an enclosed environment like a spacecraft. Obviously, it endangers the air supplies by consuming oxygen and producing toxic smoke, but fire also causes less obvious problems on a spacecraft. Pressure increases, for one. If you recall, heated gases want to expand, and if they cannot expand, then their pressure goes up. Raising a compartment’s temperature by about three hundred Celsius will double air pressure. That sort of problem, combined with heated walls, can produce buckling and bursting of bulkheads, not to mention difficulty opening hatches due to pressure differences. Firefighting is usually accomplished first by ultra-fine water mist extinguishers that help control the temperature, then inert gases that have the drawback of smothering unprotected compartment occupants, and finally venting compartments to vacuum. Handheld extinguishers and damage control are used to attack fire sources, so crew training involves more than just pushing buttons to vent compartments.

Temperature

When it comes to temperature control, most spacecraft actually have to cool their interiors despite the supposed cold of space. (I shouldn’t have to tell you that cold is an illusion—only substances are cold, and space is the absence of substance.) Spacecraft are designed with heavy insulation so they are not affected by the sharp exterior temperature extremes. However, insulation works both ways. The human crew of a typical DropShip can keep the crew spaces fairly warm with their own body heat, to the point that cramped crew facilities can have overheating problems. Cooling generally depends on the spacecraft’s heat sink network or similar heat pumps dedicated to the life support system.

Modern climate control on spacecraft is usually able to handle most reasonable extremes of temperatures, from those of typical inner planets of a system to the depths of interstellar space. External cold is always easier to handle than heat—heating is easy on heavily insulated, fusion-powered spacecraft.

Water

A sufficient supply of clean water is necessary for any long-range voyage. Humans use a lot of water every day for drinking, food preparation and hygiene. A typical large craft’s water system budgets about 500 liters of water per crewmember and passenger per day. It isn’t feasible to meet those demands—half a ton

per day per person—with just stored water, so filtration and recycling are necessary. Water may be reused on spacecraft hundreds of times. Spacecraft use a variety of recycling and filtration techniques. An old standby is a set of filters and supercritical water oxidation, which breaks down virtually anything with superhot, oxygenated water—metal, plastics, soaps, organic waste and so on—into water, carbon dioxide and some ash. Newer ships rely on a variety of fancier processing systems that avoid tanks of pressurized, superheated water. Fighters basically have no water recycling, relying on small holding tanks.

Interestingly, a sizable source of “fresh water” on spacecraft is human exhalations. I mentioned this earlier. Each kilogram of food—measured by its dehydrated mass—that you consume produces about a liter of water as inhaled oxygen is combined with the food in your cells.

Losses in the water recycling system accumulate in the “sludge tanks.” This unrecyclable waste is generally packaged in injection-molded plastic bins made on the ship—often made out of some of the waste solids that could not be recycled, or re-melted plastic food containers—and ejected from the ship into its drive plume. The few ships that have hydroponics have alternate uses for that sludge. As they say on *Invaders*, “Flush twice, it’s a long way to the gardens.”

PSYCHOLOGICAL CONSIDERATIONS

Yet another topic change: keeping the crew sane. I borrowed this from a lecture I did a few weeks ago for Dr. Ready’s other transportation tech class section...

A modern large spacecraft is...well, large. Many urbanites on advanced worlds in the Inner Sphere voluntarily lock themselves into apartments much smaller than the volume available to spacecraft crewmen, especially the under-crewed, oversized WarShips and JumpShips, and only contact the outside world through the wonders of telecommunications. Telecommuting, online food and goods ordering, direct-to-door services—yes, we can create and live in our little enclosed worlds and be perfectly happy. So why do so many spacers have trouble doing the same in roomier spacecraft?

I suppose the key word is “our” little enclosed worlds. When you turn into a shut-in, you’re going into your own safe little place. And if you need to get out once in awhile, you can always open the door and go out. A spacer is locked in a tin can with people he or she cannot avoid, duties that cannot be shirked, long hours, isolation from the outside world—there are no real-time computer nets in deep space—and grinding routine.

Isolation and Routine

Shipboard life is prone to considerable tedium, since it lacks easy access to the outside universe. You don’t have the stimulation of weather, wide-ranging social interactions, or even telecommunications that let you into chats and live games. For vulnerable personnel, it’s not unknown to see individuals

slipping into their own fantasy worlds and even deciding the outside universe is an illusion.

Phobias

Spacecraft manage to encourage a number of phobias. The primary phobias are two opposite conditions: claustrophobia and agoraphobia, the fears of enclosed spaces and open spaces, respectively.

The enclosed nature of spacecraft, even large WarShips, and restrictive shipboard lifestyles can prompt an outbreak of claustrophobia even among pre-screened, iron-willed crewmembers. Passengers are even more vulnerable, since they are rarely screened.

On the other hand, crewmembers and passengers may become used to the closed confines of spacecraft. Sometimes the thought of all that darn *space* lurking outside the hull might bother a spacer but veteran spacers are rarely troubled by deep space. After all, there’s nothing to give perspective and depth to most of it. Stars are simply specks of light on some unknowably distant background, and few other objects exist to give space any *scale*. Fighter pilots who eject sometimes suffer agoraphobia from the depths of space, but they’re also suffering from the terrible worry that they might not be rescued and be left to drift alone. So, actually, agoraphobia tends to hit spacers on the ground, where suddenly there’s way too much perspective. Even the cramped confines of an urban jungle can appear overwhelmingly vast to a spacer.

I’ve always thought that the recycling aspects of life support systems would drive a germ-o-phobe—is that the right term?—nuts, but I haven’t heard of many problems with that.

General Tensions

When you’re stuck in a small tin can for weeks and months at a time and have no chance to escape, little things can matter a lot. A critical comment or imagined slight you and I can walk away from may seem inescapable on a DropShip or JumpShip. Ship captains take a lot of care to weed out problematic crew before starting a long voyage and seek recruits with good self-discipline, but once a voyage begins it takes good care and personnel management to avoid problems. If you don’t avoid the problems, you can get explosions a lot worse than they would be on the ground. That fistfight on Salyut-8 and knifing on Crippen Station are perfect examples of crewmembers buckling under stress.

For better or worse, the long-serving crews of large craft often see some romance among crewmates. While this might seem like a great safety valve, particularly to a crowd as young as you, romance among co-workers is often begging for disaster. A romance fostered under unnecessarily confined conditions is one that might never have worked otherwise and when it goes bad...well, then you’re stuck on a ship with an unhappy ex. Even when it goes well, there can be problems—you just don’t think straight about lovers, and that’s dangerous for a spacer. There have been various approaches to dealing with this over the centuries. Most commercial lines and military ships strongly frown on fraternizing between different ranks, and sometimes even in the same sub-section of the crew. The family-run JumpShips of the late Succession Wars and modern era have figured out their means of keeping work and love separate and worked it into their culture. The

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Clans manage to mostly raise their people to separate romance and sex, so their crews can “clear their heads” without making things worse. Some of the pre-Confederation nations in Capellan space and Free Worlds member states used, well, “ship’s whores” in the 24th and 25th centuries for deliberate crew morale purposes.

SYSTEM TRANSIT

And from crazy spacers we shift to interplanetary transit. That makes sense, Dr. Ready. But I’ve got just the clip to plug in...

The groundbreaking work of the TAS *Columbia* demonstrated the power of fusion rocketry. The *Columbia* was originally built as the fourth *Altair*-class interplanetary ship. The *Altairs* had been making six-month journeys to Mars, Terra’s outer neighboring planet, using brief bursts of chemical rockets to reach Mars at its biannual closest approach to Terra of half an AU. When the *Columbia* was refitted with a GM FP-100D fusion rocket, its demonstration voyage in 2027 C.E. was accomplished in fourteen days at a constant tenth of a gravity of acceleration. Even as the *Columbia* set its record, its giant, unmanned descendants were taking form at Crippen Station: the Magellan probes. These were the largest self-propelled spacecraft built up to that time, more than 300 meters long, and their next-generation FP-2000XE fusion engines would allow them to accelerate at 2 Gs for months on end, eventually reaching 68 percent of light-speed.

Ten and a half centuries later, our fusion engines still propel us through star systems at 1 G for our health and convenience. Improvements have mostly been in the form of engine efficiency and mass, and peak size—as the Federated Commonwealth learned with the *Fox*, it takes some doing to build large fusion rockets, sometimes more than designing a compact K-F drive.

There are two general approaches to system transit: constant acceleration or the inertial-coast method. Constant acceleration picks an acceleration and uses it from start to halfway through the voyage. At the halfway point, the ship cuts its drive briefly, flips 180 degrees so its engines are now facing in the direction it’s heading, and then runs the engines at the same acceleration for the last half of the voyage. As a result, the ship ends up at its destination halted and with the crew and passengers happy that they experienced “gravity” for the whole trip.

To minimize fuel use or remain stealthy, some ships use the “inertial-coast” method. This involves the ship accelerating for a while, then cutting its engine to coast for most of the voyage until making an equal braking burn at the destination. Depending on how long and powerful the engine burns are, inertial-coasting can deliver trips almost as short as constant acceleration voyages, or it can take months, as was the case of the *Altairs* on their six-month jaunts to nearby Mars.

How fast will 1 G, or some other constant acceleration and braking, get you through a system? That takes a little algebra, the distance and the acceleration you’re interested in. The transit time is up here on the board...

$$\text{Time} = 2 \times \text{square root} (\text{Distance} / \text{Acceleration})$$

For you art and humanities types, you can’t weasel out with easy numbers or approximations. In that equation, Time is the

total transit time in seconds, Distance is the total transit length in meters, and Acceleration is in meters per second per second. For those of you looking a bit confused, remember there are 3,600 seconds in an hour and 24 hours in a day; that one kilometer equals 1,000 meters, and that there are about 150 million kilometers in an astronomical unit; and that 1 G is 9.8 m/s/s. Keep your units straight and you should get the correct numbers. Some common examples of trips at 1 G include (yes, I’m rounding):

- 2 hours, 10 minutes for a 150,000km journey to a typical moon
- 7 hours for a 1,500,000km journey to the L1 Lagrange point of a typical habitable planet and its typical star
- 49 hours for a 75 million-kilometer journey between a typical habitable planet and a typical neighboring planet
- 69 hours for a 1AU journey
- 218 hours for a 10AU journey, such as from Terra to its standard jump point

Earlier, I pointed out that transit times don’t shrink directly with increasing acceleration. For example, 2 Gs does not halve transit time. From that equation, it should be clear why. Transit time goes down with the square root of acceleration. It also shows why doubling distance only increases transit times by about 41%. So, how about looking at those six example 1 G flights at 1.5 G or 2 Gs or 4 Gs? Well, first, take the square root of the new acceleration as a fraction of the old (in this case, the square root of 1.5, or square root of 2, or square root of 4), then divide the 1 G trip time by that square root.

- 150,000km journey to a typical moon: 106 minutes at 1.5 Gs, 92 minutes at 2 Gs, and 65 minutes at 4 Gs
- 1,500,000km journey: 5 hours, 42 minutes; 4 hours, 57 minutes; and 3 hours, 3 minutes
- 75 million kilometers: 40.5 hours; 34.6 hours; and 24.5 hours
- 1AU journey: 56 hours; 49 hours; and 35 hours
- 10AU journey: 178 hours; 154 hours; and 109 hours

Another question you might ask is, “How much distance is covered by a trip of known length and acceleration?” Interstellar passenger lines tend to post their schedules in terms of days spent at the standard 1 G and many planetary overviews tend to list “transit times” from jump points to planets, not “transit distances.” Well, if you’re curious, it goes like this for constant acceleration flights:

$$\text{Distance} = 0.25 \times \text{Acceleration} \times \text{Time}^2$$

Again, Distance, the total distance covered, is in meters; Acceleration is in meters per second per second; and Time, the total transit time, is in seconds. For those of you remembering your basic physics who are about to ask why there’s a 0.25 instead of 0.5 in there, put your hands down. The equation does not give the distance covered by constant acceleration in one direction. Instead, it gives the distance covered by a ship that burns in one direction half the time, then uses a braking burn for the rest of the time.

How might you use that equation? Well, I’m not saying this will be on one of Dr. Ready’s exams, but you might want to pay real

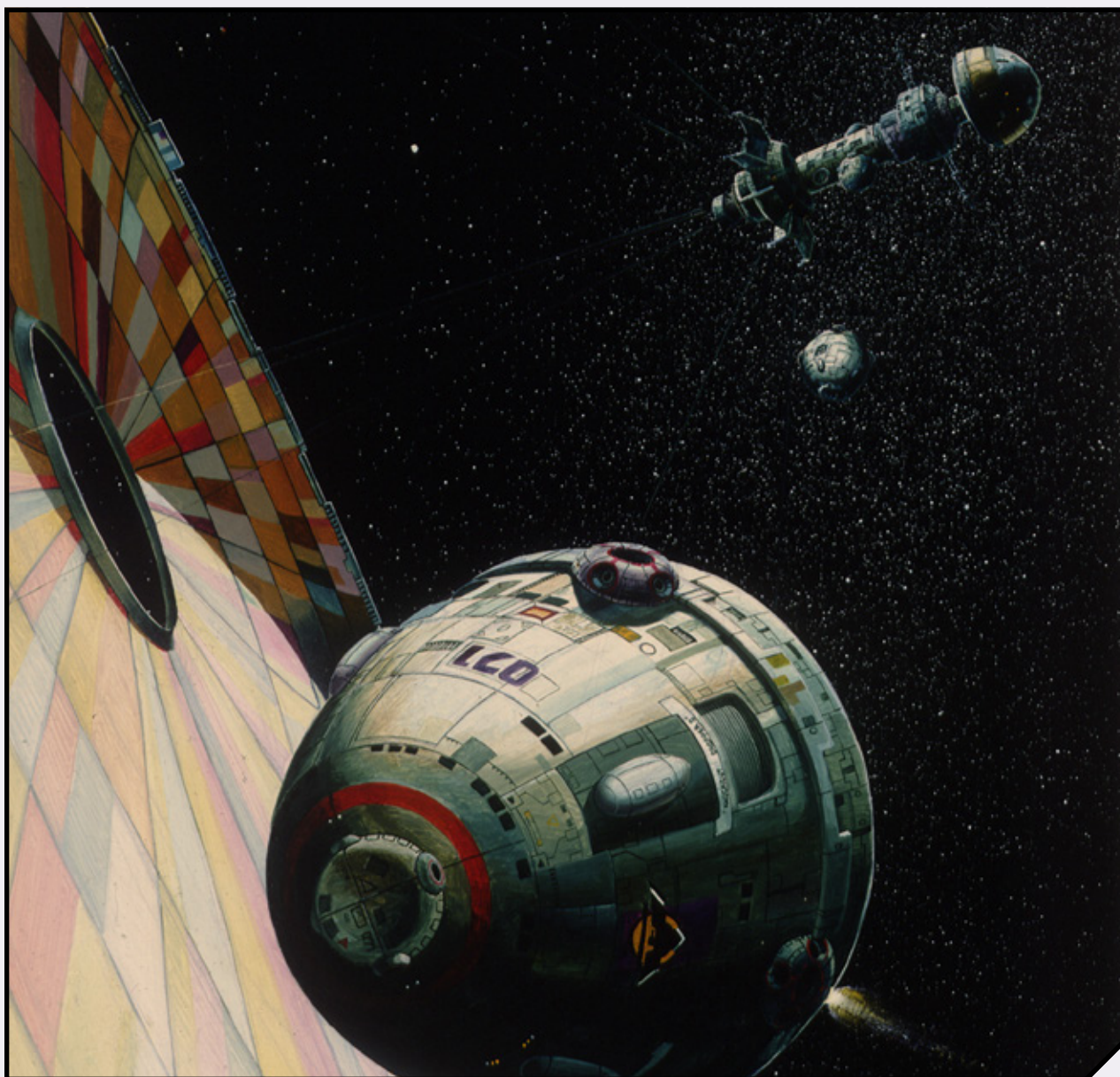
good attention to the following question: considering the transit time of Terra to its standard jump points, why are the Titan Shipyards of Terra—or I should say, the Titan Shipyards of Saturn, Sol VI—so perfectly placed for JumpShip testing and production? Chew on that tonight.

Inertial-coast transit calculations are more complicated because, well, it depends on how long you burn, how long you coast and quite possibly other factors. I suggest taking a course in interplanetary navigation if you're really curious. A freshman physics course should get you through the simpler scenarios.

Speaking of scenarios, you might wonder about trajectories and flight paths and gravity assists—sling shots—and all the other concerns that make eyes bleed and brains melt in navigation courses. Fortunately for laymen, the basics of interplanetary navigation with fusion rockets are quite simple: it's a straight line. Acceleration is so high and so prolonged that

you can do perfectly adequate back-of-the-envelope calculations assuming straight-line flights. It's only when you slow down enough to enter a planetary orbit that the math starts getting complicated. Sling shots, which depend on lingering around a planet or moon for gravitational boosts or braking, are virtually irrelevant to today's flight. When you buzz past a big gas giant in your 1 G DropShip, you're not going to be near the planet long enough to significantly boost or hinder your flight. Oh, actual navigators have to worry about the gravitational effects, but that's only because they're trying to get their ships to arrive within a kilometer or two of an aim point. For Dr. Ready's course, you don't need to worry about it.

...and that's it. I think Dr. Ready was dumping all the trans-tech topics he skipped into this lecture, but watch for them. They'll be on the exam.



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INTRODUCTION

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ADVANCED
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ADVANCED
AEROSPACE
COMBAT

ADVANCED
AEROSPACE
CONSTRUCTION

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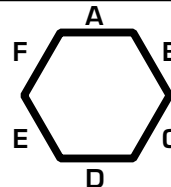
RECORD SHEETS



BATTLETECH™

ADVANCED AEROSPACE MOVEMENT SHEET

Advanced
Movement
Compass



VELOCITY RECORD

Unit: _____

Turn

Velocity

#	Thrust	Facing	A	B	C	D	E	F	Fuel
1	_____	_____	/	/	/	/	/	/	_____
2	_____	_____	/	/	/	/	/	/	_____
3	_____	_____	/	/	/	/	/	/	_____
4	_____	_____	/	/	/	/	/	/	_____
5	_____	_____	/	/	/	/	/	/	_____
6	_____	_____	/	/	/	/	/	/	_____
7	_____	_____	/	/	/	/	/	/	_____
8	_____	_____	/	/	/	/	/	/	_____
9	_____	_____	/	/	/	/	/	/	_____
10	_____	_____	/	/	/	/	/	/	_____
11	_____	_____	/	/	/	/	/	/	_____
12	_____	_____	/	/	/	/	/	/	_____
13	_____	_____	/	/	/	/	/	/	_____
14	_____	_____	/	/	/	/	/	/	_____
15	_____	_____	/	/	/	/	/	/	_____
16	_____	_____	/	/	/	/	/	/	_____
17	_____	_____	/	/	/	/	/	/	_____
18	_____	_____	/	/	/	/	/	/	_____
19	_____	_____	/	/	/	/	/	/	_____
20	_____	_____	/	/	/	/	/	/	_____

ADVANCED MOVEMENT

A vector is active if thrust is applied while the unit is facing that hexside. A vector is inactive if the unit spends no thrust to move through that hexside.

Each time a unit spends thrust, note down that number on the record sheet in the appropriate vector (the vector of the unit's facing). Next, determine the effect of spending thrust by consolidating the active vectors.

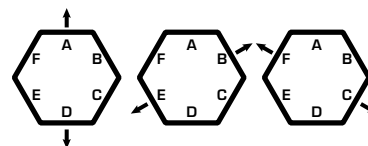
First, consolidate any active opposing vectors (see Opposing Vectors diagram) by subtracting the lowest thrust value from both vectors, reducing one vector to 0.

Next, consolidate the oblique vectors (see Oblique Vectors diagram). When any pair of oblique vectors is active, subtract the lowest of the two thrust values from both vectors (or from both if they are equal), reducing one (or both) oblique vectors to 0, and add the same value to the thrust value of the vector in between.

After consolidating all vectors, a unit should have no more than two active vectors.

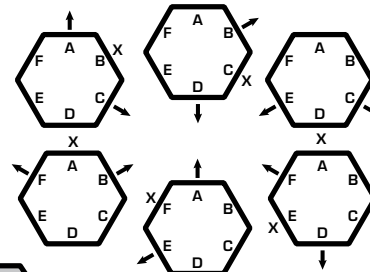
OPPOSING VECTORS

If both vectors marked with arrows are active, subtract an equal amount from both until only one of them is active.



OBLIQUE VECTORS

If both vector markers are active, subtract an equal amount from both and add that amount to vector X.



CATALYST
game labs

VELOCITY RECORD

Unit: _____

Turn

Velocity

#	Thrust	Facing	A	B	C	D	E	F	Fuel
1	_____	_____	/	/	/	/	/	/	_____
2	_____	_____	/	/	/	/	/	/	_____
3	_____	_____	/	/	/	/	/	/	_____
4	_____	_____	/	/	/	/	/	/	_____
5	_____	_____	/	/	/	/	/	/	_____
6	_____	_____	/	/	/	/	/	/	_____
7	_____	_____	/	/	/	/	/	/	_____
8	_____	_____	/	/	/	/	/	/	_____
9	_____	_____	/	/	/	/	/	/	_____
10	_____	_____	/	/	/	/	/	/	_____
11	_____	_____	/	/	/	/	/	/	_____
12	_____	_____	/	/	/	/	/	/	_____
13	_____	_____	/	/	/	/	/	/	_____
14	_____	_____	/	/	/	/	/	/	_____
15	_____	_____	/	/	/	/	/	/	_____
16	_____	_____	/	/	/	/	/	/	_____
17	_____	_____	/	/	/	/	/	/	_____
18	_____	_____	/	/	/	/	/	/	_____
19	_____	_____	/	/	/	/	/	/	_____
20	_____	_____	/	/	/	/	/	/	_____

VELOCITY RECORD

Unit: _____

Turn

Velocity

#	Thrust	Facing	A	B	C	D	E	F	Fuel
1	_____	_____	/	/	/	/	/	/	_____
2	_____	_____	/	/	/	/	/	/	_____
3	_____	_____	/	/	/	/	/	/	_____
4	_____	_____	/	/	/	/	/	/	_____
5	_____	_____	/	/	/	/	/	/	_____
6	_____	_____	/	/	/	/	/	/	_____
7	_____	_____	/	/	/	/	/	/	_____
8	_____	_____	/	/	/	/	/	/	_____
9	_____	_____	/	/	/	/	/	/	_____
10	_____	_____	/	/	/	/	/	/	_____
11	_____	_____	/	/	/	/	/	/	_____
12	_____	_____	/	/	/	/	/	/	_____
13	_____	_____	/	/	/	/	/	/	_____
14	_____	_____	/	/	/	/	/	/	_____
15	_____	_____	/	/	/	/	/	/	_____
16	_____	_____	/	/	/	/	/	/	_____
17	_____	_____	/	/	/	/	/	/	_____
18	_____	_____	/	/	/	/	/	/	_____
19	_____	_____	/	/	/	/	/	/	_____
20	_____	_____	/	/	/	/	/	/	_____



SQUADRON DATA

Name:

Gunnery Skill:

Piloting Skill:

Safe Thrust:

Max Thrust:

Weapon Bay	Loc.	Starting#/ Current#	AV Each	Heat Each / Current Total	Range Bracket	Weapon Bay	Loc.	Starting#/ Current#	AV Each	Heat Each / Current Total	Range Bracket	Weapon Bay	Loc.	Starting#/ Current#	AV Each	Heat Each / Current Total	Range Bracket

Tech Base: Inner Sphere ☐ Clan ☐ Total Heat Capacity (Current): () Total Fuel: SI:

FIGHTER DATA

Ftr #1:

Engine 2 4 D Gear +5

Avionics +1 +2 +5 Thrust

Sensors +1 +2 +5 Safe:

FCS +2 +4 D Max:

Life Support +2

Total Armor/Fatal
Threshold (/)

SI ()

HS: () Fuel:

G/P: /

Weapons and Equipment

Loc

Ht

AV/Range

Weapons and Equipment

Loc

Ht

AV/Range

Ftr #2:

Engine 2 4 D Gear +5

Avionics +1 +2 +5 Thrust

Sensors +1 +2 +5 Safe:

FCS +2 +4 D Max:

Life Support +2

Total Armor/Fatal
Threshold (/)

SI ()

HS: () Fuel:

G/P: /

Weapons and Equipment

Loc

Ht

AV/Range

Weapons and Equipment

Loc

Ht

AV/Range

Ftr #3:

Engine 2 4 D Gear +5

Avionics +1 +2 +5 Thrust

Sensors +1 +2 +5 Safe:

FCS +2 +4 D Max:

Life Support +2

Total Armor/Fatal
Threshold (/)

SI ()

HS: () Fuel:

G/P: /

Weapons and Equipment

Loc

Ht

AV/Range

Weapons and Equipment

Loc

Ht

AV/Range

Ftr #4:

Engine 2 4 D Gear +5

Avionics +1 +2 +5 Thrust

Sensors +1 +2 +5 Safe:

FCS +2 +4 D Max:

Life Support +2

Total Armor/Fatal
Threshold (/)

SI ()

HS: () Fuel:

G/P: /

Weapons and Equipment

Loc

Ht

AV/Range

Weapons and Equipment

Loc

Ht

AV/Range

Ftr #5:

Engine 2 4 D Gear +5

Avionics +1 +2 +5 Thrust

Sensors +1 +2 +5 Safe:

FCS +2 +4 D Max:

Life Support +2

Total Armor/Fatal
Threshold (/)

SI ()

HS: () Fuel:

G/P: /

Weapons and Equipment

Loc

Ht

AV/Range

Weapons and Equipment

Loc

Ht

AV/Range

Ftr #6:

Engine 2 4 D Gear +5

Avionics +1 +2 +5 Thrust

Sensors +1 +2 +5 Safe:

FCS +2 +4 D Max:

Life Support +2

Total Armor/Fatal
Threshold (/)

SI ()

HS: () Fuel:

G/P: /

Weapons and Equipment

Loc

Ht

AV/Range

Weapons and Equipment

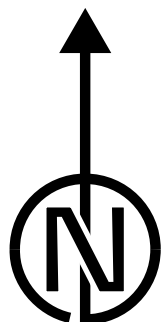
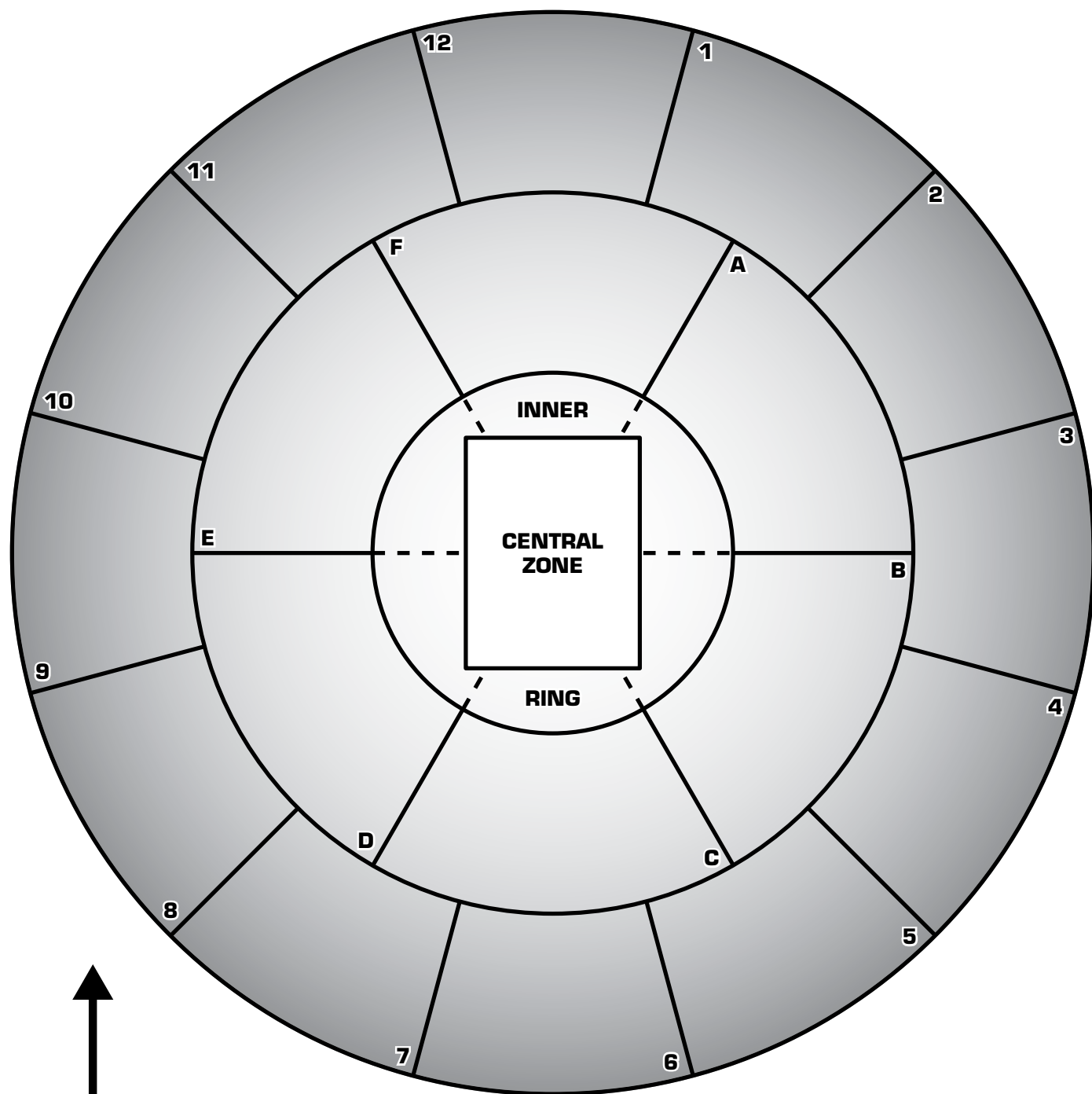
Loc

Ht

AV/Range

VELOCITY RECORD

Turn #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Thrust																				
Velocity																				
Effective Velocity																				
Altitude																				
Fuel																				
Overheat																				



PLAYER _____

Engagement Speed: _____

Angle of Attack: _____

Unit	Ship/Squadron/ Mines/Debris	Detection Phase	Capital Missile Phase		Meeting Engagement Phase	
		Maneuver	Maneuver	Target(s)	Maneuver	Target(s)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

CHARTS AND TABLES

SEQUENCE OF PLAY

- Detection and Initial Maneuver Phase
 - Determine Detection
 - Launch and Redeploy Units
 - Detection Maneuvering
- Capital Missile Phase
 - Capital Missile Maneuvers
 - Capital Missile Attacks
- Meeting Engagement Phase
 - Meeting Engagement Maneuvers
 - Meeting Engagement Weapons Fire
 - Mine/Debris/Collisions
 - Chaser Weapons Fire
- End Phase
 - Recover Detached Units

FIGHTER AND SMALL CRAFT DEPLOYMENT TABLE

1D6	% of Units Deployment*
1	15%
2	30%
3	45%
4	60%
5	75%
6	90%

*In all cases, round down to the nearest whole fighter and small craft

RANDOM ENGAGEMENT SPEED TABLE†

2D6 Roll	Speed Class
2	Fast
3	Medium
4	Medium
5	Slow
6	Slow
7	Slow
8	Slow
9	Slow
10	Medium
11	Medium
12	Fast

ANGLE OF ATTACK TABLE†

2D6 Roll	Angle of Attack (AoA)
2	Crossing
3	Crossing
4	Crossing
5	Head On
6	Head On
7	Head On
8	Head On
9	Head On
10	Head On
11	Crossing
12	Crossing

†Players may simply agree on an Engagement Speed and Angle of Attack in place of rolling on these tables.

CONVERSION OF GROUND UNITS TO FIGHTERS TABLE

BattleMechs/ProtoMechs

Thrust Rating: Jumping MP ÷ 3 (round down)

Fuel: Jumping MP x 2

Offensive Systems: Use the weapon Damage Values as presented on pages 303-305 of *TW* and pp. 216-228 of *TO:AUE*. Note that these weapons have significantly reduced ranges in aerospace engagements (see Aerospace Weapon Range Table, p. 235, *TW*). Standard ground unit arcs apply. Melee weapons may not be used, with certain exceptions (see *Zero-G Ground Unit Combat*, p. 107).

Armor: A 'Mech's armor remains in the standard locations

Battle Armor (BA squads/Points are treated as single units.)

Thrust Rating: Jumping MP ÷ 3 (round down)

Fuel: Jumping MP x 6 + any fuel tanks

Offensive Systems: Use the weapon Damage Values as presented on pages 303-305 of *TW* and pp. 216-228 of *TO:AUE*, allocating all to a hypothetical Nose arc.

Armor: Total the Armor Points (excluding the 00 box for the soldier) for all the troopers in the battle armor formation. If a unit is not equipped with Space Operations Adaptations (see p. 269, *TM*), divide this total by 2.

Conventional Infantry (Marines)

Thrust Rating: Jump Rating ÷ 3 (round down)

Fuel: Jump Rating x 2

Offensive Systems: Per weapons load-out

Armor: Conventional infantry troops normally do not mount armor (each point of damage normally eliminates a single trooper); even when they do wear armor, it is treated differently (see *Infantry Armor*, p. 129, *TO:AUE*).

FAILED HULL LANDING TABLE

Margin of Failure	Effect*
1	Hard landing. Unit takes 1D6 x Base Landing Damage.
2	Hard landing. Unit takes 2D6 x Base Landing Damage.
3	Collision. Unit bounces off the hull, taking 2D6 x Base Landing Damage, and fails to land.
4	Collision. Unit bounces off the hull, taking 2D6 x Base Landing Damage, and fails to land.
5	Collision. Unit bounces off the hull, taking 3D6 x Base Landing Damage, and fails to land.
6+	Unit misses target craft. May not make any other movement this turn.

*All damage is standard-scale. In all cases, the target takes a quarter of the damage applied to the landing unit (round down).

HULL LANDING MODIFIERS TABLE

Situation	Modifier
No fuel remaining	+2
Relative velocity	See <i>Landing on the Hull</i> , p. 23
Target is Out of Control	+3
Mechs	
BattleMech armor facing destroyed	+1 facing
Has Hatchet/Sword	-1
Has Claws or Talons	-1
Has Claws and Talons	-2
Battle Armor	
Space Operations Adaptations	-1
Has Claws and/or Magnets	-1
Has Heavy Battle Claw	-1
No manipulators	+1

RECOMMENDED FIGHTER SQUADRON FORMATION TABLE

Affiliation	Force Size (Fighters per Squadron)
Clan Star (All)	10 (Split 5/5 or 6/4 in two squadrons)
Inner Sphere	
Generic/Mercenary	6
Capellan Confederation	6
Draconis Combine	6
Federated Suns	6
Free Rasalhague Republic	4
Free Worlds League	6
Lyran Alliance	6
ComStar/Word of Blake	6
Periphery (General)*	6
Marian Hegemony	10 (Split 5/5 or 6/4 in two squadrons)
Taurian Concordat	4
Calderon Protectorate	4
Additional Formations	
Clan Aerospace Point	2
Inner Sphere Flight	2
Capellan Flight	3

*Includes Circinus Federation, Magistracy of Canopus, Niops Association, Outworlds Alliance, Nueva Castile, Hanseatic League, and pirates

BOARDING FOR DAMAGE INFANTRY VS. INFANTRY ACTION TABLE

Attacker to Defender Odds Ratio									
2D6 Roll	1 to 3<	1 to 3	1 to 2	2 to 3	1 to 1	3 to 2	2 to 1	3 to 1	>3 to 1
2	E/0% (R)	55%/0% (R)	50%/0% (R)	40%/0% (R)	45%/0% (R)	40%/2% (R)	35%/3% (R)	30%/5% (R)	25%/20% (R)
3	55%/0% (R)	50%/0% (R)	45%/0% (R)	35%/0% (R)	40%/2% (R)	35%/3% (R)	30%/5%	25%/10%	20%/25%
4	50%/0% (R)	45%/0% (R)	40%/0% (R)	35%/2%	35%/3%	30%/5%	25%/10%	20%/15%	15%/30%
5	45%/0% (R)	40%/0%	35%/2%	30%/3%	30%/5%	25%/10%	20%/15%	15%/20%	10%/35%
6	40%/2%	35%/2%	30%/3%	25%/5%	25%/10%	20%/15%	15%/20%	10%/25%	10%/40%
7	35%/3%	30%/3%	25%/5%	25%/10%	20%/15%	15%/20%	10%/25%	10%/30%	5%/45%
8	35%/5%	30%/5%	25%/10%	20%/15%	15%/20%	10%/25%	10%/30%	5%/35%	5%/50%
9	30%/10%	25%/10%	20%/15%	15%/20%	10%/25%	10%/30%	5%/35%	5%/40% (1)	5%/55% (1)
10	25%/15%	20%/15%	15%/20%	10%/25%	10%/30%	5%/35% (1)	5%/40% (1)	5%/45% (1)	3%/60% (2)
11	20%/20%	15%/20%	10%/25% (1)	10%/30% (1)	5%/35% (1)	5%/40% (1)	5%/45% (2)	3%/50% (2)	2%/65% (3)
12	15%/20% (1)	10%/25% (1)	5%/30% (1)	5%/35% (2)	5%/40% (2)	5%/45% (2)	3%/50% (2)	2%/55% (3)	1%/70% (3)

DOCKING MODIFIERS TABLE

Condition	Modifier
Unit has critical damage to thruster	+1/box
Docking conducted during combat*	+2
Docking unit is JumpShip	+4
Docking unit is WarShip	+3
Docking unit is DropShip over 20,000 tons	+2
Docking unit is DropShip under 5,000 tons	-1
Per 15 minutes added to docking time	-1
Per 5 minutes subtracted from docking time	+1
Sensor damage**	+1/box
Avionics damage**	+1/box
Towing Adaptor on docking unit	-2
Target unit is Out of Control	+5***
Docking collar damaged	Double docking time

*This modifier applies to any docking attempts made within 10 hexes of units firing or being fired upon during the docking procedure.

**On either the docking unit or the target.

*** Impossible unless docking unit has Naval Tug Adaptor (see p. 147, *70:AUE*)

RANDOM MOVEMENT (ADV. VECTORS)

1D6	Effect
1	Turn 2 hexsides left
2	Turn 1 hexside left
3	Increase vector corresponding to current facing by 1
4	Increase vector corresponding to current facing by 2
5	Turn 1 hexside right
6	Turn 2 hexsides right

SUBORBITAL AND ORBITAL FLIGHT TIMES TABLE

Distance in Kilometers	Flight Time
1,500	15 minutes
2,000	18 minutes
2,500	20 minutes
5,000	30 minutes
10,000	50 minutes
20,000	90 minutes
30,000	120 minutes
40,000	140 minutes

HYPERSPACE NAVIGATION TABLE

Situation	Modifier
Calculations made without navigation computer*	+2
Aerospace unit is moving predictably	+1
Aerospace unit is moving out-of-control	+3
Destination is nadir or zenith point	+0
Destination is non-standard point*	+4
Destination is transient point**	+4
Origin point is at nadir or zenith	0
Origin is non-standard (Lagrange) point	+2
Origin is transient point	+2

*Non-standard points cannot be calculated if a navigation computer is unavailable.

**Transient points require detailed charts of the destination system.

JUMP CALCULATION TABLE

Target is zenith or nadir
With computer: (2D6 - MoS) x 10 minutes
Without computer: (2D6 - MoS) hours
Target is non-standard jump point
With computer: (2D6 - MoS) x 30 minutes
Without computer: Impossible
Other
Unit is moving: Base time x 1.1

DOCKING DAMAGE TABLE

Margin of Failure	Effect
0	Docking successful
1	Docking successful. Both docking collars take 1 box of damage.
2	Docking unsuccessful. The craft miss each other, but the pilot can attempt another docking after 10 turns.
3	Docking unsuccessful. Both docking collars suffer damage; cross off 1 box. The pilot can attempt another docking after a delay of 10 turns.
4+	Docking unsuccessful. Apply standard-scale damage equal to (MoF - 3) x 10 to the location of both units where the docking collars chosen for the docking attempt are located. The pilot can attempt another docking after 10 turns.

FAILED PREFLIGHT CHECK LIST TABLE

2D6 Die	Effect*
2-5	No Effect
6-7	+1 modifier to all Control Rolls
8-9	+2 modifier to all Control Rolls, +1 modifier to all Weapon Attack Rolls
10-11	Randomly determine a column and location on the appropriate aerospace Hit Location Table, and apply that critical damage
12	Randomly determine a column and location twice on the appropriate aerospace unit Hit Location Table, and apply both critical damages

*If an effect occurs, cargo is damaged as well (if there is cargo; Transport Bays are considered cargo in this instance). Roll 1D6, adding the final die roll result from the roll on the Failed Preflight Check List Table to determine the number of tons damaged; use the Cargo rules on page 239 of *Total Warfare* to determine the final outcome of that damage.

ATMOSPHERIC FLIGHT TIMES TABLE

Distance in Kilometers	Ground Row	Flight Times (by Altitude)*	Atmospheric Row 1
500	18.9 minutes		14.3 minutes
1,000	32.8 minutes		23.5 minutes
2,000	60.6 minutes		42.0 minutes
5,000	2.4 hours		1.6 hours
10,000	4.7 hours		3.2 hours
20,000	9.3 hours		6.3 hours
30,000	14 hours		9.3 hours
40,000	18.6 hours		12.4 hours

* Takeoff and Landing are a military profile of 5 minutes.

SIZE CLASS DAMAGE TABLE (ALL DAMAGE IN CAPITAL SCALE)

Unit Tonnage	Damage*
Zero to 500 tons	8 + 1D6
501 to 5,000 tons	14 + 2D6
5,001 to 10,000 tons	18 + 3D6
10,001 to 20,000 tons	24 + 4D6
20,001 to 35,000 tons	30 + 5D6

*Add 1D6 damage if the unit is conducting a vertical landing.

ATMOSPHERIC CONDITIONS

Atmospheric Pressure	Modifier
Vacuum	No Damage
Trace	Multiply Damage by .5
Thin	Multiply Damage by .75
Standard	No Modifier
High	No Modifier
Very High	Multiply Damage by 1.25
Water Take Off	Multiply Damage by 1.25

JUMPSHIP/WARSHIP/SPACE STATION HIT LOCATION TABLE

2D6 Roll	Nose	Aft	Side
2	Nose/Life Support	Aft/Fuel	Nose/Avionics
3	Nose/Control	Aft/Avionics	Front Side/Sensors
4	Fore-Right/Weapon	Aft-Right/Weapon	Front Side/Front Side Weapon
5	Fore-Right/Thruster	Aft-Right/Thruster	Front Side/Docking Collar
6	Nose/CIC	Aft/Engine	Front Side/K-F Drive
7	Nose/Weapon	Aft/Weapon	Aft-Side/Broadside Weapon
8	Nose/Sensors	Aft/Engine	Aft-Side/Grav Deck
9	Fore-Left/Thruster	Aft-Left/Thruster	Aft-Side/Door
10	Fore-Left/Weapon	Aft-Left/Weapon	Aft-Side/Aft-Side Weapon
11	Nose/Crew	Aft/Control	Aft/Cargo
12	Nose/K-F Drive	Aft/K-F Drive	Aft/Engine

CAPITAL WEAPONS DETAILED RANGES TABLE

Type	Heat	Short Range	Medium Range	Long Range	Extreme Range
<i>Direct-Fire Ballistic Weapons</i>					
Light Mass Driver	30	1-10	11-20	21-30	31-40
Medium Mass Driver	60	1-9	10-18	19-27	28-36
Heavy Mass Driver	90	1-8	9-16	17-24	25-32
NAC/10	30	1-11	12-22	23-33	34-44
NAC/20	60	1-11	12-21	22-31	32-42
NAC/25	85	1-10	11-20	21-30	31-40
NAC/30	100	1-9	10-18	19-27	28-36
NAC/35	120	1-7	8-14	15-21	22-28
NAC/40	135	1-6	7-12	13-18	19-24
Light N-Gauss	9	1-14	15-28	29-40	41-56
Medium N-Gauss	15	1-13	14-26	27-39	40-52
Heavy N-Gauss	18	1-12	13-24	25-36	37-48
Light SC-Cannon	12	1-7	8-14	15-21	22-28
Medium SC-Cannon	30	1-6	7-12	13-18	19-24
Heavy SC-Cannon	42	1-5	6-10	11-15	16-20
<i>Direct-Fire Energy Weapons</i>					
NL35	52	1-11	12-22	23-33	34-44
NL45	70	1-12	13-24	25-36	37-48
NL55	85	1-13	14-26	27-39	40-52
Light NPPC	105	1-11	12-22	23-33	34-44
Medium NPPC	135	1-12	13-24	25-36	37-48
Heavy NPPC	225	1-13	14-26	27-39	40-52
SCL1	24	1-9	10-18	19-27	28-36
SCL2	28	1-8	9-14	15-19	20-24
SCL3	32	1-7	8-13	14-18	19-22
<i>Missile Weapons</i>					
Killer Whale	20	1-12	13-24	25-36	37-48
White Shark	15	1-12	13-24	25-36	37-48
Barracuda†	10	1-20	21-30	31-40	41-50
AR10*	*	*	*	*	*
<i>Sub-Capital</i>					
Manta Ray	21	1-3	4-5	6-7	8-9
Swordfish	15	1-3	4-6	7-9	10-12
Stingray	12	1-6	7-12	13-18	19-24
Piranha	9	1-9	10-18	19-27	28-36
<i>Tele-operated‡</i>					
Kraken-T	50	N/A	N/A	N/A	N/A
Killer Whale-T	20	N/A	N/A	N/A	N/A
White Shark-T	15	N/A	N/A	N/A	N/A
Barracuda-T	10	N/A	N/A	N/A	N/A
<i>Equipment</i>					
Screen Launcher	10	1-3	4-6	7-9	10-12

*Per missile type †If using weapon-specific ranges, Barracuda missiles do not gain a to-hit bonus. ‡Tele-operated missile (see p. 251, TW)

RAMMING ATTACKS TABLE
(EXPANDED)

Base To-Hit Number: 6 + (target Piloting Skill – attacker Piloting Skill)

Modifiers	
<i>Attacker existing damage:</i>	
Sensor damage	+1
Avionics damage	+1 per box
<i>Target is (in space):</i>	
Fighter or Small Craft	+4*
DropShip	+2
JumpShip	+0
WarShip	+1
Space Station	-1
Satellite	-2
Cannot spend thrust	-2
Evading	Variable**
<i>Target is (in atmosphere):</i>	
Grounded DropShip hex	-2††
Building hex	-2††
Grounded fighter or Small Craft	+4††
Ground Unit‡	+4
Large Support Vehicle	+2
Large Naval Vessel Support Vehicle	Variable‡‡
Small or Medium Airships§	-1
Large Airships§	-2
Mobile Structures	Variable§§
Airborne Air Mobile Structure	+0
Infantry	Not Possible§§§
<i>Attacker is:</i>	
Fighter or Small Craft	-2
DropShip	-1
WarShip	+1
In atmosphere	+2

*Fighter squadrons may not make (or be the target of) ramming attacks

**See page 77, TW.

†If the attack misses, make a Control Roll with +4 modifier, -1 per level above 1 (Max of 0). If the Control Roll fails, the attacker crashes into the ground in the hex behind the target. (Control Roll does not apply if the target was airborne.)

††Target's Piloting Skill Rating is considered equal to attacker.

‡Includes 'Mechs, ProtoMechs, Combat Vehicles, Support Vehicles.

‡‡Apply the following modifier based upon template size: Type A = +1; Type B = +0 Type C = -1, Type D = -2; Type E = -3.

§Grounded or airborne.

§§Start with a +0 modifier, then apply a cumulative -2 modifier for every 10 hexes of size, or fractions thereof, of, above 10; i.e. a 31 hex Mobile Structure would apply a -6 modifier.

§§§Hexes containing infantry can be targeted; apply the standard -4 to-hit modifier and treat as a standard crash (see *Avoiding or Taking Damage*, p. 82, TW) for effects on infantry in the hex.

BRACKETING FIRE MODE TABLE

Weapon Bay Damage Value Reduction*	To-Hit Modifier	Minimum Number of Weapons in Firing Bay
80%	-1	2
60%	-2	3
40%	-3	4

*Round all fractions down

OVER-PENETRATION WEAPONS FIRE

1D6 Roll	Result
1-3	All units apply standard damage
4	JumpShips and Space Stations apply over-penetration rules*
5	JumpShips, Space Stations and DropShips apply over-penetration rules*
6	WarShips with an original SI 30 or less and any JumpShips, Space Stations or DropShips apply over-penetration rules*

*All other units apply standard damage.

ADVANCED INITIATIVE TABLE

Initiative = Control Roll MoS/MoF + Class Modifier

Class	Modifiers
Fighter	+3*
Small Craft	+0
DropShip	+0
Support Vehicle (aircraft)	-1
WarShip	-3
Airship	-4
JumpShip	-5
Space Station	-5
Ground Unit in Zero-G Ops	-6
Satellite	-7

*Including squadrons

Dropping Troops: Even when using Advanced Initiative, dropping troops (see p. 20) always move after all other aerospace units have moved (including ground units in zero-g operations). The exception are ejected pilots/lifeboats/escape pods (see p. 24), which always move last after all other aerospace units have moved, including dropping troops.

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