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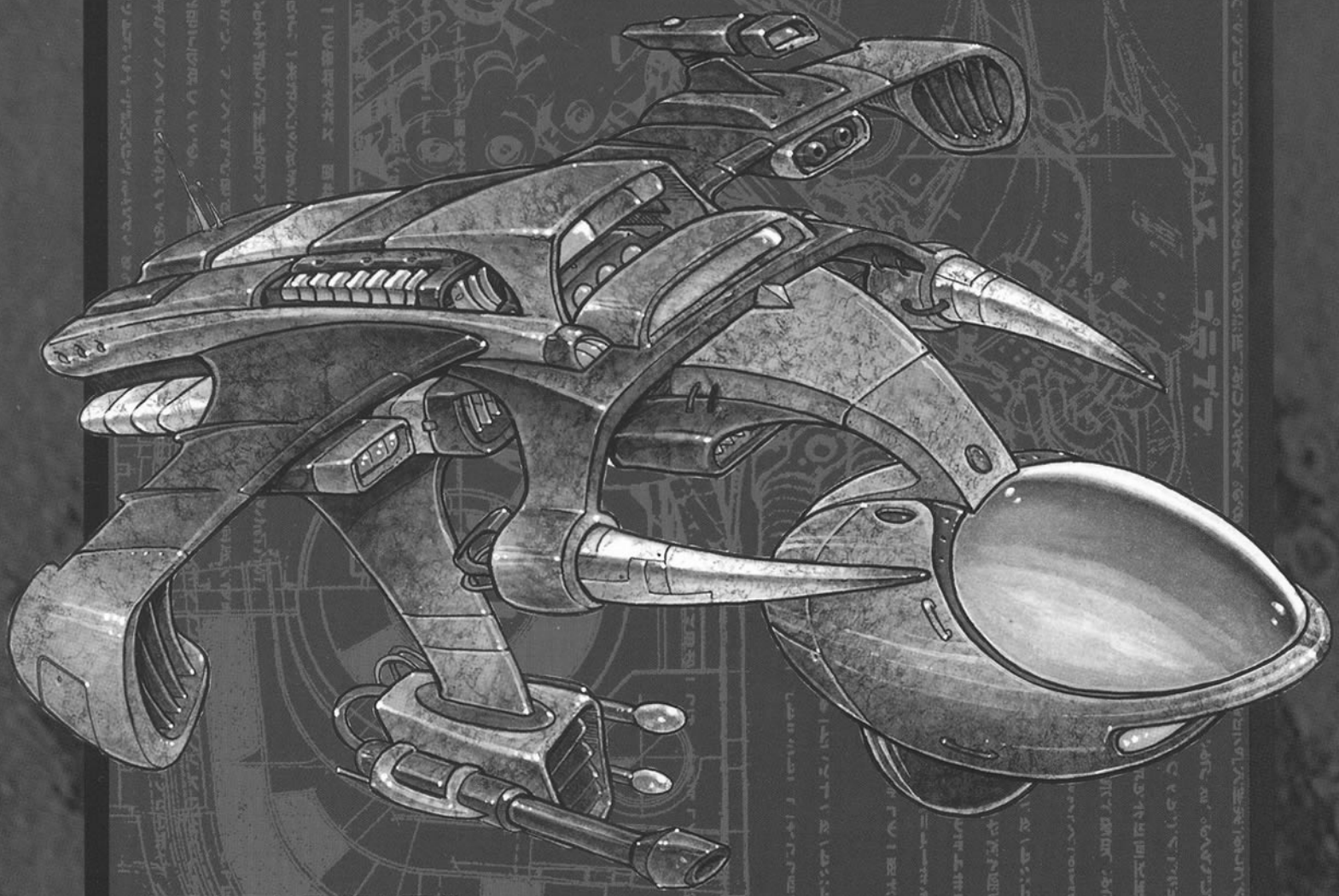
SPACEMASTER™

VEHICLE MANUAL™



TECH™ LAW

Travel in style—upgrade the transportation in your game!

TECH LAW:™ VEHICLE MANUAL

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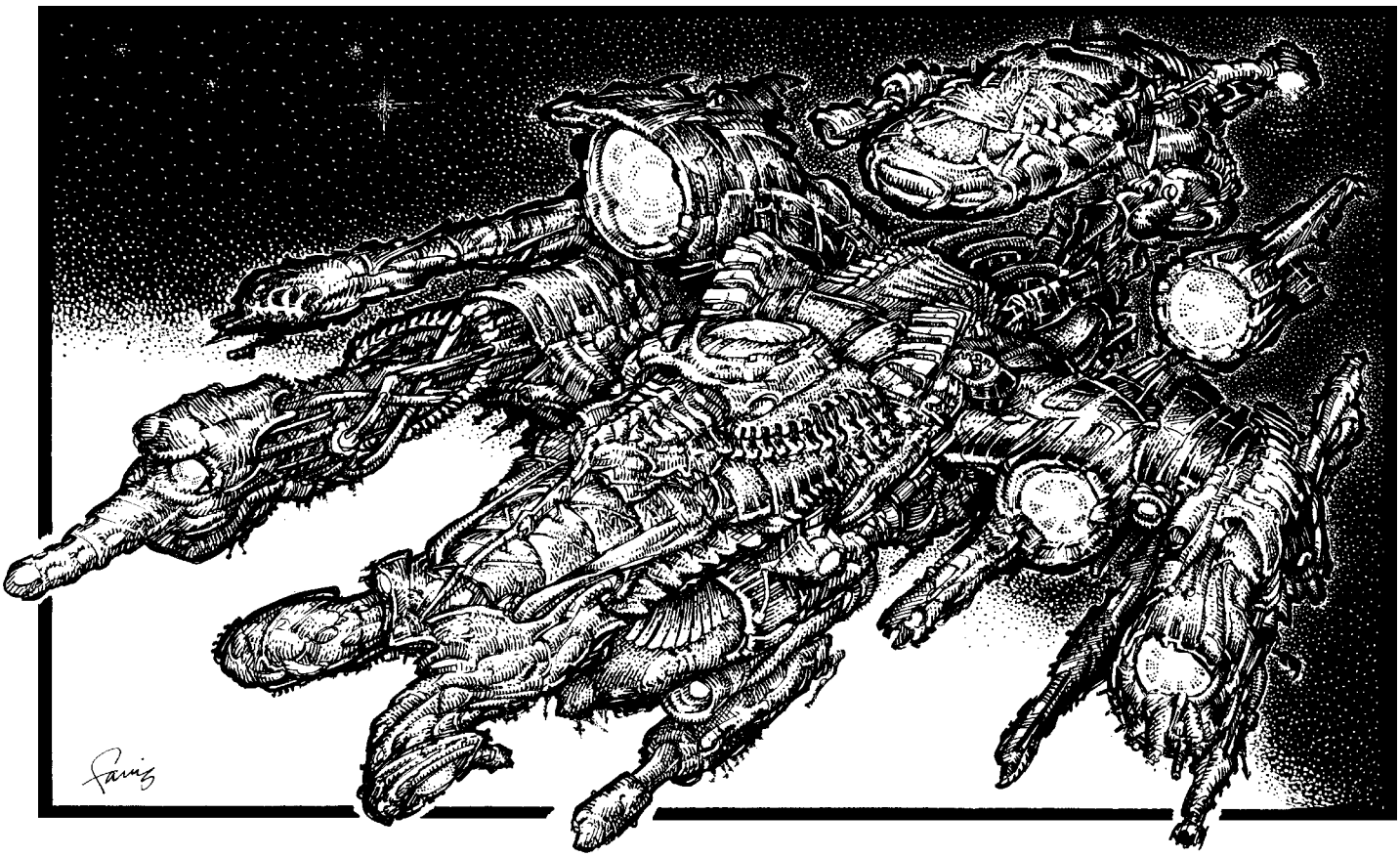

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PART I
INTRODUCTION

"Any sufficiently advanced technology is indistinguishable from magic."
— Arthur C. Clarke

Greetings. This book is called *Vehicle Manual*. It is the second volume of *Tech Law*, which is an integral part of *Spacemaster*, just as technology is an integral part of science fiction.

WHAT IS SPACEMASTER?

Spacemaster is a science fiction role playing game, set to be played in the *Privateers* universe. It uses the same concepts and conventions of Iron Crown Enterprise's *Rolemaster*, and could be played hand in hand with that system.

In *Spacemaster*, the players are whisked away to a science fiction universe where the only limit is the imagination, and whose every turn is fraught with danger. Although *Spacemaster* was published with the *Privateers* universe, it does not *have* to take place in that universe. It can take place in any universe, from the gritty, hard science fiction universes of Greg Bear and Dr. Gregory Benford to the high adventure space operas of "Doc" Smith and George Lucas.

Tech Law is an integral part of that flexibility. It allows the Gamemaster (GM) to customize his game, defining what levels of technology are available and what aren't. It allows him to decide what is possible and what isn't. It is the GM's choice, and *Tech Law* is the tool that will allow him to make a good one.

SPACEMASTER ELEMENTS

Spacemaster contains several books. These books provide all of the rules necessary to play *Spacemaster*. These books interlock into more than just a game; they are a complete system of role playing, allowing a GM to not only adjudicate rules, but combine societies, cultures and settings into wondrous and (hopefully) realistic vistas of imagination.

Spacemaster: Privateers — This is the core book of the system. All the subjects necessary to play the game are at least touched upon in this book. Character creation, action resolution, combat, psychic powers, experience and advancement are interlaced with history, culture, social structure and points of interest.

RULE BOOKS

Tech Law (*three volumes*) — There are three *Tech Law* volumes: *Equipment Manual*, *Robotics Manual*, and *Vehicle Manual*. These three books contain extensive information on the use and application of technology.

Future Law — Add the power of expanded character development to your game with *Future Law*. *Future Law* is the ultimate player's guide to *Spacemaster*, giving new professions and hundreds of new character options.

Blaster Law — This book deals with energy weapons and their use in combat. It uses a tech level system and gives complete weapon creation rules for use with anything from primitive spacefaring worlds to power weapons invented by worlds yet to be discovered.

Gamemaster Manual — The last book of the core support series is *Gamemaster Manual*. This book explores the ins and outs and pitfalls of gamemastering compiled from some of the nation's top role playing GMs!

SETTING BOOKS

Privateers: Races & Cultures — A must for any *Spacemaster* game, this book details the races of the *Privateers* universe.

Privateers: The ISC — This book details the history, locations, corporations, military, and prominent people of the ISC.

Privateers: The Jeronan Empire — This book details the Empire, its structure, and its military.

ROLEMASTER PRODUCTS

Rolemaster Fantasy Role Playing — For a game where science and fantasy are to be combined, *RMFRP* contains all the rules necessary to play a magic wielding character. It is a must for cross genre campaigns.

Arms Law — *Arms Law* contains attack charts for many primitive weapons: more weapons, more critical hit tables, more carnage for your game.

Spell Law (*three volumes*) — For games where magic and science are combined, *Spell Law* is a vital expansion. All lists go up to 50th level; that's over 2,000 spells in all!

Creatures & Monsters — ICE's full-blown bestiary.

"Companion" Products — Companions contain optional material that will add detail and/or depth to your game.

STANDARD SYSTEM PRODUCTS

Weapon Law: Firearms — A book dealing with firearms of all types. Capable of dealing with any firearm, real or fictional. A must for any game where the bullets fly!

Ten Million Ways to Die — This product has weapon charts for all sorts of different weapons. Everything from swords, to guns and blasters is covered.

...and a 10' Pole — A compilation of adventuring equipment and a system for defining and integrating various lower levels of technology.

More support products are planned. So, keep your eyes peeled for more information on ICE's website (www.ironcrown.com)!

VERY SPECIAL THANKS

I would like to thank Rob Bott, Physicist, for the help he gave me with the relativity equations in this book. Without him, my Calculus Made Easy book would be unreadable from tears of blood.

OTHER SPECIAL THANKS

I also thank my play testers. Mike "I'm not a sadist, but I play one on TV" Renstrom, Scott "I killed the entire party" Llewelyn, Gary "Captain Bligh" Llewelyn, Matt "I had a character once..." Fitt, Aaron "I like making characters" Brown, Chris "Kneel before me!" Brashier, Stephen "You may call me the Great One" Johnson.

I alos thank Jeff Rossiter who, in spite of his lack of interest in physics and engineering, listened to my facts and put up with my research. Hey, Jeff, get off Everquest, I need to look up the fuel to mass ratio of an F-4 Phantom.

APOLOGIES

We apologize to Ron Carnegie, who contributed a great deal to the original creation process of *Spacemaster*, both with materials and ideas. He should have been listed in a contributor to *SM: Privateers*, but was left off by mistake. Look for his name in the upcoming *Gamemaster Manual*.

Note: *For readability, Tech Law uses standard masculine pronouns when referring to persons of uncertain gender. In such cases, these pronouns are intended to convey the meanings: he/she, her/his, etc.*

1.0 WELCOME

"Please allow me to introduce myself . . ."
— The Rolling Stones, Sympathy for the Devil

Welcome to the *Vehicle Manual*. This book is designed to work in conjunction with the *Spacemaster* role playing game. This book deals with the heart of science fiction: technology. In the *Vehicle Manual*, we cover a wide variety of vehicles, as well as how to handle vehicle combat, manuevering, and construction. Combined with the other two *Tech Law* tomes, this manual will guide you through using, shaping, building, and repairing technology in your science fiction role playing game.

The primary goal of this work is to give the Gamemaster rules and guidelines to help him create a realistic backdrop of technology for his science fiction game. Although this book is part of the *Spacemaster* system, it can easily be adapted (along with *Blaster Law*) to any other RPG, allowing you to bring the realism and detail of *Spacemaster* to your favorite game.

USING TECH LAW WITH SPACEMASTER

Spacemaster: Privateers is the main rule and setting book for *Spacemaster*. It contains all the rules and background necessary to begin playing in this dynamic system.

But perhaps you want more.

In that case, this book is provided. It expands and details the rules for using all types of vehicles in your *Spacemaster* game. Other books expand upon other aspects of the *Spacemaster* rules. *Equipment Manual* and *Robotics Manual* expand the range of equipment, cybernetics, computers, and robots for your game, and complete the *Tech Law* volume. In *Blaster Law* you will find all of the attack tables necessary for resolving energy attacks, as well as conversion rules for firearms and other primitive weapons. *Future Law* expands and details many new, exciting character creation options. *Gamemaster Manual* provides dozens of rules for unique and interesting situations, such as vacuum exposure, high gravity environments, and radiation.

USING TECH LAW WITHOUT SPACEMASTER

Tech Law can be used without *Spacemaster*, but this probably isn't desirable without using *Blaster Law* as well. With *Blaster Law* and *Tech Law*, the *Spacemaster* combat system can be used with other role playing games, lending *Spacemaster's* realism to other systems.

If this is the intention, then *Blaster Law* contains all the rules for handling combat without *Spacemaster*. See *Blaster Law* for more details.

USING ROLEMASTER

If a serious supply of melee weapons and firearms is desired, then *Rolemaster* is the way to go. *Arms Law* is the *Rolemaster* equivalent of *Blaster Law*. It contains all of the weapons common to a medieval or fantasy setting.

If your campaign is going to use a lot of firearms, then *Weapons Law: Firearms* is very handy. This *Rolemaster* book contains an extensive list of firearms and, with a little work, nearly any firearm imaginable can be assigned to one of the attack tables contained within. With this book, *Blaster Law* only becomes necessary for handling futuristic combat.

All the rules necessary for using these books are contained in Appendix A-4. These rules allow the GM to convert these books, using their greater selection of weapons with *Spacemaster* armor types.

2.0 TECH LEVELS

"The most incomprehensible thing about the world is that it is comprehensible."
— Albert Einstein

Science fiction is poorly named. It would be much more accurate to call it "Technology Fiction," because at the heart of all science fiction is technology. Perhaps it isn't the main character, as the diehards claim it should be; but in a science fiction story, the technology lives and breathes. It moves and interacts with the main characters. Sometimes it even takes over and steals the show.

Gadgets, space ships, and ray guns are why the masses flock to see science fiction. This is what draws them like a moth to a flame, so when a GM decides to run a SF (science fiction) campaign, the phrase "what gadgets" had better not issue from his lips. When the time comes, he better be ready with all the equipment his players need.

Once a GM has worked out what races or cultures exist in his universe, he should sketch out an idea of how these races and cultures interact. Part of that will involve defining the technical abilities of all the major players. This section deals extensively with the use of technology and its application in the game.

2.1 TECH LEVEL CONCEPTS

Technology, for the sake of a SF game, must be qualified and quantified. Part of how this is done is the use of "tech levels."

Tech levels are a rating system by which technological advancement can be judged. Listed in this section are a series of tech level ratings. Each technological or scientific advance can then be dropped into the tech level system. In addition, every individual piece of tech can be placed somewhere in this structure.

2.2 USING TECH LEVELS

Each nation or race should be given tech levels. These need not be uniform, as not all races will develop at the same rate that Earth has. A pacifistic society, for instance, could easily have developed agriculture five or six tech levels higher than arms and armor.

But it's not necessary to travel to another star empire just to drop tech levels. You could drop a few on modern day Earth if you travel to the right location. The GM can have a lot of play in his tech levels, if he uses them properly.

2.3 TIME TRAVEL

A time travel campaign will most likely span a great deal of tech levels. The trick in a time travel campaign is whether to allow characters to take high tech items back in time with them. In Simon Hawke's *Time Wars* books, Lucas Priest was let loose on Richard the Lionheart's England armed with an assortment of high tech gadgets, disguised as medieval equipment. This can lead to an interesting game, but can also be unbalancing, so it must be carefully monitored.

2.4 TECH LEVELS & SKILL USE

Many skills depend heavily on the technology level at which they were learned. Medicine, for instance, is heavily dependant on pharmaceuticals and equipment. Replace a modern doctor's scalpels and drugs with leaches and herbs and watch him flounder.

The following chart depicts the penalties incurred when using skills and equipment of a differing tech level.

Note: *Skills could be learned at a lower tech level than the user on purpose. For instance, a time traveling doctor might learn First Aid and Medical Practice on a medieval level so as to be able to treat his patients in the field.*

In addition, certain skills would be unaffected. For instance, tracking is used independent of tech level, and would not be affected by temporal displacement.

2.5 RAISING THE LOCAL TECH LEVEL

In *A Connecticut Yankee in King Arthur's Court* by Mark Twain, the main character begins making gun powder and building guns. Could a group of characters accomplish the same thing?

Possibly, if they knew the formula for black powder, had primitive gunsmithing skills, and knew a good blacksmith. Should players be allowed to do it?

That is left up to the GM. The characters would definitely need unique backgrounds. To pass themselves off as wizards like the Connecticut Yankee, they'd need to be able to do a good bit of acting as well.

So what skills would characters need to make black powder? Chemical Engineering, Weapon Technology, or Gunsmithing (Crafts) might be good choices. To create gunpowder out of raw materials — sulphur (brimstone), charcoal, and saltpeter—the characters would need to make at least a Hard maneuver. If they can pull this off without blowing themselves up, they'll have it.

NOTATION

As technology, even on Earth, has developed at different rates, these levels are not necessarily intended to reflect the development of the western technology after which the ages were named. The discrepancies are purposeful and meant to represent the fact that no society evolves along a perfect tech level progression.

2.6 FITTING TECHNOLOGY TO YOUR CAMPAIGN

This is the most difficult part of building a science fiction universe. The GM must carefully assign his technology to keep the game balanced and to provide the appropriate feel to the setting.

A GM should start with these basic questions:

What genre would I like to play in? This is the most important question. An early starfaring campaign is going to have a very different feel from a game involving a vast, galactic empire.

Is this a hard science or space opera game? This is the second most important question. What kind of feel do you want? The *Star Wars* movies depict a society with a very high level of technology, and yet it is very unobtrusive. Holo-sights, specialized scanners and ultra-advanced targeting systems are almost unheard of. These detract from the feeling of the individual's story, and therefore they're removed. On the other hand, the characters in any book by Dr. Gregory Benford could not possibly survive without their scanners, HUDs, and other advanced gadgets.

How restricted is technology? It's possible that many individual pieces of tech will be unbalancing or inappropriate for the game. They can be limited by imposing strict laws on their use.

Is this piece of tech right for this universe? Certain pieces of tech may be inappropriate. After assigning all of the generic factors, the GM needs to go through and decide if any tech that was included by default needs to be removed. Maybe force fields don't fit in this game, even if they're available at this tech level.

Are there any pieces of tech that need to be included? Perhaps in this universe, pieces of tech have been discovered that the tech level says are unavailable. For instance, maybe in this universe, the force field was discovered in the year 2001, instead of many years after.

TECH LEVEL PENALTIES

User's Lvl - Equipment's Lvl	Penalty
-10 or Lower	Impossible
-9	-512
-8	-256
-7	-128
-6	-64
-5	-32
-4	-16
-3	-8
-2	-4
-1	-2
0	0
1	0
2	-1
3	-2
4	-4
5	-8
6	-16
7	-32
8	-64
9	-128
10 or more	-256

PART II
TECHNOLOGICAL DEVELOPMENT

"I have yet to see any problem, however complicated, which, when you looked at it in the right way, did not become still more complicated."
—Poul Anderson

3.0 TECH LEVEL BENCHMARKS

"Success is a journey, not a destination."
—Proverb

This section contains a listing of the tech levels, broken into various categories. The general category is meant to give an overview of technological development. This treatment is not accurate enough to give a GM a truly comprehensive look on how tech levels affect a society. Therefore, this section has been further broken into specific categories, such as agriculture. These describe in more detail the progress that comes with the advances in technology. This allows the GM to make more informed decisions involving tech levels.

3.1 GENERAL

This chart depicts a general overview of the tech levels. They are listed as a series of historical, Earth equivalents to give the reader a better idea of how the tech levels fit into the overall scheme.

Each major age of man is listed below, along with the major technological achievements of the age. Note that these ages are listed with a bias toward Western civilization. To get a good idea of how different cultures develop at different rates, look up when the oriental cultures developed these same levels of technology.

Note: *For those GMs in possession of ICE's sourcebook, ". . . and a 10-Foot Pole" (ATFP) a notation has been placed after each tech level which corresponds to a section in that book. ". . . and a 10-Foot Pole" is an invaluable resource. It is much more complete than this book was intended to be, because most of the items in there do not require descriptions for those of us who are used to them in our every day lives.*

This still requires some careful watching by the GM. First of all, many devices were invented slightly out of their tech levels, so if a GM is using this for an non-terrestrial civilization, he should keep that in mind. In addition, many of the ages from that book span multiple tech levels, so there may be equipment on a list that hasn't quite been invented yet.

0 Pre Stone Age — No technology exists. Even language has yet to be invented.

1 Stone Age — Language is invented. Fire is discovered. The club becomes the weapon of superiority. Hunting and gathering are the norm. [*ATFP* Sec. 3.0, The Stone Age, p. 10]

2 Dawn of Civilization — Domestication of sheep and cereal grains. Invention of pottery. The invention of the wheel. Tools are made of stone. Fallowing and irrigation are invented. [*ATFP* Sec. 4.0, The Copper Age, p. 15]

3 Bronze Age — Writing and bronze working are invented. Weapons and tools are made from bronze. The chariot is invented and dominates the battle field. [*ATFP* Sec. 5.0, The Bronze Age, p. 23]

4 Age of Reason — Philosophy and higher learning come into play. Paved roads are invented. Geometry and mathematics are invented. [*ATFP* Sec. 5.0, The Bronze Age, p. 23]

5 Iron Age — The ability to smelt and work iron is invented. This primarily affects the trappings of war. Construction with stone undergoes many advances. The keystone arch is invented. The waterwheel, and its use in mills, is discovered. [*ATFP* Sec. 6.0, The Iron Age, p. 34]

6 Dark Ages — Primarily innovations in warfare and ground tactics. The saddle and the stirrup make cavalry more effective than ever before. [*ATFP* Sec. 6.0, The Iron Age, p. 34]

7 Medieval Period — Windmills and wind power are invented. Gothic architecture is perfected. The flying buttress is invented. Mathematics now includes zero. Steel is invented, making warfare even more efficient. [*ATFP* Sec. 7.0, The Middle Ages, p. 51]

8 High Medieval Period — Plate armor is invented. The knight rules the battlefield. Bell casting is perfected. At the end of this period, gunpowder is introduced, but doesn't really take over until the next period. [*ATFP* Sec. 7.0, The Middle Ages, p. 51]

9 Renaissance — Gunpowder and advances in shipbuilding techniques revolutionize warfare. Fencing is invented as armor becomes obsolete. [*ATFP* Sec. 8.0, The Renaissance, p. 68]

10 Colonial Period — Ship advancements of this and the last period lead to a great spurt of exploration. The printing press hits wide-spread usage. [*ATFP* Sec. 9.0, The Age of Reason, p. 86]

11 Low Industrial Revolution — Sound cast iron is produced in a blast furnace. The steam engine is invented. A series of important inventions combine to make the steam engine more efficient. The telegraph is invented. [*ATFP* Sec. 10.0, The Industrial Revolution, p. 103]

12 High Industrial Revolution — The assembly line brings mass production into full swing. The telephone is invented, and the revolver enters the scene. Iron begins to play a part in building, and suspension bridges enter the scene. The internal combustion engine is invented and undergoes several overhauls through the end of this age. The dynamo makes electrical power useful. The incandescent lamp is invented. [*ATFP* Sec. 11.0, The Age of Steam, p. 121]

13 Low Industrial Civilization — Mass production and the automobile change the world. The airplane is invented. The radio enters widespread use. [*ATFP* Sec. 12.0, The Electric Age, p. 139]

14 Middle Industrial Civilization — Jet power becomes practical. The rocket is invented. Nuclear fission is first achieved. The television enters widespread use. The machine gun, long range artillery, poison gas, and many other military advances change warfare. [*ATFP* Sec. 13.0, The Atomic Age, p. 158]

15 High Industrial Civilization — The computer is invented. Orbital and lunar space flight is achieved. Atomic power is put into wide use. The maser and laser are invented. Transplant technology takes off. [*ATFP* Sec. 13.0, The Atomic Age, p. 158]

16 Low Cyber Age — The personal computer is invented. Orbital space flight becomes routine. Medical research takes off. The genome begins to be mapped. The early stages of human-machine interaction begin. Cloning is achieved. Subatomic particles are successfully teleported. [*ATFP* Sec. 14.0, Information Age, p. 174]

17 **High Cyber Age** — Cybernetics are invented and spread like wildfire. Planetary exploration begins. Rudimentary success with simulated intelligence is achieved. The neural interface revolutionizes entertainment. The first Self-Generating-Discharge Plasmatrons are built.

18 **Spacefaring Age** — Planetary colonies are established. Fusion power is in widespread use. Man-portable lasers & particle beams become the weapons of choice. Small scale genetic manipulation of an unborn fetus is achieved.

19 **Starfaring Age** — Ramjets begin to explore the stars. Slow colony ships leave for nearby systems. Simulated intelligence is perfected. Large scale genetic manipulation is achieved on fetuses with moderate success.

20 **Star Colonial Period** — Faster than light travel is discovered. The tachyon is discovered. Artificial intelligence is invented. Increases in medical and agricultural technology allow for colonies to survive with minimum support. Genetic manipulation, on a small scale, is achieved with adult specimens.

21 **Antimatter Age** — Antimatter power enters widespread use. Antimatter weapons are created. Medical science can now fix almost any non neural damage.

22 **Age of Gravity** — Invention of artificial gravity expands man's living capacities. Genetic manipulation on a reasonable scale can be performed on a living organism. Neural Pathway Reconstruction Therapy is invented. Non locality physics splits off of quantum physics.

23 **Quantum Age** — Vacuum energy is fully tapped. Early force screens are invented. Teleportation, on a small scale, becomes possible. Major brain reconstruction becomes possible.

24 **Age of Force** — Force screens are developed on both a large and personal scale. Direct manipulation of alloys makes engineering advances possible.

25 **Age of Antigravity** — Antigravity is invented. Inertial dampers revolutionize space combat.

26 **Age of Terraforming** — Large scale ecological engineering becomes possible.

27 **Age of World Building** — Ringworlds and zero fault technology become possible. There is little out of reach.

28 **Dysonian Age** — Dyson spheres can now be built. Zero fault technology makes them practical.

29 **Cosmic Age** — Limitless, cosmic power is discovered.

30 **Age of Omnipotence** — Direct, mathematical manipulation of reality is possible. Anything can now be achieved.

31+ **And Beyond...** — Unknown.

3.2 AGRICULTURE

Agriculture is the science of raising deliberately bred crops and livestock. Whereas the technology of herding animals has changed little over the years, the technology of growing food has undergone many changes. In the early days of agriculture, farmers were little more than hunter-gatherers. Since that time, chemistry, genetic engineering, and other sciences have combined to make farming a more advanced discipline.

Out of the thousands of plant and animal species that exist, only about two hundred plants and fifty animals have been used for agricultural purposes. Around twelve or thirteen plant species are important staples of humanity's diet, and are grown in greater volumes than any other.

Note that these advances generally are restricted to herbivore and omnivore races. Carnivores develop this area slowly, as the only application they have is for their herds.

0 **Pre Stone Age —** Hunting and gathering are the means of obtaining sustenance.

1 **Stone Age —** Little in the way agricultural development, though the development of tools for the harvesting of wild grains does begin.

2 **Dawn of Civilization —** Plant husbandry, mostly the scattering of seeds, begins. People begin herding sheep. The only tool needed is a simple scythe for the harvesting of grain.

3 **Bronze Age —** Many cereal grains grown. Implements are primarily wooden. Vineyards are kept.

4 **Age of Reason —** The water wheel is invented to bring water to elevated crops.

5 **Iron Age —** Tools such as the plow, reaper, hoe, and sickle begin to gain metal parts. Slaves are used to increase productivity.

6 **Dark Ages —** Little in the way of technological increases. Farmers are forced to surrender to nobles for protection.

7 **Medieval Period —** Little in the way of technological advances occur.

8 **High Medieval Period —** Farmers farm in strips, leaving every other strip fallow for a year.

9 **Renaissance —** Farmers begin enclosing land. This allows larger blocks of the same crop to be developed. Farmers also begin rotating crops, eliminating the need to let the land lie fallow.

10 **Colonial Period —** Invention of early mechanical farm implements.

11 **Low Industrial Revolution —** The horse drawn drill, reaper, and cotton gin are invented.

12 **Low Industrial Civilization —** Increased transportation capabilities, such as use of canals, steamboats, and locomotives, allow more centralization of goods. Invention of the steel plow allows the cultivation of the heavy, rich soils of the prairie. Invention of barbed wire allows cattle ranching on the open range and brings about the end of the cowboy. Refrigeration allows export of goods to other countries. Steam power allows the invention of mechanized combines, tractors, and threshers.

13 **Low Industrial Civilization —** Gasoline tractors increase efficiency. Theories in heredity allow plant breeding.

14 **Middle Industrial Civilization —** Agriculture evolves into big business. High tech pesticides hit the market.

15 **High Industrial Civilization —** Environmental impact of pesticides causes experiments with more eco-friendly "organic farming."

16 **Low Cyber Age —** Genetic engineering allows production of more efficient grains, bred for desired traits.

17 **High Cyber Age —** Engineered food and genetically enhanced strains produce food supplies in spite of pollution and overpopulation.

18 **Spacefaring Age —** Increased genetic manipulation of grains and fruits allow farming to be carried out in extreme and sparse environments—such as the exposed surface of Mars. Lack of nitrogen and other general terraforming techniques render these advances moot.

19 **Starfaring Age —** Genetically manufactured bacteria and other microorganisms make sterile and nitrogen deficient soils marginally fertile. This in conjunction with previous genetic hybrids allows the farming of previously untenable land.

20 **Star Colonial Period —** Advances in chemical fertilizers and genetic hybrids allow the cultivation of land that is almost completely sterile. Unfortunately these chemicals render the land almost permanently useless for any other cultivation. This will cause problems later, at tech level 26.

21 **Antimatter Age —** A combination of hybrids, nanites, and engineered microorganisms allow the cultivation of any environment, but with less long term impact than the previous tech level.

22 **Gravity Age —** Food can be grown anywhere, anytime. From this point on, the technology merely becomes more efficient and cheaper.

23 **Quantum Age —** Meat can now be cloned more cheaply than by use of herd animals. "Genuine" living meat becomes a luxury, only for the eccentric.

24 **Age of Force —** Prior technologies become cheaper and more efficient.

25 **Antigravity Age —** Vat-grown meat can now be grown in days or hours. Limitless energy, combined with genetic engineering makes food cheap and plentiful.

26 **Age of Terraforming —** Terraforming allows colonies to grow food for their own eccentrics. Once living tissue need no longer be imported.

27 **Age of World Building —** Technology becomes cheaper and more effective.

28 **Dysonian Age —** Food is no longer a problem anywhere.

29 **Cosmic Age —** There are few advances left to make.

30 **Age of Omnipotence —** Food can be created out of nothing.

31+ **And Beyond...** Unknown.

3.3 ARMS AND ARMOR

The art of war precedes civilization and social order. It's likely that it even precedes sapience. From the earliest days of intelligence weapons have been used by the strong to steal from the weak. They have also been used by the strong to protect the weak. The warrior is in fact the oldest profession.

0 **Pre Stone Age** — No weapons exist. War is conducted with fists and teeth.

1 **Stone Age** — Rocks and sticks are used. The club is invented. Hide armor and hide shields are invented.

2 **Dawn of Civilization** — Spears and then arrows are invented. The bow follows.

3 **Bronze Age** — Bronze working brings about the forging of blades and armor. Armor consists of bronze and leather.

4 **Age of Reason** — Refinements in armor is the majority of this age's accomplishments. The paved road allows the more rapid movement of troops. The phalanx is devised.

5 **Iron Age** — Forged iron revolutionizes weapons and armor. The cavalry is first used successfully, despite the lack of the stirrup. The ballista, catapult, and mangonel enter widespread use.

6 **Dark Ages** — Greek fire is introduced to maritime combat. The stirrup and saddle are introduced, increasing the effectiveness of cavalry. The reign of the heavy cavalry begins. Ground tactics are refined somewhat.

7 **Medieval Period** — Steel is invented. Armor and weapons are refitted using this lighter, stronger material. Improvements in architecture and stone masonry create bigger and more fortified castles. The heavy horse becomes more and more powerful. Chain mail is brought into its first full-scale use.

8 **High Medieval Period** — Plate armor is invented. The crossbow is developed, heralding "The End of Warfare." At the end of this period, gunpowder is invented.

9 **Renaissance** — Gunpowder and advanced shipbuilding techniques revolutionize warfare. Man-portable gunpowder weapons are brought onto the battlefield, as well as catapults. Fencing is invented as armor becomes obsolete.

10 **Colonial Period** — Ship advancements of this and the last period improve capabilities in maritime warfare. Gunpowder cannons allow for more complicated riggings. The paper cartridge increases the firing rate of the infantryman. The smoothbore musket is invented. The bayonet is introduced.

11 **Low Industrial Revolution** — Muskets and the cavalry saber rule the battlefield. Scientific research is directed toward arms technology for the first time. The first maneuverable submarine is invented.

12 **High Industrial Revolution** — The revolver is invented. Steel hulls replace wooden ones. Steam power replaces wind power. Armored turrets and the torpedo are invented. Smokeless powder, the breech loader, and the working machine gun are invented. An array of explosives are invented.

13 **Low Industrial Civilization** — The military airplane, the man-portable machine gun, the submarine, the sea mine, and gas warfare are first brought into full use.

14 **Middle Industrial Civilization** — Jet power becomes practical. The rocket is invented. Radar is invented. Submarine detection methods are invented. Electronic countermeasures, as well the proximity fuse, are invented. The machine gun rules the battlefield. The tank puts an end to trench warfare. Helicopters are invented, but not put to widespread use. Atomic weapons are first developed.

15 **High Industrial Civilization** — The helicopter enters warfare. Increases in medical techniques are the greatest improvements in warfare. Nuclear power is put to use in naval vessels.

16 **Low Cyber Age** — The rocket is brought into wide use, and the helicopter becomes a combat vessel. Ballistic body armor is invented, as are improved chemical and incendiary arms. Increased computer technology allows more accurate use of missiles. The spy satellite comes into full usage. The ICBM is the nuclear delivery system of choice.

17 **High Cyber Age** — Military lasers and particle beams are brought into use. Electrochemical propulsion replaces gunpowder. Cybernetic advancements allow the creation of a new "super soldier." Orbital weapons begin to be utilized. Further advances in computer telemetry allow for increased long range combat capabilities. Gauss weapons are invented. Kinetic armor is invented, and the usefulness of the firearm begins to wane.

18 **Spacefaring Age** — Man-portable lasers and particle beams become the infantry weapon of choice. Planetary based mass drivers replace atomic weapons in interplanetary defense. Reflective armor and aerosol screens become useful in personal defense. Genetic engineering, on a minor scale, is used to produce the next generation of soldiers. Genetically engineered bio-weapons achieve more effectiveness. VT tanks are first built.

19 **Starfaring Age** — The first space combat vessels are built, though not brought into widespread use. Plasma weapons are invented. Ablative body armor is developed to combat particle beam weapons. A new generation of genetic "super soldiers" is produced.

20 **Star Colonial Period** — Man-portable plasma weapons are developed. Personal body armor is advanced to protect against plasma weaponry. The discovery of the tachyon leads to faster than light scanning equipment. The missile nearly becomes obsolete. Space combat vehicles are brought into ready use. Advanced SI computers are now small enough to create automated combat vehicles. The combat 'droid is developed.

21 **Antimatter Age** — Weapons become smaller and deadlier. Antimatter power is used to run more and more powerful space combat vessels. The potential of tachyon sensors begins to be fully realized. Star combat is now the norm. Combat armor evolves to the point where orbital drops are possible, bringing about a new breed of paratrooper. Land invasions become more and more obsolete, as space superiority takes a central role in warfare. Genetic super soldiers and combat droids vie for supremacy on the battlefield. Medical technology can heal most wounds.

22 **Gravity Age** — Artificial gravity allows longer terms on space situated weapons platforms. Men can be kept in fighting trim even in space. Increased gravity can be used for physical training. Neural pathway reconstruction therapy allows soldiers to be revived and saved after much longer periods of brain death.

23 **Quantum Age** — Full utilization of vacuum energy brings freedom to space-based weapons they have never had before. Major brain reconstruction is possible. Increased weapons, armor and genetic technologies bring about the obsolescence of the combat droid.

24 **Age of Force** — Force screens become useful for both large vehicles and personal defense. Direct manipulation of alloys, on a molecular level, increases the effectiveness of fighting vessels. Weapon and armor technologies vie for superiority, but the personal shield has changed everything.

25 **Antigravity Age** — Antigravity allows the creation of hover tanks and other low altitude, all-terrain craft. Inertial dampers allow space combat to achieve new levels of maneuverability. The dogfight is reinvented.

26 **Age of Terraforming** — Terraforming allows holocaust weapons to be employed with greater impunity.

27 **Age of World Building** — Zero fault technology makes fighting implements more durable and effective. Increases in engineering make things harder and harder to destroy. For the first time in history it appears it may, one day, be easier to create than to destroy.

28 **Dysonian Age** — Entire worlds can now be built, giving whole new territories to take. Force technology increases to the point where active destruction is becoming more and more difficult.

29 **Cosmic Age** — The discovery of cosmic energy allows offensive technology to outstrip defensive technology.

30 **Age of Omnipotence** — Direct manipulation of reality is possible. Creating and destroying are now one.

31+ **And Beyond... —** Unknown.

3.4 COMMUNICATIONS TECHNOLOGY

Communications technology is any technology which allows the exchange of thoughts and ideas between two sapient creatures. It runs the gamut between simple language and high-tech, faster than light, com gear.

0 **Pre Stone Age** — No technology, not even language, exists.

1 **Stone Age** — Language is invented. Increasingly complicated thoughts and concepts are communicated.

2 **Dawn of Civilization** — Language is refined somewhat.

3 **Bronze Age** — Writing is invented. Further refinements in language persist, allowing the communication of complex philosophical concepts.

4 **Age of Reason** — Advancements in language of the last age allow for the birth of philosophy and the communication of scientific concepts. The invention of the paved road allows a communications base which supports larger political bodies.

5 **Iron Age** — Further advancements in language persist. Watch fires and horsemen are the primary couriers of important news. The messenger becomes a trusted commodity.

6 **Dark Ages** — Little in the way of developments are made, though the groundwork for many modern languages are laid.

7 **Medieval Period** — Increased shipbuilding technology allows greater rate of travel by sea.

8 **High Medieval Period** — Advances in this time period primarily involve ship construction.

9 **Renaissance** — More advances in ship construction are known during this period.

10 **Colonial Period** — The printing press hits wide-spread use.

11 **Low Industrial Revolution** — The telegraph is invented.

12 **High Industrial Revolution** — The telephone is invented.

13 **Low Industrial Civilization** — The radio enters widespread use.

14 **Middle Industrial Civilization** — The television enters widespread use.

15 **High Industrial Civilization** — The computer is invented. A network of communication satellites in geosynchronous orbit allow line of sight communications to circumvent the world.

16 **Low Cyber Age** — The personal computer is invented. The Internet comes into being, adding a new level to corporate and private communications. Fiber optics are invented.

17 **High Cyber Age** — Cybernetics are invented. The neural interface revolutionizes the consumption and distribution of data. The Sensenet is born.

18 **Spacefaring Age** — Interplanetary communication is restricted to speed of light signals.

19 **Starfaring Age** — Interstellar signals are still restricted to speed of light signals.

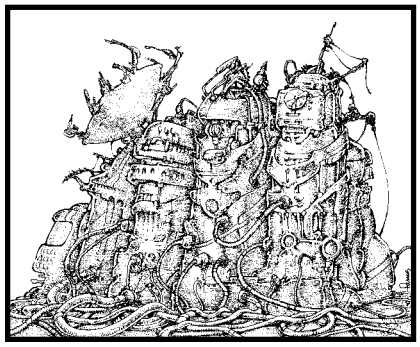
20 **Star Colonial Period** — The tachyon is discovered. Slow faster than light communication is created.

21 **Antimatter Age** — Methods of reducing a tachyon's energy are discovered. The speed of faster than light communication improves dramatically.

22 **Gravity Age** — The speed of faster than light signals is increased still more.

23 **Quantum Age** — Teleportation is heralded as the dawn of a new age of instantaneous communication. However there are many restrictions. Other breakthroughs in nonlocality make instantaneous communication possible.

24 **Age of Force** — Com systems are smaller and more efficient.



25 **Antigravity Age** — Com systems are smaller and more efficient.

26 **Age of Terraforming** — Com systems are smaller and more efficient.

27 **Age of World Building** — Com systems are smaller and more efficient.

28 **Dysonian Age** — Com systems are smaller and more efficient.

29 **Cosmic Age** — Limitless, cosmic power is discovered. Com systems lose all effective range.

30 **Age of Omnipotence** — Direct, mathematical manipulation of reality is possible. This is communication with the universe itself, in the highest form.

31+ **And Beyond...** — Unknown.

3.5 COMPUTERS AND DATA STORAGE

Computers have revolutionized many aspects of human life. The same would be true for any species. Computers can handle the functions of man with greater accuracy and greater efficiency than a biological life form.

The problem is, they are still machines. At least for many tech levels they are. What do they become when they achieve self-awareness? That is a debate for philosophers. It's obvious, however, that they will be something more than slave minds.

It is also interesting to note that computers, at least around and about tech level 16, are a highly volatile market. Moore's Law states that the power of computers will double every twelve to eighteen months. In the real world, this shows no sign of being violated.

0 **Pre Stone Age** — No advances.

1 **Stone Age —** No advances.

2 **Dawn of Civilization** — No advances.

3 **Bronze Age** — The first form of data storage, the written word, is invented.

4 **Age of Reason** — Techniques for writing and writing implements are refined somewhat.

5 **Iron Age** — The first two computational devices, the abacus for mathematics and the astrolabe for navigation, are invented.

6 **Dark Ages** — Books, at least in the hands of the clergy, achieve popularity and use.

7 **Medieval Period** — Little in the way of inventions emerge, though inevitable refinements continue.

8 **High Medieval Period —** Little in the way of inventions emerge, though inevitable refinements continue.

9 **Renaissance** — Little in the way of inventions emerge, though inevitable refinements continue.

10 **Colonial Period** — The first adding device is invented, using a system of dials. Other refinements follow, though not in great volume.

11 **Low Industrial Revolution** — The telegraph is invented, allowing near speed of light transmissions of data over large distances.

12 **High Industrial Revolution** — The first mechanical adding machines are invented. Inevitable refinements occur. The difference and analytical engines are designed, but lack of fine machine techniques make them impractical, if not impossible, to build. The telephone is invented, allowing the first transmission of sound over large distances.

13 **Low Industrial Civilization** — Punch card programming and data storage are invented. The radio is invented, allowing transmission of data over the airwaves.

14 **Middle Industrial Civilization** — The television is invented, providing the first visual imaging system. The punch card computer is improved, allowing fully automatic computations to be performed.

15 **High Industrial Civilization** — The electronic computer is invented. They are generally room-sized monstrosities.

16 **Low Cyber Age** — The personal computer is invented, revolutionizing communication and business. At the end of this age, early computer-neural interaction (all one way), is coming to be. Moore's Law is becoming strained as clock speeds approach limits imposed by the speed of light. The slack is picked up by parallel processing. The Internet becomes a household tool.

17 **High Cyber Age** — Full computer-neural interaction becomes possible. Cybernetics result, as do the Sensenet and the Datanet. Rudimentary success with simulated intelligence is achieved.

18 **Spacefaring Age** — Hardware innovations begin to slack off, no longer compensating for the lack of clock speed increases (which simply are as fast as relativity allows). Fiber optic systems are now used exclusively, with great success. Simulated intelligence becomes more and more realistic.

19 **Starfaring Age** — Moore's Law is dead. Computer technology increases, but its heyday of growth is over. Simulated intelligence is generally considered to be perfected. Computer scientists begin to wonder whether true sapient intelligence will ever be manufactured. This is sometimes referred to as the "dark age of computing."

20 **Star Colonial Period** — The light barrier is broken, resulting in a flurry of computer growth that puts Moore's Law to shame. With the light barrier no longer a problem, the top is blown off the clock speed barrier. Thanks to the tachyon, artificial intelligence is not only possible, it is difficult to restrain. Molecutronic computers are born.

21 **Antimatter Age** — Computer tech continues to increase, but the need for faster systems is becoming less and less necessary. A "home feeling" approach to computing begins, as the feel of the software begins to far outstrip other considerations.

22 **Gravity Age —** Computing power has exceeded the needs of its creators by so much that research nearly ceases. Another computer dark age ensues.

23 **Quantum Age** — Full utilization of vacuum energy, combined with an excess of computational power, allows small scale teleportations to be performed.

24 **Age of Force** — The dark age continues.

25 **Antigravity Age** — The dark age continues.

26 **Age of Terraforming** — The dark age continues.

27 **Age of World Building** — The dark age continues.

28 **Dysonian Age** — Zero fault technology, coupled with generations of striving to produce bug-free software (there was nothing else to do) produce systems where errors are almost unheard of.

29 **Cosmic Age** — With the technology of the next age in sight, a major push to expand computational power recommences.

30 **Age of Omnipotence** — Direct, mathematical manipulation of reality is possible. This requires massive computational ability—which is achieved.

31+ **And Beyond...** — Unknown.

3.6 ENERGY SOURCES

Energy is very important to technology. There has never been a time in history when the development of technology has caused the requisite amounts of energy to drop. Energy can come in several forms.

0 **Pre Stone Age** — No technology exists. Even fire is yet to be tamed. Muscle power is the only power there is.

1 **Stone Age** — Fire is discovered. So is the lever.

2 **Dawn of Civilization** — Animal power is harnessed.

3 **Bronze Age** — No real advances occur during this period.

4 **Age of Reason** — No real advances occur during this period.

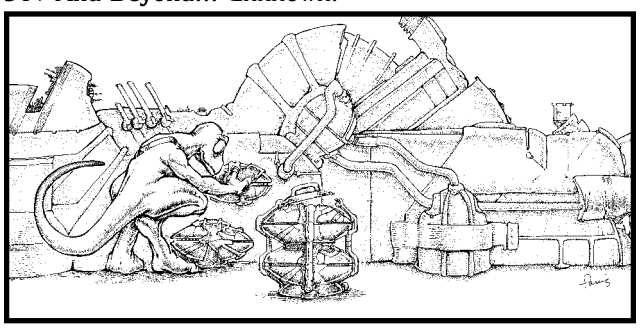
5 **Iron Age** — The waterwheel, and its use in mills, are discovered.

6 **Dark Ages** — Better horse harnesses allow for more efficient animal power.

7 **Medieval Period** — Windmills and wind power are invented.

8 **High Medieval Period** — No real advances occur during this period.

9 **Renaissance** — No real advances during this period.
10 **Colonial Period** — Coal begins to be burned in large quantities.
11 **Low Industrial Revolution** — The steam engine is invented. A series of important inventions combine to make the steam engine more efficient. The telegraph is invented. Electricity is discovered.
12 **High Industrial Revolution** — The internal combustion engine is invented and undergoes several overhauls through the end of this age. The dynamo makes electrical power useful. The incandescent lamp is invented.
13 **Low Industrial Civilization** — The automobile causes an increased use of fossil fuels.
14 **Middle Industrial Civilization** — Nuclear fission is first achieved.
15 **High Industrial Civilization** — Atomic power is put to wide use.
16 **Low Cyber Age** — Atomic power is further refined.
17 **High Cyber Age** — First prototype fusion reactors are built. The first Self-Generating-Discharge Plasmatrons (vacuum energy) are built.
18 **Spacefaring Age** — Fusion power is placed in widespread use. VT vehicles rise in popularity, keeping the fossil fuel age alive.
19 **Starfaring Age** — Ramjets, powered by fusion and interstellar hydrogen, begin to explore the stars. Advancements in the Self-Generating-Discharge Plasmatron allow VT vehicles to begin production in full electric forms. The fossil fuel age finally dies.
20 **Star Colonial Period** — Fusion power is used on all spacecraft by this time.
21 **Antimatter Age** — Antimatter power enters widespread use. Antimatter weapons are created.
22 **Gravity Age** — Antimatter power is further refined. Power converters are invented (heralded by the popular media as the rebinding of Prometheus), allowing energy to be converted from one form to another with very little loss. This allows the construction of micro power generators, as bulky steam turbines are no longer required.
23 **Quantum Age** — Vacuum energy is fully tapped. Energy is now practically limitless.
24 **Age of Force** — Further refinements are made with vacuum power.
25 **Antigravity Age —** Further refinements are made with vacuum power.
26 **Age of Terraforming** — Further refinements are made with vacuum power.
27 **Age of World Building** — Further refinements are made with vacuum power.
28 **Dysonian Age** — Dyson spheres allow all of a sun's energy to be tapped, though vacuum power makes this a moot point.
29 **Cosmic Age** — Limitless, cosmic power is discovered.
30 **Age of Omnipotence** — Direct, mathematical manipulation of reality is possible. This requires almost all the power made available by the last period.
31+ **And Beyond...** Unknown.



3.7 ENGINEERING

Engineering is the science of the design and building of machines, devices and structures.

Before the High Industrial Revolution (PL 12), the engineer is hardly distinguishable from the scientist, or inventor. Until that time engineering, technology, and science are intertwined.

0 **Pre Stone Age —** No technology exists. Building is unknown.
1 **Stone Age —** Only the most primitive tool- and structure-building skills exist.
2 **Dawn of Civilization —** Invention of pottery. The invention of the wheel. Tools are made of stone. Early machine tools such as the lathe exist.
3 **Bronze Age —** Bronze working is invented. Weapons and tools are made from bronze. The chariot is invented. Metal smelting, metal working and casting processes exist. The windlass, endless chain, and bellows are widely employed. The lever, wedge, pulley, wheel, and axle have been invented.
4 **Age of Reason —** Paved roads are invented. Geometry and mathematics are invented.
5 **Iron Age —** The ability to smelt and work iron is invented. Construction with stone undergoes many advances. The keystone arch is invented. The waterwheel, and its use in mills, is discovered. The study of the mechanics of solid objects immersed in water begins. The aqueduct is invented.
6 **Dark Ages —** Most engineering of the time involves stone masonry.
7 **Medieval Period —** Windmills and wind power is invented. Gothic architecture is perfected. The flying buttress is invented. Mathematics now include zero. Steel is invented.
8 **High Medieval Period —** Bell casting is perfected. Various machines begin to be designed. Water-driven machinery is devised.
9 **Renaissance —** Gunpowder and advanced shipbuilding techniques revolutionize warfare. The inventor reaches his heyday. Mining goes through several advances. Metallurgy becomes a science.
10 **Colonial Period —** Ship advancements of this and the last period lead to a great increase in exploration. The printing press is widely used.
11 **Low Industrial Revolution —** Sound cast iron is produced in a blast furnace. The steam engine is invented. A series of important inventions combine to make the steam engine more efficient. The telegraph is invented. The steam power pump is invented. First formal school of engineering is founded.
12 **High Industrial Revolution —** The assembly line brings mass production into full swing. The telephone is invented. Iron begins to play a greater part in building, and suspension bridges enter the scene. The internal combustion engine is invented and undergoes several overhauls through the end of this age. The dynamo makes electrical power useful. The incandescent lamp is invented. Powered machine tools are invented.
13 **Low Industrial Civilization —** Mass production and the automobile change the world. The airplane is invented. The radio enters widespread use.
14 **Middle Industrial Civilization —** Jet power becomes practical. The rocket is invented. Nuclear fission is first achieved. The television enters widespread use.
15 **High Industrial Civilization** — The computer is invented. Orbital and lunar spaceflight is achieved. Atomic power is put to wide use. The maser and laser are invented.

16 **Low Cyber Age —** The personal computer is invented. Orbital spaceflight becomes routine. The early stages of human machine interaction begin. Carbon 60 is created for the first time in a laboratory. It is heralded as the strongest material ever made, perhaps the strongest material possible.

17 **High Cyber Age —** Cybernetics are invented and spread like wildfire. Planetary exploration begins. Rudimentary success with simulated intelligence is achieved. The neural interface revolutionizes entertainment. The first Self-Generating Discharge Plasmatrons are built.

18 **Spacefaring Age —** Planetary colonies are established. Fusion power is placed in widespread use. Man-portable lasers become the weapon of choice. Titanium and carbon-60 are now the building materials of choice.

19 **Starfaring Age —** Ramjets begin to explore the stars. Slow colony ships leave for nearby systems. Carbon-60 is now cheap enough to be used in civilian projects. Robots and androids begin to be produced in large quantities. The first robotic factories are produced.

20 **Star Colonial Period —** Power source and building technologies continue to become more efficient. Polymer-titanium composites achieve strengths nearly as powerful as carbon-60. Nanite construction becomes common and efficient and replaces casting.

21 **Antimatter Age —** Antimatter power enters widespread use. Composite technologies rival the building strength of C60, though at higher costs.

22 **Age of Artificial Gravity —** The invention of artificial gravity expands mankind's living capacities. Composite technology allows materials stronger than C60 to be manufactured.

23 **Quantum Age —** Vacuum energy is fully tapped. The self-generating discharge plasmatron can now harness the entirety of the energy generated by quantum fluctuations. Early force screens are invented. Teleporters, on a small scale, are built.

24 **Age of Force —** Direct manipulation of materials, on a molecular level, coupled with nanite construction, make composites stronger than C60 and cheaper and easier to build.

25 **Antigravity Age —** Antigravity is invented. Inertial dampers allow structural designs for craft that were never possible before. It is now practical to build ships capable of acceleration and maneuvers which would tear the craft to pieces if the dampers were off. Buildings can now be built which can only handle the stress of their own weight for relatively brief periods (with C60 and stronger materials, this is most useful on high-G worlds).

26 **Age of Terraforming —** Antigravity become more reliable, and greater risks can be taken in construction.

27 **Age of World Building —** Invention of nearly indestructible materials make construction of ringworlds possible, if not entirely practical. Zero-fault technology makes it safe to build structures which could never stand under their own weight. There is little out of reach.

28 **Dysonian Age —** Dyson spheres can now be built, harnessing 100% of a star's energy. Zero-fault technology makes them almost practical. Indestructible materials are now possible.

29 **Cosmic Age —** Limitless, cosmic power is discovered. Anything that can be dreamed of can now be built, given enough time.

30 **Age of Onmipotence —** Direct, mathematical manipulation of reality is possible. All it takes to build something is a little of the limitless energy and some computer processing time.

31+ **And Beyond...** Unknown.

3.8 GENERAL SCIENCE

For many years science was used to describe any body of systematic knowledge. In the nineteenth century, the definition was refined to denote an organized inquiry into the natural and physical universe. For the purposes of *Spacemaster*, the second and more modern definition is appropriate.

0 **Pre Stone Age** — No technology exists. Even language has yet to be invented.

1 **Stone Age** — Language is invented. Fire is discovered.

2 **Dawn of Civilization** — Science begins, by necessity meeting the needs for survival. Elementary forms of arithmetic, geometry and astronomy are devised to meet the requirements of engineering, time reckoning, accounting, land measurement and agriculture.

3 **Bronze Age** — Writing and bronze working are invented.

4 **Age of Reason** — Philosophy and higher learning come into play. High-powered geometry is invented. The universe is thought to be eternally changeless and eternally in motion in a dichotomy of "Being" and "Becoming." An alternative "atomic" theory is posited. Mathematics are elevated to the pinnacle of scientific activity.

5 **Iron Age** — The ability to smelt and work iron is invented. The keystone arch is invented. The first heliocentric model of the universe is posited.

6 **Dark Ages** — Primarily innovations in warfare, with the occasional technological advance. Little in the way of scientific advances occur.

7 **Medieval Period** — Scientific refinements are made on existing subjects. Knowledge is centralized and taught in universities.

8 **High Medieval Period** — A movement to merge mysticism and science begin. Experimental method is introduced. Physics is introduced. An infinite universe is theorized. At the end of this period, gunpowder is introduced, representing a step forward in chemistry.

9 **Renaissance** — A new heliocentric theory is taken more seriously. The earth is first seriously taken as a planet. Mathematical reasoning is first introduced to cosmology, superseding the common sense approach. The theory of the immutable universe and crystalline spheres of cosmology are shaken.

10 **Colonial Period** — The printing press hits wide-spread use, bringing the book to a more common citizen. The beginnings of orbital mechanics are defined. The telescope is invented. Major revolutions in astronomy begin. The heliocentric theory is cinched. The three laws of motion are postulated. They are the law of inertia, "An object in motion stays in motion, and an object at rest stays at rest, unless acted upon by an outside force."; the law of acceleration, "The change in motion of an object is proportional to the force acting upon it and takes place in the direction of a straight line upon which the force is impressed."; and the law of reaction, "Every action has an equal and opposite reaction.") The law of gravitation is postulated.

11 **Low Industrial Revolution** — The theory of corpuscular light is introduced. The theory of colors (as they pertain to light) is introduced. The theory of uniform gravity is proven. The steam engine is invented. The telegraph is invented. Chemistry and geology are introduced as sciences.

12 **High Industrial Revolution** — The theory of evolution is postulated. The theory of heredity is postulated. The corpuscular theory of light is replaced by the wave theory. The theory of conservation of energy is introduced. The theory of electromagnetism is put forward. X rays are discovered. The telephone is invented, and the

revolver enters the scene. The internal combustion engine is invented and undergoes several overhauls through the end of this age. The dynamo makes electrical power useful. The incandescent lamp is invented. The electron is discovered. Atomic theory is put forth. The logistics of the binding of atoms into molecules is put forth. Periodic law is defined. Astronomy, physics, and biology become formal sciences.

13 **Low Industrial Civilization** — The corpuscular and wave theories of light are melded. The groundwork of quantum theory is laid out. Aerodynamics culminates in the invention of the airplane. The theories of special and general relativity are postulated. The radio enters widespread use. The expanding universe is postulated. The big bang is theorized. Continental drift is theorized, and plate tectonics follows. Genetics becomes a formal science.

14 **Middle Industrial Civilization** — The rocket is invented. Quantum physics culminates in nuclear fission. The television enters widespread use.

15 **High Industrial Civilization** — The computer is invented. Orbital and lunar space flight is achieved. Atomic power is put to wide use. The maser and laser are invented.

16 **Low Cyber Age** — The personal computer is invented. Orbital space flight becomes routine. The early stages of human machine interaction begin. Bell's inequality is shown, proving the existence of quantum non locality. Subatomic particles are successfully teleported. The first generators which harness vacuum energy are built.

17 **High Cyber Age** — Cybernetics are invented and spread like wildfire. Planetary exploration begins. Rudimentary success with simulated intelligence is achieved. The neural interface revolutionizes entertainment. Solar observation refines fusion and nucleosynthesis theory. The first drafts of the unified field theory are put together.

18 **Spacefaring Age** — Planetary colonies are established. Fusion power is placed in widespread use. Man-portable lasers become the weapon of choice. Advances in radioactive theory help in the related field of medicine. The unified field theory reaches its final form and gains full acceptance.

19 **Starfaring Age** — Ramjets begin to explore the stars. Slow colony ships leave for nearby systems. Simulated intelligence is perfected. Data from star exploration revolutionizes theories on ecosystems and biospheres.

20 **Star Colonial Period** — Faster than light travel is discovered. A universal frame of reference is discovered, and relativity theory is shaken to its very foundations. The tachyon is discovered. Artificial intelligence is invented. Nanites are produced in quantity for the first time.

21 **Antimatter Age** — Refinements in quantum theory allow for large-scale production of antimatter. Antimatter reactors are produced. These quantum advancements lay the groundwork for direct spatial manipulation. Cosmic power is theorized.

22 **Gravity Age** — Non locality physics splits off from quantum physics. The groundwork in spatial manipulation, explored during the last age, culminates in the invention of artificial gravity. There is no fine control of this science yet, and therefore inertial damping is far from reach. In addition, this can only be used to increase the gravity of an object of significant mass, such as a deck plate, and therefore it cannot be used to create antigravity. It does, however, spawn the sister technology of the reactionless drive (this still produces a feeling of acceleration).

23 **Quantum Age** — Vacuum energy is fully tapped. Non locality physics gives birth to the earliest force screens. Teleportation, on a small scale, becomes possible.

24 **Age of Force** — Force screens are developed on both a large and personal scale. Advances in non-locality physics allow direct manipulation of alloys. This is the initial groundwork for direct mathematical manipulation of reality, but it will be ages before the implications are realized.

25 **Antigravity Age** — Gravity theory is refined. Antigravity is invented. Inertial dampers revolutionize space combat and construction. Reactionless drives no longer produce a feeling of acceleration.

26 **Age of Terraforming** — Direct manipulation of molecular structure allows many advances in biological engineering. Large scale ecological engineering becomes possible.

27 **Age of World Building** — Ringworlds become possible. Advances in computers and engineering allow for zero fault technology. Malfunctions brought about by wear and poor design are a thing of the past. There is little out of reach.

28 **Dysonian Age** — Dyson spheres can now be built. They require constant artificial gravity, so zero fault technology is needed to make them practical.

29 **Cosmic Age** — Limitless, cosmic power is discovered

30 **Age of Omnipotence** — All of science culminates with the direct, mathematical manipulation of reality. Anything can now be achieved.

31+ **And Beyond...** — Unknown.

3.9 SOCIOLOGY

A society is defined by its social structure. Throughout history, many advancements in sociology have been made. The problem with sociology is that what is an advance to one being may be a step backwards to another.

The primary goal of a society is always the same. A society must, first and foremost, protect its individuals. Its next goal is to protect their rights. The only true way a society may be judged is by how successful it is in protecting its citizens, and by how happy the citizens are with their society.

It is an interesting fact of sociology that most societies will develop either a sense of chivalry (where the opposite sex is concerned) or a predilection for sexism (some might say they are the same thing, but the purpose of this discussion is not to cast judgement, only to examine in a scientific light). The reason has to do with the survival of the society in the face of hardship.

To see the reasons behind this, all you need is simple math. A human female takes nine months to bring a child to term. The man, on the other hand, can do his part in one day. Assuming that a woman can become pregnant every ten months or so, that means that approximately three hundred males can be lost before the impact on the society is as great, in the long, reproductive term, as the loss of one female.

In the early progress levels, when survival is tenuous at best, a society that protects its females and steals females from other societies will tend to flourish, while societies which allow their females to fight and perform dangerous labor will tend to perish. This is not to say that treating females as nothing more baby factories is not distasteful. Assuredly, most people will agree that it is. This is merely to say that like many other distasteful practices in the early stages of a society, it promotes survival.

Note that the tech levels for sociology are judged by the percent of the population which are happy. This does not mean happy with the government; this means happy in general. It is much easier for a society to build a government which the public approves of than it is to build a government which actually brings the people joy. The trick is to build a government where the people do not feel that they're settling for the lesser evil.

0 **Pre Stone Age —** No society exists.
1 **Stone Age —** A loose, tribal society evolves. Strength is the only thing that is respected.
2 **Dawn of Civilization —** Early society is created. These societies are rampant with despotism. Slavery and sexism are the norm.
3 **Bronze Age —** Few changes are made to society.
4 **Age of Reason —** Society has evolved to the point where sexism and slavery, as well as many other distasteful practices, are no longer necessary. This is not to say that they are abandoned, merely that they could be. In general, only the upper or ruling classes are truly capable of happiness.
5 **Iron Age —** Slavery is abolished.
6 **Dark Ages —** Women are granted equal legal rights.
7 **Medieval Period —** Racism is abolished.
8 **High Medieval Period —** Sexism is abolished.
9 **Renaissance —** 10% of the population is truly happy.
10 **Colonial Period —** 15% of the population is truly happy.
11 **Low Industrial Revolution —** 20% of the population is truly happy.
12 **High Industrial Revolution —** 25% of the population is truly happy.
13 **Low Industrial Civilization —** 30% of the population is truly happy.
14 **Middle Industrial Civilization —** 35% of the population is truly happy.
15 **High Industrial Civilization —** 40% of the population is truly happy.
16 **Low Cyber Age —** 45% of the population is truly happy.
17 **High Cyber Age —** 50% of the population is truly happy.
18 **Spacefaring Age —** 55% of the population is truly happy.
19 **Starfaring Age —** 60% of the population is truly happy.
20 **Star Colonial Period —** 65% of the population is truly happy.
21 **Antimatter Age —** 70% of the population is truly happy.
22 **Gravity Age —** 75% of the population is truly happy.
23 **Quantum Age —** 80% of the population is truly happy.
24 **Age of Force —** 85% of the population is truly happy.
25 **Antigravity Age —** 90% of the population is truly happy.
26 **Age of Terraforming —** 95% of the population is truly happy.
27 **Age of World Building —** 96% of the population is truly happy.
28 **Dysonian Age —** 97% of the population is truly happy.
29 **Cosmic Age —** 98% of the population is truly happy.
30 **Age of Onmipotence —** 99% of the population is truly happy.
31+ **And Beyond... Unknown.**

3.10 TRAVEL

Travel is an important part of any culture. Especially in an SF game, where travel between the stars is often the norm, it is important to know what the society is capable of. At the very least it is important to know whether it takes days, weeks, or even years to get to the nearest star system.

0 **Pre Stone Age —** People travel exclusively by foot.
1 **Stone Age —** The domestication of animals begins. Animals are first ridden and used for portage. Logs are used for early canoes or rafts.
2 **Dawn of Civilization —** The invention of the wheel makes way for the cart and the wagon. Early and crude boats are built.
3 **Bronze Age —** The chariot is invented. Early roads are being built. The oar-driven galley is first built.
4 **Age of Reason —** Construction begins to be cheaper and more efficient.
5 **Iron Age —** Construction methods continue to improve.
6 **Dark Ages —** The saddle and the stirrup make cavalry more effective than ever before.
7 **Medieval Period —** The horse collar is invented.
8 **High Medieval Period —** The rudder and compass are invented. The square sail is invented.
9 **Renaissance —** Ships are built with three masts. The lock allows larger canals to be built.
10 **Colonial Period —** Ship advancements of this and the last period lead to a great burst of exploration. Springs are added to coaches and carriages.
11 **Low Industrial Revolution —** The railroad is invented. The toll road is invented. The steamboat is invented.
12 **High Industrial Revolution —** Iron begins to play a part in building, and suspension bridges enter the scene. The internal combustion engine is invented and undergoes several overhauls through the end of this age. For a while the clipper ship is actually faster than the steamship. The first transcontinental railroad is built. First pipelines are built.
13 **Low Industrial Civilization —** Mass production and the automobile changes the world. The airplane is invented. Highways are devised.
14 **Middle Industrial Civilization —** Jet power becomes practical. The rocket is invented.
15 **High Industrial Civilization —** Orbital and lunar spaceflight is achieved.
16 **Low Cyber Age —** Orbital spaceflight becomes routine. Subatomic particles are successfully teleported. Vectored thrust vehicles are first put into production.
17 **High Cyber Age —** Planetary exploration begins. VT (Vectored Thrust) vehicles hit the civilian market. Personal licensing is very strict.
18 **Spacefaring Age —** VT vehicles increase in popularity as autopilot computers become more useful. The fossil fuel age is yet to die. VT tanks are first built for military use. First electrical VT turbines are built, but battery technology does not exist to support them long enough to make them practical.
19 **Starfaring Age —** Ramjets begin to explore the stars. Slow colony ships leave for nearby systems. Autopilots are now sophisticated enough to take most of the pressure in piloting VT crafts off the shoulders of the living pilot. Advances in self-generating discharge plasmatrons allow electrical turbines to become practical. The fossil fuel age ends.
20 **Star Colonial Period —** Faster than light travel is discovered. Military tanks are equipped with electrical VT turbines and fusion plants to run them.

21 **Antimatter Age —** Antimatter power makes electrical VT turbines increasingly cost effective. Experiments with antimatter plants in military ground vehicles are attempted. They are quickly abandoned. Antimatter plants are installed in all military space craft.

22 **Gravity Age —** Antimatter plants are made safe enough to use in military tanks. The first reactionless drive is created. Major refits upgrade space vehicles.

23 **Quantum Age —** Full utilization of vacuum power allows reactionless drives to achieve acceleration and maneuverability which far exceeds the structural capabilities of the engineering or the living creatures within. Small object teleporters can now be built.

24 **Age of Force —** Military vehicles are outfitted with force screens. Private vehicles are built with vacuum plants. Non-locality physics allow instantaneous teleportation on a human scale.

25 **Antigravity Age —** Antigravity and inertia dampers allow military crafts to utilize their drivers full capabilities. Hovertanks and antigravity lifters are developed. Teleportation technology allows larger and larger objects to be teleported.

26 **Age of Terraforming —** Existing hover technology becomes cheap enough to be accessible to private citizens.

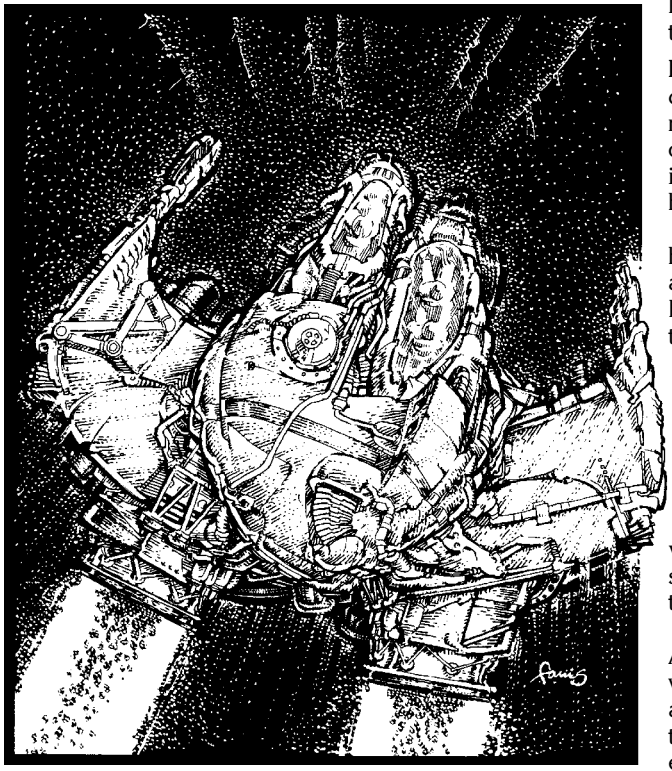
27 **Age of World Building —** The scope of available living space make space capable craft almost a necessity for the common citizen.

28 **Dysonian Age —** There are few places a being cannot travel.

29 **Cosmic Age —** There is nowhere a private citizen cannot now travel.

30 **Age of Onmipotence —** Direct, mathematical manipulation of reality is possible. Nothing cannot now be achieved.

31+ **And Beyond...** Unknown.



4.0 LEVELS OF DEVELOPMENT

"Teachers should not impose their belief that the Earth is round on students who have been brought up to believe that it is flat."
—Jim Cooper (chief for educational matters under Arizona governor Evan Mecham)

An important step in designing a culture is to assign it levels of technological development. This can be a fairly straight forward task, if the GM is looking for a quick and dirty approach, or it can be very involved.

Anyone can take the quick and dirty approach, but a truly in-depth consideration of the matter might seem rather daunting. This section is included to help GMs get a grip on this question. It is designed to give a starting point to those who don't know where to start, and some food for thought to those who do.

This section is broken into two main parts: racial considerations and cultural considerations. Racial considerations dwell mostly on matters of a biological nature. Cultural considerations deal with the biases of philosophies and other school of thought.

4.1 RACIAL CONSIDERATIONS

Many biological fundamentals drive a race. The need to eat, the need to reproduce, and the inevitability of death are but a few. These drives will greatly influence the development of a race, its culture, and its technology.

4.1.1 GENERAL BIOLOGY

The first step is to consider the most basic details of their physiology. This will drive a race on its most elemental levels. This is the level where you find the fight/flight reflex, the need to eat, and other basic, instinctual drives.

Evolutionary Considerations — Without getting into the debate of creationism vs. evolutionism, suffice it to say that most science fiction races are created from the standpoint of evolution. Even creationists typically talk like evolutionists when designing a science fiction story. Why? Well, because it's good for the story.

Anyway, when designing a race, it's best to start at the beginning. What were these creatures before they walked and talked and made tools and began looking at the stars? How does this affect their development? What hurdles did they have to overcome?

The hurdles are typically the most defining question. Eliminating disabilities and inabilities are the first task of technology. Is the race particularly slow? Then transportation will be very important. Is the race in severe peril of predators? Then arms and armor will be important.

Begin by listing the things a race isn't good at, such as speed, agility, vision or even math. Then look at the varying technological categories for solutions. The more solutions you find in those categories, the more emphasis that category should have in development.

The second thing to look at are the aptitudes of the race. A flying race, though it won't need early, slow airplanes, will have a much better innate understanding of flight. The air foil might have been a leap in logic for us, learning that the atmosphere was a gas composed of many particles and extrapolating on how the flow of those particles would effect density and produce lift. However, we have never felt air rush over our wings. We have never learned how one curvature increases lift, while another reduces it.

Therefore a race should be examined for aptitudes. Though the fields associated with these aptitudes might not be of great importance to the race, the development will be much more effortless. The field may be a cherished hobby, if not a vital necessity. Observe how the game industry has driven computer technology. We are not always motivated by survival.

Endurance — A creature's endurance will tell one a lot about its capabilities. A creature that loves to run, and is good at running, even if its not good at running fast, is not going to be as motivated to develop transportation.

Endurance doesn't just refer to aerobic activities, however. Some creatures are better suited for handling temperature extremes than others. The more tolerant the creature is of temperature extremes, the less likely they are to develop temperature-control technologies.

On the other hand, failings are still very motivating. Poor cold resistance is likely to drive a creature to develop controllable forms of heat. Inability to stand the driving wind is going to lead to better structures.

Height — How tall are the creatures? Short creatures will have a much easier time building multi-level dwellings. They might also have an easier time building mines and extracting natural resources.

Tall creatures, on the other hand, will have a much harder time building multi-level structures. A two-story house for a large being must be much stronger for each level added, since it must also be much taller.

This could very well force these races to avoid building such structures. Eventually, however, they will probably be driven by space considerations to build large buildings. Then they will be forced to become masters of the art, or give it up completely.

Life Span — With life span, it's important not only to look at the creature's actual life span, but more importantly, their perceived life span. Do they mature as quickly intellectually as they do physically? If not, then they might not have as much time to work toward advancing their accumulated knowledge, and all their technology will suffer.

On the other hand, if a race is nigh immortal, much of their research will likely be placed in the oldest and most wizened. This will greatly advance the progression in fields that are accepted, but radical ideas are often discovered by the young, who haven't invested large amount of emotional energy in the ideas of the past. Such a long-lived race may have trouble making radical leaps.

On the other had, a race that has a long, but finite, intellectual life would develop very quickly. They'd likely develop quickly in all areas, having enough time to build strong foundations for the next generation to question and overthrow.

Special Abilities — This is a more difficult subject, mainly because it's so broad. All special abilities should be examined. How do these abilities affect the creature's development? Do they give it any edges that would speed development along? Do they give it any abilities that might make it neglect a certain area of development?

For instance, if members of a race are born, lightning calculators, how would that affect their data storage technology? Computers were born of calculators. Calculators were born from difference engines. If a race has no need for mechanical aid in mathematics, how long would it take the race to make the leap to computers and data storage?

Food and Competition — How a race eats and what it must compete with is another important factor in a race's development. A race that is in heavy competition with another race might develop arms and armor at an accelerated rate. A race with poor food resources may develop agriculture at an accelerated rate.

On the other hand, a race that has little competition for food or resources will have less motivation to develop agricultural skills. They might spend their leisure time on science, communication, or even warring amongst themselves.

Cursorial Hunters — A cursorial hunter is one that is capable of tracking its prey for days if necessary. A noncursorial hunter is capable of only short bursts of speed. Humans are cursorial; cats are not.

A cursorial hunter will probably have a much longer attention span than a noncursorial hunter. It may even be that noncursorial hunters will never develop sapience.

At any rate, a noncursorial hunter will probably not develop technology very quickly at all. They might require some extreme external stimuli to force them into sapience.

Other Considerations — This is a catchall category, the time when you consider all those other little strange things that might be stacked for or against a race. Like special abilities, it's hard to give firm advice in this area.

For instance, an amphibian race might develop underwater technologies at a rate vastly faster than a surface race. For them, the high pressures of the depths of the water might be an every-day barrier, a line of death that they are unable to cross. When a limitation is staring a race in its face, they are more motivated to overcome it.

4.1.2 PSYCHOLOGY

The psychology of a race will have a lot to do with how they develop. A race that values warfare will develop arms and armor much quicker than a race of pacifists. On the other hand, a race that values honorable combat might never develop weapons of mass destruction.

A GM should take a close look at a race's outlook. What do they value? What do they abhor? What motivates them? What awakens them in the middle of the night, frightened to their very core? The answer to these questions will give a lot of clues as to how a race will develop.

4.1.3 PERCEPTION

How a race perceives the universe is also important. Do they see color? Can they see infrared light? Can they hear the ultrasonic?

Many of these questions may not give radical shifts to a race's development, but a race that can see infrared wavelengths isn't going to develop infrared gear. They might not even develop street lamps. A color blind race isn't going to color-coordinate controls. They might put together colors that look the same to them but clash horrifyingly to a race that percieves light in a different spectrum.

4.1.4 MATING

The speed and means by which a race reproduce can have a lot to do with their development. Do they reproduce very slowly? In that case, warfare might be unheard of. Do they require birth control to keep from going completely out of control? If so, then medical science, at least endocrinology, might be highly developed.

A good example of this is the novel *A Mote in God's Eye*, and its sequel, *The Gripping Hand*, by Larry Niven and Jerry Pournelle. In this, the Moties had no way to control their population growth. Anytime a Motie went too long without reproducing, they died.

This drove their society to terrible wars which ended in a complete collapse of Motie society. They were driven by this motivation for millions of years, until these collapses were considered as inevitable as night and day, and they began preparing for, dreading, and expecting them.

This is an extreme example, of course, but a good one. It should give a GM an example of where this subject might

lead them.

4.2 CULTURE CONSIDERATIONS

Once the racial considerations are considered, the GM should consider the race's culture. Sometimes a race might build a star-spanning society that then collapses. At this point, each member world, crawling out of its own dark age, will be defined as much by their differences in culture as their similarities in race.

Physical Resources — How has the culture's abundance or shortage of resources effected their technology. What do they waste? What can't they afford to waste? How has development on a metal-poor world affected construction? How has it affected their metallurgy skills?

In any case, the haves and the have-nots develop very differently. What they have and what they have not will say a lot about how they develop.

Subsistence Patterns — After a culture's resources are defined, a GM should decide what the culture's subsistence patterns are. What resources do they use? What resources do they value?

These questions will help determine not only why a race survives and why they go to war, but how a race survives and how they go to war.

Imagine a world where metal is scarce. What do they use to build? What kind of polymers have they been forced to develop? What do they value?

A world that values aluminum is not going to use it frivolously, like humans do. A world that lives in and cherishes trees may not make paper the way we do. A culture that has been forced to survive without large trees would have to build without wood. These patterns of existence tie in with physical resources to help define a lot about a culture and how they use their technology.

Values and Kinship — What a race holds dear says a lot about how it will develop. A culture that values both the born and the unborn infant will probably never develop abortion. They may never develop birth control.

A society based on strong family and clan ties might be prone to war with other clans, forcing accelerated arms development. A society that feels all its members are kin might have just the opposite trend.

Values tell a great deal about a race. Perhaps they feel the wounded are weak, and should die. They might never develop medicine. Perhaps they feel that no person should toil to feed another. These cultures might never develop agriculture.

At any rate, these questions should be carefully considered. They help to shape a race, and thereby shape a race's technology.

Language — Language is often more of a result of all these other factors than a motivating factor in and of itself. This doesn't mean that it's unimportant.

How does the culture communicate? A culture without verbal communication may develop technology at a much slower rate. Then again, a race whose language is very easily converted into a binary code, like Morse code, might make that leap to the telegraph much earlier. Once there, the telegraph might spread quickly, accelerating the growth of communication technology beyond what might be achieved with a culture whose language translates poorly.

Religion, Myths, And History — This ties into psychological considerations. What are the religious imperatives placed on a race? What are they compelled to do? What are they compelled not to do? It is unlikely that a race whose religious dogma exclusively teaches passive resistance will devote many resources to arms and warfare.

What have their myths touted? Myths filled with the wonders of flight might promote travel technologies. Myths involving telepathy and other form of instantaneous communication might be compelled to develop these things in real life.

These myths translate into literature as well. Many of the technological wonders of today were envisioned by science fiction writers of yesterday. Would we have developed television when we did without science fiction? How about the laser? Certainly these items might well have been developed, but how quickly? What technologies would have been delayed? How would this have cascaded?

History is also a driving factor in a culture. Horrible events in a culture's past might render certain technologies taboo. A culture haunted by a past nuclear holocaust might not develop weapons of mass destruction. A culture haunted by terrible plagues might spend fortunes on medical research. A culture fleeing a terrible dark age might cherish communication and data storage.

Whatever the culture fears, cherishes, or dreams about should be considered. This will help define a culture.

Class Specialization — How specialized is this culture's class system? A culture with a highly structured slave class is going to have less need for industrial equipment. A society that values its trade class might have a retarded development of mass production technology. A society with a structured, ritualized warrior-caste may disdain advanced weapon technology.

The class system is the heart of many cultures. Any culture with class systems should have them scrutinized. What technologies does the class structure replace? What technologies does it promote? These questions are very important.

Art, Architecture, and Symbolism — Architecture will tell a great deal about a culture's construction technology. Other factors, such as art and symbolism, will give more clues to the forms of technology than their functionality.

The phallus and the cross are common symbols in occidental culture. Because of this, their forms are often repeated in designs and structures. Details like this can lend a great sense of realism and style to a culture.

Politics and Welfare — The politics of a culture will determine what the people with money will buy. Rulers in a warlike culture will spend more money on arms and weapons. Rulers who are trying to keep a culture together across vast distances will develop technologies that improve communication.

The welfare of a nation also motivates its development. How does a nation treat its elderly? What do they need to protect themselves against? A culture that is bombarded with asteroids will have a strong space program. One that is plagued with diseases will develop good medical technologies.

A Final Note

Entire volumes could be filled with a discussion on how these factors shape and mold a culture's development. This section does not pretend to be a complete treatment of the subject. It doesn't even dream of being a complete treatment.

The purpose of this section is to make a GM think. It is to help get the creativity flowing and to intrigue and inspire.

A GM can do a lot with the implications of a well designed race and culture. Once he begins the process of culture design, things often just fall into place.

Hopefully, this will give the GM a good start. Hopefully, it will point him in the right direction. If the campaign is to be space opera, then this isn't very important. If the campaign is to be hard SF, however, then it can be imperative. A realistic race and culture can make or break hard science fiction.

5.0 SPECIFIC ADVANCEMENTS

"The universe is full of magical things, patiently waiting for our wits to grow sharper."
—Eden Phillpotts

In Section 2.0, an overview of the various tech levels was presented. However, the reader may not be familiar with some of the terms presented there. Certain advancements, such as FTL travel, could be handled in many different ways.

The purpose this section is to cover various specific developments in technology. As with all things, this is presented as a GM tool. It is likely that many of these pieces of technology will not be included in any given campaign, or that they will be changed radically before they are. This is more than okay, it's expected.

Using Specific Advancements

After the tech levels for a specific culture have been defined, it's necessary (assuming the tech level is not particularly primitive), to give some thought to the technologies involved.

The GM should go through this section carefully, taking note on each of the advancements that are necessary for his culture. He should alter them as needed to fit the campaign and give careful consideration to their affects on game balance.

In certain areas, hard decisions may have to be made. With FTL travel, for instance, the GM must decide, first of all, which of the methods are even possible. Then he must determine which races use which methods. Finally, assuming that different species use different methods, the implications of these technologies must be compared to one another, to make sure the balance of power that the GM intended is not disturbed.

When the GM has finished examining this section he is ready to move on to the rest of this work. There he can define the specific pieces of equipment the races of his universe will have.

5.1 ENERGY SOURCES

Energy is important to any civilization. The higher the civilization's tech level, the higher their energy consumption probably is. Never in the history of man has there been an age where technology used less power than the age before, despite the invention of power-saving devices. It is likely that this trend will continue, that technology will become more and more hungry for power.

It is therefore necessary to define what sources of power a civilization has at its disposal. Entire political structures are built around the generation of power (take the Middle East, for example). Wars have been fought over less important resources.

FOSSIL FUELS (Tech Level 3) — After wood, fossil fuels are the most common form of power available. Coal has been burned for heat or steam for almost as long as history can record. More recently, natural gas and petroleum have replaced coal as the primary fossil fuel. The problem with fossil fuels is two-fold. First of all, there are finite amounts of it, far less than technology will require in the long run. Second, and perhaps more important, is the devastating effect that the burning of fossil fuels can have on the world's ecology. Fossil fuels are, at best, a short term solution to a world's power problems.

NUCLEAR FISSION (Tech Level 15) — At the end of tech level 14, the atom will be split. By tech level 15, it will be possible to use nuclear fission to generate power. At the time, this will be the cleanest power source available to any locale. (Hydroelectric is cleaner, but requires a large river.)

There are many myths about nuclear power. Let's dispel them. First, nuclear reactors cannot explode. They simply do not have a high enough density of fissionable materials. Theoretically, they can melt down. With proper precautions, this should never have to happen. Even if this does happen, the long term biological effects are far more pleasant than the long term effects of burning fossil fuels to produce electricity.

Another popular misconception is that nuclear reactors produce waste which is highly radioactive for tens of thousands of years. This is not only inaccurate, it is a contradiction in terms. The very term "highly radioactive" means that it cannot be radioactive for long. In fact there is radioactive waste today which is already less radioactive than the fissionable materials from which it was produced.

Radioactive power sources are used on many modern vehicles. The Radioisotope Thermal Generator generates power for the space shuttle, for instance. An RTG is so durable the shuttle could explode without causing harm.

Are nuclear reactors safe? Of course not. Are they safer than fossil fuel plants? Definitely, in the long run. France has been working almost exclusively off nuclear power for years, without a major mishap.

HYDROELECTRIC (Tech Level 13) — Dam off a river, let the water build up really high, then shoot the water through a turbine or series of turbines. The resulting energy is called hydroelectric. This is probably the most plentiful, eco-friendly form of power. Its only problem is that it requires the flooding of a large area of land when the dam is built, and must be located on a large moving body of water.

WIND POWER (Tech Level 12) — With the invention of the power generator came the need for a force to motivate it. Wind power is used as early as tech level 7 to provide simple, mechanical force in mills. It is only natural that it would be an early source of motivation for turbines.

Wind power is cheap, efficient, and clean. The problem is that it is not reliable. The wind does not blow constantly. A second problem is that it takes many windmills to generate wind power, making it impractical for large-scale use. Naturally this is useless in a vacuum.

GEOTHERMAL (Tech Level 13) — In its simplest sense, geothermal power can be used for heating homes as early as tech level 3, merely by channeling heat from an open fissure in the ground through pipes and into a home. For the purposes of *Tech Law*, however, geothermal energy will be used to refer to using geothermal energy to generate electricity.

Until the invention of the power converter in tech level 22, allowing the free exchange of energy from one form to another, all generation of electricity is performed by heating water. With geothermal power, the water is heated using the energy of the interior of the earth.

Naturally this can only be used on worlds with an active interior. It often requires some significant digging to harness, and as many of the prime locations are near volcanoes or on fault lines, many would feel this method of generating power has it's safety issues as well.

SOLAR (Tech Level 15) — The photoelectric cell is invented around tech level 15. At that point, it becomes possible to generate power using only the light of the sun. This is the safest form of power ever devised.

Unfortunately, it has its drawbacks. It takes a lot of photocells to satisfy a civilization's needs for power. Also, it requires sunlight. This means that it is impossible to collect energy during the night or during deep cloud cover.

Solar power is most useful in space, where night and weather conditions are not relevant. It is used on most satellites and space craft for at least backup power.

FUSION (Tech Level 17) — Fusion power is achieved by bringing hydrogen (or rather deuterium) together in such conditions that it fuses into helium. This is the same process that keeps the sun and all the stars burning.

Fusion power is a good source of heat, and therefore electricity. Unfortunately, it is very difficult to control. Fusion temperatures are measured in the millions of degrees. It involves intense and powerful forces which, should they be released, can cause violent and dangerous reactions. Whereas making a fission reactor safe is merely a matter of planning, making a fusion reactor safe requires a process more akin to prayer.

Cold Fusion, Fact or Fantasy? — Cold fusion is a difficult subject, and one of heated debate, even now. What exactly did happen in that lab in Utah? Did we discover a new form of power, one that was safe, clean, and limitless?

No one knows. Something happened. Energy was generated. But what was the cause? The efforts to reproduce the effect have been notoriously fickle. Was it cold fusion?

It's difficult to say. Whether to treat cold fusion in a serious fashion probably has a lot to do with the players involved. A normal playing group will probably take it in stride. In fact, it's the type of thing SF fans want to believe in. A group that involves anyone even remotely connected with nuclear power will probably not accept the idea of cold fusion. The reactions tend to run the gamut from hysterical laughter to outright belligerence. As with any controversial subject, the GM would be wise to examine the issue before using it in his campaign.

MATTER/ANTIMATTER (Tech Level 21) — Needless to say, matter and antimatter do not react well together. Whenever the two are brought together they annihilate each other in a violent release of energy. If the amounts of matter involved is at all significant, this release can be measured in megatons, gigatons, teratons, or more.

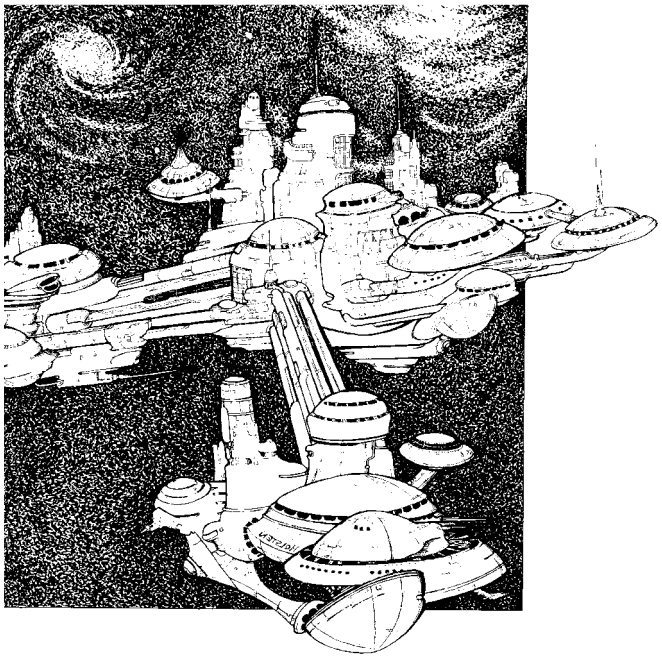
Starting in tech level 21, antimatter can be produced in quantities to make its use as a power source practical. The problem with this type of reactor is safety. Using it is to ride the current of a long, controlled explosion. In addition, the antimatter must be stored, perhaps magnetically, in a manner that does not allow it any contact with matter, as the results of error are explosive at best.

Another benefit of antimatter power is its use in star craft. In universes where reactionless drives do not exist, antimatter is a convenient manner by which to provide a lot of energy for thrust. It just needs to be controlled safely.

VACUUM ENERGY (Tech Level 17) — So-called "empty space" is actually seething with fluctuations in the quantum field. These fluctuations take the form of virtual particles that appear as a matter and antimatter pair which then annihilate each other. If this happens within the period dictated by the uncertainty principle, then the law of conservation of energy is not violated.

At the end of the low cyber age, a Self-Generating-Discharge Plasmatron first captures the energy of virtual particles. As the tech levels increase, this process becomes more efficient. By the quantum age, all the energy can be harnessed, providing a nearly limitless source of energy.

COSMIC POWER (Tech Level 29) — At tech level 29, infinite cosmic power is discovered. This cosmic power draws from the very fabric of reality. It supplies limitless power at almost no cost. It helps pave the road for direct, mathematical manipulation of reality.



5.2 STAR TRAVEL

Most SF games will probably involve some form of star travel. How that travel is handled has a great deal to do with the feel of the universe and the pace of the campaign. If all travel is done with ramjets and slow boats, then the characters are not going to be doing a lot of flitting around. If, on the other hand, travel is magical and near instantaneous, then the characters might be tremendously mobile.

SLOW BOATS (Tech Level 19)

This method of travel involves a long and arduous journey. These colony ships take years, perhaps even generations, to reach the nearest stars. They must be more than craft, they must be completely self-sustained communities capable of dealing with any emergencies which might come up.

These craft, unless they are the sole setting of the campaign, do not lend themselves well to a science fiction game. They are tedious in the extreme, requiring infinite patience to be useful. Most players would never put up with them.

RAMJETS (Tech Level 19)

These ships use massive (many kilometers wide) magnetic scoops. These scoops collect ionized hydrogen and focus it into a fusion flame. This allows constant acceleration, for indefinite periods of time, without carrying large amounts of fuel.

There are two problems with ramjets. First of all, for at least the early parts of this age, no living creature can survive inside the intense magnetic fields produced by a ramjet. Second of all, the ramjet must be accelerated to high relative velocities before enough hydrogen can be collected for the fusion flame to be sustained.

EINSTEIN-ROSEN BRIDGES (Wormholes) (Tech Level 29)

It may be possible, through the use of a large singularity, to forge a tunnel through space, connecting two distant points with a bridge of space and time. This would allow many light years to be crossed in a matter of minutes.

The problem with wormholes is that they are only open for the briefest instant when first created. Late in the low cyber age (about 1980), it was proven that a wormhole could be propped open, assuming the existence of exotic matter.

If this exotic matter is ever discovered, then a wormhole might be created as early as tech level 25. If this exotic matter does not exist, then the force field technology necessary to prop open this bridge would require power supplies not available until tech level 29.

TELEPORTATION (Tech Level 23)

In the low cyber age (these developments are occurring even as we speak), the first particles are successfully teleported. Unfortunately, the power involved is so tremendous that logistically it is impossible to teleport objects until much later.

Small objects can be teleported at the speed of light beginning at tech level 23. Breakthroughs in nonlocality physics allow objects to be teleported instantaneously, and man-sized objects can be handled by tech level 24. From then on objects of larger and larger sizes may be teleported at each tech level.

Until tech level 29, teleporters never are able to teleport farther than 100,000 kilometers or so. Objects must be teleported between specially designed teleportation booths.

FASTER THAN LIGHT DRIVES (Tech Level 20+)

Many science fiction stories include faster than light engines. The way that this is accomplished has a lot to do with the feel and the style of the story.

Note that many people believe that Einstein proved that it is impossible to travel faster than light. This is not correct. Relativity only states that it is impossible to travel the same speed as light. Many different methods have been used in science fiction stories as a tool to get around this speed limit. Some of the more typical ones are listed below.

Only an individual GM can decide exactly how fast a craft should be able to travel in his universe. Because of this, no speeds are given for the drives below.

HYPERSPACE (Tech Level 20) — Hyperdrive engines shift the vehicle into another state of being. The most typical method is to shift the craft into another dimension, where distances are actually shorter, or the speed of light is faster.

The second method is to give the craft an FTL signature, perhaps using tachyons, which shift the craft into a faster than light state. The craft then only travels faster than light until it is dropped to a slower than light state. This causes the possibility of some interesting time contraction problems, so it should probably be avoided unless the GM has a good handle on such things.

WARP DRIVES (Tech Level 20) — Warp drives somehow warp space or time, bending them to the point where the craft can appear to travel faster than light, even though, in its little bubble of space-time, it is traveling at normal speeds. Usually, this type of drive uses some form of near-magical "field technology."

JUMP DRIVES (Tech Level 25) — This type of drive is akin to the teleporter. It allows the ship to leap from one location to another, instantly, without traveling the distance in between. For game balance reasons, these drives can usually only jump a certain distance, or between certain points.

If the trip is limited to a certain distance, then some restriction should be placed on how often this can be done. This could involve a recharge time, or perhaps it is just enormously expense.

If this can only occur between two points, then all travel to and from the jump point must be handled by mundane means. This means that space travel would involve long periods of travel via normal acceleration and deceleration, followed by an instantaneous journey, followed by long periods of acceleration and deceleration.

SPATIAL FOLD (Tech Level 26) — This type of drive folds space and time to transport the craft from one place to another. It is practically identical to the jump drive. All the same restrictions and balances applied to the jump drive should be applied to the spatial fold as well.

5.3 COMMUNICATIONS TECHNOLOGY

Communication is the heart of every society. How a society communicates has a lot to do with whether the society is a success or a failure. No interstellar community can exist as a cohesive whole without faster than light communications.

RADIO (Tech Level 13) — Radio is a form of electromagnetic communication. As such, it is restricted to the speed of light. Radio will be the communications method of choice for societies at tech levels less than 20. Radio, being a form of light, requires line of sight to operate (though it can penetrate a short way through solid objects).

Tightbeam (Tech Level 15) — With the invention of the maser (and later the laser), it becomes possible to reach the next stage of electromagnetic communications. No different in theory than radio, a communication laser or maser simply transmits the electromagnetic information in a focused beam instead of in a global transmition (as with radio).

This has three benefits. First of all, it is difficult, if not impossible, to monitor the communication without cutting it. The only real way to do it is by monitoring the energy changes at the transmitter or reciever (watching the temperature on the reciever pulse, for instance). Unfortunately, this often requires close proximity.

The second benefit is range. A laser can throw a beam across the solar system for a fraction of the energy that it would take to crank a broadbeam communication across the same distance.

The third benefit is defense. A com laser usually is energetic enough to act as a Mark 10 laser in all ways.

There is only one drawback. A com laser has to be pointed directly at its target. This can be difficult over long distances, unless the target is stationary (a planet for instance). Otherwise, time lag adds up quickly.

TACHYONS (Tech Level 20) — A tachyon is the name for any particle that travels faster than light (all "normal" particles are called tardons). An interesting thing about tachyons is that all the effects of relativity operate on them, but in the opposite manner as they do on tardons.

OTHER (Tech Level 20+) — Occasionally, in science fiction, other forms of communication are used. They might be called "subspace" or "Z-ray" or some other such name. The point is that these signals generally travel faster than light, and therefore are the heart of communications in the universe.

5.4 COMPUTERS

Computers are a part of everyday life in most science fiction worlds. The more advanced a society's technology becomes, the more dependent a society becomes on its computers. Computers gradually infuse themselves into the soul of a society, taking more and more jobs that human beings are incapable of handling, or at least incapable of handling quickly enough.

Moore's Law states that computer power doubles every twelve to eighteen months. For a while, this is represented primarily by a straight-forward increase in clock speed. Eventually, however, clock speed comes up hard against the speed of light, and the signals simply cannot be pushed through any quicker.

But Moore's Law continues. Parallel processors, more efficient computing systems and eventually FTL signals continue to push computing technology forward. It is unknown how powerful it will eventually get.

During tech level 20, molecutronics are born. These computers have infinite clock speed potential. They are immune to electromagnetic pulses.

CAPABILITIES AND LIMITATIONS

One of the first things that must be determined is what the computer systems of the world should be capable of. Is artificial intelligence possible? What is the state of virtual reality? Is a neural interface possible? How about personality downloads?

Each of these subjects is treated separately below. A GM should give each careful consideration, as each can have ramifications on many areas of the game.

ARTIFICIAL VS. SIMULATED INTELLIGENCE (Tech Level 19 or 20) — Artificial intelligence is an elusive and difficult technology. When Arthur C. Clarke wrote *2001: A Space Odyssey*, he was hopeful that artificial intelligence would be achieved by 2001. He was, of course, wrong. In the early days of artificial intelligence, many victories were achieved. It wasn't until much later that it was discovered that those victories were the easy ones.

It might be that artificial intelligence simply requires a twenty year boot period.

An artificially intelligent computer is fully self aware. It is capable of everything a natural mind is capable of, including guessing, lying, and making leaps in logic. An artificial intelligence is even capable of kindness, generosity, and self interest.

A simulated intelligence appears in most every way to be artificially intelligent. They are programmed to show feeling, make leaps in reason, and even lie. They are not, however, capable of true self interest. They will make guesses when they are able, but will often fall back on the old answer of "insufficient data."

VIRTUAL REALITY (Tech Level 16) — As computer processing ability progresses, virtual reality technology becomes better and better. As this technology improves, virtual reality begins to replace television as the entertainment venue of choice.

As the neural interface is invented, a whole new dimension is added to virtual reality. As the technology progresses, more and more of civilization's social life will probably become virtual. Eventually something happens or they just say "enough," and quit.

NEURAL INTERFACE (Tech Level 17) — With the increasing integration of man and machine that follows the cyber ages, the neural interface eventually becomes possible. Toward the end of the low cyber age (within the last decade), sensor equipment is designed which can read and interpret the intentions (if they're simple) of the human brain. This is primarily used for video games and simple vehicle control.

By the high cyber age, this link begins to work both ways. In the beginning it is only used to give commands to robotic prosthetics, but eventually an entire link between mind and machine is formed, allowing data transfers, virtual reality, and sense imaging.

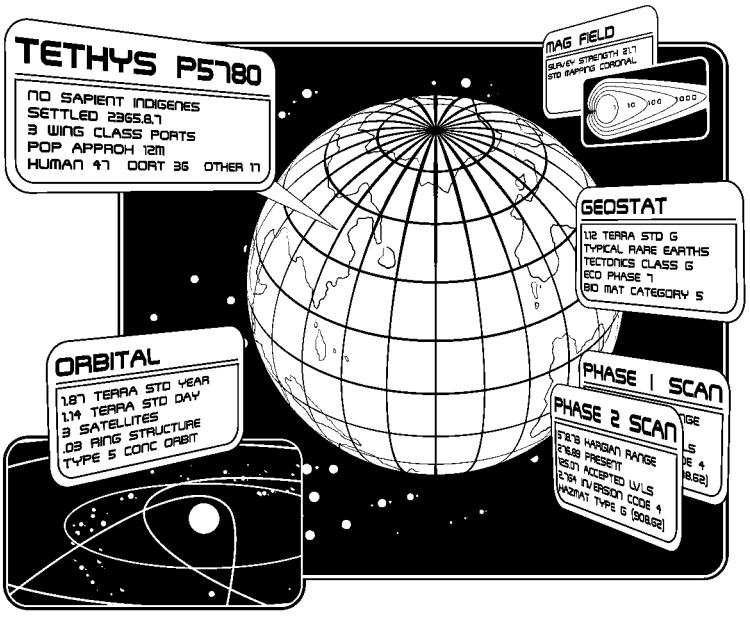
As the age progresses, the neural interface begins to become more and more important. Why build a night club when you can build a virtual night club? Real estate is expensive, but virtual estate is only as expensive as volatile memory.

The Sensenet and the Datanet come into being. The Sensenet is an entire virtual universe designed for the user's pleasure, while the Datanet is a gigantic virtual library. If dependence on these technologies continues to increase, the society will probably never leave the cyber age.

PERSONALITY DOWNLOADS (Tech Level 17)— With the neural interface comes the personality download. By the end of the low cyber age, technology is approaching the ability to build enough memory to store a human intellect. By the high cyber age, Moore's Law guarantees it.

What the effects of this are depend greatly on the GM. If he believes that the soul has a place in the game, but that it can't be downloaded, then this will probably be nothing but a depository of data. If he believes that one vessel is as good as another, then the entire being might then be alive in memory. This is purely a judgment call.

Of course, having a fully sapient intellect running around the Sensenet will have many ramifications in the game. Having a dozen, a hundred, a thousand of them…



INTERLUDE ONE

The panel exploded in a glowing crash of sparks. Mrrralff cursed violently in Frazin and waited for the diagnostics to flicker across his screen. He breathed a sigh of relief. Nothing was damaged that didn't have a redundant system.

Their relative velocities had carried Mrrralff and his enemy far apart. It would take a moment for the Jeronan to pull his craft back into a firing position, but only a moment.

The gimbal hadn't adjusted yet. The computer was still fighting to orient after the torpedo impact.

His father, when training him to fly, had been very clear on the matter. "Recover from the tumble within three seconds or I'll beat you until you're unconscious." His ISC flight instructor had been more helpful. "When your gimbals are out and you don't have time to tackle, roll, pitch, and yawl one at a time, just pick a point in the sky fly toward it."

Easier said than done.

Mrrralff focused on the transport they were tracking and fought the controls, trying to keep the glow of the drive flame in his field of view. It was guerilla rocket-jocking at its worst. The sudden blast of sound from his acquisition sensors didn't help matters.

Then the stars stopped spinning and settled in their heavens. His gimbal oriented, for all it mattered. His scopes showed four torpedoes, burning hard to cancel their relative velocities. The Jeronan had jumped the gun and fired too soon.

That would buy him a little time.

He opened his engine up full, trying to put as much distance between him and the torps as he could. The inertial dampers were slow to compensate, and his rib cage rattled in his chest. He'd have to have that fixed. It probably would have killed a human.

The missiles had matched velocity and were gaining. Small torps. They had greater acceleration than Mrrralff's heavy fighter. There was no way he could outrun them.

The enemy had almost matched velocity as well. A smaller fighter, its main armament was its torps. They were all in flight now, but if even one hit, that fighter would be more than a match for Mrrralff's crippled craft.

Time passed slowly as he closed the distance to the freighter. He could see his wing mate's ejection beacon. It was transmitting the "Strong Vitals" code. He'd be alright. In the distance, his scopes showed Mitchell's gunboat, swarmed by four fighters. No help was coming; he was on his own.

The torps continued to chew up the distance between them. The freighter loomed closer. He punched up a Time on Target reading. He'd make it … barely.

There was a flash in the distance as Mitchell and the team splashed another fighter. He could hear the excited chatter on the com. They weren't worried. They'd be fine; they were just too far away to help.

The freighter was looming quickly. The proximity sensors were sounding the ten second alert. He fired all his belly thrusters, pushing his craft up, then firing back down as the freighter passed underneath.

The torps were traveling too fast to compensate. They crashed into the freighter's drive section, disintegrating in a glowing ball of expanding gas. The freighter, its engines shattered, ceased accelerating, a gentle roll added to its ballistic trajectory. Perfect salvage.

The fighter would be coming in fast. Mrrralff used the cover of the freighter's exploding engines to flip and burn off his delta-v. He was nestled, all warm and cozy, in the freighter's sensor shadow when the fighter streaked by.

Mrrralff fired his engines, falling in behind the fighter. They had tremendous relative velocity, and he knew he would only have one shot before his opponent blew through his weapon range.

It took a moment for his tracking systems to acquire their target. But only a moment, and then they were locked on nothing more than a tumbling ball of molten metal.

PART III
STARSHIPS AND VEHICLES

"Unsafe at any speed."
—Ralph Nader

Technology is technology, but without spaceships, then what's the point? Starships and fast flying cars are more than just the gear of the modern age. They are the dragons and magic carpets of the science fiction game. They are the lost artifacts and toys of all kinds that players love to collect and brag about.

This part of *Tech Law* is perhaps the most important one for the *Spacemaster* game. It contains all of the marvelous vehicles that the players will want to get their hands on.

It is important that a GM carefully examine the technology in this section. It would be very easy for a GM to allow a starship or weapon into the game that undermines much of the feel he intended when devising the game.

6.0 VEHICLES

"She'll make point five past light speed.
She may not look like much,
but she's got it where it counts, kid."
—Some Smuggler

Vehicles come in many shapes and sizes. This diversity is a necessary offshoot of the many different possibilities that vehicle technology offers. This subject depends greatly on the genre of the game.

This dependence does not, however, keep us from a general treatment of various modes of transportation. Below are listed each of the primary forms of transportation with a rough outline of their capabilities. Also listed are their common range of prices. All these details are subject to GM approval.

The following stats are provided for most vehicles. Some of these will be supplied for all vehicles, but some of them will not. If a stat is omitted, it is simply because it is inappropriate (translight capability is not necessary for ground vehicles, for instance). These stats should be all that's necessary to run vehicular encounters.

These vehicles do not include those already detailed in *Spacemaster: Privateers*.

Crew — This describes how many biological beings the craft is designed to carry. The number in parenthesis is the number of crewmembers actually necessary to pilot the craft.

Cargo — This describes the amount of available area the vehicle has for cargo. In most vehicles, one passenger can be exchanged for two kiloliters of storage space.

Mass — This is the average weight of the vehicle. It gives the vehicle's mass in metric tons. (One metric ton is equal to 1000 kilograms, or approximately 2204.6 pounds (1.1023 English tons).)

Hits — This is the amount of damage a vehicle can withstand before it is rendered completely inoperable.

CAT — This lists the ship's Construction Armor Type.

Vacuum Power Rating — The amount of total power put out by the craft's generator. The number in parenthesis is the amount of extra power the craft doesn't use.

DB — The ship's Defensive Bonus. It does not include any bonus granted by electronic warfare.

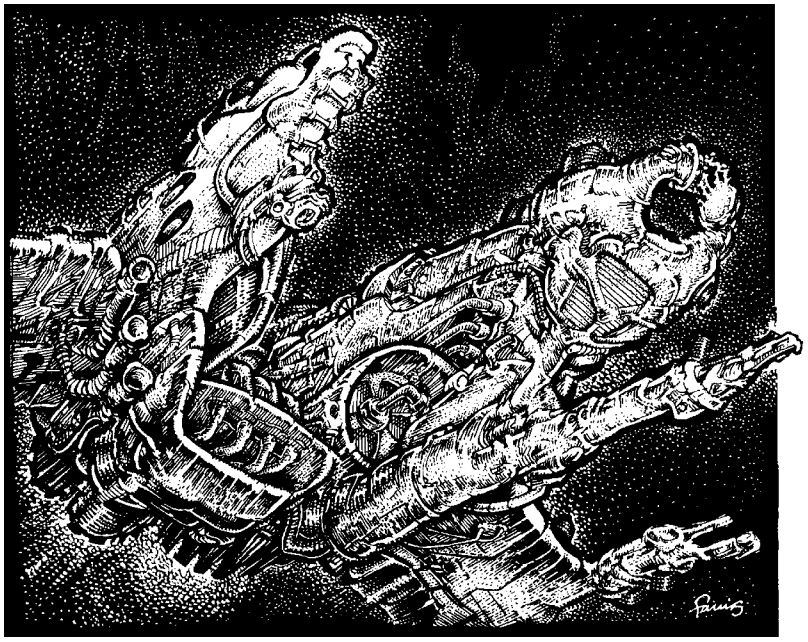
EW — Electronic Warfare. The EW bonus is added to the vehicle's DB after a successful use of the Electronic Warfare skill. It is listed in two numbers. The number before the slash is active EW. This bonus is granted after a successful Electronic Warfare maneuver. The number after the slash is passive EW. This bonus is applied automatically to the craft's DB vs. certain attack forms.

Cost — This is the value of the craft. The value is given in ISC Credits (¢), which are roughly equal in purchase value to the American dollar.

Top Speed — The craft's maximum speed—measured in kilometers per hour for planetary vehicles, or in Gs of acceleration for space vehicles.

Translight Capability — This indicates if the craft is capable of FTL travel, and how fast it can travel.

Atmospheric Capability — This gives the craft's capabilities in an atmosphere. Some vehicles are exclusively atmospheric.



Armament — This describes the typical armament of the vehicle. Note that this is merely typical armament. Many private vehicle owners add their own special modifications. After each weapon is listed the weapon's OB, which is added to the gunner's attack roll.

Features — Special features of the craft, not detailed in other areas.

Auxiliary Systems — These are backup systems. Most combat craft have auxiliary systems.

See Appendix A-5 for more rules on making your own vehicles.

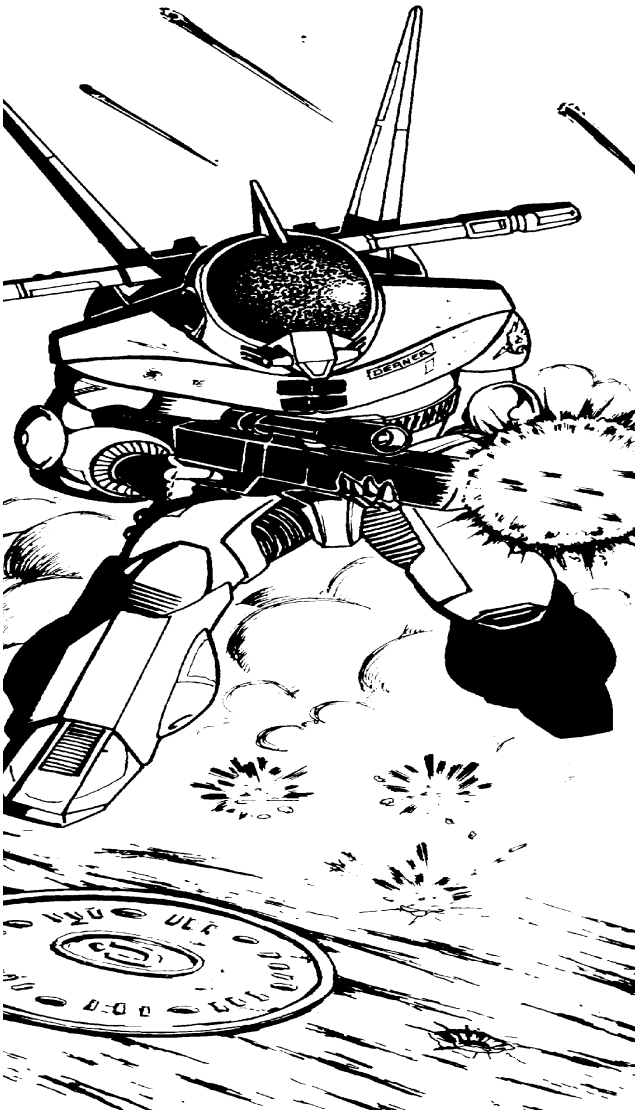
6.1 GROUND CONVEYANCE VEHICLES

These vehicles generally have wheels or tracks; although some might have more exotic means of locomotion (i.e., legs). They are typically not intended to fly or travel on or under water.

APE Orbital Drop Armor

Crew 1
Cargo ..... None
Mass ..... 5.824 Metric tons
Hits 7
CAT XVI
Vacuum Power Rating 5 (0)
DB 90
- Armor Belt ..... +20
- Defense Screens ..... +70

EW 0/15
Cost ..... ¢1,056,382 (Normal), ¢1,162,382 (Command)
Top Speed ..... Running



Armament:
- Steyr-Klough L-15 Heavy Assault Laser
- Steyr-Klough APC-27 Heavy Assault Plasma Carbine
- Steyr Klough T-26 Heavy Assault Blaster
- Chrometech X-7 Grenade Launcher
- H&K Assault Flamer (Ten flamer cells worth of fuel)
- Security Systems Deluxe Stunner

Features:
- Medical Treatment System
- Tactical Scanner
- Gravchute
- Microfrequency Comm Rig
- Tightbeam Comm Rig
- Quantum Comm Rig
- Command Suite (Command Versions Only)

Commentary: The Armored Personal Environment (APE) armor is the heart of the Marine Corps Force Recon. These suits are used to perform High Orbit Low Opening (HOLO) drops into enemy territory. They turn each infantryman into a small vehicle, and are feared among imperial troops.

In a major marketing coup, Steyr-Klough managed to snatch the contract to build these suits away from Heckler & Koch. This was mainly because of H&K's lack of heavy assault weaponry, and a major push by SK's marketing and sales departments. There is still bad blood between Steyr-Klough and H&K over the contract.

One of the primary features of this suit is a full three metric ton life support rig. This allows the suit to operate behind enemy lines as long as food and water supplies can be replenished. Initial designs had the armor equipped much like a space suit, but discussions with Force Recon veterans led them to build a fully self sufficient system.

The tonnage came at a cost, however. The APE has no ship scale weaponry. The soldiers generally go into combat carrying a Spectrum Arms Support Blaster, jacked straight into the suit's power supply. For heavy missions, they carry ultra compact blaster cannons (mark 5). These are bulky, and even with the armor's waldos, sometimes they slow down the soldier by their sheer mass alone.

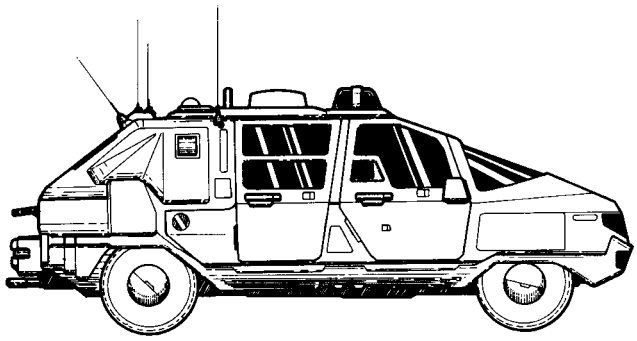
The biggest criticism with this armor is that it has no native mobility. It is thought that it would have been far more effective as a hopper, but with the life support gear, there simply wasn't room.

This armor has a basic sensor suite; though with the tacscanner, it's almost never used. It has comm gear for every occasion and its medical suite will inject the occupant with ziclo-mene, thetacoagulin, or any other basic pharmaceuticals, as needed (see *SM,* p. 184).

Command versions have a full command suite. This links all tactical scanners and allows the user to direct battle easily and effectively. It even has ablative coating for protection against blasters and other similar weapons.

This armor has an out-standing combat record. It has allowed Force Recon to perform all sorts of assault and rescue missions, and has proved to be durable and reliable.

Game Notes: Powered armor can be treated as a vehicle, but in combat against infantry (single men, not squads), it is slightly more vulnerable than a normal vehicle. If *Blaster Law* is possessed, ignore all damage done by small arms. Criticals are applied normally, but they use the Powered Armor Critical Table (also found in the *Equipment Manual, p. 100*).



Ground Car

Crew ..... 2 to 5 (1)
Cargo ..... 1 Kiloliter
Mass ..... 1.4 Metric tons
Hits 5
CAT XII
Vacuum Power Rating 1 (0)
DB 0
EW ..... Not standard
Cost ..... ¢25,000
Top Speed ..... 100-300 kph
Armament ..... Not standard
Features:

- Basic Sensor Suite
- Microfrequency Comm Rig

Commentary: This is typically an enclosed vehicle. It rides on more than two wheels, and is favored for its ease of operation.

Ground Bike

Crew ..... 1 or 2 (1)
Cargo ..... 0.25 Kiloliters
Mass ..... 0.41 Metric tons
Hits 1
CAT XI
Vacuum Power Rating 1 (0)
DB 0
EW ..... Not standard
Cost ..... ¢25,000
Top Speed ..... 300 kph
Armament ..... Not standard
Features:

- Basic Sensor Suite
- Microfrequency Comm Rig

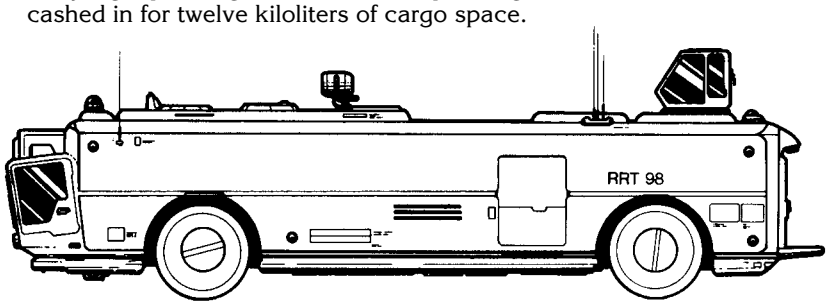
Commentary: This is a two-wheeled, motorized bicycle. It is nimble, but not nimble enough to avoid targeting computers. Cheaper, slower models are available.

Ground Van

Crew ..... 2 to 6 (1)
Cargo ..... 6 Kiloliters
Mass ..... 10 Metric tons
Hits 10
CAT XII
Vacuum Power Rating 1 (0)
DB 0
EW ..... Not standard
Cost ..... ¢30,000
Top Speed ..... 200 kph
Armament ..... Not standard
Features:

- Basic Sensor Suite
- Microfrequency Comm Rig

Commentary: With the invention of the car comes the invention of the van. The van is an enclosed cargo vehicle, often used for transporting multiple passengers. It can carry eight passengers, but six of the passengers are often cashed in for twelve kiloliters of cargo space.

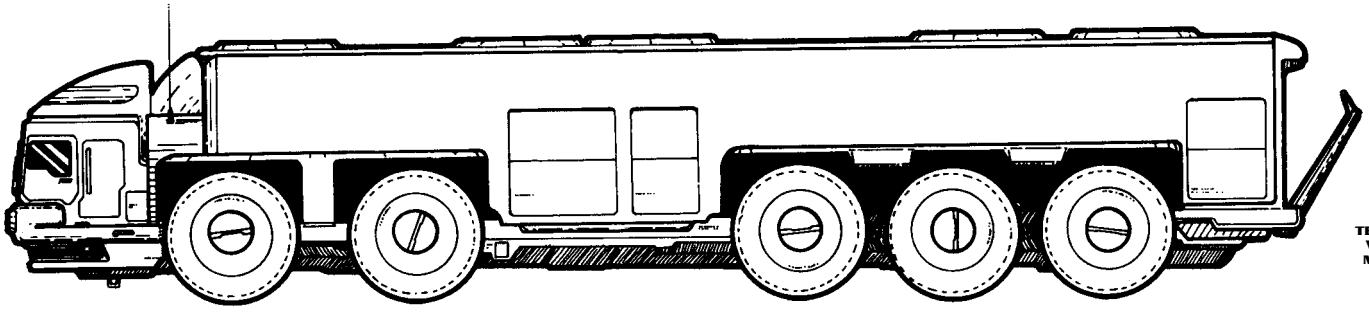


Ground Truck

Crew ..... 2 to 3 (1)
Cargo ..... 60 Kiloliters
Mass ..... 25 Metric tons
Hits 25
CAT XII
Vacuum Power Rating 1 (0)
DB 0
EW ..... Not standard
Cost ..... ¢50,000
Top Speed ..... 150 kph
Armament Not standard
Features:

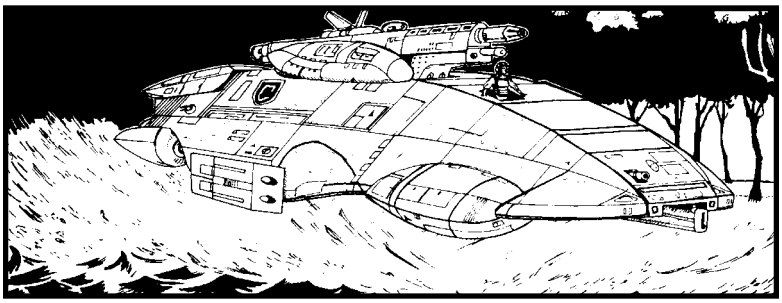
- Basic Sensor Suite
- Microfrequency Comm Rig

Commentary: With the invention of the automobile comes the invention of the truck. The truck is the cargo version of the passenger car. It can manage about 11 metric tons of cargo before its top speed is affected.



6.2 MARINE SHIPS

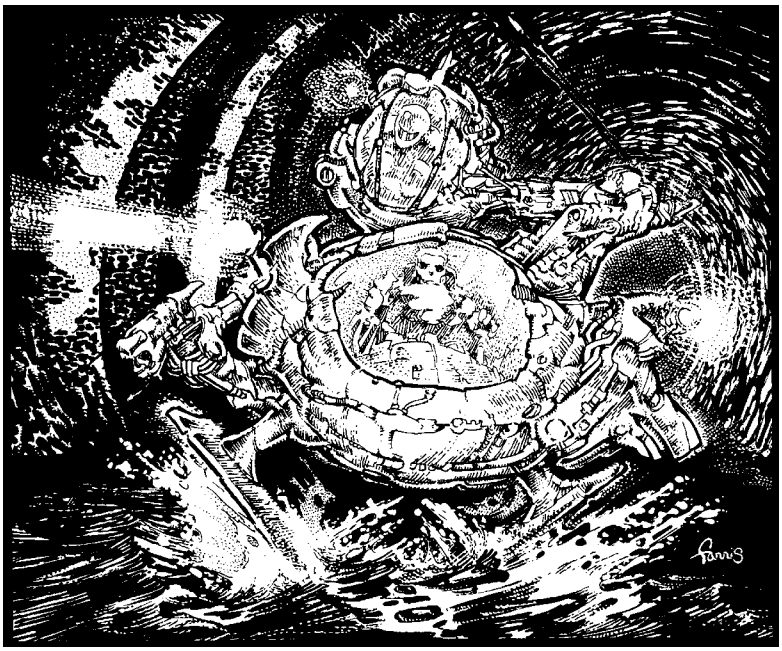
These ships are intended to traverse water. They typically float on top of the water, though certain ones ride on an air skirt. These "hover" craft are capable of traversing flat land in addition to water.



Hovercraft

Crew 2 (1)
Cargo ..... 4 Kiloliters (Only .2 Metric tons)
Mass ..... 1 Metric ton
Hits 5
CAT XI
Vacuum Power Rating 1 (0)
DB 0
EW ..... Not standard
Cost ..... ¢30,000
Top Speed ..... 100 kph
Armament ..... Not standard
Features:
- Basic Sensor Suite
- Microfrequency Comm Rig

Commentary: This craft rides on an air skirt. It is therefore capable of travel on both land and sea. It is not particularly good at either, however, so it is not common for use in terrain other than marshlands.



Speedboat

Crew 4 (1)
Cargo ..... 2 Kiloliters (Only .2 Metric tons)
Mass ..... 1 Metric ton
Hits 5
CAT XI
Vacuum Power Rating 1 (0)
DB 0
EW ..... Not standard
Cost ..... ¢25,000
Top Speed ..... 75 kph
Armament ..... Not standard
Features:
- Basic Sensor Suite
- Microfrequency Comm Rig

Commentary: This craft comes in open and closed versions. It is a high speed water craft, typically used for recreational purposes. It can comfortably fit four passengers, more if they don't mind sitting on the floor.

Hydrofoil

Crew 4 (1)
Cargo ..... 2 Kiloliters
Mass ..... 3 Metric tons
Hits 5
CAT XI
Vacuum Power Rating 1 (0)
DB 0
EW ..... Not standard
Cost ..... ¢15,000
Top Speed ..... 150 kph
Armament ..... Not standard
Features:
- Basic Sensor Suite
- Microfrequency Comm Rig

Commentary: This craft comes in open or closed versions. It is a modified speedboat, utilizing retractable hydrofoils. When the hydrofoils extend (the craft must be traveling fairly quickly), the craft is lifted out of the water, achieving greater speeds.

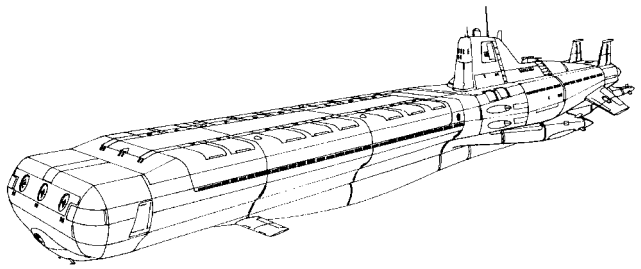
Hydroskimmer

Crew 2-4 (1)
Cargo ..... 5 Kiloliters
Mass ..... 2 Metric tons
Hits 5
CAT XI
Vacuum Power Rating 1 (0)
DB 0
EW ..... Not standard
Cost ..... ¢80,000
Top Speed ..... 250 kph
Armament ..... Not standard
Features:
- Basic Sensor Suite
- Microfrequency Comm Rig

Commentary: This is a fast version of the hydrofoil. It is about the fastest thing on the water (faster vehicles tend to fly).

6.3 AIRCRAFT AND SMALL SPACECRAFT

These crafts are capable of atmospheric and space travel. They range from private craft to military vehicles and tend to cover all walks of life.



Submersible, Large

Crew 6 (1)
Cargo ..... 10 Kiloliters
Mass ..... 40 Metric tons
Hits 40
CAT XI
Vacuum Power Rating 1 (0)
DB 0
EW ..... Not standard
Cost ..... ¢35,000
Top Speed ..... 35 kph submerged,70 kph exposed
Armament ..... Not standard
Features:

- Basic Sensor Suite
- Microfrequency Comm Rig

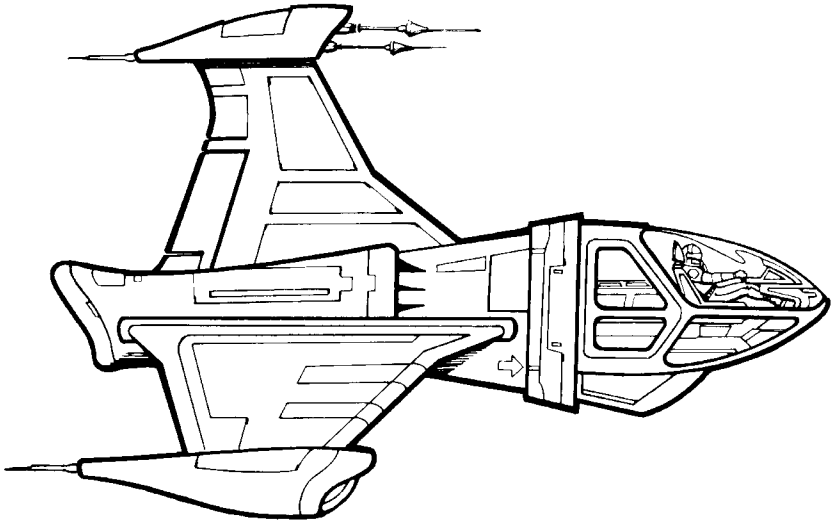
Commentary: This craft is capable of traveling underwater. This is only large in comparison to the small submersible and is nowhere near the size of military submersibles. This has a full-blown life support system, and can operate underwater indefinitely.

Submersible, Small

Crew 2 (1)
Cargo ..... 2 Kiloliters
Mass ..... 4 Metric tons
Hits 5
CAT XIV
Vacuum Power Rating 1 (0)
DB 0
EW ..... Not standard
Cost ..... ¢30,000
Top Speed ..... 15 kph submerged, 30 kph exposed
Armament ..... Not standard
Features:

- Basic Sensor Suite
- Microfrequency Comm Rig

Commentary: This craft is electrically powered and capable of operating for 4 mandays before its life support runs out. This submersible is often used for research trips.



Courier Shuttle

Crew 4 (1)
Cargo ..... 150 Kiloliters (50 metric tons)
Mass ..... 98 Metric tons
Hits 98
CAT XII
Vacuum Power Rating 11 (0)
DB 50
EW ..... Not standard
Cost ..... ¢465,000
Top Speed ..... 10.211 Gs, 6,000 kph airspeed
Translight Capability ..... None
Atmospheric Capability ..... Full
Armament ..... Not standard
Features:

- Basic Sensor Suite
- Microfrequency Comm Rig
- Artificial Gravity

Commentary: This is a high speed shuttle. It is atmosphere capable; however, it is rarely used for atmospheric landings.

Death Howl II Heavy Fighter

Crew 1
Cargo ..... 1 Kiloliter
Mass ..... 370 Metric tons
Hits 462
CAT XIV
Vacuum Power Rating 214 (0)
DB 95
- Armor Belt ..... +25
- Defense Screens ..... +30
- Evade Program ..... +40
- 20 Decoys
- Point Defense Rating: 8, 6 Attacks

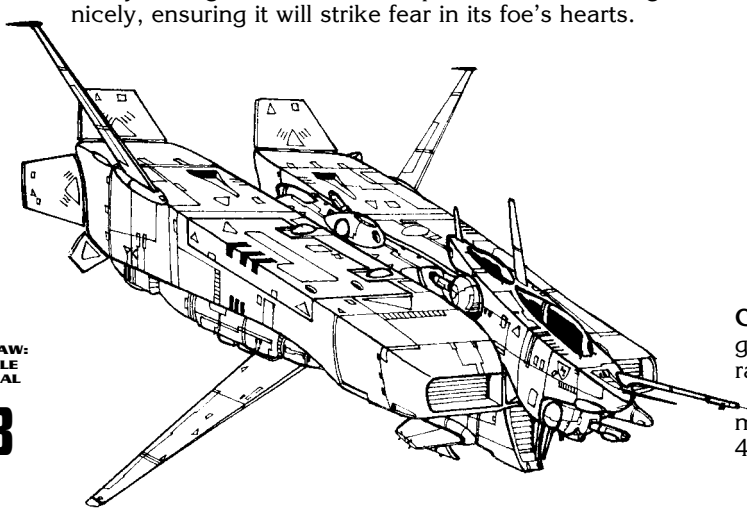
EW 25/5
Cost ..... ¢56,000,000
Top Speed ..... 15.137 Gs, 5,000 kph airspeed
Translight Capability ..... None
Atmospheric Capability ..... Full
Armament:
- 6 MK 10 Blasters (Flexible Mount), +90
- 1 MK 10 Missile Launcher (10 Missiles, Turret), +91

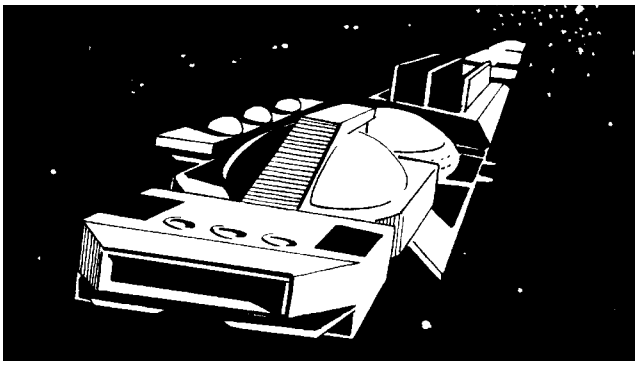
Features:
- Microfrequency Comm Rig
- Advanced Sensor Suite
- Quantum Comm Rig
- Shielded Weapons
- Well Shielded Drive
- Cramped

Auxiliary Systems:
- RIF Generator
- Life Support
- Vacuum Power Generator
- Advanced Sensor Suite
- Drive (1.849 Gs Loaded, 2,000 kph airspeed)

Commentary: The Death Howl is the supreme fighter of the Jeronan Empire. It is the fighter of choice, and is generally reserved for Falanar. As the Jeronans don't believe in spreading the glory of battle between a pilot and a gunner, this is the ultimate craft of the enemy.

The Death Howl is 370 metric tons of roaring terror. When the six-blaster technology was stolen by Jeronan spies from the S-8 Hawk, the old design was immediately scrapped. The missile launcher is merely an afterthought, more of an insult than an injury. In addition, the Death Howl is a masterful design, with heavily shielded engines and emergency systems, the craft can persevere in the face of heavy damage. The durable weapons round out this fighter nicely, ensuring it will strike fear in its foe's hearts.





Goliath Heavy Freighter

Crew 694 (70)
- 60 Military Stateroom
- 634 Crew Berths

Cargo ..... 344,976 Kiloliters (114,992 Metric tons)
Mass ..... 200,001 Metric tons
Hits 200,001
CAT XVII
Vacuum Power Rating 5,400 (0)
DB 0
- Radiation Shielding ..... (+20)

EW ..... Not standard
Cost ..... ¢595,100,000
Top Speed ..... 2 Gs
Translight Capability ..... Level One Drive
Atmospheric Capability ..... None
Armament ..... Not standard
Features:
- Microfrequency Comm Rig
- Basic Sensor Suite
- Quantum Comm Rig
- Artificial Gravity
- Medical Dispensary

Commentary: This freighter is very large (it takes large vehicle criticals). It is the most commonly built ISC heavy freighter, known throughout ISC space.

Though it is possible for the engines to accelerate an unloaded Goliath at more than 4 Gs, this is not advisable, since the hull can only withstand 2 Gs of acceleration before collapsing.

Gravcar

Crew 2-5 (1)
Cargo ..... 3 Kiloliters
Mass ..... 2 Metric tons
Hits 5
CAT XI
Vacuum Power Rating 1 (0)
DB 0
EW ..... Not standard
Cost ..... ¢730,000
Top Speed ..... 500 kph
Translight Capability ..... None
Atmospheric Capability ..... Exclusive
Armament ..... Not standard
Features:
- Basic Sensor Suite
- Microfrequency Comm Rig

Commentary: This is typically an enclosed vehicle. It rides on gravitic lifters, allowing flight at any altitude, though it is rarely wise to take one out of the atmosphere.

The speed assumes cargo and passengers weighing not more than 200 kg. A full load drops the maximum speed to 400 kph.

Gravprop Plane, Small

Crew 2 (1)
Cargo ..... 2 Kiloliters
Mass ..... 2 Metric tons
Hits 5
CAT XI
Vacuum Power Rating 1 (0)
DB 0
EW ..... Not standard
Cost ..... ¢20,000
Top Speed ..... 750 kph
Translight Capability ..... None
Atmospheric Capability ..... Exclusive
Armament ..... Not standard
Features:
- Microfrequency Comm Rig
- Basic Sensor Suite

Commentary: This is a small private aircraft, powered with a reactionless drive. It does not have hover ability; it merely uses a reactionless drive for forward motion, thus creating lift.

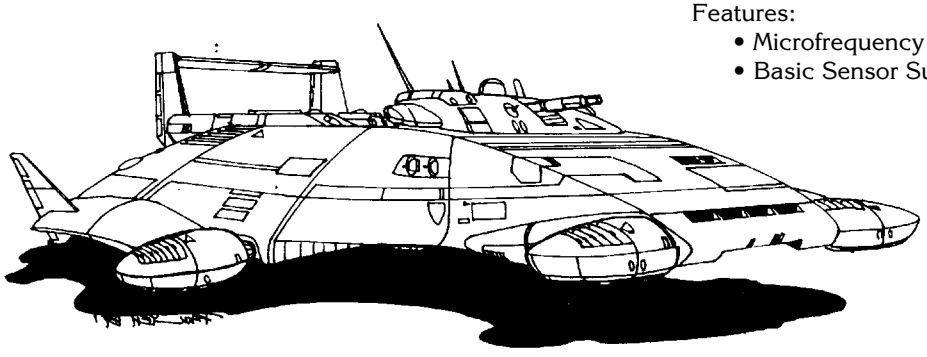
Gravitic Assault Craft

Crew 2-12 (1)
Cargo ..... 5 Kiloliters
Mass ..... 18 Metric tons
Hits 18
CAT XIV
Vacuum Power Rating 3 (0)
DB 40
- Material Bonus ..... +25
- Evade ..... +15

EW 10/0
Cost ..... ¢6,693,610
Top Speed ..... 200 kph
Translight Capability ..... None
Atmospheric Capability ..... Exclusive
Armament:
- 1 MK 10 Chaingun, +45
- 40 MK 10 Dumbfire Missiles, +30

Features:
- Microfrequency Comm Rig
- Advanced Sensor Suite

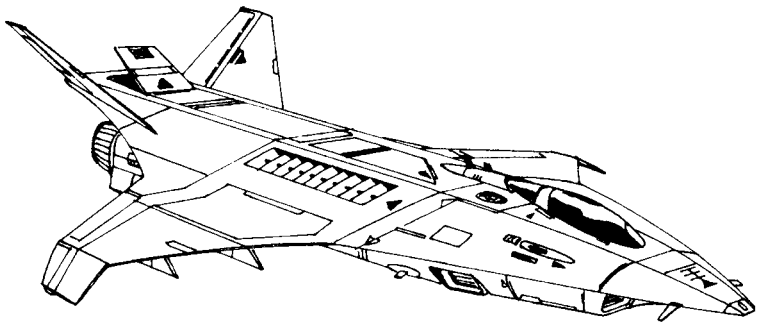
Commentary: This is an assault version of the gravvan. This is useful in urban pacification and troop insertion.



Gravprop Plane, Large

Crew 4 (1)
Cargo ..... 4 Kiloliters
Mass ..... 2 Metric tons
Hits 5
CAT XI
Vacuum Power Rating 1 (0)
DB 0
EW ..... Not standard
Cost ..... ¢40,000
Top Speed ..... 75 kph
Translight Capability ..... None
Atmospheric Capability ..... Exclusive
Armament ..... Not standard
Features:
- Microfrequency Comm Rig
- Basic Sensor Suite

Commentary: This is a larger gravprop plane.



Gravvan

Crew 2-8 (1)
Cargo ..... 7 Kiloliters
Mass ..... 8 Metric tons
Hits 8
CAT XI
Vacuum Power Rating 1 (0)
DB 0
EW ..... Not standard
Cost ..... ¢750,000
Top Speed ..... 300 kph
Translight Capability ..... None
Atmospheric Capability ..... Exclusive
Armament ..... Not standard
Features:
- Microfrequency Comm Rig
- Basic Sensor Suite

Commentary: With the invention of the gravcar comes the invention of the gravvan. The gravvan is an enclosed cargo vehicle, often used for transporting multiple passengers. It can carry eight passengers, but six of the passengers are often cashed in for twelve kiloliters of cargo space.

Kizzari Military Packet

Crew 764
- 200 General Crew Berths
- 70 Military Staterooms
- 10 First Class Staterooms
- 20 Standard Staterooms
- 30 Low Staterooms
- (60 Passengers)

Cargo ..... 6,837 Kiloliters (2,279 Metric tons)
Mass ..... 25,000 Metric tons
Hits 25,000
CAT XX
Vacuum Power Rating 105,432 (0)
DB 70
- Defensive Screens ..... +70
- Point Defense Rating: 8, 6 Attacks

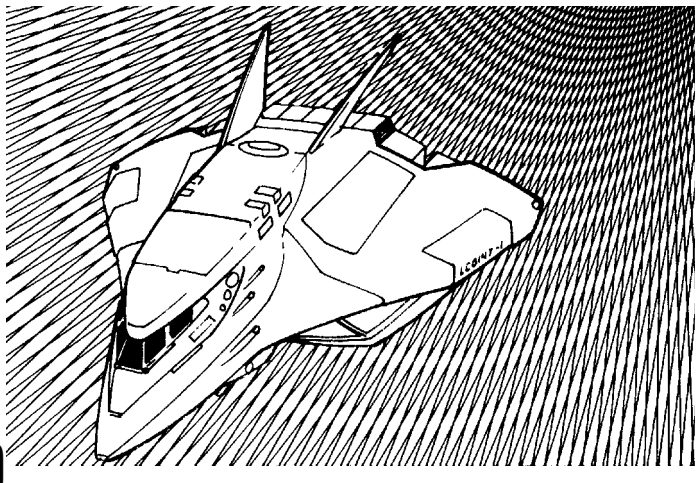
EW ..... Not standard
Cost ..... ¢666,875,000
Top Speed ..... 17 Gs loaded, 18.7 unloaded
Translight Capability ..... Level 3 Quantum Drive
Atmospheric Capability ..... None
Armament:
- 4 Mark 10 Blaster Turret, +122
- 4 Mark 10 Blaster Turret, +122
- 4 Mark 10 Blaster Turret, +122
- 4 Mark 10 Blaster Turret, +122

Features:
- Microfrequency Comm Rig
- Quantum Comm Rig
- Advanced Sensor Suite
- Artificial Gravity
- Workshop (4,500,000 CIP)
- Sick Bay (50 Capacity)

Commentary: Named after the fastest bird in civilized space, this is the fastest ship ever created. A massive amount of labor and tonnage is devoted to accelerating a relativity small payload. This ship is designed to carry passengers and cargo of the most time-critical nature.

This craft is poorly armed, but since nothing can catch it, this is of little concern. It is lightly armed to handle self defense while coming into a system, and the hull requirements necessary to support its bulk and acceleration make it durable enough to hold out until a fighter escort can arrive.

It should be noted that the crew requirements of this craft far exceed its housing and life support capabilities.



Hierarch FTL Shuttle

Crew 9 (1)
- 6 Passenger Seats
- 3 Military Staterooms
- 6 Crew Berths
- 3 First Class Staterooms

Cargo ..... 12 Kiloliters (4 Metric tons)
Mass ..... 218 Metric tons
Hits 218
CAT XIII
Vacuum Power Rating 1,013 (0)
DB 40
EW ..... Not standard
Cost ..... ¢1,700,000
Top Speed ..... 5.045 Gs, 4,000 kph airspeed
Translight Capability ..... Level One Drive
Atmospheric Capability ..... Full
Armament ..... Not standard
Features:
- Basic Sensor Suite
- Microfrequency Comm Rig
- Quantum Comm Rig
- Medical Dispensary
- Artificial Gravity

Commentary: This shuttle is only used for short trips for VIPs. Since it takes more personnel to man it than it transports, and since it has few staterooms, its uses are limited.

This craft is undermanned as it is, having no one to man the comm gear or the sensors. Typically, if something occurs that requires someone to pay close attention (they are usually set up on automatic scanning), they pull one of the three pilots who's off duty.

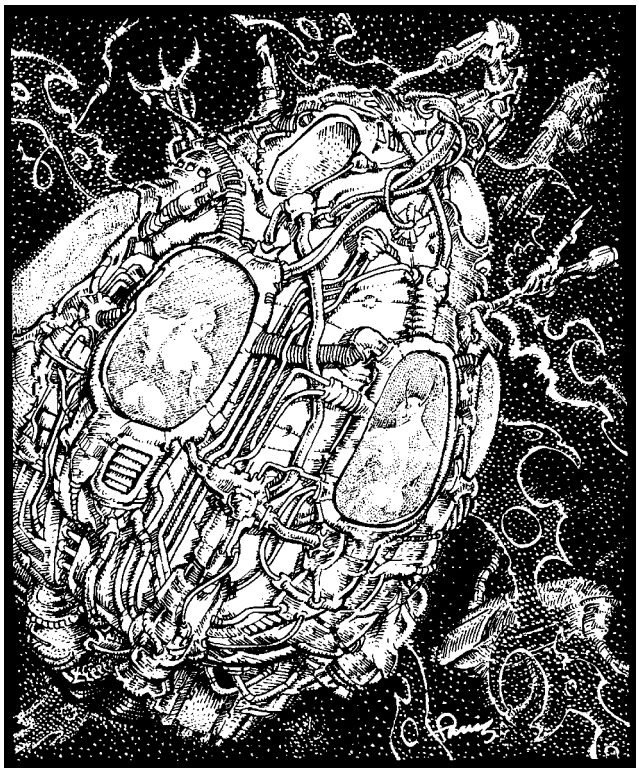
This shuttle has a problem. The 6 seats were added late in design, as an afterthought. Because of this, its once more than ample life support system now is sub par. After three days of use, the CO_2 scrubbers tend to go out and the ship begins filling with poisons. Therefore, on trips longer than three days, this craft must travel with three people less than its maximum.

"Light Horse" Class FAV

Crew 2 (1)
Cargo ..... 0.5 Kiloliters
Mass ..... 3 Metric tons
Hits 5
CAT XIII
Vacuum Power Rating 6 (0)
DB 70
- Material Bonus ..... +25
- Evade ..... +45

EW ..... Not standard
Cost ..... ¢2,093,000
Top Speed ..... 500 kph
Translight Capability ..... None
Atmospheric Capability ..... Exclusive
Armament ..... 1 MK 5 Pulse Laser, +65
Features:
- Microfreq. Comm Rig
- Basic Sensor Suite

Commentary: Knights of the Horse come in two types. The Light Horse, the most common, ride these fast assault vehicles. Typically piloted by one man, these gravbikes are used for a fast-moving attack.



Life Pod

Crew 5 (0)
Cargo ..... 2 Kiloliters
Mass ..... 2 Metric tons
Hits 5
CAT XI
Vacuum Power Rating 1 (0)
DB 0
EW ..... Not standard
Cost ..... ¢250,000
Top Speed ..... Maneuverability thrusters only
Armament ..... Not standard
Features:

- Microfrequency Comm Rig
- Basic Sensor Suite

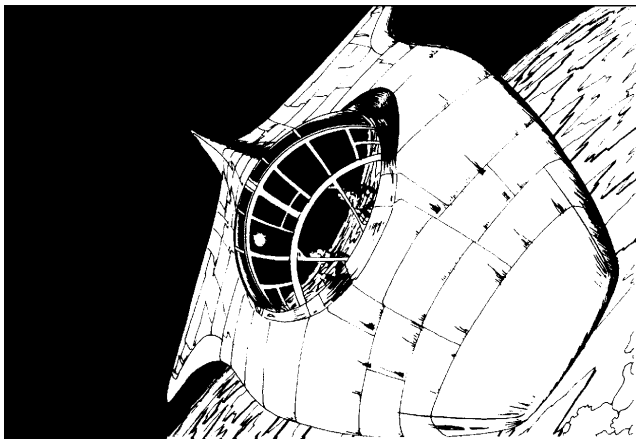
Commentary: This is a small, five passenger life pod. It is capable of very little maneuverability. It has parachutes for atmospheric braking. It only has enough life support to last one week.

Maintenance Pod

Crew 1
Cargo ..... 2 Kiloliters
Mass ..... 1 Metric ton
Hits 5
CAT XI
Vacuum Power Rating 1 (0)
DB 0
EW ..... Not standard
Cost ..... ¢10,000
Top Speed ..... Maneuverability thrusters only
Translight Capability ..... None
Atmospheric Capability ..... None
Armament ..... Not standard
Features:

- Microfrequency Comm Rig
- Basic Sensor Suite

Commentary: This is a small, one-man space pod. It is capable of only the slowest maneuvers and has two manipulator arms. It is usually carried on space stations or ships. It only has about 12 hours worth of air.



Orbital Shuttle, Small

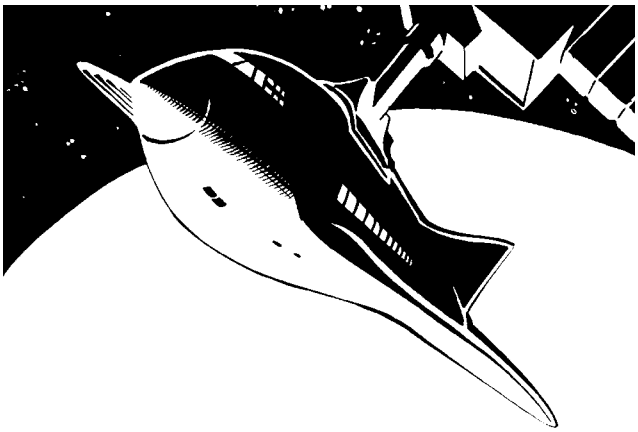
Crew 1

- 12 Seats

Cargo ..... 15 Kiloliters (5 Metric tons)
Mass ..... 25 Metric tons
Hits 25
CAT XI
Vacuum Power Rating 3 (0)
DB 0
EW ..... Not standard
Cost ..... ¢200,000
Top Speed ..... 5,000 kph airspeed, 10 Gs loaded, 12.745 Gs unloaded
Translight Capability ..... None
Atmospheric Capability ..... Take off and landing only
Armament ..... Not standard
Features:

- Microfrequency Comm Rig
- Basic Sensor Suite
- Artificial Gravity

Commentary: This is a small orbital shuttle, capable of achieving high orbit; though it rarely needs to pass the Clarke orbit, where geosynchronous stations are placed.



Orbital Shuttle, Large

Crew 1
- 54 Passengers

Cargo ..... 25 Kiloliters (8.8 Metric tons)
Mass ..... 90 Metric tons
Hits 90
CAT XI
Vacuum Power Rating 10 (0)
DB 0
EW ..... Not standard
Cost ..... ¢400,000
Top Speed ..... 5,000 kph airspeed, 10 Gs loaded, 11.088 Gs unloaded
Translight Capability ..... None
Atmospheric Capability .. Take off and landing only
Armament ..... Not standard
Features:
- Microfrequency Comm Rig
- Basic Sensor Suite
- Artificial Gravity

Commentary: This is a larger orbital shuttle. It usually is used to ferry passengers to space stations.

Tiltrotor, Attack

Crew 2 (1)
Cargo ..... 1 Kiloliters
Mass ..... 19 Metric tons
Hits 19
CAT XI
Vacuum Power Rating 13 (0)
DB 40
- Defensive Screens ..... +40

EW 15/0
Cost ..... ¢7,000,000
Top Speed ..... 200 kph
Translight Capability ..... None
Atmospheric Capability ..... Exclusive
Armament:
- 1 MK 10 Laser, +65
- 50 MK 10 Missiles, +65

Features:
- Advanced Sensor Suite
- Microfrequency Comm Rig
- Cramped

Commentary: This two-man helicopter is used for military support. It is a workhorse in the infantry support venue.

Tiltrotor, Large

Crew 14 (1)
Cargo ..... 10 Kiloliters
Mass ..... 2 Metric tons
Hits 5
CAT XI
Vacuum Power Rating 1 (0)
DB 0
EW ..... Not standard
Cost ..... ¢50,000
Top Speed ..... 150 kph
Translight Capability ..... None
Atmospheric Capability ..... Exclusive
Armament ..... Not standard
Features:
- Microfrequency Comm Rig
- Basic Sensor Suite

Commentary: This larger helicopter is often used for medical evacuation. It seats 12 and is capable of accepting weapon mounts.

Tiltrotor, Small

Crew 2 (1)
Cargo ..... 2 Kiloliters
Mass ..... 1 Metric ton
Hits 5
CAT XI
Vacuum Power Rating 1 (0)
DB 0
EW ..... Not standard
Cost ..... ¢25,000
Top Speed ..... 150 kph
Translight Capability ..... None
Atmospheric Capability ..... Exclusive
Armament ..... Not standard
Features:
- Microfrequency Comm Rig
- Basic Sensor Suite

Commentary: This small helicopter is used most often for private or commercial use.

S-5B Sparrow, Long Range Interceptor

Crew 1
Cargo ..... 1 Kiloliter (1 Metric ton)
Mass ..... 56.8 Metric tons
Hits 62
CAT XIV
Vacuum Power Rating 90 (0)
DB 85
- Armor Belt ..... +10
- Defensive Screens ..... +25
- Evade ..... +50
- 5 Decoys

EW 50/10
Cost ..... ¢3,900,000
Top Speed ..... 18.627 Gs, 6,000 kph airspeed
Translight Capability ..... None
Atmospheric Capability ..... Full
Armament ..... 2 MK 10 Pulse Lasers (Flexible mount +90)

Features:
- Microfrequency Comm Rig
- Advanced Sensor Suite
- Quantum Comm Rig
- Cramped

Commentary: Built by Faluph Aerospace, The Sparrow is the scout ship of choice of the ISC. It is the fastest fighter in mainline production, but is rarely used in full combat. Though its dogfighting capabilities are adequate for its size, it is just too fragile for hard combat.

The Sparrow has nothing going for it but its speed. Its weapons yield poor damage and have a weak range, and though it's tough for its size, it will always be a popcorn ship.

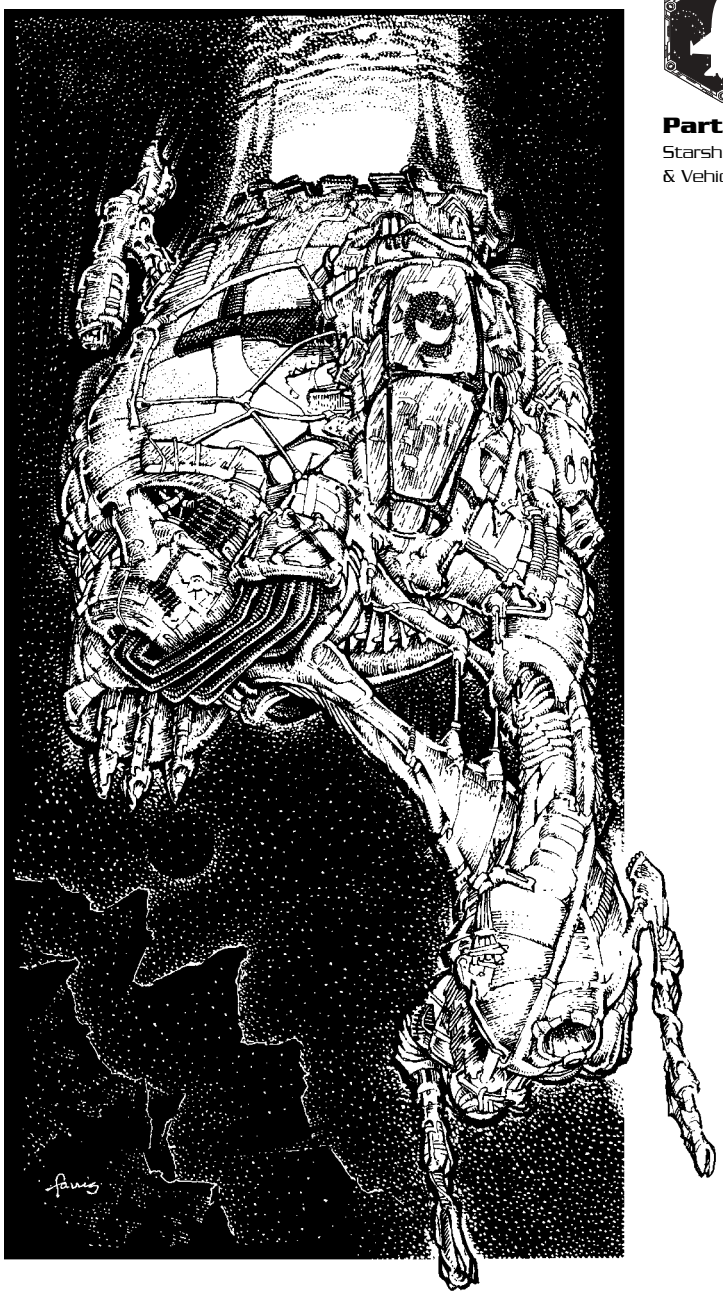
S-8B Hawk, Space Superiority Fighter

Crew 1
Cargo ..... 1 Kiloliter (1 Metric ton)
Mass ..... 338.9 Metric tons
Hits 424
CAT XV
Vacuum Power Rating 225 (0)
DB 75
- Armor Belt ..... +25
- Defensive Screens ..... +20
- Evade ..... +30
- 10 Decoys
- Point Def. Rating: 8, 6 Attacks

EW 50/10
Cost ..... ¢46,607,000
Top Speed ..... 14.163 Gs, 5,000 kph airspeed
Translight Capability ..... None
Atmospheric Capability ..... Full
Armament ..... 6 MK 10 Blasters (Flexible +60)

Features:
- Microfrequency Comm Rig
- Quantum Comm Rig
- Advanced Sensor Suite
- Shielded Weapons
- Armored Cockpit
- Cramped
- Top Quality Weapons

Auxiliary Systems:
- RIF Generator
- Quantum Comm Rig
- Adv. Sensor Suite
- Life Support
- Vacuum Power Generator



Commentary: Built by Faluph Aerospace, The Hawk is not only the fighter of choice for the Knights of the Hawk, it is perhaps the greatest single-person fighter ever built. It is so well designed that the Jeronans stole its weapon configuration for their Death Howl (though they don't have the production facilities to build them as well). This, along with the Blood Hawk, is the only battle-tested fighter in the ISC arsenal.

If your enemy isn't afraid of you yet, wait until those six blasters take a piece out of them. Sure, they're the Hawk's only weapons, but they are so well shielded, the Hawk keeps them until the bloody end. In fact, the Hawk is one of the most durable fighters in the skies, with its heavy armor belt and powerful weapons. If you're on the side of the good guys, you want to try to crawl into one of these.

Every Knight of the Hawk who hasn't taken a squire pilots one of these. This fighter, and its predecessors, has taken part in almost every major conflict of the ISC. If the knighthood thinks a cause is just, expect a carrier to drop several hundred of these fighters into the fray within days.

S-9C Blood Hawk, Heavy Assault Fighter

Crew 2 (1)
Cargo ..... 2 Kiloliters (1 Metric ton)
Mass ..... 1,015 Metric tons
Hits 1,269
CAT XV
Vacuum Power Rating 437 (38)
DB 85
- Armor Belt ..... +25
- Defensive Screens ..... +40
- Evade ..... +20
- 10 Decoys
- Point Defense Rating: 8, 6 Attacks

EW 50/10
Cost ..... ¢100,730,000
Top Speed ..... 12.808 Gs, 5,000 kph airspeed
Translight Capability ..... None
Atmospheric Capability ..... Take off and landing only

Armament:
- 4 MK 10 Blasters, +75
- 4 MK 20 Blasters, +85
- 2 MK 10 Disruptors, +75

Features:
- Microfrequency Comm Rig
- Quantum Comm Rig
- Advanced Sensor Suite
- Shielded Weapons
- Armored Cockpit
- Armored Gunner
- Cramped
- Top Quality Weapons
- Artificial Gravity

Auxiliary Systems:
- RIF Generator
- Quantum Comm Rig
- Advanced Sensor Suite
- Life Support
- Vacuum Power Generator

Commentary: When a Knight of the Hawk acquires a squire, they are upgraded to the Blood Hawk, where their squire can prove himself on the disruptors. The Blood Hawk is another miracle product of Faluph Aerospace. It is big, mean, and durable, the most durable fighter out there. Since this is a Knighthood fighter, it has been extensively battle tested.

The Blood Hawk is big; so big that it's simply not capable of atmospheric combat. It's powerful, however. With its 4 compact blasters to soften up a foe and 4 small blasters to finish them off, this fighter is a killing machine.

Another problem that sometimes plagues this craft is its less efficient point defense system. The system was dropped in quality from the smaller model, assuming that the gunner could pick up the slack, shooting down incoming torpedoes. Unfortunately, the larger disruptors aren't maneuverable enough to target many torpedoes. This problem is rarely a concern, however. If there is one thing this craft can do, it's take a torpedo hit.

S-12B Hammer, Heavy Weapons Platform

Crew 1
Cargo ..... 1 Kiloliter (1 Metric ton)
Mass ..... 367.9 Metric tons
Hits 405
CAT XIV
Vacuum Power Rating 195 (0)
DB 75
- Armor Belt ..... +10
- Defensive Screens ..... +15
- Evade ..... +50
- 10 Decoys • Point Def. Rating: 7, 3 Attacks

EW 50/10
Cost ..... ¢33,000,000
Top Speed ..... 15.489 Gs, 5,000 kph airspeed
Translight Capability ..... None
Atmospheric Capability ..... Full

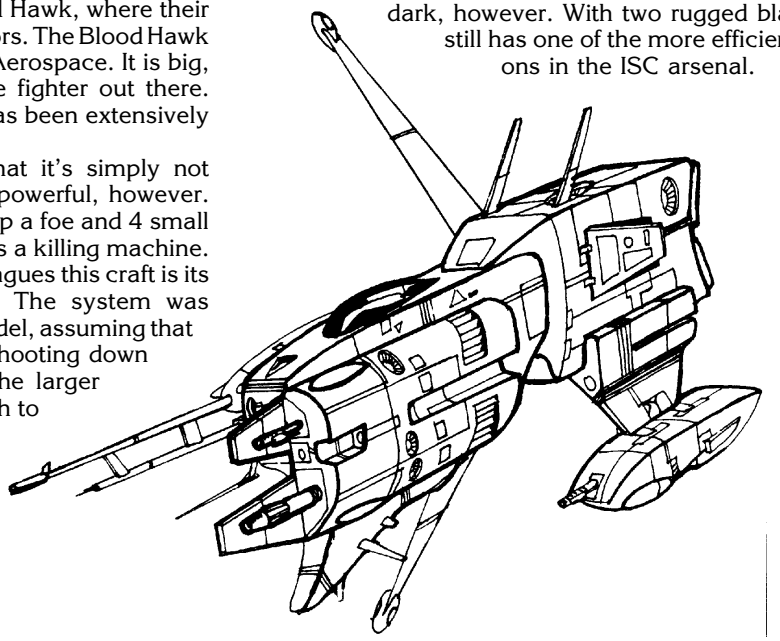
Armament:
- 2 MK 10 Blasters (Flexible, +75)
- 3 MK Missile Launchers (50 Missiles each), +65
- 4 MK 50 Torpedoes
- 10 MK 10 Torpedoes

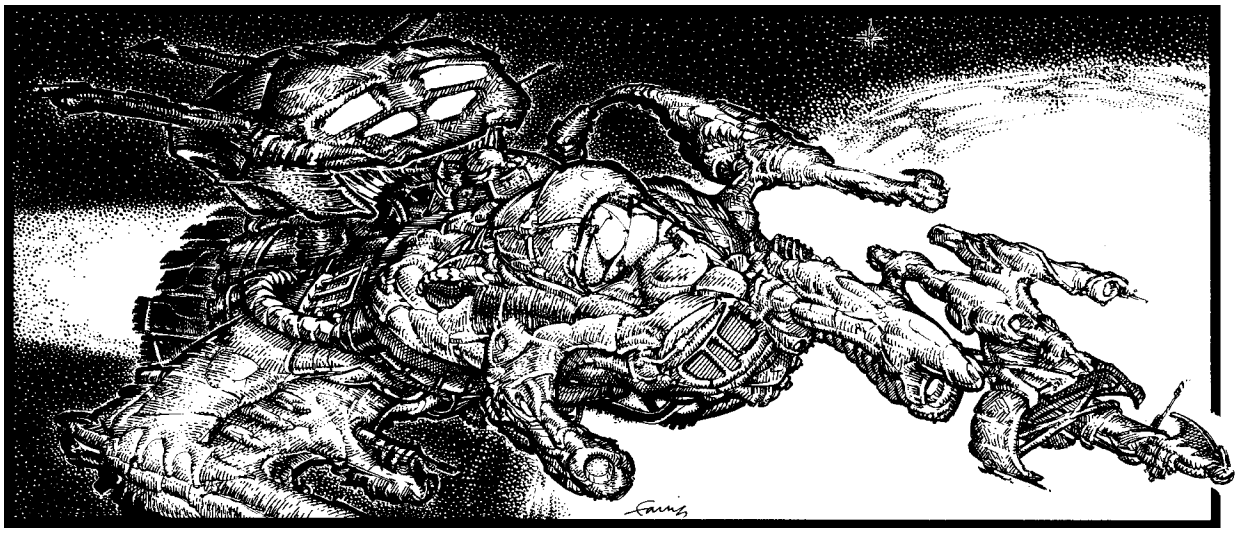
Features:
- Microfrequency Comm Rig
- Quantum Comm Rig
- Adv. Sensor Suite • Cramped

Auxiliary Systems:
- RIF Generator • Quantum Comm Rig
- Adv. Sensor Suite • Life Support
- Vacuum Power Generator

Commentary: Made by General Dynamics, the Hammer is a hard-hitting, payload-intensive fighter. One of the best designs to be flying at the beginning of the war, it is not plagued by the problems of other ISC fighters. This is probably due to the relative simplicity of the craft, which was designed to fly in, drop its payload, and get the hell out of Dodge.

The Hammer is designed to do one thing, and that is to deliver its payload. Though it is a reasonably durable craft, it is not designed to dogfight, and it probably wants to avoid it. The designers did not leave it completely out in the dark, however. With two rugged blasters, it still has one of the more efficient weapons in the ISC arsenal.





S-17B Thunderstroke, Heavy Defense Fighter

Crew 2 (1)
Cargo ..... 2 Kiloliters (1 Metric ton)
Mass ..... 792 Metric tons
Hits 871
CAT XIV
Vacuum Power Rating 249 (0)
DB 75
- Armor Belt ..... +10
- Defensive Screens ..... +15
- Evade ..... +50
- 10 Decoys • Point Def. Rating: 5, 6 Attacks

EW 50/10
Cost ..... ¢66,000,000
Top Speed ..... 12.626 Gs loaded, 13.761 Gs unloaded, 5,000 kph airspeed
Translight Capability ..... None
Atmospheric Capability ..... Full
Armament:
- 6 MK 10 Autocannons (Flexible, +75, 1,250 rnds)
- 1 MK 10 Missile Launcher (20 Missiles, Flexible, +65)
- 4 MK 10 Autocannons (Turret, +76, 7,500 rnds)
- 1 MK 10 Missile Launcher (20 Miss., Turret, +65)
- 1 MK 40 Torpedo • 4 MK 10 Torpedoes

Features:
- Microfreq. Comm Rig • Quantum Comm Rig
- Advanced Sensor Suite • Cramped
- Agile Communication System
- Armored Cockpit • Armored Gunner
- Artificial Gravity • Computer Translator
- Top Quality Weapons • Overly Complex

Auxiliary Systems:
- RIF Generator • Quantum Comm Rig
- Advanced Sensor Suite • Life Support
- Vacuum Power Generator

Commentary: The Thunderstroke is the defense fighter of the ISC. Built by Douglas-Galuph, this is the height of ISC technology. If it had been battle tested before the war, it would have certainly stemmed the tide of the initial assault. It wasn't tested, and it was therefore plagued with problems throughout the early days.

The S-17 is the best and the worst of all ISC fighters. Plagued by its own complexity, it proved to be incredibly fragile, with rampant system problems and exposed torpedoes. The ship wasn't a complete write off however; the engines and weapons proved to be well shielded and durable, and it rarely ran out of ammo before having a chance to refuel and reload.

The biggest problem with this fighter is the lack of a punch weapon. Though the original disruptors proved in simulation to be potentially damaging weapons for their size, in reality, they proved to be painfully underpowered.

Slashing Blow III Medium Fighter

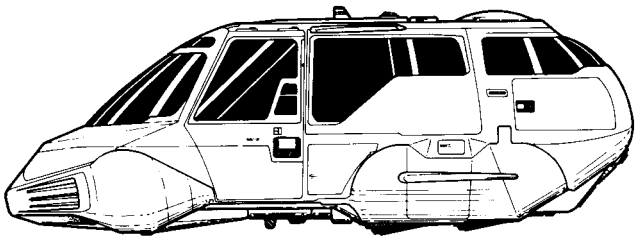
Crew 1
Cargo ..... 1 Kiloliter
Mass ..... 244.8 Metric tons
Hits 269
CAT XIV
Vacuum Power Rating 174 (0)
DB 90
- Armor Belt ..... +10
- Defensive Screens ..... +30
- Evade ..... +50
- 10 Decoys • Point Def. Rating: 8, 6 Attacks

EW 25/5
Cost ..... ¢42,300,000
Top Speed ..... 16.34 Gs, 6,000 kph airspeed
Translight Capability ..... None
Atmospheric Capability ..... Full
Armament: • 4 MK 10 Blasters (Flexible, +90)
- 1 Missile Launcher (5 Missiles, Fixed, +90)

Features:
- Microfreq. Comm Rig • Adv. Sensor Suite
- Quantum Comm Rig • Shielded Weapons
- Well Shielded Drive • Cramped

Auxiliary Systems: • Advanced Sensor Suite
- RIF Generator • Life Support
- Vacuum Power Generator
- Drive (.817 Gs, 1,800 kph airspeed)

Commentary: This is the medium fighter of the Empire. As such, it is primarily piloted by Falaron. This is an unremarkable fighter. It is solid, but not remarkably so. Its greatest claim to fame is its durable engines.

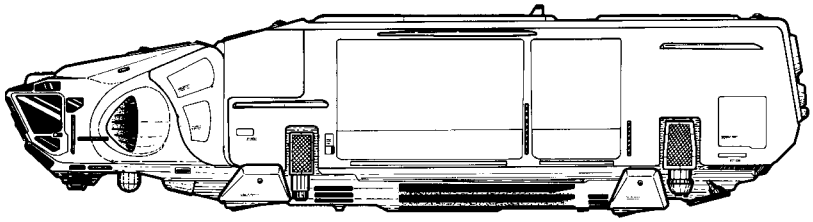


VT Car

Crew 2-5 (1)
Cargo ..... 3 Kiloliters (.2 Metric tons)
Mass ..... 2 Metric tons
Hits 5
CAT XI
Vacuum Power Rating 1 (0)
DB 0
EW ..... Not standard
Cost ..... ¢150,000
Top Speed ..... 400 kph
Translight Capability ..... None
Atmospheric Capability ..... Exclusive
Armament ..... Not standard
Features:

- Microfrequency Comm Rig
- Basic Sensor Suite

Commentary: This is typically an enclosed vehicle. It is propelled by vectored thrust, and is thus capable of hovering.



VT Van

Crew 8 (1)
Cargo ..... 6 Kiloliters (2 Metric tons)
Mass ..... 10 Metric tons
Hits 10
CAT XI
Vacuum Power Rating 1 (0)
DB 0
EW ..... Not standard
Cost ..... ¢170,000
Top Speed ..... 450 kph
Translight Capability ..... None
Atmospheric Capability ..... Exclusive
Armament ..... Not standard
Features:

- Microfrequency Comm Rig
- Basic Sensor Suite

Commentary: With the invention of the VT car comes the invention of the VT van. Th van is an enclosed cargo vehicle, often used for transporting multiple passengers. It can carry eight passengers, but six of the passengers are often cashed in for twelve kiloliters of cargo space.

VT Truck

Crew 2-3 (1)
Cargo ..... 50 Kiloliters (15 Metric tons)
Mass ..... 20 Metric tons
Hits 20
CAT XI
Vacuum Power Rating 1 (0)
DB 0
EW ..... Not standard
Cost ..... ¢200,000
Top Speed ..... 450 kph
Translight Capability ..... None
Atmospheric Capability ..... Exclusive
Armament ..... Not standard
Features:

- Microfreq. Comm Rig
- Basic Sensor Suite

Commentary: With the invention of the VT car comes the invention of the VT truck. The truck is the cargo version of the car.

VT Bike

Crew 2 (1)
Cargo ..... Negligible
Mass ..... 0.25 Metric tons
Hits 1
CAT XI
Vacuum Power Rating 1 (0)
DB 0
EW ..... Not standard
Cost ..... ¢125,000
Top Speed ..... 500 kph
Translight Capability ..... None
Atmospheric Capability ..... Exclusive
Armament ..... Not standard
Features:

- Microfreq. Comm Rig
- Basic Sensor Suite

Commentary: This is a motorcycle suspended on vectored thrust engines. It seats one passenger comfortably, two if they're cozy.

VT Weapons Platform

Crew 10 (1)
Cargo ..... 5 Kiloliters (1.5 Metric tons)
Mass ..... 12 Metric tons
Hits 17
CAT XIII
Vacuum Power Rating 3 (0)
DB 25
EW 15
Cost ..... ¢13,000,000
Top Speed ..... 200 kph
Translight Capability ..... None
Atmospheric Capability ..... Exclusive
Armament:

- 1 MK 5 Chaingun, +45
- 40 Dumbfire Missiles

Features:

- Microfreq. Comm Rig
- Basic Sensor Suite

Commentary: This is an assault version of the VT Van. This is useful in urban pacification and troop insertion, but the helicopter is generally considered more useful for infantry support. It seats ten.

Warthog Medium Freighter

Crew 109 (10)
Cargo ..... 22,521 Kiloliters (7507 Metric tons)
Mass ..... 20,000 Metric tons
Hits 20,000
CAT XIV
Vacuum Power Rating 1,880 (0)
DB 0
EW ..... Not standard
Cost ..... ¢41,396,000
Top Speed ..... 4.001 Gs loaded, 6,404 unloaded, 4,000 kph airspeed
Translight Capability ..... Level One Drive
Atmospheric Capability ..... Partial
Armament ..... Not standard
Features:

- Microfrequency Comm Rig
- Quantum Comm Rig
- Basic Sensor Suite
- Medical Dispensary
- Artificial Gravity
- Catastrophic Atmospheric Flight Problems

Commentary: This freighter is of moderate size, just enough for a good-sized hold. It is known as the warthog because of its tremendously ugly appearance.

This craft is sturdy, aside from its problems with atmospheric flight. The hull was designed to take up to 8 Gs of acceleration, but the engine size was reduced just before the freighter went into production.

Wolverine Light Fighter

Crew 1
Cargo ..... 1 Kiloliter (1 Metric ton)
Mass ..... 113.6 Metric tons
Hits 125
CAT XIV
Vacuum Power Rating 82 (0)
DB 90

- Armor Belt ..... +10
- Defensive Screens ..... +30
- Evade ..... +50
- 10 Decoys
- Point Defense Rating: 5, 1 Attacks

EW 25/5
Cost ..... ¢10,000,000
Top Speed ..... 16.737 Gs, 6,000 kph airspeed
Translight Capability ..... None
Atmospheric Capability ..... Full
Armament:

- 2 MK 10 Blasters (Flexible, +90)

Features:

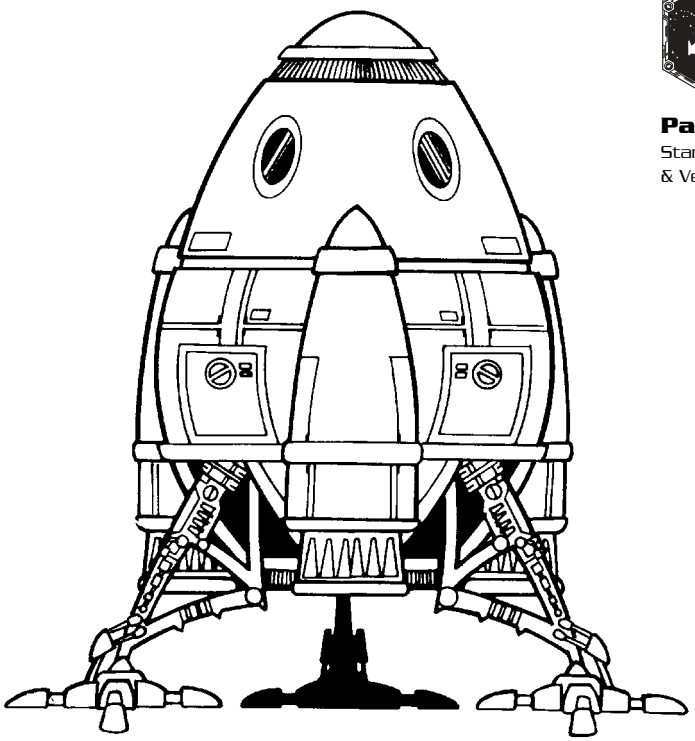
- Microfrequency Comm Rig
- Advanced Sensor Suite
- Quantum Comm Rig
- Shielded Weapons
- Well Shielded Drive
- Cramped

Auxiliary Systems:

- RIF Generator
- Life Support
- Vacuum Power Generator
- Adv. Sensor Suite
- Drive (1.761 Gs, 2,000 kph airspeed)

Commentary: The lightest Imperial fighter, this craft is generally forced on Falaris. It is a light interceptor.

This is a good workhorse of a fighter. Above all, it's cheap, so many pilots of many races are stuck inside. Its only real claim to fame is its durable engines, but it is a good fighter.



Zephyr Light Freighter

Crew 8 (1)

- 8 Military Staterooms

Cargo ..... 3,000 Kiloliters (1,000 Metric tons)
Mass ..... 2,200 Metric tons
Hits 2,200
CAT XIII
Vacuum Power Rating 1260 (0)
DB 0

- Radiation Shielding ..... (+20)

EW ..... Not standard
Cost ..... ¢9,000,000
Top Speed ..... 9.076 Gs loaded, 15 Gs unloaded, 5,000 kph airspeed
Translight Capability ..... Level One Drive
Atmospheric Capability ..... Full
Armament ..... Not standard
Features:

- Microfrequency Comm Rig
- Basic Sensor Suite
- Quantum Comm Rig
- Artificial Gravity
- Poor Atmospheric Entry

Commentary: This freighter is of moderate size, just enough for a small hold. It is actually capable of 16.619 Gs of acceleration unloaded, but the hull is only designed to handle 15.

This craft has a sophisticated SI computer. It takes on the roles of many crewmen (a real crew would total 34 men). The ship can run perfectly well like this, but in case of a malfunction, it's dangerously understaffed for damage control. As it's not intended to enter combat, this hasn't been a problem.

Lately, however, privateers have been taking these to the front line. Many have begun hiring androids to flesh out the crew.

6.4 DECOMMISSIONED GUNBOATS

It has long been the policy of the ISC to sell military craft that have been decommissioned to the private sector. All weapons are stripped from the craft, including payload pallets, decoys, and point defense systems. The craft is then sold at an even further reduced rate.

It is ISC policy to rely heavily on naval droids, so that they don't need to house and provide life support for the entire crew. Though the ISC can easily automate 80% of the tasks these crewmembers perform, in combat damage, control is as important as monitoring the systems, and that requires active hands. Often, these droids will work 25 hours a day, reducing the required number of androids to one third.

Since these craft are not meant to be taken into combat anymore, an SI is installed to bring the crew complement down to the number of beds. In addition, inert mass is used to replace the missing components, to maintain the craft's flight dynamic.

Izzari Police Gunboat

Crew 10 (2)
- 3 Military Staterooms
- 7 Crew Berths

Cargo ..... 30 Kiloliter (10 Metric tons)
Mass ..... 1,364.4 Metric tons
Hits 1,501
CAT XIV
Vacuum Power Rating 1,563 (224)
DB 90
- Armor Belt ..... +10
- Defensive Screens ..... +40
- Evade ..... +40

EW 50/10
Cost ..... ¢6,700,000
Top Speed ..... 14.292 Gs, 5,000 kph airspeed
Translight Capability ..... Level One Quantum Drive
Atmospheric Capability ..... Full
Armament ..... Removed
Features:
- Microfreq. Comm Rig
- Adv. Sensor Suite
- Cramped
- Docking Ring
- 16 Hard Points
- Wiring Defect
- Quantum Comm Rig
- Artificial Gravity
- 2 Airlocks
- External Speakers
- 246 metric tons of inert mass

Auxiliary Systems:
- RIF Generator
- Quantum Comm Rig
- Vacuum Power Generator
- Life Support
- Adv. Sensor Suite

Commentary: The Izzari was a fast gunboat. Fully atmosphere capable, it was used to approach and put down local unrest. With two quad-blaster turrets and a larger twin plasma cannon mount for bigger targets, it was more than adept at taking out ground targets. In the case of hardened bunkers, it had 16 torpedoes of various sizes. However a wiring defect made these sometimes difficult to fire.

The Izzari had a good record of subduing unrest and delivering paramilitary forces into riot situations. With its external speakers, it could present a message of peace or a threat of force long before it opened fire.

The Izzari was unpopular, however, due to its visual threat. No matter what spin the government placed on a situation, when the Izzari flew in, it was always interpreted as a direct attack.

The point defense system, payload pallets, and weapons have all been removed for sale. Otherwise, this is a highly modern craft. It was only decommissioned due to public opinion, not age.

The original crew complement was 39 (2 Gunners), 29 of them naval droids (though it was usually 10 naval droids performing voluntary round the clock duty). This has been supplemented by an SI to monitor the engine, generator, and other systems.

Kalzari System Patrol Boat

Crew 30 (3)
- 30 Military Staterooms

Cargo ..... 90 Kiloliter (30 Metric tons)
Mass ..... 3,186.2 Metric tons
Hits 3,504
CAT XVI
Vacuum Power Rating 10,919 (313)
DB 80
- Armor Belt ..... +10
- Defensive Screens ..... +50
- Evade ..... +20

EW 50/10
Cost ..... ¢4,000,000
Top Speed ..... 9.417 Gs, 5,000 kph airspeed
Translight Capability ..... Level Two Quantum Drive
Atmospheric Capability ..... Full
Armament ..... Removed
Features:
- Microfreq. Comm Rig
- Adv. Sensor Suite
- Cramped
- Docking Ring
- Medical Dispensary
- 16 Hard Points
- Quantum Comm Rig
- Artificial Gravity
- 2 Airlocks
- Workshop (382,822)
- 325 metric tons of inert mass

Auxiliary Systems:
- RIF Generator
- Quantum Comm Rig
- Vacuum Power Generator
- Life Support
- Adv. Sensor Suite

Commentary: One of the great workhorses of the ISC, this gunboat was prominently featured in many border skirmishes leading up to the war. With 6 twin-plasma cannon turrets and a large payload selection, this craft was able to tear its way through the opposition. In fact, the single full-framed disruptor mounted for the pilot's use probably received an inflated reputation because of the rest of the craft's performance.

It was because of this reputation that disruptors were originally installed on the S-17. Of course, their battle record on the fighter was much less exemplary.

Originally crewed for 91 (30 of them biological) the 61 androids (typically 21 working round the clock) were replaced by an SI. Some of the tasks were reassigned, as the gunners were invariably biological.

This craft was forced out of service ten years ago due to a powerful economic lobby. If not for this contract coup, it would probably still be in service today.

Raptor Response Gunboat

Crew 25 (2)
- 25 Military Staterooms

Cargo ..... 75 Kiloliters (25 Metric tons)
Mass ..... 2,807.2 Metric tons
Hits 3,088
CAT XV
Vacuum Power Rating 10,541 (58)
DB 90
- Armor Belt ..... +10
- Defensive Screens ..... +50
- Evade ..... +30

EW 50/10
Cost ..... ¢3,900,000
Top Speed ..... 9.262, 5,000 kph airspeed
Translight Capability ..... Level Two Quantum Drive
Atmospheric Capability ..... Full
Armament ..... Removed
Features:
- Microfreq Comm Rig
- Medical Dispensary
- Adv. Sensor Suite
- Quantum Comm Rig
- Cramped
- Artificial Gravity
- Docking Ring
- 2 Airlocks
- 16 Hard Points
- Shielded Weapons
- 325 metric tons of inert mass
- Workshop (336,864 CIP)

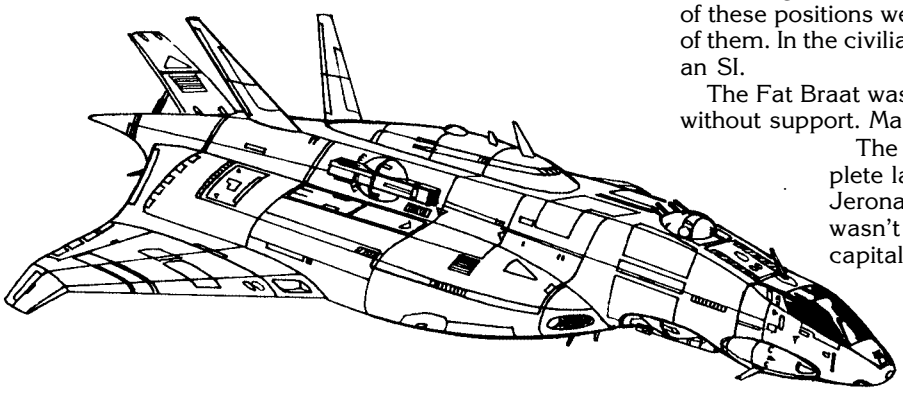
Auxiliary Systems:
- RIF Generator
- Life Support
- Quantum Comm Rig
- Adv. Sensor Suite
- Vacuum Power Generator

Commentary: The Raptor served well in its time. Though not fast for its mass, so many of these were in production at one time that they were always invariably the closest ship to an incident. They typically were the first on the scene at any problem, handling it until a larger military force could arrive.

Armed with ten autocannon turrets, this craft packed a punch. Its greatest problem was a complete lack of payload. Against larger ships, it had no punch weapon, and had to out maneuver and whittle the foe down (often easier said than done, with its acceleration).

Crewed by 25 biological and 53 androids (usually 18 in round the clock shifts), this craft served well. It now sports an SI to automate all but 25 crew positions.

This craft was phased out shortly before the war. Its lack of payload was a hindrance, and newer tech was available.



"Fat Braat" Border Patrol Boat

Crew 40 (4)
- 20 Military Staterooms
- 20 Crew Berths

Cargo ..... 120 Kiloliters (40 Metric tons)
Mass ..... 4,436.1 Metric tons
Hits 5,102
CAT XVII
Vacuum Power Rating 11,158 (290)
DB 75
- Armor Belt ..... +15
- Defensive Screens ..... +50
- Evade ..... +10

EW 70/10
Cost ..... ¢6,900,000
Top Speed ..... 13.525 Gs, 5,000 kph airspeed
Translight Capability ..... Level Two Quantum Drive
Atmospheric Capability ..... Full
Armament ..... Removed
Features:
- Microfrequency Comm Rig
- Adv. Sensor Suite
- Quantum Comm Rig
- Cramped
- Artificial Gravity
- Docking Ring
- 2 Airlocks
- 16 Hard Points
- Shielded Weapons
- 473 metric tons of inert mass
- Sick Bay (10 Capacity)
- Workshop (532,332 CIP)

Auxiliary Systems:
- RIF Generator
- Life Support
- Quantum Comm Rig
- Adv. Sensor Suite
- Vacuum Power Generator

Commentary: The Fat Braat has long been a facet of the ISC, Jeronan border. It has a long record of rugged and reliable service, and was only recently retired. In light of the war, many are being refitted and thrown back on the line.

With twin full-sized plasma cannons at the pilot's command, even large ships worried when the Fat Braat hit the scene. This threat was backed up by 4 quad ion cannons for fighters.

These ion cannons proved so effective that the Fat Braat's entire torpedo complement was dedicated to destroying capital ships. Ten Mark 50 torpedoes can take a chunk out of any foe, and woe to the carrier that was all alone against a flight of these ships.

The original crew complement numbered 124, though 84 of these positions were filled by androids, usually only 28 of them. In the civilian market, these tasks are handled by an SI.

The Fat Braat was fast and able to operate a long time without support. Many crews still swear by this craft.

The Fat Braat's only failing was the complete lack of a point-defense system. Since Jeronan fighter pilots disdain torpedoes, this wasn't a big deal in small battles. Against capital ships, however, this was often fatal.

7.0 VEHICULAR COMBAT

"The blitzkrieg will never work."
—Nearly every pre-World War II European leader except for Hitler

It will happen eventually. Someone will take a shot at someone else. This can happen when the person's on foot, and it's resolved according to the normal *Spacemaster* combat system.

This can get more complicated when combat involves vehicles. This section expands on the combat rules given in *Spacemaster: Privateers*.

7.1 DETECTION AND DETECTION AVOIDANCE

For some reason, it seems that player characters are most at ease when sneaking someplace where they don't belong. These characters generally do not wish to be noticed.

When a character is at risk of being detected by conventional means, the process is pretty straightforward. In that case, it's merely the character's ability to sneak versus the spotter's ability to notice the sneaky.

When sensors are involved, the task becomes more difficult. Most senors notice pretty much everything, and in the depths of space, this makes it difficult to hide.

Therefore, in situations where sensors are being used it will generally take running silent to hide the ship. This process is covered in Section 11.0 (p. 61).

7.2 MOVEMENT

Movement is a complicated subject in an SF game. Many types of movement are possible, just as many types of vehicles are possible. This is a big subject, way bigger than the scope of this book. A general treatment is all that is possible.

7.2.1 VACUUM

Vacuum based movement is most typically used by spacecraft. Vacuum based movement is achieved by applying thrust in a given direction. This causes a ship to travel, not a certain rate, but at a certain acceleration.

In some space opera style games, constant speeds will be used. These however, are most often methods of convenience, not representations of physics.

When traveling with this style engine, one of two methods is used. Either the ship accelerates to a certain speed, then shuts off it's engine and coasts, or it accelerates constantly until the halfway point, turns over, and decelerates constantly the rest of the journey. The first method is used when fuel is a consideration. The second when fuel is effectively limitless (as with ramjets, which scoop hydrogen, or reactionless drives with cheap and plentiful power sources).

Measurements

Ship power is measured in Gravities, or Gs. One G is equal to the acceleration of an object under Earth's gravity. A G is equal to about 9.8 meters/second/second.

Travel Under No Power

With this method, the vehicle accelerates until a desired speed is achieved, then cuts engines. Typically, this means they are only accelerating or decelerating for a fraction of the journey.

Using this method, the acceleration and deceleration portions of the journey can be largely ignored. Simply calculate how long the journey would take at the coasting speed. This will be close enough for all but the most precise measurements.

Travel Under Constant Acceleration

This assumes the ship is always either accelerating or decelerating. To calculate the travel time, use the following equation:

$$T = \sqrt{(2 \times D) \div A}$$

Where D = distance (in meters), A = acceleration (in meters/second/second), and T equals time (in seconds). Remember, 1 G is equal to 9.8 m/s/s of acceleration.

Remember also that most of the time, the ship will be accelerating half the journey, then decelerating the rest of the way. This makes the trip longer than if the craft could just accelerate all the way. To represent this, calculate the time it takes to travel half the distance, then double it.

Dealing with complicated relativity equations is beyond the scope of this work, therefore we will try to keep to non-relativistic speeds.

To shift the resulting time into a more useful figure, divide it by 60 for minutes, 3,600 for hours, or 86,400 for earth days (90,000 for ISC Standard Days).

As everyone seems to be aware of these days, the faster one travels, the more time is dilated (for you skeptics, this has been experimentally shown, up to nearer the speed of light than your characters will ever get). The difference on these tables is never much. More complete treatment will be saved for future works.

Table T-5.6 , *Spacemaster: Privateers*, is provided to give transit times under full acceleration of different interplanetary distances. Time dilation and mass increases can generally be ignored in these instances.

Delta-V (ΔV)

ΔV is the measurement of how much fuel a spacecraft can carry. Spacecraft fuel is not measured in terms of how many miles per gallon the craft achieves, but by how much the craft's speed can be altered.

ΔV is typically measured in the total speed that could be achieved in a single burn. This can be then broken up into smaller bursts.

Example: *Lou has 400 meters per second of ΔV in his EVA pack. He could accelerate to 400 meters per second, then run out of fuel. He could accelerate to 200 meters per second, then has just enough left to decelerate again. He could also accelerate to ten meters per second and decelerate again twenty times (two 10m/second bursts, twenty times total, 10 x 2 x 20 = 400).*

A Note on Relativity

The greater the speed of two objects differs, the greater the effects of relativity. This means that if you look at another spaceship, and your relative velocities are very different, time will appear to be running slower on the other ship; their measuring rods will appear to be squashed, and they will appear to have a much greater mass.

Of course, to them, you appear the same way.

Relativity does not favor either frame of reference, both are correct. So you might wonder, how does anyone ever lose time, if they think everyone else is losing time as well? How is this paradox resolved?

The answer is, everyone agrees on what is happening while the ship is accelerating. While accelerating, everyone else seems to speed up, their mass is reduced, etc, etc.

So, when a journey is done, after the acceleration on one end and the deceleration at the other, both the traveler and a stationary observer agree. The traveler lost time. Appendix A-1.0 (p. 76) has tables for commonly handled travel times.

7.2.2 ATMOSPHERIC

Air vehicles travel by applying thrust to the medium of air through which they are traveling. The air is applying resistance, and these vehicles are measured by their maximum speed, not acceleration (though acceleration can be handy when trying to outmaneuver another vehicle).

Airspeed is measured in relation to the air, not the ground. Therefore, in a 20 kph headwind, reduce the speed by 20 kph. A tailwind adds to the speed.

However, for the most part, this evens out over time, and can be ignored for large scale travel.

Handling Acceleration

Each air vehicle has an acceleration rating. This is rated as a percentage of it's maximum speed, and indicates the amount it can accelerate in one round. (Thus, an air vehicle with a 10% acceleration rating could accelerate to its maximum speed in 10 rounds.)

7.2.3 FLUID

Fluid-medium vehicles are designed to travel on or below the surface of a fluid (water, ammonia, liquid methane, etc.). These boats and submersibles are designed with this fluid in mind.

All submarines have two travel rates: exposed and submerged. Submerged vehicles are not affected by the surface conditions of the fluid. Below is a list of sea conditions and their effects on movement:

Condition	Small Craft	Medium Craft	Large Craft
Calm	100%	100%	100%
Choppy	50%	75%	100%
Turbulent	25%	50%	75%

7.2.4 GROUND

Ground vehicles come in many types. They move themselves by pushing against the ground in some fashion, and therefore all speeds are relative to the surface.

There are several types of ground vehicles.

Ground (Walker/Hopper)

These vehicles move just like many living creatures. They have two or more legs and they actually emulate walking. Some emulate hopping, but however they use their legs, the game effects are the same.

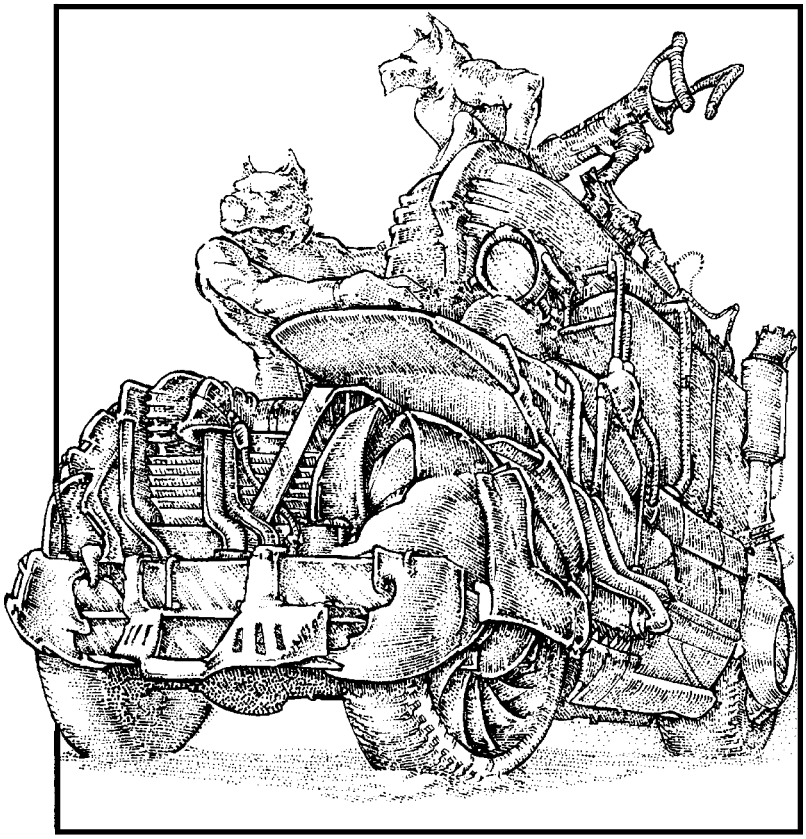
Ground (Jumper)

These vehicles actually jump from location to location. They attain respectable altitudes while doing so, and therefore ignore quite a few terrain problems.

TERRAIN EFFECTS CHART

Wheel/ Terrain	Walker/ Track*	Hopper	Surface Jumper	Effect	Gravitic
Clear	100%	100%	100%	100%	100%
Brush	100%	75%	100%	100%	100%
Sparse Wood	100%	75%	100%	90%	90%
Medium Wood	75%	33%	75%	80%	80%
Dense Wood	50%	10%	33%	70%	70%
Jungle	25%	5%	20%	50%	50%
Broken/Rocky	75%	33%	25%	100%	100%
Soft Sand	75%	20%	20%	100%	100%
Marsh	50%	20%	15%	100%	100%
Good Road	100%	100%	100%	100%	100%
Poor Road	100%	75%	100%	100%	100%
Light Rubble	90%	50%	75%	100%	100%
Heavy Rubble	50%	20%	75%	100%	100%
Snow	75%	50%	100%	100%	100%
Deep Snow	50%	25%	50%	100%	100%
Ice	100%	50%	25%	100%	100%

* — This assumes that the vehicle is designed for heavy off-road use. Otherwise, halve all values under 100%.



Ground (Wheeled/Tracked)

These vehicles crawl over the planet's surface. Some do so on wheels; others use tracks as their form of propulsion. For the purposes of this work, there are no differences between the two.

Ground (Surface Effect)

These vehicles use some sort of surface effect (typically generated by large fans, but other sources are possible) to move over the ground. These vehicles travel over ground and fluids with equal ease, but must have something to react with (air, etc) and stay close to the surface.

Ground (Gravitic Effect)

These vehicles use special gravitic effects to lift them into the air. They need nothing to react with are able to achieve greater heights than surface-effect vehicles. This means they can often ignore terrain entirely.

Terrain Effects

All ground vehicles need to worry about terrain. Terrain reduces a vehicle's maximum speed as detailed in the Terrain Effects Chart.

7.3 FLIGHT

Evolution has instilled humanity with two primary reflexes with which to handle danger: flight and fight. This section deals with the first of the two options.

When a vehicle wishes to run away the act should be resolved as a series of vehicular maneuvers. The rules for handling such maneuvers is detailed in Section 9.0 (p. 52).

The GM needs to keep track of a few details.

- The distance separating the vehicles.
- The relative velocity of each vehicle.
- The direction in which each vehicle is heading.

In many cases it is easy to keep track of this in one's head, such as a ballistic chase in outer space or a race on a strip of freeway. Other times, this will require some form of representation, be they miniatures or something else (such as hex paper).

Ending the Chase

Generally, common sense will determine exactly when a chase ends. Some common examples are:

- One of the vehicles is disabled.
- A certain location is reached, such as a safe haven.
- The vehicles can no longer detect each other.
- One or the other vehicles gives up.
- The fleeing vehicle decides to fight.

Fighting During a Chase

During many chases, shots are fired. Depending on the arc of the vehicle weapons, one or both vehicles might participate.

For the purposes of fighting, an attack can be made every time a maneuver roll is made. The combat is conducted normally, using the ranges determined by the distance between the vehicles at the beginning of the round.

7.4 FIGHTING

The second survival reflex is fighting. Fighting makes for a much more satisfying encounter (assuming, of course, that the PCs win; otherwise, it's often only satisfying for the GM). Vehicular combat should follow the following basic pattern based upon the standard Battle Round Sequence (see *SM*, p. 60):

During the Action Declaration Phase:
- Declare All Actions (see *SM,* p. 60)
- Roll Combat Pilot Static Maneuvers
- Split OB/DB from Combat Pool

During the Initiative Determination Phase:
- Determine Initiative

During the Snap Action Phase:
- Launch Warheads
- Maneuver
- Gunnery Attacks

During the Normal Action Phase:
- Maneuver
- Gunnery Attacks

During the Deliberate Action Phase:
- Maneuver
- Gunnery Attacks
- Resolve Warhead Attacks
- Disengagement Attempts

This combat then continues, from round to round. For a description of each step in combat, see below:

Declaring Actions

This takes place during the Action Declaration Phase. Captains give brief orders (brief cannot be stressed too much) to their gunnery crews, and helmsmen. Targets are chosen by each gunner. Basic, inter-ship communications take place (these too must be brief, "Regroup at vector Charlie" would be pushing it); helmsmen declare their maneuvers. This is typically when any Electronic Warfare actions take place (See Section 11.2, p. 64).

Combat Pilot Static Maneuvers

This takes place during the Action Declaration Phase. The pilot of each craft should roll a Combat Pilot static maneuver. The result is compared to the Static Maneuver Table T-4.3, (*SM* p.65 and 141). This will give a modification, between -30 and +30, to subsequent related actions (that is, the round about to take place). This is the pilot's combat pool.

Combat Pilot is a skill in the Combat Maneuvers category. It is recommended that it not be permitted for a character to have more effective ranks in combat pilot than the piloting skill he is currently using.

Splitting the Combat Pool

This takes place during the action declaration phase. The combat pool will be a bonus or penalty between -30 and +30. It is determined by a Combat Pilot static maneuver in the step above.

This penalty or bonus represents how well the pilot jockeyed for position this round. The modification is divided between the craft's OB and DB. Any number added to OB affects all OBs equally.

All of the combat pool must be spent. It cannot be carried from one round to the next.

Example: *Mike is piloting the group's gunship when four fighters attack. Mike, confident in the abilities of his crew, rolls his combat pilot maneuver. To his horror, he rolls open-ended low, a 01. The second roll is a 96. The third roll is a 67. The final result, after adding his considerable bonus (+110) to the roll, is a -52 (01 - 96 - 67 + 110). That gives him a combat pool of -30. He places 0 on the ship's DB and -30 on OB (Which grants a penalty of -30 to every weapon). Maybe the fighters will roll badly as well …*

COMBAT PILOT STATIC MANEUVER CHART

Static Maneuver Result	Combat Pool for OB and DB
-26 down	-30
-25 – 04	-15
05 – 75	+0
66 (UM)	+1d50
76 – 90	+5
91-110	+10
100 (UM)	+40
111-175	+20
176+	+30

Determine Initiative

This takes place during the Initiative Determination Phase. Each ship rolls 2d10, adding the pilot's Intuition bonus. The result is the ship's initiative. As an optional rule, the GM may allow each ship to roll 2d10, and each individual gunner to add their Intuition bonus. This allows more varied distribution of attacks, but can add a bit of bookkeeping in ships with lots of gunners.

Maneuver

This takes place during different Action Phases. Each helmsman rolls a Combat Pilot static maneuver and compares it to the Vehicular Maneuver/Astrogation Table VM-9.1 (p. 54-55). The percentage is noted for each pilot. Pilots can perform the following maneuvers.

- Maintain range.
- Close Range.
- Increase Range.
- Other Maneuvers (Head for base, etc.)

Each of these maneuvers have different possible action phases. All maneuvers are considered to take place throughout the entire round, however.

If a maneuver is pass/fail, the percentage is the chance of success. If the maneuver takes place over multiple rounds, then the percentage is the amount of the maneuver completed. If the maneuver is contested, the pilot with the higher percentage wins.

Maintaining Range

This takes place in the snap action phase, with no penalty. See Table VM-7.1 to see if the two ships' combat pool allocations and relative speeds allow this maneuver. All the speed requirements assume that the enemy does not wish to maintain range.

Close Range

This takes place throughout the action phases. See Table VM-7.1 to see if the two ships' combat pool allocations and relative speeds allow this maneuver. If the pilot is closing four levels, two of them are during the normal phase. If the pilot is closing three range levels, one takes place each phase. If they are closing two range levels, then one takes place in the normal action phase and one in the deliberate action phase. If they are closing one range level, it takes place in the deliberate action phase. The speed requirements below assume the enemy does not wish to close. (The GM may wish to place more sophisticated rules here if the ships are both trying to close, but these rules are beyond what can be handled in a "generic" combat system, and require information of ship speed and exact weapon ranges.)

RANGE MODIFICATION TABLE VM-7.1

Relative Speed	Vehicle X is Flying Defensively?*	Vehicle Y is Flying Defensively?*	Is it possible to maintain Range?	Is it Possible to increase or close range?	The number of range levels increased/closed.
$X \leq \frac{1}{2}Y$	–	–	No	No	0
$\frac{1}{2}Y < X \leq Y$	No	No	No	No	0
$\frac{1}{2}Y < X \leq Y$	Yes	No	No	No	0
$\frac{1}{2}Y < X \leq Y$	No	Yes	Yes	Yes	1
$\frac{1}{2}Y < X \leq Y$	Yes	Yes	No	No	0
$Y < X \leq 2Y$	No	No	Yes	Yes	1
$Y < X \leq 2Y$	Yes	No	Yes	No	0
$Y < X \leq 2Y$	No	Yes	Yes	Yes	2
$Y < X \leq 2Y$	Yes	Yes	Yes	Yes	1
$2Y < X \leq 3Y$	No	No	Yes	Yes	2
$2Y < X \leq 3Y$	Yes	No	Yes	Yes	1
$2Y < X \leq 3Y$	No	Yes	Yes	Yes	3
$2Y < X \leq 3Y$	Yes	Yes	Yes	Yes	2
$3Y < X$	No	No	Yes	Yes	3
$3Y < X$	Yes	No	Yes	Yes	2
$3Y < X$	No	Yes	Yes	Yes	4
$3Y < X$	Yes	Yes	Yes	Yes	3

X is the acting vehicle. Y is the opponent vehicle.

* — A vehicle is *Flying Defensively* if the pilot either applied a bonus from his combat pool to his DB, or (if the combat pool is a penalty) he did not apply all of the penalty to his DB. If a ship is not *Flying Defensively*, it must sacrifice its evade bonus.

Increase Range

The rules for increasing range are exactly the same as those for closing range. The only difference is the direction traveled.

Range Levels

These levels are arbitrary, just as the ranges of weapons are arbitrary. To see what range levels equate to which weapon ranges, see below.

Range Level	Range
0	Point Blank
1-2	Short
3-5	Medium
6-9	Long
10-14	Extreme

Other Maneuvers

This will require judgement calls on the part of the GM. A maneuver roll should be required for the completion of any action.

Launch Warheads

This takes place during the snap action phase. It requires very little skill on the part of the launcher. The pilot merely designates a target for each missile rack or torpedo, then fires. The missiles and torpedoes then hunt and attack their targets.

Missiles: Missiles travel one range category for every 2 marks in their rating (Mark 4 missiles can travel 2 range categories). If missiles do not hit in the round they're fired, they detonate harmlessly.

Torpedoes: Torpedoes close one range level per phase. Any attack on a torpedo which causes a critical destroys it. A torpedo can travel for a full hour before running out of fuel.

Gunnery Attacks

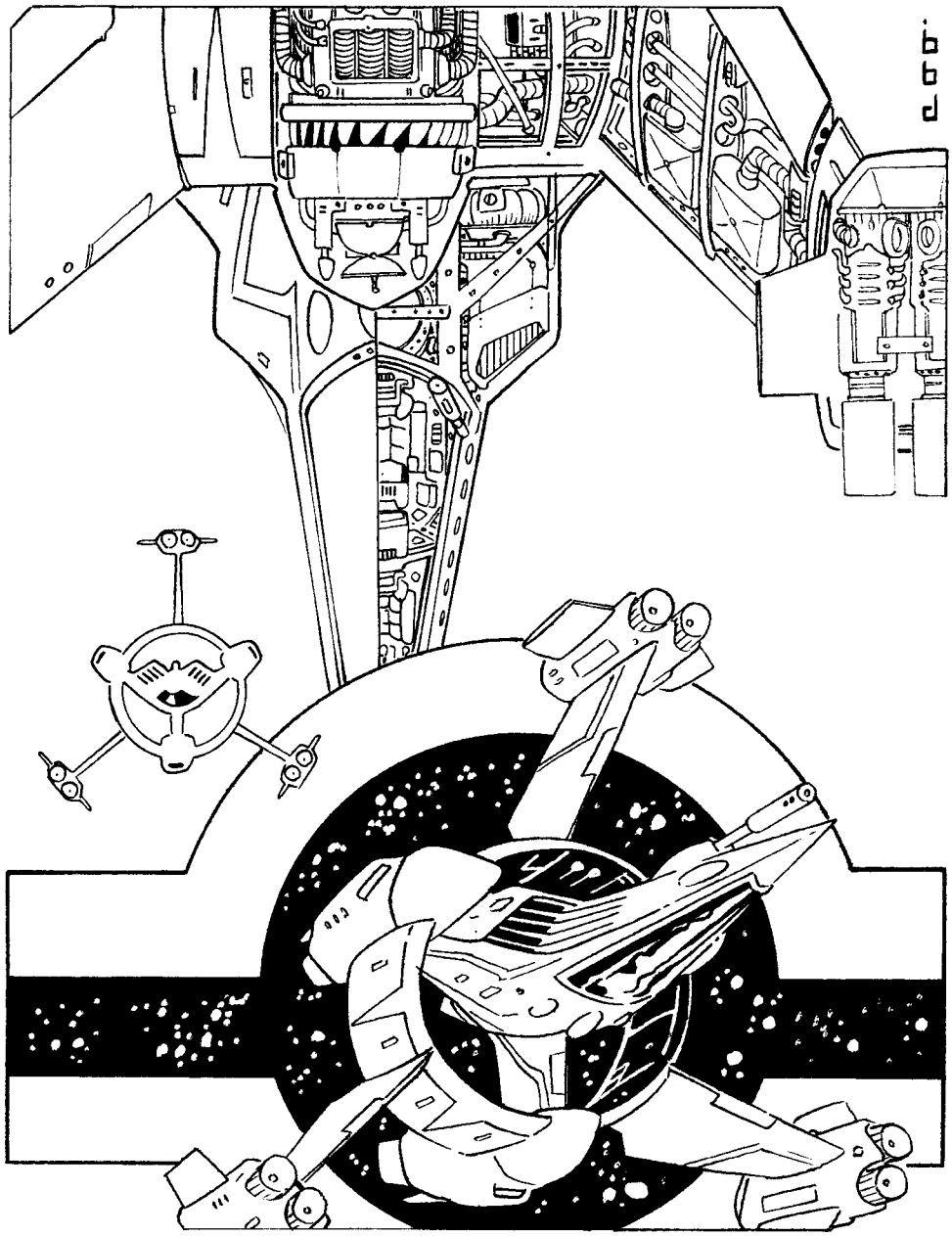
This takes place during one of the action phases. This is when all non-warhead attacks are resolved. Gunners attack their targets, and attacks are resolved. These can take place in the snap, normal, or deliberate phases with the standard -20, +0, or +10 modification. This can occur before warheads are fired or after warheads impact. (If necessary, roll an initiative check for each warhead or missile volley. See Sections 7.5 and 7.6 (p. 46-47) for details on attack resolution.

Warhead Attacks

This takes place during the deliberate action phase. Warheads impact with their targets. If torpedoes are in flight, then they detonate if their range level has reached zero. Attack resolution is covered in more detail in Sections 7.5 and 7.6 (p. 46-47).

Disengagement Attempts

If the ships are at the very extent of extreme range, one or the other can attempt to disengage. This requires a Piloting static maneuver. Success means that the pilot begins the next round out of range. It must be possible for the escapee to increase range.



7.5 ATTACK RESOLUTION

Vehicle attacks are handled in much the same way as personal attacks. The main difference is the scale on which they occur, and the differences in vehicle armor.

Construction Armor Types

Ship hull covers a wide range of armor types. The weapon charts in this book assume ten construction armor types. Listed below are suggested descriptions for these armor types.

XI Steel: This is the most simple of armor types. It is made from simple stainless steel. (Tech Level 15)

XII Titanium: This powerful metal is orangish in tint and extremely strong. It can handle tremendous pressure. (Tech Level 16)

XIII Crysteel: This steel has been grown in a special chemical vat. It's crystalline structure is very strong, but it takes a great deal of time to grow. It cannot be forged or cast. (Tech Level 17)

XIV Crystanium: This is an advanced form of crysteel. It has greater strength and is less brittle than crysteel. This cannot be cast, but after it's grown, it can be reshaped in a forge. (Tech Level 18)

XV Reinforced Crystanium: This crystanium hull has been reinforced and braced with massive structural buttresses. This has given it increased ability to absorb abuse. (Tech Level 18)

XVI Fullerene: Named after Buckminster Fuller, this material is made from C60. Fullerene is an incredibly strong material, stronger even than diamond. Fullerene is first developed during tech level 16, but it isn't until tech level 18 that is can be produced in a fashion usable in ship hulls. (Tech Level 18)

XVII Reinforced Fullerene: This Fullerene hull is reinforced with massive braces. This makes it unbelievably durable. (Tech Level 18)

XVIII Crystanium Double Hull: This crystanium hull is actually two hulls, connected by a honeycomb infrastructure. This honeycomb is generally filled with thermal-resistant foam, to disperse both the heat of energy weapons and the kinetic energy of projectiles. (Tech Level 19)

XIX Fullerene Double Hull: This fullerene hull is actually two hulls, connected by a honeycomb infrastructure. This honeycomb is generally filled with thermal-resistant foam, to disperse both the heat of energy weapons and the kinetic energy of projectiles. (Tech Level 19)

XX Colossium: This composite is constructed at a nearly molecular level by industrial nanites. It is even stronger than C60. (Tech Level 24)

The Attack Roll

This is conducted like any other attack roll. The player rolls a d100 (high open-ended). He adds his OB with the weapon and subtracts his opponent's DB. He then adds in any appropriate range modifiers. The final result is cross-indexed on the appropriate attack chart.

There are a few situations which require special note.

- Each weapon has a fumble range listed on its weapon chart. If the unmodified roll is within this range, then consult the weapon's attack table to determine whether the malfunction is temporary or permanent.
- Each weapon has a Mark Number. This number has a maximum result on the attack chart. If the attack roll exceeds the maximum result, then the maximum result is used.

Warheads are handled a little different than normal gunnery-type attacks. Missiles and torpedoes are launched during the snap action phase. To launch a torpedo, the gunner simply designates a target and lets the torpedo fly. To fire missiles, the gunner must get a missile lock. This requires an attack roll which exceeds 100. (This does not determine damage, merely whether or not the missiles launch.)

To resolve a warhead attack, merely roll an open-ended d100 roll on the Warhead Attack Chart and subtract the ships' DB. Add (only) the warhead's mark number and the number of missiles in the volley to the attack roll.

Attack Limitations

There are certain limitations which must be placed on any attack. They are as follows:

- No gunner may attack a target that they did not declare at the beginning of the round. If the GM allows them to switch targets for some reason, then they incur a -25 penalty to their attack.
- Each weapon may only attack once per round.
- No two weapons whose firing arcs do not overlap may fire at the same target. In other words, if two weapons face opposite directions, then they cannot be brought to bear on the same foe in the same round.
- The vehicle attacked must be within range.

Offensive Bonus

The gunner's OB is a combination of several factors. They are as follows:

- The gunner's skill bonus with the weapon. This is typically one of three skills: High-Energy Projectors (H.E.P.), Projectile Gunnery, and Missiles. These are skills in the Technical/Trade • Gunnery skill category.
- The mark number of the weapon. *
- +2 for every additional weapon in mount. *
- The Heads Up Display (HUD) bonus of the gunnery system. *
- The vehicle's "Predict" program bonus. *
- Whatever portion of the bonus or penalty granted by the pilot's Combat Pilot static maneuver (the combat pool) the pilot allocates to offense.

* — These items are already calculated into the OB of the weapons in the vehicles published in this book.

Defensive Bonus

A craft's DB is determined by several factors. They are as follows:

- Armor quality bonus for craft (probably zero). *
- Any bonus from force screens. *
- Any Electronic Warfare that has been allocated to the ship's defense (this may be affected by the electronic warfare of the opposing ship).
- The ship's "Evade" program bonus. *
- Whatever portion of the bonus or penalty generated by the pilot's Combat Pilot static maneuver (the combat pool) that has been allocated to defense.
- Armor Belt bonus. *

* — These items are already calculated into the DB of the vehicles published in this book.

7.6 VEHICULAR ATTACK TABLES

There are several possible weapons a GM may wish to allow on his ships. Listed below are descriptions of each weapon type and its relative tech level. The actual attack tables themselves are located in Appendix A-3 (p. 124-133).

The tables themselves are used in much the same way as the attack tables for personal arms. Simply cross-reference the gunner's attack result with the target's Construction Armor Type.

Autocannon/Projectile Cannons: These weapons fire solid metal slugs, much like modern firearms and chainguns. The round is designed to penetrate heavy armor and is generally a steel-backed high-explosive, armor-piercing depleted-uranium slug. The round itself is generally propelled by gunpowder, electrochemical propulsion, or electromagnetic propulsion. (Tech Level 16)

Blaster Cannons: These are powerful particle beam weapons, dealing tremendous force. They are valued for their compact size, and not their armor piercing capabilities. They do have the advantage of a more sustained attack, however, and cause Blast criticals to represent their raking fire. (Tech Level 17)

Disruptor Cannons: These weapons cause sympathetic vibrations to resonate in the target's molecular structure. This causes the target material to begin to disintegrate. These weapons do not do well against force fields, and receive a -20 penalty against any ship with working screens. (Tech Level 21)

Apocalyptic Weapons: These weapons include fission, fusion, or matter/antimatter bombs. They are often used in space combat, where combatants are often separated by many kilometers. These weapons do not differentiate between the different methods of energy release. The mark number is all that's necessary to determine the weapon's destructive capabilities. See the *Gamemaster Manual* for blast radius based on mark number, or just assume that each blast radius is a kilometer. (Tech Level 14)

Ion Cannons: These powerful weapons use a magnetic field and ionization principles to help particle beams penetrate armor and bulkheads with more deadly efficiency. This makes the particle beam that much more damaging. (Tech Level 20)

Laser Cannons: These weapons fire beams of coherent light. The purpose of these weapons is to cut through the armor and bulkheads of the target. These weapons have no kinetic energy, so they are less damaging than other arms. (Tech Level 17).

Plasma Cannons: These weapons fire blasts of superheated helium. This plasma delivers tremendous energy to its target, and is a powerful and deadly weapon. These cannons have tremendous power requirements, and are more prone to damaged circuits and over-heating. (Tech Level 17)

Warheads: These devices, typically missiles and torpedoes, detonate chemical explosives. The damage and criticals assume that the target is hit with a missile salvo or a single torpedo.

Missile salvos are conducted in the following fashion. Determine the total number of missiles fired at the target, then compare to the Missile Salvo Chart (p. 48). This will give you the mark number, OB modification, and damage multiplier for the attack. It is then resolved as single attack.

Decoys

Small fighters (less than 1000 metric tons) can carry decoys to trick missile salvos and torpedoes. A fighter will drop a decoy at the last moment in an attempt pull to the missile or torpedo away. This is a difficult proposition. One error fails to distract to missile, while another causes the warheads to detonate too close.

Upon dropping a decoy, the pilot makes a Combat Pilot static maneuver to time it properly. For torpedoes, subtract the mark number of the torpedo. For missiles, subtract ten times the number of missiles in the salvo.

Compare the result to the Static Maneuver Table. An unusual success, absolute success, or success results in the torpedo or salvo missing the ship. A near success results in dropping a torpedo mark number two levels. A near success on missiles results in dropping the critical two levels. A partial success works as a near success, but drops it one level.

Each individual torpedo and salvo requires a separate decoy, but multiple decoys can be dropped in a single round. Each result is resolved separately.

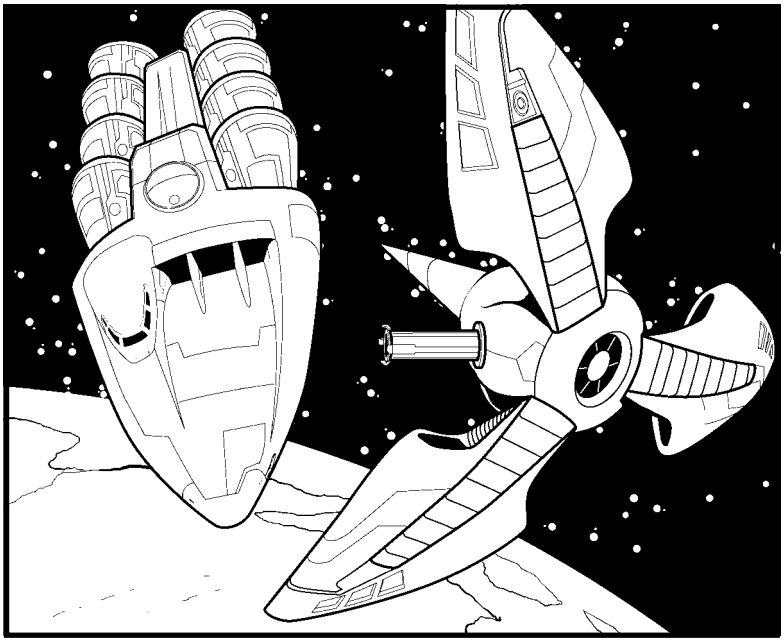
A decoy can be used instead of jamming a missile. The two tasks take too much attention to do both.

Dodging Torpedoes

The pilot of a fighter or gunboat may attempt to dodge one or more torpedoes. To do this, the pilot makes a Combat Pilot static maneuver. He subtracts 15 per torpedo. For every ten by which the roll exceeds 150, one torpedo is dodged. The pilot can decide which torpedoes are dodged, should some hit. This maneuvering is wild enough to foul any attempts from the point defense system.

MISSILE SALVO CHART

Number of Missiles Fired	Warhead Mark # Threshold	Offensive Bonus Modification	Concussion Damage Multiplier
1	Mk. 10	0	x1
2	Mk. 10	+4	x1
3	Mk. 10	+6	x1
4	Mk. 10	+8	x1
5-9	Mk. 10	+10	x2
	Maximum Effective Limit Against Vehicles ≤ 1K Metric tons		
10-19	Mk. 10	+15	x3
20-29	Mk. 20	+20	x4
	Maximum Effective Limit Against Vehicles ≤ 100K Metric tons		
30-39	Mk. 30	+30	x6
40-49	Mk. 40	+40	x8
	Maximum Effective Limit Against Vehicles ≤ 1 Million Metric tons		
50+	Mk. 50	+50	x10



Point Defense Systems

Many craft have point defense systems. These are typically small lasers with extremely high rates of fire. The purpose of these lasers is to target and destroy incoming warheads.

Point defense systems are rated from 1 to 10. This rates the overall effectiveness of the weapons.

If torpedoes are about to strike the vessel, and it does not attempt to dodge, roll a d10 for each torpedo. If the result is less than or equal to the point defense rating, the torpedo is destroyed.

Against missiles, the point defense system is rolled for each salvo. If the system works against the salvo, the number rolled on the die is the number of missiles destroyed.

A point defense system has a maximum number of attacks it can make per round. This is determined by the system.

A Note on Missiles

Certain small, heavily armored vehicles (such as tanks) act much like large bells. A missile striking such a vehicle, though it might not penetrate, will make an awful noise. It is not unheard of for such a noise to stun a crew for several rounds. A GM may wish to make the crew make an orientation roll in this situation or any other he deems similar.

Targeting Restrictions

There are certain restrictions to targeting other craft. The first is the size of the vehicle where missile salvos are concerned—the Missile Salvo Chart summarizes these effects. If more than the maximum number of missiles are fired at a target, the rest explode harmlessly, too far away.

The second targeting restriction has to do with the size of the gun and the speed on the target—the Targeting Restrictions for Cannons Chart summarizes these effects. Certain guns are too big to target certain craft under 100,000 metric tons.

Since range is an abstract concept in these rules, this is the only restriction involving cannons.

TARGETING RESTRICTIONS FOR CANNONS CHART

Frame	Available Gs of Acceleration
Compact	No Limit
Small	10 or Less
Full-Sized	6 or Less
Large	3 of Less
Ultra-Large	1 or Less

8.0 MIXING TYPES OF COMBAT

"You tank guys have a name for everything. What do you call us infantry?"
"Tread-grease"
—A conversation between an infantryman and a tank commander

In the clean cut, antiseptic world of game design, it's easy to divide vehicle combat, personal combat, demolitions and the like into discrete packages. It's inevitable, however that a GM will have to deal with mixing different types of combat. For instance, as the bounty hunter's ship flies off, carrying the party's companion, frozen in carbonite, they're going to open fire. During a flyby on enemy marines, a player character pilot is not going to be able to resist a strafing run.

This section provides options for resolving these types of situations. Each of the sections below will have different options. It's up to the GM to decide which options to use based his choice of genre and style.

Each combat system in this work is designed to be internally balanced. It is up to the GM to decide how these systems relate to one another in his game world. What happens when a ship fires on a human being? Is the damage multiplied by two, by ten, or by one thousand? These details will depend on the game's genre, but some suggestions are given below.

Aperture Energy Notation

The destructive power of personal arms is rated by the Aperture Energy (AE) of the weapon. For slug throwers, this is often referred to as Muzzle Energy (ME). For blasters, lasers, and plasma guns, the Aperture Energy is referred to as Blaster Energy (BE), Laser Energy (LE), and Plasma Energy (PE), respectively. Generally, a weapon with a higher AE has more destructive potential. See *Equipment Manual* for AE values, and see *Blaster Law* for more details about this rating system.

The power of vehicle weapons is rated by the weapon's Mark Number. Weapons with higher Mark Numbers are more powerful.

If *Blaster Law* and *Equipment Manual* are not available, use these guidelines when estimating the Aperture Energy of personal arms. Subassault Blasters have an AE of 3, Pistols are AE 4, Assault Weapons are AE 5, and Heavy Weapons are AE 6, 7, or even 8.

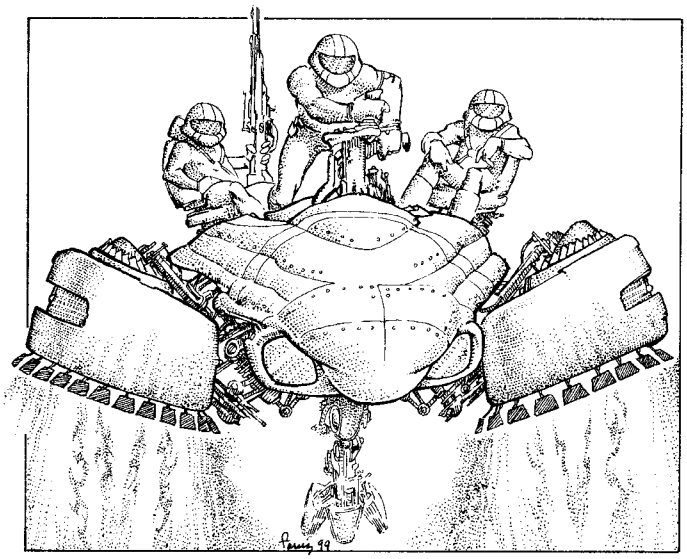
8.1 PERSONAL ARMS VS. CONSTRUCTION ARMOR TYPES

This section covers the use of personal weapons against vehicles. The GM must consider the relative power of vehicles vs. infantry to determine how he wants to handle this. Perhaps vehicles are only slightly more durable than personal arms and armor. Maybe they're so powerful that a man would be vaporized if a mounted weapon even touched him.

After the GM has determined this relative power, he needs to decide what game mechanic to use. There are several options listed below.

Option 1: Take the Aperture Energy of the weapon and multiply by two. This will give the equivalent Mark Number of the weapon. Resolve the attack on the most appropriate vehicle weapon chart, using the equivalent Mark Number. With this option, vehicles are a bit less powerful than modern vehicles. A good burst from an AKM will disable a car every time. This option is appropriate to a fantastic genre where vehicles can be easily disabled by small arms fire.

Option 2: Take the Aperture Energy of the weapon and divide by a number to obtain the weapon's equivalent Mark Number. Always round down after dividing. Resolve the attack on the most appropriate vehicle attack chart. With a divisor of 2, this option is most appropriate for a modern, realistic genre. In a game where vehicles were more durable, use a higher divisor (such as 5, or even 10). With a divisor of 2, the best hit from an AKM would disable a motorbike through hits alone, but would need a critical to take out a car. The *Privateers* universe uses this option, with a divisor of 5.



Option 3: Assume that vehicle weapons are an order of magnitude more powerful than personal weapons. Vehicle armor is correspondingly thick and bulky. As such, it is impossible for man-portable weapons to significantly harm a vehicle. Some vehicles may be more vulnerable than others. (For example, starships might use this option, while aircars use option 1 or 2 instead.) In this case assume that all energy and projectile weapons deliver Pierce criticals. All explosions deliver Blast criticals.

Note: *These options assume that projectile attacks use high-energy armor piercing rounds of some sort (perhaps not a true HEAP round, as reactive armor is very effective against these). Any firearm not using HEAPs or equivalent ammunition is only half as powerful as indicated.*

8.2 MOUNTED WEAPONS VS. PERSONAL ARMOR TYPES

It is, generally, never a pleasant experience to be fired on by ship weapons. It will probably happen sometime, however. Here are options for dealing with the effects of mounted weapons on personnel.

Option 1: Assume that ship weapons aren't that much more powerful than hand weapons. Divide the weapon's Mark Number by two (round down) to obtain the equivalent AE of the attack. Resolve the attack on the appropriate attack table in *Blaster Law*. This option assumes that vehicles are considerably less powerful than modern day vehicles. If this option is used, option one from Section 8.1 should be used as well.

Option 2: Assume that ship weapons are more powerful than personal arms, and should therefore be transferred to a more powerful chart in *Blaster Law*. Multiply the Mark Number of the weapon by an appropriate value (2 for a modern, realistic campaign, 5 for the Privateers universe) to obtain the weapon's equivalent AE. If the AE exceeds the charts in *Blaster Law*, then use the most powerful chart and assume that the rest of the energy blows harmlessly out the other side of the target's body. If this option is used, option 2 should be used in Section 8.1 as well, with the same number for multiplication and division.

Option 3: Vehicle weapons are so devastating that no mere biological organism could survive their baleful attentions. If a ship weapon fires on a lifeform, resolve the attack on the most powerful equivalent chart in *Blaster Law*. If a single point of damage is indicated, then the character is dead.

Note: *If Blaster Law is not available, you can estimate the power of high AE weapons using the charts found in Spacemaster: Privateers and other products. For each multiple of the chart's AE, increase the damage and critical delivered. For example: Using option 1, an attack by a Mark 30 plasma cannon is treated as a plasma cannon (a heavy weapon) with a PE of 15. The PE of the plasma cannon chart in SM is 6, so this attack is 2.5 times greater than that chart. It will deliver double damage and criticals of one degree of severity greater.*

8.3 WEAPONS VS. STRUCTURES

Weapons can be used against structures or people within structures. In the case of the former, the intent is probably to destroy the structure itself. In the case of the latter, the structure merely acts as armor for the occupants within.

Destroying Structures

All structures should be treated as vehicles for the effects of small arms (although it's likely that a GM will consider structures to be indestructible for purposes of small arms). The structure should then be assigned a CAT and an appropriate number of hits. Consult Table VM-8.1 for examples:

SAMPLE STRUCTURE STATISTICS TABLE VM-8.1

Structure	CAT	Hits
Hut	XI	10
Shed	XI	15
Small House	XI	200
Large House	XI	500
Small Building	XI	1,000
Large Building	XI	5,000
Hanger	XI	200
Warehouse	XI	700
Small Skyscraper	XI	10,000
Large Skyscraper	XI	20,000
Small Space Station	XII	5,000
Large Space Station	XII	20,000
Small Battlestation	XVI	6,000
Large Battlestation	XVI	24,000
Spacedock	XII	10,000

Combat is conducted normally. When the structure's hits are exceeded, the structure loses integrity. If the structure is in a gravity well, this is the point when it typically collapses (though gravity plays a role in this, a structure is usually built with its intended gravity well in mind, and therefore the hits rarely change much due to gravity). If the structure is in a vacuum, then this is the point where it loses its ability to function and maintain internal pressure.

Firing Through Structures

The time may come when one character wishes to kill another character, and yet a wall or other intervening structure is in between. In these cases, the structure robs the attack of energy, causing it to deliver less damage to the target on the other side. The amount depends on the thickness and composition of the wall. See Table VM-8.2 for examples of a structure's energy absorption capabilities.

For materials not intended for vehicles or space constructs, the reduction is given as a rating of a weapon's Aperture Energy. For other structures, the reduction is given as a Mark Number. For weapons whose effects are not given in the appropriate form, the GM should use the option he chose in Sections 8.1 and 8.2 to convert the attack.

Example 1: *Scott is EVA during an enemy boarding action. Through one of the windows, he spots an enemy boarder working unhindered at a control console. Scott decides to open up with his Spectrum Arms S-12 (BE 7). The GM decides that the window is an advanced transparent composite, CAT XII.*

Take 1: The GM is using option 1 (Section 8.1) to convert personal arms to vehicle attacks. This means that Scott's weapon (BE 7) converts to a Mark 14 weapon. The GM then subtracts 2 for the CAT, reducing it to Mark 12 attack. This converts straight back to BE 6 after the window is penetrated.

STRUCTURAL ENERGY REDUCTION TABLE VM-8.2

Structure	Reduction
Straw or Glass	-0*
Wood	-1*
Lathe and Plaster	-2*
Plywood, Sheetrock, Safety Glass	-1*
Sheet Metal	-3*
Concrete	-13*
Reinforced Concrete	-15*
Thin Steel	-4*
CAT XI	-1
CAT XII	-2
CAT XIII	-3
CAT XIV	-4
CAT XV	-5
CAT XVI	-6
CAT XVII	-7
CAT XVIII	-8
CAT XIX	-9
CAT XX	-10

* — A proper armor piercing round will halve this number. Energy weapons double the effects of these reductions.

Take 2: The GM is using option 2, dividing the BE by 2. Scott's BE 7 weapon therefore converts to a Mark 3 (remember to round down) weapon. The GM then subtracts 2 for the CAT, leaving the blast as a Mark 1 attack. Multiplying this by 2 again shows that the attack is a BE 2 attack if it penetrates the window.

Take 3: *The GM uses Option 3. Scott's weapon has no effect on the window, none whatsoever.*

Example 2: *Rick has taken up a position at 200 meters in a VT Weapons Platform. His target, a cyber-terrorist with fifteen hostages, sits in a concrete bunker. The GM has determined that the cyber-terrorist is beyond a full conversion borg, and should be considered a vehicle. Rick has targeted him through thermal targeting and when the terrorist gestures toward the ceiling with his weapon, Rick fires.*

Take 1: The GM is using option 1 from Section 8.2. The Mark 10 chaingun converts to a ME 5 weapon. This won't penetrate the concrete bunker (which reduces a weapon's AE by 13). The hostages might be done for.

Take 2: The GM is using option 2, and multiplying by 5. This converts the chaingun to a ME 50 weapon! The GM subtracts 13 from the ME and divides it by 5 again. This means that the chaingun rounds are considered a Mark 7 attack (37 ÷ 5 = 7.4) after they penetrate the bunker.

Take 3: *The GM is using option 3. The chaingun rounds barely notice the concrete bunker. The attack is still Mark 10 after passing through the wall.*

To fire through a structure, the character must have either some manner of targeting through the structure (such as a thermographic scope) or be using suppression fire.

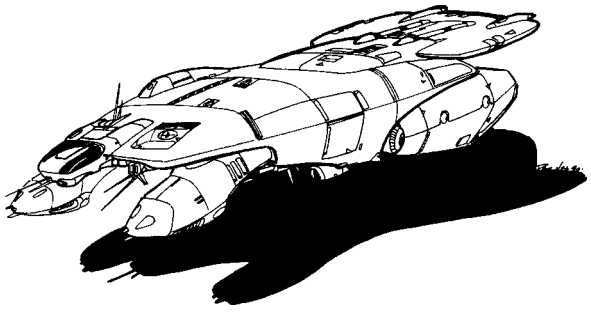
To use suppression fire, the character must have some idea where they wish to lay suppression fire. They then perform a normal Suppression Fire static maneuver, with a –20 penalty. The attack is then conducted normally (using the above rules for energy reduction).

If the character can target through the material, they are still penalized due to deflection. The penalty is equal to ten times the reduction of the material, with a minimum of 5. Even glass has been known to alter the trajectory of a bullet.

Example 1: *Gary knows that there's a room full of smugglers on the other side of the wall. He knows that it's a small room, and that no hostages are being held (he has an unarmed flyer overhead equipped with thermographic sensors). He decides to fire through the ancient lathe and plaster wall. He makes his Suppression Fire maneuver, rolling a 76. His skill is 103 (Gary loves suppression fire). His result is 159 (76 + 103 - 20). This is a success. He inflicts a +20 OB attack on everyone in the room who can't take cover. Due to the lathe and plaster wall, his rifle (ME 7) is reduced to ME 5. (Too bad he wasn't using armor piercing rounds.)*

Example 2: *Matt watches the robber pace on the other side of the transparent teller wall. From his sniping position on the other side of the street, he adjusts his cyber-linked, .50 caliber sniper rifle (ME 13). The cyber link grants just enough bonus to negate the range and windage penalties. Between him and his target is the bank-front glass (no energy reduction, -5 penalty) and the teller shield, made of a "bullet-proof" polymer (-20 energy reduction, -200 penalty). Luckily, they don't make rounds for this rifle which are not armor piercing. That reduces the total reduction to 10 (0 + 20 = 20 ÷ 2 = 10) and the total penalty to 103 (5 + 200 = 205 ÷ 2 = 102.5, or 103 after rounding). Matt rolls a 26 (Matt rarely rolls above 60). His skill is 179. This results in a total attack of 102 (26 + 179 – 103 = 102). The target has no DB and is not wearing armor, so the resulting attack causes 44 hits and a "B" critical. Hopefully, Matt will roll higher on the critical.*

Firing though any object with a reduction value causes at least minor trauma to the bullet. For the purposes of safety rounds and the like, this has the same effect as hitting armor.



8.4 INFANTRY UNITS

One lone soldier, charging a tank for king and country, is a powerfully evocative image. It is something that player characters will try, and the GM might very well allow them a little leeway for poetic license.

For a common foot soldier, however, it is suicide.

Infantry do attack armored fighting vehicles, but they do it with proper ordnance or with proper numbers. Preferably with proper ordnance.

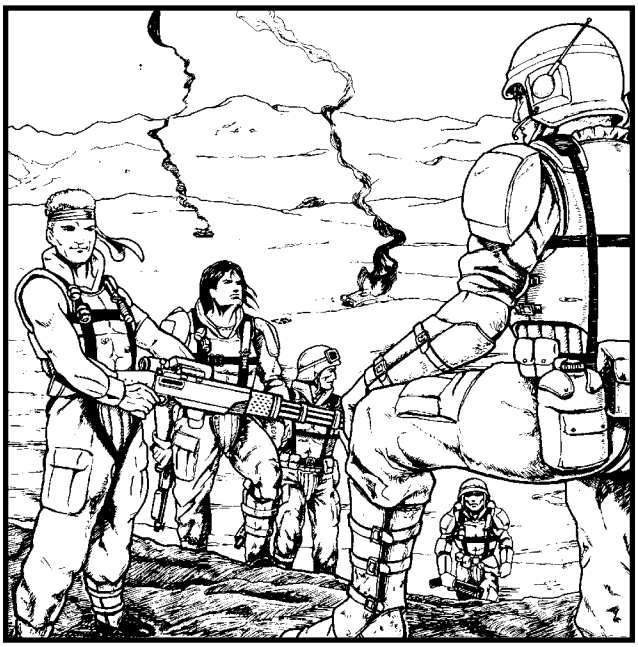
An infantry unit is a squad of twelve men. For the purposes of vehicular combat, they attack and are attacked as a single entity.

Appendix A-3 contains attack tables for resolving combat between infantry and constructs. Use the Infantry vs. Vehicles Attack Table A-VM-3.8 (p. 131) to resolve attacks made by infantry units against armored fighting vehicles. Use the Vehicles vs. Infantry Attack Table A-VM-3.9 (p. 132) to resolve vehicle attacks against infantry.

Use Section 8.1 to determine the Mark Number of the attacks made by the infantry unit. Use the average value of the unit's weapons, if they are not all identically armed.

Note that certain pieces of ordnance might only contain one shot. In this case, an infantry unit might be capable of a single, devastating attack, but they would then drop drastically in power.

Use the average OB, DB, and Hits of the individuals to determine their group's values. Use the most prominent armor type to resolve the attack.



8.5 LARGE-SCALE COMBAT

An offshoot of the infantry versus vehicles tables is a good method for resolving combat on a large scale. A large scale for infantry, that is.

To deal with large-scale conflicts, break the combatants into squads. Then use the Infantry vs. Infantry Attack TableA-VM-3.10 (p. 133) to resolve attacks.

This makes for a good, quick resolution for combat involving several squads, but no more. Large conflicts could be handled by scaling the size of the infantry units upwards, but this will take a little GM supervision.

9.0 VEHICULAR MANEUVERS AND OPERATIONS

"Day after day, day after day,
We stuck, nor breath nor motion;
As idle as a painted ship,
Upon a painted ocean.

Water, water everywhere,
And all the boards did shrink;
Water, water everywhere,
Nor any drop to drink.

—Samuel Taylor Coleridge,
The Rime of the Ancient Mariner

Vehicles can serve many purposes, but the most typical is getting from one place to another. For this to happen, the pilot must often perform a *vehicular maneuver*.

A vehicular maneuver is much like any other maneuver. The player performs a maneuver roll, modifying the open-ended roll with their bonus in the relevant skill. The result is then applied to the Vehicular Maneuver/Astrogation Table VM-9.1 (p. 54-55).

9.1 USING THE VEHICULAR MANEUVER/ASTROGATION TABLE

To use the table, the first step is to decide which column is most appropriate for the type of maneuver being attempted. Second, the GM must assign a difficulty to the maneuver. Next, the GM must assign any appropriate modifiers to the maneuver. Finally, the player must make a maneuver roll.

AFV maneuvers are made with the Ground Vehicle Pilot skill. This skill is in the Technical/Trade • Vehicles skill category. For the purposes of piloting an armored fighting vehicle, this skill may not have a higher bonus than the character's Crewmember AFV skill (Combat Maneuvers).

Aircraft maneuvers are made with the Atmospheric Pilot skill (Technical/Trade • Vehicles). This skill is not used after a craft has left the atmosphere (if capable).

Astrogation maneuvers are used for plotting courses through outer space. The Astrogation skill is in the Scientific/Analytical • Specialized skill category, and is used for journeys of any length.

Ground Craft maneuvers are used for any ground craft, be they marine based or land based. The Ground Vehicle Pilot skill (Technical/Trade • Vehicles) is used for land maneuvers. The Marine Pilot skill (Technical/Trade Vehicles) is used for water based maneuvers.

Navigation maneuvers cover plotting a course on a large sphere (such as a planet). Navigation is located in the Scientific/Analytical • Specialized skill category.

Spacecraft maneuvers are performed using the Space Pilot skill (Technical/Trade • Vehicles) or other appropriate skill, such as FTL Pilot. If the ship is dual natured, than any skill check performed in the atmosphere is performed as an aircraft maneuver.

If the ship has taken a critical, then a damage maneuver is made by the engineer (if one exists) before other maneuvers are resolved. If there is no engineer, the maneuver is still made, but without a bonus. The roll is made using the engineer's Scientific/Analytical • Technical category bonus, but no specific skill, as the engineer is trying to hold the vehicle together in general, and not one specific system. The roll is also modified by situational modifications, such as damage severity. After the maneuver has been made, then the results are applied to any maneuver which occurs later in the round.

Maneuvers must be made every hour the craft is under power, or when unusual events occur, such as large gusts of wind. If the craft no longer needs guidance, such as a spaceship after it's done accelerating, then no more maneuvers are necessary until the craft needs guidance again.

Many of the results are self-explanatory. The GM may have to modify the result slightly to fit the situation, but otherwise, it explains exactly what happened.

Other results produce nothing but a percentage. In most cases, this percentage indicates the amount of the maneuver that was completed. If this is more than 100%, then this means that the character has some of the round remaining. For instance, if the result is 150%, that means that the pilot has an additional 50% activity remaining in the round.

Sometimes a maneuver will require that it either be completed or not. For instance, if the check is to determine whether the pilot can dodge a rock, then the percentage indicates the chance of the character succeeding, and a second roll must be made to determine the final result.

9.2 GENERAL MODIFICATIONS

These modifications affect all maneuvers. The most common modifications are based on the difficulty. Others are based on the condition of the character.

Difficulty	Modification
Routine	+30
Easy	+20
Light	+10
Medium	+0
Hard	-10
Very Hard	-20
Extremely Hard	-30
Sheer Folly	-50
Absurd	-70

Pilot/Navigator /Engineer Condition	Modification
25% -50% of Hits taken	-10
51% -75% of Hits taken	-20
76% + Hits taken	-30
Per Hit/Round of Bleeding	-5
Each Limb non-functional	-10
Stunned	-50
Drunk/Drugged	-10 to -50

9.3 AFV MODIFICATIONS

These are some modifications for running an armored fighting vehicle. This covers a wide range of situations and vehicles, but is generally used for tanks or battle armor.

Precipitation	Modification
Drizzle	-5
Light Rain	-10
Sleet/Snow/Hail	-20
Heavy Rain	-20
Blizzard/Downpour	-30
Hurricane	-40

Visibility	Modification
Per each 50 meters < 1 Kilometer	-5

Night	Modification
Lo-Lite Imaging	-5
If vehicle has lights	-10
If vehicle has no lights	-50

Surface	Modification
Surface Wet	-5
Surface Snowy	-5
Surface Icy	-25

Speed	Modification
Per 2 KPH over speed limit	-1
Vehicle handling ability	GM assigned

9.4 AIRCRAFT MODIFICATIONS

Aircraft modifications primarily deal with weather. Other conditions often apply, however, especially during takeoff and landing.

Winds	Modification
For every 10 KPH at maximum gust	-5

Precipitation	Modification
Drizzle	-5
Light Rain	-10
Sleet/Hail	-20
Snow	-30
Heavy Rain	-20
Downpour	-30
Blizzard	-40
Hurricane	-50

Visibility	Modification
Per each Kilometer < 10 Kilometers	-10

Night	Modification
Lo-Lite Imaging	-5
If vehicle has no lights	-20

Landing	Modification
Surface is not paved	-30
Area not marked	-30
Pilot has landed here before	+20
Landing at night without lights	-40

Combat	Modification
No Combat Pilot skill	-25

(If pilot has the Combat Pilot skill, that skill can be used instead.)

VEHICULAR MANEUVERS/ASTROGATION TABLE VM-9.1

ROLL	AFV	AIRCRAFT	GROUND CRAFT	NAVIGATION
-201	You choked, didn't you. You throw your AFV onto one side, causing a random 'D' Blast critical.	Unbelievably inept maneuver causes a flame out and out of control spin. Only an Absurd maneuver can restart the engine before the craft is spread over fifty acres.	Total disaster. You roll the vehicle. Both you and the vehicle take an 'E' critical (Blast and Krush respectively).	You blow the entire nav computer. The damage is Extremely Severe.
(-200) – (-151)	You lose control, driving the AFV into the nearest obstacle. If this might damage the AFV, roll a random 'C' Blast Critical.	You manage to manhandle the pilot console into a Severe Malfunction. There is a 50% chance the craft continues its maneuver, 50% chance it does something random.	You drive headlong into the nearest obstacle or vehicle. You and the craft take a 'D' critical, you a Krush, it a Blast.	You plot a terrible course. It will take you dead into the greatest hazard in the area (mountains, rocks, etc.).
(-150) – (-101)	You overcompensate for a terrain flaw, take the vehicle d10 ÷ 2 meters off course, in a random direction.	Was that a sneeze, or do you often lurch 1000 meters off course (50 meters if taking off or landing). Hope there wasn't anything in the way.	You weave 1-10 meters in a random direction. If there's an object in the way, you take a 'C' Krush, the vehicle a 'C' Blast.	You plot a course in a random direction. The pilot must make an Absurd maneuver every hour until he notices the problem.
(-100) – (-51)	Aren't you supposed to be gentle with these things? You complete half the maneuver. One related system is at -25 until repaired.	Insensitive handling of the craft results in 1-4 Routine maneuvers.	Cruel abuse to the appropriate system (breaks, steering, etc.) Causes moderate damage. -50 until the blasted thing is repaired.	You head off to destinations unknown. You notice the problem next sunrise/sunset. The new course is a Very Hard maneuver.
(-50) – (-26)	You panic and perform the maneuver backwards.	Sloppy execution. If landing/ taking off, you cause a moderate malfunction to the craft's landing gear. If not, you cause a Routine malfunction to the craft's control mechanisms.	Panicked confusion causes you to drop to half speed (unless that was your intent, in which case you accelerate).	You waste ten minutes before you realize that the earth if curved. Try again.
(-25) – 0	You choke. Try again next round.	Your mind is on other things. You don't even attempt the maneuver.	You have a lapse and fail to attempt the maneuver.	You drift off, but only for a couple minutes.
01 – 20	10%	10%	10%	10% You'll get it done eventually.
21 – 40	30%	30%	30%	30%
41 – 55	50%	50%	50%	50%
56 – 65	70%	70%	70%	70%
66 – 75	90%	90%	90%	90%
76 – 85	100%	100%	100% It doesn't have to be pretty.	100%
86 – 95	100%	100%	100%	100%
96 – 105	110%	110%	110% You have time to sigh with relief.	110%
106 – 115	110%	110%	110%	110%
116 – 125	110%	110%	110%	110%
126 – 135	120%	120%	120%	120%
136 – 145	120%	120%	120%	120%
146 – 155	120%	120%	120%	120%
156 – 165	130%	130%	130%	130%
166 – 185	150%	150%	150%	150%
186 – 225	150% Well done. +10 to all crew rolls for the next three rounds.	150% Skillful execution. +30 to your next roll.	150% Nice job, try on a +10 for your next roll.	200% Three rounds. Good job.
226 – 275	200% Superb. Add 20 to all crew rolls for 4 rounds. Carry on, soldier.	200% Superbly done. You have half the round to act, but because of an intense rush of adrenaline, you get a full round of action.	200% Artful maneuver. You're the man. All crewmembers gain a +20 for four rounds.	400%. Fifteen seconds. That was impressive. +20 to next roll.
	200% That, gentlemen, is how we do that. All crewmembers gain a +30 bonus for six rounds.	200% Stunning move. All non-friendly observers are stunned for three rounds while they contemplate just how outclassed they really are.	200% You are one with the vehicle. All crewmembers are +30 for six rounds.	600% Ten seconds. Some kind of record. Everyone on board gets a +30 to their next roll.

VEHICULAR MANEUVERS/ASTROGATION TABLE VM-9.1 (Continued)

ASTROGATION	SPACECRAFT	DAMAGED	ROLL
Worst course of all time. The console blows, losing all information. If this is FTL travel, the course initiates, and will take you through the nearest solid body. Roll over 200 on a FTL Pilot maneuver, or you don't react in time.	Slow learning curve. You engage the autopilot before the course is laid in. The entire astrogation computer blows (Ext. Severe). The ship travels in a random direction at full acceleration until the system is repaired or the drive cut. Hope you have inertial damping.	And you thought it couldn't get worse. The hull buckles, causing the ship to take one and a half times maximum hits. 10 Extremely Severe malfunctions occur. The drive is out. All compartments are leaking air. What was that maneuver you were about to try?	-201
You plot your course to sling shot you around the nearest gravity well. Next time you should check your math. 50% you go high and cause a random malfunction. 50% chance you go low, roll an Absurd piloting check or splash across the object's surface.	You slam the drive into full acceleration without checking the intake mix. You cause a Severe malfunction.	That didn't sound promising. There is a screech of metal as the maneuvering system you're using sustains a Very Severe malfunction (it's now -90). The same happens to the pilot's controls. Uh... oops?	(-200) – (-151)
You plot your course in a random direction. If such things matter in this universe's FTL, you hit a gravity well ten hours later (1-10 malfunctions). It's a Very Hard maneuver to figure out where you are.	You make an inept job of it. All passengers not strapped in take an 'A' Unbalancing critical. All others take 1-10 hits and resist level 10 nausea.	Sparks fly as all the bridge systems blow. Piloting and Astrogation controls are Extremely Severely damaged. Roll two random malfunctions. You're done.	(-150) – (-101)
You plot a course to nowhere. A day passes before you notice. It's a Very Hard maneuver to plot a new course.	You blow the cooling system (moderate damage). The drive is at half power until repaired.	The ship takes a 'C' Blast critical from the strain. Roll 3 Severe malfunctions. The maneuver is at -100.	(-100) – (-51)
You spend ten long minutes plotting a completely inaccurate course. You have a headache (-10 'til you nap). Try again. Hope you're not in a hurry.	You only manage to throw yourself into a less convenient orbit. Re-plot course at -20. Next maneuver is two difficulties higher.	The power plant malfunctions (Severely). You can shut it down or attempt the maneuver at -100. If you push on, it will work for one hour, then shut down, Extremely Severely damaged.	(-50) – (-26)
Doesn't that plotter screen have pretty lights? Why don't you stare at it for a minute? How about two? Okay, that's enough.	You fail to take action.	You cut all the safeties on the controls. If the maneuver isn't 100% successful, the system is Very Severely damaged and you take a 'B' Electricity critical.	(-25) – 0
10% They say Rome wasn't built in a day.	10%	Amidst 5 random malfunctions, you attempt the maneuver at -70.	01 – 20
30%	30%	The ship shudders ominously. 2 Moderate malfunctions. -50.	21 – 40
50% Maybe it would quicker if you weren't playing computer games.	50%	One crew chamber, gun port and the engine room are exposed to space. Bulkheads seal. Start dealing out vacuum damage. -50.	41 – 55
70%	70%	The ship fights back. You flip to manual. -70.	56 – 65
90%	90%	Hull breach exposes cargo bay. One severe malfunction occurs. -40.	66 – 75
100%	100% A complete, if uninspired, success.	Computer control out. Take appropriate modifiers.	76 – 85
100%	100%	The ship lurches. 'B' Unbalancing criticals all around. +300 hits. -50.	86 – 95
110%	110%	You push it beyond specs. 3 Moderate malfunctions. -40. 100 hits to ship.	96 – 105
110% +10 to subsequent piloting.	110%	Your engineer holds the ship together. You think there's duct tape involved. -30.	106 – 115
110% Crew gets +10 to their next roll.	110%	No modifier, but the maneuver system is Severely damaged.	116 – 125
120% Pilot gets a +20 to his next roll.	120%	-30 to attempt. Ship takes +50 hits.	126 – 135
120% Crew gets +20 for the next three rounds.	120%	Your craft takes a Moderate malfunction while you perform your -20 maneuver.	136 – 145
120% As above, but four rounds.	120%	No penalty, but take an 'A' Electricity critical.	146 – 155
130%	130%	You work well under pressure. +30. Your craft takes two Light malfunctions.	156 – 165
150% It only took 4 rounds.	150% Well done.	The ship shudders, but holds. No penalties.	166 – 185
200% That only took three rounds. Give the pilot a +30 bonus.	150% All crewmembers gain a +20 bonus for three rounds.	You hold your breath expectantly, but nothing else fails. No penalties.	186 – 225
400% That only took one and a half rounds.	200% Amazing. You are an artist. All foes subtract 50 from their rolls for 2 rnds as they gape in wonder.	A swift kick to the console cures one malfunction. No penalty.	226 – 275
600% Isn't that supposed to take longer than one round? The pilot may implement the course this round if he's alert and take a -10 penalty.	200% Adrenaline (or whatever you're on) is a wonderful thing. All crewmembers are at +30 for six rounds.	Truly amazing. You need not roll the maneuver. Two malfunctions clear up. Physician, heal thyself.	276+

9.5 ASTROGATION MODIFICATIONS

Each astrogation maneuver is assumed to take one minute. All astrogation maneuvers are considered Medium difficulty.

Situation	Modification
Preset Course	+30
No Astrogation Computer	-70
Per parsec traveled after first	-5

9.6 GROUND CRAFT MODIFICATIONS

These modifications affect craft which travel on land or water. These modifications are handled separately.

Precipitation	Modification
Drizzle	-5
Light Rain	-10
Sleet/Snow/Hail	-20
Heavy Rain	-20
Blizzard/Downpour	-30
Hurricane	-40

Visibility	Modification
Per each 50 meters < 1 Kilometer	-5

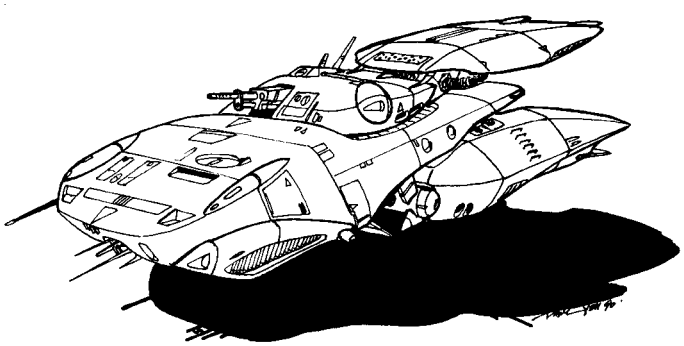
Night	Modification
Lo-Lite Imaging	-5
If vehicle has lights	-10
If vehicle has no lights	-50

Combat	Modification
Vehicle under fire	-25
(If pilot has the Crewmember AFV skill, he can attempt an AFV maneuver instead.)	

Land Only	Modification
Surface Wet	-10
Surface Snowy	-30
For every 10 cm above 10 cm	-10
Surface Icy	-50

Marine	Modification
Each meter of wave height	-10
Each 5 kph of wind	-5

Speed	Modification
Per 2 kph over speed limit	-1
Vehicle handling ability	GM assigned



9.7 NAVIGATION MODIFICATIONS

Each navigation maneuver is assumed to take one minute. All navigation maneuvers are considered Medium difficulty.

Situation	Modification
Preset Course	+30
No Nav Computer	-50
Per 100 km after first	-5

9.8 SPACECRAFT MODIFICATIONS

These modifications apply to spacecraft maneuvers. They only affect maneuvers made outside the atmosphere.

Ship Under Fire	Modification
No Combat Pilot skill	-25

Autopilot	Modification
Active (not for combat or special maneuvers)	-25

Physical Hazards	Modification
Generally manmade	GM discretion

No Course	Modification
Flying by the seat of your pants	-50

9.9 DAMAGE MODIFICATIONS

These are the modifications to engineer maneuvers. These primarily reflect the condition of the ship.

Number of Criticals or Malfunctions	Modification
One	+30
Two	+10
Three	+0
Four	-10
Five	-30
Six	-50
Seven +	-70

Most Severe Malfunction / Critical	Modification
Routine / 'A'	+30
Light / 'B'	+10
Moderate / 'C'	+0
Severe / 'D'	-25
Very Severe / 'E'	-50
Extremely Severe / 'E'	-75

Overall Craft Condition	Modification
25% -50% of Hits taken	-10
51% -75% of Hits taken	-20
76% + Hits taken	-30

10.0 ORDNANCE

"There are very few personal problems which can't be solved by a suitable application of high explosives."
—Anonymous

Support weapons are important to any army, because they bring the ability to destroy a vehicle into the hands of the infantryman. For the purposes of this section, ordnance deals with any armament which is designed for use against constructs, but is still man-portable (though sometimes barely so).

10.1 VEHICLE WEAPONS

Infantry often cart around ultra-compact vehicle weapons. These weapons are usually moved via vehicles, but are small enough for a squad of infantrymen to muscle into place.

An ultra-compact vehicle weapon has half the power (Mark Number) of a compact weapon (see Appendix A-5) of the same tech level. (They weigh about 10% the weight, but have none of the armor or heavy targeting equipment of a vehicle mount.) They weigh about 500 kilograms, so moving one with a single infantryman is problematic without a waldo or cybernetic enhancement of some sort.

An ultra-compact vehicle weapon is typically mounted for use. Sometimes this means attaching them to a suit of powered armor. Sometimes it means placing them on a tripod. Note that any ultra-compact autocannon requires some sort of solid base, such as the top of a vehicle, to absorb the recoil.

10.2 MINES AND DEMOLITIONS

Delivering an explosive payload to a military target is a time-honored goal of warfare. Many times, these explosives are humped to the target on the backs of the infantry. This method is as old as explosives themselves.

Generally, explosives have two targets, constructs or personnel. The effectiveness of these weapons is rated, like all vehicle weapons, by a Mark Number. Their effectiveness against a single person has more to do with the conversion between vehicle and personnel than the actual Mark Number. Against infantry units, the conversion has no effect, as the damage has more to do with how many men were taken down than how much damage was done to each man.

Mines come in three forms. I-mines are activated by infantry units and personnel, they are too smart to detonate for a vehicle. They are designed to tear apart living beings in heavy body armor. They are not designed to damage vehicles. Anti-personnel mines are designed to injure people in light body armor. As it is often better to injure a man than to kill him, these mines are not designed to kill outright (although they certainly can). V-mines are vehicle mines. They are shaped charges designed for destroying vehicles. Personnel would need to fire upon these mines in order to detonate them. They are not set for an individual's weight.

Demolitions are another matter. They are applied to a structure or vehicle by a demolitions expert. An appropriate maneuver (using the Demolitions skill, in the Combat Maneuvers skill category) is necessary to determine proper placement.

To determine the Mark Number of the mine or demolitions, compare the tech level to the chart below. This will determine the weight per Mark Number.

Tech Level	Demolitions	Mine
13	3	6
14	2	4
15	1	2
16	0.5	1
17	0.4	0.6
18	0.3	0.5
19	0.2	0.3
20	0.1	0.1
21	0.09	0.09
22	0.08	0.08
23	0.07	0.07
24	0.06	0.06
25	0.05	0.05
ISC/Empire	0.046	0.046
26	0.04	0.04
27	0.03	0.03
28	0.02	0.02
29	0.01	0.01
30	0.009	0.009

Example: *Mike intends to set a demolitions charge on the prototype Jeronan fighter. He decides that he needs to use typical demolitions, because he won't be able to sneak a nuclear grenade onto the base. He figures that a Mark 20 demo charge should be enough, as he can place it on the fighter's own weapon payload, greatly increasing the destructive force.*

ISC demolitions weigh .046 kilograms per Mark Number. This means that enough explosive to cause a Mark 20 charge would weigh .92 kilograms. Not bad for enough explosives to jeopardize the entire hanger bay. He decides to double that for safety's sake.

10.2.1 PERSONNEL

To determine the effects of demolitions versus a single individual, two methods can be used.

If no other books are possessed, multiply the Mark Number by 10 and add this as an OB to a grenade attack. Subtract 10 per blast radius after the first. This is a quick and dirty method, and doesn't really represent the deadliness of the attack.

If *Blaster Law* is possessed, multiply the Mark Number by the amount determined in Section 8.1 (p. 49). This is the effective Plasma Energy of the attack. Resolve the attack on the appropriate plasma weapon table. If the amount exceeds 10, use the PE 10 table, and add the remainder as a bonus to the attack.

Blast Radii

Explosives have blast radii. Each blast radius is equal to the Mark Number of the charge, in meters. The blast radius does not effect the energy of the attack, only the OB.

Note: *It may occur to some to wonder how the conversion of Mark Number to AE affects the blast radii. The greater the difference between vehicle and personnel become, the hotter the plasma or chemical reaction of the explosion becomes. This does not affect the size of the explosion, just the deadliness.*

Blast Radius	OB
In contact	200
1st	100
2nd	90
3rd	80
4th	70
5th	60
6th	50
7th	40
8th	30
9th	20
10th	10
11th	0
12th and above	-10 per Radii

Criticals

By tech level 18, all demolitions and mines are plasma-based. This means that the criticals are treated as burst attacks.

These are treated as normal plasma criticals. The first round, they are scorch criticals if armor is worn Stripping the armor quickly will end all criticals (though with these attacks, it would have to be the entire suit or armor, as the target is doused in plasma). After the first round, the armor dissolves and normal burst criticals are taken every round, each round of one severity less than the round before.

There is one tremendous difference between this and a normal burst attack, however. Because the target is covered from head to toe, the critical is re-rolled every round.

Before tech level 18, mines cause Ballistic Shrapnel criticals and demolitions cause Heat criticals with secondary Impact criticals (see *RoM,* p. 121).

Demolitions check

A static maneuver is necessary to place the demolitions. The result of the placement depends on the result rolled on the static maneuver.

Result	Effect
Spectacular Failure	Charge detonates during placement
Absolute Failure	Materials destroyed
Failure	Dud
Unusual Event	Hangfire. Detonation delay d10 rounds
Partial Success	Mark # x .5
Near Success	Mark # x .75
Unusual Success	Mark # x 2
Success	Mark # x 1
Absolute Success	Mark # x 1.5

Shaped Charges

All charges set against constructs must be shaped. Charges set against infantry or personnel can be shaped or not.

The blast radii of a shaped charge are doubled in the direction of the attack. They are divided by 10 in all other directions. Assume a 45° arc against personnel.

Example: *Mike has just finished planting his charge on the prototype fighter when a guard sets off the booby trap he left on the hanger door. The guard is wearing AT X.*

Mike, having two doors to cover, sets a Mark 10 demo charge on each. Since this is the *Privateers* universe, this is multiplied by 5 to achieve a Plasma Energy of 50.

The charge is shaped and facing the hallway from the hanger. As the charge detonates, the guard setting it off is considered in contact. A second guard is positioned 15 meters down the hall.

The guard in contact with the charge receives a 200 OB attack for being in contact with the explosion. To this, a +40 bonus is added because PE 10 is the biggest plasma chart in Blaster Law. This 240 OB attack pegs the PE 10 chart. Say goodnight, Gracie.

The second guard has a bit better chance of surviving. He is in the second blast radii, receiving a 90 OB attack (still +40), so 130 is the base. A low roll might leave him alive, but it isn't likely.

Anti-Personnel Mines

Anti-personnel mines are designed to injure their targets, not necessarily kill them. As they are less and less effective against heavier armors, they fall out of popularity with the advent of kinetic armors, then begin to make a comeback as combat armor becomes the norm.

Anti-personnel mines are given a Mark Number. This determines its blast radii and OB bonus as listed above. It attacks on the Grenade Attack Table A-Em-2.9 (*Equipment Manual,* p. 112).

Final Note

There was a time when mines were designed not to kill, but to make messy wounds. As anti-personnel mines became less and less useful in the light of kinetic armor, so did medical technology make this a less practical approach. By tech level 18, it's becoming increasingly practical for one medic to care for a patient. This brings mines into a more deadly purpose.

Vehicle scale combat is incredibly deadly to human scale combatants. Use of demolitions and mines should be applied judiciously.

Luckily, demolitions are almost never used against personnel. I-mines, however, are common on the battlefield. It is recommended that if mines are used, the emphasis be placed on drama, not just dealing out damage. Scanners can spot a mine easily enough, so mines could be placed in front of a careful party for them to discover and disarm, not to destroy them.

10.2.2 INFANTRY AND CONSTRUCTS

Mine attacks versus infantry units and constructs are easier to handle. First assign a Mark Number normally. Then conduct an attack. For infantry, use the Vehicles vs. Infantry Attack Table (p. 132). For vehicles, use the Warhead Attack Table (129).

It is very rare for an army to use any but the most powerful mines or demolitions. They are simply too cost effective.

10.3 SUPPORT WEAPONS

Support weapons are designed to devastate vehicles and infantry alike. They are deadly and incredibly efficient.

Infantry Mortar (Tech Level 14)

This device is used to fire a small warhead high into the sky. It then lands, damaging everything in the immediate area.

Mortar attacks are resolved on the Warhead Attack Table A-VM-3.6 (p. 129). The character or squad may add his skill with Weapon, Support (Mortar) to his open-ended roll to see how close the mortar lands to its target. Any range modifications are added to this roll, not the roll on the attack chart itself.

The GM may allow any character or unit to make an Awareness maneuver to notice the mortar in time to dive for cover. Rules for diving for cover are located in *Blaster Law*. If the accuracy roll was less than 100, then the difference is added as a positive modifier to the maneuver. A GM may also rule that results over 100 act as a negative modifier.

As stated before, the character rolls a d100 (open-ended), adding any modifiers for range, his skill, or special conditions. At the same time, the GM rolls a d100 (not open ended). If the GM rolls doubles (11, 22, etc.), then the mortar hits the target dead on, regardless of the player's roll or diving for cover. Otherwise, an even roll on the part of the GM means the mortar lands to the right of the target, an odd roll, to the left. Finally, the lesser roll is subtracted from the greater and the result is compared to the Mortar Accuracy Chart to determine how many degrees off the lob was. The final result shows where the Mortar landed.

Example: *Fitt lobs a mortar at the nearest vehicle, 50 meters away. There is a –2 penalty for an attack at this range. He rolls a 37 (about average for his luck), but gets to add 76 for his skill. The GM rolls a 56. The mortar lands to the right of the target, and subtracting 56 from 111 (37 + 76 –2), the GM finds that the attack was 4d10° off. Fitt rolls and, typically, gets a 38. The mortar flies 38° off target, to the right.*

A similar method is used to determine the number of meters by which the attack missed. The player and GM each roll. If the GM rolls doubles, then the mortar was fired the right distance. An even number indicates a long lob, and an odd number indicates a short lob. Note that this is relative to the distance the mortar should have traveled. In the example above, if this results in 0 feet, then the grenade will still fall short, as the mortar flies 50 meters, 38˚ to the right.

MORTAR ACCURACY CHART

Difference Between Rolls	Degrees Off	Meters Off
0 to 10	9d10°	10d10
11to 20	8d10°	9d10
21 to 30	7d10°	8d10
31 to 40	6d10°	7d10
41 to 50	5d10°	6d10
51 to 60	4d10°	5d10
61 to 70	3d10°	4d10
71 to 80	2d10°	3d10
81 to 95	d10°	2d10
96 to 100	0°	d10
Greater than 100	0°	0

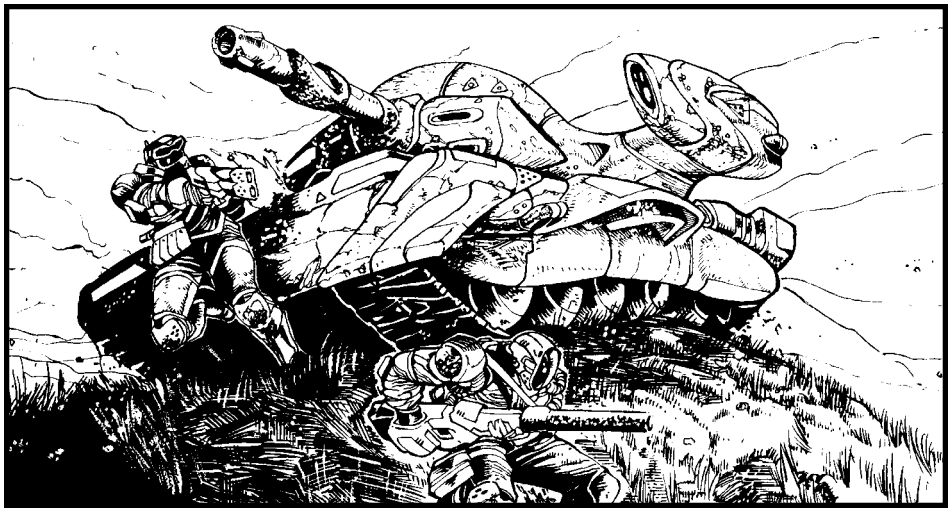
Note: In all cases, if the random result indicates that the grenade ends up somewhere that is physically impossible the GM should determine the result of grenade placement using common sense (e.g., if the grenade cannot go 5' behind the target without going through the wall, the grenade will hit the wall and bounce back a few feet).

Range: A mortar receives a -1 penalty per tech level in meters. (For instance, an ISC mortar receives a -1 for every 25 meters traveled).

Indirect Fire: Indirect fire can be achieved by use of spotters. All range penalties are doubled.

Zeroing In: Every subsequent attack on a stationary target receives a cumulative +10 bonus, until a dead on hit is achieved.

Resolving the Attack: A mortar attacks as a warhead with half its tech level as the Mark Number. For instance, an ISC mortar has a Mark Number of 12. A mortar's attack is resolved like a mine for personnel and infantry. Only a direct hit is effective against vehicles.



Light Anti-vehicle Weapon (LAW) (Tech Level 14)

These one shot rockets are designed for an infantryman to use against vehicles and constructs. LAWs are fired at a vehicle by one or more infantrymen. The amount of missiles fired is compared to the missile salvo chart to determine the effects, however the Mark Number is halved. They are one shot weapons.

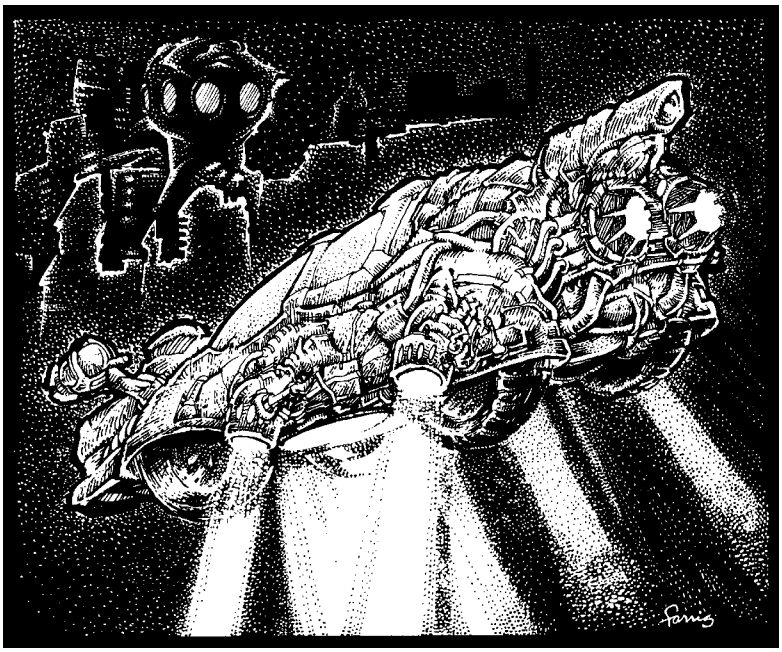
10.4 OTHER WEAPONS

There are many other types of battlefield weapons. A few of the most common are listed here.

Amboathorphin (Tech Level 17)

This is a universal nerve gas antidote for human beings. One dose will protect a human for twelve hours. During this time, no standard nerve agents will harm them. If the victim has been affected by a nerve agent and still lives, this can be injected directly into the heart to save him (a Hard maneuver). Alien versions of this antidote exist, under different names, and affect their creator species in much the same manner.

Addiction Factor: 10



Munitions for Anti-Laserlight and Smoke (MASK) (Tech Level 16)

Mask puts up a cloud of smoke which is opaque to laser and blaster fire (technically, any radiation effects from blasters might get through). This creates a ten cubic meter area which blocks all sight, as well as negating any attacks made by laser weapons and blasters. Plasma and other weapons could still be fired through on a sensor lock.

MASK canisters can be fired from a mortar or hurled like grenades. They cause no damage except on a direct hit (GM's discretion).

Nerve Gas (Tech Level 14)

Used by only the most dishonorable militaries (neither the ISC nor the Jeronan Empire use it), nerve gas requires only skin contact to work and kills almost instantly. To represent the deadliness of this substance, it is recommended that no RR be allowed. If one is allowed, treat it as a 50th level nerve poison.

The easiest way to protect against nerve gas is to not come in contact with it. The safest way is to take amboathorphin.

Nerve gas attacks as a Mark 1 mine or mortar. Any critical results in a loss of suit integrity, should protective gear be worn. Powered armor is only breached if the critical rolled on the Powered Armor Critical Table (Equipment Manual) indicates such. If the chart is not available, assume that the armor retains its integrity.

Nerve gas will spread. Its initial radius is ten meters. It spreads ten meters per round for ten rounds, then dissipates.

It's up to the GM to adjudicate the effects of wind.

10.5 PRICE CHART

This chart gives the prices of the items listed in this section. Below is a list of the necessary definitions.

Item: These are the specific items to be purchased. All these items are military grade gear. They may only be purchased by someone with access to such.

Tech Level: The tech level at which this item is introduced.

Weight: The item's weight, in kilograms. Remember this is reduced to ten percent, except where noted otherwise, in subsequent tech levels.

Costs: The cost of the item.

ORDNANCE TABLE VM-10.1

Item	Tech Level	Weight	Cost
Ultra-Compact Autocannon	14	500	¢25,000
Ultra-Compact Blaster Cannon *	18	500	¢50,000
Ultra-Compact Disruptor *	18	800	¢100,000
Ultra-Compact Ion Cannon *	18	600	¢75,000
Ultra-Compact Laser Cannon *	18	400	¢40,000
Ultra-Compact Plasma Cannon *	18	650	¢75,000
Anti-Personnel Mine	13	Varies	¢10 x Mk.
Demolitions	13	Varies	¢100/KG
I-Mine	13	Varies	¢150/KG
V-Mine	13	Varies	¢150/KG
Infantry Mortar	14	20	¢10,000
Ammunition (box of 10)	14	10	¢1,000
LAW	14	5	¢2,000
Amboathorphin †	17	–	¢2,300
MASK (box of 10) †	16	10	¢1,000
Nerve Gas (Box of 10)	14	10	¢10,000

* — Tripod included.

† — These items are ten times more expensive on the tech level of their introduction.

PART IV
APPLIED TECHNOLOGY

"An educated man should know everything about something and something about everything."
—C.V. Wedgewood

It isn't enough to have gadgets and technological marvels in your game. Technology is more than just a collection of toys. Technology must be maintained and developed. It must be used and applied.

Many of the problems of society are solved through the application of technology, but technology doesn't apply itself. Technology needs skilled scientists, technicians, and technophiles to put it into effect.

This part contains the rules necessary to use and develop technology. It also contains rules for repairing and maintaining technology.

11.0 USING EQUIPMENT

"Handle with care."
—Unknown

Many activities in an SF game involve the use of high tech equipment. Most of them, firing a gun for instance, are covered by the appropriate skills.

But some skills require more expanded coverage. Using scanners, for instance, is a very broad topic. Other topics, such as electronic warfare, are covered here as well.

11.1 SHIP SENSORS

Ship sensors can be much more difficult to use than simple, hand-held scanners. This is mostly because the sensors are capable of retrieving much more sophisticated data.

Skill Use

Interpreting sensor results requires a Sensor Analysis static maneuver, exactly like with a hand-held scanner. The major difference is that there are several additional possible modifiers, due to the wider range of possible types of scans.

Repairing Sensors

Repairing sensors can require several different skills. Damage to the emissions unit requires a Power System Technology static maneuver. Repairing the sensor array requires an Electronic Technology static maneuver. Repairing damage to the data processor requires a Computer Technology static maneuver.

Data Output

Data can be displayed in three different forms. These forms can be useful for different tasks.

Raw Data: This data is the most plentiful, precise, and tedious of the three. It is not commonly used, and it's completely useless without an SI computer or a tremendous amount of time. It is generally only used when the sensor's data processor is out of commission.

Analyzed Telemetry: This text data has been run through thorough processing. It distills and evaluates the data, producing an accurate interpretation of the results.

Graphical Output: This presents a visual image representing the object scanned. This can provide everything from a simple image to a tactical display.

Range

Ship sensor range is greatly dependant on tech level. For the purposes of these rules, no ranges are given for sensors below tech level 20. Sensors at tech level 19 and lower are completely passive. Radar simply is not suited for scanning the distances involved in space.

Range Caps

Many of the sensor tasks have range caps. These tasks cannot be performed at ranges beyond the caps. No attempt may be made.

• • •

INTERLUDE TWO

The freighter swam through a maze of electromagnetic and quantum signals. Quay bent over his console, studying the esoteric world of electronic countermeasures.

The light of atomic fire shined through the ship's canopy, casting strange shadows across the console. Another ship down. Another friend.

The battle had been raging for over ten minutes now, and Quay wanted nothing more than to get away. The captain was flying the ship like his life depended on it, and it probably did, but the real task fell on Quay.

An alarm went off as one of the enemy fighters, spotting the freighter, started to lock on with its targeting sensors. Quay's fingers danced across the console, breaking the lock.

The fighter shifted its sensor frequency, and Quay moved to counter. The fighter shifted its tactics again, and again Quay countered.

In the background, Quay heard someone say something, but he was too far gone to notice. He was in his element now, dancing a dance on spatial, electromagnetic, and quantum levels. It was a complicated game, more subtle than chess, more involved than go. It was the ultimate game of cat and mouse, and the one area where Quay shined above all.

Quay was in his element. He had come home.

SENSOR ANALYSIS STATIC MANEUVER TABLE VM-11.1

-26 Down Spectacular Failure: -100%
Wow, is that scanner supposed to smoke like that? It is a complete write off. You have no idea what that data said before the scanner went up in smoke.

-25 — 04 Absolute Failure: -50%
Did you really want to know that object's capacitance? I think you had the scanner on the wrong setting. You just wasted all the time necessary to do that scan.

05 — 75 Failure: 0%
Yep, that's data alright. I wonder what all those little numbers mean ...

UM 66 Unusual Event: 0%
Wow, that is really cool! Did you know this thing can record what it scans? You start playing back old recordings. Hey, didn't you declare that scan a negative? It looks like you were wrong. Didn't you make a bet on that one? It looks like you owe someone ¢200. Wait, weren't you doing something?

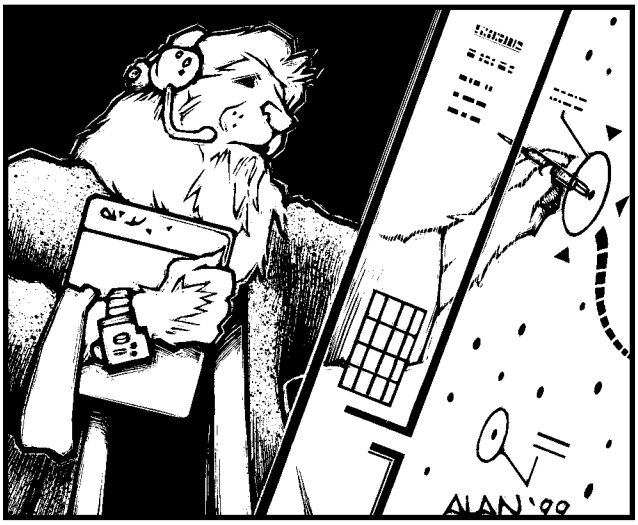
76 — 90 Partial Success: 25%
Well, this is some good preliminary data. You have a good overview of the subject, but no details (you know the kingdom of a creature, whether a material is a metal or a noble gas, etc.)

91 — 110 Near Success: 75%
You almost have it. Can you afford one more scan? If so, you can make another scan with a +10 bonus.

UM 100 Unusual Success: 130%
Wow, that is really incredible. You suddenly understand some fine points of chemistry or biology that you've never grasped before. You may immediately develop two free ranks in a related Scientific/Analytical or Technical/Trade skill.

111 — 175 Success: 100%
There it is. It's so obvious. Your analysis is quick and efficient. The proper tool for the proper job.

176 up Absolute Success: 120%
You rattle off the analysis quickly, just seconds behind the scroll of data on the screen. Mr. Spock, eat your heart out.



SHIP SENSORS RANGE MODIFICATIONS TABLE VM-11.2

Range	Penalty
Short Range	+10
Medium Range	+0
Long Range	-30
Extreme Range	-70

SHIP SENSORS RANGE TABLE VM-11.3

Range	Base Distance
Short	1 Light Second (300,000 km)
Medium	1 Astronomical Unit (150 million km)
Long	1 Light Year (9.5 Trillion km)
Extreme	1 Parsec (3.258 Light Years)

Tech Level	Range Adjustment
20	12.5%
21	25%
22	50%
23	100%
24	200%
25	400%
26	800%
27	1,600%
28	3,200%
29	6,400%
30	∞

BIO-ANALYSIS TASKS TABLE VM-11.4

Task	Mod	Notes
Detect Lifeforms	+20	Must be of known type
Determine Bio-Kingdom	+0	Flora/Fauna/Fungi
Determine Distribution	-10	Must have data on lifeform
Determine Chemical Base	-20	Must be of a known type
Determine Body Shape/Size	+0	
Determine Body Temp.	+10	
Determine Body Structure	-20	Skeleton/Organs
Determine Health	-30	Must have data on physiology
Determine Diet	-20	From internal waste matter
Search for known individual	+20	In a construct
	-50	On a planet
Display being	+10	2-D colorless image
	+0	2-D Color image
	-20	Color Hologram

CONSTRUCT ANALYSIS TASKS TABLE VM-11.5

Task	Mod	Notes
Power Use: Personal	-10	
Vehicle	+10	
Civic	+30	
Communication: Personal	-30	Includes Band/
Vehicle	-10	Frequency
Civic	+10	
Computer Complexity	-50	
Drive: Vacuum Power*	-30	Includes accel. and
Atomic Power*	-20	maneuvering
Lesser*	-50	capabilities.
Detect Energy Weapons*	-20	Vehicle scale or larger
Analyze Energy Weapons*	-50	Weapons On/Off line
Detect Electronic Warfare*	-70	
Analyze Electronic Warfare*	-100	
Fuel: Will determine remaining fuel supply. If used with a tonnage task, can determine Δv.		
Vacuum Power	n/a	
Atomic Power	-70	
Lesser	-100	
Artificial/Antigravity Field	+0	
Molecular Analysis	-10	Known Alloys
Atomic Structure	-30	Know Elements
Detect Missiles/Torpedo	-10	Known "type" only
Analyze Missiles/Torpedo	-70	Known make only
Detect Open Spaces	+10	Bays, Holds, etc.
Silhouette/Display	+30	
Detect Workshop	-50	
Detect Screens/Shields*	-20	Tech Level 24+
Detect Sensors*	-50	
Tonnage	+10	
Damage/Integrity	-10	
Visual Display of Structure Image	+30	Colorless 2-D
	+10	Color 2-D Image
	-10	Color Hologram
Visual Display of Civic Area Image	+0	Colorless 2-D
	-20	Color 2-D Image
	-40	Color Hologram

* — These figures assume that the items are powered down. If they are currently burning/firing/scanning, add a +100 bonus to this figure.

QUANTUM ANALYSIS TASKS TABLE VM-11.9

Task	Mod	Notes
Analyze Subatomic Structure	-70	
Detect Subatomic Field	-50	
Detect Force Structure	+80	E.g., Force Fields
Detect Non-locality Field	+0	Communications, etc.
Detect Teleportation	+20	

PLANETARY ANALYSIS TASKS TABLE VM-11.6

Task	Mod	Notes
Atmospheric Makeup	+0	Known compounds/gasses
Climate*	-10	
Mean Planetary Density	+0	
Geological Makeup	-30	Known elements/ores
Gravity/Escape Velocity	+10	
Hydrosphere*	+20	
Meteorological Patterns*	-20	
Planetary Circumference	+30	
Precipitation*	+0	
Rotation Period	+20	
Mean Surface Temperature	+10	
Current Surface Temperature	+20	
Visual Display of Area	+10	

* — These tasks are -50 if performed without a full planetary orbit.

STAR SYSTEM ANALYSIS TASKS TABLE VM-11.7

Task	Mod	Notes
Locate Asteroid Belt	+10	
Estimate # of Asteroids	-10	
Locate Planet	+30	
Size of Stellar Gravity Well	+10	
Locate Stellar Ecosphere	-20	By Race
Locate Moons	+20	
Locate Empty Orbit	-10	
Determine Orbital Period	+0	
Star's Spectral Type	+30	
Star's Stellar Brightness	+10	
Star's Stellar Class	+30	
Star's Stellar Mass	+0	
Star's Stellar Radius	+10	
Star's Stellar Temperature	+20	
Visual Display of Area	-30	Very Scant Detail

SPATIAL ANALYSIS TASKS TABLE VM-11.8

Task	Mod	Notes
Locate Planetary Well	-20	
Locate Stellar Well	+30	
Locate Gravity Wave	-50	
Locate Black Hole	+100	Detects Wormholes Too
Analyze Wormhole	-50	
Detect Spatial Distortion	-20	
Analyze Spatial Distortion	-70	
Analyze Spatial Integrity	-100	

Tasks

Range is merely one modification to a Sensor Analysis static maneuver. Each task has its own difficulties and corresponding penalties or bonuses. Each type of scan has its own common tasks.

When performing a task, add not only the range modification, but the task modification as well. To determine the task modification, see tables VM-11.4 through VM-11.9.

Bio-Analysis — These tasks have to do with lifeforms. They require extensive biological and medical data to operate properly.

Many of these require beings scanned to be of a known "type." For these purposes, that type is a pretty general term. These are merely specified so that sensors cannot be used to determine that an object is alive, when nothing even remotely like it has ever been discovered before. These tasks have a range cap of Medium.

Construct Analysis — These tasks involve the analysis of artificial structures. They are most commonly used to scan ships and space stations, though ground targets can be scanned as well. These tasks have a range cap of Medium.

Planetary Analysis — These tasks revolve around more general data on a planetary level. Actual lifeform/ecosystem data is gathered by bio-analysis. These tasks have a range cap of Medium.

There is a way to check for life without bio-analysis capabilities. Check the planet's atmosphere for composition. If the planet has no life, its atmosphere will be in equilibrium (there will be no gasses, like oxygen, which tend to combine with other substances). The presence of non-equilibrium gasses, without other good cause, indicates the presence of life.

Star System Analysis — These scans are used to determine information about a star system in general. Asteroid belts, planets and moons, solar activity. These things are detectable by a star system analysis.

Spatial Analysis (Tech Level 25) — These scans are used to detect flaws or anomalies in the fabric of space-time. They are used to detect gravity wells, gravity waves, and odd, spatial constructs. Except for particularly large phenomena, such as wormholes, which have a range cap of Extreme, the range cap for these tasks is Short.

Quantum Analysis (Tech Level 24) — These scans study things on a subatomic level. They can detect the obvious quarks, snarks, and boojums. They can also detect non-locality fields and effects, such as those caused by teleportation.

11.2 STEALTH/ELECTRONIC WARFARE

Many games will have at least some form of stealth or electronic warfare. There are many types of possible electronic warfare techniques. Which ones are possible has a lot to do with the genre of the campaign. Below are some of the more common methods of stealth and electronic warfare.

Electronic Warfare

These devices use electromagnetic fields to jam radar, scramble sensors, and make the vehicle otherwise difficult to spot. The problem with these devices is that they are usually very obvious. Though it may be hard to get an active lock on an object with EW, it is typically screaming in the electromagnetic spectrum, and although it may be difficult to pinpoint, everyone will know it's out there.

Because of this, most craft will have two values for EW. The first tells how good it is at actively jamming enemy sensors. This can aid a ship's DB or jam communications, but it makes it difficult for the craft to keep a low profile. The second number represents passive EW. Often, this isn't actually "electronic" warfare. It has more to do with building the ship in such a way to present a small sensor signature.

Cloaking

This device magically makes the ship disappear from scanners. This is a difficult device to rationalize, in hard science terms. The problem is that a ship must emit energy, otherwise the occupants will roast to death. Even cooling units actually produce more heat than they get rid of. To do otherwise would be to violate the law of entropy.

If cloaking is used in the campaign, then it is very hard to detect. The ship's cloaking device will give a -100 penalty to all detection attempts. It may even, at the GM's discretion, be impossible to detect.

Psychic Cloaking

It may be possible, in some games, to cloak someone psychically. This would involve editing the object or person out of the observer's mind. Alternately, if a computer interface can be achieved psychically, a person might convince an enemy computer to ignore them during a data analysis with a Computer Crime static maneuver.

Electronic Warfare Use

Some EW devices, such as a cloaking device, have only two modes, on and off. These tend to be magical technologies requiring no skill to use. Other EW requires extensive computer and operator guidance. This is the type of electronic warfare which requires the most coverage from a game mechanics standpoint.

Before utilizing electronic warfare, the operator must first make an Electronic Warfare static maneuver. Success in this maneuver allows the operator to utilize some or all of their ship's electronic warfare rating. Once this has been accomplished, the user can then try to accomplish one of the following tasks.

Missile Jamming: In this task, the operator attempts to use EW to prematurely detonate a missile or torpedo. The operator makes an attack, using the EW rating as his bonus. The warhead receives a bonus to defense, equal to its Mark Number. Make an Electronic Warfare static maneuver, adding the operator's skill and the EW allocation, and subtracting the target's Mark Number. Compare the result to Table VM-11.10. If the result is not 100% success, roll again. If that roll is equal to or less than the percentage of success, the torpedo/missile detonates.

It is possible to use EW to jam more than one missile. This requires more than one operator, and the EW rating must be split up among targets.

Example: *The Kathrick's Pride is under intense assault by unknown pirates. The pirates, sensing the Pride is about to escape, drop five Mark 10 torpedoes. Alex is generally the only operator, but Jen, the doctor, is manning an EW post until there are casualties.*

Alex gives Jen 30 points of the Pride's +50 EW bonus. He then makes his static maneuver. He rolls a 9. Not good. 9 + 54 (his skill bonus) + 20 (his portion of the ship's EW) -10 (torpedo's Mark Number) = 73. Failure. The torpedo doesn't detonate.

Jen rolls an 88. 88 + 13 (her skill) + 30 (her portion of the ship's EW) -10 (the torpedo's Mark Number) = 121. Success. Her torpedo detonates harmlessly.

Running Silent

A ship can go silent, cutting its engines and powering down non-essential systems. While running silent, a ship can subtract its passive EW rating from all scans made to locate or analyze it.

EW Defensive Bonus

A successful Electronic Warfare static maneuver allows the ship to add its EW rating to it DB. This lights the ship up brightly to all sensors. It makes the ship easy to spot, but hard to pinpoint.

COM JAMMING TABLE VM-11.11

Points Spent	Radius (in Light Seconds)
1-3	1
4-8	2
9-15	3
16-24	4
25-35	5
36-48	6
49-63	7
64-80	8
81-99	9
100-121	10
122-143	11
144-168	12
169-195	13
196-124	14
225-255	15
256-288	16
289-323	17
324-360	18
361-399	19
400+	20

Electronic Counter Warfare

With this use, the electronic warfare officer paints the enemy with his electronic warfare, stripping the enemy's EW defensive bonus. This requires that the EW officer make an Electronic Warfare static maneuver. If successful the EW officer strips away the enemy's EW defensive bonus. This cannot drop the enemy's DB below its base, (i.e., it can only remove the target's EW bonus).

Com Jamming

This allows the EW officer to jam any transmissions going into or out of a sphere of interference surrounding the officer's ship. No transmissions can penetrate this sphere, period. The size of this sphere is subject to the inverse square law.

ELECTRONIC WARFARE STATIC MANEUVER TABLE VM-11.10

-26 Down Spectacular Failure: -100%
That was quite the display. You seem to have blown your EW rig, but not before lighting up like a Christmas tree to everyone within sensor range. Nice shot, Ace.

-25 — 04 Absolute Failure: -50%
I think that was the reset button. It's going to take a bit of time before those EW systems come back online.

05 — 75 Failure: 0%
Well, whatever benefits your EW rig might have given to you were ruled out by your inept handling. You might be a fuzzy dot, but you're a really bright fuzzy dot. No benefit.

UM 66 Unusual Event: 100%
Did you know you could turn it up that far? That one will be heard by the SETI programs of civilizations your grandchildren will meet. Nobody's going to paint you with a targeting system with this much interference (automatic). Of course, every sensor within (Tech Level) light years knows you're here now.

76 — 90 Partial Success: 50%
Okay, now that's the way to annoy them. You get 50% of your EW rating into play. Good work, cadet. You are still a cadet, aren't you?

91 — 110 Near Success: 75%
Good blanket you got going. You get 75% of you're craft's EW rating.

UM 100 Unusual Success: 200%
Ride those light waves, cowboy. You are the wind and the stars. You are as intangible as the night, as ineffable as a dream. Your EW is double effective this round.

111 — 175 Success: 100%
Nice rig, isn't it. You receive 100% of your craft's EW rating.

176 up Absolute Success: 150%
That's the way to blind them. This round, you get 150% of your craft's EW rating to play with.

12.0 CONSTRUCTION AND DESIGN

"It is said that a man's life can be measured by the dreams he fulfills."
—Mr. Roarke, Fantasy Island

Technology does not exist in a vacuum. It must be constructed. It is possible that characters will go through their entire lives without building anything, but there will always be those characters who love to create, and a GM must be ready for this when it arises.

The heart of science fiction is technology, and that technology must have come from somewhere. The science fiction world belongs to the engineer. It is his vision which molds the future.

Notation: *These rules are written solely from the point of view of the player characters. It does not handle the design, from a game mechanics aspect, of the device. For more on vehicle creation, see Appendix A-2.0 (p.80).*

12.1 THE CONSTRUCTION/ DESIGN CHART

Building a device involves two major steps: design and construction. Design involves all the initial design and experimentation stages. Construction involves the building of the actual prototype.

After the GM assigns a difficulty, the engineer must make his design and construction checks. Each check is made on the Construction/Design Table VM-12.2 (p. 68). During a design check, the first number is the percentage of the design which is completed. During a construction check, the first number represents the chance the device functions. The second number is the amount of man-hours it takes to build the device.

Failure

When constructing a device, it is possible that the character will fail. It is possible to make a second attempt, but each successive attempt moves the difficulty to the right one column. The percentage chance of success is cumulative.

12.1.1 ASSIGNING A DIFFICULTY

In most situations, the difficulty for designing and the difficulty for constructing an item are the same, but it is not inconceivable that these two numbers could be different. If so, then the GM must make any judgement calls necessary.

The GM must, of course, decide on what all difficulties should be. Below are some guidelines for the GM to follow.

Routine: This difficulty is for designing simple, everyday devices, such as simple mechanical devices. It is also the difficulty for assembling simple, modular devices, such as those which might be purchased by a consumer. Some assembly required.

Easy: For simple electrical devices and more complicated machines. Construction generally involves a simple assembling of prefabricated parts. Not quite in the "some assembly required" range, but not far beyond it.

Moderate: This is for very complicated, yet purely mechanical machines and any simple electronic devices. Construction tasks will generally involve machining or soldering certain parts. This generally requires at least a couple sophisticated tools, such as a current probe or metal lathe.

Hard: These tasks often involve circuits, machined parts with low error tolerances, or drug design. This is the lowest level at which an original design can be created. Construction tasks will involve careful machining and circuit etching.

Complex: These tasks would involve cloning, non-original replicant creation, or simple microorganism work. Construction generally requires an elaborate lab and even many of the materials must be manufactured. This is the lowest level for simple molecutronics.

Very Complex: This is for normal molecutronics: genetic manipulation, such as is done when designing an alterant replicant, and totally new devices. These constructions require specialized labs for each level of construction.

Absurd: This is for the most sophisticated devices: sapient molecutronics, starships, or devices involving experimental research fields. It also includes previous difficulties in which proper labs or not available.

12.1.2 DESIGN MANEUVER

Once the GM and the player have thoroughly discussed the device, and the GM has assigned a difficulty, a design maneuver must be made. The player rolls an Engineering static maneuver and compares it to the appropriate column on the Construction/Design Table VM-12.2 (p. 68).

If the result is more than 100%, then the research is completed. If not, then the amount depicted is the percentage of the task completed. Subsequent checks are made and their results are added to the total until 100% of the task is completed.

Some objects require different design checks involving different skills. In these cases, a separate set of checks must be made with each skill until the object is completely designed. The component which required the most checks is used for determining the amount of time taken.

Each design takes time. The amount of time depends on the amount of checks the character must make and the difficulty of the task. Each difficulty has a design period. This is the time that each design maneuver takes.

DESIGN PERIOD TABLE VM-12.1

Difficulty	Period
Routine	Five Minutes
Easy	One Hour
Moderate	Six Hours
Hard	One Day
Complex	One Week
Very Complex	One Month
Absurd	One Year

12.1.3 CONSTRUCTION MANEUVER

Once the device has been designed, a working prototype must be constructed to determine whether or not the design is viable.

The character makes an engineering maneuver, using the appropriate skill. If more than one skill is appropriate, a maneuver must be made for each skill. The lowest result is compared to the Construction/ Design Table VM-12.2 (p. 68).

The result determined by the chart will produce two numbers. The first is the chance that the item works. The second is the amount of man-hours the construction took.

If the result is a failure (in the case of composite items, involving many different checks the GM should consider any chance under 100% as an automatic failure). Then a second check may be made, one column higher. The man-hours are taken, and the percentage is added to the chance of the device working.

All time results are given in man-hours. This can be divided up among multiple engineers.

Quirks

Alpha designs rarely run perfectly. In fact, initial designs are often plagued with bugs.

When the design is created with a single design maneuver which resulted in more than 100%, the design has no quirks. Otherwise, the design has a number of quirks equal to the number of design rolls made.

It is up to the GM to assign these quirks. As a general rule, each quirk assigned should be about twice as bad as the one before that. If using the ship creation rules, each subsequent quirk is a design flaw of a higher category.

Example: *Rick's character is an engineer. He is designing a gravbike. The GM assigns it a Very Complex difficulty. He rolls, requiring three rolls to achieve 100%. The gravbike will have three quirks. The first one, the GM decides, if that the fuse on the horn will blow if ever the horn, the turn signal, and the high beam lights are used at the same time. For the second quirk, the GM decides that the bike vibrates in an annoying fashion whenever braking. The third quirk is that the gravbike also vibrates whenever it exceeds 90% maximum speed, imparting –10 penalty while traveling at these speeds.*

Forced Redesign

Often the quirks overwhelm a design, and the design becomes useless. This is often after the third or forth quirk. When a designer goes back to the drawing board, they make a new set of design maneuvers and construction maneuvers.

This generally takes place in phases. First, the designer makes a new set of design maneuvers. The number of quirks in this design are one less than the number determined by the amount of design roles. These quirks are not necessarily the same quirks as plagued the first design.

To determine what the new quirks are, first compare the current number to the original number. If the current design has less quirks, the engineer can determine which quirks are dropped first, as these are the problems upon which he concentrated during the redesign.

Roll a d100 for each quirk. If the result is 01-25, then the quirk is replaced by a new quirk, of lesser severity. If the result is 26-75, then the quirk remains. If the result is 76-100, then the quirk is replaced by one of increased severity. It is up to the GM to determine the effects of each of the quirks.

The engineer must then build the thing. This consists of taking the original prototype and altering it to meet the new specifications. This requires only 10% of the required time and materials.

This process can be repeated multiple times. Every successive redesign reduces the number of quirks by one, until an acceptable prototype is created.

12.1.4 EFFECTS OF RESEARCH AND DEVELOPMENT

Most R&D departments use computer modeling to weed out quirks before hand. This adds a bonus to the design maneuver of +5 per tech level above 16.

The R&D team first creates a design. Then, before building a prototype, they build a computer model. They then redesign the device and model it again, repeating the process until they have a viable design. Since the computer helps the design process as well as the modeling, this takes no extra time.

This of course requires a more extended team, involving a mainframe, computer programmers, and various experts to achieve.

12.1.5 COST

The obvious cost of designing a device is the salaries of the technicians. In addition, a certain amount of raw materials and work space are calculated into the cost. Assume that each prototype costs 100 times the price of a finished, production model.

Therefore, the final cost tends to be a sum of the total of all the prototypes. Generally, the salaries of the design technicians are insignificant compared to this, and can be ignored.

12.2 MACHINES

Machines are the easy devices to build. Generally, all that is really needed is a machine shop. Most electrical needs are met by a machine shop, but electronics might require special needs, such as circuit etchers, computers, and electronic diagnostic devices. Generally speaking, any but the simplest machines requires some sort of workshop.

12.3 LARGER CONSTRUCTS

Larger constructs (vehicles, starfighters, factories, and the like) take a lot of space to design and build. Many of these are less complicated than smaller machines, but their sheer size demands a lot of room.

Some constructs (warships, battlestations…) cannot even be built within an atmosphere, as there would be no way to lift it out of the gravity well.

With items like this, the GM must use his best judgement. At the very least, these would take a factory-sized installation. At worst, it would take an entire orbital dry dock facility.

CONSTRUCTION / DESIGN TABLE VM-12.2				
ROLL	**ROUTINE**	**EASY**	**MODERATE**	**HARD**
-201	Moderate malfunction. Engineer takes an 'A' Electricy critical.	Severe malfunction. Engineer takes a 'B' Electricy critical.	Severe malfunction. Engineer takes a 'C' Electricy critical.	Severe malfunction. Engineer takes a 'D' Electricy critical.
(-200) – (-151)	Light equipment malfunction.	Moderate equipment malfunction.	Moderate equipment malfunction.	Moderate equipment malfunction.
(-150) – (-101)	Routine equipment malfunction.	Routine equipment malfunction.	Routine malfunction to equipment.	Routine equipment malfunction.
(-100) – (-51)	5%. 5 minutes.	5%. 40 minutes.	Upgrade to HARD. Waste one hour.	Upgrade to COM-PLEX. Waste 100 hours.
(-50) – (-26)	10%. 12 rounds.	10%. 40 minutes.	5%. 4 hours.	5%. 80 hours.
(-25) – 0	20%. 6 rounds.	10%. 30 minutes.	10%. 2 hours.	10%. 60 hours.
01 - 20	40%. 6 rounds.	30%. 30 minutes.	20%. 1 hour.	20%. 50 hours.
21 – 40	60%. 6 rounds.	50%. 30 minutes.	30%. 50 minutes.	25%. 40 hours.
41 – 55	80%. 6 rounds.	70%. 20 minutes.	40%. 50 minutes.	30%. 40 hours.
56 – 65	90%. 6 rounds.	95%. 20 minutes.	50%. 40 minutes	35%. 30 hours.
66 – 75	95%. 6 rounds.	95%. 10 minutes.	60%. 40 minutes.	40%. 30 hours.
76 – 85	99%. 6 rounds.	99%. 10 minutes.	70%. 35 minutes.	45%. 30 hours.
86 – 95	100%. 6 rounds.	99%. 5 minutes.	70%. 30 minutes.	50%. 30 hours.
96 – 105	100%. 6 rounds.	100%. 12 rounds.	95%. 20 minutes.	60%. 30 hours.
106 – 115	110%. 5 rounds.	100%. 6 rounds.	98%. 20 minutes.	65%. 25 hours.
116 – 125	120%. 4 rounds.	120%. 6 rounds.	99%. 20 minutes.	70%. 25 hours.
126 – 135	120%. 4 rounds.	120%. 5 rounds.	100%. 20 minutes.	80%. 25 hours.
136 – 145	130%. 3 rounds.	130%. 5 rounds.	100%. 20 minutes.	90%. 25 hours.
146 – 155	130%. 3 rounds.	130%. 5 rounds.	110%. 15 minutes.	95%. 25 hours.
156 – 165	140%. 2 rounds.	140%. 5 rounds.	110%. 10 minutes.	100%. 20 hours.
166 – 185	150%. 1 round.	140%. 4 rounds.	120%. 10 minutes.	100%. 16 hours.
186 – 225	150%. 1 round.	150%. 4 rounds.	120%. 9 minutes.	110%. 12 hours.
226 – 275	150%. 1 round.	150%. 3 rounds.	130%. 8 minutes.	110%. 8 hours.
276+	150%. 1 round.	150%. 2 rounds.	130%. 7 minutes.	120%. 4 hours.

CONSTRUCTION / DESIGN TABLE VM-12.2 (Continued)			
Complex	**Very Complex**	**Absurd**	**ROLL**
Very Severe malfunction. Engineer takes an 'E' Electricy critical.	Take an 'E' Electricy and an 'A' Krush critical. 3,750 hours wasted. 100% of materials destroyed.	Physically impossible. Take an 'E' Electricy and a 'B' Krush critical for spite.	**-201**
Severe equipment malfunction.	2,500 hours wasted. 100% of all materials destroyed.	Physically impossible.	**(-200) – (-151)**
50 hours wasted. 50% of materials (not tools) destroyed.	No progress. 1,250 hours wasted. 100% of materials destroyed.	All materials destroyed. 10,000 hours wasted. Tough break.	**(-150) – (-101)**
10 hours lost. 20% of materials destroyed due to error.	Problem occurs, wasting 1,000 hours. 50% of materials destroyed.	8,000 hours wasted. 100% of all materials destroyed.	**(-100) – (-51)**
Upgrade to VERY COMPLEX. 350 hours wasted. 10% of materials destroyed.	750 hours wasted. 20% of materials destroyed.	5,000 hours wasted. 50% of all materials destroyed.	**(-50) – (-26)**
10%. 350 hours.	Upgrade to ABSURD. 500 hours wasted. 10% of materials destroyed.	2,000 hours wasted. 20% of all materials destroyed.	**(-25) – 0**
15%. 350 hours.	10%. 2,125 hours.	1,000 hours wasted. 10% of all materials destroyed.	**01 - 20**
15%. 300 hours.	15%. 2,075 hours.	5%. 20,000 hours.	**21 – 40**
20%. 300 hours.	20%. 2,000 hours.	5%. 15,000 hours.	**41 – 55**
25%. 250 hours.	30%. 2,000 hours.	5%. 10,000 hours.	**56 – 65**
25%. 250 hours.	30%. 1,950 hours.	6%. 10,000 hours.	**66 – 75**
30%. 250 hours.	35%. 1,875 hours.	7%. 10,000 hours.	**76 – 85**
40%. 250 hours.	35%. 1,800 hours.	8%. 10,000 hours.	**86 – 95**
40%. 200 hours.	35%. 1,750 hours.	9%. 10,000 hours.	**96 – 105**
40%. 200 hours.	40%. 1,725 hours.	10%. 8,750 hours.	**106 – 115**
45%. 200 hours.	40%. 1,600 hours.	10%. 8,500 hours.	**116 – 125**
50%. 200 hours.	45%. 1,500 hours.	10%. 7,250 hours.	**126 – 135**
50%. 125 hours.	50%. 1,425 hours.	10%. 7,000 hours.	**136 – 145**
50%. 110 hours.	50%. 1,325 hours.	10%. 6,750 hours.	**146 – 155**
60%. 100 hours.	55%. 1,275 hours.	10%. 6,500 hours.	**156 – 165**
60%. 100 hours.	60%. 1,250 hours.	10%. 6,250 hours.	**166 – 185**
65%. 80 hours.	60%. 1,225 hours.	10%. 6,000 hours.	**186 – 225**
70%. 60 hours.	65%. 1,200 hours.	10%. 5,750 hours.	**226 – 275**
75%. 40 hours.	70%. 1,175 hours.	10%. 5,500 hours.	**276+**

13.0 MALFUNCTION AND REPAIR

"Captain, I canna guarantee she'll hold together!"
—A Miracle Worker

Entropy increases. It's not just an annoying fact of life. It's a fundamental law of the universe. Even with the invention of zero fault technology, things break down. The only difference is that when technology becomes advanced enough, it is possible to predict when something will break down, and give it an operational life span.

What does this mean in an SF game?

It means that things will break. They'll be shot to hell. They'll be incinerated, folded, stapled, perforated, scratched, prodded, probed, used as a weapon, and dropped from very high places. As a general rule, player characters are harder on their equipment than any other people in the universe.

It's as fundamental as the law of entropy.

13.1 WHEN MALFUNCTIONS OCCUR

Malfunctions can occur for a variety of reasons. The main ones are listed below.

A Poor Maneuver Result

Often during play, a maneuver will result in an equipment malfunction. This is generally because of a fumble or extremely low roll.

During Normal Use

This situation is most common in the case of vehicles. Vehicles don't generally receive results that indicate a simple malfunction. Therefore, vehicles should have a chance of breaking down through their normal use. This depends upon the type of vehicle.

13.2 VEHICLE MALFUNCTIONS AND DAMAGE

The GM should roll periodically to see if a malfunction occurs. After he has determined there is a malfunction, he must determine the malfunction's actual nature.

Did a Malfunction Occur?

First the GM must determine whether there is a malfunction. The chance of malfunction and the frequency of the check are determined below, according to the type of vehicle.

The GM is encouraged to alter these figures according to the individual case. An old ship with a poor maintenance history might break down all the time, while a new, expensive yacht might tout its extraordinary reliability. The GM (of course) has the final say on such matters.

Interstellar Travel: A vehicle has a 1% chance of a malfunction for every ten light years traveled. This is not cumulative. A separate roll should be made for every ten light year span.

Interplanetary Travel: A vehicle has a 1% chance of a malfunction for each AU traveled. Like interstellar travel, this should not be cumulative.

Planetary Air Travel: A vehicle has a 1% chance of a malfunction for each 1,000 kilometers traveled. It also has a 1% chance for every takeoff and landing. As with interstellar travel, these are non-cumulative.

Planetary Ground Travel: A vehicle has a 1% chance of a malfunction when it starts, as well as a 1% chance for every 100 kilometers traveled on a highway, or every 50 kilometers traveled in a city. As with interstellar travel, these are non-cumulative.

Roll a d100 to determine whether or not a malfunction occurs. Keep track of when the malfunction occurs. If a malfunction does occur, roll again. If the result is another malfunction, roll again. Continue until no malfunction is rolled. Then determine the nature of the malfunction, as outlined below.

Note: *If the idea of rolling a d100 every time a starship travels an AU seems onerous, then consider the following approximation. On average, a vehicle will have one malfunction out of every 100 checks, so roll a d100 when the vehicle begins its trip. The number rolled determines when the inevitable malfunction will occur. For example, if you roll a 28, then a malfunction will occur after the starship has traveled 28 AU.*

Nature of the Malfunction

When a vehicle malfunctions, consult the Vehicle Malfunction Table VM-13.1 (p. 72). First roll a d10 to determine the ship's category. If the ship does not have this category (weapons for instance), roll until an appropriate system results.

Then roll a second time to determine the exact system. This will give a better idea of the exact nature of the malfunction. The GM will probably have to make a judgement call or two.

Finally the GM rolls a d10 to determine the severity of the malfunction. This will determine the difficulty of any repairs.

13.3 WEAPON MALFUNCTIONS

Occasionally a character, be they a PC or an NPC, will experience a weapon malfunction. This occurs whenever a breakage check or fumble indicates a problem.

Weapons are much more high tech in most SF games than in the modern era. This makes them more complicated and thus more susceptible to break down. As an alternative to the breakage rules indicated in *Blaster Law*, the following rules can be used.

Whenever a weapon malfunctions, roll to determine the severity of the malfunction:

Roll	Severity	Modifier
1-5	Routine	-35
6	Light	-20
7	Moderate	+0
8	Severe	+30
9	Very Severe	+50
10	Extremely Severe	+70

Next, roll on the Weapon Malfunction Table VM-13.2 (p.73), adding the modifier and comparing the result to the column appropriate for the weapon. Apply the appropriate results.

13.4 REPAIRS

So you broke it. How do you fix it?

David Brin's Startide Rising was a book about a group of earthlings stranded on a world trying to repair their ship, while entire nations warred overhead for the right to capture them. Repair work can be more than integral to the story. It can be the story.

The first thing that must be determined is how bad the damage or malfunction is. Sometimes, as with the vehicle and weapon rules listed above, the severity is neatly determined while generating the malfunction. Other times, the GM must use common sense. One way or the other, a severity must be determined.

Once the severity has been determined, the technician can begin making repairs. He makes a static maneuver, adding his appropriate technical skill. The result is compared to the Malfunction/Repair Table VM-13.3 (p. 74) to determine the result.

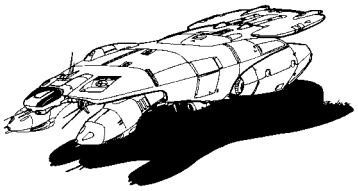
There will be times when other characters wish to help. It is up to the GM to decide how many people can effectively work on a repair task. Those the GM determines can help may add their appropriate skill and category ranks to the head technician's static maneuver roll, as a straight bonus. All technicians involved must have access to tools appropriate to the task (often they can share). *School of Hard Knocks* has guidelines for combining the skills of multiple characters to perform maneuvers.

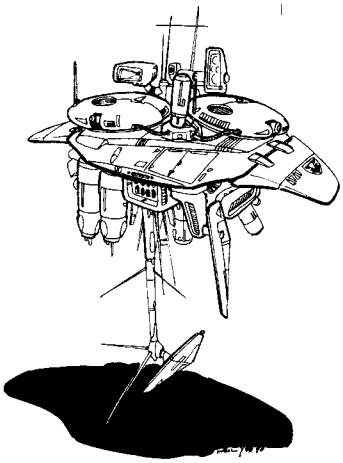
There are two types of problems an item can have: damage and malfunctions. Damage is inflicted externally, whether by fire, flood, or fumble. A malfunction is an internal problem, caused by natural wear and tear. Maneuvers often produce slightly different results depending on whether the device was damaged or malfunctioned. That is why the distinction is necessary.

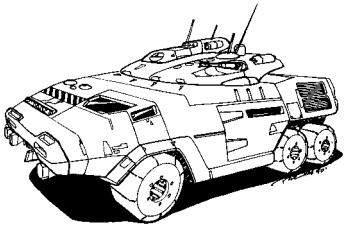
Often parts must be supplied. If the maneuver results in a "Cost in Parts" then the indicated percentage of the item's original value must be paid to obtain the necessary parts for repair.

This seems simple enough for small items, but in a vehicle, it is difficult to judge what the individual cost of a system is. Therefore Table VM-13.1 gives an "Area" for each section. This is the cost of the vehicle's system as indicated by a percentage of a vehicle's total value. This is then compared to the "Cost in Parts" percentage for the total parts cost.

Example: *Mike's fighter blows its computer on the way to a very important battle. It is determined that this is a Very Severe malfunction in the main processing core. Afterwards Gizmo's character decides to fix the fighter. His static maneuver results in 128, indicating 5 hours of repair time and a 10% CIP (Cost in Parts). The area of the computer is 10% of the ship's 47 million credit value, or 4.7 million credits. The CIP is therefore 470,000 credits. This is why only governments own fighter craft.*







VEHICLE MALFUNCTION TABLE VM-13.1

1st Roll	AREA	2nd Roll	SYSTEM
1-2	MECHANICAL (5%)	1	Environment: Lose atmosphere in 1-10 hours.
		2	Environment: Lose heating and cooling in 1-10 hours.
		3-5	Bulkhead/Airlock/Hanger frozen or malfunctioning.
		6	Landing gear inoperative.
		7-8	Internal Lighting out. Emergency lighting on.
		9	Running/Landing Lights out.
		10	Other System or GM choice.
3-5	ELECTRONIC (15%)	1	Helm Control (Main/Auxiliary).
		2	Navigation Control (Main/Auxiliary).
		3	Other Console.
		4	Other Console.
		5	Communications.
		6	Electronic Warfare.
		7-8	Sensors.
		9	Medical.
		10	Other System or GM choice.
6-7	COMPUTER (10%)	1	Deflector Shield Control.
		2-3	Sensor Analysis (now at -100).
		4	Computer Aided Astrogation.
		5-6	Memory Banks (Course plots/Archives).
		7	Autopilot.
		8	Sentient Functions/Diagnostics (Higher Brain Functions).
		9	Main Processing Core (All of the above are out).
		10	Other System or GM Choice.
8-9	POWER SYSTEMS (60%)	1	Sublight Drives.
		2	FTL Drives.
		3	Main Reactor/Axillary Reactor.
		4	Inertial Dampers.
		5-6	Deflector Shields.
		7	Artificial Gravity.
		8	Tractor Beams.
		9	Control Surfaces/Maneuver Drives.
		10	Other System or GM choice.
10	WEAPONS (10%)	1-2	Central Control.
		3	Central HUD.
		4	Tracking Control (Computer).
		5	Other System or GM choice.
		6	Weapon System.
		7	Weapon System.
		8	Weapon System.
		9	Weapon System.
		10	Weapon System.

Make a 3rd Roll Separately for Severity:

3rd Roll	Severity
1-5	Routine (50% chance of a Moderate malfunction for each hour of use or each time it is stressed.)
6	Light (System at 75% normal capability.)
7	Moderate (System a 50% of normal capability. If multiple systems exist, one system has failed.)
8	Severe (System Inoperative until repaired or upgraded.)
9	Very Severe (System Inoperative until repaired or upgraded.)
10	Extremely Severe (Inoperative until repaired or upgraded. May be irreplaceable without spacedock.)

WEAPON MALFUNCTION TABLE VM-13.2

Energy Weapons	Projectile Weapons And Firearms	Support Wp., Grenades, Demolitions	Powered Melee Weapons	ROLL
Weapon cooling. Lose d5 rounds.	Safety on. Alertness, Situational Awareness (Combat) or Weapon Technology maneuver to figure out what's wrong.	Sights are off. -20 until sighted in.	Temporary power drain. Weapon "blinks" this round.	**Less than 1**
In-line fuse blows. Final shot at -10.	Misfire. Better sit this one out.	Weak blast. Criticals reduced 1 severity.	Minor power hiccup. Attack at -20.	**01 – 30**
Weapon grounds. Energy cell and internal wiring damaged.	Sights are off. -15 until sighted in.	Firing glitch. -20.	Weapon loses focus. -40 to all attacks.	**31 – 50**
Focusing array off. Weapon at -25.	Weapon jammed hard. Routine Weapon Technology maneuver to fix.	Detonator problem. Explosion occurs d20 seconds late.	Regulator flaw. Weapon at -30 until fixed.	**51 – 65**
Weapon blows. 50 hits. Hand useless until regeneration therapy.	Slide blows off weapon. 20 hits. Your eyes are flash burned and will take d10 days before vision returns.	Explodes in launcher. +50 point blank attack. You're deaf for d10 days.	Weapon flashes, fusing itself to your hand. 30 hits.	**UM 66**
Fire control stuck. (50% chance it's stuck on.) If on, take one attack at +50.	Weapon jams and is damaged. Reliability halved.	Safety is stuck on.	Power surge grants a +10 to this attack. Then the weapon goes dead.	**66 – 75**
Surge damages focal array. Last shot at +15.	Rifling flaw causes -50 penalty.	Hang fire. Round detonates in d10 rounds.	Major power malfunction. -50 to all attacks. I think it's grounding out.	**76 – 90**
Burst of sparks. Reliability now divided by three.	Gun overheats. If this is an autoloader, it must cool for d10 rounds.	That round never did arm.	Your hand twitches as the weapon grounds through you. It still works, but its reliability just dropped to one third.	**91 – 100**
Power surge. You take a +20 attack. No quickness bonus to your DB.	Ejector malfunction. 10% chance each round jams (unless caseless, where the chance drops to 5%).	Missile explodes a d20 meters from you.	Major surge. This attack is at +30, then the power dies.	**101 – 120**
Discharges in your face. How does a +40 attack sound (no Qu DB)?	Pin malfunction. 50% of all shots misfire.	Fire in the hole! Take a point blank +50 attack.	As above, but take a 'C' Electricy critical for spite.	**121 – 150**
Weapon explodes. If you survive the +100 attack (no Qu DB), it's time to go shopping.	Blowback. You are blind for a d10 rounds. There's a 10% chance it's permanent.	What was that timer set for? Take a +100 point blank attack, and next time, be more careful.	As above, but the critical is an 'E'.	**151 & above**

MALFUNCTION/REPAIR TABLE VM-13.3

ROLL	Routine (1-5)	Light (6)	Moderate (7)
-201	Malfunction: becomes damaged, severity becomes Very Severe. Damage: severity becomes Extremely Severe. That was pathetic.	Malfunction: becomes damaged, severity is Very Severe. Damage: severity becomes Extremely Severe. What were you thinking?	You damage the system and upgrade the severity to Extremely Severe. Is it supposed to spark like that?
(-200) – (-151)	Sad job. Severity is increased to Very Severe after one round.	Severity increases to Very Severe after one round.	Severity increases to Very Severe after one round.
(-150) – (-101)	Severity increases to Severe after 4 rounds.	Severity increases to Severe after 5 rounds.	Severity increases to Extremely Severe after 1 min.
(-100) – (-51)	Severity becomes Moderate after 4 rounds.	Severity becomes Moderate after 6 rounds.	Severity becomes Very Severe after 2 minutes.
(-50) – (-26)	Severity becomes Light after 3 rounds.	20 minutes with 5% CIP. Otherwise, 30 minutes.	Severity becomes Severe after 1 minute.
(-25) – 0	You fumble with the device for 5 minutes before it begins working again.	10 minutes to repair unit. It operates at -25 with a Routine malfunction.	40 minutes to repair with 10% CIP. You cause a random malfunction.
01 – 20	3 minutes to repair.	8 minutes to repair.	Malfunction: repaired with no cost. Damage: 30 minutes to repair with 10% CIP.
21 – 40	2 minutes to repair.	5 minutes to repair. A Routine malfunction remains.	20 minutes to repair with 10% CIP.
41 – 55	1 minute to repair.	5 minutes to repair.	15 minutes to repair with 5% CIP. 25 minutes otherwise.
56 – 65	5 rounds to repair.	5 minutes to repair.	13 minutes to repair with 5% CIP. 25 minutes otherwise.
66 – 75	5 rounds to repair.	5 minutes to repair.	12 minutes to repair.
76 – 85	4 rounds to repair.	4 minutes to repair.	10 minutes to repair.
86 – 95	4 rounds to repair.	4 minutes to repair.	9 minutes to repair.
96 – 105	3 rounds to repair.	3 minutes to repair.	8 minutes to repair.
106 – 115	3 rounds to repair.	2 minutes to repair.	Malfunction: 6 min. to repair. Damage: 7 min. to repair.
116 – 125	2 rounds to repair.	2 minutes to repair.	You isolate 3 Routine malfunctions to repair unit. Start next round.
126 – 135	2 rounds to repair.	6 rounds to repair.	5 minutes to repair.
136 – 145	You may use equipment next round.	4 rounds to repair.	Unit at -25% in 3 minutes. Unit repaired in 5 minutes.
146 – 155	Unit ready next round.	3 rounds to repair.	Unit at -50% in 6 rounds. Unit repaired in 5 minutes.
156 – 165	Unit ready. You have half the round to act.	2 rounds to repair.	3 minutes to repair.
166 – 185	Quick adjustment. You have the full round to act.	1 round to repair.	2 minutes to repair.
186 – 225	THUMP. Wow. It worked.	Piece of cake. You have 1/2 the round to act.	6 rounds to repair.
226 – 275	There's nothing wrong with this.	You flip a breaker. You have the whole round to act.	3 rounds to repair.
276+	What problem?	Maybe it would work better if it was turned on.	1 round. You've got the knack.

MALFUNCTION/REPAIR TABLE VM-13.3 (Continued)

Severe (8)	Very Severe (9)	Extremely Severe (10)	ROLL
Maybe next time you shouldn't have used a hammer, huh? The system is a total loss.	Well that didn't work very well. The system is a total loss. Take an "A" crit of the GM's choosing, just for fun.	The system is destroyed, and in a fit of spite, it takes the whole ship with it. 100% crew casualties.	-201
You damaged it. It's now an Extremely Severe problem.	You blow the entire system. Smooth job.	System is destroyed, explosively if possible. 100% crew casualties.	(-200) – (-151)
Severity increases to Very Severe. Waste 10% CIP.	System is a write off after 2 hours of tinkering.	System destroyed, spectacularly. 1-100% of repair crew becomes casualties.	(-150) – (-101)
Severity becomes Very Severe after 6 minutes.	Severity becomes Extremely Severe after 1 hour.	2 members of the repair crew take a "D" critical.	(-100) – (-51)
3 hr. to repair with 10% CIP.	72 hr. to repair with 50% CIP.	1 member of the repair crew receives an appropriate "C" crit.	(-50) – (-26)
2 hr. to repair with 10% CIP.	48 hr. to repair with 50% CIP.	System receives second random malfunction.	(-25) – 0
Malfunction: 60 min. to repair with 10% CIP. Damage: 90 min. to repair with 10% CIP.	36 hr. to repair unit to 50% effectiveness. 48 hr. to fully repair. 50% CIP.	Repair may not be attempted until 2 Severe procedures are completed.	01 – 20
1 hour to repair with 10% CIP.	24 hr. to repair with 25% CIP.	200 hr. to repair with 50% CIP.	21 – 40
Malfunction: 1 hr., no cost. Damage: 1hr., costs 10% CIP.	24 hr. to repair with 25% CIP.	120 hr. to repair with 50% CIP.	41 – 55
13 minutes to repair with 5% CIP. 25 minutes otherwise.	Malfunction: 24 hr., no cost. Damage: 24 hr., 25% CIP. Smooth work.	110 hr. to repair to 50% effectiveness. 120 hr. to repair to full effectiveness.	56 – 65
Malfunction: 50 min., no cost. Damage: 50 min., 10% CIP.	Malfunction: 18 hr., no cost. Damage: 18 hr., 25% CIP.	110 hr. to repair with 50% CIP.	66 – 75
Malfunction: repair with two Light procedures. Damage: 45 min., 10% CIP.	15 hr. to repair with 10% CIP.	100 hr. to repair with 50% CIP.	76 – 85
40 minutes to repair with 5% CIP.	15 hr. to repair with 10% CIP.	Malfunction: 90 hr., 25% CIP. Damage: 90 hr., 50% CIP.	86 – 95
40 minutes to repair.	Malfunction: 13 hr., no cost. Damage: 13 hr., 25% CIP. Who's the miracle worker?	Repair reduced to 2 Severe procedures.	96 – 105
30 minutes to repair with 5% CIP. 40 minutes to repair otherwise.	10 hr. to repair to 50% capacity. 11 more hr. to repair fully. 10% CIP.	80 hr. to repair with 50% CIP.	106 – 115
30 minutes to repair.	8 hr. to repair. 10% CIP.	Malfunction: 70 hr., 25% CIP. Damage: 70 hr., 50% CIP.	116 – 125
25 minutes to repair.	5 hr. to repair. 10% CIP.	Malfunction: 60 hr., 25% CIP. Damage: 70 hr., 25% CIP.	126 – 135
20 minutes to repair.	Malfunction: downgrade to Severe. Damage: 5 hr. to repair with 10% CIP.	60 hr. to repair to 50% effectiveness. 70 more hr. to repair fully. 25% CIP.	136 – 145
Malfunction: repair with 3 Routine procedures. Damage: 20 min. to repair.	4 hr. to repair. 10% CIP.	50 hr. to repair with 25% CIP.	146 – 155
Downgrade severity to Moderate after 5 minutes.	3 hr. to repair. 10% CIP.	Repair reduced to 2 Moderate procedures.	156 – 165
10 minutes to repair.	Only 2 Light procedures will correct the problem.	40 hr. to repair with 25% CIP.	166 – 185
5 minutes to repair.	2 hr. to repair.	2 Moderate procedures will fix the problem.	186 – 225
4 minutes to repair.	1 hour to repair.	30 hr. and its done.	226 – 275
This is only a Routine problem.	2 Routine procedures and it will work.	2 Light procedures would fix this.	276+

PART V
THE APPENDICES

Cum catapultae proscriptae erunt tum soli proscripti catapultas havebunt!
—Bumper Sticker on a Roman Chariot

Appendix A-1 provides some optional transit time rules. Appendix A-2 some extensive guidelines for constructing vehicles, heavy ordnance, and infantry units. Appendices A-3 and A-4 provide new critical tables and attack tables to use with vehicles. Appendix A-5 provides some detailed ship diagrams

A-1.0 TRANSIT TIMES

So your characters are flitting about the galaxy. How long, exactly, does this take?

This depends on the universe in question. Some games will have sophisticated wormhole networks. Some will use hyperspace. Some will use warp drives or some other such technology.

It is up to the GM to decide the specifics. Here are some examples.

A-1.1 THE PRIVATEERS

The *Privateers* universe has fairly sophisticated propulsion technology. Still, with both interstellar drives and normal drives, they accelerate for half the trip, then decelerate the rest of the way.

Interstellar Travel

Named for the specialized field of quantum nonlocality that allowed the drive to be created, the quantum drive is the primary engine of both nations (the Jeronans stole it from the ISC). It uses special field technology (the precursor of the force field) to contract space in front of the craft and dilate it behind. This causes a relativity trick to make the craft appear to be travailing *faster than light*.

These drives come in three orders of magnitude. A Level 1 drive reduces the effective distance traveled by a factor of 1,000. These are the typical commercial drives. The Level 2 drive reduces the effective distance traveled by a factor of 10,000. These are much more expensive, and are the typical military drives. The Level 3 drive reduces the effective distance traveled by a factor of 100,000. These are very bulky and expensive and only used for the highest speed couriers.

The drive only shortens the effective distance traveled, it doesn't move the craft, so a craft with higher Gs of acceleration can travel faster than one with a lower level of acceleration. This effect can be reversed for when the craft is decelerating, shortening the distance *behind* the craft.

A quantum drive does not work well near a star or planetary atmosphere. The actual math for calculating their use is too complicated to be delved into here, but here are some good rules of thumb:

A quantum drive will not engage within 100 planetary circumferences of a planet with an atmosphere. It simply will not activate. This is because of the planet's magnetic field and atmosphere. Flying into this area does not cause undue problems. There is simply a hard jolt as the drive cuts out. It's scary (all on board make fear RRs), but doesn't cause any damage.

A quantum drive's effectiveness increases in proportion to its distance from the sun. There are a lot of factors that cause this, including solar atmosphere, solar wind, electromagnetic radiation, quantum flux, etc. This is a difficult one to calculate, but as a very general rule, assume that the quantum drive can contract space by a factor of the distance from the sun (measured in AU). In other words, when calculating travel times, add the in-system time for each leg of the journey that will end in a solar system.

See *Spacemaster: Privateers* for the tables containing the transit times for these drives.

It is interesting to note that these craft still accelerate normally. This means that on very long trips (such as a 1G acceleration for 200 days) the travelers will begin to feel noticeable relativity effects. For the effect, compare the time in transit to a similar earth time figure on the relativity tables below. Check the ship time figure to get an idea of how much time transpires on board the ship.

This also means that the craft maintains its inertia, even if the drive gives out. If the drive gives out halfway through a long journey, rescue crafts are going to have to burn their engines a long time to match velocities.

The Reactionless Drive

The reactionless drive is old tech. It was developed long before the quantum drive. This was invented by both the ISC and the Imperials, and though they go about it in different ways, the effect is the same.

The reactionless drive uses field technology (a distant predecessor to antigravity) to force a craft to accelerate without ejecting reactants out the back. This means that starships don't require large engines to spew fire out the back. Acceleration is achieved by the use of a field generator deep inside the craft.

Though these could conceivably be designed to push in any direction, they rarely are. More acceleration can be achieved in less space if the reactionless drive is designed to only push the craft in one direction, because of structural engineering restraints.

With this technology and powerful gyros/flywheels, most craft require no thrusters at all.

A-1.2 OTHER

There are many other types of travel. Some the GM will invent. Some are common to all universes.

Interplanetary Transit

These rules are useful for any universe. They are not specific to any genre, and simply represent the laws of physics.

After reading any book on special relativity it will become obvious that the only things that really mean anything in space are relative velocity and acceleration. When fuel technology becomes good enough,

almost all travel will probably be performed under constant acceleration. When calculating the time it takes to go from point A to point B at a given acceleration, use the following equation:

$$T = \sqrt{(2 \times D) \div A}$$

Where D = distance (in meters), A = acceleration (in meters/second/second), and T equals time (in seconds). Remember, 1 G is equal to 9.8 m/s/s of acceleration.

Remember also that most of the time, the ship will be accelerating half the journey, then decelerating the rest of the way. This makes the trip longer than if the craft could just accelerate all the way. To represent this, calculate the time it takes to travel half the distance, then double it.

Dealing with complicated relativity equations is beyond the scope of this work, therefore we will try to keep to non-relativistic speeds.

To shift the resulting time into a more useful figure, divide it by 60 for minutes, 3,600 for hours, or 86,400 for earth days (90,000 for ISC Standard Days).

As everyone seems to be aware of these days, the faster one travels, the more time is dilated (for you skeptics, this has been experimentally shown, up to nearer the speed of light than your characters will ever get). The difference on these tables is never much. More complete treatment will be saved for future works.

Tables T-5.7-5.10, *Spacemaster: Privateers* (p. 97-100), are provided to give transit times under full acceleration of different interplanetary distances. Time dilation and mass increases can generally be ignored in these instances.

Delta-V (ΔV)

ΔV is the measurement of how much fuel a spacecraft can carry. Spacecraft fuel is not measured in terms of how many miles per gallon the craft achieves, but by how much the craft's speed can be altered.

ΔV is typically measured in the total speed that could be achieved in a single burn. This can be then broken up into smaller bursts.

Example: *Lou has 400 meters per second of ΔV in his EVA pack. He could accelerate to 400 meters per second, then run out of fuel. He could accelerate to 200 meters per second, then has just enough left to decelerate again. He could also accelerate to ten meters per send and decelerate again twenty times (two ten meter per second bursts, twenty times total, 10 x 2 x 20 = 400).*

Relativistic Speeds

In some universes, there will be no FTL travel, or the time may arise where non-FTL times are needed. Maybe the characters are stranded on a distant star and their wormhole collapses, leaving them with little choice but to travel back the hard way. Such situations should be avoided, because of the time involved, but certain plot devices may require such a situation.

The *Gamemaster Manual* provides a greater treatment of relativity. The basic equation every one thinks of, however, is time dilation. How much is time dilated? Compare to the following formula:

$$t = T \div \sqrt{1 - v^2}$$

Where t = Earth time, T = ship time, and v = velocity.

This becomes very complicated under constant acceleration. For the sake of convenience, the following tables have been provided.

The first, Transit Time Chart (p. 78), assumes an infinite fuel supply. In this scenario, the ship accelerates until the halfway point, then kicks over, decelerating the rest of the way. Compare the acceleration to the distance traveled. This will result in an Earth time figure and a ship time figure.

The second table assumes that the ship has a finite amount of Δv. The problem with relativity is that the ship increases its mass as it approaches the speed of light, and consequently requires more fuel to accelerate. Thus, a ship might be said to have 2 lights (2 light speeds) worth of Δv. As it takes an infinite number of lights worth of fuel to accelerate the ship to the speed of light, the ship cannot actually accelerate to 2 times the speed of light.

If a ship has a set amount of Δv, it will probably accelerate to a set speed then cut its engines. It will then decelerate again when it reaches its destination.

For this purpose, the Acceleration Time Chart (p. 79) has been included. It shows how long it takes to accelerate (and decelerate) to a certain speed. It also shows how much actual Δv is used due to relativity. Finally, it shows the time dilation experienced at that speed, once the engines are cut.

A Note on Relativity

The greater the speeds of two objects differ, the greater the effects of relativity. This means that if you look at a another spaceship when your relative velocities are very different, time will appear to be running slower on the other ship, their measuring rods will appear to be squashed, and they will appear to have a much greater mass.

Of course, to them you appear the same way.

Relativity does not favor either frame of reference; both are correct. So you might wonder: how does anyone ever lose time if they think everyone else is losing time as well? How is this paradox resolved?

The answer is that everyone agrees on what is happening while the ship is accelerating. While accelerating, everyone else seems to speed up, their mass is increased, and their length is reduced.

So when a journey is done, after the acceleration on one end and the deceleration at the other, both the traveler and a stationary observer agree. The traveler lost time.

TRANSIT TIME CHART

Distance (In LY)	Acceleration 1 G Earth Time	1 G Ship Time	2 Gs Earth Time	2 Gs Ship Time	3 Gs Earth Time	3 Gs Ship Time	4 Gs Earth Time	4 Gs Ship Time	5 Gs Earth Time	5 Gs Ship Time	6 Gs Earth Time	6 Gs Ship Time	7 Gs Earth Time	7 Gs Ship Time	8 Gs Earth Time	8 Gs Ship Time	9 Gs Earth Time	9 Gs Ship Time	10 Gs Earth Time	10 Gs Ship Time
.1	.6	.6	.5	.4	.4	.4	.3	.3	.3	.3	3	.2	.3	.2	.2	.2	.2	.2	.2	.2
.2	.9	.9	.7	.6	.5	.5	.5	.4	.4	.4	.4	.3	.4	.3	.4	.3	.4	.3	.3	.3
.3	1.1	1.1	.8	.7	.7	.6	.6	.5	.6	.5	.5	.4	.5	.4	.5	.4	.5	.3	.5	.3
.4	1.3	1.2	1.0	.9	.8	.7	.7	.6	.7	.5	.6	.5	.6	.4	.6	.4	.6	.4	.6	.3
.5	1.5	1.4	1.1	.9	.9	.8	.9	.6	.8	.6	.8	.5	.7	.5	.7	.4	.7	.4	.7	.4
.6	1.6	1.5	1.2	1.0	1.1	.8	1.0	.7	.9	.6	.9	.6	.8	.5	.8	.5	.8	.4	.8	.4
.7	1.8	1.6	1.4	1.1	1.2	.9	1.1	.7	1.0	.7	1.0	.6	.9	.5	.9	.5	.9	.5	.9	.4
.8	1.9	1.7	1.5	1.2	1.3	.9	1.2	.8	1.1	.7	1.1	.6	1.0	.6	1.0	.5	1.0	.5	1.0	.4
.9	2.1	1.8	1.6	1.2	1.4	1.0	1.3	.8	1.2	.7	1.2	.6	1.1	.6	1.1	.5	1.1	.5	1.1	.5
1	2.2	1.9	1.7	1.3	1.5	1.0	1.4	.9	1.3	.8	1.3	.7	1.2	.6	1.2	.6	1.2	.5	1.2	.5
2	3.4	2.6	2.8	1.7	2.6	1.4	2.4	1.1	2.4	1.0	2.3	.9	2.3	.8	2.2	.7	2.2	.7	2.2	.6
3	4.5	3.1	3.9	2.0	3.6	1.6	3.5	1.3	3.4	1.1	3.3	1.0	3.3	.9	3.2	.8	3.2	.7	3.2	.7
4	5.6	3.5	4.9	2.2	4.6	1.7	4.5	1.4	4.4	1.2	4.3	1.1	4.3	1.0	4.2	.9	4.2	.8	4.2	.7
5	6.7	3.8	5.9	2.4	5.6	1.8	5.5	1.5	5.4	1.3	5.3	1.1	5.3	1.0	5.2	.9	5.2	.8	5.2	.8
6	7.7	4.1	6.9	2.6	6.6	2.0	6.5	1.6	6.4	1.4	6.3	1.2	6.3	1.1	6.2	1.0	6.2	.9	6.2	.8
7	8.7	4.3	7.9	2.7	7.6	2.0	7.5	1.7	7.4	1.4	7.3	1.2	7.3	1.1	7.2	1.0	7.2	.9	7.2	.8
8	9.8	4.5	8.9	2.8	8.6	2.1	8.5	1.7	8.4	1.5	8.3	1.3	8.3	1.1	8.2	1.0	8.2	.9	8.2	.9
9	10.8	4.7	9.9	2.9	9.6	2.2	9.5	1.8	9.4	1.5	9.3	1.3	9.3	1.2	9.2	1.1	9.2	1.0	9.2	.9
10	11.8	4.9	10.9	3.0	10.6	2.3	10.5	1.8	10.4	1.5	10.3	1.3	10.3	1.2	10.2	1.1	10.2	1.0	10.2	.9
20	21.9	6.1	20.9	2.7	20.6	2.7	20.5	2.2	20.4	1.8	20.3	1.6	20.3	1.4	20.2	1.2	20.2	1.1	20.2	1.0
30	31.9	6.8	31	4.0	30.6	2.9	30.5	2.3	30.4	2.0	30.3	1.7	30.3	1.5	*	1.3	*	1.2	*	1.1
40	41.9	7.3	41	4.3	40.6	3.1	40.5	2.5	40.4	2.1	*	1.8	*	1.6	*	1.4	*	1.3	*	1.2
50	51.9	7.7	51	4.5	50.6	3.3	50.5	2.6	*	2.2	*	1.9	*	1.6	*	1.5	*	1.3	*	1.2
60	61.9	8.1	61	4.7	60.6	3.4	*	2.7	*	2.2	*	1.9	*	1.7	*	1.5	*	1.4	*	1.2
70	71.9	8.4	71	4.8	*	3.5	*	2.8	*	2.3	*	2.0	*	1.7	*	1.5	*	1.4	*	1.3
80	81.9	8.6	81	5.0	*	3.6	*	2.8	*	2.3	*	2.0	*	1.8	*	1.6	*	1.4	*	1.3
90	91.9	8.8	91	5.1	*	3.6	*	2.9	*	2.4	*	2.0	*	1.8	*	1.6	*	1.5	*	1.3
100	101.9	9.0	101	5.2	*	3.7	*	2.9	*	2.4	*	2.1	*	1.8	*	1.6	*	1.5	*	1.3
200	*	10.4	*	5.9	*	4.2	*	3.3	*	2.7	*	2.3	*	2.0	*	1.8	*	1.6	*	1.5
300	*	11.1	*	6.2	*	4.4	*	3.5	*	2.9	*	2.4	*	2.1	*	1.9	*	1.7	*	1.6
400	*	11.7	*	6.5	*	4.6	*	3.6	*	3.0	*	2.5	*	2.2	*	2.0	*	1.8	*	1.6
500	*	12.1	*	6.7	*	4.8	*	3.7	*	3.1	*	2.6	*	2.3	*	2.0	*	1.8	*	1.7
600	*	12.5	*	6.9	*	4.9	*	3.8	*	3.1	*	2.7	*	2.3	*	2.1	*	1.9	*	1.7
700	*	12.8	*	7.1	*	5.0	*	3.9	*	3.2	*	2.7	*	2.4	*	2.1	*	1.9	*	1.7
800	*	13.0	*	7.2	*	5.1	*	3.9	*	3.2	*	2.8	*	2.4	*	2.1	*	1.9	*	1.8
900	*	13.3	*	7.3	*	5.1	*	4.0	*	3.3	*	2.8	*	2.4	*	2.2	*	1.9	*	1.8
1,000	*	13.5	*	7.4	*	5.2	*	4.0	*	3.3	*	2.8	*	2.5	*	2.2	*	2.0	*	1.8
2,000	*	14.8	*	8.1	*	5.7	*	4.4	*	3.6	*	3.0	*	2.7	*	2.4	*	2.1	*	1.9
3,000	*	15.6	*	8.5	*	5.9	*	4.6	*	3.7	*	3.2	*	2.8	*	2.5	*	2.2	*	2.0
4,000	*	16.2	*	8.8	*	6.1	*	4.7	*	3.9	*	3.3	*	2.8	*	2.5	*	2.3	*	2.1
5,000	*	16.6	*	9.0	*	6.2	*	4.8	*	3.9	*	3.3	*	2.9	*	2.6	*	2.3	*	2.1
6,000	*	17.0	*	9.1	*	6.4	*	4.9	*	4.0	*	3.4	*	3.0	*	2.6	*	2.4	*	2.1
7,000	*	17.2	*	9.3	*	6.5	*	5.0	*	4.1	*	3.5	*	3.0	*	2.7	*	2.4	*	2.2
8,000	*	17.5	*	9.4	*	6.5	*	5.1	*	4.1	*	3.5	*	3.0	*	2.7	*	2.4	*	2.2
9,000	*	17.7	*	9.5	*	6.6	*	5.1	*	4.2	*	3.5	*	3.1	*	2.7	*	2.4	*	2.2
10,0000	*	17.9	*	9.6	*	6.7	*	5.2	*	4.2	*	3.6	*	3.1	*	2.7	*	2.5	*	2.2
100,000	*	22.4	*	11.9	*	8.2	*	6.3	*	5.1	*	4.3	*	3.7	*	3.3	*	3.0	*	2.7
1 Mil.	*	26.9	*	14.1	*	9.7	*	7.4	*	6.0	*	5.1	*	4.4	*	3.9	*	3.5	*	3.1

Note: All times are given in years.

* — The difference between the distance and transit time at this acceleration is less than one percent. A GM can calculate the trip at the speed of light for brevity's sake.

ACCELERATION TIME CHART

Speed (in Lights)	Acceleration (in Gs) 1	2	3	4	5	6	7	8	9	10	Total Δv	Time Dilation
.1 (Earth Time)	35.6	17.8	11.9	8.9	7.1	5.9	5.1	4.5	4.0	3.6	.1003	.994987
.1 (Ship Time)	35.6	17.8	11.9	8.9	7.1	5.9	5.1	4.4	4.0	3.6		
.2 (Earth Time)	72.3	36.2	24.1	18.1	14.5	12.1	10.3	9.0	8.0	7.2	.2027	.979796
.2 (Ship Time)	71.8	35.9	23.9	18.0	14.4	12.0	10.3	9.0	8.0	7.2		
.3 (Earth Time)	111.4	55.7	37.1	27.9	22.3	18.6	15.9	13.9	12.4	11.1	3.095	.953939
.3 (Ship Time)	109.7	54.8	36.6	27.4	21.9	18.3	15.7	13.7	12.2	11.0		
.4 (Earth Time)	154.7	77.3	51.6	38.7	30.9	25.8	22.1	19.3	17.2	15.5	.4236	.916515
.4 (Ship Time)	150.1	75.1	50.5	37.5	30.0	25.0	21.4	18.8	16.7	15.0		
.5 (Earth Time)	204.6	102.3	68.2	51.1	40.9	34.1	29.2	25.6	22.7	20.5	.5493	.866025
.5 (Ship Time)	194.7	97.3	64.9	48.7	38.9	32.4	27.8	24.3	21.6	19.5		
.6 (Earth Time)	265.8	132.9	88.6	66.4	53.2	44.3	38.0	33.2	29.5	26.6	.6931	.800000
.6 (Ship Time)	245.6	122.8	81.9	61.4	49.2	40.9	35.1	30.7	27.3	24.6		
.7 (Earth Time)	347.4	173.7	115.8	86.8	69.5	57.9	49.6	43.4	38.6	34.7	.8673	.714143
.7 (Ship Time)	307.3	153.7	102.4	76.8	61.5	51.2	43.9	38.4	34.1	30.7		
.8 (Earth Time)	472.5	236.2	157.5	118.1	94.5	78.7	67.5	59.1	52.5	47.2	1.0986	.600000
.8 (Ship Time)	389.3	194.7	129.8	97.3	77.9	64.9	55.6	48.7	43.3	38.9		
.9 (Earth Time)	731.7	365.8	243.9	182.9	146.3	121.9	104.5	91.5	81.3	73.2	1.4722	.435890
.9 (Ship Time)	521.7	260.9	173.9	130.4	104.3	87.0	74.5	65.2	58.0	52.2		

Note: All times are given in days.

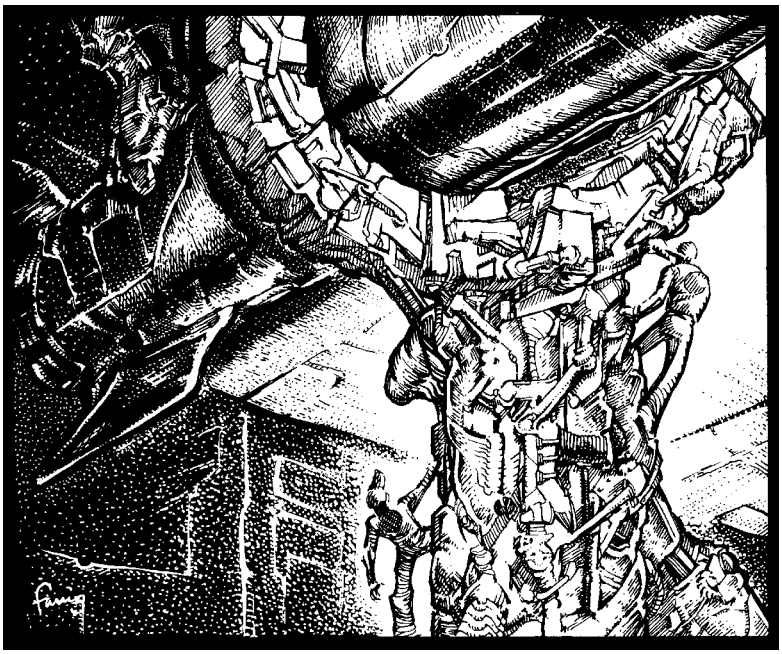
Note: Wasted Δv figures are given in light speeds (lights). Naturally, light speed can never actually be reached. These figures are given in the Δv that would be necessary without (noticeable) increase in mass or time dilation.

A-2.0 VEHICLE CREATION RULES

Visne me currum agere?
—Unknown Passenger in a Roman Chariot

Neutiquam erro.
Carri Cabus Cani veharis posthac.
—Answer to Unknown Passenger

The following section allows players or GMs to create ships (and various other things) for various genres. This is meant mainly for ships that are being created by others in the universe. For rules on PCs trying to design and create vehicles, see Section 12.0 (p. 66).



A-2.1 THE QUICK AND DIRTY METHOD

This section presents a boiled-down set of rules that can be used to create quick spacecraft. For more involved creation rules, and for vehicles other than spacecraft. See Appendix A-2.4 for more complete vehicle creation rules.

These rules are designed to create ships for the *Privateers* universe. It can be used for small fighters from either the ISC or the Jeronan Empire.

The empire has stolen much technology from the ISC. Because of this, fighter technology is about equal between the two universes. This is because ships of this size can be built using standard pieces of equipment.

Bigger ships, which are often built using custom designs, are not equal. These ships need to be designed from the ground up, and can't take advantage of stolen ISC components.

1) **Select Fighter Type:** Decide what type of fighter this is.
2) **Select Mass:** Determine the size of the vehicle.
3) **Select Hull:** Determine the characteristics of the hull.
4) **Select Hard and Strong Points:** Figure out how many hard and strong points the vehicle has.
5) **Add Armor Belt:** Armor, when applied to the hull, will increase the hits and defensive capabilities of the vehicle.
6) **Select Drives:** Determine the thrust of the vehicle.
7) **Select Armaments:** Add weapons to the vehicle.
8) **Determine Targeting Bonus:** Add a HUD and predict programs to each weapon.
9) **Select Payload Pallets:** Add payload pallets to the vehicle.
10) **Select Electronic Warfare:** Outfit the craft with an electronic warfare suite.
11) **Select Defensive Screens:** Add defensive screens.
12) **Select Decoys:** Add decoys to trick enemy missiles and torpedoes.
13) **Select Point Defense System:** Many vehicles use point defense to attack and detonate incoming warheads. Select the PD capabilities of the craft.
14) **Select Maneuverability:** The ability to dodge fire and warheads is important to many space vehicles. Select the maneuverability of the craft.
15) **Select Atmospheric Streamlining:** If the vehicle must operate inside an atmosphere, it must be streamlined.
16) **Select Landing Gear:** If the space or atmospheric vehicle is capable of landing, then it needs landing gear.

SELECT FIGHTER TYPE (1)

The first step is to determine what sort of fighter is to be created. The first question is what the fighter is designed to accomplish. The should be kept in mind throughout the creation process. For instance, a fighter designed to destroy large targets is going to lean heavily toward payload weaponry, while one designed to destroy other fighters is going to push maneuverability and more direct armaments.

The second thing to consider is how many people the fighter crews. Below are listed the base tonnage taken up by the core components of the craft.

Crew	Tonnage	Cost
SMAC (1-Person)	8	¢145,500
TMAC (2-Person)	14	¢151,000
MMAC (3-Person)	20	¢156,500

SELECT MASS (2)

Determine the mass of the vehicle. This can sometimes be subjective, but it's not usually more than 1,500 metric tons.

The volume of the fighter is not an issue. Assume all fighters have the Cramped feature (See Appendix A-2.4).

HULL REINFORCEMENT FOR ACCELERATION CHART

	Construction Armor Type									
Mass	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX	XX
≤ 50	.05%	0	0	0	0	0	0	0	0	0
≤ 100	.1%	0	0	0	0	0	0	0	0	0
≤ 200	.2%	.1%	0	0	0	0	0	0	0	0
≤ 300	.3%	.2%	.1%	0	0	0	0	0	0	0
≤ 400	.4%	.3%	.2%	.1%	0	0	0	0	0	0
≤ 500	.5%	.4%	.3%	.2%	.1%	0	0	0	0	0
≤ 600	.6%	.5%	.4%	.3%	.2%	.1%	0	0	0	0
≤ 700	.7%	.6%	.5%	.4%	.3%	.2%	.1%	0	0	0
≤ 800	.8%	.7%	.6%	.5%	.4%	.3%	.2%	.1%	0	0
≤ 900	.9%	.8%	.7%	.6%	.5%	.4%	.3%	.2%	.1%	0
≤ 1K	1%	.9%	.8%	.7%	.6%	.5%	.4%	.3%	.2%	.1%
≤ 2K	1.5%	1.3%	1.1%	.9%	.7%	.6%	.5%	.4%	.3%	.2%

SELECT HULL (3)

The next step is to determine what the hull and superstructure of the vehicle is made from. Each hull has a minimum tech level at which it can be constructed. If the tech level has been achieved, the ship can be created.

HULL & SUPERSTRUCTURE DATA

CAT	Material	Tech Lvl	Cost Multiplier
XI	Steel	15	1.0
XII	Titanium	16	1.5
XIII	Crysteel	17	3.0
XIV	Crystanium	18	5.5
XV	Reinforced Crystan.	18	7.0
XVI	Fullerene	18	8.5
XVII	Reinforced Fullerene	18	10.0
XVIII	Crystan. Double Hull	19	15.0
XIX	Fullerene Double Hull	19	30.0
XX	Collosium	24	50.0

It's possible to use superior alloys to increase the strength of the hull and superstructure. If a superior alloy is purchased, it can be purchased to either increase the Defensive Bonus of the vehicle or increase the tonnage minimum for the material (See Hull Reinforcement for Acceleration Chart for the maximum tonnage per CAT).

Effect	Superior Alloy Cost Multiplier
+5 DB	2.0
+10 DB	4.0
+15 DB	8.0
+20 DB	16.0
+25 DB	32.0

To come up with the total cost multiplier, multiply the two multipliers together. This will give you the total multiplier.

Hull Mass = (Mass ÷ 10) + (Mass ÷ 100)

Hull Cost = Mass x 100 x (Total Cost Multiplier)

The craft will need to be reinforced to support its own weight under full acceleration. The reinforcement necessary depends a great deal on the CAT of the hull. The number given on the chart below is the percent of the volume and mass of the craft taken up by the additional reinforcements. Multiply the volume of the ship by the acceleration (in Gs) it's meant to support by the factor on the chart below. This will show how much of the volume is taken up by additional reinforcements. Do the same for the mass of the ship.

This step can be ignored if the ship accelerates at one G or less.

Reinforcement Cost =
[Gs] x [Percentage from Chart] x [Cost of Hull]
x [Total Hull Multiplier]

SELECT HARD & STRONG POINTS (4)

A weapon can only be mounted on a hard or strong point. These are sections of the superstructure that are reinforced to handle a weapon mount. Strong points are solid enough to mount energy weapons. Hard points are necessary to mount a missile launcher or autocannon.

All vehicles have a minimum number of valid strong points, just as a side effect of solid construction. This number is equal to the mass of the vehicle, divided by 100. All vehicles have at least 2 strong points.

Adding strong or hard points during construction is easy, and becomes easier the more solid the hull is (less buttressing has to be done). Adding after the fact requires more work, and the cost is multiplied by the cost multiplier of the material (the base, not the total).

STRONG AND HARD POINTS				
	Cost		Volume	
CAT	Strong	Hard	Strong	Hard
XI	¢1,000	¢10,000	3	30
XII	¢900	¢9,000	2	20
XIII	¢500	¢5,000	1	10
XIV	¢100	¢1,000	.4	4
XV	¢90	¢900	.3	3
XVI	¢80	¢800	.2	2
XVII	¢70	¢700	.1	1
XVIII	¢10	¢100	.02	.2
XIX	¢5	¢50	.01	.1
XX	¢0	¢0	0	0

ADD ARMOR BELT (5)

The armor of a vehicle can be thickened to resist damage. Though this does not take up any of the internal volume of the craft, it does increase the hull's mass. Increase the mass of the hull by the same percentage by which the hits are increased.

Armor Belt Protection	Cost Multiplier
+5 DB and +5%Hits	100
+10 DB and +10%Hits	200
+15 DB and +15%Hits	300
+20 DB and +20%Hits	400
+25 DB and +25%Hits	500

Armor Belt Mass = (Hull Mass) x (Hits %)

Armor Belt Cost = (Vehicle Mass) x (Cost Multiplier)

Hits

The base hits for a vehicle are equal to the tonnage of the vehicle. Add the percentage of the armor belt to the total. For most vehicles, a minimum of 5 would be appropriate. For extremely small vehicles (motorcycles), the minimum hits would be 1.

SELECT DRIVES (6)

Select the acceleration of the vehicle. This is accomplished by adding reactionless drive units.

Reactionless Drive

The reactionless drive allows thrust to be applied without reactants, merely by the application of power. This means that as long as a ship has power, it can operate, and the only fuel necessary is that which supplies the generator (but by this TL, vacuum power provides limitless power).

To add a reactionless drive, choose the metric tons of thrust desired. Decide how many drive units are needed to supply this thrust (this can be one big drive). Multiply metric tons of thrust, volume, mass, crew, power, and cost by the # of units purchased.

Total Acceleration of the Drive (in Gs):
(Metric tons of Thrust) ÷ (Mass of vehicle)

Total Cost of Reactionless Drive:
(# of Drive Units) x 35,000

Total Mass of Reactionless Drive: .9 per Unit

SELECT ARMAMENTS (7)

The first step is to determine the firing mechanism (FM) that is to be housed in the mount. You may select from the following list:

- Autocannon/Projectile Cannon
- Laser Cannon
- Blaster Cannon
- Disruptor Cannon
- Ion Cannon
- Plasma Cannon
- Missile Launcher

Number of Firing Mechanisms in Mount

After the type of weapon is determined, determine the total number of firing mechanisms per mount. Only one missile launcher may be placed on a mount.

Mass of Missile Launcher: .25

Missile Launcher Cost: ¢1,000,000

MASS OF FRAME BY FIRING MECHANISM					
Firing Mechanism	Compact	Small	Full	Large	Ultra-Large
Auto/Proj.	5	10	15	20	25
Blaster	5	10	15	20	25
Disruptor	10	20	30	40	50
Ion	8	16	24	32	40
Laser	4	8	12	16	20
Plasma	6.5	13	19.5	26	32.5
Note: Mass is given in metric tons.					

MARK NUMBERS					
Firing Mechanism	Compact	Small	Full	Large	Ultra-Large
Disruptors	5	10	15	20	25
Other	10	20	30	40	50

COST OF FIRING MECHANISMS					
Firing Mechanism	Compact	Small	Full	Large	Ultra-Large
Auto/Proj.	¢1.1	¢2.1	¢3.1	¢4.1	¢5.1
Blaster	¢1.4	¢5.6	¢10.2	¢17.6	¢27
Disruptor	¢2.8	¢11.2	¢20.4	¢35.2	¢54
Ion	¢2.2	¢9	¢16.3	¢28.2	¢43.2
Laser	¢1.1	¢4.5	¢8.2	¢14.1	¢21.6
Plasma	¢2.1	¢8.4	¢15.3	¢26.4	¢40.5
Note: Costs are given in millions.					

Magazine Capacity

Missile launchers, autocannons, and projectile cannons all use ammo. The magazine shows how many attacks a weapon can make and how many missiles a launcher can fire.

Both types of magazine are rated by how many metric tons of ammo they can hold. How many missiles or attacks are in a metric ton depends on the tech level.

Missiles only have one magazine. Guns with multiple firing mechanisms must have equal-sized magazines.

The mass of the magazine is equal to one metric ton for every metric ton of ammo it is meant to hold.

Total Cost of Magazine and Ammo:

Cost of Magazine: ¢10,000 per metric ton.

Cost of Auto/Projectile Cannon Ammo: ¢10,000 per metric ton.

Cost of Missiles: ¢50,000 per missile.

Shots per Metric Ton for Missiles: 50

AUTO CANNON AMMO BY WEAPON SIZE

Firing Mechanism	Compact	Small	Full	Large	Ultra-Large
Shots/Metric ton	250	125	83	62	50

Anti-Infantry Weapons

Anti-infantry weapons can be mounted on a ship. These weapons have all the physical statistics of vehicle weapons of the same size. If they are used against infantry, they attack on the Infantry vs. Infantry Attack Table (p 133).

Mounting Weapons

After the firing mechanism have been purchased and supplied with ammo, they must be attached to the vehicle—a weapon mount must be selected.

Fixed Mount:

A fixed mount points the gun in a single direction. It can be moved for the purpose of aiming, but the arc is only 60˚. A fixed mount can be placed on a strong point unless it is mounting an autocannon or missile launcher, which must be mounted on a hard point.

Total Mass of Weapon Mount:
(Total Mass of Firing Mech. & ammo)

Total Cost of Mount:
(Total cost of Firing Mech. & ammo) + ¢50,000

Flexible Mount:

A flexible mount points the gun in a single direction, but allows a great range of motion. It can be moved up to 120˚ for the purpose of aiming. A flexible mount can be placed on a strong point unless it is mounting an autocannon or missile launcher, or the weapon is full-sized, in which case it must be mounted on a hard point.

Total Mass of Weapon Mount:
(Total Mass of Firing Mech.) x 2 + (ammo)

Total Cost of Mount:
(Total cost of Firing Mech. & ammo) + ¢100,000

Turret Mount:

A turret mount places all the firing mechanisms in a large, swiveling turret, allowing a great range of motion. It can be moved for the purpose of aiming, able to hit everything within an entire hemisphere. A turret must be mounted on a hard point.

Total Mass of Weapon Mount:
(Total Mass of Firing Mech.) x 3 + (ammo)

Total Cost of Mount:
(Total cost of Firing Mech. & ammo) + ¢150,000

DETERMINE TARGETING BONUS (8)

Purchase the bonus granted by the HUD. The HUD bonus purchased depends on the tech level of the system, and must be purchased separately for each mount.

HUD Bonus	Cost
+5	¢10,000
+10	¢20,000
+15	¢60,000
+20	¢240,000
+25	¢1,200,000

After determining the HUD bonus, add in the other bonuses of the mount. Add the Mark Number of the weapon (missiles get a bonus based on the number of missiles in the salvo, and so ignore this). Finally, if there are more than one firing mechanisms, there is a +2 bonus per firing mechanism beyond the first.

Predict Program

A ship's predict bonus is its ability to track and target enemy craft. The predict bonus can only be purchased once, but it applies to all weapons. To calculate the maximum bonus that can be applied to any given weapon, multiply the HUD bonus by three and add the bonus for any multiple firing mechanisms.

Total Cost of Predict Program:
¢10,000 + (Rating) x ¢5,000

COMPUTER PROGRAM RATING CHART

Rating	Bonus	Rating	Bonus
1	5	16	62
2	10	17	64
3	15	18	66
4	20	19	68
5	25	20	70
6	30	21	71
7	35	22	72
8	40	23	73
9	45	24	74
10	50	25	75
11	52	26	76
12	54	27	77
13	56	28	78
14	58	29	79
15	60	30	80
		31+	+.5 per level

SELECT PAYLOAD PALLETS (9)

There is a reason that a fighter will always be the cheapest way to deliver the most damage in any situation. That reason is the fighter's payload.

The job of most fighters, even at tech level 16, is to carry a destructive payload to within the range of its payload's delivery system. If your payload can kill a bunker at 200 km, you fly to 200 km, fire, then get the hell out of Dodge.

The destructive potential of payloads increase as time goes by. See the chart below for the Mark Number of a warhead by tech level.

TORPEDOES

	Mk 10	Mk 20	Mk 30	Mk 40	Mk 50
Pallet Mass	1	2	3	4	5
Torpedo Mass	.25	.5	.75	1	1.25
Pallet Cost	1K	2K	3K	4K	5K
Torpedo Cost	25K	50K	75K	100K	125K
Gs/Speed	18/5K	16/4K	14/3K	12/2K	10/1K

SELECT ELECTRONIC WARFARE (10)

Electronic warfare is an important part of any advanced warfare. There are two types of electronic warfare, passive and active.

Passive electronic warfare is your basic stealth technology. The ship is designed to absorb or deflect sensors, reducing its visible signature. The maximum TL of passive EW is the society's Engineering tech level.

Total Mass of Passive EW: 0

Total Cost of Passive EW: ¢10,000 per point.

Active electronic warfare is used to block or overload the sensors of another craft. Active electronic warfare systems must be controlled by an operator. The maximum TL of active EW is determined by the society's level in Energy Sources. Large ships will have many separate EW arrays, so that many different ships and attacks can be stopped at once.

Total Mass of Active EW: .01 per +1

Total Cost of Active EW: ¢5,000 per point.

Maximum Active EW: 60

Maximum Passive EW: 40

SELECT DEFENSIVE SCREENS (11)

An important part of any war ship is its defensive capabilities. With the advent of force fields, war craft are equipped with defensive screens.

Defensive screens add to the ship's Defensive Bonus. The screens, plus the armor belt, plus any evade bonus makes the total DB of the craft.

Total Mass Defensive Screen Generator:
(Mass) x 0.003 x (Rating)

Total Cost of Defensive Screen Generator:
(Mass) x 20 x (Rating)

DEFENSIVE SCREENS

Rating	Bonus	Rating	Bonus	Rating	Bonus
1	5	11	52	21	71
2	10	12	54	22	72
3	15	13	56	23	73
4	20	14	58	24	74
5	25	15	60	25	75
6	30	16	62	26	76
7	35	17	64	27	77
8	40	18	66	28	78
9	45	19	68	29	79
10	50	20	70	30	80
				31+	+.5 per level

SELECT DECOYS (12)

Decoys go through many evolutions, everything from flares and chaff at early tech levels, to small generators that project force screens that reflect sensor images of the craft. Whatever the state these are dropped behind the craft to fool missiles and torpedoes into targeting them.

Total Mass of Decoys: (#) x .1 +.5

Total Cost of Decoys: (#) x 5,000 + ¢10,000

SELECT POINT DEFENSE SYSTEM (13)

Determine the point defense system of the ship. It is a bulky system, consisting of multiple sub-compact lasers, and is therefore the size of multiple weapon systems in and of itself. The point defense rating assumes it is being used against weapons of equal levels of technology. If the tech levels differ, consult the table in Section 2.0. If the PD system is inferior, apply the result as a penalty to the rating and number of attacks. If it is superior, apply it as a bonus.

POINT DEFENSE MASS

# of Attacks	Point Defense Rating 2	3	4	5	6	7	8
1	5	10	15	20	25	30	35
2	10	15	20	25	30	35	40
3	15	20	25	30	35	40	45
4	20	25	30	35	40	45	50
5	25	30	35	40	45	50	55
6	30	35	40	45	50	55	60

Result is the mass in metric tons.

POINT DEFENSE COST

# of Attacks	Point Defense Rating 2	3	4	5	6	7	8
1	1	2	2	3	3	4	4
2	2	3	4	5	6	7	8
3	3	5	6	8	9	11	12
4	4	6	8	10	12	14	16
5	5	8	10	13	15	18	20
6	6	9	12	15	18	21	24

Result is the cost in millions of credits.

SELECT MANEUVERABILITY (14)

Aircraft and spacecraft have maneuverability ratings. This represents how quickly a craft can dodge and jig to avoid enemy fire.

The maneuverability rating doesn't affect much in actual game play, just in ship design. The primary effect is that the ship's evade program can be no more effective than the ship's maneuverability. If the evade program is higher than the ship's maneuverability, the difference is discarded.

Maneuverability has many factors affecting it. As a ship increases in size, its initial inertia increases, the amount of leverage caused by spin in the object increases, and the profile (and thus the ease to hit it) increases. It takes additional structural reinforcements to combat the shear of the tidal effects as the craft rotates. This means that larger ships become harder and harder to miss.

This is a complicated subject, and therefore it takes a bit more work than most steps. First, the desired bonus is determined. This will produce the rating. Second, the size of the ship is checked to determine how many maneuverability units are necessary per level of rating. Finally, the tech level is checked to determine the size of a unit.

MANEUVERABILITY RATING CHART

Rating	Bonus	Rating	Bonus	Rating	Bonus
1	5	11	52	21	71
2	10	12	54	22	72
3	15	13	56	23	73
4	20	14	58	24	74
5	25	15	60	25	75
6	30	16	62	26	76
7	35	17	64	27	77
8	40	18	66	28	78
9	45	19	68	29	79
10	50	20	70	30	80
				31+	+.5 per level

Total Mass of Maneuverability:
.9 x (Number of Units)

Total Cost of Maneuverability:
(# of Drive Units) x 20K
+ Rating x 5,000 + ¢10,000

MANEUVERABILITY UNITS

Metric tons	Units per Rating
≤ 50	0.25
≤ 100	0.5
≤ 200	1.5
≤ 300	2.5
≤ 400	4
≤ 500	5.5
≤ 600	7.5
≤ 700	9
≤ 800	11.5
≤ 900	13.5
≤ 1,000	16
≤ 2,000	45

SELECT ATMOSPHERIC STREAMLINING (15)

Many craft are meant to fly through an atmosphere. These craft must be streamlined with airfoils.

Total Atmospheric Streamlining Mass: 0

Total Atmos. Streamlining Cost: (Mass) x 50

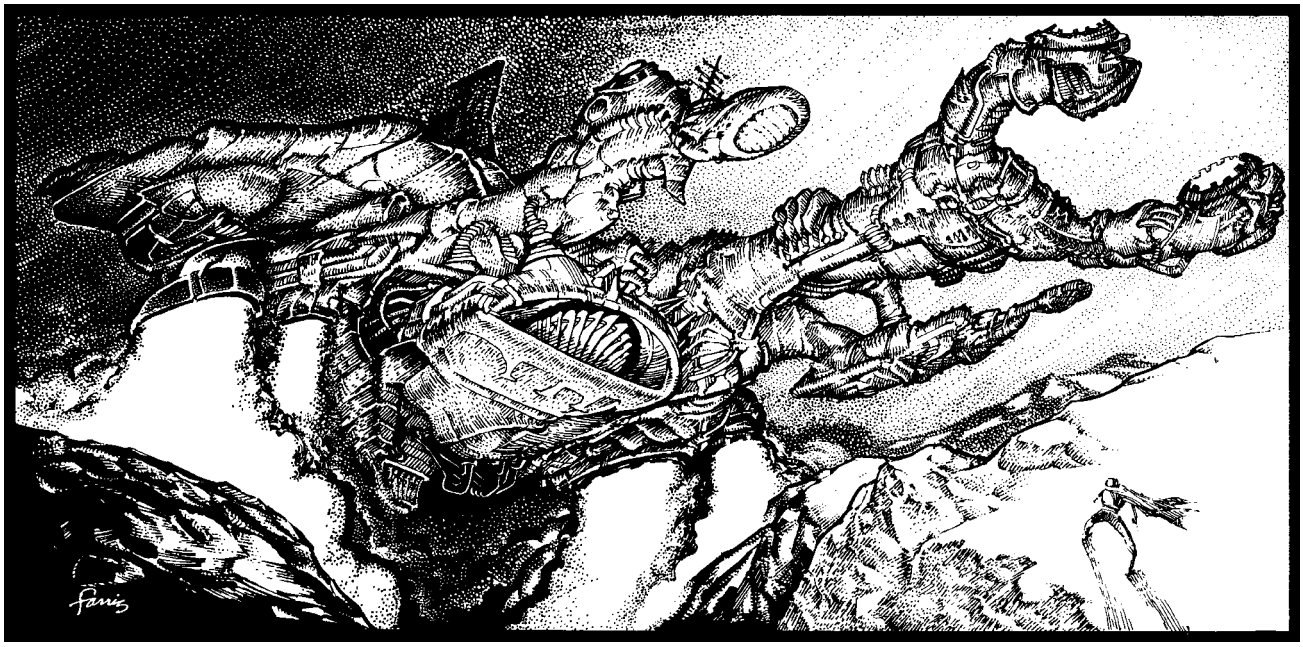
SELECT LANDING GEAR (16)

Craft under 100,000 metric tons are sometimes capable of landing on a planet's surface. These craft require landing gear.

Total Landing Gear Volume: (Volume) x .05

Total Landing Gear Mass: (Mass) x .05

Total Landing Gear Cost: (Mass) x 5



A-2.2 BIOLOGICAL ELEMENT CONSTRUCTION

This section is used to generate pilots, crewmembers, and other biological elements. Rules on creating computer brains can be found in *Tech Law: Robotics Manual* (the zero-interface law makes them impossible to use on a *Privateers* battlefield).

To create a crew or squad, use the following steps:

1) **Determine Type and Number:** Choose whether you are creating a crew or an infantry squad.
2) **Purchase Armor:** If this is an infantry squad, chose the type of armor its wearing.
3) **Purchase Shields:** If this is an infantry unit, select any personal shields.
4) **Purchase Ordnance and Weapons:** If this is an infantry unit, purchase additional ordnance.
5) **Determine Unit Training:** Determine, either by random rolls, or through purchase, the skill levels of the crew or squad members.
6) **Determine Defensive Bonus:** If this is an infantry unit, determine their total Defensive Bonus.
7) **Determine Hits:** If this is an infantry unit, determine the unit's total hits.
8) **Calculate Total Cost:** Determine the total cost of the unit.

DETERMINE TYPE AND NUMBER (1)

There are several types of units and crews that can be purchased. Each has a different set of skills, and possibly equipment, that must be purchased.

AFV Crew: One or more people who crew an armored fighting vehicle. These vehicles require a disciplined, well-trained crew. Their typical skill set is as follows:

- Crewmember AFV
- Combat Pilot
- Technician (Optional)
- Electronic Surveillance (Optional)
- Electronic Warfare (Optional)
- Sensor Analysis (Optional)
- H.E.P. (As Needed)
- Missiles (As Needed)
- Projectile Gunnery (As Needed)
- AFV Pilot
- Other

Atmospheric Crew: One or more people who fly an atmospheric craft. This ranges from fighter planes to cargo transports. Their typical skill set is as follows:

- Combat Pilot
- Technician (Optional)
- Electronic Surveillance (Optional)
- Electronic Warfare (Optional)
- Sensor Analysis (Optional)
- H.E.P. (As Needed)
- Missiles (As Needed)
- Projectile Gunnery (As Needed)
- Ship Crewmember
- Atmospheric Pilot
- Other

Ground Vehicle Crew: One or more people who crew a normal ground vehicle. These vehicles have no direct combat value, but are often used for transport or support. Their typical skill set is as follows:

- Medical (Optional)
- Technician (Optional)
- Electronic Surveillance (Optional)
- Electronic Warfare (Optional)
- Sensor Analysis (Optional)
- Ground Vehicle Pilot
- Other

Heavy Ordnance Crew: this crew operates a piece of heavy ordnance, such as an artillery piece. These often have their own motive transport, but are not considered vehicles. Their common skill set is as follows:

- Technician (Optional)
- Electronic Surveillance (Optional)
- Electronic Warfare (Optional)
- Sensor Analysis (Optional)
- H.E.P. (As Needed)
- Missiles (As Needed)
- Projectile Gunnery (As Needed)
- Ground Vehicle Pilot (Optional)
- Other

Infantry Squad: 12 men in a squad of combatants. These men work as a single entity on the battle field. Their typical skill set includes:

- Appropriate Armor Skill (Optional)
- Alien Environment (Optional)
- Leadership
- Electronic Surveillance (Optional)
- Electronic Warfare (Optional)
- Sensor Analysis (Optional)
- Weapons Skills (As Needed)
- Other

Marine Crew: One or more crewmembers running a marine vehicle (ship or submarine, usually). Their typical skill set is as follows:

- Combat Pilot
- Medical (Optional)
- Technician (Optional)
- Electronic Surveillance (Optional)
- Electronic Warfare (Optional)
- Sensor Analysis (Optional)
- H.E.P. (As Needed)
- Missiles (As Needed)
- Projectile Gunnery (As Needed)
- Ship Crewmember
- Marine Pilot
- Other

Powered Armor Pilot: A single soldier trained in the use of powered combat armor. This is as powerful as an infantryman can become, and when in the armor, they fight as a vehicle.

- Assault Armor
- Electronic Surveillance (Optional)
- Electronic Warfare (Optional)
- Sensor Analysis (Optional)
- H.E.P. (As Needed)
- Missiles (As Needed)
- Projectile Gunnery (As Needed)
- Weapons Skills (As Needed)
- Other

Starship Crew: One or more crewmembers who run a starship. This ranges everywhere from a one-man fighter to a city-sized carrier. Their typical skill set is as follows:

- Combat Pilot
- Medical (Optional)
- Technician (Optional)
- Electronic Surveillance (Optional)
- Electronic Warfare (Optional)
- Sensor Analysis (Optional)
- H.E.P. (As Needed)
- Missiles (As Needed)
- Projectile Gunnery (As Needed)
- Ship Crewmember
- FTL Pilot
- Space Pilot
- Other

After the type of crew is decided, it is necessary to determine their number. All vehicles have their crew requirements listed in their description. The crew must be at least this big.

Example: *Gary is creating an infantry unit for a game. He decides they will be a single squad of Falanar.*

PURCHASE ARMOR (2) (Infantry Only)

Most infantry units wear some form of body armor. It is necessary to purchase this armor. All prices are for one suit. The cost must be multiplied by the number of soldiers in the squad (usually 12).

Example: *Falanar typically wear grazzin and since all Falanar wear grazzin, the GM tells him the grazzin cost nothing. Gary moves on.*

INFANTRY ARMOR CHART

Item	AT	Cost*
Kevlar (Tech Level 16):		
Flack Vest (P)	I	¢50
Extended Flack Vest (P)	II	¢70
Reinforced Flack Vest (P)	III	¢100
Reinforced flack Armor (P)	IV	¢200
Kinetic Armor (Tech Level 18):		
Vest (P)	V	¢100
Jacket (P)	VI	¢200
Body Armor (P)	VII	¢500
Combat Armor (Tech Level 19):		
Torso (P)	VIII	¢5K
Torso and Greaves (P)	IX	¢10K
Full Combat Armor (P)	X	¢100K

* — Multiply by ten if the armor is being used the same tech level it is introduced.

PURCHASE SHIELDS (3) (Infantry Only)

Many infantry units, especially those that qualify as elite units, go into battle with personal shields. If the squad will have shields, select them now. The entire squad must be assigned shields to qualify.

SHIELD TYPE CHART

Shield Type	Energy	Pro-jectile	Missile	Melee	Cost*
Absorption	+30	+30	+30	+30	¢2K
Barrier	+90	+70	+70	+60	¢15K
Deflector	+60	+40	+15	+5	¢2K
Velocity	0	+60	+45	+30	¢2K

* — Assume tech level 25 or higher. For tech level 24, multiply costs by ten. Below TL 24, shields may not be purchased.

Example: *The unit is equipped with barrier shields. Twelve barrier shields are worth 180,000 credits.*

PURCHASE ORDNANCE & WEAPONS (4) (Typically Infantry Only)

Section 10.0 (p. 57) details various common pieces of ordnance. It may be desirable to purchase these for an infantry unit. It so, the prices of each individual piece are reprinted here.

For infantry weapons (blasters, lasers, assault rifles), see *Equipment Manual, Spacemaster: Privateers,* or *Blaster Law*.

ORDNANCE TABLE VM-10.1

Item	Tech Level	Weight	Cost
Ultra-Compact Autocannon	14	500	¢25,000
Ultra-Compact Blaster Cannon *	18	500	¢50,000
Ultra-Compact Disruptor *	18	800	¢100,000
Ultra-Compact Ion Cannon *	18	600	¢75,000
Ultra-Compact Laser Cannon *	18	400	¢40,000
Ultra-Compact Plasma Cannon *	18	650	¢75,000
Anti-Personnel Mine	13	Varies	¢10 x Mk.
Demolitions	13	Varies	¢100/KG
I-Mine	13	Varies	¢150/KG
V-Mine	13	Varies	¢150/KG
Infantry Mortar	14	20	¢10,000
Ammunition (box of 10)	14	10	¢1,000
LAW	14	5	¢2,000
Amboathorphin †	17	–	¢2,300
MASK (box of 10) †	16	10	¢1,000
Nerve Gas (Box of 10)	14	10	¢10,000

* — Tripod included.

† — These items are ten times more expensive on the tech level of their introduction.

Example: *The unit is only equipped with H & K X-25s. These are standard ISC issue. X-25s cost 8,500 credits each. That 102,000 credits total.*

DETERMINE UNIT TRAINING (5)

All units need skills. The next step is to assign those skill levels. This is done in three stages.

First of all, design the skill set of unit or group. In step one, typical skill sets were listed. Choose the ones that are necessary for the vehicle or a task.

Next, determine how many people in the unit require the skill. Obviously, everyone on an AFV needs Crewmember AFV, but only one person needs to know how to fire the gun.

After you have each skill, and how many members have it, consult the chart below. The result can either be randomized (open-ended roll) or purchased, depending on the situation. Note that it's much easier to find one highly skilled person than five, and with skills where multiple people are involved, their skill is averaged. Therefore with large groups, it's difficult to both purchase or roll very high skills. If you need 100 highly skilled crewmembers, the cost of training (or finding people willing to work for you) gets higher and higher, raising the average cost per crewmember. This must be done for each skill and represents the overall investment in career soldiers and raw market value of mercenaries.

The final step is to add in any appropriate racial skill bonuses. Then add in any item bonuses. This will give the final skill totals. Gunnery and weapon skill totals will be the character's OB.

Standard Skill Notes

Here are some special notes for each of the skills listed. More descriptions of these skills can be found in *SM:P*.

AFV Pilot — Typically, each AFV has only one pilot. Unlike ships, they rarely work 24 hours a day, pulling shifts. Therefore more AFV crews develop this skill for each member.

Alien Environment — If a unit takes this skill, everyone must take it. Use the number of the full unit for determining the skill.

Appropriate Armor Skill — This skill is most useful for pace maneuvers. The entire unit must take this skill for it to be useful.

Assault Armor — Since assault armor is only operated by a single individual, use the "1" column when developing this skill. Two person assault armor suits do not exist.

Atmospheric Pilot — Most planes have only one or two pilots.

Combat Pilot — This is used with other pilot skills, but not assault armor. This is only purchased for multiple pilots on vehicles where the pilot works in shifts. Even then, ships often have a single combat pilot.

Crewmember AFV — Everyone in the crew must have this skill. This skill is most useful when an AFV is damaged. The crew of a damaged AFV may make a maneuver every round. This conducted exactly like a Combat Pilot maneuver. It will result in a value from -30 to +30, which is applied to vehicle's penalty. This maneuver is not mandatory, but once made, the result must be applied.

Electronic Surveillance — Not everyone in a crew needs this skill. Often, only one or two choice crewmembers have this skill.

Electronic Warfare — Small vehicles typically only have one electronic warfare officer. Larger vehicles have three or more, operating in shifts. See Section 11.2 (p. 64) for more details on electronic warfare.

FTL Pilot — On ships where faster than light trips are instantaneous, they may have only one FTL pilot. In other universes, there will be three or more, operating in shifts.

Ground Vehicle Pilot — Typically, there is only one driver.

H.E.P. (High Energy Projectors) — This skill must be purchased for as many crewmen as there are appropriate gunner positions. Gunners don't typically operate in shifts.

Leadership — This is only purchased for the officer in charge. If he dies, the leadership of his second in command can be determined randomly.

Marine Pilot — Unless this is a small craft, at least three pilots operate in shifts.

CREW SKILL CHART

Die Roll	Cost	Number of Crewmembers Requiring Skill							
		1	2-15	16-35	36-75	76-150	151-250	251-750	751+
286 – 295	¢1,000,000	121	113	86	73	64	58	52	49
276 – 285	¢900,000	120	109	84	72	63	57	51	48
266 – 275	¢800,000	118	106	83	71	62	57	50	47
256 – 265	¢700,000	117	105	82	70	61	56	50	47
246 – 255	¢600,000	115	103	81	69	61	55	50	47
236 – 245	¢500,000	113	102	80	68	60	55	50	47
226 – 235	¢400,000	110	101	79	68	60	55	49	47
216 – 225	¢300,000	108	101	79	67	60	55	49	47
206 – 215	¢200,000	105	100	78	67	59	54	49	47
196 – 205	¢110,000	103	99	77	67	59	54	49	47
186 – 195	¢100,000	100	91	73	64	57	53	49	46
176 – 185	¢90,000	98	88	71	62	56	52	48	46
166 – 175	¢80,000	95	85	69	61	55	51	48	46
156 – 165	¢70,000	93	83	67	60	54	50	48	46
146 – 155	¢60,000	90	81	66	59	54	50	47	45
136 – 145	¢50,000	86	79	65	58	53	49	46	45
126 – 135	¢40,000	82	78	65	58	53	49	46	45
116 – 125	¢30,000	78	77	64	57	52	49	46	45
106 – 115	¢20,000	74	76	63	57	52	49	46	44
96 – 105	¢10,000	70	75	63	56	52	49	46	44
86 – 95	¢9,000	66	63	55	51	48	46	45	44
76 – 85	¢8,000	62	56	51	48	46	44	44	43
66 – 75	¢7,000	58	50	47	45	44	43	43	42
56 – 65	¢6,000	51	44	44	43	42	42	42	41
46 – 55	¢5,000	40	40	40	40	40	40	40	40
36 – 45	¢4,000	30	36	36	37	38	38	38	39
26 – 35	¢3,000	20	30	33	35	36	37	37	38
16 – 25	¢2,000	10	24	29	32	34	36	36	37
06 – 15	¢1,000	5	17	25	29	32	35	35	36
(-04) – 05	¢900	0	5	17	24	28	34	34	36
(-14) – (-05)	¢800	-15	4	17	23	28	31	34	36
(-24) – (-15)	¢700	-15	3	16	23	28	31	34	35
(-34) – (-25)	¢600	-15	2	15	22	27	31	34	35
(-44) – (-35)	¢500	-15	1	15	22	27	31	34	35
(-54) – (-45)	¢400	-15	-1	14	21	26	30	33	35
(-64) – (-55)	¢300	-15	-3	13	20	26	30	32	34
(-74) – (-65)	¢200	-15	-5	11	19	25	29	32	34
(-84) – (-75)	¢100	-15	-8	9	18	24	28	32	34
(-94) – (-85)	¢90	-15	-11	7	16	23	27	31	34
(-104) – (-95)	¢80	-30	-19	3	13	21	26	31	33
(-114) – (-105)	¢70	-30	-20	2	13	21	26	31	33
(-124) – (-115)	¢60	-30	-21	1	13	20	25	31	33
(-134) – (-125)	¢50	-30	-21	1	12	20	25	31	33
(-144) – (-135)	¢40	-30	-22	0	12	20	25	30	33
(-154) – (-145)	¢30	-30	-23	-1	11	19	25	30	33
(-164) – (-155)	¢20	-30	-25	-2	10	19	24	30	33
(-174) – (-165)	¢10	-30	-26	-3	9	18	23	30	33
(-184) – (-175)	¢5	-30	-28	-4	8	17	23	29	32
(-195) – (-185)	¢0	-30	-29	-6	7	16	22	28	31

Medical — This is a composite of all medical skills. Treat this skill as if you are purchasing it for four times as many people (both for cost and number). This is usually only useful between battles.

Missiles — This skill must be purchased for as many crew man as there are appropriate gunner positions. Gunners don't typically operate in shifts.

Projectile Gunnery — This skill must be purchased for as many crew man as there are gunner positions. Gunners don't typically operate in shifts.

Sensor Analysis — Small ships only have one sensor officer, while larger ships have three or more, operating in shifts.

Ship Crewmember — Every naval crewmember picks up this skill, and uses it daily. It includes acts like safety procedures, damage control, fire suppression, basic maintenance, and the like. Any maneuver having to do with the operation of a ship that does not have a more appropriate skill uses this one. This skill is most useful when a ship is damaged. The crew of a damaged ship may make a maneuver every round. This conducted exactly like a Combat Pilot maneuver. It will result in a value from -30 to +30, which is applied to vehicle's penalty. This maneuver is not mandatory, but once made, the result must be applied.

Space Pilot — Small craft only have one pilot. Large crafts (those that are intended for more than brief journeys or sorties) have three or more pilots, operating in shifts.

Technician — This is a composite of all repair skills. Treat this skill as if you are purchasing it for three times as many people (both for cost and number). This is usually only useful between battles, but some battlefield checks are often useful.

Weapons Skills — These are only purchased for powered armor and infantry units. These must be purchased for the entire unit. This, when added to bonuses for the weapon, determines the unit's OB.

Other Skills

There are many other skills that might be useful to a unit. Some more suggestions include:

- Demolitions
- Electronic Countermeasures
- Gunnery Ambush
- Mounted Combat
- Surveillance

Example: *This unit is a straight combat squad. It needs only Leadership and it's Assault Blaster skill. Gary rolls for each. He rolls an 86 for Leadership and a 15 for Assault Blaster. Only the officer in charge needs a Leadership skill. That means that he has a 66 base skill (an 86 on the "1" column). His Presence racial bonus is 0; his Empathy, -6; and his Intuition, +8. That means the total leadership skill is 68 (66 + 0 - 6 + 8). A 15 on the "2-15" column results in a 17 base skill. Obviously this unit is green. An Assault Blaster uses Ag/Ag/Ag. A Falanar's racial Agility bonus is +0. This means that their OB is 32 (17 plus the +15 bonus of an X-25). The total value is 21,000 credits (9,000 for Leadership skill, 1,000x12 for the Assault Blaster skill.)*

DETERMINE DEFENSIVE BONUS (6) (Infantry Units Only)

Determining a unit's defensive bonus is very simple. Merely add the unit's bonuses for shields to three times any racial Quickness bonus.

Example: *Calculating the squad's DB is fairly straightforward. The barrier shield grants a DB of +70 vs. energy and +90 vs. projectile (the GM tells Gary he doesn't need to calculate missile or melee for this scenario). In addition, a grazzin grants a +5 bonus to DB. Falanar don't receive Quickness bonuses, so the total is +75 and +95.*

SQUAD HIT CHART

Die Roll	Cost	Body Development Progression 3	4	6	7	9	10
286 – 295	¢1,000,000	117	125	141	149	165	173
276 – 285	¢900,000	113	121	137	145	161	169
266 – 275	¢800,000	110	118	134	142	158	166
256 – 265	¢700,000	109	117	133	141	157	165
246 – 255	¢600,000	108	116	132	140	156	164
236 – 245	¢500,000	107	115	131	139	155	163
226 – 235	¢400,000	106	114	130	138	154	162
216 – 225	¢300,000	105	113	129	137	153	161
206 – 215	¢200,000	104	112	128	136	152	160
196 – 205	¢110,000	103	111	127	135	151	159
186 – 195	¢100,000	95	103	119	127	143	151
176 – 185	¢90,000	92	100	116	124	140	148
166 – 175	¢80,000	89	97	113	121	137	145
156 – 165	¢70,000	87	95	111	119	135	143
146 – 155	¢60,000	85	93	109	117	133	141
136 – 145	¢50,000	83	91	107	115	131	139
126 – 135	¢40,000	82	90	106	114	130	138
116 – 125	¢30,000	81	89	105	113	129	137
106 – 115	¢20,000	80	88	104	112	128	136
96 – 105	¢10,000	79	87	103	111	127	135
86 – 95	¢9,000	67	75	91	99	115	123
76 – 85	¢8,000	60	68	84	92	108	116
66 – 75	¢7,000	54	62	78	86	102	110
56 – 65	¢6,000	48	56	72	80	96	104
46 – 55	¢5,000	44	52	68	76	92	100
36 – 45	¢4,000	40	48	64	72	88	96
26 – 35	¢3,000	34	42	58	66	82	90
16 – 25	¢2,000	28	36	52	60	76	84
06 – 15	¢1,000	25	29	45	53	69	77
(-04) – 05	¢900	24	27	33	41	57	65
(-14) – (-05)	¢800	23	25	32	40	56	64
(-24) – (-15)	¢700	22	24	31	39	55	63
(-34) – (-25)	¢600	21	23	30	38	54	62
(-44) – (-35)	¢500	20	22	29	37	53	61
(-54) – (-45)	¢400	19	21	27	35	51	59
(-64) – (-55)	¢300	18	20	25	33	49	57
(-74) – (-65)	¢200	17	19	23	31	47	55
(-84) – (-75)	¢100	16	18	21	28	44	52
(-94) – (-85)	¢90	15	17	20	25	41	49
(-104) – (-95)	¢80	14	16	19	24	33	41
(-114) – (-105)	¢70	13	15	18	23	32	40
(-124) – (-115)	¢60	12	14	17	22	31	39
(-134) – (-125)	¢50	11	13	16	21	30	38
(-144) – (-135)	¢40	10	12	15	20	29	37
(-154) – (-145)	¢30	9	11	14	19	28	36
(-164) – (-155)	¢20	8	10	13	17	27	35
(-174) – (-165)	¢10	7	9	12	17	26	34
(-184) – (-175)	¢5	6	8	11	16	23	31
(-195) – (-185)	¢0	5	7	10	15	19	27

DETERMINE HITS (7)

Hits are an average of the hits of all unit members. This means that they suffer from the same averaging problems as with skills. As all infantry units are twelve men strong, there is only one column (for Body Development) to consider on the table.

As with skills, hits can either be randomized or purchased. The price is give on a per-soldier basis (in case a squad is designed that is slightly above or below strength, for some reason.

Compare the roll or purchase to the following table. A separate column is provided for each Body Development progression. Only the first Body Development value matters. For example, if the race's progression is 0 • 6 • 5 • 2 • 1, use the column for "6."

After the unit's hits are determined, add in their racial bonus for Constitution twice and Self Discipline once. This will give you their final hit total.

Example: *It is now time to calculate the unit's hits. Gary rolls 168. Since the first rank of Body Development would grant a bonus of 6 to a Falanar, the result is 113 (168 on the "6" column). A Falanar has a racial Constitution bonus of +6 and Self Discipline bonus of +4. That means that the unit's total hits are 129 (116 + 6 + 6 + 4). At least they can take a beating. This is a total value 960,000 credits (80,000 x 12).*

CALCULATE TOTAL COST (8)

The final step is to total the cost of the unit. This requires totaling the following:

- Total cost of unit's armor (if appropriate).
- Total cost of unit's shields (if appropriate).
- Total cost of all weapons and ordnance (if appropriate).
- Total cost of all skills for all unit members.
- Total cost of unit hits (if appropriate).
- Total racial cost of each member.

To determine the racial cost of a unit, use the following formula:

([7 – (Background Options)] x ¢5,000)

Example: *For the sake of curiosity, Gary calculates the squad's total value. The total cost so far is:*

Armor: 0
Barrier Shields: ..... ¢180,000
Assault Blasters: ..... ¢102,000
Skills: ..... ¢21,000
Hits: ..... ¢960,000
Total: ..... ¢1,263,000

The racial cost of a Falanar is 15,000 ([7 – 4 (Background Options of a Falanar) x5,000). The total is therefore 180,000 (15,000 x 12).

This means that the grand total of the unit is 1,443,000 (1,263,000 + 180,000). This would be an expensive unit, is Gary had to purchase it, but not nearly as expensive as a single tank.

By comparison, a normal infantry unit, without armor or shields, and with average hits and skills, would only cost 407,000. The hits aren't much bang for their buck.

A-2.3 HEAVY ORDNANCE CONSTRUCTION

This section is used to generate artillery and other non-vehicle ordnance— use the following steps:

1) **Select the Firing Mechanism Type:** Select what type of ordnance this is.
2) **Select the Number of Firing Mechanisms:** Determine the number of firing mechanisms.
3) **Select the Mark Number of the Firing Mechanism:** Determine the power of the firing mechanisms.
4) **Select Magazine Capacity:** If the mechanisms require ammo, determine the magazine capacity.
5) **Determine Targeting Bonus:** Artillery pieces have computer targeting. The details are now selected.
6) **Calculate Total Weight:** Calculate the total weight.
7) **Select Mobility:** Some artillery pieces are mobile. If so, determine its motive force.
8) **Calculate Total Cost:** Determine the total cost.

Notation on Tech Level: *For this section, consider both the ISC and Empire to be tech level 25.*

SELECT THE FIRING MECHANISM TYPE (1)

The first step is to determine the firing mechanism (FM) that is to be housed in the piece. You may select from the following list:

Autocannon/Projectile Cannon: for the purposes of heavy ordnance, auto cannons all fire a single large shell. They can therefore be lobbed over intervening terrain with an appropriate spotter (with GPS and high tech triangulation gear, this doesn't even have a penalty, though the spotter will probably be killed right after getting a range on the target).

Laser Cannon: A standard, high-powered laser.

Blaster Cannon: A standard blaster.

Disruptor Cannon: A standard disruptor.

Ion Cannon: A standard Ion Cannon.

Plasma Cannon: A standard plasma cannon. Most plasma is lighter than most atmospheres. So, they are not usually capable of indirect fire.

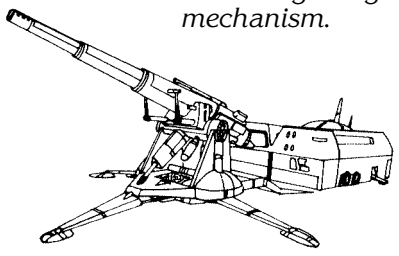
Missile Launcher: A standard missile rack.

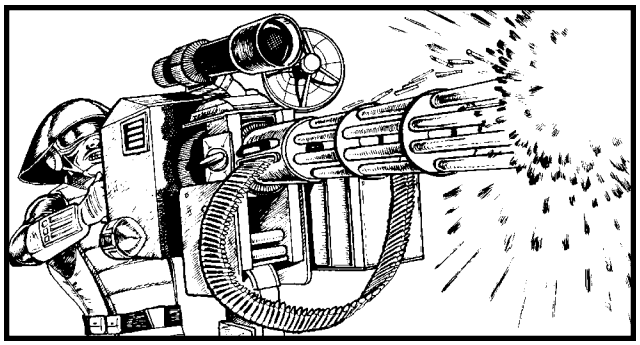
Example: *Gary wants to build a piece of field artillery. He decides on a missile launcher.*

SELECT THE NUMBER OF FIRING MECHANISMS (2)

Determine the total number of firing mechanisms per mount. Only one missile launcher may be placed on a piece of ordnance.

Example: *Gary has an easy decision—a missile launcher may only have one firing mechanism.*





SELECT THE MARK NUMBER OF THE FIRING MECHANISM (3)

For missiles, Mark Number is determined by the number of missiles in the volley. For other weapons, there are five sizes of cannon: Compact, Small, Medium, Large, and Ultra-Large. The maximum Mark Number is determined by the size of the frame and the tech level as outlined in the power template charts.

POWER TEMPLATE: AUTO/PROJECTILE CANNON

Tech Level	Frame Size: Compact	Small	Med.	Large	Ultra-Large
15	4	8	12	16	20
16	4	8	12	16	20
17	4	8	12	16	20
18	6	12	18	24	30
19	6	12	18	24	30
20	6	12	18	24	30
21	8	16	24	32	40
22	8	16	24	32	40
23	8	16	24	32	40
24	10	20	30	40	50
25	10	20	30	40	50
26	10	20	30	40	50
27	20	30	40	50	60
28	20	30	40	50	60
29	20	30	40	50	60

A Note on Focusing: *As detailed in Blaster Law, weapons can be focused. This is typically done when then the damage is far too tremendous to be entirely useful (that is, it goes off the top of the chart). If a weapon has a Mark Number greater than 50, the remaining power is represented as a bonus, to represent focusing the attack into a more effective armor-piercing attack. For instance, an ultra-large tech level 26 laser canon attacks as a +50 Mark 50 cannon. Fighting foes above your tech level is dangerous, if not suicidal.*

Each weapon has a weight. The frame of the weapon determines its weight, not the Mark Number. Missile launchers are rated by tech level.

POWER TEMPLATE: DISRUPTORS

Tech Level	Frame Size: Compact	Small	Med.	Large	Ultra-Large
21	–	–	–	1	2
22	–	–	1	2	3
23	–	1	2	3	4
24	1	2	3	4	5
25	5	10	15	20	25
26	10	20	30	40	50
27	20	40	60	80	100
28	40	80	120	160	200
29	80	160	240	320	400

POWER TEMPLATE: LASERS/BLASTER/PLASMA

Tech Level	Frame Size: Compact	Small	Med.	Large	Ultra-Large
18	–	–	–	1	2
19	–	–	1	2	3
20	–	1	2	3	4
21	1	2	3	4	5
22	2	4	6	8	10
23	4	8	12	16	20
24	8	16	24	32	40
25	10	20	30	40	50
26	20	40	60	80	100
27	40	80	120	160	200
28	80	160	240	320	400
29	160	320	480	640	800

Note on Pulse Lasers: A laser cannon can be chosen as a Pulse Laser instead. This doubles the bonus from the HUD, but halves the damage.

POWER TEMPLATE: ION CANNONS

Tech Level	Frame Size: Compact	Small	Med.	Large	Ultra-Large
20	-	-	-	1	2
21	-	-	1	2	3
22	-	1	2	3	4
23	1	2	3	4	5
24	5	10	15	20	25
25	10	20	30	40	50
26	20	40	60	80	100
27	40	80	120	160	200
28	80	160	240	320	400
29	160	320	480	640	800

WEIGHT (Metric Tons) OF FRAME BY FIRING MECHANISM

Firing Mech.	Frame Size: Compact	Small	Med.	Large	Ultra-Large
Auto/Proj.	5	10	18	20	25
Blaster	6	12	18	24	30
Disruptor	12	24	36	48	60
Ion	10	19	29	38.5	48
Laser	5	10	14.5	19	24
Plasma	8	17	25	31	39

WEIGHT OF MISSILE LAUNCHER BY TECH LEVEL

Tech Level	Weight	Tech Level	Weight
16	2.50	23	0.75
17	2.25	24	0.50
18	2.00	25	0.25
19	1.75	26	0.125
20	1.50	27	0.10
21	1.25	28	0.05
22	1.00	29	0.025

Example: *Gary is making a missile launcher, so the Mark Number is based on his tech level (which is 25). It won't become relevant until next step. The weight of the launcher is .25 metric tons.*

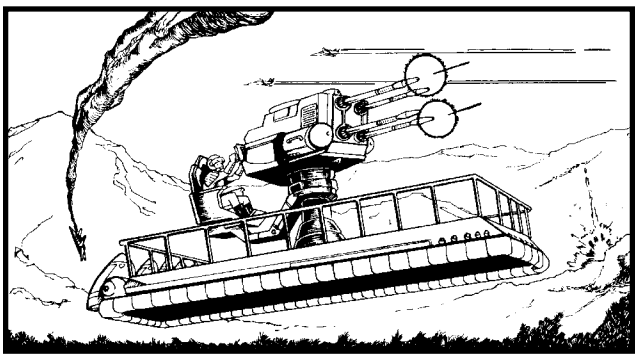
SELECT MAGAZINE CAPACITY (4)

Missile launchers, autocannons, and projectile cannons all use ammo. The magazine shows how many attacks a gun can make and how many missiles a launcher can fire.

Both types of magazine are rated by how many metric tons of ammo they can hold. How many missiles or attacks are in a metric ton depends on the tech level.

Missiles only have one magazine. Guns with multiple firing mechanisms must have equal-sized magazines.

The weight of a magazine depends on the metallurgy of the age (tech level). It is rated by how many metric tons of magazine are required to safely hold a metric ton of ammo.



METRIC TONS OF MAGAZINE PER METRIC TON OF AMMO

Tech Level	Metric tons per Metric ton	Tech Level	Metric tons per Metric ton
14	2.50	22	1.25
15	2.25	23	1.25
16	2.00	24	1.00
17	2.00	25	1.00
18	1.75	26	0.75
19	1.75	27	0.75
20	1.50	28	0.50
21	1.50	29	0.50

SHOTS PER METRIC TON, AUTO/PROJECTILE CANNON

Tech Level	Frame Size: Compact	Small	Med.	Large	Ultra-Large
15	100	50	33	25	20
16	100	50	33	25	20
17	100	50	33	25	20
18	125	62	41	31	25
19	125	62	41	31	25
20	125	62	41	31	25
21	166	83	55	41	33
22	166	83	55	41	33
23	166	83	55	41	33
24	250	125	83	62	50
25	250	125	83	62	50
26	250	125	83	62	50
27	500	250	166	125	100
28	500	250	166	125	100
29	500	250	166	125	100

MISSILES PER METRIC TON

Tech Level	Missiles	Tech Level	Missiles
15	14	23	33
16	15	24	40
17	16	25	50
18	18	26	66
19	20	27	100
20	22	28	200
21	25	29	400
22	28		

Example: *Gary feels that the piece needs 100 missiles. At tech level 25, that is an even 2 metric tons. At tech level 25, 1 metric ton worth of ammo requires 1 metric ton of magazine. That means that the ammo and the magazine total 4 metric tons.*

DETERMINE TARGETING BONUS (5)

Purchase the bonus granted by the HUD. The HUD bonus purchased depends on the system's tech level:

HUD BONUS

Tech Level	¢10K	¢20K	Cost ¢60K	¢240K	¢1200K
15	+1	+2	+5	+10	+15
16	+1	+2	+6	+11	+16
17	+1	+2	+7	+12	+17
18	+1	+3	+8	+13	+18
19	+1	+4	+9	+14	+19
20	+1	+5	+10	+15	+20
21	+1	+6	+11	+16	+21
22	+2	+7	+12	+17	+22
23	+3	+8	+13	+18	+23
24	+4	+9	+14	+19	+24
25	+5	+10	+15	+20	+25
26	+10	+15	+20	+25	+30
27	+15	+20	+25	+30	+35
28	+20	+25	+30	+35	+40
29	+25	+30	+35	+40	+45

After determining the HUD bonus, add in the other bonuses of the firing mechanism. Add the Mark Number of the weapon (missiles get a bonus based on the number of missiles in the salvo, and so ignore this). Finally, if there is more than one firing mechanism, there is a +2 bonus per firing mechanism beyond the first.

Example: *Gary wants this piece of artillery to be as effective as possible against aircraft. Since aircraft have an innate advantage over ground craft, he selects a +25 bonus. Since missiles have no Mark Numbers and there is only on firing mechanism, this is the total bonus.*

CALCULATE TOTAL WEIGHT (6)

It is now time to add up the total weight of the piece. Add the weight of firing mechanisms and any ammo and magazines. The weight of the HUD is negligible.

Example: *Gary makes note of the total weight so far. The missile launcher itself weighs .25 metric tons. The 100-missile magazine weighs 4 metric tons. That means that this piece weighs a total of 4.25 metric tons.*

SELECT MOBILITY (7)

Most modern artillery pieces can be moved of their own volition. The amount that the motive engine can move the piece is a factor of the weight of the piece and the speed at which it is intended to be moved. It also depends on the type of motive transport.

To make a piece *wheeled*, use this equation:
(11% weight) + ([wt.]÷3 x TLF x [desired speed])

To make a piece *tracked*, use this equation:
(11% weight) + ([wt.]÷3 x TLF x [desired speed])

To make a *surface effect* piece, use this equation:
(28% weight) + ([wt.]÷3 x TLF x [desired speed])

To make an *antigrav* piece, use this equation:
(17% weight) + ([wt.]÷3 x TLF x [desired speed])

TLF stands for Tech Level Factor. To determine the tech level factor of a given type of engine, check the following chart.

The equation will result in the weight of the engine and any gear. This is added to the final weight.

TECH LEVEL FACTOR CHART

Tech Level	Wheeled	Tracked	Surface Effect	Gravitic
15	.03	.033	.03	–
16	.02	.023	.02	–
17	.01	.013	.01	–
18	.009	.012	.009	–
19	.008	.011	.008	–
20	.007	.010	.007	–
21	.006	.009	.006	–
22	.005	.008	.005	–
23	.004	.007	.004	–
24	.003	.006	.003	–
25	.002	.005	.002	.02
26	.001	.004	.001	.002
27	.0005	.002	.0005	.001
28	.00025	.001	.00025	.0005
29	.000125	.0005	.000125	.00025

Each type of mobility has a maximum tonnage of vehicle it can be used with. Compare the tech level to the chart below for the maximum tonnage of the vehicle (this includes the final weight of the engine).

MAXIMUM VEHICLE WEIGHT

Tech Level	Wheeled	Tracked	Surface Effect	Gravitic
15	200	2K	2	–
16	400	4K	4	–
17	800	8K	8	–
18	1.5K	15K	15	–
19	3K	30K	30	–
20	6K	60K	60	–
21	12K	120K	120	–
22	24K	240K	240	–
23	50K	500K	500	–
24	100K	1 Mil	1K	–
25	200K	2 Mil	2K	Any
26	400K	4 Mil	4K	Any
27	800K	8 Mil	8K	Any
28	1.5 Mil	1.5 Mil	15K	Any
29	3 Mil	3 Mil	20K	Any

Result is given in metric tons.

Example: *Gary wants the piece to run on tracks. He wishes its top speed to be 150k per hour. Plugging the weight and speed into the tracked vehicle equation, we get the following: (4.25 x .11) + (4.25 ÷ 3 x .005 x 150). The result is 1.53. Rounding to two decimal places, that makes the total weight of the vehicle 5.78 metric tons.*

CALCULATE TOTAL COST (8)

Now for the final step. The total cost of the weapon must be determined. To do so, follow these steps:

Total Cost of Firing Mechanisms:
For the cost of most weapons, use the following table:

COST OF FIRING MECHANISMS

Firing Mech.	Compact	Small	Med	Large	Ultra-Large
Auto/Proj.	¢1.1	¢2.1	¢3.1	¢4.1	¢5.1
Blaster	¢1.4	¢5.6	¢10.2	¢17.6	¢27
Disruptor	¢2.8	¢11.2	¢20.4	¢35.2	¢54
Ion	¢2.2	¢9	¢16.3	¢28.2	¢43.2
Laser	¢1.1	¢4.5	¢8.2	¢14.1	¢21.6
Plasma	¢2.1	¢8.4	¢15.3	¢26.4	¢40.5

Note: All costs are given in millions.

Missile Launcher Cost: ¢1,000,000

Total Cost of Magazine and Ammo:
Cost of Magazine: ¢10,000 per metric ton.
Cost of Auto/Projectile Cannon ammo: ¢10,000 per metric ton.
Cost of Missiles: ¢50,000 per missile.

Total Cost of HUD bonuses:
Add together the cost of all the HUDs.

Total Cost of Mobility:
Wheeled vehicles:
(Tonnage x Speed / 12) + ¢5,000
Tracked vehicles:
(Tonnage x Speed / 6) + ¢8,000
Surface Effect vehicles:
(Tonnage x Speed / 2) + ¢10,000
(At tech level 15, multiply total by ten)
Gravitic Vehicles:
(Tonnage x Speed x 2) + ¢100,000
(At tech level 25, multiply total by ten).

Notation on Cost: *Ships can be built cheaper if they use old technology. Buying weapons of an older tech level reduces the cost of the weapons to 10%.*

Example: *Gary totals the cost of the artillery piece.*
Missile Launcher: ..... ¢1,000,000
Magazine: ..... ¢20,000 (10,000 x 2)
Missiles: ..... ¢5,000,000 (50,000 x 100)
Mobility: ..... ¢8,145 (5.78 x 150 ÷ 6 +8,000)
Total: ..... ¢6,028,145

The price of the piece is mostly tied up in the 5 million dollars worth of ammo. Now Gary knows why most fighters have only have ten missiles.

A-2.4 COMPLETE VEHICLE CONSTRUCTION RULES

The rules in this section can be used to create almost any kind of vehicle, in almost any tech level. It is a complicated system, but it creates more realistic and diverse vehicles.

Effort has been taken to make these rules complete and yet usable. Some discretion and common sense must be applied. Though it takes a metric ton of support structure and other components (galleys, lavatories, etc.) to put a man in a seat on a spacecraft, obviously a seat doesn't cost a metric ton on a motorcycle, or even a car.

Creating a vehicle follows a set of phases. An outline of the process is as follows:

1) **Select Vehicle Type:** Decide what sort of vehicle this is.
2) **Select Mass and Volume:** Determine the exact size of the vehicle.
3) **Select Hull:** Determine the characteristics of the hull.
4) **Select Hard and Strong Points:** Figure out how many hard and strong points the vehicle has.
5) **Add Armor Belt:** Armor, when applied to the hull, will increase the hits and defensive capabilities of the vehicle.
6) **Select Drives:** Determine the characteristics of the conventional drives.
7) **Select FTL Drive:** Determine the nature of the FTL drives the ship might have.
8) **Select Armaments:** Add weapons to the vehicle.
9) **Determine Targeting Bonus:** Add a HUD to each weapon.
10) **Select Payload Pallets:** Add payload pallets to the vehicle.
11) **Select Special Ordnance:** Add any special ordnance to the vehicle.
12) **Select Melee Value:** Select the vehicle's ability to fight up close and personal with infantry.
13) **Select Tractor Beam Projectors:** Some vehicles have tractor beams, for use in capturing vehicles.
14) **Select Communications Gear:** Select the communications gear with which the craft is equipped.
15) **Select Sensors:** Determine the sensor capabilities of the craft.
16) **Select Electronic Warfare:** outfit the craft with an electronic warfare suite.
17) **Select Defensive Screens:** Add defensive screens.
18) **Select Decoys:** Add decoys to trick enemy missiles and torpedoes.
19) **Select Point Defense System:** Many vehicles use point defenses to attack and detonate incoming warheads. Select the PD capabilities of the craft.
20) **Select Maneuverability:** The ability to dodge fire and warheads is important to many space vehicles. Select the maneuverability of the craft.
21) **Select Power Source:** Total the power requirements of the craft. Select a power source that can supply the power needs.
22) **Determine Minimum Crew:** Calculate minimum number of crew members and technical personnel.
23) **Determine Crewmember Control Areas:** Crewmembers need a place to work. Define the

crewmember areas now.

24) **Select AI Systems:** Certain tasks on a vehicle can be performed by Artificial Intelligence, if the universe permits. AI brains can perform vital ship roles.

25) **Select Crew Quarters:** Living crewmembers need a place to sleep. Select the crew quarters.

26) **Select Passenger Accommodations:** Many vehicles are meant to carry passengers. Select staterooms.

27) **Select Life Support:** Many vehicles are meant to operate in harsh environments. Select the life support systems that keep the crew and passengers alive.

28) **Determine Recreational Facilities:** Vehicles that are meant to operate independently for long periods of time require way to occupy the crew and passengers. Select these facilities.

29) **Select Medical Dispensary:** Long range vehicles need medical facilities. Select these facilities.

30) **Select Medical Sick Bay:** If the ship need medical facilities, select the sick bay.

31) **Select Labs:** Many crafts serve as research facilities. Select these labs.

32) **Select Workshop:** Many vehicles need to make repairs when out on a mission. Select workshops for these vehicles.

33) **Select Security Stations:** These stations are made to keep the peace and control illegal behaviors.

34) **Select Fighter Bays:** If the vehicle carries fighters, they will need fighter bays.

35) **Select Vehicle Bays:** If the vehicle carries other types of vehicles, then bays must be installed.

36) **Select Cargo Hold:** If the vehicle is meant to carry cargo, then space must be set aside for it.

37) **Select Atmospheric Streamlining:** If the vehicle must operate inside an atmosphere, it must be streamlined.

38) **Select Submarine Streamlining:** If the vehicle must operate under water, then it must be streamlined.

39) **Select Landing Gear:** If the space or atmospheric vehicle is capable of landing, then it needs landing gear.

40) **Select Radiation Shielding:** Many vehicles enter highly radioactive areas. They need to be shielded.

41) **Select Computer Programs:** Air and spacecraft can have software to predict and evade the enemy. Select that software.

42) **Select Auxiliary Systems:** There are many other systems that a vehicle might need.

43) **Select Features and Design Flaws:** Many craft have special features or flaws. Select them.

44) **Determine Final Mass and Volume:** Make any final adjustments to mass and volume.

45) **Determine Final Cost:** Calculate the final cost of the vehicle.

Notation on ISC and Jeronan Craft: *For the most part, each table in this section has an entry for the ISC and the Empire. The empire has stolen enough tech, however, that they can build SMACs at the ISC level (they don't build TMACs, and MMACs and larger vehicles require more customized technology).*

SELECT VEHICLE TYPE (1)

The first step is to determine what sort of vehicle is to be created. Some common selections are:

Atmospheric Vehicle: A vehicle meant to fly through the air.

Ground Vehicle: A land-based vehicle, be it a motorcycle, truck, or tank.

Marine Vehicle: A sea-based vehicle, be it a boat or ship.

Powered Armor: This is a suit of super-heavy, robotic armor. It turns a man into a small vehicle, but still allows them to fight in a normal fashion.

Space Vehicle: A vehicle capable of traveling through the void of space. Some common vehicles are SMACs (Single-Manned Assault Craft) or one-person fighters, TMACs (Two-Manned Assault Craft) or two-person fighters, and MMACs (Multi-Manned Assault Craft) or gunboats.

Submarine Vehicle: A vehicle meant to travel below the surface of the ocean.

Walker or Hopper: A vehicle that walks like a living creature or one that hops from place to place. These typically have an animal or anthropomorphic shape.

Combination: Some vehicles may combine elements of these selections. For example, a skycar may have qualities common to both ground vehicles and atmospheric vehicles.

Example: *Gary wants to make a 100 metric ton TMAC (Two-Man Assault Craft) This is for a straight tech level 25 society.*

SELECT MASS AND VOLUME (2)

Determine the mass of the vehicle. This can sometimes be subjective, but the following are guidelines.

Metric tons	Common Vehicles
< 1	attack bikes and light vehicles
1-5	powered armor
1-50	trucks, surveillance vessels, helicopters, aircraft
50-200	AFVs, hovertanks, troop transports
100-400	SMAC fighter, 1-person space vehicle
100-500	small multi-motive ground craft
100-1k	jumptanks, large multi-motive ground craft, TMAC fighter, small survey vessel, yacht
500-5k	battle pods, ground craft carriers, surface control vehicles
1k-5k	MMAC gunboat, frigate, scout, light freighter
1k-10k	surface ships, submarines, supply vehicles, support cruisers, destroyer, small liner
10k-50k	line cruiser, heavy freighter, large liner
10k-500k	mobile battle stations, flag cruiser, carrier, small orbital station
100k+	surface dreadnought, dreadnought, large orbital station

After the mass of the craft has been determined, the volume must be calculated. With the exception of submarine craft and powered armor, the volume of a craft is equal to three kiloliters (that is, three cubic meters) per metric ton. A submarine has a volume of about one kiloliter per metric ton. A suit of powered armor doesn't need to worry about volume (but use 3 per metric ton as a figure if needed).

The volume of a craft can be altered later, with features and flaws. Altering the volume of a craft will alter the way that craft takes criticals.

Example: *This fighter will mass 100 metric tons. It will be mall and maneuverable. It will have three kiloliters of space per metric ton. Since this is a fighting craft, it will probably come in far below the 300 kiloliters that allows, but he can always take the Compact Feature Later.*

SELECT HULL (3)

The next step is to determine what the hull and superstructure of the vehicle is made from. Each hull has a minimum tech level at which it can be constructed.

HULL & SUPERSTRUCTURE DATA

CAT	Material	Tech Level	Volume Factor	Cost Mult.
XI	Steel	15	.02	1.0
XII	Titanium	16	.02	1.5
XIII	Crysteel	17	.02	3.0
XIV	Crystanium	18	.02	5.5
XV	Reinforced Crystani.	18	.06	7.0
XVI	Fullerene	18	.02	8.5
XVII	Reinforced Fullerene	18	.06	10.0
XVIII	Crystan.Double Hull	19	.10	15.0
XIX	Fullerene Double Hull	19	.10	30.0
XX	Collosium	24	.04	50.0

It's possible to use superior alloys to increase the strength of the hull and superstructure. If a superior alloy is purchased, it can either increase the vehicle's Defensive Bonus or increase the minimum tonnage for the material (See Hull Reinforcement for Acceleration Table (@#$) for the maximum tonnage per CAT).

Effect	Superior Alloy Cost Multiplier
+5 DB or +10% to hull maximum	2.0
+10 DB or +20% to hull maximum	4.0
+15 DB or +30% to hull maximum	8.0
+20 DB or +40% to hull maximum	16.0
+25 DB or +50% to hull maximum	32.0

To come up with the total cost multiplier, multiply the two multipliers together. This will give you the total multiplier.

Hull Volume = (Volume of Vehicle) x (Vol. Factor)

Hull Mass = (Volume of Vehicle) ÷ 20

Hull Power Cost = 0

Hull Cost = Mass x 100 x (Total Cost Multiplier)
(Multiply the total cost by ten during the tech level the armor was introduced.)

Minimum Crew = 0

If the hull is for a surface, marine, or air vehicle with less than 1G of acceleration, then no special considerations are necessary. If the hull is a rocket, or capable of accelerating at more than 1G, then the craft will need to be reinforced to support its own weight under full acceleration.

The reinforcements necessary depend a great deal on the CAT of the hull. The number given on the chart below is the percent of the volume and mass of the craft taken up by the additional reinforcements. Multiply the volume of the ship by the acceleration (in Gs) it's meant to support by the factor on the chart below. This will show how much of the volume is taken up by additional reinforcements. Do the same for the mass of the ship.

This step can be ignored if the ship accelerates at 1G or less.

Reinforcement Power Cost = 0

Reinforcement Cost = [Gs] x [% from Chart] x [Cost of Hull] x [Total Hull Multiplier]

Minimum Crew = 0

Example: *Gary decides that the TMAC should be constructed of advanced Fullerenes, so he selects a CAT of XVI and no superior quality bonuses. This means the armor masses 15 (300/20) metric tons. The volume is 6 (300 x .02) kiloliters. The cost is ¢85,000 (100 x 100 x 8.5). This material requires no structural reinforcement at this tonnage, which is a good thing, since Gary intends it to pull 20 Gs.*

SELECT HARD & STRONG POINTS (4)

A weapon can only be mounted on a hard or strong point. These are sections of the superstructure that are reinforced to handle a weapon mount. Strong points are solid enough to mount energy weapons. Hard points are necessary to mount a missile launcher, auto/projectile cannon, or payload pallet.

All vehicles have a minimum number of valid strong points, just as a side effect of solid construction. This number is equal to the mass of the vehicle (in metric tons) divided by 100. All vehicles have at least 2 strong points.

Adding strong or hard points during construction is easy, and becomes easier the more solid the hull is (less buttressing has to be done). Adding after the fact requires more work, and the cost is multiplied by the cost multiplier of the material (the base, not the total).

STRONG AND HARD POINTS

	Cost		Volume/Mass	
CAT	Strong	Hard	Strong	Hard
XI	¢1,000	¢10,000	3	30
XII	¢900	¢9,000	2	20
XIII	¢500	¢5,000	1	10
XIV	¢100	¢1,000	.4	4
XV	¢90	¢900	.3	3
XVI	¢80	¢800	.2	2
XVII	¢70	¢700	.1	1
XVIII	¢10	¢100	.02	.2
XIX	¢5	¢50	.01	.1
XX	0	0	0	0

Example 1: *Gary is satisfied with the two free strong points. He doesn't buy any others.*

HULL REINFORCEMENT FOR ACCELERATION

	CONSTRUCTION ARMOR TYPE									
Mass	**XI**	**XII**	**XIII**	**XIV**	**XV**	**XVI**	**XVII**	**XVIII**	**XIX**	**XX**
≤ 50	.05%	0	0	0	0	0	0	0	0	0
≤ 100	.1%	0	0	0	0	0	0	0	0	0
≤ 200	.2%	.1%	0	0	0	0	0	0	0	0
≤ 300	.3%	.2%	.1%	0	0	0	0	0	0	0
≤ 400	.4%	.3%	.2%	.1%	0	0	0	0	0	0
≤ 500	.5%	.4%	.3%	.2%	.1%	0	0	0	0	0
≤ 600	.6%	.5%	.4%	.3%	.2%	.1%	0	0	0	0
≤ 700	.7%	.6%	.5%	.4%	.3%	.2%	.1%	0	0	0
≤ 800	.8%	.7%	.6%	.5%	.4%	.3%	.2%	.1%	0	0
≤ 900	.9%	.8%	.7%	.6%	.5%	.4%	.3%	.2%	.1%	0
≤ 1K	1%	.9%	.8%	.7%	.6%	.5%	.4%	.3%	.2%	.1%
≤ 2K	1.5%	1.3%	1.1%	.9%	.7%	.6%	.5%	.4%	.3%	.2%
≤ 3K	2%	1.7%	1.4%	1.1%	.8%	.7%	.6%	.5%	.4%	.3%
≤ 4K	2.5%	2.1%	1.7%	1.3%	.9%	.8%	.7%	.6%	.5%	.4%
≤ 5K	3%	2.5%	2%	1.5%	1%	.9%	.8%	.7%	.6%	.5%
≤ 6K	3.5%	2.9%	2.3%	1.7%	1.1%	1%	.9%	.8%	.7%	.6%
≤ 7K	4%	3.3%	2.6%	1.9%	1.2%	1.1%	1%	.9%	.8%	.7%
≤ 8K	4.5%	3.7%	2.9%	2.1%.	1.3%	1.2%	1.1%	1	.9%	.8%
≤ 9K	5%	4.1%	3.2%	2.3%	1.4%	1.3%	1.2%	1.1%	1%	.9%
≤ 10K	5.5%	4.5%	3.5%	2.5%	1.5%	1.4%	1.3%	1.2%	1.1%	1%
≤ 20K	10%	8%	6%	4%	3%	2%	1.4%	1.3%	1.2%	1.1%
≤ 30K	15%	12%	9%	6%	4.5%	3%	1.5%	1.4%	1.3%	1.2%
≤ 40K	20%	16%	12%	8%	6%	4%	1.6%	1.5%	1.4%	1.3%
≤ 50K	25%	20%	15%	10%	7.5%	5%	1.7%	1.6%	1.5%	1.4%
≤ 60K	30%	24%	18%	12%	9%	6%	1.8%	1.7%	1.6%	1.5%
≤ 70K	35%	28%	21%	14%	10.5%	7%	2%	1.8%	1.7%	1.6%
≤ 80K	40%	32%	24%	16%	12%	8%	3%	2%	1.8%	1.7%
≤ 90K	45%	36%	27%	18%	13.5%	9%	4%	3%	2%	1.8%
≤ 100K	50%	40%	30%	20%	15%	10%	5%	4%	3%	2%
≤ 200K	*	80%	60%	40%	30%	20%	10%	8%	6%	4%
≤ 300K	–	*	*	60%	45%	30%	15%	12%	9%	6%
≤ 400K	–	–	*	80%	60%	40%	20%	16%	12%	8%
≤ 500K	–	–	–	*	75%	50%	25%	20%	15%	10%
≤ 600K	–	–	–	–	90%	60%	30%	24%	18%	12%
≤ 700K	–	–	–	–	–	70%	35%	28%	21%	14%
≤ 800K	–	–	–	–	–	–	40%	32%	24%	16%
≤ 900K	–	–	–	–	–	–	–	36%	27%	18%
≤ 1–Mil	–	–	–	–	–	–	–	–	30%	20%
1–Mil+	–	–	–	–	–	–	–	–	–	22%

* = These sizes can only accelerate at 1G or less.
– = Sizes are impossible with this construction armor type.

ADD ARMOR BELT (5)

The armor of a vehicle can be thickened to resist damage. Though this does not take up any of the internal volume of the craft, it does increase the hull's mass. Increase the mass of the hull by the same percentage by which the hits are increased.

Armor Belt Protection	Cost Multiplier
+5 DB and +5%Hits	100
+10 DB and +10%Hits	200
+15 DB and +15%Hits	300
+20 DB and +20%Hits	400
+25 DB and +25%Hits	500

Armor Belt Volume = 0

Armor Belt Mass = (Hull Volume) x (Hits %)

Armor Belt Power Cost = 0

Armor Belt Cost =
(Vehicle Mass) x (Cost Multiplier)
(At the Tech Level the CAT was originally introduced, multiply the result by ten)

Minimum Crew = 0

Hits

The base hits for a vehicle are equal to the tonnage of the vehicle. Add the percentage of the armor belt to the total. For most vehicles, a minimum of 5 would be appropriate. For extremely small vehicles (motorcycles), the minimum hits would be 1.

Example: The TMAC needs to be a bit resistant to damage. Gary selects +5 for the armor belt. This takes up a mass of 5 (5% of 100) and no volume. It costs ¢10,000 (100 x 100). The hits are 105 (105% of 100). At this point in the game, the craft weighs 20 metric tons with 6 kiloliters of volume. This is to be expected; most combat related equipment is dense. The total cost is ¢95,000.

SELECT DRIVES (6)

Select the propulsion method of the vehicle. This can include anything from wheels, to helicopter blades, to vectored thrust.

For the following equations, TLF stands for Tech Level Factor. See the following tables for appropriate Tech Level Factors.

Notation on Early Rocketry: *This system is meant to handle vehicles which have at least some degree of commonality. Early rockets (including the space shuttle and everything else in tech level 16) cannot begin to make this claim. Tech level 16 rockets spend almost all of their energy pushing their own fuel out of the gravity well. So many metric tons of fuel are necessary just to move a tiny object into orbit that spacecraft are individually crafted masterpieces.*

If a GM wishes to place this kind of craft into a game, it is most likely more of a setting than a common vehicle. Those that are adept at the sort of math necessary to calculate the thrust and DV of such a vehicle already have access to the formulas. This work picks up the matter with the invention of the highly efficient second generation rocket fuels. These allow a ship to be pushed into orbit with a fraction of the fuel required at tech level 16.

Conventional Drives

These equations allow the creation of any surface or atmospheric drives not typically capable of breaking the sound barrier.

Gravitic drives float the vehicle on an antigravity cushion, and can work with any size vehicle and achieve almost any altitude. These are very advanced drives, and come about long after all the others.

It should be noted that this is not a gravprop. The gravprop is merely a reactionless drive misnamed by the marketing media. It is not capable of nullifying gravity (although it can produce downward trust).

Helicopter drives use a huge prop to cause the vehicle to hover in the air. Since these can never apply their full thrust forward, they are slower than prop drives.

Hopper drives leap from one location to another, usually on jump jets. Many walkers are also hoppers. To determine the length of a single jump, divide the distance traveled in an hour by 1000. For instance, is the vehicle is capable of 50 kph, it hops 50 meters in a single jump.

Marine drives travel across water (or other liquid surfaces). They use a propeller, which can be powered by anything from diesel fuel to nuclear power.

Prop drives use a propeller to propel an aircraft forward. If the craft is atmospherically streamlined, this then provides lift.

Surface effect drives ride on a cushion of air. They can travel across any solid or liquid surface, as long as they can withstand being within a couple meters of the surface. They are not capable of higher altitudes.

Tracked drives are the next evolution after the wheeled drive. They are more durable and capable of handling larger vehicles. They are typically used for tanks.

Walker drives walk across the ground like bipeds or quadrupeds. They tend to take the shape of humanoids or animals, and look like giant robots.

Wheeled drives are the most primitive drive systems. They move the vehicle around on wheels turned by an internal engine.

To make a drive, use the following equations:

Total Wheeled/Tracked Drive Volume:
(10% Volume) + (Volume x TLF x [desired speed])

Total Gravitic/Marine/Prop Drive Volume:
(15% Volume) + (Volume x TLF x [desired speed])

Total Walker Drive Volume:
(20% Volume) + (Volume x TLF x [desired speed])

Total Surface Effect/Hopper Drive Volume:
(25% Volume) + (Volume x TLF x [desired speed])

Total Helicopter Drive Volume:
(30% Volume) + (Volume x TLF x [desired speed])
(Minimum speed for a Helicopter is 100)

Total Wheeled/Tracked Drive Mass:
(10% Mass) + ([Mass] x TLF x [desired speed])

Total Gravitic/Marine/Prop Drive Mass:
(15% Mass) + ([Mass] x TLF x [desired speed])
(Minimum speed for a prop is 90)

Total Walker Drive Mass:
(20% Mass) + ([Mass] x TLF x [desired speed])

Total Surface Effect/Hopper Drive Mass:
(25% Mass) + ([Mass] x TLF x [desired speed])

Total Helicopter Drive Mass:
(30% Mass) + ([Mass] x TLF x [desired speed])
(Minimum speed for a Helicopter is 100)

Total Gravitic Drive Cost:
(Mass x Speed x 2) + ¢100,000
(At tech level 25, multiply total by ten)
(For the ISC, multiply the total by 7)

Total Helicopter Drive Cost:
(Mass x Speed) + ¢20,000

Total Hopper Drive Cost:
(Mass x Speed x 3) + ¢300,000
(At tech level 19, multiply total by ten)

Total Marine Drive Cost:
(Mass x Speed ÷ 12) + ¢5,000

Total Prop Drive Cost:
(Mass x Speed ÷10) + ¢8,000

Total Surface Effect Drive Cost:
(Mass x Speed ÷ 2) + ¢10,000
(At tech level 15, multiply total by ten)

TECH LEVEL FACTOR CHART

Tech Level	Wheeled /Prop	Tracked/ Surface/ Marine	Helicopter	Gravitic	Walker	Hopper
15	.003	.004	.006	-	-	-
16	.003	.004	.005	-	-	-
17	.003	.004	.005	-	.04	-
18	.002	.003	.004	-	.004	-
19	.002	.003	.004	-	.004	.03
20	.002	.003	.003	-	.003	.003
21	.002	.003	.003	-	.003	.003
22	.001	.002	.002	-	.003	.003
23	.001	.002	.002	-	.002	.002
24/Emp.	.001	.002	.002	-	.002	.002
25/ISC	.001	.002	.002	.001	.002	.002
26	.0005	.001	.001	.0001	.001	.001
27	.00025	.0005	.0005	.00009	.0005	.0005
28	.000125	.00025	.00025	.000045	.00025	.00025
29	.00005	.000125	.000125	.0000225	.000125	.000125

MAXIMUM VEHICLE WEIGHT CHART

Tech Level	Wheeled	Tracked	Surface Effect	Gravitic	Walker	Hopper	Marine	Helicopter	Prop
15	200	2K	2	-	-	-	200K	10	300
16	400	4K	4	-	-	-	400K	20	600
17	800	8K	8	-	100	-	800K	40	1.2K
18	1.5K	15K	15	-	200	-	1.5 Mil	80	2.4K
19	3K	30K	30	-	400	50	3 Mil	150	5K
20	6K	60K	60	-	800	100	6 Mil	300	10K
21	12K	120K	120	-	1.5K	200	12 Mil	600	20K
22	24K	240K	240	-	3K	400	24 Mil	1.2K	40K
23	50K	500K	500	-	6K	800	50 Mil	2.4K	80K
24	100K	1 Mil	1K	-	12K	1.5K	100 Mil	5K	150K
25/Emp	200K	2 Mil	2K	Any	24K	3K	200 Mil	10K	300K
25/ISC	270K	2.7 Mil	2.7K	Any	33K	4K	270 Mil	14K	400K
26	400K	4Mil	4k	Any	50K	6K	400Mil	20K	600K
27	800K	8 Mil	8K	Any	100K	12K	800 Mil	40K	1.2 Mil
28	1.5 Mil	15 Mil	15K	Any	200K	24K	1.5 Bil	80K	2.4 Mil
29	3 Mil	30 Mil	20K	Any	400K	50K	3 Bil	150K	5 Mil

Total Tracked Drive Cost:
(Mass x Speed ÷ 6) + ¢8,000

Total Walker Drive Cost:
(Mass x Speed) +¢100,000
(At tech level 17, multiply total by ten)

Total Wheeled Drive Cost:
(Mass x Speed ÷ 12) + ¢5,000

Total Wheeled/Tracked/Marine/Helicopter/ Prop/Walker Drive Power Cost:
At lower tech levels, wheeled and tracked drives generate their own power. To determine the total power rating, for fuel consumption purposes, use the following:
(Mass x Speed ÷ 10,000) per hour.
(Double the rate for helicopters.)

Notation: *All the stats above assume the craft needs to burn fuel in an internal combustion engine. If the craft is powered by a generator, divide volume, cost, and mass by two.*

Total Surface Effect/Gravitic/Hopper Drive Power Cost:
These drives run on fuel at the lower tech levels. Eventually, they run on electricity once portable reactors become the norm.
(Mass x Speed ÷ 1,000) per hour.

Minimum Crewmembers: (Mass) ÷ 1,000

Each type of mobility has a maximum tonnage of vehicle it can be used with. Compare the tech level to the chart below for the maximum tonnage of the vehicle (this includes the final weight of the engine).

Jet Drives

These drives suck air through an intake, heat it so it expands tremendously, then shoot it out the back. This provides a tremendous amount of thrust, but is only useful within an atmosphere.

Calculate the stats of this engine like a conventional engine. The equations are as follows:

Total Jet Drive Volume:
(15% Volume) + (Volume x TLF x [desired speed])

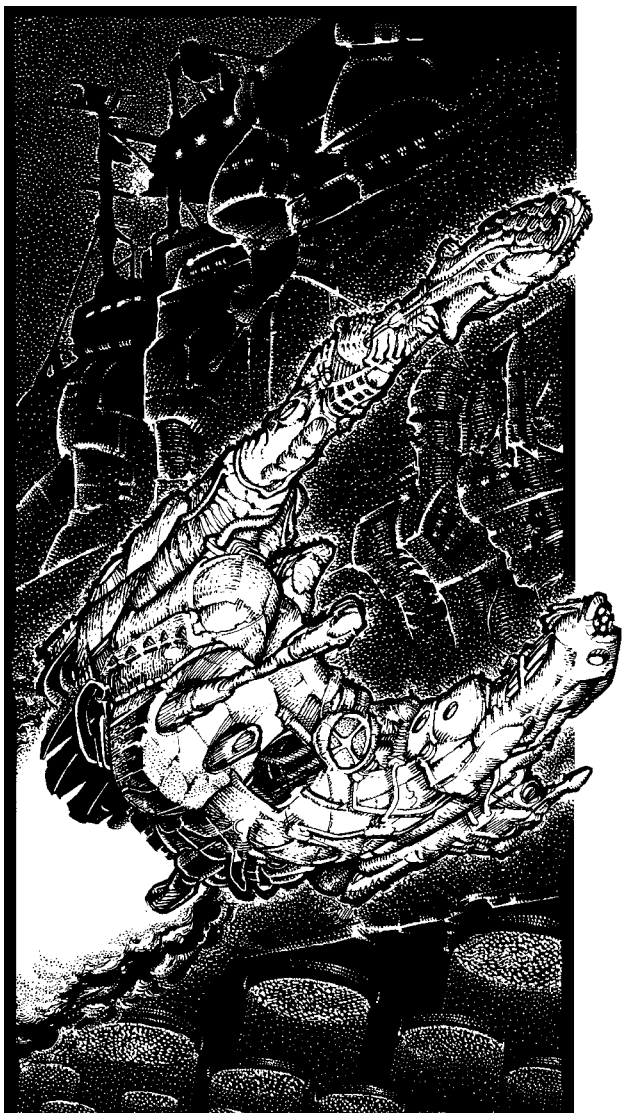
Total Jet Drive Mass:
(15% Mass) + (Mass÷3 x TLF x [desired speed])
(Minimum speed for a jet is 450)

Total Jet Drive Cost:
(Mass x Speed) + ¢80,000

Total Jet Drive Power Cost:
Jet drives typically generate their own power. To determine the total power rating, for fuel consumption purposes, use the following:
(Mass x Speed ÷ 100) per hour.

Minimum Crew: Mass/1000

Total Acceleration:
Jets are also rated by acceleration (actually, even a prop plane can be, if fighting statistics need to be known). To calculate the acceleration, use the acceleration chart. This can also be used to determine the air speed of a space vehicle.



JET DRIVE TECH LEVEL FACTORS

Tech Level	Factor	Tech Level	Factor
15	0.09	23	0.01
16	0.08	24/Emp.	0.009
17	0.07	25/ISC	0.008
18	0.06	26	0.007
19	0.05	27	0.006
20	0.04	28	0.003
21	0.03	29	0.0015
22	0.02		

ACCELERATION CHART

Air Speed (kph)	Acceleration (Gs)	Air Speed (kph)	Acceleration (Gs)
450	0.03	1,600	0.6
500	0.04	1,700	0.7
600	0.05	1,800	0.8
700	0.06	1,900	0.9
800	0.07	2,000	1
900	0.08	3,000	2
1,000	0.09	4,000	4
1,100	0.1	5,000	8
1,200	0.2	6,000	16
1,300	0.3	7,000	32
1,400	0.4	8,000	64
1,500	0.5	9,000	128

Vectored Trust/Tiltrotor Capability

Certain jets are built with a vectored thrust engine. This means that they can redirect their trust, allowing the jet to hover in place. Conversely, certain helicopters are capable of tilting their rotors forward, allowing lift to be taken up by an airfoil.

To make a jet that has a vectored thrust engine, or a helicopter with a tiltrotor, multiply the drive mass, drive volume, and drive cost by 1.5.

Tiltrotor helicopters no longer consume double fuel. They also travel twice as fast.

Gravchutes

A gravchute is added to a piece of equipment to decelerate its fall. The size of gravchute necessary depends on the mass of the object to be decelerated. See the chart below:

GRAVCHUTE VOLUME AND MASS PER METRIC TON

Tech Level	Cost	Volume	Mass
25	¢85,000	.09	.03
ISC	¢55,000	.06	.02
26	¢8,500	.009	.003
27	¢7,000	.006	.002
28	¢5,000	.003	.001
29	¢2,000	.0015	.0005

Total Gravchute Power Cost: (Mass) ÷ 50

Minimum Crew: 0

Second Generation Drives

By tech level 17, advances in rocket and fuel technology allow a series of second generation drives to be developed. These drives combine sturdy engineering with highly explosive fuel. The fuel explodes with such force that the exhaust and particulate mass reach relativistic velocities. This provides tremendous amounts of thrust from comparatively little fuel mass.

To add a second generation drive, choose the metric tons of thrust desired. Decide how many drive units are needed to supply this thrust (this can be one big drive). Multiply metric tons of thrust, volume, mass, cost, and crew by the number of units purchased.

Finally, figure out how long the drive needs to operate, in hours (fractions of hours are OK, many craft cannot sustain full thrust for an entire hour). Multiply the hours of use by the number of units. Multiply this number by the volume and mass of the fuel.

Total Acceleration of the Drive (in Gs):
(Metric tons of Thrust) ÷ (Mass of vehicle)

Total ΔV (in Gs): (Hours of fuel) x Gs x 3600

Total Cost of Fusion Drive: (# of Drive Units) x 15K

SECOND GENERATION DRIVE
(PER 100 METRIC TONS OF THRUST)

Tech Level	Mass	Volume	Fuel Mass	Fuel Volume	Crew
17	10	30	12.5	10	.5
18	5	15	11.25	9	.2
19	2	6	10	8	.1
20	1	3	8.75	7	.1
21	.9	2.7	7.5	6	.1
22	.8	2.4	6.25	5	.1
23	.7	2.1	5	4	.1
24/Emp.	.6	1.8	3.75	3	.1
25/ISC	.5	1.5	2.5	2	.1
26	.4	1.2	1.25	1	.1
27	.3	.9	.63	.5	.1
28	.2	.6	.31	.25	.1
29	.1	.3	.13	.1	.1

Ion Drives

Ion drives are low yield, but extremely efficient drives. They accelerate ionized particles to relativistic speeds. This creates an incredibly efficient drive, but the thrust is never good. When speed in not an issue, however, this is your drive.

To add an ion drive, choose the metric tons of thrust desired. Decide how many drive units are needed to supply this thrust (this can be one big drive). Multiply metric tons of thrust, volume, mass, crew, power, and cost by the number of units purchased.

Finally, figure out how long the drive needs to operate, in hours (fractions of hours are ok, many craft cannot sustain full thrust for an entire hour). Multiply the hours of use by the number of units. Multiply this number by the volume and mass of the fuel.

Total Acceleration of the Drive (in Gs):
(Metric tons of Thrust) ÷ (Mass of vehicle)

Total ΔV (in Gs): (Hours of fuel) x Gs x 3600

Total Cost of Ion Drive: (# of Drive Units) x 2K

ION DRIVE
(PER 10 METRIC TONS OF THRUST)

Tech Level	Mass	Volume	Fuel Mass	Fuel Volume	Crew
17	10	30	.5	.1	.1
18	1	3	.45	.09	.1
19	.1	.3	.4	.08	.1
20	.09	.27	.35	.07	.1
21	.08	.24	.3	.06	.1
22	.07	.21	.25	.05	.1
23	.06	.18	.2	.04	.1
24/Emp.	.05	.15	.15	.03	.1
25/ISC	.04	.12	.1	.02	.1
26	.03	.09	.05	.01	.1
27	.02	.06	.045	.009	.1
28	.01	.03	.04	.008	.1
29	.005	.015	.035	.007	.1

Note: The Power Cost for all tech levels is 0.1.

Fusion Drives

A fusion drive combines deuterium into helium. In the process of fusion, the exhaust is expelled at a high speed. This makes the drive very effective. The exhaust is also radioactive. This makes it a terrible crime to use it within an inhabited atmosphere.

To add a fusion drive, choose the metric tons of thrust desired. Decide how many drive units are needed to supply this thrust (this can be one big drive). Multiply metric tons of thrust, volume, mass, crew, power, and cost by the number of units purchased.

Finally, figure out how long the drive needs to operate, in hours (fractions of hours are OK, many craft cannot sustain full thrust for an entire hour). Multiply the hours of use by the number of units. Multiply this number by the volume and mass of the fuel.

Total Acceleration of the Drive (in Gs):
(Metric tons of Thrust) ÷ (Mass of vehicle)

Total ΔV (in Gs): (Hours of fuel) x Gs x 3600

Total Cost of Fusion Drive: (# of Drive Units) x 25K

FUSION DRIVE
(PER 100 METRIC TONS OF THRUST)

Tech Level	Mass	Volume	Fuel Mass	Crew	Power Cost
18	11	22	.08	2	10
19	1.1	2.2	.08	1	5
20	1.0	2	.08	.9	2
21	.9	1.8	.08	.8	1
22	.8	1.6	.08	.7	.9
23	.7	1.4	.08	.6	.8
24/Emp.	.6	1.2	.08	.5	.7
25/ISC	.5	1	.08	.4	.6
26	.4	.8	.08	.3	.5
27	.3	.6	.08	.2	.4
28	.2	.4	.08	.1	.3
29	.1	.2	.08	.1	.2

Note: The Fuel Volume for all tech levels is 0.5.

Ramjet Drives

A ramjet uses a many kilometer-wide magnetic scoop to gather up ionized hydrogen and focus it into a fusion flame. This allows a ship to travel indefinitely, without expending fuel. At tech level 19, this magnetic scoop kills any biological lifeform within its radius. At tech level 20, the technology becomes familiar enough that it is possible to shield biological lifeforms inside the ship.

The only drawback of this kind of drive is that the ramjet must be accelerated to 1% of the speed of light. Therefore, certain ships will have fuel tanks that allow it to accelerate to the proper speed.

To add a ramjet drive, choose the metric tons of thrust desired. Decide how many drive units are needed to supply this thrust (this can be one big drive). Multiply metric tons of thrust, volume, mass, crew, power, and cost by the number of units purchased.

Finally, figure out how long the drive needs to operate, in hours below 1% c. Multiply the hours of use by the number of units. Multiply this number by the volume and mass of the fuel.

Total Acceleration of the Drive (in Gs):
(Metric tons of Thrust) ÷ (Mass of vehicle)

Total ΔV (in 1% lights): (Hours of fuel) x Gs ÷ 8.33

Total Cost of Ramjet Drive: (# of Drive Units) x 30K

RAMJET DRIVE
(PER 10 METRIC TONS OF THRUST)

Tech Level	Mass	Volume	Fuel Mass	Fuel Volume	Crew
19	.22	.44	.008	.05	0
20	.2	.4	.008	.05	0
21	.18	.36	.008	.05	0
22	.16	.32	.008	.05	0
23	.14	.28	.008	.05	0
24/Emp.	.12	.24	.008	.05	0
25/ISC	.1	.2	.008	.05	0
26	.08	.16	.008	.05	0
27	.06	.12	.008	.05	0
28	.04	.08	.008	.05	0
29	.02	.04	.008	.05	0

Note: The Power Cost for all tech levels is 0.

Reactionless Drives

By tech level 22, the final evolution of space drive is invented. The reactionless drive allows thrust to be applied without reactants, merely by the application of power. This means that as long as a ship has power, it can operate, and the only fuel necessary is that which supplies the generator (but by this time, vacuum power provides limitless power).

To add a reactionless drive, choose the metric tons of thrust desired. Decide how many drive units are needed to supply this thrust (this can be one big drive). Multiply metric tons of thrust, volume, mass, crew, power, and cost by the number of units purchased.

Total Acceleration of the Drive (in Gs):
(Metric tons of Thrust) ÷ (Mass of vehicle)

Total Cost of Reactionless Drive:
(# of Drive Units) x 35K

REACTIONLESS DRIVE
(PER 100 METRIC TONS OF THRUST)

Tech Level	Mass	Volume	Crew	Power Cost
22	10	10	1	10
23	5	5	.5	1
Empire	3	3	.3	1
24	2	2	.2	1
25	1	1	.1	1
ISC	.9	.9	.09	1
26	.8	.8	.08	1
27	.4	.4	.04	1
28	.2	.2	.02	1
29	.1	.1	.01	1

Relative Inertial Force Generators

An RIF is an inertial damper. It enforces the inertial frame of reference of the ship upon all of its occupants. This means that anything within the ship feels no effects from acceleration and deceleration. This is invaluable on high-performance fighters, where high-G forces are common, and on larger ships with artificial gravity, where they want "down" to stay "down."

This device must ground the field on something, be it an engine or hull. The object that the field is grounded on takes all of the inertia of everything in the field. Therefore, the field is usually grounded on the entire hull of the craft, because to ground it on just the engine would exceed the stress capabilities of the engine.

For instance, a vehicle may have a total mass of 1,000 metric tons. The engine and hull of the vehicle only weigh about 250 metric tons. When the field is engaged, only the hull and engine retain their mass, as far as thrust is concerned. However, the hull and engine take on the mass of all the contents of the field, quadrupling in mass.

In other words, a RIF doesn't affect the mass of the vehicle as a whole, just shifts the burden of the inertia. The inhabitants can't tell the difference.

Total Volume of RIF: (Volume) x TLF (Volume)

Total Mass of RIF: (Mass) x .01

Total RIF Cost: (Mass) x TLF (Cost) + (Base Cost)

Total RIF Power Cost:
(Mass) ÷ 1,000 x (Acceleration)

Minimum Crew: 0

RIF CHART

Tech Level	TLF (Volume)	TLF (Cost)	Base Cost
Empire	.01	1000	¢100,000
25	.001	100	¢10,000
ISC	.0007	65	¢6,500
26	.0001	10	¢1,000
27	.00008	8	¢800
28	.00004	4	¢400
29	.00002	2	¢200

SELECT FTL DRIVE (7)

There are several possible faster than light drives that might be used in Spacemaster. Depending on the universe, one or more of these methods might be possible. For instance, in the Privateers universe, only the flux drive and the quantum drive are valid choices.

Flux Drives

The flux drive makes the ship become "unstuck" in space. This allows the ship to travel at a higher rate of speed, ignoring the effects of relativity.

A side effect of the flux drive is that conventional drives become less effective. Therefore the flux drive requires its own motive force.

The flux drive allows a ship to travel at a rate of a light year every week. The problem is, there has never been a method discovered to increase this constant rate. Every attempt to create a second generation flux drive caused the craft to explode in a total conversion of matter to energy.

Total Volume of Flux Drive: (Vol.) x TLF + 15,000

Total Mass of Flux Drive: (Mass) x TLF + 5,000

Total Cost of Flux Drive: (Mass) x 1,000 + 5 Mil.

Total Flux Drive Power Cost: (Mass) ÷ 20

Minimum Crew: (Mass of Drive) ÷ 100

FLUX DRIVE TECH LEVEL FACTORS

Tech Level	TLF	Tech Level	TLF
20	0.5	25	0.09
21	0.4	26	0.08
22	0.3	27	0.07
23	0.2	28	0.06
24	0.1	29	0.05

Hyperdrives

The hyperdrive shifts the craft into hyperspace, where the normal laws of relativity do not apply. A hyperdrive is powered by matter/antimatter reactions, and provides its own power. Each drive has a rating. This rating tells how many light years the ship is displaced per day.

Total Hyperdrive Vol: ([Vol.] x [TLF] x [Rating]) + 50

Total Hyperdr. Mass: ([Mass] x [TLF] x [Rating]) + 15

Total Hyperdrive Cost:
([Mass] x 30 x [Rating]) + [Base Cost]

Total Hyperdrive Power Cost:
None. Hyperdrive uses an antimatter power source.

Minimum Crew: (Hyperdrive Mass) ÷ 100

HYPERDRIVE TECH LEVEL FACTOR

Tech Level	TLF	Base Cost
20	0.6	1.5 Mil
21	0.06	150K
22	0.05	140K
23	0.04	130K
24	0.03	120K
25	0.02	110K
26	0.01	100K
27	0.005	50K
28	0.0025	25K
29	0.00125	12.5K

HYPERDRIVE RATINGS

Rating	Translight Displacement (LY/day)	Rating	Translight Displacement (LY/day)
1	1	16	13
2	2	17	13.5
3	3	18	14
4	4	19	14.5
5	5	20	15
6	6	21	15.25
7	7	22	15.5
8	8	23	15.75
9	9	24	16
10	10	25	16.25
11	10.5	26	16.5
12	11	27	16.75
13	11.5	28	17
14	12	29	17.25
15	12.5	30	17.5
		31+	17.5 + .1 x (Rating - 30)

Quantum Drives

Named for the specialized field of quantum non-locality that allowed the drive to be created, this is the primary drive in the Privateers universe. It uses special field technology (the precursor of the force field) to contract space in front of the craft and dilate it behind. This causes a relativity trick to make the craft appear to be travailing faster than light.

These drives come in three orders of magnitude. A Level 1 drive reduces the effective distance traveled by a factor of 1,000. These are the typical commercial drives. The level 2 drive reduces the effective distance traveled by a factor of 10,000. These are much more expensive, and are the typical military drives. The Level 3 drive reduces the effective distance traveled by a factor of 100,000. These are very bulky and expensive and only used for the highest speed couriers.

The drive only shortens the effective distance traveled, it doesn't move the craft, therefore a craft with higher Gs of acceleration can travel faster than one with a lower level of acceleration. This effect can be reversed for when the craft is decelerating, shortening the distance behind the craft.

A quantum drive covers a very large area. This means that the drive is not dependent on the size of the ship. Therefore, quantum drives come in one size.

Total Level 1 Drive Power Cost: 1,000

Total Level 1 Minimum Crew: 1

Total Level 2 Power Cost: 10,000

Total Level 2 Minimum Crew: 5

Total Level 3 Power Cost: 100,000

Total Level 3 Minimum Crew: 10

LEVEL 1 QUANTUM DRIVES			
Tech Level	**Volume**	**Mass**	**Cost**
20	1,000	500	¢50 Mil
21	100	50	¢5 Mil
22	80	40	¢4 Mil
23	60	30	¢3 Mil
Empire	46	23	¢2.3 Mil
24	40	20	¢2 Mil
25	20	10	¢1 Mil
ISC	18.6	9.3	¢930K
26	16	8	¢800K
27	8	4	¢400K
28	4	2	¢200K
29	2	1	¢100K

LEVEL 2 QUANTUM DRIVES			
Tech Level	**Volume**	**Mass**	**Cost**
20	10,000	5,000	¢500 Mil
21	1,000	500	¢50 Mil
22	800	400	¢40 Mil
23	600	300	¢30 Mil
Empire	460	230	¢23 Mil
24	400	200	¢20 Mil
25	200	100	¢10 Mil
ISC	186	93	¢9.3 Mil
26	160	80	¢8 Mil
27	80	40	¢4 Mil
28	40	20	¢2 Mil
29	20	10	¢1 Mil

LEVEL 3 QUANTUM DRIVES			
Tech Level	**Volume**	**Mass**	**Cost**
20	100,000	50,000	¢5 Bil
21	10,000	5,000	¢500 Mil
22	8,000	4,000	¢400 Mil
23	6,000	3,000	¢300 Mil
Empire	4,600	2,300	¢230 Mil
24	4,000	2,000	¢200 Mil
25	2,000	1,000	¢100 Mil
ISC	1,860	930	¢93 Mil
26	1,600	800	¢80 Mil
27	800	400	¢40 Mil
28	400	200	¢20 Mil
29	200	100	¢10 Mil

Warp Drives

Warp drives shift a starship partially into another dimension, one where the speed of light is much faster. This allows the ship to travel faster than light.

To calculate the speed (in lights) take the warp factor and raise it to the power of three. To calculate these drives, see the following equations:

Total Volume of Warp Drive: (Volume) ÷ 5

Total Mass of Warp Drive: (Mass) ÷ 5

Total Cost of Warp Drive: (Mass) x 1,000

Total Warp Drive Power Cost:
None. Warp Drives produce their own power.

Total Minimum Crew: (Mass of Drive) ÷ 1,000

WARP DRIVE CHART			
Tech Level	**Maximum Warp**	**Tech Level**	**Maximum Warp**
20	1	25	10
21	2	26	10
22	4	27	10
23	6	28	10
24	8	29	10

Jump Drives

This type of drive is akin to the teleporter. It allows the ship to leap from one location to another instantly, without traveling the distance in between. For game balance reasons, these drives can usually only jump a certain distance, or between certain points.

If the trip is limited to a certain distance, then some restriction should be placed on how often this can be done. This could involve a recharge time, or perhaps it is just enormously expense.

If this can only occur between two points, then all travel to and from the jump point must be handled by mundane means. This means that space travel would involve long periods of travel via normal acceleration and deceleration, followed by an instantaneous journey, followed by long periods of acceleration and deceleration.

Total Jump Drive Volume: (Volume) x .5

Total Jump Drive Mass: (Mass) x .5

Total Jump Drive Cost: (Mass) x 10,000

Tot. Jump Drive Power Cost: 1,000 per light year

Total Minimum Crew: (Mass of Drive) ÷ 10,000

Spatial Folds

This type of drive folds space and time to transport the craft from one place to the other. It is functionally identical to the jump drive. All the same restrictions and balances applied to the jump drive should be applied to the spatial fold as well.

Total Spatial Fold Volume: (Volume) x .3

Total Spatial Fold Mass: (Mass) x .3

Total Spatial Fold Cost: (Mass) x 1,000

Total Spatial Fold Power Cost: 10,000 per fold

Total Minimum Crew: (Mass of Drive) ÷ 10,000

Example: *Gary will power the craft with a reactionless drive. He assigns 20 units. These mass 20 metric tons (1 metric ton each) and the same volume. At ¢35,000 each, this adds ¢700,000 to the bill. The drive (Gary pictures it as a single drive) draws 20 power (1 each) and would take 2 technicians to maintain it (20 x .1) if it were intended for extended use (which is isn't).*

Gary also installs an RIF, so that the pilot doesn't die the moment he floors the throttle. The RIF weighs 1 metric ton (100 x .1) and takes up .3 kiloliters (300 x .001). It costs ¢20,000 (100 x 100 + 10,000). It draws 2 power (100 ÷ 1,000 x 20). It doesn't require enough maintenance to warrant any crewmembers.

The craft is not capable of faster than light travel.

This puts our running total at the following: 41 metric tons of mass, 26.3 kiloliters of volume, ¢815,000, 22 power, 2 crew.

SELECT ARMAMENTS (8)

The first step is to determine the firing mechanism (FM) that is to be housed in the mount. You may select from the following list:

Autocannon/Projectile Cannon: This fires either large, heavy shells or thousands of smaller rounds.

Laser Cannon: A standard, high-powered laser.

Blaster Cannon: A standard blaster.

Disruptor Cannon: A standard disruptor.

Ion Cannon: A standard ion cannon.

Plasma Cannon: A standard plasma cannon.

Missile Launcher: A standard missile rack.

Number of Firing Mechanisms in Mount

After the type of weapon is determined, determine the total number of firing mechanisms per mount. Only one missile launcher may be placed on a mount.

Determine Mark Number of Firing Mechanisms

Next, the Mark Number of the weapons must be determined. For missiles, the Mark Number is determined by the number of missiles in the volley. For other weapons, there are five sizes of cannon: Compact, Small, Medium, Large, and Ultra-Large. The maximum Mark Number depends on the frame size and tech level of the campaign.

A Note on Focusing: *As with Blaster Law, weapons can be focused. This is typically done when then the damage is far to tremendous to be entirely useful (that is, it goes off the top of the chart). Is a weapon can have more than a mark 50 damage, the remaining power can be placed into a bonus, to represent focusing the attack into a more effective armor-piercing attack. For instance, an ultra-large tech level 26 laser canon attacks as a +50 mark 50 cannon. Fighting foes above your tech level is dangerous, if not suicidal.*

Each weapon has a mass. The frame of the weapon determines it's mass, not the Mark Number. Missile launchers are rated by tech level.

POWER TEMPLATE: AUTO/PROJECTILE CANNON

Tech Level	Size: Compact	Small	Med.	Large	Ultra-Large
15	4	8	12	16	20
16	4	8	12	16	20
17	4	8	12	16	20
18	6	12	18	24	30
19	6	12	18	24	30
20	6	12	18	24	30
21	8	16	24	32	40
22	8	16	24	32	40
23	8	16	24	32	40
24	10	20	30	40	50
25	10	20	30	40	50
26	10	20	30	40	50
27	20	30	40	50	60
28	20	30	40	50	60
29	20	30	40	50	60

POWER TEMPLATE: LASERS/BLASTER/PLASMA

Tech Level	Frame Size: Compact	Small	Med.	Large	Ultra-Large
18	–	–	–	1	2
19	–	–	1	2	3
20	–	1	2	3	4
21	1	2	3	4	5
22	2	4	6	8	10
23	4	8	12	16	20
24	8	16	24	32	40
25	10	20	30	40	50
26	20	40	60	80	100
27	40	80	120	160	200
28	80	160	240	320	400
29	160	320	480	640	800

Note on Pulse Lasers: A laser cannon can be chosen as a Pulse Laser instead. This doubles the bonus from the HUD, but halves the damage.

POWER TEMPLATE: DISRUPTORS

Tech Level	Frame Size: Compact	Small	Med.	Large	Ultra-Large
21	–	–	–	1	2
22	–	–	1	2	3
23	–	1	2	3	4
24	1	2	3	4	5
25	5	10	15	20	25
26	10	20	30	40	50
27	20	40	60	80	100
28	40	80	120	160	200
29	80	160	240	320	400

POWER TEMPLATE: ION CANNONS

Tech Level	Frame Size: Compact	Small	Med.	Large	Ultra-Large
20	-	-	-	1	2
21	-	-	1	2	3
22	-	1	2	3	4
23	1	2	3	4	5
24	5	10	15	20	25
25	10	20	30	40	50
26	20	40	60	80	100
27	40	80	120	160	200
28	80	160	240	320	400
29	160	320	480	640	800

MASS AND VOLUME OF FRAME BY FIRING MECHANISM

Firing Mech.	Frame Size: Compact	Small	Med.	Large	Ultra-Large
Auto/Proj.	5	10	15	20	25
Blaster	5	10	15	20	25
Disruptor	10	20	30	40	50
Ion	8	16	24	32	40
Laser	4	8	12	16	20
Plasma	6.5	13	19.5	26	32.5

MASS AND VOLUME OF MISSILE LAUNCHER BY TECH LEVEL

Tech Level	Mass & Volume	Tech Level	Mass & Volume
16	2.50	23	0.75
17	2.25	24	0.50
18	2.00	25	0.25
19	1.75	26	0.125
20	1.50	27	0.10
21	1.25	28	0.05
22	1.00	29	0.025

Magazine Capacity

Missile launchers, autocannons, and projectile cannons all use ammo. The magazine shows how many attack a gun can make and how many missiles a launcher can fire.

Both types of magazine are rated by how many metric tons of ammo they can hold. How many missiles or attacks are in a metric ton depends on the tech level.

Missiles only have one magazine. Guns with multiple firing mechanisms must have equal sized magazines.

The mass and volume of a magazine depends on the metallurgy of the age (tech level). It is rated by how many metric tons of magazine are required to safely hold a metric ton of ammo.

METRIC TONS OF MAGAZINE PER METRIC TON OF AMMO

Tech Level	Metric tons per Metric ton	Tech Level	Metric tons per Metric ton
14	2.50	22	1.25
15	2.25	23	1.25
16	2.00	24	1.00
17	2.00	25	1.00
18	1.75	26	0.75
19	1.75	27	0.75
20	1.50	28	0.50
21	1.50	29	0.50

SHOTS PER METRIC TON, AUTO/PROJECTILE CANNON

Tech Level	Frame Size: Compact	Small	Med.	Large	Ultra-Large
15	100	50	33	25	20
16	100	50	33	25	20
17	100	50	33	25	20
18	125	62	41	31	25
19	125	62	41	31	25
20	125	62	41	31	25
21	166	83	55	41	33
22	166	83	55	41	33
23	166	83	55	41	33
24	250	125	83	62	50
25	250	125	83	62	50
26	250	125	83	62	50
27	500	250	166	125	100
28	500	250	166	125	100
29	500	250	166	125	100

MISSILES PER METRIC TON

Tech Level	Missiles	Tech Level	Missiles
15	14	22	28
16	15	23	33
17	16	24	40
18	18	25	50
19	20	26	66
20	22	27	100
21	25	28	200
		29	400

COST OF FIRING MECHANISMS

Firing Mech.	Frame Size: Compact	Small	Med.	Large	Ultra-Large
Auto/Proj.	¢1.1	¢2.1	¢3.1	¢4.1	¢5.1
Blaster	¢1.4	¢5.6	¢10.2	¢17.6	¢27
Disruptor	¢2.8	¢11.2	¢20.4	¢35.2	¢54
Ion	¢2.2	¢9	¢16.3	¢28.2	¢43.2
Laser	¢1.1	¢4.5	¢8.2	¢14.1	¢21.6
Plasma	¢2.1	¢8.4	¢15.3	¢26.4	¢40.5

Note: All costs are given in millions.

Missile Launcher Cost: ¢1,000,000

Total Cost of Magazine and Ammo:

Cost of Magazine: ¢10,000 per metric ton.

Cost of Auto/Projectile Cannon ammo: ¢10,000 per metric ton.

Cost of Missiles: ¢50,000 per missile.

Total Autocannon Power Cost: 1

Total Missile Launcher Power Cost: 1

Total Plasma Cannon Power Cost: (Mark #) x 2

Total Power Cost (All Other Weapons): Mark #

Anti-Infantry Weapons

Anti-infantry weapons can be mounted on a ship. These weapons have all the physical statistics of vehicle weapons of the same size. If they are used against infantry, they attack on the Small Arms vs. Infantry Table (@#$).

Mounting Weapons

After the firing mechanism have been purchased and supplied with ammo, they must be attached to the vehicle. An appropriate weapon mount must be selected.

Fixed Mount:

A fixed mount points the gun in a single direction. It can be moved for the purpose of aiming, but the arc is only 60˚. A fixed mount can be placed on a strong point unless it is mounting an Autocannon or Missile Launcher, which must always be mounted on a hard point.

Total Volume of Weapon Mount:
(Total Volume of Firing Mechanisms & ammo)

Total Mass of Weapon Mount:
(Total Mass of Firing Mechanisms & ammo)

Total Cost of Mount:
(Total cost of Firing Mech. & ammo) + ¢50,000

Flexible Mount:

A flexible mount points the gun in a single direction, but allows a great range of motion. It can be moved for the purpose of aiming, up to 120˚. A flexible mount can be placed on a strong point unless it is mounting an Autocannon or Missile Launcher, or the weapon is full-sized, in which case it must be mounted on a hard point.

Total Volume of Weapon Mount:
(Total Volume of Firing Mech.) x 2 + (ammo)

Total Mass of Weapon Mount:
(Total Mass of Firing Mech.) x 2 + (ammo)

Total Cost of Mount:
(Total cost of Firing Mech. & ammo) + ¢100,000

Turret Mount:

A turret mount places all the firing mechanism in a large, swivelling turret, allowing a great range of motion. It can be moved for the purpose of aiming, able to hit everything within an entire hemisphere. A turret must be mounted on a hard point.

Total Volume of Weapon Mount:
(Total Volume of Firing Mech.) x 3 + (ammo)

Total Mass of Weapon Mount:
(Total Mass of Firing Mech.) x 3 + (ammo)

Total Cost of Mount:
(Total cost of Firing Mech. & ammo) + ¢150,000

DETERMINE TARGETING BONUS (9)

Purchase the bonus granted by the HUD. The HUD bonus purchased depends on the tech level of the system, and must be purchased separately for each mount.

HUD BONUS

Tech Level	Cost: ¢10K	¢20K	¢60K	¢240K	¢1200K
15	+1	+2	+5	+10	+15
16	+1	+2	+6	+11	+16
17	+1	+2	+7	+12	+17
18	+1	+3	+8	+13	+18
19	+1	+4	+9	+14	+19
20	+1	+5	+10	+15	+20
21	+1	+6	+11	+16	+21
22	+2	+7	+12	+17	+22
23	+3	+8	+13	+18	+23
24	+4	+9	+14	+19	+24
25	+5	+10	+15	+20	+25
26	+10	+15	+20	+25	+30
27	+15	+20	+25	+30	+35
28	+20	+25	+30	+35	+40
29	+25	+30	+35	+40	+45

After determining the HUB bonus, add in the other bonuses of the mount. Add the mark number of the weapon (missiles get a bonus based on the number of missiles in the salvo, and so ignore this). Finally, if there are more than one firing mechanisms, there is a +2 bonus per firing mechanism beyond the first.

Example: *Gary feels the fighter should have two blasters, fire linked. He begins with two compact blaster cannons. The mass and volume of each of these weapons is 5 metric tons and 5 kiloliters. This means that together they mass 10 metric tons and 10 kiloliters. At tech level 25, these are Mark Number 10. This means that they draw 10 power each (20 total). He mounts them in fixed mounts, which require no extra volume or mass. The total cost of these guns is ¢2,850,000 (1.4 Mil x 2 + ¢50,000 for mounting).*

He adds a ¢1.2 million HUD. This grants a +25 to the attacks by the gun mount (+2 for having a second gun).

SELECT PAYLOAD PALLETS (10)

There is a reason that a fighter will always be the cheapest way to deliver the most damage in any situation. That reason is the fighter's "payload."

The job of most fighters, even at tech level 16, is to carry a destructive payload to within the range of it's payload's delivery system. If your payload can kill a bunker at 200 km, you fly to 200 km, fire, then get the hell out of Dodge.

The destructive potential of payloads increase as time goes by. See the chart below for the Mark Number of a warhead by tech level.

Notation: *During the early tech levels (up to 19) when space combat begins to evolve, payloads are specialized by their medium (water, air, etc.). Starting at tech level 20, a generic "torpedo" enters the scene which is capable of being used in space, sea, or air.*

TORPEDOES

Tech Level	Compact	Small	Med.	Large	Ultra Large
15	5	10	15	20	25
16	5	10	15	20	25
17	6	12	18	24	30
18	6	12	18	24	30
19	7	14	21	28	35
20	7	14	21	28	35
21	8	16	24	32	40
22	8	16	24	32	40
23	9	18	27	35	45
24	9	18	27	35	45
25	10	20	30	40	50
26	10	20	30	40	50
27	12	24	36	48	60
28	14	28	42	52	68
29	20	40	60	80	100
Volume	1	2	3	4	5
Pallet Mass	1	2	3	4	5
Torp. Mass	.25	.5	.75	1	1.25
Pallet Cost	¢1K	¢2K	¢3K	¢4K	¢5K
Torp. Cost	¢25K	¢50K	¢75K	¢100K	¢125K
Gs/Speed	18/5K	16/4K	14/3K	12/2K	10/1K

Apocalyptic Warhead: ¢500,000

Total Payload Pallet Power Cost: 1

Example: *Gary's TMAC will not be used for delivering payloads, nevertheless, it should have something. Gary selects a single compact torpedo, which at his tech level is Mark 10. The pallet masses 1 metric ton and has 1 kiloliter of volume. The torpedo weighs a mere .25 metric tons. It takez 1 power to target and fire, and ¢26,000 (¢1,000 for the pallet, ¢25,000 for the torpedo).*

SELECT SPECIAL ORDNANCE (11)

Section 10.0 details various common pieces of ordnance. It may be desirable to purchase these for a vehicle, especially if the vehicle is powered armor. If so, the prices of each individual piece are reprinted here.

For infantry weapons (blasters, lasers, assault rifles), see *Equipment Manual, SM: Privateers,* or *Blaster Law*.

Total Vol. of Ordnance: (Mass in Metric tons) x 1

Total Mass of Ordnance: See below.

Total Cost of Ordnance: See below.

Total Weapon Power Cost: As other armaments.

ORDNANCE TABLE VM-10.1

Item	Tech Level	Mass	Cost
Ultra-Compact Autocannon	14	500	¢25,000
Ultra-Comp. Blaster Cannon*	18	500	¢50,000
Ultra-Compact Disruptor*	18	800	¢100,000
Ultra-Compact Ion Cannon*	18	600	¢75,000
Ultra-Comp. Laser Cannon*	18	400	¢40,000
Ultra-Comp. Plasma Cannon*	18	650	¢75,000
Anti-Personnel Mine	13	Varies	¢10 x Mk.
Demolitions	13	Varies	¢100/KG
I-Mine	13	Varies	¢150/KG
V-Mine	13	Varies	¢150/KG
Infantry Mortar	14	20	¢10,000
Ammunition (box of 10)	14	10	¢1,000
LAW	14	5	¢2,000
Amboathorphin	17	–	¢2,300
MASK (box of 10)	16	10	¢1,000
Nerves Gas (Box of 10)	14	10	¢10,000

* — Tripod included.

† — These items are ten times more expensive on the tech level of their introduction.

Example: *A TMAC rarely has any need for ordnance. This is no exception.*

SELECT MELEE VALUE (12)

Some vehicles (usually only powered armor) get up close and personal with infantry squads. These vehicles need a melee value to represent their combat effects at extremely close range. This is resolved as a Small Arms vs. Infantry attack.

Mark Number vs. Infantry: [Mass] ÷ 100

Vehicle to Vehicle Melee

Vehicles may smash into one another to do damage. This is most effective with a humanoid walker and a MIRC system. To harden a vehicle for a melee attack (just one specific attack, like "right fist"), use the following equations:

Total Volume of Melee Attack: (Volume) x .01 ÷ 3

Total Mass of Melee Attack: (Mass) x .01

Total Cost of Melee Attack: (Mass) x 1,000

Total Melee Attack Power Cost: None

The attack attacks as an autocannon. To determine the Mark Number, see below.

One final note; any vehicle can attempt a melee attack. It takes as much damage as it delivers and receives a critical of two degrees less severity.

MELEE BONUS					
Tech Level	Cost ¢10K	¢20K	¢60K	¢240K	¢1200K
15	+1	+2	+5	+10	+15
16	+1	+2	+6	+11	+16
17	+1	+2	+7	+12	+17
18	+1	+3	+8	+13	+18
19	+1	+4	+9	+14	+19
20	+1	+5	+10	+15	+20
21	+1	+6	+11	+16	+21
22	+2	+7	+12	+17	+22
23	+3	+8	+13	+18	+23
24	+4	+9	+14	+19	+24
25	+5	+10	+15	+20	+25
26	+10	+15	+20	+25	+30
27	+15	+20	+25	+30	+35
28	+20	+25	+30	+35	+40
29	+25	+30	+35	+40	+45

VEHICULAR MELEE ATTACKS					
	Mass of Vehicle				
Attacker's CAT	1–100	101–500	500–1K	1K–50K	50K+
XI	1	2	3	4	5
XII	2	3	6	8	10
XIII	3	6	9	12	15
XIV	4	8	12	16	20
XV	5	10	15	20	25
XVI	6	12	18	24	30
XVII	7	14	21	28	35
XVIII	8	16	24	32	40
XIX	9	18	27	36	45
XX	10	20	30	40	50

Example: *Melee values are only helpful if a vehicle intends to perform vehicle to vehicle melee, or is much larger. Gary does not select a melee value. If he wanted an attack against infantry, he'd select anti-infantry weapons. To chalk up the running totals, the craft now masses 52.25 metric tons, it has 37.3 kiloliters of volume, it costs ¢4,891,000, it draws 43 power, and it requires 3 crewmembers (if you include a gunner).*

SELECT TRACTOR BEAM PROJECTORS (13)

Often, ships use tractor beams to capture other ships. A tractor beam can be used to pull in another ship.

Range: Tractor beams are fairly short range. The range is equal to the Mark Number in kilometers.

Capabilities: The effects of the tractor beam depends on the respective masses of the vehicles. If the beaming vehicle is twice as big as the target, the beam is twice as powerful. If it is half as big, then the beam is half as powerful.

Effect: A tractor beam can reduce or increase the speed of a target ship, as long the force is being applied to shorten the distance between them. For every mark of the tractor beam, the speed is affected by .1 G (as modified by capabilities, see above).

Total Tractor Beam Power Cost: (Mark #) x 5

POWER TEMPLATE: TRACTOR BEAMS					
	Frame Size				
Tech Level	Compact	Small	Med.	Large	Ultra-Large
22	1	2	3	4	5
23	2	4	6	8	10
24	5	10	15	20	25
25	10	20	30	40	50
26	13	26	39	52	65
27	25	50	75	100	125
28	50	100	150	175	200
29	100	200	300	400	500
Mass	10	20	30	40	50
Volume	10	20	30	40	50
Cost (in Mil.)	¢2.8	¢11.2	¢20.4	¢35.2	¢54

Example: *Gary doesn't see a reason to get a tractor beam. Save it for the tugs.*

SELECT COMMUNICATIONS GEAR (14)

There are several possible sets of communications gear. However, most have them have been around for so long that details like Mark Numbers have become meaningless.

Microfrequency Comm Rig

This generally broadcasts and receives old fashioned speed-of-light signals. It operates just like a radio (at lower tech levels, it is a radio). These have a maximum range of a few thousand kilometers.

Total Vol. of Microfrequency Comm Rig: Negligible

Total Mass of Microfrequency Comm Rig: Negligible

Total Cost of Microfrequency Comm Rig: Negligible

Total Power Cost of Microfr. Comm Rig: Negligible

Tight Beam Comm Rig

This is much like a microfrequency rig, except the data is transmitted on a laser. This gives the communication a range that far exceeds problems with the delay of a light speed transmission. Assume it can work at any range where lag doesn't render it useless.

Total Volume of Tight Beam Comm Rig:
.1 (1 at Tech Level 17, when they are introduced)

Total Mass of Tight Beam Comm Rig:
.1 (1 at Tech Level 17, when they are introduced)

Total Cost of Tight Beam Comm Rig:
¢1,000 (¢10,000 at Tech Level 17, when they are introduced)

Total Power Cost of Tight Beam Comm Rig: 1

Tachyon Comm Rig

A tachyon com rig puts out a broad tachyon signal that can be heard for light years. The range depends on the tech level.

Total Vol. of Tachyon Comm Rig: .1 (1 for TL 20.)

Total Mass of Tachyon Comm Rig: .1 (1 for TL 20.)

Total Cost of Tachyon Comm Rig:
¢20,000 (¢200,000 for Tech Level 20)

Total Power Cost of Tachyon Comm Rig: 1

TACHYON COMM RIG

Tech Level	Range	Days/LY
20	4	100
21	8	50
22	16	25
23	32	12.5
Empire	53	6.25
24	64	3
25	128	1.5
ISC	218	1
26	256	.75
27	512	9 Hours
28	1024	4.5 Hours
29	2048	2 Hours

Quantum Comm Rig

This device communicates instantly across long distances (how long depends on the tech level). This is the highest evolution of communications gear.

Total Volume Quantum Comm Rig:
Negligible (.1 at tech level 23)

Total Mass of Quantum Comm Rig:
Negligible (.1 at tech level 23)

Total Cost of Quantum Comm Rig:
¢40,000 (¢400,000 at tech level 23)

Total Power Cost of Quantum Comm Rig: 1

Minimum Crew: 3

QUANTUM COMM RANGES

Tech Level	Range
23	10
Empire	15
24	20
25	40
ISC	40
26	80
27	160
28	320
29	640

Example: *First of all, Gary buys a microfrequency comm rig, after all, it costs nothing. He also purchases a quantum comm rig. It costs ¢40,000 and draws one power.*

Vehicles that spend a long time in space have a communications officer on duty at all times. Therefore, the minimum crew is 3.

SELECT SENSORS (15)

Sensor suites come in two forms. The first is a basic suite. This involves a simple set of passive sensors meant to alert the occupants of danger. The second is an advanced suite. It has all the capabilities of a basic suite, plus the ability to do full, deep scans.

A third package is an electronic surveillance suite. This allows the craft to tap into hard lines and monitor communications going into or out of an area. It is used with the Electronic Surveillance skill.

Total Vol. of Basic/Electronic Surveillance Suite: .1

Total Mass of Basic/Electronic Surveillance Suite: .1

Total Cost of Basic/Elect. Surveill. Suite: ¢10,000

Total Power Cost of Basic/El. Surv. Suite: Negligible

Total Volume of Advanced Suite: 1

Total Mass of Advanced Suite: 1

Total Cost of Advanced Suite: ¢100,000

Total Power Cost of Advanced Suite: 1

Minimum Crew: 3

Example: *Gary purchases an advanced sensor suite. It costs ¢100,000, masses one metric ton, takes up one kiloliter of space, and draws one power. On a long-range craft, this would require 3 crew members.*

SELECT ELECTRONIC WARFARE (16)

Electronic warfare is an important part of any advanced warfare. There are two types of electronic warfare, passive and active.

Passive EW

Passive electronic warfare is your basic stealth technology. The ship is designed to absorb or defect sensor reading, reducing its visible signature.

Total Volume of Passive EW: 0

Total Mass of Passive EW: 0

Total Cost of Passive EW: ¢10,000

Total Power Cost of Passive EW: 0

Minimum Crew: 0

Active EW

Active electronic warfare is used to block or overload the sensors of another craft. Active electronic warfare must be controlled by an operator. Large ships will have many separate EW arrays, so that many different ships and attacks can be stopped at once.

Total Volume of Active EW: .03 per +1

Total Mass of Active EW: .01 per +1

Total Cost of Active EW: ¢5,000 per point.

Total Power Cost of Actsive EW: 1 per +1

Minimum Crew: # of desired EW Officers (1 or more)

ELECTRONIC WARFARE TECH LEVEL

Tech Level	Passive EW Max	Active EW Max
16	10	10
17	12	15
18	14	20
19	16	25
20	18	30
21	20	35
22	25	40
23	30	45
24/Emp.	35	50
25	40	60
ISC	42	65
26	45	70
27	50	100
28	100	200
29	200	400

Stealth Technology

In universes where stealth technology is possible, consider an EW rig powerful enough to grant a +200 bonus to be true "stealth."

Example: *Gary wants the TMAC to be EW nimble. That's the purpose of the second crewmember, after all. He selects a passive EW of +10. This costs ¢100,000 (10,000 x 10), but no mass or space. He selects 45 on the active EW. This masses .45 (.01 x 45), takes up 1.35 kiloliters of space (.03 x 45) and costs ¢225,000 (5,000 x 45). It draws 45 power. It needs a single crewmember, since even on long-range craft, they usually know combat is coming in time to wake up the EW officer.*

He only buys one active rig. On a larger ship, he might buy more.

Time for a new running total. Mass is up to 53.7 metric tons, volume is up to 39.65 kiloliters, price is up to ¢5,356,000, it now draws 90 power, and it would require 10 crew (including the gunner) if it were a long-range vessel.

SELECT DEFENSIVE SCREENS (17)

An important part of any war ship is its defensive capabilities. With the advent of force fields, war craft are equipped with defensive screens.

Defensive screens add to the ship's defensive bonus. The screens, plus the armor belt, plus any evade bonus, makes the total DB of the craft.

Total Volume Defensive Screen Generator:
(Volume) x 0.003 x (Rating)
(Times ten for tech level 24)

Total Mass Defensive Screen Generator:
(Mass) x 0.003 x (Rating)
(Times ten for tech level 24)

Total Cost of Defensive Screen Generator:
(Mass) x 20 x (Rating)
(Times ten for tech level 24)

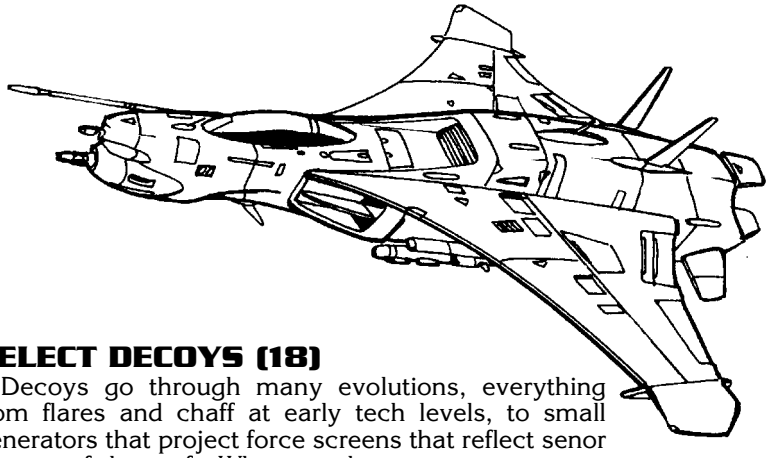
Total Power Cost of Defensive Screen Generator: (Rating)

Minimum Crew: (Generator Mass) ÷ 100

DEFENSIVE SCREENS AND RADIATION SHIELDING

Rating	Bonus	Rating	Bonus
1	5	16	62
2	10	17	64
3	15	18	66
4	20	19	68
5	25	20	70
6	30	21	71
7	35	22	72
8	40	23	73
9	45	24	74
10	50	25	75
11	52	26	76
12	54	27	77
13	56	28	78
14	58	29	79
15	60	30	80
		31+	+.5 per level

Example: *Gary's TMAC is not a rock hard little fighter. It needs to avoid taking damage, not try to soak it up. He therefore gives it a screen rating of 6 (+30). The screen generator masses 1.8 metric tons (100 x .003 x 6) and takes up 5.4 kiloliters (300 x .003 x 6) of space. It costs ¢12,000 (100 x 20 x 6) and draws 6 power. It would normally take .018 crewmembers (1.8 / 100) to service it.*



SELECT DECOYS (18)

Decoys go through many evolutions, everything from flares and chaff at early tech levels, to small generators that project force screens that reflect senor images of the craft. Whatever the

state these are dropped behind the craft to fool missiles and torpedoes into targeting them.

Total Volume of Decoys: (#) x .1 +.5

Total Mass of Decoys: (#) x .1 +.5

Total Cost of Decoys: (#) x 5,000 + ¢10,000

Total Power Cost of Decoys: 0

Minimum Crew: 0

Example: *Gary selects 15 decoys. You never know when you need help jigging away from a torpedo. 15 decoys mass 2 metric tons (15 x .1 + .5) and take up 2 kiloliters of space (15 x .1 + .5). They cost ¢85,000 (15 x 5,000 +10,000) and draw no real power. They do not require maintenance, only replacement, so they don't have a minimum crew.*

SELECT POINT DEFENSE SYSTEM (19)

Determine the Point system of the ship. It is a bulky system, consisting of multiple sub-compact lasers, and is therefore the size of multiple weapon systems in and of itself. The point defense rating assumes it is being used against weapons of equal levels of technology. If the tech levels differ, consult the table in Section 2.0. If the PD system is inferior, apply the result of the table as a penalty to the rating and number of attacks. If it is superior, apply it as a bonus.

POINT DEFENSE VOLUME AND MASS

# of Attacks	Point Defense Rating 2	3	4	5	6	7	8
1	5	10	15	20	25	30	35
2	10	15	20	25	30	35	40
3	15	20	25	30	35	40	45
4	20	25	30	35	40	45	50
5	25	30	35	40	45	50	55
6	30	35	40	45	50	55	60

Result is the mass in metric tons.

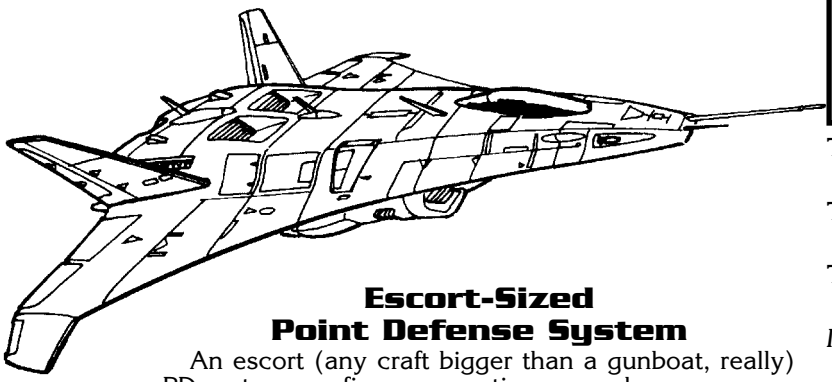
POINT DEFENSE COST

# of Attacks	Point Defense Rating 2	3	4	5	6	7	8
1	1	2	2	3	3	4	4
2	2	3	4	5	6	7	8
3	3	5	6	8	9	11	12
4	4	6	8	10	12	14	16
5	5	8	10	13	15	18	20
6	6	9	12	15	18	21	24

Result is the cost in millions of credits.

Total Point Def. Power Cost: (Rating) x (Attacks)

Minimum Crew: 0



Escort-Sized Point Defense System

An escort (any craft bigger than a gunboat, really) PD system can fire as many times round as necessary. Purchase it like a 6 attack system of the same rating, but multiply all numbers by ten.

These will attack fighters and gunboats as well, if they are within point blank range. They act like an ultra-compact laser of the appropriate tech level.

Example: *Every TMAC needs point defense. Gary purchases a single pulse laser (1 attack) with a rating of 5. This masses 20 metric tons and takes up 20 kiloliters of space. It costs ¢3,000,000 even. Military tech isn't cheap!*

SELECT MANEUVERABILITY (20)

Aircraft and space craft have maneuverability ratings. This represents how quickly a craft can dodge and jig to avoid enemy fire.

The maneuverability rating doesn't effect much in actual game play, just in ship design. The primary effect is that the ship's evade program can be no more effective than the ship's maneuverability. If the evade program is higher than the ship's maneuverability, the difference is discarded.

Maneuverability has many factors affecting it. As a ship increases in size, it's initial inertia increases, the amount of leverage caused by spin in the object increases, and the profile (and thus the ease to hit it) increases. It takes additional structural reinforcements to combat the shear of the tidal effects as the craft rotates. This means that larger ships become harder and harder to miss.

This is a complicated subject, and therefore it takes a bit more work than most steps. First, the desired bonus is determined. This will produce the rating. Second, the size of the ship is checked to determine how many maneuverability units are necessary per level of rating. Finally, the tech level is checked to determine the size of a unit.

MANEUVERABILITY RATING CHART

Rating	Bonus	Rating	Bonus
1	5	16	62
2	10	17	64
3	15	18	66
4	20	19	68
5	25	20	70
6	30	21	71
7	35	22	72
8	40	23	73
9	45	24	74
10	50	25	75
11	52	26	76
12	54	27	77
13	56	28	78
14	58	29	79
15	60	30	80
		31+	+.5 per level

Total Volume of Maneuverability:
(Volume of Unit) x (Number of Units)

Total Mass of Maneuverability:
(Mass of Unit) x (Number of Units)

Total Cost of Maneuverability:
(# of Drive Units) x 20K

Minimum Crew: 0

Craft power by a fueled drive use the craft's fuel, and don't appreciably effect Δv. For reactionless drives, use the following:

Total Power Cost of Maneuverability:
(# of Units) ÷ 2

Minimum Units for Basic Maneuverability:
(Units per Rating) ÷ 10

MANEUVERABILITY UNITS

Metric tons	Units per Rating	Metric tons	Units per Rating
≤ 50	0.25	≤ 10,000	500
≤ 100	0.5	≤ 20,000	1,414
≤ 200	1.5	≤ 30,000	2,598
≤ 300	2.5	≤ 40,000	4,000
≤ 400	4	≤ 50,000	5,590
≤ 500	5.5	≤ 60,000	7,348
≤ 600	7.5	≤ 70,000	9,260
≤ 700	9	≤ 80,000	11,314
≤ 800	11.5	≤ 90,000	13,500
≤ 900	13.5	≤ 100,000	15,811
≤ 1,000	16	≤ 200,000	44,721
≤ 2,000	45	≤ 300,000	82,158
≤ 3,000	82	≤ 400,000	126,491
≤ 4,000	126	≤ 500,000	176,777
≤ 5,000	177	≤ 600,000	232,379
≤ 6,000	232	≤ 700,000	292,831
≤ 7,000	293	≤ 800,000	357,771
≤ 8,000	358	≤ 900,000	426,907
≤ 9,000	427	≤ 1,000,000	500,000
		>1,000,000	mass÷2

SIZE OF MANEUVERABILITY BY TECH LEVEL

Tech Level	Unit Volume & Mass	Tech Level	Unit Volume & Mass
15	10	23	1
16	10	Empire	1
17	10	24	1
18	1	25	1
19	1	ISC	0.9
20	1	26	0.8
21	1	27	0.4
22	1	28	0.2
		29	0.1

Example: *This TMAC has got to be a nimble little bug. Gary decides he wants a maneuverability rating of 10. Each point of rating costs .5 metric tons and kiloliters, so this adds 5 metric tons and kiloliters to the total. It costs ¢100,000 (10,000 x 10), and draws 2.5 power (5 ÷ 2). It requires no extra maintenance (and therefore no crewmembers).*

Now for the running totals. Total mass is up to 82.5 metric tons. Total volume is up to 72.05 kiloliters. Total cost is up to ¢8,553,000. It's now drawing 103.5 power and has a minimum crew of 10.018, including gunners.

SELECT POWER SOURCE (21)

Vehicles require power. Small craft that run on fuel and don't have any other systems to draw power don't require a power source. All others do.

Total the power cost of all systems and weapons. This is the power draw of the ship. The ship needs a power generator that has a rating of at least that level.

Note that some ships do not have the generator to power all systems at once. It is entirely possible to build a craft with a power rating that only is enough to power a certain set of systems. For instance, a ship might not be able to fire its weapons while its FTL drive is operating.

Chemical Fuels

The earliest forms of fuel are petroleum products. These fossil fuels power all early engines. Soon fossil fuels are replaced by more advanced chemical fuels, but the thought remains the same. To determine how many metric tons of fuel are required for the desired range, compare the power cost of the engine to the power provided by fuel.

Volume of Chemical Fuel: 1 Kiloliter per Metric ton

Vehicle Range: (Power per Metric ton)
x (Metric tons of fuel) ÷ (power cost)

Chemical Fuel Cost: 250 per Metric ton

POWER PROVIDED BY CHEMICAL FUELS

Tech Level	Power Provided Per Metric ton	Tech Level	Power Provided Per Metric ton
14	1	22	9
15	2	23	10
16	3	24	20
17	4	25	30
18	5	26	40
19	6	27	50
20	7	28	60
21	8	29	70

Second Generation Fuel

Most of details of second generation fuels are outlined under the second generation drive. For refueling purposes, use the following equation:

Cost of 2nd Generation Fuel per Metric ton: ¢20,000

Ion Drive Fuel

Most of details of ion drive fuels are outlined under the ion drive. For refueling purposes, use this equation:

Cost of Ion Drive Fuel per Metric ton: ¢10,000

Fusion Drive Fuel

Most of details of liquid deuterium are outlined under the fusion drive. For refueling purposes, use this equation:

Cost of Liquid Deuterium per Metric ton: ¢50,000

Matter/Antimatter Reactor Fuel

If you are using a matter/antimatter reactor, you need to purchase fuel. The cost is as follows.

Cost of Antimatter per Metric ton: ¢5,000,000

Fuel Scoops and Deuterium Plant

A fuel scoop is used to scoop hydrogen from a gas giant. After that, the plant creates liquid deuterium from the hydrogen. It has a built-in fusion plant to supply its own power. This isn't available until tech level 19.

Total Volume of Scoop and Plant: 4,000 Kiloliters

Total Mass of Scoop and Plant: 1,000 Metric tons

Total Production of Plant:
5 Metric tons x Tech Level per hour

Total Cost: ¢100,000

Total Power Cost: 0

Minimum Crew: 1

Hyperdrive Fuel

This matter/antimatter fuel is used to power a hyperdrive. The size of the fuel is negligible. ¢5,000 worth of fuel will move a ship one light year.

Fission Reactor

A fission reactor splits atoms to create energy. A fission reactor is a bulky affair, but once one is purchased, great amounts of power can be created.

Total Volume of Fission Reactor:
(Rating) x .003 + 900

Total Mass of Fission Reactor:
(Rating) x .003 + 300

Total Cost of Power Reacor:
(Rating) x 500 + ¢50,000

Minimum Crew: (Volume) ÷ 100

Solar Panels

Solar panels are a handy addition to any craft. They produce far too little power to fuel most ship's systems. Solar panels are enough, however, to power computers, life support, and all the other systems a ship needs to survive long enough to repair their primary power source.

Total Volume of Solar Panels: (Volume) x .001

Total Mass of Solar Panels: (Mass) x .001

Total Cost of Solar Panels:
(Mass of Panels) x 1,000

Minimum Crew: (Mass of Panels) ÷ 100

Fusion Reactors

Fusion power is an extremely efficient power source. It combines two molecules into a third. Typically, liquid deuterium is used, because it fuses so easily into helium.

To determine the physical characteristics of a fusion reactor, multiply each of the statistics by the required rating. The volume and mass of the fuel shows how much fuel is consumed during a week of use. To determine the total amount of fuel, multiply this by the total number of weeks the reactor is meant to run without refueling.

Total Cost: (Rating) x 500 + ¢50,000

FUSION REACTOR
(PER POINT OF RATING)

Tech Level	Mass	Volume	Fuel Mass	Fuel Volume	Crew Crew
17	.11	.22	.0008	.005	.02
18	.011	.022	.0008	.005	.01
19	.01	.02	.0008	.005	.009
20	.009	.018	.0008	.005	.008
21	.008	.016	.0008	.005	.007
22	.007	.014	.0008	.005	.006
23	.006	.012	.0008	.005	.005
24/Emp.	.005	.01	.0008	.005	.004
25/ISC	.004	.008	.0008	.005	.003
26	.003	.006	.0008	.005	.002
27	.002	.004	.0008	.005	.001
28	.001	.002	.0008	.005	.001
29	.0005	.001	.0008	.005	.001

A Notation on Cold Fusion: *If cold fusion is allowed into a campaign, then use the stats of a normal fusion reactor. The difference is that the fuel needed is so minimal that is can be ignored. Also, the reactor is safe, and cannot melt down or explode in any fashion.*

Matter/Antimatter Reactors

A matter/antimatter reactor uses the mutual destruction of these tow opposed forces to create massive amounts of power. This reactor type is very dangerous, but very efficient. Any reactor hit destroys the craft.

To determine the physical characteristics of a M/A reactor, multiply each of the statistics by the required rating. The volume and mass of the fuel shows how much fuel is consumed during a week of use. To determine the total amount of fuel, multiply this by the total number of weeks the reactor is meant to run without refueling.

Total Cost: (Rating) x 5000 + ¢500,000

MATTER/ANTI MATTER REACTOR
(PER POINT OF RATING)

Tech Level	Mass	Volume	Fuel Mass	Fuel Volume	Crew Crew
21	.11	.22	.00008	.0005	.02
22	.011	.022	.00008	.0005	.01
23	.01	.02	.00008	.0005	.009
24/Emp.	.009	.018	.00008	.0005	.008
25/ISC	.008	.016	.00008	.0005	.007
26	.007	.014	.00008	.0005	.006
27	.006	.012	.00008	.0005	.005
28	.005	.01	.00008	.0005	.004
29	.004	.008	.00008	.0005	.003

Vacuum Power Generators

The penultimate evolution of power technology is vacuum power. This form of power is clean, limitless, and absolutely safe. It enters the scene during tech level 17, but doesn't become truly practical until tech level 23.

To determine the physical characteristics of a vacuum power generator, multiply each of the statistics by the required rating. Vacuum power requires no fuel.

Total Cost: (Rating) x 100 + ¢10,000

VACUUM POWER GENERATOR (PER POINT OF RATING)

Tech Level	Mass	Volume	Crew
17	10K	22K	2
18	1K	2.2K	1
19	100	200	.9
20	9	18	.8
21	.8	1.6	.7
22	.07	.14	.06
23	.006	.012	.005
24/Emp.	.005	.01	.004
25/ISC	.004	.008	.003
26	.003	.006	.002
27	.002	.004	.001
28	.001	.002	.001
29	.0005	.001	.001

Cosmic Power Generators

A cosmic power generator is the ultimate power source. It supplies absolutely unlimited power, and has no rating. It is not available until tech level 29.

Total Cosmic Power Generator Volume: 30

Total Cosmic Power Generator Mass: 10

Total Cosmic Power Generator Cost: ¢100

Minimum Crew: 0

Example: *Gary estimates (by skimming ahead) that he'll need 111 power. He buys a vacuum power generator of that rating. It masses .444 metric tons (.004 x 111) and takes up .888 (.008 x 111) kiloliters. It costs ¢21,000 (vacuum power is cheap) and would take .333 (.003 x 111) crew to maintain.*

That puts the running total up to 82.994 metric tons, 72.938 kiloliters, ¢8,574,100, 103.5 power, and 10.351 crew. The end is in sight.

DETERMINE MINIMUM CREW (22)

Every craft has a minimum crew. This is the minimum number of bodies necessary to run the craft. It is now important to figure out how many people are necessary to run the ship.

The minimum crew is calculated by adding all of the following:

- The total minimum crew ratings of all components (technicians).
- Total gunnery technicians as per tonnage.
- Total gunners
- 3 pilots
- General personnel as per tonnage.
- Any vehicle technicians (see steps 34 and 35)
- Additional Crewmembers (Pilots, Scientists, Marines, etc.)

The number of gunnery technicians is determined by totaling the tonnage of weapons (not payloads). Multiply the tonnage by the tech level factor determined below.

General personnel are necessary to monitor, clean, and take care of the ship. They handle basic maintenance as well. Multiply the tonnage of the vehicle by the tech level factor below to determine the total general personnel.

CREW TECH LEVEL FACTORS

Tech Level	Gunnery	General
15	0.11	0.011
16	0.1	0.01
17	0.09	0.009
18	0.08	0.008
19	0.07	0.007
20	0.06	0.006
21	0.05	0.005
22	0.04	0.004
23	0.03	0.003
24/Empire	0.02	0.002
25/ISC	0.01	0.001
26	0.009	0.0009
27	0.004	0.0004
28	0.002	0.0002
29	0.001	0.0001

Note: *A craft, subject to GM approval, can be manned by a single person. It requires all controls to be routed through the pilot's console. The pilot can then run the ship, though they have to split up their actions. For instance, to fire the weapons and operate the electronic warfare suite, the character would have to spilt up their 100% of activity.*

This can only be done if the craft is short range. If a craft is meant to operate for more than 50 hours, it cannot qualify for a single crewmember.

Note 2: *Many craft are equipped with a sophisticated AI that replaces crewmen at a cost of ¢10,000 per crewman. In case of emergency, this leaves the crew dangerously understaffed for damage control procedures (-50). This cannot reduce a crew below 20% of its normal minimum.*

Example: *Here is what the TMAC would require in the way of crew. 9.351 general technicians (this including communication officers, EW officers and the like) from everything so far. They would require .1 (.01 x 10) gunnery technician. They would require 1 gunner, 3 pilots, and .1 general personnel (.001 x 100).*

However, this is a two-man fighter, and these numbers assume the craft is under constant use. It isn't. It runs its missions and returns for high level maintenance. Gary assigned it two personnel so that one could fly and shoot and the other could handle communications, basic damage control, and EW.

DETERMINE CREWMEMBER CONTROL AREAS (23)

Crewmembers need an area to operate. Subtract the general personnel of the ship from the total crew. This is how many control areas are needed. These can be organized into bridges, engineering departments, and work stations as needed.

Total Volume of Control Areas:
(Number of non-general members) x 9

Total Mass of Control Areas:
(Number of non-general members) x 3

Total Cost of Control Areas:
(Number of control areas) x 5,000

Example: *The TMAC needs crew control areas for two people. At 3 metric tons and 9 kiloliters per person, this gives Gary a total of 6 metric tons and 9 kiloliters. It costs ¢10,000 (5,000 x 2).*

SELECT AI SYSTEMS (24)

In some universes, robot brains can be installed to control a vehicle (this is not common in the Privateers universe because of the restrictions of the Zero Interface law). These typically do not take up enough volume or mass to worry about. As for cost, see *Robotics Manual*.

A lower form of AI is MIRC (Maneuver Interface Robotic Controller). This installs a low-level AI which will scan the movements of a single crewmember, and if the vehicle is humanoid-shaped, replicate them. This allows the vehicle to make a single extra striking attack using the crewmember's Martial Arts skill and the vehicle's Melee value. This also takes no appreciable mass or volume.

MIRCs aren't necessary for powered armor. They work fine without.

Total MIRC Cost: (Mass) x 10 + 10K

Example: *Gary doesn't need AI or MIRC systems. He moves on.*

SELECT CREW QUARTERS (25)

Living crewmembers need to sleep. Others (such as androids) don't. Total the amount of crewmembers that need accommodations. A ship needs crew accommodations if it is meant to operate with living crewmembers for more than 50 hours at a time.

Total Volume of Crew Quarters:
(# of living crewmembers) x 9

Total Mass of Crew Quarters:
(# of living crewmembers) x 3

Total Cost of Crew Quarters:
(# of living crewmembers) x 500

SELECT PASSENGER ACCOMMODATIONS (26)

If a ship is meant to carry passengers, and take trips longer than 50 hours, the passengers need a place to stay. On shorter trips, seating will do. There are many different types of accommodations, ranging from first class staterooms to cryogenic berths. Obviously, these aren't needed in powered armor or short range craft.

Total Volume of First Class Staterooms:
(# of Staterooms) x 40

Total Mass of First Class Staterooms:
(# of Staterooms) x 9

Total Cost of First Class Staterooms:
(# of Staterooms) x 1,500

Total Volume of Standard Staterooms:
(# of Staterooms) x 30

Total Mass of Standard Staterooms:
(# of Staterooms) x 8

Total Cost of Standard Staterooms:
(# of Staterooms) x 1,000

Total Volume of Low/Military Staterooms:
(# of Staterooms) x 21

Total Mass of Low/Military Staterooms:
(# of Staterooms) x 7

Total Cost of Low/Military Staterooms:
(# of Staterooms) x 800

Total Volume of Cryogenic Berths:
(# of Berths) x 9

Total Mass of Cryogenic Berths:
(# of Berths) x 3

Total Cost of Cryogenic Berths:
(# of Berths) x 1,000

Total Volume of Seating: (# of Seats) x 3

Total Mass of Seating: (# of Seats) x 1

Total Cost of Seating: (# of Seats) x 100

Example: *Being a fighter, there isn't much need (or room) for a stateroom. Gary moves on.*

SELECT LIFE SUPPORT (27)

Many craft need to provide air, pressure, and temperature control to their living inhabitants. In these craft, life support systems are necessary. Powered armor doesn't need life support. It acts as a spacesuit by default.

Total Volume of Life Support:
[(Living Crewmembers) + (Passengers)] x 9

Total Mass of Life Support:
[(Living Crewmembers) + (Passengers)] x 3

Total Cost of Life Support:
[(Living Crewmembers) + (Passengers)] x 500

Total Power Cost of Life Support: Negligible

Example: *The TMAC needs life support for two people. That's 6 metric tons (3 x 2), 18 kiloliters (9 x 2). It costs ¢1,000 (2 x 500).*

DETERMINE RECREATIONAL FACILITIES (28)

Any craft that has passengers warranting staterooms will have recreational facilities. To calculate the costs of recreational facilities, use the following.

Total Recreation Facility Volume:
(# of Stateroom Passengers) x 5

Total Recreational Facility Mass:
(# of Stateroom Passengers)

Total Recreational Facility Cost:
(# of Stateroom Passengers) x 1,000

Total Recreational Facility Power Cost: Negligible

Example: *This ship has no need for recreational facilities.*

SELECT MEDICAL DISPENSARY (29)

In all but the most extreme cases (small fighters and gunboats) every ship needs at least a medical dispensary. A dispensary is a small station, good only for first aid.

Total Volume of Dispensary:
(Living Crewmembers) + (Passengers)

Total Mass of Dispensary:
[(Living Crewmembers) + (Passengers)] ÷ 2

Total Cost of Dispensary:
[(Living Crewmembers) + (Passengers)] x 200

Example: *A first aid kit under the seat will do.*

SELECT SICK BAY (30)

In all but the most extreme cases (small fighters and gunboats) every ship needs at least a medical facilities. A sick bay is a full facility, capable of performing full surgeries and advanced medical procedures.

Total Vol. of Sick Bay: (Patient Capacity x 24) + 99

Total Mass of Sick Bay: (Patient Capacity x 8) + 33

Total Vol. of Sick Bay: (Patient Capacity) x 4,000

Total Power Cost of Sick Bay: Negligible

Example: *That's what carriers are for.*

SELECT LABS (31)

Labs add bonuses to scientific skills performed on the ship. Each lab must be dedicated to a scientific skill. The size and cost of the lab determines the bonus granted. The bonus may not exceed +50.

Total Volume of Lab: (Bonus) x 10

Total Mass of Lab: (Bonus) x 3

Total Cost of Lab: (Bonus) x 10,000

Total Power Cost of Labs: Negligible

Example: *No sense in putting a lab in this thing.*

SELECT WORKSHOP (32)

A workshop is necessary if the craft is meant to perform spaceborne repairs. A workshop will machine parts to order for repairs. The ship therefore needs only to stock the workshops with raw materials for CIP.

Total Workshop Volume: (Volume) x .03

Total Workshop Mass: (Mass) x .03

Total Workshop Cost: (Volume of Workshop) x 100

Total Power Cost of Workshop: Negligible

Total CIP to be Stored: (Vol. of Workshop) x 2,000

Example: *Fighters don't need workshops.*

SELECT SECURITY STATIONS (33)

These include weapon and armor lockers, security stations, and checkpoints. They are necessary if the craft is meant for prolonged military duty.

Total Sec. Station Vol.: (# of military personnel) x 2

Total Sec. Station Mass: (# of military personnel)

Total Security Station Power Cost: Negligible

Total Sec. Station Cost: (# of milit. personnel) x 50

Example: *A fighter doesn't need security stations.*

SELECT FIGHTER BAYS (34)

Many craft are designed to carry and launch fighters. These craft need fighter bays. Fighter bays include all the storage, repair, and launch facilities necessary to house a fighter.

Total Vol. of Each Fighter Bay: (Fighter Mass) x 15

Total Mass of Each Fighter Bay: (Fighter Mass) x 5

Total Power Cost of Fighter Bay: Negligible

Total Cost of Each Fighter Bay: (Vol. of Bay) x 50

Minimum Crew: [Mass of fighter] ÷ 100

Example: *A fighter cannot contain a fighter bay.*

SELECT VEHICLE BAYS (35)

Certain craft are meant to carry shuttles, land vehicles, or AFVs. If so, storage bays must be purchased.

Total Vol. of Each Vehicle Bay: (Vehicle Mass) x 9

Total Mass of Each Vehicle Bay: (Vehicle Mass) x 3

Total Power Cost of Vehicle Bay: Negligible

Total Cost of Each Vehicle Bay: (Vol. of Bay) x 20

Minimum Crew: [Mass of Vehicle] ÷ 100

Example: *A large fighter might store a small vehicle, but they wouldn't need a full vehicle bay.*

SELECT CARGO HOLD (36)

Most craft are meant to carry at least a small amount of cargo. These are environmentally sealed.

Total Volume of Cargo Hold: Designer's discretion.

Total Mass of Cargo Hold: Designer's discretion.

Total Power Cost of Cargo Hold: 0

Total Cost of Cargo Hold: (Volume of Hold) x 5

Minimum Crew: 0

Example: *Gary sets aside .5 kiloliters for storage of supplies, but no mass. The pilots will need to keep the stowed survival gear light. That costs ¢2.5.*

SELECT ATMOSPHERIC STREAMLINING (37)

Many craft are meant to fly through an atmosphere. These craft must be streamlined with airfoils.

Total Atmospheric Streamlining Volume: 0

Total Atmospheric Streamlining Mass: 0

Total Atmospheric Streamlining Power Cost: 0

Total Atmospheric Streamlining Cost: (Mass) x 50

Example: *The TMAC is needed in atmosphere. Streamlining only costs money: ¢5,000 (50 x 100).*

SELECT SUBMARINE STREAMLINING (38)

Certain vehicles are meant to be operated under water (or other fluid). They need to be streamlined. These vehicles must have a volume of 1 kiloliter per metric ton to actually submerge.

Total Submarine Streamlining Volume: 0

Total Submarine Streamlining Mass: 0

Total Submarine Streamlining Power Cost: 0

Total Submarine Streamlining Cost: (Mass) x 50

Example: *The craft won't float by the time it's done. Submarine streamlining is right out.*

SELECT LANDING GEAR (39)

Craft under 100,000 metric tons are sometimes capable of planetfall. These craft require landing gear.

Total Landing Gear Volume: (Volume) x .05

Total Landing Gear Mass: (Mass) x .05

Total Landing Gear Cost: (Mass) x 5

Example: *The TMAC definitely needs landing gear. Gary calculates the mass at 5 (100 x .05), the volume at 15 (300 x .05), and the cost at ¢500 (5 x 100). They don't draw hardly any power.*

SELECT RADIATION SHIELDING (40)

Many craft are hardened against radiation. This shielding acts as a bonus to resistance rolls and as a DB versus radiation attacks. See the section on defensive screens for bonuses associated with the rating of the shielding.

Total Shielding Volume: 0

Total Shielding Mass: 0

Total Shielding Power Cost: 0

Total Shielding Cost: (Mass) x 39 x (Rating)

Example: *Apocalyptic weapons are rare in this universe, and the craft isn't designed to head into nasty areas (like a research vessel might be). Gary opts against radiation shielding. The defense screens will protect the pilots from solar flares.*

SELECT COMPUTER PROGRAMS (41)

An air or spacecraft requires computer programs to operate its systems. The two most important are Predict and Evade. A ship's evade bonus rates the craft's ability to dodge enemy fire and outmaneuver enemy target locks. This program may not have a higher bonus than that granted by the craft's maneuverability. Any bonus above this is lost. The evade bonus is added to the craft's defensive bonus, along with armor belt bonus and defensive screens.

A ship's predict bonus is its ability to track and target enemy craft. The predict bonus can only be purchased once, but it applies to all weapons. To calculate the maximum bonus that can be applied to any given weapon, multiply the HUD bonus by three and add the bonus for any multiple firing mechanisms.

Cost of Each Program: 10,000 + (Rating) x 5,000

COMPUTER PROGRAM RATING CHART

Rating	Bonus	Rating	Bonus
1	5	16	62
2	10	17	64
3	15	18	66
4	20	19	68
5	25	20	70
6	30	21	71
7	35	22	72
8	40	23	73
9	45	24	74
10	50	25	75
11	52	26	76
12	54	27	77
13	56	28	78
14	58	29	79
15	60	30	80
		31+	+.5 per level

Example: *For computer programs, Gary just buys the best ones he can. For evade that means 10 ranks for ¢60,000 (the limit of the TMACs maneuverability. For the predict, that means 27 for ¢145,000 (thank to that million+ HUD <<??@#$).*

SELECT AUXILIARY SYSTEMS (42)

There are many types of auxiliary systems. An auxiliary system is one meant to back up another system. For instance, an auxiliary RIF generator might be purchased, in case the primary was destroyed.

Auxiliary systems have the exact same volume, mass and cost as primary systems. They do not require extra crewmembers.

Example: *No room left. This little gem is now weighing in at 99.944 metric tons and 124.438 kiloliters. Gary goes back and adjusts the generator back down to 104 power and it drops to 99.916 metric tons and 124.382 kiloliters.*

SELECT FEATURES AND DESIGN FLAWS (43)

At this stage, it's necessary to assign special features and design flaws. These add to a vehicles capabilities, and make it unique. Cost and credit are a rating of what the feature or flaw does to affect the cost of the vehicle. Cost is a measure of how the feature affects overall ship cost. It is given as a percentage of the total cost. Credit is a negative percentage, it shows how the flaw reduces the overall value of the craft (not the actual cost to build, just what the completed craft is worth).

Occasionally, costs are given in a set dollar value. In this case, the cost is simply added to the craft.

Also, certain costs will have a value in parenthesis. This is the cost at the tech level of introduction.

Features

These abilities are built into a craft. They increase the market value of the craft, sometimes dramatically.

Advanced Combat Computer — This craft is constructed with an advanced combat computer. It helps predict and outmaneuver the enemy. It grants a +10 to any Combat Pilot maneuvers. *Cost:* ¢300,000

Agile Communications System — This craft uses an extremely well designed comm system. It uses quickly changing frequencies and microbursts to communicate while avoiding detection. The system is so hard to track that any attempt to locate this craft by comm frequencies is made at a –100 penalty. *Cost:* ¢200,000

Agile Targeting Computer — This is only available to craft that cannot fly (in the air or space). This craft's targeting computer is designed to compensate for the problems targeting air or space craft. Aerospace craft targeted are done so with a +10 bonus. *Cost:* +5%

Airlock — This craft has at least one air lock. This is a valve through which a person can be cycled. It minimizes the loss of atmosphere. *Cost:* ¢5,000 each

Armored Cockpit — The bridge or cockpit of this craft has been specially armored to resist fire. Any critical resulting in the injury or death of the pilot of bridge crew is ignored. This can be purchased a second time for gunners as well. *Cost:* +10%

Artificial Gravity — This craft is equipped with artificial gravity. This allows the occupants of the craft to maintain a coherent concept of the direction "down." This is not allowed until tech level 22.

Cost: ¢100 x Mass (¢1,000 x Mass)

Computer Translator — This craft's computer has built-in software translation. This will translate speech made by any creature that has a known language. Given time, it can build a language dictionary of a newly encountered race. This takes anywhere from fifteen minutes to several hours, depending on the similarity of the language to known languages. This assumes the race is transmitting language codes. If they are simply talking, this takes much longer. *Cost:* ¢10,000

Cramped — This craft has less than the normal volume. It has only two kiloliters of volume per metric ton. It cannot be taken by submarines.

Vehicles with this feature are more resistant to damage. They reduce criticals by two levels of severity. *Cost:* 0

Docking Rings — This craft is equipped with a universal docking ring, through which it can dock with another craft with a similar ring. This doubles as an airlock. *Cost:* ¢50,000

External Speakers — This craft is equipped with external speakers for the purpose of public announcements. It is cool for police vehicles. *Cost:* ¢1,000

Extreme Temperature Shielding — This craft is designed to delve into extremely hot environments. It can delve even into the outer layers of a red giant. This craft gets a +100 DB vs. plasma attacks. It receives a +50 bonus vs. lasers, blasters, and ion cannons. This requires at least a CAT of XVI. *Cost:* +100%

G-Force Suppression System — This craft places its crew in a fluid suspension, from which they can still pilot a ship. This halves the G-Forces that the crew feels. It's useful before inertial damping technology is developed. *Cost:* ¢100,000 per crewmember.

GPS and Mapping System — This craft has a global positioning system and automapper. This craft will build a map of the surrounding area, and locate its position. *Cost:* ¢50,000

Infrared HUD — This craft has an infrared overlay. It allows the pilot to see by infrared at night. This is good for finding targets at night. *Cost:* ¢10,000

Lo-Lite HUD — This craft can place a lo-lite image overlaying the HUD. This can make night-flying a breeze. *Cost:* ¢10,000

Melee Weapon — Especially useful for humanoid-style robot mecha, this vehicle is equipped with a melee weapon. This does double damage when melee attacks are made. *Cost:* Mass x 1,000

Plush — This craft is lavishly appointed. It has every luxury, and the passengers can travel in the lap of luxury. This is most commonly taken for luxury passenger liners. It really is a luxury. Yessir, plush luxury. *Cost:* +100%

Shielded Weapons — Weapons are the life-blood of any combat vessel. This craft has taken great pains to build redundant systems into firing mechanisms and layer on armor to protect them. Any critical or malfunction to the weapons system has a 50% chance of being ignored. *Cost:* +10%

Spacious — This craft is a lot more roomy that others. For every metric ton of mass, it has four kiloliters of volume. This makes the ship much more fragile. Any criticals dealt are raised two levels of severity. *Cost:* 0

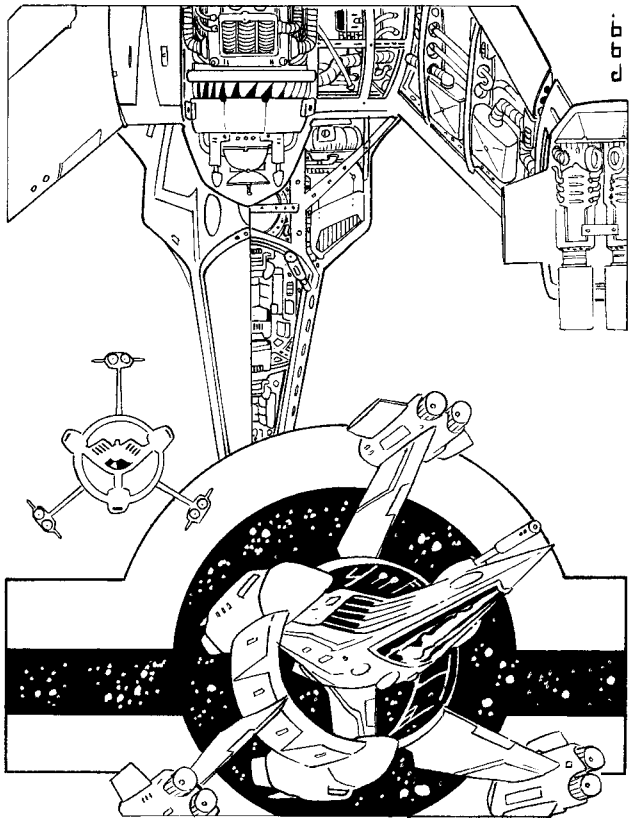
Telescopic HUD — This craft has the ability to magnify images. It can display a visual image of any object within short sensor range. *Cost:* ¢100,000

Top Quality Weapons — This craft is equipped with the most reliable weapons money can buy. Divide all weapon failure ranges by two. *Cost:* +10%

Well-Shielded Drives — This craft has protected its drives more than most craft. Any critical that would result in the loss of any power to its engines has a 50% chance of being ignored. *Cost:* +10%

Design Flaws

These flaws creep up during the design phase of the craft's development cycle. The development of these flaws is detailed under craft design.



Possible Quirks

These flaws are only of an annoying nature. They appear as the first and second flaws developed in the design process. If it is selected as the first flaw, it is a slight problem. As the second flaw, it is not serious enough to cause penalties, but only barely so. These are only a small sampling of possible quirks.

Bad Lights — This craft has uneven power level. It causes lights to blow out periodically. *Credit:* 0

Electrical Problems — This craft has niggling electrical problems. The lights might flicker, fuses blow, or lights burn out too soon. *Credit:* 0

Loud — This craft has poor sound damping between its engines (or other loud components) and the crew in general. It makes it a bit more difficult to sleep. *Credit:* 0

Poor Handling — This craft doesn't handle very well. It's not bad enough to cause a penalty, but pilots will complain. *Credit:* 0

Sticking Latch — This craft has a sticking latch. This makes whatever container it's on difficult to open. *Credit:* 0

Uneven Wear — This craft has parts that don't wear evenly. If taken as the first flaw, it increases maintenance costs by 10%. If taken as the second flaw, it increases maintenance by 20%. *Credit:* 0

Vibrations — This craft develops a vibration under certain circumstances. Some possibilities include braking, changing course, traveling at a certain speed or under a certain degree of acceleration. *Credit:* 0

Possible Minor Flaws

This craft has a minor flaw. It will come in as the third flaw created during the design process.

Atmospheric Entry Problems — This vehicle becomes unstable upon hitting the atmosphere. It picks up spin upon atmospheric entry, and while this only takes a round to correct, during this round, the craft is completely vulnerable. *Credit:* -5%

Bad Coolant Line — This craft has a bad coolant line feeding a single weapon. Every hit the craft takes has a 5% chance of pinching the line. Once the line is pinched, the weapon may only fire every third round. *Credit:* -5%

Cramped Cockpit — Only available to fighters, this craft has a cockpit so small that the pilot must literally squeeze into it. It requires a tech or other helper to pull the pilot out. *Credit:* -5%

Dangerous Ejection System — This craft has a problem with the flight path of the ejection seat or life pods. There is a 5% chance that when a ejection system fires, the seat or pod explodes. *Credit:* -5%

Extremely Poor Handling — This craft doesn't handle very well. It cause a -5 to any piloting maneuvers. *Credit:* -5%

Heat Problems — This can only taken by craft that use lasers on a flexible or turret mount. The heat of the laser breaks down the lubricants in the mount. After five rounds in which a laser weapon is fired (they don't have to be consecutive) the mount drops one level (turret to flexible, flexible to fixed). Each laser weapon is tracked separately. This flaw can be removed permanently by swapping out all lasers with other weapons. *Credit:* -5%

No Hands — Good only for mecha-style craft, this vehicle has arms, but not hands. It cannot pick anything up. *Credit:* -5%

Poor Structural Integrity — This craft is not designed to take damage. It has a penalty to DB and hits as if it had a negative armor belt. This is not usually an unplanned design flaw. It is typically the result of the designer and manufacturer purposefully "cutting corners." *Credit:* As positive armor belt of same rating.

Severe Electrical Problems — This craft has niggling electrical problems. The lights might flicker, fuses blow, or lights burn out too soon. This causes a -10 to any maneuvers made while the craft is damaged. *Credit:* -5%

Severe Uneven Wear — This craft has parts that don't wear evenly. This increases all maintenance costs by 30%. *Credit:* -5%

Severe Vibrations — This craft develops a vibration under certain circumstances. Some possibilities include braking, changing course, traveling at a certain speed or under a certain degree of acceleration. It causes a -10 to piloting under these circumstances. *Credit:* -5

Possible Major Flaws

These flaws are pretty bad. They will cause significant problems in any craft that possesses them. They come as the fourth flaw in the design process.

Ammunition Feed Problems — This craft has been plagued by problems feeding its ammunition. The failure range of all weapons that use ammo is doubled. This must be taken by a craft the has two or more weapons requiring ammo. *Credit:* -10%

Exposed Weapons — This craft's weapons are exposed to the dangers of the combat environment. Any time the craft takes a critical, there is a 2% per level of severity chance (A=2%, B=4%, etc) that a weapon develops a malfunction due to collateral damage. *Credit:* -10%

Niggling Problems — The ship has a glitch which causes systems to blow periodically. It is up to the GM to decide what system it is.

Every round that the craft is under physical stress (maneuvering for combat, taking damage, etc.) you must make a d100 roll. Any unmodified role of 01-03 will result in that system blowing out. *Credit:* -10%

Planned Obsolescence — This craft has one component that has been designed to fail. The manufacturer makes a lot of money replacing this system every year. *Credit:* -10%

Poor Atmospheric Performance — This craft may perform well in space or on land, but when it takes to the air, it flies like a cow. -20 to atmospheric piloting maneuvers. *Credit:* -10%

Poor Maneuverability — This can only be taken by a craft without a maneuverability bonus. A craft with this flaw takes a full round to change course if it's 1,000 metric tons or less, a full minute if it's 100,000 metric tons or less, five minutes if it's 1 million metric tons or less and ten minutes if it is bigger. *Credit:* -10%

Poor Temperature Tolerance — This craft does not distribute incoming energy well. It has a -10 to its DB versus plasma attacks and a -20 verses lasers, blasters, and ion cannons. *Credit:* -10%

Poorly Shielded Engines — This craft's engines are exposed to the dangers of the combat environment. Any time the craft takes a critical, there is a 2% per level of severity chance (A=2%, B=4%, etc) that the engines develop a malfunction due to collateral damage. *Credit:* -10%

Thin Underbelly — This craft has paper-thin belly armor. If struck in the belly, the attack receive a +25. *Credit:* -10%

Top Heavy — This can only be purchased by walkers and marine vehicles. This craft is too top heavy. When moving at full speed through rough terrain or waters, this craft imparts a –10 penalty to any piloting maneuvers. *Credit:* -10%

Weak Superstructure — This craft had a poorly designed superstructure. All hard points become strong points. All strong points disappear. All criticals are one severity worse. *Credit:* -10%

Wiring Defect — This ship has trouble conveying lock on information to torpedoes and missiles. This results in a -10 to any lock on attempts with missiles and torps. It can only be purchased by a ship with two or more warhead delivery systems. *Credit:* -10%

Possible Greater Flaws

Quite often, these flaws will stop the production of a craft. They are extreme in nature, and are only reason a craft won't do back to the drawing board with one of these is if the flaw doesn't directly interfere with the craft's mission.

Catastrophic Atmospheric Flight Problems — This craft can fly in the atmosphere, but it will VMAX at the slightest combat maneuvers. If the ship attempts any sort of combat maneuvers, the wings are torn right off. *Credit:* -20%

Critical Reactor Problems — During combat, there is a 20% chance that the reactor will shut down after every hit. *Credit:* -20%

Flawed Engine Mount — This craft has a critical flaw in its engine mount. Under normal use, this will never show up. Under the hard, sudden changes of combat, there is a 5% chance per round that the engine will try to shear away from the craft. An Absurd piloting maneuver will keep the craft whole, but a failed maneuver tears the engine completely free. *Credit:* -20%

Lemon — This craft has a terrible maintenance history. All maintenance costs are increased 50%. *Credit:* -20%

No Ejection System — This craft has no ejection system or life pods of any kind. If the ship explodes, the crew is lost. *Credit:* -20%

Overly Complex — This craft has been designed with too much complexity. The designers indulged in their own egos a bit too much when designing this craft.

Every time this craft takes a critical, there is a chance that it will develop a malfunction. The chance is equal to 5% for an 'A', 10% for a 'B', 15% for a 'C', 20% for a 'D' and 25% for an 'E'. *Credit:* -20%

Low Quality Weapons — This craft was built with substandard weapons. The failure ranges of all weapons are doubled. *Credit:* -20%

Terrible Handling — This craft imparts a -20 to all piloting maneuvers. Frankly, it steers like a cow. *Credit:* -20%

Weakened Component — This craft has some movable piece that is structurally unsound (major turret, leg, etc). If this component take more than two hits in the lifespan of the craft, it is torn free. The only way to repair it is to replace it. *Credit:* -20%

> **Example:** *There is no reason not to take the "Cramped" feature, so Gary does. He could use the critical reduction.*

DETERMINE FINAL MASS AND VOLUME (44)

Determine the final mass and volume of the vehicle. Add together the total mass of all components and make certain that this is under total mass.

If this mass is over, then the volume of the vehicle can be recalculated, at the GM's discretion. The vehicle will have to be checked to make certain that no other mass-dependent stats need to be recalculated.

After the mass has been settled, determine the volume. Left over volume is fine, it can be spread about the craft for the comfort of the crew. If the volume exceeds the limit, then either the ship must be adjusted to reduce its volume, or the Cramped feature must be taken.

After the craft statistics have been finalized, it's a good idea to recalculated the loaded and unloaded speeds of the craft.

> **Example:** *Gary adjusts the kiloliters down to 200. This changes the total mass of the vehicle to 95.916 and the volume to 115.482. Gary adds a second attack to the PD system and it comes up to 99.91 and 120.482. Plenty of room to make the pilots comfy and allow easy access for the technicians.*
>
> Some relevant data:
>
> Hits 110
> DB 85
> OB 114
> Loaded Acceleration ..... 20.017 Gs
> Unloaded Acceleration ..... 20.478 Gs
> Airspeed ..... 6,000 kph.
>
> A nimble little ship. Good thing it's got a high DB, however, otherwise it would be eaten up in the first dogfight.

DETERMINE FINAL COST (45)

Add up the costs of all the components of the vehicle. This is the base cost. Add together any percentage costs and credits from features or design flaws. After the total percentage has been determined, apply it (be it positive or negative) to the base cost. Finally, add in any set costs from features.

> **Example:** *Since Gary took only one feature, and it has no cost, calculating the final value of the ship is straight forward enough. The final cost is ¢10,794,903.*

A-3.0 ATTACK TABLES

There are 10 new attack tables on pages 124-133. *These tables are used to resolve attacks against vehicles and infantry units.*

A-4.0 CRITICAL TABLES

There are 6 new critical tables on pages 134-139. *These tables are used to resolve critical strikes against vehicles and infantry units.*

Morale Checks

If a critcal result requires a morale check, make an open-ended roll and add the unit leader's leadership skill bonus and any appropriate modifiers. If the result is greater than 100, the check succeeds. Otherwise, the check fails.

Each infantry unit is in one of four states:

1) *Normal:* A unit's standard state unless a morale check is failed. +20 to morale checks.
2) *Pinned:* The unit must dig in (+25 to DB) and refuses to take any action. +40 to morale checks.
3) *Routed:* The unit flees as quickly as possible.
4) *Dispersed:* The unit breaks up and flees.

When a unit fails a morale check, its state worsens by one step. When a unit makes a successful morale check, its state improves by one step. A pinned or routed unit may make a morale check once a round.

Autocannon/Projectile Attack Table A-VM-3.1

	Construction Armor Type										
	XX	XIX	XVIII	XVII	XVI	XV	XIV	XIII	XII	XI	
	Maximum Result for Mk. 50 Weaponry										
148-150	20A	35B	90B	155C	300C	350D	380E	420F	500H	900H	**148-150**
145-147	19A	34B	87B	151C	294C	343D	372E	412F	490H	882H	**145-147**
142-144	16	32A	84A	145B	286B	334D	364E	402F	480H	863H	**142-144**
139-141	14	30A	80A	140A	279B	326D	355D	393E	469G	844H	**139-141**
	Maximum Result for Mk. 40 Weaponry										
136-138	11	28	76	135A	271A	318C	347D	384E	458G	824G	**136-138**
133-135	9	26	73	129	264A	310C	338D	374E	448G	805G	**133-135**
130-132	7	24	69	124	256	301C	330D	365D	437F	786G	**130-132**
127-129	4	22	65	119	249	293B	321C	356D	427F	767G	**127-129**
	Maximum Result for Mk. 30 Weaponry										
124-126	2	20	61	113	241	285B	312C	346D	416F	748F	**124-126**
121-123	–	17	58	108	234	277B	304C	337C	405E	729F	**121-123**
	Maximum Result for Mk. 25 Weaponry										
118-120	–	15	54	103	227	268B	295B	328C	395E	710F	**118-120**
115-117	–	13	50	97	219	260A	287B	318B	384D	690E	**115-117**
	Maximum Result for Mk. 20 Weaponry										
112-114	–	11	47	92	212	252A	278B	309B	373D	671E	**112-114**
109-111	–	9	43	87	204	244A	270A	300B	363D	652E	**109-111**
	Maximum Result for Mk. 15 Weaponry										
106-108	–	7	39	81	197	235	261A	290A	352C	633E	**106-108**
103-105	–	5	36	76	189	227	252A	281A	341C	614D	**103-105**
	Maximum Result for Mk. 10 Weaponry										
100-102	–	3	32	70	182	219	244	272A	331C	595D	**100-102**
97-99	–	1	28	65	175	210	235	262	320B	575D	**97-99**
94-96	–	–	24	60	167	202	227	253	310B	556C	**94-96**
91-93	–	–	21	54	160	194	218	244	299A	537C	**91-93**
	Maximum Result for Mk. 9 Weaponry										
88-90	–	–	17	49	152	186	210	234	288A	518C	**88-90**
85-87	–	–	13	44	145	177	201	225	278A	499C	**85-87**
82-84	–	–	10	38	137	169	192	216	267	480B	**82-84**
79-81	–	–	6	33	130	161	184	206	256	461B	**79-81**
	Maximum Result for Mk. 8 Weaponry										
76-78	–	–	2	28	122	153	175	197	246	441B	**76-78**
73-75	–	–	–	22	115	144	167	188	235	422A	**73-75**
70-72	–	–	–	17	108	136	158	178	224	403A	**70-72**
67-69	–	–	–	12	100	128	150	169	214	384A	**67-69**
	Maximum Result for Mk. 7 Weaponry										
64-66	–	–	–	6	93	120	141	160	203	365A	**64-66**
61-63	–	–	–	1	85	111	132	150	192	346	**61-63**
58-60	–	–	–	–	78	103	124	141	182	327	**58-60**
55-57	–	–	–	–	70	95	115	132	171	307	**55-57**
	Maximum Result for Mk. 6 Weaponry										
52-54	–	–	–	–	63	86	107	122	161	288	**52-54**
49-51	–	–	–	–	56	78	98	113	150	269	**49-51**
46-48	–	–	–	–	48	70	90	104	139	250	**46-48**
	Maximum Result for Mk. 5 Weaponry										
43-45	–	–	–	–	41	62	81	94	129	231	**43-45**
40-42	–	–	–	–	33	53	72	85	118	212	**40-42**
	Maximum Result for Mk. 4 Weaponry										
37-39	–	–	–	–	18	37	55	66	97	173	**37-39**
34-36	–	–	–	–	3	20	38	48	75	135	**34-36**
	Maximum Result for Mk. 3 Weaponry										
35-33	–	–	–	–	–	12	21	29	54	97	**35-33**
28-30	–	–	–	–	–	4	12	10	33	58	**28-30**
	Maximum Result for Mk. 2 Weaponry										
25-27	–	–	–	–	–	–	4	1	12	20	**25-27**
22-24	–	–	–	–	–	–	–	–	6	10	**22-24**
	Maximum Result for Mk. 1 Weaponry										
19-21	–	–	–	–	–	–	–	–	1	1	**19-21**
16-18	–	–	–	–	–	–	–	–	–	–	**16-18**
13-15	–	–	–	–	–	–	–	–	–	–	**13-15**
10-12	–	–	–	–	–	–	–	–	–	–	**10-12**
07-09	–	–	–	–	–	–	–	–	–	–	**07-09**
03-06	–	–	–	–	–	–	–	–	–	–	**03-06**
UM 01-02	F	F	F	F	F	F	F	F	F	F	**01-02 UM**

WEAPON DATA

Critical Type:

'A', 'B', 'C', 'D', & 'E' are Pierce crits.
'F' = 'E' Pierce crit & 'A' Blast crit
'G' = 'E' Pierce crit & 'C' Blast crit
'H' = 'E' Pierce crit & 'E' Blast crit

UM — Unmodified roll. Apply result with no modifications.

F — Weapon failure. Roll a d10:
1-7 = *Temporary Overload* (weapon may not fire next round);
8-10 = *Malfunction* (roll for severity).

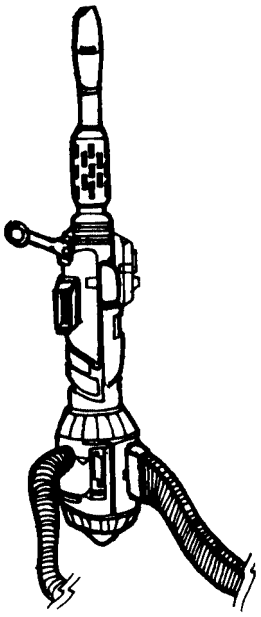
Note: If *Arms Law* is used:
Breakage Numbers: 1, 2, 3, 4, 5;
Reliability/Strength: 85.
In the event of breakage, roll a d10:
1-7 = *Temporary Overload* (weapon may not fire next round);
8-10 = *Malfunction* (roll for severity).

Range Mods:

Point Blank	+10
Short	+0
Medium	-20
Long	-40
Extreme	-50

OB Mods (based on Mark #):

Mk. 1	-100	Mk. 6	-50
Mk. 2	-90	Mk. 7	-40
Mk. 3	-80	Mk. 8	-30
Mk. 4	-70	Mk. 9	-20
Mk. 5	-60	Mk. 10	-10



Blaster/Laser Cannon Attack Table A-VM-3.2

WEAPON DATA

Critical Type:

For Blasters, use Blast criticals.

For Lasers, use Pierce criticals.

UM — Unmodified roll. Apply result with no modifications.

F — Weapon failure. Roll a d10:
1-7 = *Temporary Overload* (weapon may not fire next round);
8-10 = *Malfunction* (roll for severity).

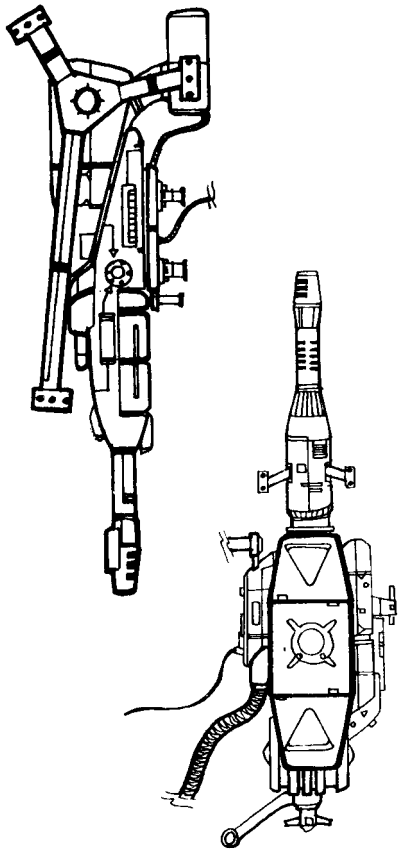
Note: If *Arms Law* is used:
Breakage Numbers: 1, 2, 3, 4;
Reliability/Strength: 90.
In the event of breakage, roll a d10:
1-7 = *Temporary Overload* (weapon may not fire next round);
8-10 = *Malfunction* (roll for severity).

Range Mods:

Point Blank	+10
Short	+0
Medium	-20
Long	-40
Extreme	-50

OB Mods (based on Mark #):

Mk. 1	-100	Mk. 6	-50
Mk. 2	-90	Mk. 7	-40
Mk. 3	-80	Mk. 8	-30
Mk. 4	-70	Mk. 9	-20
Mk. 5	-60	Mk. 10	-10



	Construction Armor Type										
	XX	XIX	XVIII	XVII	XVI	XV	XIV	XIII	XII	XI	
	Maximum Result for Mk. 50 Weaponry										
148-150	11B	20C	40C	60C	80C	95D	100D	125E	255E	300E	**148-150**
145-147	11A	20C	40C	59C	79C	94D	99D	123E	250E	295E	**145-147**
142-144	11	19B	39C	58C	77C	92D	96D	121E	245E	288E	**142-144**
139-141	10	18B	38B	56B	75C	89D	94D	118E	239E	282E	**139-141**
	Maximum Result for Mk. 40 Weaponry										
136-138	9	17A	37B	55B	73B	87D	92D	115E	234E	275E	**136-138**
133-135	9	16A	36A	53B	71B	85C	90D	113D	228E	269E	**133-135**
130-132	8	15	35A	52A	69B	83C	87C	110D	223D	262E	**130-132**
127-129	7	14	34A	50A	67B	80C	85C	107D	217D	256D	**127-129**
	Maximum Result for Mk. 30 Weaponry										
124-126	7	13	33	49	65A	78C	83C	104D	212D	249D	**124-126**
121-123	6	12	32	47	63A	76C	80C	102C	206D	243D	**121-123**
	Maximum Result for Mk. 25 Weaponry										
118-120	5	11	31	46	61A	74B	78C	99C	201D	236D	**118-120**
115-117	5	10	30	44	59A	71B	76B	96C	195C	230D	**115-117**
	Maximum Result for Mk. 20 Weaponry										
112-114	4	9	28	43	57	69B	74B	94C	190C	223D	**112-114**
109-111	3	8	27	41	55	67B	71B	91C	184C	217C	**109-111**
	Maximum Result for Mk. 15 Weaponry										
106-108	3	7	26	39	53	65B	69B	88B	179C	210C	**106-108**
103-105	2	6	25	38	51	62A	67B	86B	173C	204C	**103-105**
	Maximum Result for Mk. 10 Weaponry										
100-102	1	5	24	36	49	60A	64B	83B	168B	197C	**100-102**
97-99	–	4	23	35	47	58A	62A	80B	162B	191C	**97-99**
94-96	–	3	22	33	45	56A	60A	77A	157B	184C	**94-96**
91-93	–	2	21	32	43	53A	57A	75A	151B	178B	**91-93**
	Maximum Result for Mk. 9 Weaponry										
88-90	–	1	20	30	41	51	55A	72A	146B	172B	**88-90**
85-87	–	–	19	29	39	49	53A	69A	140B	165B	**85-87**
82-84	–	–	18	27	37	47	51	67A	135A	159B	**82-84**
79-81	–	–	17	26	35	44	48	64	129A	152B	**79-81**
	Maximum Result for Mk. 8 Weaponry										
76-78	–	–	16	24	33	42	46	61	124A	146B	**76-78**
73-75	–	–	15	23	31	40	44	59	118A	139A	**73-75**
70-72	–	–	14	21	29	38	41	56	113A	133A	**70-72**
67-69	–	–	13	19	27	35	39	53	107	126A	**67-69**
	Maximum Result for Mk. 7 Weaponry										
64-66	–	–	12	18	25	33	37	50	102	120A	**64-66**
61-63	–	–	11	16	23	31	35	48	96	113A	**61-63**
58-60	–	–	10	15	21	29	32	45	91	107A	**58-60**
55-57	–	–	9	13	20	26	30	42	85	100	**55-57**
	Maximum Result for Mk. 6 Weaponry										
52-54	–	–	8	12	18	24	28	40	80	94	**52-54**
49-51	–	–	7	10	16	22	25	37	74	87	**49-51**
46-48	–	–	6	9	14	20	23	34	69	81	**46-48**
	Maximum Result for Mk. 5 Weaponry										
43-45	–	–	4	7	12	17	21	32	63	74	**43-45**
40-42	–	–	3	6	10	15	19	29	58	68	**40-42**
	Maximum Result for Mk. 4 Weaponry										
37-39	–	–	1	3	6	11	14	23	47	55	**37-39**
34-36	–	–	–	1	2	6	9	18	36	42	**34-36**
	Maximum Result for Mk. 3 Weaponry										
35-33	–	–	–	–	–	4	5	13	25	29	**35-33**
28-30	–	–	–	–	–	2	3	7	14	16	**28-30**
	Maximum Result for Mk. 2 Weaponry										
25-27	–	–	–	–	–	–	1	2	3	3	**25-27**
22-24	–	–	–	–	–	–	–	1	1	1	**22-24**
	Maximum Result for Mk. 1 Weaponry										
19-21	–	–	–	–	–	–	–	1	1	1	**19-21**
16-18	–	–	–	–	–	–	–	–	–	–	**16-18**
13-15	–	–	–	–	–	–	–	–	–	–	**13-15**
10-12	–	–	–	–	–	–	–	–	–	–	**10-12**
07-09	–	–	–	–	–	–	–	–	–	–	**07-09**
04-06	–	–	–	–	–	–	–	–	–	–	**04-06**
UM 01-03	F	F	F	F	F	F	F	F	F	F	**01-03 UM**

Disruptor Cannon Attack Table A-VM-3.3

	Construction Armor Type										
	XX	XIX	XVIII	XVII	XVI	XV	XIV	XIII	XII	XI	
	Maximum Result for Mk. 50 Weaponry										
148-150	110E	20B	45C	85C	90C	85D	87D	90E	75E	85E	**148-150**
145-147	109E	20A	44C	84C	89C	84D	86D	89E	74E	84E	**145-147**
142-144	106E	19	43C	82C	87C	82D	84D	87E	72E	82E	**142-144**
139-141	104E	17	41B	80B	85C	80D	82D	85E	70E	80E	**139-141**
	Maximum Result for Mk. 40 Weaponry										
136-138	101D	16	40B	78B	83C	78D	80D	83D	68D	78E	**136-138**
133-135	99D	15	38B	76B	81C	76C	78C	81D	67D	76D	**133-135**
130-132	96D	14	37A	74A	79B	74C	76C	79D	65D	74D	**130-132**
127-129	94D	13	35A	71A	77B	71C	74C	77D	63C	71D	**127-129**
	Maximum Result for Mk. 30 Weaponry										
124-126	91C	12	34	69A	75B	69C	72C	75C	61C	69D	**124-126**
121-123	89C	10	32	67	73B	67B	70B	72C	59C	67C	**121-123**
	Maximum Result for Mk. 25 Weaponry										
118-120	86C	9	30	65	71B	65B	67B	70C	57B	65C	**118-120**
115-117	84B	8	29	63	69A	63B	65B	68C	55B	63C	**115-117**
	Maximum Result for Mk. 20 Weaponry										
112-114	81B	7	27	61	67A	61B	63B	66B	53B	61C	**112-114**
109-111	79B	6	26	59	65A	59A	61B	64B	51B	59B	**109-111**
	Maximum Result for Mk. 15 Weaponry										
106-108	76B	5	24	57	63A	57A	59A	62B	50A	57B	**106-108**
103-105	74A	3	23	55	61A	55A	57A	60B	48A	55B	**103-105**
	Maximum Result for Mk. 10 Weaponry										
100-102	71A	2	21	53	59A	53A	55A	58A	46A	53B	**100-102**
97-99	69A	1	20	51	56	51A	53A	56A	44	51A	**97-99**
94-96	66A	–	18	49	54	49	51	54A	42	49A	**94-96**
91-93	64	–	17	47	52	47	49	52A	40	47A	**91-93**
	Maximum Result for Mk. 9 Weaponry										
88-90	61	–	15	45	50	45	47	50	38	45A	**88-90**
85-87	59	–	13	42	48	42	45	48	36	42	**85-87**
82-84	56	–	12	40	46	40	43	46	34	40	**82-84**
79-81	54	–	10	38	44	38	41	44	33	38	**79-81**
	Maximum Result for Mk. 8 Weaponry										
76-78	51	–	9	36	42	36	39	42	31	36	**76-78**
73-75	49	–	7	34	40	34	37	39	29	34	**73-75**
70-72	46	–	6	32	38	32	35	37	27	32	**70-72**
67-69	44	–	4	30	36	30	33	35	25	30	**67-69**
	Maximum Result for Mk. 7 Weaponry										
64-66	42	–	3	28	34	28	30	33	23	28	**64-66**
61-63	39	–	1	26	32	26	28	31	21	26	**61-63**
58-60	37	–	–	24	30	24	26	29	19	24	**58-60**
55-57	34	–	–	22	28	22	24	27	17	22	**55-57**
	Maximum Result for Mk. 6 Weaponry										
52-54	32	–	–	20	26	20	22	25	15	20	**52-54**
49-51	29	–	–	18	24	18	20	23	14	18	**49-51**
46-48	27	–	–	16	22	16	18	21	12	16	**46-48**
	Maximum Result for Mk. 5 Weaponry										
43-45	24	–	–	13	20	13	16	19	10	13	**43-45**
40-42	22	–	–	11	18	11	14	17	8	11	**40-42**
	Maximum Result for Mk. 4 Weaponry										
37-39	19	–	–	9	16	9	12	15	6	9	**37-39**
34-36	17	–	–	7	14	7	10	13	4	7	**34-36**
	Maximum Result for Mk. 3 Weaponry										
35-33	14	–	–	5	12	5	8	11	2	5	**35-33**
28-30	12	–	–	3	10	3	6	9	–	3	**28-30**
	Maximum Result for Mk. 2 Weaponry										
25-27	9	–	–	1	8	1	4	6	–	1	**25-27**
22-24	7	–	–	–	6	–	2	4	–	–	**22-24**
	Maximum Result for Mk. 1 Weaponry										
19-21	4	–	–	–	4	–	1	2	–	–	**19-21**
16-18	2	–	–	–	2	–	–	1	–	–	**16-18**
13-15	–	–	–	–	1	–	–	–	–	–	**13-15**
09-12	–	–	–	–	–	–	–	–	–	–	**011-12**
09-10	–	–	–	–	–	–	–	–	–	–	**06-12**
06-08	–	–	–	–	–	–	–	–	–	–	**06-12**
UM 01-05	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**01-05 UM**

WEAPON DATA

Critical Type:
Use Pierce criticals.

UM — Unmodified roll. Apply result with no modifications.

F — Weapon failure. Roll a d10:
1-7 = *Temporary Overload* (weapon may not fire next round);
8-10 = *Malfunction* (roll for severity).

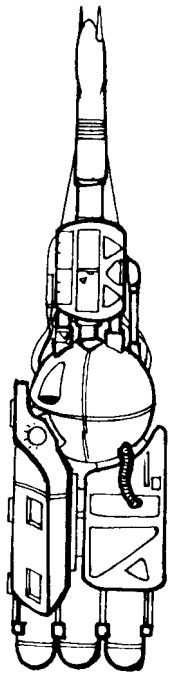
Note: If *Arms Law* is used:
Breakage Numbers: 1, 2, 3, 4, 5, 6;
Reliability/Strength: 85.
In the event of breakage, roll a d10:
1-7 = *Temporary Overload* (weapon may not fire next round);
8-10 = *Malfunction* (roll for severity).

Range Mods:

Point Blank	+10
Short	+0
Medium	-20
Long	-40
Extreme	-50

OB Mods (based on Mark #):

Mk. 1	-100	Mk. 6	-50
Mk. 2	-90	Mk. 7	-40
Mk. 3	-80	Mk. 8	-30
Mk. 4	-70	Mk. 9	-20
Mk. 5	-60	Mk. 10	-10



Ion Cannon Attack Table A-VM-3.4

WEAPON DATA

Critical Type:
'A', 'B', 'C', 'D', & 'E' are Pierce crits.
'F' = 'E' Pierce crit & 'A' Blast crit
'G' = 'E' Pierce crit & 'C' Blast crit

UM — Unmodified roll. Apply result with no modifications.

F — Weapon failure. Roll a d10:
1-7 = *Temporary Overload* (weapon may not fire next round);
8-10 = *Malfunction* (roll for severity).

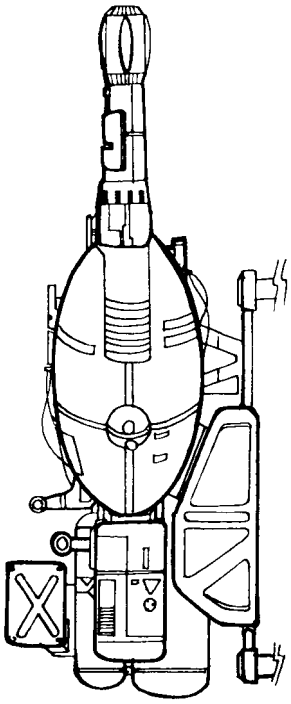
Note: If *Arms Law* is used:
Breakage Numbers: 1, 2, 3, 4, 5, 6, 7;
Reliability/Strength: 80.
In the event of breakage, roll a d10:
1-7 = *Temporary Overload* (weapon may not fire next round);
8-10 = *Malfunction* (roll for severity).

Range Mods:

Point Blank	+10
Short	+0
Medium	-20
Long	-40
Extreme	-50

OB Mods (based on Mark #):

Mk. 1	-100	Mk. 6	-50
Mk. 2	-90	Mk. 7	-40
Mk. 3	-80	Mk. 8	-30
Mk. 4	-70	Mk. 9	-20
Mk. 5	-60	Mk. 10	-10



	Construction Armor Type										
	XX	XIX	XVIII	XVII	XVI	XV	XIV	XIII	XII	XI	
	Maximum Result for Mk. 50 Weaponry										
148-150	11C	20D	45D	60D	80D	95E	100F	125F	255G	300G	**148-150**
145-147	11C	20D	45D	59D	79D	94E	99F	123F	250G	295G	**145-147**
142-144	11C	19D	44D	58D	77D	92E	96F	121F	245G	288G	**142-144**
139-141	10B	18C	42D	56C	75D	89E	94F	118F	239G	282G	**139-141**
	Maximum Result for Mk. 40 Weaponry										
136-138	9B	17C	41C	55C	73D	87E	92E	115F	234F	275G	**136-138**
133-135	9A	16B	40C	53C	71C	85D	90E	113E	228F	269F	**133-135**
130-132	8A	15B	39C	52B	69C	83D	87E	110E	223F	262F	**130-132**
127-129	7	14A	38B	50B	67C	80D	85E	107E	217F	256F	**127-129**
	Maximum Result for Mk. 30 Weaponry										
124-126	7	13A	37B	49B	65C	78D	83D	104E	212E	249F	**124-126**
121-123	6	12	35B	47A	63C	76C	80D	102D	206E	243F	**121-123**
	Maximum Result for Mk. 25 Weaponry										
118-120	5	11	34A	46A	61B	74C	78D	99D	201E	236E	**118-120**
115-117	5	10	33A	44A	59B	71C	76D	96D	195E	230E	**115-117**
	Maximum Result for Mk. 20 Weaponry										
112-114	4	9	32A	43	57B	69C	74C	94D	190D	223E	**112-114**
109-111	3	8	31	41	55B	67B	71C	91C	184D	217E	**109-111**
	Maximum Result for Mk. 15 Weaponry										
106-108	3	7	30	39	53B	65B	69C	88C	179D	210D	**106-108**
103-105	2	6	28	38	51A	62B	67C	86C	173D	204D	**103-105**
	Maximum Result for Mk. 10 Weaponry										
100-102	1	5	27	36	49A	60B	64B	83C	168C	197D	**100-102**
97-99	–	4	26	35	47A	58A	62B	80B	162C	191D	**97-99**
94-96	–	3	25	33	45A	56A	60B	77B	157C	184D	**94-96**
91-93	–	2	24	32	43A	53A	57B	75B	151C	178C	**91-93**
	Maximum Result for Mk. 9 Weaponry										
88-90	–	1	23	30	41	51A	55A	72B	146B	172C	**88-90**
85-87	–	–	21	29	39	49	53A	69A	140B	165C	**85-87**
82-84	–	–	20	27	37	47	51A	67A	135B	159C	**82-84**
79-81	–	–	19	26	35	44	48A	64A	129B	152B	**79-81**
	Maximum Result for Mk. 8 Weaponry										
76-78	–	–	18	24	33	42	46	61A	124A	146B	**76-78**
73-75	–	–	17	23	31	40	44	59	118A	139B	**73-75**
70-72	–	–	15	21	29	38	41	56	113A	133B	**70-72**
67-69	–	–	14	19	27	35	39	53	107A	126B	**67-69**
	Maximum Result for Mk. 7 Weaponry										
64-66	–	–	13	18	25	33	37	50	102	120A	**64-66**
61-63	–	–	12	16	23	31	35	48	96	113A	**61-63**
58-60	–	–	11	15	21	29	32	45	91	107A	**58-60**
55-57	–	–	10	13	20	26	30	42	85	100A	**55-57**
	Maximum Result for Mk. 6 Weaponry										
52-54	–	–	8	12	18	24	28	40	80	94	**52-54**
49-51	–	–	7	10	16	22	25	37	74	87	**49-51**
46-48	–	–	6	9	14	20	23	34	69	81	**46-48**
	Maximum Result for Mk. 5 Weaponry										
43-45	–	–	5	7	12	17	21	32	63	74	**43-45**
40-42	–	–	4	6	10	15	19	29	58	68	**40-42**
	Maximum Result for Mk. 4 Weaponry										
37-39	–	–	1	3	6	11	14	23	47	55	**37-39**
34-36	–	–	–	1	2	6	9	18	36	42	**34-36**
	Maximum Result for Mk. 3 Weaponry										
35-33	–	–	–	–	–	2	5	13	25	29	**35-33**
28-30	–	–	–	–	–	1	3	7	14	23	**28-30**
	Maximum Result for Mk. 2 Weaponry										
25-27	–	–	–	–	–	–	1	2	3	10	**25-27**
22-24	–	–	–	–	–	–	–	1	1	3	**22-24**
	Maximum Result for Mk. 1 Weaponry										
19-21	–	–	–	–	–	–	–	–	1	1	**19-21**
16-18	–	–	–	–	–	–	–	–	–	–	**16-18**
13-15	–	–	–	–	–	–	–	–	–	–	**13-15**
10-12	–	–	–	–	–	–	–	–	–	–	**10-12**
07-09	–	–	–	–	–	–	–	–	–	–	**07-09**
05-06	–	–	–	–	–	–	–	–	–	–	**05-06**
UM 01-04	F	F	F	F	F	F	F	F	F	F	**01-04 UM**

Plasma Cannon Attack Table A-VM-3.5

	Construction Armor Type										
	XX	XIX	XVIII	XVII	XVI	XV	XIV	XIII	XII	XI	
	Maximum Result for Mk. 50 Weaponry										
148-150	11B	20C	80C	120D	160D	190D	200E	250F	510G	600G	**148-150**
145-147	11B	20C	79C	118D	157D	186D	196E	245F	499G	587G	**145-147**
142-144	11B	19C	76C	114D	152D	181D	191E	239F	487G	573G	**142-144**
139-141	10A	18B	74C	111D	148D	176D	185E	234F	475G	559G	**139-141**
	Maximum Result for Mk. 40 Weaponry										
136-138	9A	17B	71C	107C	143D	170D	180E	228F	464F	545G	**136-138**
133-135	9	16B	69B	104C	139C	165D	175D	222E	452F	531F	**133-135**
130-132	8	15A	66B	100C	134C	160C	170D	216E	440F	517F	**130-132**
127-129	7	14A	64B	97C	130C	155C	164D	210E	428F	503F	**127-129**
	Maximum Result for Mk. 30 Weaponry										
124-126	7	13A	62B	93B	125C	150C	159D	204E	416E	489F	**124-126**
121-123	6	12	59A	90B	121B	145C	154D	199D	404E	475F	**121-123**
	Maximum Result for Mk. 25 Weaponry										
118-120	5	11	57A	86B	116B	140C	149C	193D	392E	461E	**118-120**
115-117	5	10	54A	83B	112B	135B	144C	187D	381E	448E	**115-117**
	Maximum Result for Mk. 20 Weaponry										
112-114	4	9	52A	79A	107B	129B	138C	181D	369D	434E	**112-114**
109-111	3	8	49	76A	103B	124B	133C	175C	357D	420E	**109-111**
	Maximum Result for Mk. 15 Weaponry										
106-108	3	7	47	72A	98A	119B	128B	170C	345D	406D	**106-108**
103-105	2	6	45	69A	94A	114B	123B	164C	333D	392D	**103-105**
	Maximum Result for Mk. 10 Weaponry										
100-102	1	5	42	65	89A	109A	118B	158C	321C	378D	**100-102**
97-99	–	4	40	62	85A	104A	112B	152B	309C	364D	**97-99**
94-96	–	3	37	58	80	99A	107B	146B	298C	350D	**94-96**
91-93	–	2	35	55	76	93A	102A	141B	286C	336C	**91-93**
	Maximum Result for Mk. 9 Weaponry										
88-90	–	1	33	51	71	88A	97A	135B	274B	322C	**88-90**
85-87	–	–	30	48	67	83	91A	129A	262B	308C	**85-87**
82-84	–	–	28	44	62	78	86A	123A	250B	294C	**82-84**
79-81	–	–	25	41	58	73	81A	117A	238B	280B	**79-81**
	Maximum Result for Mk. 8 Weaponry										
76-78	–	–	23	37	53	68	76	111A	226A	266B	**76-78**
73-75	–	–	20	34	49	63	71	106	214A	252B	**73-75**
70-72	–	–	18	30	44	57	65	100	203A	238B	**70-72**
67-69	–	–	16	27	40	52	60	94	191A	224B	**67-69**
	Maximum Result for Mk. 7 Weaponry										
64-66	–	–	13	23	35	47	55	88	179	210A	**64-66**
61-63	–	–	11	20	31	42	50	82	167	196A	**61-63**
58-60	–	–	8	16	26	37	44	77	155	182A	**58-60**
55-57	–	–	6	13	22	32	39	71	143	168A	**55-57**
	Maximum Result for Mk. 6 Weaponry										
52-54	–	–	3	9	17	27	34	65	131	154	**52-54**
49-51	–	–	1	6	13	22	29	59	120	141	**49-51**
46-48	–	–	–	2	8	16	24	53	108	127	**46-48**
	Maximum Result for Mk. 5 Weaponry										
43-45	–	–	–	–	4	11	18	48	96	113	**43-45**
40-42	–	–	–	–	–	6	13	42	84	99	**40-42**
	Maximum Result for Mk. 4 Weaponry										
37-39	–	–	–	–	–	–	3	30	60	71	**37-39**
34-36	–	–	–	–	–	–	1	18	37	43	**34-36**
	Maximum Result for Mk. 3 Weaponry										
35-33	–	–	–	–	–	–	–	7	13	15	**35-33**
28-30	–	–	–	–	–	–	–	1	3	5	**28-30**
	Maximum Result for Mk. 2 Weaponry										
25-27	–	–	–	–	–	–	–	–	1	1	**25-27**
22-24	–	–	–	–	–	–	–	–	–	–	**22-24**
	Maximum Result for Mk. 1 Weaponry										
19-21	–	–	–	–	–	–	–	–	–	–	**19-21**
16-18	–	–	–	–	–	–	–	–	–	–	**16-18**
14-15	–	–	–	–	–	–	–	–	–	–	**14-15**
12-13	–	–	–	–	–	–	–	–	–	–	**12-13**
11	–	–	–	–	–	–	–	–	–	–	**11**
10	–	–	–	–	–	–	–	–	–	–	**10**
UM 01-09	F	F	F	F	F	F	F	F	F	F	**01-09 UM**

WEAPON DATA

Critical Type:

'A', 'B', 'C', 'D', & 'E' are Blast crits.
'F' = 'E' Blast crit & 'A' Blast crit
'G' = 'E' Blast crit & 'C' Blast crit

UM — Unmodified roll. Apply result with no modifications.

F — Weapon failure. Roll a d10:
1-7 = *Temporary Overload* (weapon may not fire next round);
8-10 = *Malfunction* (roll for severity).

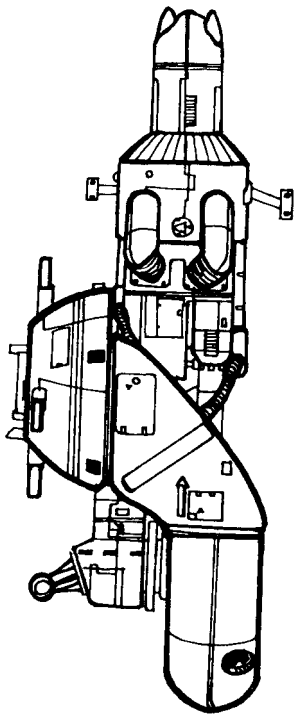
Note: If *Arms Law* is used:
Breakage Numbers: 1,2,3,4,5,6,7,8,9;
Reliability/Strength: 55.
In the event of breakage, roll a d10:
1-7 = *Temporary Overload* (weapon may not fire next round);
8-10 = *Malfunction* (roll for severity).

Range Mods:

Point Blank ..... +10
Short ..... +0
Medium ..... -20
Long ..... -40
Extreme ..... -50

OB Mods (based on Mark #):

Mk. 1 ..... -100
Mk. 2 ..... -90
Mk. 3 ..... -80
Mk. 4 ..... -70
Mk. 5 ..... -60
Mk. 6 ..... -50
Mk. 7 ..... -40
Mk. 8 ..... -30
Mk. 9 ..... -20
Mk. 10 ..... -10



Warhead Attack Table A-VM-3.6

Critical Type:
Use Blast criticals.

UM — Unmodified roll. Apply result with no modifications.

F — Weapon failure. Roll a d10:
1-7 = *Temporary Overload* (weapon may not fire next round);
8-10 = *Malfunction* (roll for severity).

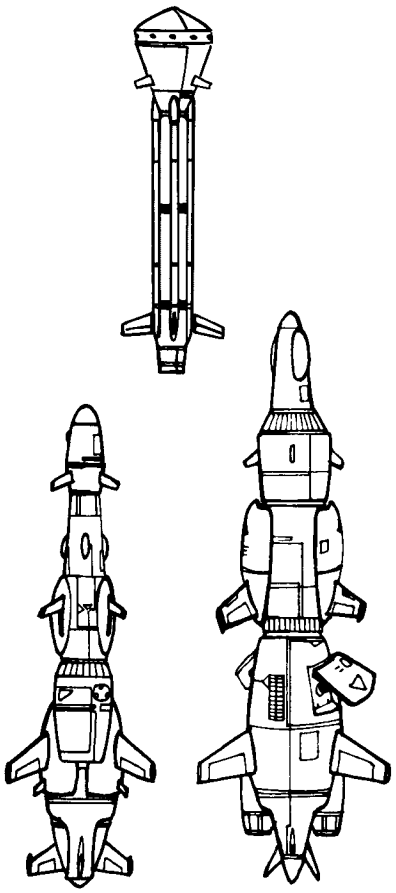
Note: If *Arms Law* is used:
Breakage Numbers: 1;
Reliability/Strength: 95.
In the event of breakage, roll a d10:
1-7 = *Temporary Overload* (weapon may not fire next round);
8-10 = *Malfunction* (roll for severity).

Range Mods:

Point Blank	+10
Short	+0
Medium	-20
Long	-40
Extreme	-50

OB Mods (based on Mark #):

Mk. 1	-100	Mk. 6	-50
Mk. 2	-90	Mk. 7	-40
Mk. 3	-80	Mk. 8	-30
Mk. 4	-70	Mk. 9	-20
Mk. 5	-60	Mk. 10	-10



WEAPON DATA	Construction Armor Type										
	XX	XIX	XVIII	XVII	XVI	XV	XIV	XIII	XII	XI	
	Maximum Result for Mk. 50 Weaponry										
148-150	20C	30C	70D	100D	150E	100E	250E	300E	400E	500E	**148-150**
145-147	20C	30C	69D	98D	147E	99E	245E	294E	392E	490E	**145-147**
142-144	19B	29C	66D	95D	143E	96E	239E	288E	384E	480E	**142-144**
139-141	18B	28C	64D	92D	139E	94E	234E	281E	375E	469E	**139-141**
	Maximum Result for Mk. 40 Weaponry										
136-138	18A	27C	62C	89D	135D	91E	228E	274E	367E	458E	**136-138**
133-135	17A	25B	59C	86C	131D	89D	222E	268E	358E	448E	**133-135**
130-132	16	24B	57C	83C	127D	86D	216D	261D	350E	437E	**130-132**
127-129	15	23B	55B	80C	123D	84D	210D	254D	341D	427D	**127-129**
	Maximum Result for Mk. 30 Weaponry										
124-126	14	22B	53B	77C	119C	81D	204D	248D	333D	416D	**124-126**
121-123	13	21A	50B	74B	115C	79D	199D	241D	324D	405D	**121-123**
	Maximum Result for Mk. 25 Weaponry										
118-120	13	20A	48A	71B	110C	76C	193D	234D	316D	395D	**118-120**
115-117	12	19A	46A	68B	106B	74C	187C	228D	307D	384D	**115-117**
	Maximum Result for Mk. 20 Weaponry										
112-114	11	18A	43A	65B	102B	71C	181C	221C	299D	373D	**112-114**
109-111	10	17	41A	62A	98B	69C	175C	214C	290C	363D	**109-111**
	Maximum Result for Mk. 15 Weaponry										
106-108	9	15	39	59A	94B	66B	170C	208C	282C	352C	**106-108**
103-105	8	14	36	56A	90A	64B	164C	201C	273C	341C	**103-105**
	Maximum Result for Mk. 10 Weaponry										
100-102	7	13	34	53A	86A	61B	158B	194C	265C	331C	**100-102**
97-99	7	12	32	51	82A	59B	152B	188C	256C	320C	**97-99**
94-96	6	11	29	48	78	56B	146B	181B	248C	310C	**94-96**
91-93	5	10	27	45	74	54A	141B	174B	239C	299C	**91-93**
	Maximum Result for Mk. 9 Weaponry										
88-90	4	9	25	42	70	51A	135B	168B	231B	288C	**88-90**
85-87	3	8	23	39	66	49A	129B	161B	222B	278B	**85-87**
82-84	2	7	20	36	62	46A	123A	154B	214B	267B	**82-84**
79-81	2	5	18	33	58	44A	117A	148B	205B	256B	**79-81**
	Maximum Result for Mk. 8 Weaponry										
76-78	–	4	16	30	54	41	111A	141A	197B	246B	**76-78**
73-75	–	3	13	27	50	39	106A	134A	188B	235B	**73-75**
70-72	–	2	11	24	46	37	100A	128A	180A	224B	**70-72**
67-69	–	1	9	21	42	34	94	121A	171A	214B	**67-69**
	Maximum Result for Mk. 7 Weaponry										
64-66	–	–	6	18	37	32	88	114A	163A	203A	**64-66**
61-63	–	–	4	15	33	29	82	108A	154A	192A	**61-63**
58-60	–	–	2	12	29	27	77	101	146A	182A	**58-60**
55-57	–	–	–	9	25	24	71	94	137A	171A	**55-57**
	Maximum Result for Mk. 6 Weaponry										
52-54	–	–	–	6	21	22	65	88	129	161A	**52-54**
49-51	–	–	–	3	17	19	59	81	120	150A	**49-51**
46-48	–	–	–	–	13	17	53	74	112	139A	**46-48**
	Maximum Result for Mk. 5 Weaponry										
43-45	–	–	–	–	9	14	48	68	103	129	**43-45**
40-42	–	–	–	–	5	12	42	61	95	118	**40-42**
	Maximum Result for Mk. 4 Weaponry										
37-39	–	–	–	–	1	9	36	54	86	107	**37-39**
34-36	–	–	–	–	–	7	30	48	78	97	**34-36**
	Maximum Result for Mk. 3 Weaponry										
35-33	–	–	–	–	–	4	24	41	69	86	**35-33**
28-30	–	–	–	–	–	2	18	34	61	75	**28-30**
	Maximum Result for Mk. 2 Weaponry										
25-27	–	–	–	–	–	–	13	28	52	65	**25-27**
22-24	–	–	–	–	–	–	7	21	44	54	**22-24**
	Maximum Result for Mk. 1 Weaponry										
19-21	–	–	–	–	–	–	1	14	35	44	**19-21**
16-18	–	–	–	–	–	–	–	8	27	33	**16-18**
13-15	–	–	–	–	–	–	–	1	18	22	**13-15**
10-12	–	–	–	–	–	–	–	–	10	12	**10-12**
07-09	–	–	–	–	–	–	–	–	1	1	**07-09**
03-06	–	–	–	–	–	–	–	–	–	–	**03-06**
UM 01-02	F	F	F	F	F	F	F	F	F	F	**01-02 UM**

Apocalyptic Weapon Attack Table A-VM-3.7

	Construction Armor Type										
	XX	XIX	XVIII	XVII	XVI	XV	XIV	XIII	XII	XI	
	Maximum Result for Mk. 50 Weaponry										
148-150	*	*	*	*	*	*	*	*	*	*	**148-150**
145-147	429E	*	*	*	*	*	*	*	*	*	**145-147**
142-144	407D	550E	*	*	*	*	*	*	*	*	**142-144**
139-141	385C	525E	*	*	*	*	*	*	*	*	**139-141**
	Maximum Result for Mk. 40 Weaponry										
136-138	362B	500D	512E	696F	*	*	*	*	*	*	**136-138**
133-135	340B	474C	490E	669F	682F	*	*	*	*	*	**133-135**
130-132	318A	449C	468D	643E	658F	755G	767G	*	*	*	**130-132**
127-129	296	424B	445D	616E	635E	731F	745F	761G	*	*	**127-129**
	Maximum Result for Mk. 30 Weaponry										
124-126	274	398B	423C	590D	611E	706F	722F	741F	748G	748G	**124-126**
121-123	252	373A	401C	564D	587D	682E	700E	721F	729F	729G	**121-123**
	Maximum Result for Mk. 25 Weaponry										
118-120	230	347	379B	537C	563D	658E	678E	701E	710F	710F	**118-120**
115-117	208	322	357B	511C	540C	633D	656D	681E	690F	690F	**115-117**
	Maximum Result for Mk. 20 Weaponry										
112-114	185	297	334A	485B	516C	609D	633D	661E	671E	671F	**112-114**
109-111	163	271	312A	458B	492B	585C	611D	641D	652E	652E	**109-111**
	Maximum Result for Mk. 15 Weaponry										
106-108	141	246	290	432A	468B	560C	589C	621D	633E	633E	**106-108**
103-105	119	221	268	405A	445A	536B	566C	601C	614D	614E	**103-105**
	Maximum Result for Mk. 10 Weaponry										
100-102	97	195	245	379	421A	512B	544B	581C	595D	595E	**100-102**
97-99	75	170	223	353	397	487A	522B	561C	575D	575D	**97-99**
94-96	53	145	201	326	373	463A	499A	541B	556C	556D	**94-96**
91-93	31	119	179	300	350	439	477A	521B	537C	537D	**91-93**
	Maximum Result for Mk. 9 Weaponry										
88-90	8	94	157	274	326	415	455	501A	518C	518C	**88-90**
85-87	–	69	134	247	302	390	432	481A	499B	499C	**85-87**
82-84	–	43	112	221	278	366	410	461A	480B	480C	**82-84**
79-81	–	18	90	194	254	342	388	441	461B	461B	**79-81**
	Maximum Result for Mk. 8 Weaponry										
76-78	–	–	68	168	231	317	365	421	441A	441B	**76-78**
73-75	–	–	45	142	207	293	343	401	422A	422B	**73-75**
70-72	–	–	23	115	183	269	321	381	403A	403A	**70-72**
67-69	–	–	1	89	159	244	299	361	384	384A	**67-69**
	Maximum Result for Mk. 7 Weaponry										
64-66	–	–	–	63	136	220	276	341	365	365A	**64-66**
61-63	–	–	–	36	112	196	254	321	346	346A	**61-63**
58-60	–	–	–	10	88	171	232	301	327	327	**58-60**
55-57	–	–	–	–	64	147	209	281	307	307	**55-57**
	Maximum Result for Mk. 6 Weaponry										
52-54	–	–	–	–	41	123	187	261	288	288	**52-54**
49-51	–	–	–	–	17	98	165	241	269	269	**49-51**
46-48	–	–	–	–	–	74	142	221	250	250	**46-48**
	Maximum Result for Mk. 5 Weaponry										
43-45	–	–	–	–	–	50	120	201	231	231	**43-45**
40-42	–	–	–	–	–	25	98	181	212	212	**40-42**
	Maximum Result for Mk. 4 Weaponry										
37-39	–	–	–	–	–	1	75	161	192	192	**37-39**
34-36	–	–	–	–	–	–	53	141	173	173	**34-36**
	Maximum Result for Mk. 3 Weaponry										
35-33	–	–	–	–	–	–	31	121	154	154	**35-33**
28-30	–	–	–	–	–	–	8	101	135	135	**28-30**
	Maximum Result for Mk. 2 Weaponry										
25-27	–	–	–	–	–	–	–	81	116	116	**25-27**
22-24	–	–	–	–	–	–	–	61	97	97	**22-24**
	Maximum Result for Mk. 1 Weaponry										
19-21	–	–	–	–	–	–	–	41	78	78	**19-21**
16-18	–	–	–	–	–	–	–	21	58	58	**16-18**
13-15	–	–	–	–	–	–	–	1	39	39	**13-15**
10-12	–	–	–	–	–	–	–	–	20	20	**10-12**
07-09	–	–	–	–	–	–	–	–	1	1	**07-09**
03-06	–	–	–	–	–	–	–	–	–	–	**03-06**
UM 01-02	F	F	F	F	F	F	F	F	F	F	**01-02 UM**

WEAPON DATA

Critical Type:

'A', 'B', 'C', 'D', & 'E' are Blast crits.
'F' = 'E' Blast crit & 'A' Blast crit
'G' = 'E' Blast crit & 'B' Blast crit
'H' = 'E' Blast crit & 'C' Blast crit
'I' = 'E' Blast crit & 'E' Blast crit

UM — Unmodified roll. Apply result with no modifications.

***** — Any target that suffers this result is utterly destroyed.

F — Weapon failure. Roll a d10:
1-7 = *Temporary Overload* (weapon may not fire next round);
8-10 = *Malfunction* (roll for severity).

Note: If *Arms Law* is used:
Breakage Numbers: 1;
Reliability/Strength: 95.
In the event of breakage, roll a d10:
1-7 = *Temporary Overload* (weapon may not fire next round);
8-10 = *Malfunction* (roll for severity).

Range Mods:

Point Blank ..... +10
Short ..... +0
Medium ..... -20
Long ..... -40
Extreme ..... -50

Range: xxx?

Special Mods:

- Add +100 OB to the attack if the target is in the 1st blast radius.
- Add +50 OB to the attack if the target is in the 2nd blast radius.
- Add +25 OB to the attack if the target is in the 3rd blast radius.
- Add +10 OB to the attack if the target is in the 4th blast radius.
- Add +0 OB to the attack if the target is in the 5th blast radius.

OB Mods (based on Mark #):

Mk. 1 ..... -100	Mk. 6 ..... -50
Mk. 2 ..... -90	Mk. 7 ..... -40
Mk. 3 ..... -80	Mk. 8 ..... -30
Mk. 4 ..... -70	Mk. 9 ..... -20
Mk. 5 ..... -60	Mk. 10 ..... -10

Infantry vs. Vehicles Attack Table A-VM-3.8

WEAPON DATA

Critical Type:
Use Pierce criticals.

UM — Unmodified roll. Apply result with no modifications.

F — Weapon failure. Roll a d10:
1-7 = *Temporary Overload* (weapon may not fire next round);
8-10 = *Malfunction* (roll for severity).

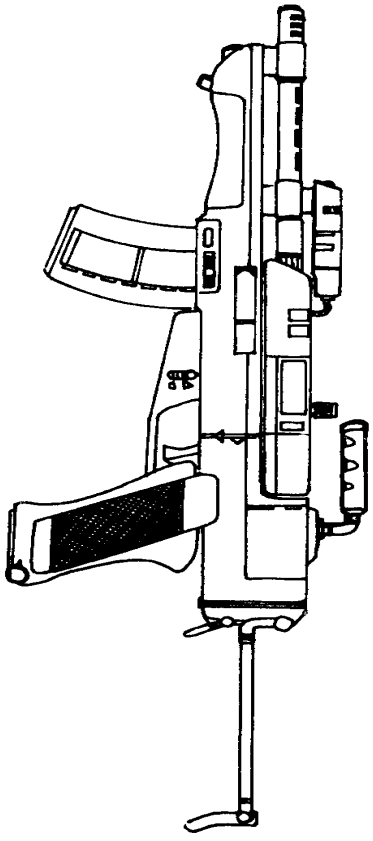
Note: If *Arms Law* is used:
Breakage Numbers: 1, 2, 3, 4, 5, 6, 7;
Reliability/Strength: 80.
In the event of breakage, roll a d10:
1-7 = *Temporary Overload* (weapon may not fire next round);
8-10 = *Malfunction* (roll for severity).

Range Mods:

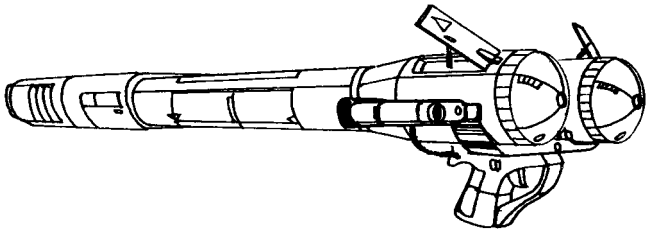
Point Blank	+10
Short	+0
Medium	-20
Long	-40
Extreme	-50

OB Mods (based on Mark #):

Mk. 1	-100	Mk. 6	-50
Mk. 2	-90	Mk. 7	-45
Mk. 3	-80	Mk. 8	-30
Mk. 4	-70	Mk. 9	-15
Mk. 5	-60	Mk. 10+	0



	Construction Armor Type										
	XX	XIX	XVIII	XVII	XVI	XV	XIV	XIII	XII	XI	
	Maximum Result for Mk 10+ Weaponry										
148-150	2A	4A	80B	130B	350B	425C	475C	530C	650D	1200D	148-150
145-147	2A	4A	78B	127B	341B	415C	464C	519C	636D	1173D	145-147
142-144	2A	4A	74B	122B	331B	403C	451C	506C	621D	1145D	142-144
139-141	2	4A	71B	118B	322B	392C	439C	494C	606D	1117D	139-141
136-138	2	4A	68A	113B	312B	380C	426C	482C	591D	1089D	136-138
	Maximum Result for Mk 9 Weaponry										
133-135	2	4A	65A	109A	302B	369C	414C	469C	575D	1061D	133-135
130-132	2	4	61A	104A	292A	357B	402C	457C	560D	1034D	130-132
127-129	1	3	58A	100A	282A	346B	389B	445B	545C	1006D	127-129
124-126	1	3	55	95A	272A	334B	377B	432B	530C	978C	124-126
121-123	–	3	51	91A	263A	323B	364B	420B	515C	950C	121-123
	Maximum Result for Mk 8 Weaponry										
118-120	–	3	48	86	253A	311B	352B	408B	500C	922C	118-120
115-117	–	2	45	82	243A	300B	340B	395B	485C	894C	115-117
112-114	–	2	42	77	233	288A	327B	383B	470C	866C	112-114
109-111	–	2	38	73	223	277A	315B	371B	454B	838C	109-111
106-108	–	2	35	68	214	265A	303A	358B	439B	810C	106-108
	Maximum Result for Mk 7 Weaponry										
103-105	–	1	32	64	204	254A	290A	346A	424B	782B	103-105
100-102	–	1	28	59	194	242A	278A	334A	409B	754B	100-102
97-99	–	1	25	55	184	231A	265A	321A	394B	727B	97-99
94-96	–	–	22	50	174	219	253A	309A	379B	699B	94-96
91-93	–	–	19	46	165	208	241A	297A	364A	671B	91-93
	Maximum Result for Mk 6 Weaponry										
88-90	–	–	15	41	155	196	228A	284A	349A	643B	88-90
85-87	–	–	12	37	145	185	216	272A	334A	615B	85-87
82-84	–	–	9	32	135	173	203	260	318A	587B	82-84
79-81	–	–	5	28	125	162	191	248	303A	559A	79-81
76-78	–	–	2	23	115	150	179	235	288A	531A	76-78
	Maximum Result for Mk 5 Weaponry										
73-75	–	–	–	19	106	139	166	223	273A	503A	73-75
70-72	–	–	–	14	96	127	154	211	258	475A	70-72
67-69	–	–	–	10	86	116	141	198	243	448A	67-69
64-66	–	–	–	5	76	104	129	186	228	420A	64-66
61-63	–	–	–	1	66	93	117	174	213	392A	61-63
	Maximum Result for Mk 4 Weaponry										
58-60	–	–	–	–	57	81	104	161	198	364A	58-60
55-57	–	–	–	–	47	70	92	149	182	336	55-57
52-54	–	–	–	–	37	58	79	137	167	308	52-54
49-51	–	–	–	–	27	47	67	124	152	280	49-51
46-48	–	–	–	–	17	35	55	112	137	252	46-48
	Maximum Result for Mk 3 Weaponry										
43-45	–	–	–	–	8	24	42	100	122	224	43-45
40-42	–	–	–	–	–	12	30	87	107	196	40-42
37-39	–	–	–	–	–	1	18	75	92	168	37-39
34-36	–	–	–	–	–	–	5	63	77	141	34-36
35-33	–	–	–	–	–	–	–	50	61	113	35-33
	Maximum Result for Mk 2 Weaponry										
28-30	–	–	–	–	–	–	–	38	46	85	28-30
25-27	–	–	–	–	–	–	–	26	31	57	25-27
22-24	–	–	–	–	–	–	–	13	16	29	22-24
	Maximum Result for Mk 1 Weaponry										
19-21	–	–	–	–	–	–	–	1	6	9	19-21
12-18	–	–	—	–	–	–	–	–	1	5	12-18
05-11	–	–	—	–	–	–	–	–	–	1	05-11
UM 01-04	F	F	F	F	F	F	F	F	F	F	**01-04 UM**



Vehicles vs. Infantry Attack Table A-VM-3.9

	No Armor							Combat Armor			Kinetic Armor			Armored Cloth				
	12	11	8	5	4	3	1	X	IX	VIII	VII	VI	V	IV	III	II	I	
								Maximum Result for Mk 50 Weaponry										
148-150	85E	87E	105E	131E	87E	131E	172E	40E	50E	61E	101E	127E	154E	101E	119E	136E	154E	**148-150**
145-147	84E	85E	103E	128E	85E	128E	168E	40E	50E	60E	99E	124E	150E	99E	117E	133E	150E	**145-147**
142-144	82E	83E	101E	125E	83E	125E	164E	39E	48E	59E	97E	121E	147E	97E	114E	130E	147E	**142-144**
139-141	80E	82E	98E	123E	81E	122E	160E	38E	47E	57E	95E	119E	144E	95E	111E	127E	144E	**139-141**
								Maximum Result for Mk 40 Weaponry										
136-138	78E	80E	96E	120E	79E	119E	156E	37E	46E	56E	92E	116E	140E	92E	109E	124E	140E	**136-138**
133-135	76E	78E	94E	117E	78E	116E	152E	36E	45E	55E	90E	113E	137E	90E	106E	121E	137E	**133-135**
130-132	74E	76E	92E	114E	76E	113E	148E	36E	44E	53E	88E	110E	133E	88E	103E	118E	133E	**130-132**
127-129	72E	74E	89E	111E	74E	110E	145E	35D	43D	52D	86D	107D	130D	86D	101D	115D	130E	**127-129**
								Maximum Result for Mk 30 Weaponry										
124-126	70D	72D	87D	108D	72D	107D	141D	34D	42D	51D	84D	105D	126D	84D	98D	112D	126D	**124-126**
121-123	69D	70D	85D	105D	70D	104D	137D	33D	41D	49D	81D	102D	123D	82D	96D	109D	123D	**121-123**
								Maximum Result for Mk 25 Weaponry										
118-120	67D	68D	82D	103D	68D	101D	133D	32D	40D	48D	79D	99D	120D	79D	93D	106D	120D	**118-120**
115-117	65D	66D	80D	100D	66D	98D	129D	31D	39D	47D	77D	96D	116D	77D	90D	103D	116D	**115-117**
								Maximum Result for Mk 20 Weaponry										
112-114	63D	64D	78D	97D	64D	95D	125D	30D	37D	45D	75D	93D	113D	75D	88D	100D	113D	**112-114**
109-111	61D	62D	76D	94D	62D	92D	121D	29C	36D	44D	73C	91D	109D	73C	85D	97D	109D	**109-111**
								Maximum Result for Mk 15 Weaponry										
106-108	59D	60D	73D	91D	60D	89D	117D	29C	35C	43C	70C	88C	106C	71C	83C	94C	106D	**106-108**
103-105	57D	58D	71D	88D	58C	86C	114C	28C	34C	41C	68C	85C	103C	68C	80C	91C	103C	**103-105**
								Maximum Result for Mk 10 Weaponry										
100-102	55C	56C	69C	85C	56C	83C	110C	27C	33C	40C	66C	82C	99C	66C	77C	88C	99C	**100-102**
97-99	54C	54C	66C	83C	54C	80C	106C	26C	32C	39C	64C	79C	96C	64C	75C	85C	96C	**97-99**
94-96	52C	52C	64C	80C	52C	77C	102C	25C	31C	37C	61C	77C	92C	62C	72C	82C	92C	**94-96**
91-93	50C	50C	62C	77C	50C	74C	98C	24C	30C	36C	59C	74C	89C	60C	70C	79C	89C	**91-93**
								Maximum Result for Mk 9 Weaponry										
88-90	48C	48C	60C	74C	48C	71C	94C	23B	29C	34C	57B	71C	85C	57B	67C	76C	85C	**88-90**
85-87	46C	46C	57C	71C	46C	68C	90C	23B	28B	33B	55B	68B	82B	55B	64B	73B	82C	**85-87**
82-84	44C	45C	55C	68C	44C	66C	86C	22B	27B	32B	53B	65B	79B	53B	62B	70B	79C	**82-84**
79-81	42C	43B	53C	66C	42B	63B	82B	21B	25B	30B	50B	63B	75B	51B	59B	67B	75B	**79-81**
								Maximum Result for Mk 8 Weaponry										
76-78	40B	41B	50C	63C	40B	60B	79B	20B	24B	29B	48B	60B	72B	49B	57B	64B	72B	**76-78**
73-75	39B	39B	48B	60B	38B	57B	75B	19B	23B	28B	46B	57B	68B	46B	54B	61B	68B	**73-75**
70-72	37B	37B	46B	57B	36B	54B	71B	18A	22B	26B	44A	54B	65B	44A	51B	58B	65B	**70-72**
67-69	35B	35B	44B	54B	34B	51B	67B	17A	21A	25B	42A	51A	61B	42A	49A	55B	61B	**67-69**
								Maximum Result for Mk 7 Weaponry										
64-66	33B	33B	41B	51B	32B	48B	63B	17A	20A	24A	39A	49A	58A	40A	46A	52A	58B	**64-66**
61-63	31B	31B	39B	48B	30B	45B	59B	16A	19A	22A	37A	46A	55A	38A	44A	49A	55B	**61-63**
58-60	29B	29B	37B	46B	28A	42A	55B	15A	18A	21A	35A	43A	51A	35A	41A	46A	51B	**58-60**
55-57	27B	27A	34B	43B	27A	39A	51A	14A	17A	20A	33A	40A	48A	33A	38A	43A	48A	**55-57**
								Maximum Result for Mk 6 Weaponry										
52-54	25A	25A	32B	40B	25A	36A	48A	13A	16A	18A	30A	37A	44A	31A	36A	40A	44A	**52-54**
49-51	24A	23A	30A	37A	23A	33A	44A	12	15A	17A	28	35A	41A	29	33A	37A	41A	**49-51**
46-48	22A	21A	28A	34A	21A	30A	40A	11	13	15A	26	32	38A	27	31	34A	38A	**46-48**
								Maximum Result for Mk 5 Weaponry										
43-45	20A	19A	25A	31A	19A	27A	36A	10	11	14	24	29	34	24	28	31	34A	**43-45**
40-42	18A	17A	23A	29A	17A	24A	32A	9	10	13	22	26	31	22	25	28	31A	**40-42**
								Maximum Result for Mk 4 Weaponry										
37-39	16A	15A	21A	26A	15A	21A	28A	8	9	11	19	23	27	20	23	25	27A	**37-39**
34-36	14A	13A	19A	23A	13	18	24	7	8	10	17	21	24	18	20	22	24	**34-36**
								Maximum Result for Mk 3 Weaponry										
31-33	12A	11A	16A	20A	11	15	20	6	7	9	15	18	20	16	18	19	20	**31-33**
28-30	10	9	14A	17A	9	12	16	5	6	8	13	15	16	14	16	17	19	**28-30**
								Maximum Result for Mk 2 Weaponry										
25-27	8	7	12A	15A	7	9	12	4	5	7	11	12	13	12	13	14	18	**25-27**
22-24	4	5	10	12A	5	7	9	3	4	6	8	9	10	9	10	11	17	**22-24**
								Maximum Result for Mk 1 Weaponry										
19-21	2	3	8	9	3	5	7	1	2	3	5	6	7	6	7	8	14	**19-21**
16-18	1	2	6	7	1	3	5	1	1	1	3	4	5	4	5	5	11	**16-18**
13-15	–	1	3	5	–	1	3	1	–	–	2	1	1	3	3	1	8	**13-15**
10-12	–	–	1	3	–	–	1	–	–	–	1	–	–	2	1	–	5	**10-12**
07-09	–	–	–	1	–	–	–	–	–	–	–	–	–	1	–	–	1	**07-09**
04-06	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**04-06**
UM 01-03	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	**01-03 UM**

Critical Type:
For Warheads, use Blast criticals.
Otherwise, use Pierce criticals.

UM — Unmodified roll. Apply result with no modifications.

F — Weapon failure. Roll a d10:
1-7 = *Temporary Overload* (weapon may not fire next round);
8-10 = *Malfunction* (roll for severity).

Note: If *Arms Law* is used:
Breakage Numbers: 1, 2, 3, 4;
Reliability/Strength: 90.
In the event of breakage, roll a d10:
1-7 = *Temporary Overload* (weapon may not fire next round);
8-10 = *Malfunction* (roll for severity).

Range Mods:

Point Blank	+10
Short	+0
Medium	-20
Long	-40
Extreme	-50

OB Mods (based on Mark #):

Mk. 1	-100	Mk. 6	-50
Mk. 2	-90	Mk. 7	-40
Mk. 3	-80	Mk. 8	-30
Mk. 4	-70	Mk. 9	-20
Mk. 5	-60	Mk. 10	-10

Infantry vs. Infantry Attack Table A-VM-3.10

	No Armor							Combat Armor			Kinetic Armor			Armored Cloth				
	12	11	8	5	4	3	1	X	IX	VIII	VII	VI	V	IV	III	II	I	
								Maximum Result for AE 13+ Weaponry										
148-150	134M	139M	164M	203M	137M	204M	266M	64K	75L	96M	159K	198L	239M	159K	185L	212L	239M	148-150
145-147	130M	135M	159M	198M	133M	198M	259M	63K	73L	94M	155K	193L	232M	155K	181L	207L	232M	145-147
								Maximum Result for AE 12 Weaponry										
142-144	127M	131M	155M	193M	129M	192M	251M	61K	72L	91M	150K	188L	226M	151K	176L	201L	226M	142-144
139-141	123L	127L	151L	188L	125L	186L	244L	60J	70K	89L	146J	183K	220L	147J	171K	195K	220L	139-141
								Maximum Result for AE 11 Weaponry										
136-138	120L	124L	147L	182L	121L	181L	236L	58J	68K	86L	142J	177K	213L	143J	166K	190K	213L	136-138
133-135	116L	120L	143L	177L	118K	175L	229L	57I	66J	83K	138I	172J	207K	139I	162J	184J	207L	133-135
								Maximum Result for AE 10 Weaponry										
130-132	113K	116K	139K	172K	114K	169K	221K	55I	64J	81K	134I	167J	200K	135I	157J	179J	200K	130-132
127-129	109K	112K	135K	167K	110K	163K	214K	53I	62J	78J	130I	162J	194J	131I	152J	173J	194K	127-129
								Maximum Result for AE 9 Weaponry										
124-126	106K	108K	131K	161K	106J	157J	206J	52H	60I	76J	126H	156I	187J	127H	147I	167I	187J	124-126
121-123	102J	105J	126J	156J	102J	151J	199J	50H	58I	73J	122H	151I	181J	123H	142I	162I	181J	121-123
								Maximum Result for AE 8 Weaponry										
118-120	99J	101J	122J	151J	98J	145J	191J	49G	56H	71I	118G	146H	175I	119G	138H	156H	175J	118-120
115-117	95I	97I	118J	146J	94I	140I	184I	47G	54H	68I	114G	141H	168I	115G	133H	150H	168I	115-117
								Maximum Result for AE 7 Weaponry										
112-114	92I	93I	114I	140I	91I	134I	176I	45G	52H	66H	110G	135H	162H	111G	128H	145H	162I	112-114
109-111	88I	89I	110I	135I	87H	128I	169I	44F	50G	63H	106F	130G	155H	107F	123G	139G	155I	109-111
								Maximum Result for AE 6 Weaponry										
106-108	84H	86H	106I	130I	83H	122H	161H	42F	48G	60G	102F	125G	149G	103F	119G	134G	149H	106-108
103-105	81H	82H	102H	125H	79H	116H	154H	41F	47F	58G	97F	120F	142G	99F	114F	128F	142H	103-105
								Maximum Result for AE 5 Weaponry										
100-102	77H	78H	97H	120H	75G	110G	146G	39E	45F	55G	93E	114F	136G	95E	109F	122F	136G	100-102
97-99	74G	74G	93H	114H	71G	104G	139G	37E	43F	53F	89E	109F	130F	91E	104F	117F	130G	97-99
								Maximum Result for AE 4 Weaponry										
94-96	70G	71G	89G	109G	68G	99G	131G	36D	41E	50F	85D	104E	123F	87D	100E	111E	123G	94-96
91-93	67G	67G	85G	104G	64F	93F	124F	34D	39E	48E	81D	99E	117E	83D	95E	106E	117F	91-93
								Maximum Result for AE 3 Weaponry										
88-90	63F	63F	81G	99G	60F	87F	116F	33D	37D	45E	77D	94D	110E	78D	90D	100E	110F	88-90
85-87	60F	59F	77F	93F	56E	81F	109F	31C	35D	43D	73C	88D	104D	74C	85D	94D	104F	85-87
								Maximum Result for AE 2 Weaponry										
82-84	56F	55F	73F	88F	52E	75E	101E	30C	33D	40D	69C	83D	97D	70C	80D	89D	97E	82-84
79-81	53E	52E	69F	83F	48E	69E	94E	28B	31C	38D	65B	78C	91D	66B	76C	83C	91E	79-81
								Maximum Result for AE 1 Weaponry										
76-78	49E	48E	64E	78E	45D	63D	86E	26B	29C	35C	61B	73C	85C	62B	71C	78C	85D	76-78
73-75	46D	44D	60E	72E	41D	58D	79D	25B	27B	32C	57B	67B	78C	58B	66B	72C	78D	73-75
70-72	42D	40D	56E	67E	37D	52D	71D	23A	25B	30B	53A	62B	72B	54A	61B	66B	72D	70-72
67-69	39D	36D	52D	62D	33C	46C	64C	22A	23B	27B	49A	57B	65B	50A	57B	61B	65C	67-69
64-66	35C	33C	48D	57D	29C	40C	56C	20A	22A	25A	44A	52A	59A	46A	52A	55A	59C	64-66
61-63	32C	29C	44D	52D	25B	34C	49C	18	20A	22A	40	46A	52A	42	47A	50A	52C	61-63
58-60	28C	25C	40C	46C	21B	28B	41B	17	18A	20A	36	41A	46A	38	42	44A	46B	58-60
55-57	25B	21B	35C	41C	18B	22B	34B	15	16	17	32	36	40	34	38	38	40B	55-57
52-54	21B	17B	31C	36C	14A	17A	26B	14	14	15	28	31	33	30	33	33	33A	52-54
49-51	17B	14B	27B	31B	10A	11A	19A	12	12	12	24	25	27	26	28	27	27A	49-51
46-48	14A	10A	23B	25B	6A	5A	11A	11	10	9	20	20	20	22	23	22	20A	46-48
43-45	10A	6A	19B	20B	2	–	4A	9	8	7	16	15	14	18	18	16	14	43-45
40-42	7A	2A	15A	15A	–	–	–	7	6	4	12	10	7	14	14	10	7	40-42
37-39	3	–	11A	10A	–	–	–	6	4	2	8	4	1	10	9	5	1	37-39
34-36	–	–	7A	4A	–	–	–	4	2	–	4	–	–	6	4	–	–	34-36
31-33	–	–	2A	–	–	–	–	3	–	–	–	–	–	2	–	–	–	31-33
28-30	–	–	1	–	–	–	–	1	–	–	–	–	–	1	–	–	–	28-30
XX-27	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	XX-27
UM 01-XX	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	01-XX **UM**

Critical Type: Use Small Arms vs. Infantry criticals.
'F' = 'E' crit and 'A' crit
'G' = 'E' crit **and** 'B' crit
'H' = 'E' crit **and** 'C' crit
'I' = 'E' crit **and** 'D' crit
'J' = Two 'E' crits
'K' = Two 'E' crits **and** an 'A' crit
'L' = Two 'E' crits **and** a 'B' crit
'M' = Two 'E' crits **and** a 'C' crit

Note: If weapons are not capable of burst or continuous fire, reduce critical severity by two.

Note: For plasma weapons, increase the critical severity by one.

Note: Damage Maximums are based on the Aperture Energy of the weapons (see p. 49, *Equipment Manual*, and *Blaster Law*).

Range: If appropriate, use the range for the weapons used by the infantry.

UM — Unmodified roll. Apply result with no modifications.

Failure/Fumble Range:
Average = 01-04[UM] (XX=4)
If appropriate, use the failure/fumble range for the weapons used by the infantry.

F — Weapon failure. Roll a d10:
1-7 = Temporary Overload (weapon may not fire next round);
8-10 = Malfunction (roll for severity).

Note: If *Arms Law* is used:
Breakage Numbers: 1, 2, 3, 4;
Reliability/Strength: 90.
In the event of breakage, roll a d10:
1-7 = *Temporary Overload* (weapon may not fire next round);
8-10 = *Malfunction* (roll for severity).

OB Mods (based on AE):

AE 1 .....-60	AE 7 ..... -30
AE 2 .....-55	AE 8 ..... -25
AE 3 .....-50	AE 9 ..... -20
AE 4 .....-45	AE 10 ..... -15
AE 5 .....-40	AE 11 ..... -10
AE 6 .....-35	AE 12+ ..... -5

BLAST (AGAINST INFANTRY) CRITICAL STRIKE TABLE VM-A-4.1

	A	B	C	D	E
01-05	Aren't you supposed to be tough? +0H	That was close. +1H	Boom. +2H	Did that attack scatter? +3H	Bloodied but unbowed. +5H
06-10	Too bad they had cover. +1H	Squad lets lose a barbaric yelp and charges. +2H	Lets have a morale check. (-5)	Squad loses on piece of ordnance, his choice. +5H	Team pinned down for one round as blasts crash into their cover. +7H
11-15	Unit must make a morale check or be pinned for one round. (-10)	Scattered bursts still manage to cause damage. +5H – (-15)	Unit digs in for one round. (-15)	Foes are pinned down while they lick their wounds. +14H -- (-30)	Men scatter like bowling pins.
16-20	You call that an explosion? What is this a cartoon? Light or No Armor: +4H Otherwise: +1H	The unit is pinned for one round while they plan their next move. +4H	Blast stuns squad. They are pinned for one round while they decide which piece of ordnance was destroyed. +7H	Wow! So this is what battle is like. Squad pinned for one round while they make a morale check. (-20)	Unit is pinned down for one round. 2 pieces of ordnance of his choice are lost. (-20)
21-30	The ground bucks under the explosions. A morale check might be in order. +0H	Unit must make a morale check. No Armor: +3H	Squad is pinned for one round. When the round is over, make a morale check. +10H	Squad is one morale check away from being okay. (-15)	That's a pretty thorough whuppin', boy. +20H
31-40	Blast confuses and deafens unit. (-15)	Bracketing fire creates a nice kill zone. Armored: +4H – (-15) No Armor: +4H – (-20)	You're attack makes them wish they had joined the Navy. +8H – (-30)	Multiple casualties blast through squad. The medic scramble like a madman. +8H – (-50)	Multiple casualties from light shrapnel. w/armor: +10H – (-30) w/o armor: (-30)
41-50	Blast spreads the shrapnel around. (-15)	All LAWs, demolitions, and mines are destroyed. They're just happy to have survived that. (-15)	Two piece of ordnance, foe's choice, are destroyed. They make rude gestures. (-15)	That's why they call them "Crunchies". Pinned for one round. +19H – (-10)	Squad losses two pieces of ordnance of your choice. +7H – (-30)
51-55	Troop must make morale check or be pinned for one round. Good shooting. +3H – (-10)	Squad pinned for one round. +5H	The explosions are so loud, and they just won't stop! Pinned for one round. +10H – (-10)	Barrage is causing squad to keep their heads down. Pinned for one round. +10H – (-10)	Never look up right before the explosion. (-50)
56-60	One piece of ordnance (foe's choice) is destroyed. +5H	Is everyone all right? +6H – (-10)	Any spotters are killed. +14H – (-10)	Blast destroys two piece of ordnance (your choice). +20H – (-20)	Scorched earth. Foe loses all special ordnance. (-55)
61-65	Your attack is more frightening than it deserves. Morale Check. (-10)	Who's blood is this? Who's blood is this!? (Morale Check). +6H – (-10)	Blast wounds several squad members. (-20)	Brutal assault causes two morale checks. +20H	Unrelenting stream of fire causes two morale tests. (-20)
66	After the blast, the officer is nowhere to be found. +5H – (-20)	Blast kills officer. Unit is pinned for two rounds while the sergeant talks them into sticking around. +10H – (-10)	Blast kills officer and sergeant. Unit pinned for three rounds while they reevaluate the situation. Morale check. (-20)	Blast kills sergeant. 2nd lieutenant flees. Unit is pinned for 10 rounds. +22H – (-60)	Blast launches squad high into the air. The ground is unforgiving. Who's got burial detail? (+25)
67-70	Blast causes foe to crawl under the rocks for a round. +2H	Air burst. Pinned for one round. +5H	Suppression fire pins squad for two rounds. +13H – (-30)	Pinned down under thundering explosions (one round). +20H – (-35)	Cataclysmic thunder pins unit down for 10 rounds. +30H
71-75	Casualty destroys one piece of ordnance of foes choice. +5H	Blast sets off all MASK ordnance at current location. Light or no armor: +10H – (-20) Otherwise: +10H (-10)	Blast scorches the right sides of all squad members. +15H – (-10)	Blast sets off or destroys all squads ordnance, including mortars and grenades. (-40)	Blast blows apart much of the team. (-40)
76-80	Blast puts unit to the ground. (-10)	2nd Lieutenant starts weeping like a little girl. Sergeant slaps him 'til he comes around. Morale check. (-20)	That blast sounded worse than it was. Squad pinned until they make a morale check. +8H – (-25)	Maybe "deserter" isn't such a bad label after all. Morale check. +24H – (-30)	Concussion presses squad against the ground. +20H – (-40)
81-85	Blast caches one soldier, turning him into deadly shrapnel, tearing through the squad. Morale check. +6H – (-15)	Look at them disperse. They're like little bunnies. Heavy Armor: (-20) w/o Heavy Armor: +12H – (-30)	Look at those poor fools hug the ground. Pinned for one round. (-50)	Shock waves break multiple bones. +20H – (-50)	Blast scatters unit like dolls. +12H – (-60)
86-90	Oh look, a foxhole. Foe pinned for one round. Light armor or worse: +7H Medium or heavier armor: +4H	Thundering blast triggers a morale check. (-10)	They think they'll stay where they are. Pinned for one round. +17H – (-25)	Several team members dissolve under plasma barrage. +25H – (-20)	Effective Aperture Energy of unit drops d10 levels, and unit must make two morale checks under the punishing salvos. +0H
91-95	Squad makes for better cover, dropping one piece of ordnance of their choice. Have them make a morale check when their done displacing. +3H	Squad routes. They throw away one piece of ordnance of your choice and one of foe's choice. That's why Caesar gilt his weapons with gold, you know. +13H	Plasma washes over squad. That looks painful. +18H – (-35)	They route and turn their backs to your guns. Fish in a barrel. Squad eliminated. +26H	All special ordnance and capabilities are lost. Unit pinned down for 12 rounds. +27H
96-99	Debris bounces off their body armor. (-15)	Shock wave knocks out several team members. +14 H	It will take a week to sort out the pieces for burial. (-30)	That's what they call a clean kill. +0H	Body parts are thrown 100 meters. All squads in range must check morale. (+20)
100	Thundering blast incapacitates entire team. Hope they have good health insurance. (+20)	Blasts kill squad to a man. Break out the ol' dental records. (+20)	Team obliterated. Send in the scrap wagon. (+20)	Plasma blasts through them like they were so much smoke. (+20)	Only thing left is their after image on the targeting screen (+25)

Key: ßπ =must parry ß rounds; ß[]=no parry for ß rounds; ß∑=stunned for ß rounds; ßʃ =bleed ß hits per round; (-ß)=foe has -ß penalty; (+ß)=attacker gets +ß next round.

BLAST (AGAINST VEHICLES) CRITICAL STRIKE TABLE VM-A-4.2

	A	B	C	D	E
01-05	Weak attack. +0H	Ineffectual attack. +0H	Pretty, if ineffectual, hit. +0H	Weak blow. +2H	No warheads may be launched next round. +5H
06-10	Stowed cargo takes light damage. +0H	Crew stunned for one round. One payload pallet is destroyed. +0H	Little effect. +0H	One payload pallet destroyed. Weak. +10H	Craft is knocked out of control. +20H
11-15	Not very good. +0H	Tight beam com rig knocked out. +0H	Payload pallets disabled for one round. Com gear knocked out. +2H	Maneuverability out next round. In addition, one com set is out. +20H	Blast knocks out ship's targeting capabilities. +40H
16-20	Light damage hits sensors, causing all readings to be at -20 for 5 rounds. In addition, light damage to engines cause a reduction in acceleration by 1 G. +0H	One HUD goes offline. +2H	Computer damage. -5 to OBs and DB. +4H	Engines offline for one round. All crewmembers take a 'B' Impact critical. +40H	Blast knocks out sensors. Ship cannot attack and DB is reduced to 0. Computer is damaged. +80H
21-30	Light damage to EW reduces it by 5. +0H	May not Jam torpedoes for one round. +2H	Moderate damage to EW causes a -10. Cargo takes light damage. +6H	Severe damage to EW reduces it by 20. +70H	EW reduced by 25. Each crewmember takes a 'C' Impact critical. +140H
31-40	Weapon targeting systems go offline for one round. One crewmember takes and 'A' Electricity critical. +0H	One weapon mount goes offline for 1-2 rounds. +2H	No missiles or torpedoes may be launched for 1-2 rounds. +8H	Targeting knocked out. 1-2 weapon mounts destroyed. Thrust reduced by 2 Gs. +100H	Attack knocks out d10 weapons and d10 payload pallets. +200H
41-50	Blast causes a routine malfunction in foe's computer. One weapon mount may not fire for 1-5 rounds. Foe's DB is reduced by 15. +0H	One weapon mount knocked out. Cargo takes moderate damage. +4H	Computer reboots. Ship loses HUD bonuses and DB for d10 rounds. +10H	Attack rocks craft. DB reduced by 20. All crewmembers take a 'C' Impact critical. +140H	Craft's computer is knocked out. Craft is effectively helpless. +300H
51-55	Screen generator takes light damage. DB is reduced by 10. +2H	Attack damages screens. -5 to DB. +4H	Craft knocked out of control. +14H	DB reduced to 0. Craft knocked out of control. +180H	Blast takes out ship power plant. Crew is stunned for 1d10 rounds. +400H
56-60	Hard hit is redirected by screens and armor. +2H	Foe goes out of control. +4H	Moderate damage to life support system. 60 minutes of life support left. One weapon pallet destroyed. +20H	Each crewmember takes a 'D' Impact critical. DB is reduced by 10. +240H	Concussion rolls through craft. All crewmembers take an 'E' Impact critical. Ship is dead in space. +500H
61-65	Blast takes damage control offline for two rounds. In addition, all cargo takes moderate damage. +2H	One payload pallet and load are destroyed. +6H	Damage reduces all systems by 5. All crewmembers take an 'A' Impact critical. +26H	Damage control offline for 10 rounds. Weapon mount and two payload mounts destroyed. +300H	Explosion rolls through craft. All systems knocked out. Crewmembers take an 'E' Shrapnel critical. Ship explodes in 2d10 rounds. +600H
66	Devastating blast. +100H	Brutal assault tears through foe. +200H	Blast blows through foe's armor. +1,000H	Pin point strike obliterates craft. (+20)	Craft is crushed like a paper cup. (+25)
67-70	Internal fires sprout up throughout ship. Until doused, all crewmembers take an 'A' Heat critical every round. +3H	Internal fires through ship. Until extinguished, all on board take a 'B' Heat critical every round. +6H	Internal fires. Until extinguished, each crewmember takes a 'C' Heat critical. +29H	Fires rage through craft. All crewmembers take a 'D' Heat critical a round until it's put out. +330H	Flames rage inside vehicle. Until put out, all crewmembers take an 'E' Heat critical per round. +650H
71-75	Shuddering blast knocks craft out of control and stuns crew for 1-5 rounds. +4H	Blast rocks craft. All on board take a 'B' Impact critical. Cargo takes moderate damage. DB is decreased by 5. +6H	Concussion stuns crew for 2d10 rounds. 1-2 weapon mounts destroyed. +32H	Concussion stuns all crew for 10 rounds. Cargo and cargo hold are destroyed. +360H	Blast takes out crew and all ship systems. Call a tug. +700H
76-80	Inertial dampers taken offline for 1-5 rounds. During this time, craft may not exceed 2 Gs. +4H	Inertial dampers lightly damaged. Craft cannot exceed 5 Gs. +8H	Inertial damper intermittent for d10 rounds. During this time, the craft cannot exceed 2 Gs. +40H	Craft loses inertial dampers. Any acceleration of 2 Gs or greater will destroy craft. +440H	Inertial damper destroyed. If ship has no backup, it will be destroyed as soon as it pulls 2 Gs. +1,000H
81-85	Blast stuns crew for one round. In addition, one pallet, complete with load, is destroyed. Finally, DB is reduced by 5. +5H	Computer damaged. No maneuvers may be performed next round. All OB's are reduced by 10. DB is reduced by 30. +10H	Ship's computer damaged. Ship loses DB and all HUD bonuses. +50H	Craft shuts down. It will take 2d10 rounds to bring the craft back online. +540H	Craft is gutted by blast. Decent salvage. (+20)
86-90	Shuddering blast knocks out one weapon mount. -5 to DB. +6H	Blast damages all payload pallets. Their payloads will not activate. DB is reduced by 5. +12H	1-5 weapon mounts are destroyed. Crew is stunned for one round. +60H	Craft is devastated. Reactor and engines overload. Ship blows in one round. One crewmember can make it out alive. +660H	Ship loses structural integrity. It simply falls apart next round. (+20)
91-95	Shot damages drive, reducing it by 5 Gs. If ship was FTL capable, it isn't anymore. +6H	Craft flies out of control. +14H	Drive damaged. Acceleration reduced by d10 Gs. +80H	Blast bounces around inside ship. There isn't much left. (+20)	Blast destroys craft and kills crew.
96-99	Light damage to foe's reactor. All crew takes 1 REM per round until reactor is taken offline and repaired. One payload pallet and load are destroyed. One weapon mount cannot fire next round. +8H	Reactor damage. Craft is functional, but after 5 rounds, all power is lost (lifepods are under battery power). +16H	Craft's reactor begin to overload. It will detonate in five rounds. +100H	Hull collapses. That's all folks. (+20)	Foe's craft is eliminated in a single, cruel instant. There are no survivors. (+20)
100	Craft crushes bulkhead. After one round, all seams blow, and the craft explosively decompresses. +10H	Powerful blast crushes foe. (+20)	Direct hit obliterates enemy. That's what they call money shot. (+20)	Blast tears through craft. Crewmembers perish. (+20)	Foe's craft flashes into an expanding cloud of glowing gas. (+25)

Key: ßπ =must parry ß rounds; ß∏=no parry for ß rounds; ß∑=stunned for ß rounds; ßƒ =bleed ß hits per round; (-ß)=foe has -ß penalty; (+ß)=attacker gets +ß next round.

PIERCE (AGAINST INFANTRY) CRITICAL STRIKE TABLE VM-A-4.3

	A	B	C	D	E
01-05	Nada. +0H	Killing gophers? +0H	Does this thing seem sluggish to you? +0H	That's a clean miss. +0H	Not as easy on the battlefield, huh? +0H
06-10	Buttkiss. +0H	Better luck next round. +0H	You slowed him down, a bit. +0H	Multiple hits produce squat. +1H	Very weak. Maybe you should spend more time in the simulator. +4H
11-15	Looks like that "duck and cover" thing really works. +0H	Troops hide. +0H	Strike hits squad with little effect. +0H	Foe is pinned for one round unless they make a morale check. +0H	Unit pinned for one round. +0H
16-20	Imprecise shots trigger a morale check. Failure only results in squad being pinned for one round, then the figure out just how bad a shot you are. +0H	Foe effectively dives for cover. Unit is spared. +0H	You nailed a specialist. Foe loses one piece of ordnance (his choice). +0H	Close shot requires morale check. (-5)	Foe loses one piece of ordnance, his choice. (-10)
21-30	Shots frighten inexperienced troops. A failed morale check will result in the squad being pinned for one round. +0H	The attack looks worse than it is. A failed morale check will result in the squad being pinned for one round. +0H	Squad is pinned for one round unless they make a morale check. +0H	A failed morale check will result in the squad being pinned for one round. +0H	That was close. Morale check. +6H
31-40	Light raking attacks cause some minor damage to unarmored squad members. No Armor: (-5) Armored: +0H	Shots are ineffective at best. +0H	Attack leaves them shaking in their boots. +0H	You land several shots among them, for what it's worth. No armor: +3H – (-10) Armored: +3H	Your barrage is accurate. +7H
41-50	Maybe you shouldn't be singling out a single man. +0H	Squad loses one piece of special munitions (their choice). +0H	Any mortar ordnance is squad is destroyed. +3H	You nail one piece of ordnance (his choice). +6H	Series of mind-numbing blasts destroy men and equipment. +13H – (-5)
51-55	Random shots will pin you foe if they fail a morale check. +0H	Your attack is wild, but a failed morale check will still pin them for one round. +3H	Squad must make a morale check or be pinned for one round. +5H	Suppression fire pins the team for one round. Light or no armor: +7H Otherwise: +5H	Grazing fire effectively pins squad for one round. +7H – (-5)
56-60	Unit must make a morale check or lose comm gear in a false panic. +1H	Squad loses communication, global positioning, and targeting. They are lost. +0H	One piece of ordnance (their choice) is destroyed as light shrapnel is kicked up by the attack. Light or no Armor: (-10) Otherwise: +0H	Strike destroys one piece of ordnance, their choice. +0H	Two piece of ordnance (your choice) are destroyed. +12H – (-10)
61-65	Impressive, but completely ineffective. A morale check will see if they call your bluff +0H	Light casualties merit a morale check.. (-5)	The blast did little damage, but the exploding earth took it's toll. Morale check. +9H	That was close. Squad needs to make a morale check. (-10)	Veteran members killed. Squad must check morale. (-10)
66	Maybe the team leader shouldn't stand up like that. He's dead, Jim. (-10)	Team leader is put down. Medic! +6H – (-10)	Team leader drilled. Looks like everyone gets a promotion. Squad is pinned for one round. Morale check. (-10)	Everyone with any leadership ability is wiped out. Squad is pinned until a successful morale check is made. 16H – (-40)	Heavy strikes disembowels squad. Ick. (+25)
67-70	That'll teach them to keep their heads down. Morale check. +0H	Fire catches squad off guard. Morale check. Armored: +0H No Armor: +4H	Bracketing fire pins them for one round. (-5)	Foe is pinned for one round. +9H – (-5)	Precision strike pins foe for one round. +14H – (-20)
71-75	That could have been better. Light or No Armor: 5H Otherwise: 1H	Confusion reigns. Squad loses one piece of ordnance of his choice. +5H	Team loses one piece of ordnance (his choice). Light or no armor: +6H Otherwise: +0H	Team loses two pieces of ordnance. Go ahead and pick for them. +8H – (-15)	Strike tears through squad like so much tissue paper. Armor: +15H – (-30) No Armor: +25H – (-30)
76-80	Real close shave. (-10)	A few soldiers break under the pressure. (-10)	Squad is scared spitless. Maybe a morale check would be in order. (-20)	Determined attacks weed out the less apt soldiers. It's called survival of the fittest, boys. (-30)	Strike is brutal. Squad wishes it had never mustered for morning mess. Morale Check. (-40)
81-85	Just spread those wounds around like sarge said. Armor: (-10) No Armor: (-20)	Close strikes causes shrapnel to perforate squad. And they say close only counts in horseshoes and hand grenades. Armor: +2H – (-10) No Armor: (-25)	Your beams rake through the squad. They twitch when they die. +7H – (-30)	Takes two men to care for them, but only one man to bury them. +11H – (-40)	Squads chain of command destroyed. Loses 3 pieces of ordnance of his choice. +23H (-50)
86-90	They are pinned until they make a morale check. +0H – (-10)	Squad is pinned until the make a morale check. +6H – (-30)	Watch them die. Sort of brings a tear to the old eye. +6H – (-40)	A holocaust of energy tears through the squad. Heavy Armor: -20 Otherwise: -40	Precision strike leaves squad without leadership. +25H – (-60)
91-95	Team needs to make a morale check. Boot camp wasn't anything like this. Armor: +0H – (-20) No Armor: +2H – (-20)	Squad is thrown into confusion. Two pieces of ordnance (their choice) are destroyed. +6H – (-40)	Ravaging attack causes multiple casualties. +12H – (-50)	The entire team routes. Way to flex the old muscles. +10H	The beams take out key members of the squad. Squad is pinned down for d10 rounds while it reorganizes its command. +26H – (-80)
96-99	Don't need to kill a soldier when you can wound them like that. (-30)	Unit's best soldier is put down. That's the way to pick 'em. +10H (-50)	Raking fire tears through unit. A morale check might be in order. +8H – (-60)	Precision strike eliminates entire squad. (+20)	The deed is messy and unpleasant, but alas, it is done. All units within 50 meters must make a morale check. (+20)
100	The beams tears through their fragile armor. (-40)	You perforate and spindle them. (-60)	Your attack scythes through the squad. (-80)	Lancing beams drill trough the squad, leaving no one standing. (+20)	Squad is rendered away like so much fat. The smell is awful. (+25)

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PIERCE (AGAINST VEHICLES) CRITICAL STRIKE TABLE VM-A-4.4

	A	B	C	D	E
01-05	Targeting bungle. Foe may not fire next round. Tough luck. +0H	A new targeting system might be in order. +0H	Zip. +0H	Poor shot. Foe may not maneuver next round. +1H	Foe is quite lucky. +2H
06-10	Foe is elusive. +0H	Light damage to landing gear penalizes landings by -15. -5 to DB. +0H	Moderate damage causes all docking and landing checks to be made at -20. One payload pallet destroyed. Pretty weak. +0H	Moderate damage to foe's landing gear. Foe cannot land . Sever damage to power systems takes one energy weapon offline. -5 to foe's DB. +5H	Foe's cannot land or dock without aid due to Very Severe damage to landing gear and attitude thrusters. Power surge takes out energy weapon. +10H
11-15	Weak shot, but foe may make no maneuvers next round. +0H	Random energy dissipation delivers Moderate damage to drive reduces thrust by 2 Gs. +0H	Standard com rig is destroyed. Power flux takes weapons offline for 1-5 rounds. -5 to foe's DB. +1H	Power surge destroys all com arrays. Additional Severe damage reduces drive by 2 Gs. -10 to foe's DB. +10H	All com gear knocked out. OBs at -15 and DB at -5 due to Severe computer damage. One turret destroyed. +20H
16-20	Light damage reduce foe's drive by 1 G. +0H	Overheating knocks out one HUD. One payload pallet and load destroyed. 5 to foe's DB. +1H	Blast causes sever damage to computer, reducing DB and HUD bonuses by 10. One HUD destroyed. +2H	Pulsed attack knocks out computer with moderate damage. DB and HUD bonuses reduced to 0. +20H	Severe damage to computer and screens reduce HUD bonuses and DB to 0. Drive reduced by 10 Gs. +40H
21-30	Light damage to two systems. EW is reduced by 5. Drive is reduced by 1 G. +0H	Light damage reduces EW by 10. Foe may not jam warheads for 1-5 rounds. Light damage reduces drive by a G. +1H	Wild energy sends craft out of control. Severe damage reduces EW by 40. Light damage reduces drive by 2 Gs. +3H	Screens splatter you vengeful attack. EW knocked out. +35H	Power surge knocks out EW. If foe has no DB, Severe damage to computer reduces HUD bonuses by 30. +70H
31-40	One payload pallet and load are destroyed. -5 to foe's DB. +0H	Feeble attempt to cleave foe's craft renders random weapon inoperative for 1-5 rounds. -5 to foe's DB. +1H	Energy surge. Foe may not fire any missiles or torpedoes for 1-5 rounds. One energy weapon is knocked out. -10 to foe's DB. +4H	Piercing strike sends craft out of control. 1-5 weapon mounts knocked out. Severe damage reduces drive by 1-5 Gs. +50H	Attack knocks out d10 random weapon mounts and all payload pallets. -25 to DB. +100H
41-50	Your soft strike gives foe's computer a Routine malfunction, reducing DB by 15. Weapons may not fire next round. +0H	Foe's automatic damage control is knocked out. One energy weapon is knocked out. Light damage reduces drive by 2 Gs. +2H	Hard strike damages computer. DB and HUD bones are reduced to 0 for 2d10 rounds. Moderate damage reduces drive by 1-5 Gs. +5H	A section of ship's computer takes very severe damage. DB and HUD bonuses reduced by 1-100. One turret weapon knocked out. +70H	Computer takes out. DB and HUD bonuses reduced to 0. Foe is adrift. +150H
51-55	Deflected impact jars drive. Moderate damage results, reducing drive by 2 Gs. +1H	Foe's screens absorb the strike, but now foe's DB is at -20 for d10 rounds. Moderate damage reduces drive by 2 Gs. +2H	Brutal strike knocks out EW for d10 rounds. +7H	Searing blast destroys screens, reducing foe's DB by 20. +90H	Devastating attack knocks out computer. DB and HUD bonuses reduced to zero. All energy weapons knocked out. Very Severe damages reduces drive by 1-10 Gs. Crew stunned for 2 rounds. +200H
56-60	Foe's life support system takes Light damage. Crew will die in 1 hour unless system can be repaired. Moderate damage to drive: -2 Gs to acceleration. +1H	Lancing shot delivers moderate damage to life support. Crew will die in one hour unless repaired. A short circuit reduces drive by 1-5 Gs for 2 rounds. +2H	Severe damage to life support system. Crew will die in 30 minutes unless repairs are made. –15 to DB. +10H	Pinpoint strike cause very severe damage to foe's life support system. All on board will suffocate in 5 minutes. In addition, everyone takes a 'B' heat critical. -10 to foe's DB. +120H	Rude shot causes toxin in life support. All crew will perish in 1-5 rounds unless they eject or don environment suits. -30 to DB. Craft knocked out of control. +250H
61-65	Foe's automatic damage control offline for 10 rounds. Additional light damage reduces drive by 1 G. -5 to foe's DB. +1H	Damage control system takes moderate damage. No energy weapons may be fired next round. -10 to foe's DB. +3H	Energy lance takes out foe's damage control. +13H	Demolishing attack knock's out foe's damage control. One turret is destroyed. If foe is FTL capable, FTL takes very sever damage. +150H	Shocking blast rips through craft. All systems out. There is just enough emergency power to launch life pods. +300H
66	Searing strike blows through foe. Damage control tries to seal craft. +100H – (+20)	Intense attack burns through screens and riddles foe. +200H – (+20)	Beam is unimpeded by foe's screens. Armor plates buckle. +500 (+20)	Cruel, sizzling burst splits foe's craft into pieces. (+20)	Foe's craft split apart by irresistible blast. No survivors. (+25)
67-70	Swath of heat starts fires. Each crewmember takes an 'A' Heat crit a round until extinguished. +1H	Heat triggers internal fires. Until extinguished, all crewmembers take a 'B' Heat critical each round. +3H	Undissipated heat starts internal fires. Until extinguished, each crewmember takes a 'D' Heat critical/round. +14H	Flames rage inside of craft. Until fires are put out, all crewmembers take a 'D' Heat critical per round. +165H	Flames rage inside craft. Until put out, all crew members take an 'E' heat critical per round. +325H
71-75	Secondary concussion stuns crew for one round. Moderate damage reduces drive by 2 Gs. +2H	Energy discharge delivers an 'A' Electricity critical to each crewmember. -10 to foe's DB. +3H	Blazing strike stuns crew for d10 rounds. Have your way with them. +16H	Rocking strike stuns crew for fifteen rounds. All crewmembers take 'C' Electricity criticals from power surges. · 35 to foe's DB. +180H	Secondary blasts cause all crewmembers to take an 'E' impact critical and suffer 2 rounds of stun. Craft will come apart in d10 rounds. -40 to DB. +350H
76-80	Crackling strike reduces drive by 2 Gs for 1-5 rounds. During this time, craft will fall apart if it hits 5 Gs. +2H	Inertial dampers out. Craft may not hit 4 Gs of acceleration without falling apart. FTL may not be engaged. Each crewmember takes an 'A' Impact crit. +4H	Pummeling strike blows inertial dampers. Craft will disintegrate if it pulls 2 Gs. -5 to foe's DB. +20H	Slashing energy attack causes Very Severe damage to craft's inertial dampers. Random inertial forces will destroy foe next round. +220H	Inertial dampers taken out and any auxiliary systems may not be accessed. Craft cannot survive 2 Gs of acceleration. -50 to DB. +500H
81-85	Scary blast sends craft out of control. Moderate damage to computer causes HUD's to be reduced by 20. +2H	Light damage to computer. HUD's are reduced by 10. DB is reduced by 20. +5H	Determined attack sends craft out of control. DB and HUD bonuses are reduced to 0. +25H	Pyrotechnic display takes out a variety of systems. Craft drifts for d10 rounds, then detonates. (+20)	Funneled energy stream guts craft. It is destroyed. (+20)
86-90	Destructive energy causes one weapon to go offline for 1-10 rounds. -15 to foe's DB. +3H	Attack knocks out 1-5 payload pallets. Moderate damage reduces drive by 2 Gs. -20 to DB. +6H	Hot secondary blasts blow all systems. Weapons offline. Runaway reactions will blow ship in 2d10 rounds. +30H – (+20)	Craft reels from the impact of your attack. Reactor and weapons over load. Crew has one round eject. (+20)	Point blank attack causes total lose of structural integrity. Foe's craft comes quietly apart. (+20)
91-95	Lucky blow delivers Moderate damage, reducing drive by d10 Gs. +3H	Severe damage from your passing shot reduces drive by 2d10 Gs. You have him now. +7H	Drive knocked out. Craft drifts for 1-5 rounds, then explodes. +40H – (+20)	Ravaging beams of destruction crisscross foe. Engine detonate like a tiny sun. (+20)	Scorching rays of death fry craft. Life-pods malfunction. Ejection systems fires crew into closed canopies. Very sad. (+20)
96-99	Cruel strike cause moderate damage to reactor. Crew takes 1 REM per minute until reactor is taken offline. +4H	Stream of destruction overloads foe's reactor. They have 1-5 rounds. +8H	Ray burns through screens, breeches hull, and melts reactor. Boom. +50H – (+20)	Hull breached by pinpoint assault. Reactor detonates. (+20)	Foe becomes expanding cloud of glowing gas. Carry on. (+20)
100	Bulkhead buckles. Craft will come apart in 1-5 rounds. +5H – (+20)	Powerful swath of energy rakes hull. Craft suffers from structural collapse. (+20)	Foe's craft ripped in half by your raking strike. Slash one. (+20)	Your artful strike detonates foe's ordnance reactor. No one survives. (+20)	Foe's craft passes beyond the veil. There is little trace left. (+25)

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SMALL ARMS VS. INFANTRY CRITICAL STRIKE TABLE VM-A-4.5

	A	B	C	D	E
01-05	Maybe you should try harsh language. +0H	Who taught you to shoot? +0H	That could have been better. +1H	Foes take cover. +2H	Lucky bastard dodges. +3H
06-10	Firing over their heads only works in hostage situations. +0H	Poorly directed fire insults more than injures. +2H	Your attack triggers a morale check, though it probably doesn't warrant it. +3H	All of foe's missile and rockets are destroyed. +0H	You hit close. They are pinned for one round while you try to find their range. +3H
11-15	Troops are pinned for one round. +0H	You take down a few men, but they are certainly not the cream of the crop. +1H – (-5)	They call that a pin. Let's see how long it takes them to stick their heads up (morale check). (-5)	Unit is pinned until they reevaluate their situation (read: Morale Check). +5H	All that accomplished was pinning them until they make a morale check. +4H
16-20	You wild shooting scares the enemy, but only because they think you're having some sort of fit. +1H	Where'd you learn to lay down suppressing fire, soldier? +3H	Your scattered fire only takes out one piece of ordnance. They get to pick it, too. +5H – (-5)	You blow away all their mines. They need to make a morale check to see if they think those things are gonna explode.. +3H – (-15)	You destroy two pieces of ordnance, your choice. +5H
21-30	Let's have a morale check, fellas. +0H	They are scared, but little else. Morale check. +0H	A morale check is in order. +2H	Attack causes them to check morale. +5H	Attack is frightening. Morale check. +6H
31-40	Your suppression fire suppresses them, but only for a moment. (-5)	Mediocre attack, at best. +4H – (-5)	Blast causes unit to hit the dirt. +6H – (-5)	Foe take several issues. They are shaken. +6H – (-5)	You inflict multiple casualties, but they're still kicking. +11H (-5)
41-50	Sporadic fire destroys all mines the foes is carrying. Better dump them in case their just hang firing. +2H – (-5)	All demolitions are destroyed. Good thing those don't cook off. +3H – (-10)	Foe's mortar ammunition (and the man carrying it) go up in a brilliant display. One piece of ordnance (foe's choice) is destroyed as well. +3H	You inflict grievous injuries on key squad members. They lose two pieces of ordnance, your choice. +7H	Unit loses all ordnance except for MASK. Good thing to, at least they can hide. +12H – (-10)
51-55	Firepower pins the unit until they make a morale check. +2H – (-5)	Unit is pinned until they make a morale check. The sergeant is shooting something awful. +4H	Unit is pinned until they make a morale check. This is the real thing! +5H	A well-directed attack pins the team until they make a morale check. Is that the sergeant, down? +3H – (-10)	You strike at the entire unit, forcing them to go to ground. A morale check is necessary for them to become unpinned. +14H – (-20)
56-60	Comm gear seriously damaged. Do they have a good tech? +3H	Unit loses it's communications and all missiles or rockets. +5H	A sharpshooter picks of their communications guy. Hope their good at taking initiative. (-20)	Squad loses its comm gear and a piece of ordnance (your choice). (-30)	Unit loses all ordnance. At lease they have their… oh never mind. +8H – (-30)
61-65	Why did we muster for revelry again, sarge? Morale check. +3H – (-5)	You attack catches foe off guard. He must make a morale check. (-10)	Your relentless attack forces a morale check. They know fear. +5H – (-20)	Your attack is masterfully orchestrated. Thinking that they are being attacked by multiple units, they must make two morale checks. +7H – (-30)	You tear into them ruthlessly. Two morale checks would be in order. +7H – (-40)
66	The officer in charge is killed. The team is pinned for a minimum of 3 rounds, after which they can begin making morale checks to try to stick their heads up again. +17H – (-60)	The squads command structure is ruined. Private Wilson, what do we do now, sir? +24H – (-80)	Your fire kills everyone in the squad with a backbone. The rest are gunned down as they route. (+20)	Concentrated fire wipes out most of the squad. The remaining members desert. (+20)	The squad cowers, but there is nowhere to hide. No survivors. (+25)
67-70	A spray of fire pins unit until they make a morale check. +4H – (-10)	Unit must is pinned until the make a morale check. They think you mean business. +5H – (-20)	Effective dispersion fire pins troops until they make a successful morale check. +7H – (-30)	Suppression fire works as advertised. Foe is pinned until they make a morale check. +9H – (-40)	The squad is badly shaken. They are pinned until they make a morale check. +9H – (-50)
71-75	Demoralizing attack causes unit to make a morale check or abandon one piece of ordnance (their choice). +4H – (-20)	In the confusion of your attack, your foe loses all chemical weapons. +5H – (-25)	Attack destroys all of the squads spare ammo. It also destroys chemical weapons and MASK. 2 more rounds, and they're weapons will run dry. +5H – (-30)	Attack leaves squad lost and confused. They lose all ordnance and are pinned until they make a morale check. +10H – (-40)	Application of extreme force destroys all special ordnance. +19H – (-60)
76-80	Discipline falters. The center does not hold. +6H – (-30)	Foe's officer in charge hesitates under your fire. Troops lose their confidence. +7H – (-40)	The volume of fire is simply too much. The squad is torn apart. +11H – (-50)	The troops have a complete breakdown of discipline. Their sergeant attempts to pull them back together. +14H – (-d10 x 10)	You cruelly rip them to pieces. The survivors are badly shaken. Two morale checks are warranted. (-80)
81-85	Light injuries are distributed throughout the unit. +8H – (-40)	You well-aimed attacks cause considerable damage to the unit. +9H – (-50)	You distribute wounds throughout the squad. +16H – (-60)	Several of the squad's troops are incapacitated. +20H – (-80)	All the veterans are slaughtered. If the squad fails a morale check, they are eliminated. (-100)
86-90	The attack is not the best you've done, but it does pin the unit until they make a morale check. +10H – (-50)	Troops must make two morale checks. They are scared and disoriented. +12H – (-60)	Stream of death eliminates the most experienced troops. Unit is pinned until they make a successful morale check. +21H – (-80)	Disrupting firepower kills most of the unit. If they fail a morale check, the unit is eliminated. (-100)	They are eliminated. They call that the Art of War. (+20)
91-95	Squad is scattered. All mortars and equipment are destroyed. Morale check. +15H – (-60)	Squad is thrown into turmoil. They lose two pieces of ordnance, your choice. +18H – (80)	They run, but you cut them down from behind. (+20)	Squad throws down their weapons and runs. Eliminated. (+20)	It could have been prettier, but dead is dead. (+20)
96-99	You manage to kill or injure the majority of the squad. +20H – (-80)	Unit is devastated. Survivors are shot dead while trying to surrender. That was an accident, right? (+20)	Attack kills most of the squad. The survivors are shot crawling away. (+20)	Devastating attack eliminates squad to a man. Unit is no more. (+20)	You butcher them indiscriminately. All units within 100 meters must make a morale check. (+20)
100	Your center fire flushes out the squad while your wings mowed them down. That's a wrap. (+20)	Your determined attack kill s squad to a man. (+20)	You move in light a lightning-fast strike force. Squad is dead before they've even realized you fired. (+20)	You disassemble them without mercy. Ever think of a career as a butcher? All foes within 100 meters are pinned for one round. (+20)	You blast them into little pieces, then kill the bits. Was that really necessary? (+25)

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LARGE & SUPER LARGE VEHICLE CRITICAL STRIKE TABLE VM-A-4.6

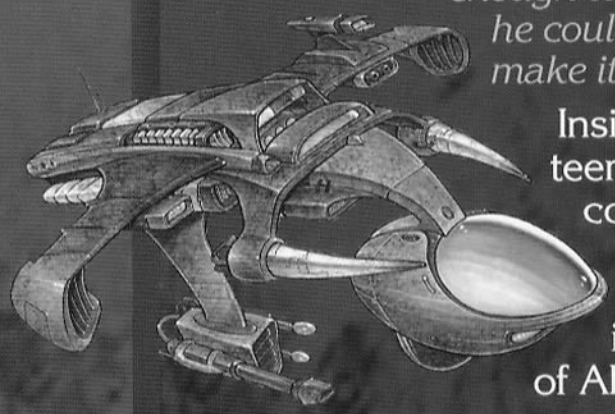
	PIERCE: Large	BLAST: Large	PIERCE: Super Large	BLAST: Super Large
01-05	Deflected raking shots deliver good damage, but in your fervor, you overload the weapon's capacitors. It may not fire next round. +100H	Multiple concussion deliver good damage but the blast overloads sensors. Sensors are at -20 for 6 rounds. +100H	Refracted but determined assault delivers good damage, but your weapon mount jams and is unable to fire for 1-2 rounds. +100H	Blast delivers good damage, but your EW system is momentarily scrambled. EW is at -20 for 6 rounds. +100H
06-10	Not so good. +5H	Weak. +15H	Not good. +5H	Negative. It just impacted on the surface. +30H
11-20	1 random Light malfunction. +10H	Foe is rocked. +30H	This could have been better. +10H	Foe barely feels it. +60H
21-30	2 random Light malfunctions. +20H	1 random Light malfunction. +60H	You aren't even trying, aren't you? +20H	Weak. Very weak. +120H
31-40	2 random Medium malfunctions. +40H	1 random Light malfunction. +120H	Your going to have to do better than that. +40H	Maybe it was a dud. +240H
41-50	3 random Light malfunctions. Light damage reduces drive by 1 G. +70H	2 random light malfunctions. +210H	1 random light malfunction. +H70	Try again. Aim this time. +420H
51-65	1 random Severe malfunction. 10% of cargo is moderately damaged. +110H	2 random Medium malfunctions. 10% of any staterooms are destroyed. +330H	1 random Medium malfunction. Ship loses one workshop and contained CIP. +110H	1 random Light malfunction. +660H
66	Penetrating shot burns through screens and slices armor. Reactor damaged. Vessel operates normally for 20 rounds, then explodes. (+20)	Miraculous point blank detonation rock's foe's vessel. Reactor overloads and will cause a cataclysmic explosion in 30 rounds. Foe's reactor may not be shut down. (+20)	Shocked foe bears the brunt of your well directed attack. Vessel's computers, drives and backups are destroyed. Foe is drifting helplessly. +1,000H – (+20)	Seeing-eye attack detonates just inside foe's hull. 50% crew casualties. With the drives out, the craft drifts for the 60 round it takes to explode. (+20)
67-70	A d10 weapon mounts are knocked out. Moderate damage reduces foes drive by 1 G. +160H	2 random Medium malfunctions. Foe's fighter bay affected by blast: d10 fighters destroyed. 10% crew casualties. +480H	1 random Medium malfunction. Moderate malfunction reduces drive by 1 G. +160H	1 random Medium malfunction. Moderate damage reduce drive by 1 G. +960H
71-80	EW takes Moderate damage. -20 to EW. +220H	Foe's armor shattered. DB is reduced by 10. Moderate damage reduces drive by 1 G. +660H	1 random Severe malfunction. -10 to DB. +220H	1 random Severe malfunction. Foe's armor loses some integrity. -5 to DB. +1,320H
81-90	Screen generator takes Moderate damage. -20 to DB. +300H	Screen generator takes Moderate damage. -10 to DB. +900H	1 random Very Severe malfunction. -15 to DB. 10% crew casualties. +300H	1 random Severe malfunction. 10% crew casualties. +1,800H
91-95	Raking energy beams cause Moderate damage to several systems. -10 to sensors. -10 to DB. -20 to EW. Drive reduced 1-2 G. +400H	Proximate blast cause Moderate damage to multiple systems. -5 to EW. -5 to DB. -10 to sensors. 10% crew casualties. +1,200H	Powerful destructive swath delivers moderate damage to multiple systems: -15 to sensors. –10 to DB. -10 to EW. Drive reduced by 1 G. +400H	Explosion inflicts Moderate damage on several systems. -10 to EW. -5 to DB. -5 to sensors. +2,400H
96-98	Ravening streams of energy destroy sublight and FTL drives. 10% crew casualties. +500H	Localized blast knocks out sublight engines. +1,500H	Cruel beams deliver Severe damage to foe's FTL drive. He ain't goin' nowhere. +500H	Lucky blast knocks out light support and all auxiliary systems. Crew has one hour. +3,000H
99-100	Gruesome, but adept, display of gunnery skill. Ripping strike bores deep into foe's reactor core, destroying the craft in an instantaneous, irresistible fireball. No survivors. (+25)	Hull pierced. Detonation occurs within craft, destroying it utterly in a fleeting instant. (+25)	Your blistering strikes prove irresistible to foe's defenses. Foe drifts, helpless, for two rounds, then explodes. (+25)	Deep internal detonation. Foe's vessel operates for 1-10 rounds, then is destroyed. If attack is apocalyptic, then destruction is instantaneous. (+25)
101-150	Passing shot discharges on the Power Deck. Roll 1-5 Severe malfunctions in the Power area of the Malfunction Chart. +1,000H	Detonation within screens destroys screen generator and causes 1-2 Severe malfunctions to be rolled on the Power Area of the Malfunction Chart. 20% crew casualties. +3,000H	Strike slips through screens before discharging its destructive energy. Roll 1-5 random Severe malfunctions. Cargo takes Moderate Damage. 10% crew casualties. +1,000H	1 random Very Severe malfunction. 30% crew casualties. +6,000H
151-175	Cruel beams tear at Control systems. Roll 1-5 Very Severe malfunctions on the Control Area of the Malfunction chart. 10% crew casualties. +5,000H	Engulfing blast sends deadly concussive wave through control systems. Roll 1-2 Very Severe malfunctions on the Control Area of the Malfunction Chart. 30% Crew casualties. +15,000H	Indiscriminate rays penetrate craft. Roll d10 random Very Severe malfunctions. +5,000H	1-5 random Very Severe malfunctions. +30,000H
176-200	Vigorous attack brutalizes crafts Electronics. Roll 1-5 Extremely Severe malfunctions on the Electronics section of the Malfunction Chart. +10,000H	Multiple internal blasts ravage foe. Vessel drifts inert for 10 rounds, then explodes. 40% crew casualties. +30,000H	Energy tears through armor, reaching foe's internal systems. Roll 1-5 Extremely Severe malfunctions. 20% crew casualties. +10,000H	Your attack delivers 1-10 random Extremely Severe malfunctions to foe's craft. +60,000H
201-250	Attack overloads screens. Follow-up attacks blow through Bridge and Auxiliary Systems. Foe is drifting helplessly with all Computers and Control Areas destroyed. +50,000H	Savage detonation convert foe's craft to scrap metal. Craft destroyed. (+20)	Unbelievably, all major systems are knocked out. Foe is drifting, helpless. And they said it could never happen! +50,000H	Foe overwhelmed by stunning blast. 10% crew casualties. With all major systems knocked out, vessel drifts pathetically. +120,000H
251+	Brilliantly orchestrated attack! Not surprisingly, craft begins to disintegrate. It explodes after drifting helplessly for 1-5 rounds. (+25)	Foe's craft internalizes destructive energy, then disappears in a tremendous explosion. (+25)	Simply put, the beam penetrates the reactor and detonates core. Vessel explodes in one round. (+25)	Strangely, foe's vessel seems unaffected by powerful blast. However, every round brings a cumulative 1% chance that the vessel explodes in an apocalyptic display. (+25)

SPACEMASTER™

VEHICLE MANUAL™

Havagract reversed the polarity on his drive, rocking forward as the inertial dampers fought to keep up with a sudden blast from his foe. His control panel exploded in a shower of sparks. Not good. All his weapons were redlining, and damage control had failed to reroute power. He had to get far enough away from the planetary atmosphere to kick in the quantum drive.

He brought the craft into a tight orbit. His pursuers might be faster, but all objects orbit at the same rate, and only Havagract would be foolish enough to attempt a close forced orbit around a gas giant. If he could come out with enough of a lead, he just might make it...



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