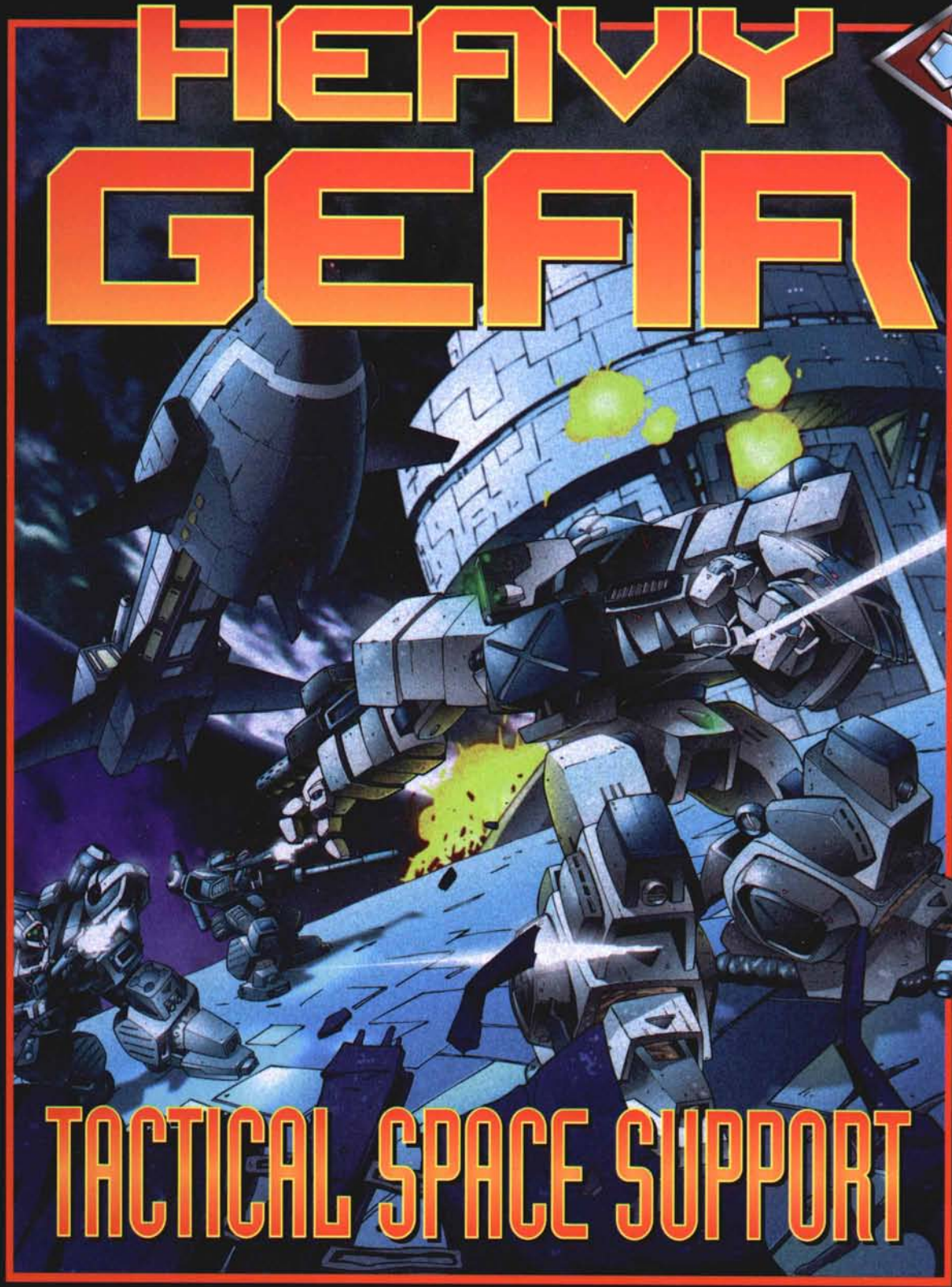
SPACE COMBAT RULES

DP9-060

HEAVY GEAR



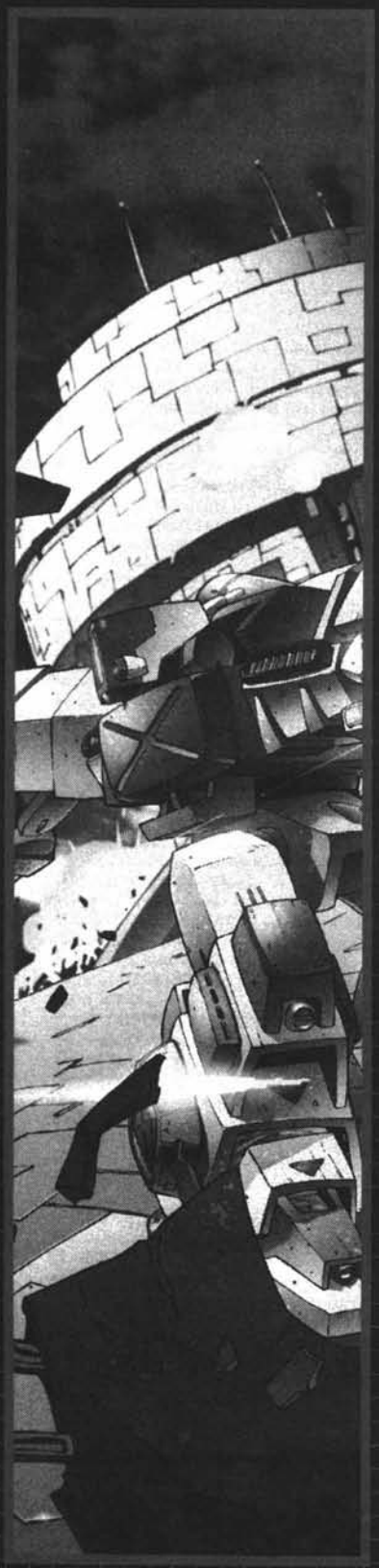
TACTICAL SPACE SUPPORT

SPACE WARFARE

A TACTICAL RULES SUPPLEMENT FOR THE HEAVY GEAR UNIVERSE

HISTORY · GATES · OUTPOSTS · SPACE STATIONS · SPACE ORGANISATIONS · SENSORS AND COMMUNICATION · LASER COMM · OFFENSIVE SYSTEMS · DEFENSIVE SYSTEMS · SANDCASTERS · LOW-GRAVITY TOOLS · TELEOPERATORS AND REMOTE CONTROLS · SPACE SUITS · SURVIVAL EQUIPMENT · PHYSICS OF SPACE FLIGHT · CLIPPERS · HEAVY LIFT VEHICLES · SCRAMJETS · SHUTTLES · SPACE STATIONS AND BASES · SPACESHIPS · GATESHIPS · ESCAPE AND SURVIVAL VEHICLES · SPACE MINING · SHIPYARDS AND ORBITAL FACTORIES · SPACE COMBAT · ADVANCED SENSOR OPERATION · BOARDING ACTIONS · CONTINUOUS LASER FIRE · LOW-GRAVITY STRUCTURES · ORBITAL ARTILLERY · SPACECRAFT TECHNOLOGY · BURN POINTS · WEATHERING IN SPACE · FUEL, POWER AND REACTION MASS · ATMOSPHERE & PRESSURE · RADIATION LIFE IN SPACE · CREWMAN · MARINE · OFFICER · SPACER · HISTORY · GATES · OUTPOSTS · SPACE STATIONS · SPACE ORGANISATIONS · SENSORS AND COMMUNICATION · LASER COMM · OFFENSIVE SYSTEMS ·

DREAM POD 9



HEAVY GEAR™

Behind the Scene

Most science fiction games take space travel and spaceships in general for granted. The heroes will be able to jet from one planet to the other in style, and few give any thought as to how their rides are propelled and how they navigate from one planet to the other.

Heavy Gear is a different case. From the beginning, the game has been designed around very sturdy design principles extrapolated from present day science. Whenever possible, elements have been studied to ensure that they made sense, that they felt right. Our handling of space travel in the Heavy Gear universe needed to receive the same degree of attention and perfectionism.

Despite the common public perception (and our own wishes, we must admit), space is not just the beautiful, infinite new frontier portrayed in most science fiction shows. It is an hostile realm, where temperatures range from just above absolute zero to many millions of degrees Celsius; where hard radiation, immediately lethal to the unprotected human body, are commonplace; where there is no atmosphere to breathe, and where carelessness has fatal consequences.

Perhaps one day, our technology will be good enough to create extremely thin spacesuits that seal themselves at the slightest rip, or computers that are able to throw forcefields to protect against any danger. It is even conceivable than the human race will find a way to modify its own bodies to make them impervious to the rigors of space. No one knows. So, in the meantime, we represented space as one mean and dangerous space, and it felt right.

Heavy Gear is very much patterned on ancient history, as you'll note from our choices of names, places and plots. Curiously, an historical parallel was found for space travel as well. In the Heavy Gear universe, space is much like the seas of old: useful, dangerous and yet somewhat alluring to a hardy breed of men and women. It is a source of great riches, if one is willing to follow the rules and work hard in difficult conditions. It is a place where death lurks at every corner, but also where incredible beauty and tranquility lies open for all to see. The spacers are to the 62nd century what the mariners were to the last half of the second millennium.

So whatever you do, don't forget to check your suit before stepping out of the airlock.

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DEDICATION

NO NEW FRONTIER IS OPENED WITHOUT THE LOSS OF HUMAN LIVES. THIS BOOK IS DEDICATED TO THE MEN AND WOMEN WHO HAVE LAID DOWN THEIR LIVES TO GIVE US THE STARS.

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First Timer

Arn let go of the handle uneasily. It was his first time in space, and his inner ear was still rebelling against the absence of gravity. He tried to reach the next handhold, but he misjudged his swing and overcompensated, missing it by mere centimeters. His clumsy movement only set him slowly rotating across the compartment.

"Watch what you're doing, boy." The burly cabin steward, dressed only in a spacesuit inner liner, caught him with one hand and swung in back toward the wall of the compartment with practiced ease. The velcro patches made a scratching sound as they helped Arn grabs unto his new perch.

The young man's stomach tried to climb up his throat; he managed to force it down again by an effort of will, but the exertion left him pale and sweating. He closed his eyes for a moment and tried not to move, just like they taught him in basic training. It sounded so much easier and exciting then.

"Don't worry, kid, you'll get over it. Sometimes it takes a day or two to get used to. Until then, better not eat too much." The steward laughed at his own joke and moved out of the compartment and into the cockpit airlock with a well practiced push.

The older workers, casually floating in the rear section of the cabin, shook their heads in approval. They all had had more or less the same experience when they had first left the planet where they had spent all their lives to enter the dark airless void of space. It was a sort of rite of passage, to test the worthiness of the new arrivals.

An older man, busy looking over his spacesuit, scowled. "You'll have to grow out of it soon, though. The next missed handhold could easily send you on your way to Caprice, the old-fashioned sub-light method."

Another spacer, his suit covered with work patches, piped up. "Yeah, and not everyone here might be willing to spend the fuel to go get a clumsy space walker."

The cabin bursts into riotous laughter, though Arn did not join in. He was too busy holding down his lunch.

A warning klaxon cut the laughter almost immediately; everyone casually reached for the nearest handhold. Arn followed suit within a few seconds, just in time to avoid being thrown against the forward bulkhead. The shuttle seemed to stand on its nose for a second as the retro-thrusters worked ferociously to cut its velocity.

Arn, his position more stable now, looked through the starboard porthole. Although the shuttle bringing him was slowly rotating to help radiate the heat from Terra Nova's brilliant, yet distant sun, he still couldn't see the edge of the gigantic Gateship.

The steward reappeared in the door. "We've arrived. Check your suit — buddy system — and file out."

Arn carefully checked the suit of his partner. He was moving to the backpack when the spacer grabbed his hand.

"You missed a valve. See, it's open," the man pointed out, matter-of-fact. Arn nodded gratefully, glad both that his partner was more vigilant and not vindictive.

"Good thing you caught it. I'm sorry, I'm not..."

"Save it. Just don't forget. You'll learn in time." The spacer added to himself, "or die trying."

He just hoped the kid wouldn't take anyone with him if that happened.

SPACE TECHNOLOGY - 1.1

Interstellar space travel is a fact of life for the humans of the 62nd century. Their ancestors came to new worlds via the Gates, faults in the time-space continuum that allowed gigantic transport vessels to leap thousands of light-years away in a brief instant. Everyone has seen, at least once in their lives, a newscast of a spaceship gliding through the darkness en route to a patrol or a friendly outpost, and though few people ever get to visit space, all know about it.

Despite advances in technology, space remains a dangerous place, hostile to all human life and unforgiving of the slightest mistake. It has no atmosphere to breathe or to shield oneself from the heat and radiation, and no pressure to keep the body's fluids from boiling off and evaporating within minutes. Each and every life-sustaining act, taken for granted by all on the ground, requires the assistance of some kind of machinery. Only the brightest and most-level headed may survive here.

The great majority of Mankind, unfortunately, is not suited to such a life. Stressed and space-sick, they can stand space travel for only a short time and constantly long for solid ground beneath their feet and clear sky above their heads. The visionary giant station projects of the twentieth and twenty-first centuries never came to be; efforts were made instead to find planets that would resemble Earth, and which would eventually become the new homes of Mankind.

Not all intentions are peaceful as far as the use of space is concerned, however. Military doctrines dating as far back the earliest organized warbands dictated that to hold the high ground was to hold victory, and space is the ultimate high ground. He who controls space sees all and can attack all. As a result, all Terranovan powers maintain at least token manned forces in orbit and prudently stock numerous anti-sat weapons and orbital killer armament, both of which have served well to repel the CEF invaders. Unknown to most, they may be called to do so again in the future as a new era of inter-colonial interaction dawns on the 62nd century.

Role of Space in Heavy Gear - 1.1.1

Unlike in most conventional science-fiction universes where space travel occupies a prominent place, such is not the case with **Heavy Gear**. Here, space is a dangerous void ready to engulf the unwary and the ill-prepared. It is a deep and dark place that separates the colonies of Mankind from one another, and which must be traveled and visited from time to time.

For the inhabitants of the **Heavy Gear** universe, space is much like the seas of old: useful, dangerous and yet somewhat alluring to a hardy breed of men and women. It is a source of great riches, if one is willing to follow the rules and work hard in difficult conditions. It is a place where death lurks at every moment, but also where incredible beauty and tranquility lies open for all to see. The spacers are to the 62nd century what the mariners were to the last half of the second millennium.

Book Content ◆

The main objective of this book is to cover the basics of space travel and related occupations in the Heavy Gear universe. Detailed accounts of the organizations and the installations present in the Terranovan system have been included, along with overviews of the various space technologies in use in the 62nd century.

The first chapter opens with a brief history of space travel from its humble beginnings in the remote twentieth century all the way through the discovery of the Tannhauser Gates and the subsequent colonization of the colony worlds. The second chapter examines the hardware that makes living in space possible, including electronic systems and computer devices. All tools, from the measly reaction-balanced hammer to the most complex space suit, is given at least a cursory look.

The third chapter is devoted entirely to spacecraft and other space constructs such as ground to orbit Vehicles, Gateships, escape vehicles, shipyards and orbital factories. Everything, from traveling to construction and design, is examined and discussed. This chapter also briefly covers space mining and shipyards.

The fourth chapter is dedicated entirely to space-related rules. It includes the basic space movement and combat rules for spaceship combats as well as advanced rules for special maneuvers and situations, such as re-entry and gravity whips. The last section of the chapter deals with the more human side of space, namely the maintenance and life support rules.

The fifth chapter, *Gamemaster Resources*, is contains space-related archetypes and adventure seeds. The chapter is rounded off with several Terranovan spacecraft designs.

1.2 - HISTORY OF SPACE FLIGHT

Mankind first ventured into space in the late part of the twentieth century using crude chemically-propelled rockets to perform short hops into Earth orbit and, later, to the Moon. Space flight technology remained more or less stagnant through the Information Age, as the various governments of the planet concentrated their efforts on competing commercially rather than scientifically.

A renewed interest in space exploration brought on the historical period known as the Space Age in the middle of the twenty-first Century. The first truly permanent space outposts date from this time, as do the first manned missions beyond the Earth-Moon system. A wealth of probes were also sent out during this period. It was not until near the end of the Ice Age, however, that manned ships were aimed, not at a destination within our solar system, but beyond. There were a few failed experiments with giant sleeper/generation ships and other primitive technologies. The key to interstellar travel was discovered as the ice was retreating to the poles, but it was not applied until much later.

Exploration was followed by settlements, which were followed by disillusion. Space was an hostile place, which could kill mercilessly. The attitude of Mankind toward space travel soon echoed the seafaring model of old, with the spacers being the new mariners and the masses taking one-way trips in cramped and miserable conditions in the hope of reaching a new shore to build a better life for themselves. This model has perpetuated itself to the 62nd century, but it did not start right away.

1.2.1 - The Space Age (2218-2421)

Many have argued that the Space Age began with the launch of the first man into orbit, but modern historians generally agree to identify as the "Space Age" the period starting in 2218 through the early twenty-fifth century. The year 2218 marked the launch of the PSC *Edison*, the first privately owned spaceship. While this hardly seems like a historical milestone, it was a key transition point: before that time, spaceships were only fielded by wealthy countries and corporations, and crewed by a select few. From 2218 on, space belonged to any individual capable of affording and operating a space vehicle. This created a new surge of excitement in space, and within a few decades numerous industrial and scientific outposts dotted the planets and moons of the Solar System.

With the establishment of permanent inhabited stations came a new age of prosperity and scientific development. Although the stations were not entirely self-sufficient, they were able to survive on their own for extended periods of time, using resources mined from the occasional asteroids or by recycling older technology. The Space Age was a golden age for humanity as science and technology advanced to heights previously thought unattainable.

Like the Information Age, the Space Age was rather quiet. The only major conflict of the period was the Martian Revolt of 2304. The red planet had become a self-supporting colony in the late 2290s. The Martian population soon grew angry over the lack of support and the constantly increasing mineral quotas and taxes levied on them by the governments of Earth. On March 15, 2304, they declared their independence, announcing that they would rather fend for themselves than give their resources to off-worlders. The ensuing conflict was bloody and lasted for over eleven years, claiming millions of lives. It raged on and off the red planet before Earth finally recognized Mars' independence.

For the first time in history, spacecraft were extensively used to ferry troops and instruments of war. Though the governments of both planets preferred to use local partisans and produce their weapons locally to cut on transit time and shipping costs, ships often transported loads of guns and ammunition, along with troops in cold sleep, to battlefields millions of kilometers away. Not all these vessels made it to their destination, victims of deep space weaponry or more simply, technical failures; derelicts and hulks, ghostly reminders of a conflict long past, continued to drift into the solar system's space lanes well into the millennium.

1.2.2 - The Ice Age (2422-4475)

The year 2422 marks the official historical beginning of what is now known as the Ice Age. It was not the first, nor will it be the last, that Earth had known, but it was the first one to hit the Earth since the rise of human civilization. The human race's first reaction to the advancing glaciers was slow emigration towards the equator where people thought they would be safer (and warmer). Inevitably, conflicts arose between the immigrants and those already established there.

In space, the situation was bleak. Cut off from a steady supply of goods, food and trained people, the space stations fared poorly. Although almost all were self-sufficient, the technology to make them perfectly closed ecosystems simply did not exist. As a result, losses and accidents, although rare, took their toll over time. In addition, many installations were simply shot down by killer satellites and ground-based missiles when they attempted to influence the Emigration Wars on the ground.

The stations held out as long as they could, but most were eventually forced to close down and send their people back to Earth. The settlements on the Moon, on Mars and in the Asteroid Belt fared somewhat better, but never expanded, being too busy with the simple day-to-day operations necessary for survival. Of those three, Mars fared best since it was already self-sufficient.

Space Experiments

The ice slowly covered the planet below as the masses of Mankind huddled in the comparative warmth of the Equatorial regions. From space, the situation looked particularly dramatic; the increased albedo (reflectivity) of the Earth's surface, caused by the ice and snow, simply compounded the problem, reflecting the light and heat back into space. Soon, it became credible that the entire planet would be engulfed under a blanket of solid ice that would last for millennia.

The surviving space settlements started an ambitious deep space reconnaissance program in an effort to discover new worlds, should it prove impossible for their inhabitants to return to Earth. Nearly a hundred probes were carved out of small asteroids, equipped with fusion engines and navigation systems, and sent out at sublight speeds toward the planets identified by the large long range telescope arrays already in orbit. The probes would accelerate to 12% of the speed of light and then coast until they reached their destination. About one fourth of the probes signaled back, only to report that no inhabitable planet lay near the solar system. Although the final probe model could reach nearly 23% of light speed, the program was abandoned a few years later as more pressing problems drew away the attention of the scientific community.

The North American States tried to build orbital solar reflector satellites in an attempt to slow and perhaps turn the advance of the ice. Although test trials were encouraging, the first full-scale arrays caused wild climatic effects of a poorly understood nature, probably due to localized hot spots created at the satellites' target points. The superheated air along the path of the beam gave birth to savage tornadoes and created warm fronts which would in turn cause erratic and extreme precipitation. The program was abandoned until scientists could figure out how to prevent these weather patterns. The arrays laid dormant in orbit until 2689, when they were destroyed by killer satellites to prevent them from being used as weapons in the emigration struggles.

The Argo Project

Midway through the Ice Age, a new world alliance was formed. Arrogantly named the United Earth Government (UEG), the alliance was nothing more than a formal accord between the many communities that populated the equator of the Earth at the time. The UEG was generally regarded as yet another bureaucratic monstrosity which generated countless reports and suggestions, but few useful courses of action. The Argo Project, implemented in 3136, was a notable exception to the UEG's impotence.

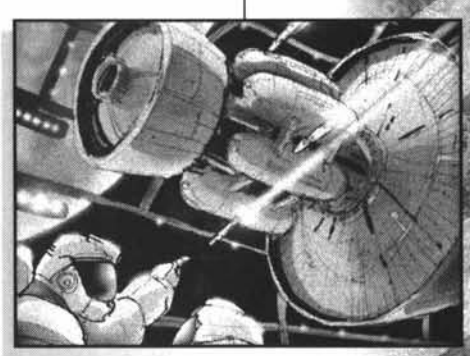
Many believed that the planet would be totally enshrouded in ice in the next few centuries, with no sign of the trend reversing. The only means of survival for Mankind was to leave. The probe experiments of the space colonies had already indicated that although no habitable planet existed nearby, long space voyages and generation ships were definitely within the realm of possibility.

The small mountain arcology of Lake Kennedy, in the Sierra Nevada region, was chosen as the site of the main dry-docks for the construction of long-ranged spacecraft. It had all the facilities needed, along with an ample supply of raw materials to work with. Its geographical situation made it easier to build vessels and launch them. Ice from nearby glaciers provided the large quantity of necessary reaction mass.

Five Argo ships would be constructed and launched during the next 250 years (3136-3387, roughly 1 ship per 50 years). They were aimed for stars that offered short travel times and very high probability of habitable planets. None of the five ships was ever seen or heard from again. Some suggested they were destroyed by a design flaw, others thought aliens captured them, but no clues as to what happened to the Argos were ever found. After waiting for a signal for 300 years, Earth simply gave up and turned its attention inward once more.

Argo Ships

The Argos were massive STL (slower-than-light) nuclear ramjet vessels, of a mixed generation/sleeper type. They were the peak of human space technology of the time, able to reach 99.999% of the speed of light by continuously applying up to 0.4 gee acceleration. A powerful magnetic field funneled particles that strayed into the path of the vessel, fueling the enormous fusion furnace. The crew was protected from this intense energy field by the ship's heavy shielding. Each vessel's frame was constructed in the arcology's artificial lake, which was emptied to allow the hull to be launched into orbit by solid-fuel rockets and plasma drives. The construction of the ships was then completed in space. The Argos were crewed by young volunteers who would rotate shifts to spend time in hibernation. The cryogenic technology of the period could not prevent DNA and tissues degeneration for longer than a few decades, forcing the crew to live out of stasis for extended periods. Each ship was expected to develop a whole society as the people within lived, loved and died while their vessel sped toward the stars.



INTRODUCTION

A Strange Anomaly

Although the world would not know it until much later, the year 4318 saw an unexpected development that would change the face of history and the fate of the human race as a whole. After centuries of isolation, humanity was once again turning its attention to the stars above.

The discovery of the phenomena that would later be called "Tannhauser Gates" was made possible by extensive space observation programs. Their use as a means of faster-than-light travel was based on theoretical researche performed during the Ice Age on methods of interstellar travel as an option to escape the ice-encrusted planet. Although the Gates themselves were thought possible as far back as the twentieth century, their discovery in space sent a tremor through the scientific world.

In 4318, a team of astronomers testing a new, highly sensitive, space-based radio telescope array detected a strange anomaly just outside the solar system. The science vessel *Starseeker* was sent out to examine it. The anomaly was similar to a Schwartzchild discontinuity and occupied a single point-like area of space, orbiting an area no bigger than a square centimeter. It was first mistaken for a dying black hole, as it shared many of a black hole's characteristics. However, further investigations showed that the pattern of emissions of sub-atomic particles was all wrong and much too limited, so the black hole theory was out.

For the next forty-nine years, team after team of researchers studied and tried to manipulate the anomaly with various energy fields and beams. The scientific community was divided over the possible consequences of such research. According to the most popular pessimistic theories of the time, such an anomaly, if tampered with, could start a chain reaction that would destroy the very fabric of time and space. Other theories described space-time anomalies as the means to unravel the secrets of the universe.

On November 9th, 4367, a group from the Sagan Institute of Science (SIS) directed a drone vessel to fire a high intensity beam directly into the fault to measure the feedback radiation (if any). Much to their surprise, the anomaly emitted a bright light followed by a glowing energy cloud. The power supply of the drone exploded from some unforeseen strain, propelling it forward directly into the cloud. Seconds later, the cloud collapsed on itself in a flash of light, releasing heat and low levels of radiation. The damaged drone later reappeared one light-year away, proving that faster-than-light travel was within humanity's grasp. However, the theory behind such a wonder was still unknown.

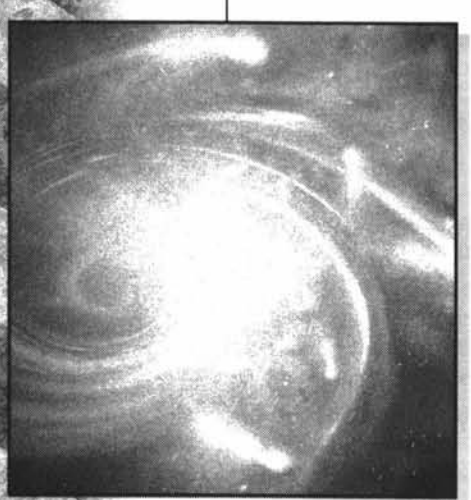
The Tannhauser Phenomenon

Using data gathered from the bizarre experiment, Professor Markus Tannhauser developed a unified field theory which was published in the book "Principia Universalis." He practically rewrote modern physics, explaining time-space anomalies and their potential as spatial wormholes. Applying Tannhauser's insights to the technology of the SIS probe, scientists began to develop the first experimental Gatedrives. Scientists from all over the Equator looked at the data and made comparative experiments for decades.

The calculations involved very complex derivative equations of the Unified Relativity Principle in ways that even Einstein and Hawkins could not imagine. Indeed, without the raw mathematical power of super-conductor, neural-based computer systems, the problem might never have been solved. Even then, its resolution was made possible only by abstracting the gravitational effect of nearby bodies such as planets and stars.

The newly discovered space phenomenon was christened a "Tannhauser Gate" in reference to Markus Tannhauser. A few historians pointed out that his name coincided with some obscure pre-Ice Age space phenomenon theories, although more than one scholar has debated that the "theories" were, in fact, popular fiction.

Tannhauser Gates



A Tannhauser Gate is a spatial discontinuity, a tiny point in space like a miniature black hole, only with a gravity field hundreds of times more powerful than its size should allow. This gravity field bends space to the degree that it folds back upon itself, creating a consanguinity between two distant points. A Gate is a fault in the space-time continuum, a tiny point in space where the fabric of reality is "thinner" than usual. It is thus possible to force open a rift by supplying specially-modulated energy waves to raise the energy level of the Gate and cross the "Opening Threshold." This threshold is normally impossible to attain in normal space, even if using the much-theorized anti-matter powerplant: the energy requirement is just far too great, exceeded only by the most powerful black holes (of course, Gates created this way are pretty much useless because of the black hole's tidal stress). The weakened point of the Gate, however, lowers the threshold and enables the opening of a temporary wormhole to distant locations.

Gates are relatively common, but those with low energy thresholds – low here being many terawatts of energy – are few and hard to find. There is usually between one and three Gates of various energy levels within a light-year of most stellar systems. The presence of a large gravity well, such as the one caused by a star, seems to "pull" at the fabric of space, weakening it and creating conditions propice to the appearance of the Gates.

The 2nd Renaissance (4476-4587) - 1.2.3

Ironically, the discovery of faster-than-light (FTL) space travel happened much at the same time as the ice began its retreat from the surface of the planet. The official end of the Ice Age is 4476, the year when the mountain arcology of Lake Kennedy was reclaimed from the ice. Lake Kennedy had been abandoned shortly after the completion of the Argo Project many centuries before, and it seemed appropriate to choose it as a symbol of Mankind's survival.

As the land became once again able to support a large population, resources were diverted to the construction of spaceports and the re-establishment of regular communication with the orbital colonies. There was never a complete break in relations — a few shuttles and supply rockets came and went throughout the Ice Age — but only now could a serious effort be made to recolonize space. The space colonies were slowly reestablished and repopulated. The first station to be reopened was Space Island One in 4489. After the three Space Island stations were brought on line, the smaller, more advanced Hope series of space stations were established.

The Human Concordat, a supra-national organization intended to guide the development of humanity as a whole, was formed in 4503. As Earth began to expand its influence over space, the old pre-Ice Age space colonies of the Moon and Mars gained membership in the Concordat.

The Interstellar Age (4588-5103) - 1.2.4

After a century of pondering Tannhauser's revolutionary ideas and experimenting with primitive wormhole technology, Earth's scientific community finally developed a reliable Tannhauser Gatedrive in 4582. Under the auspices of the Human Concordat, the first large scale gating experiments started in 4588 with the launch of the *Vanguard* series of automated Gatedrones. The scientists were not yet sure that human beings could survive the transition through the severe gravity distortion of the Gate. For this reason, the first few hundred flights were completely automated, sometimes transporting plants, insects and animals. In addition, the guidance systems of the early vessels were quite crude, resulting in a large number of misdirected and lost ships.

With time, the Tannhauser theory was perfected and better understood. The Gates were not so much "holes" as tunnels created by the deformation of the fabric of space. This new understanding made the whole process of Gating safer, and in January of 4650, a team of military pilots crossed the Gate in the HCS *Keldysh*, the first manned Gateship ever built.

The team found itself just outside a binary star system that was highly unfamiliar. The starscape was wrong, as if they had dramatically shifted positions. Then the ship's navigator suggested they try correcting the star chart by adjusting the stars' positions for drift. Once the computers managed to determine their position, the team members were shocked to learn that they had traveled nearly 7700 light years in just under a minute.

After spending nearly a month studying the immediate vicinity of the emergence point — and waiting for the fusion plants to recharge the Gatedrive's large superconducting capacitor banks — the ship initialized the Gate opening sequence once more. In no time (literally), the Keldysh was back in human space. A new era had just begun.

The Exploration Years ◆

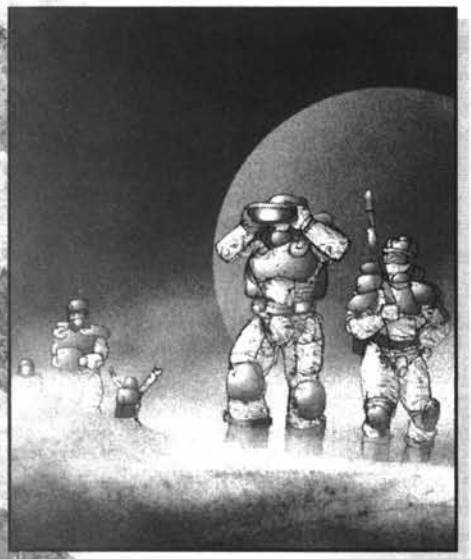
Much to humanity's dismay, Portal, the binary system discovered by the *Keldysh*, had no planets that could be colonized by human beings. Within a few years, an automated station called Port Haven was built within a hundred kilometers of the anomaly. Its purpose was to serve as shelter, storage area and base for further exploration of the Portal system. It relied entirely on external supplies from unmanned, one-way Gatepods, which were usually sent or carried back by the next manned Gateship.

Portal, however, had another Tannhauser type anomaly. Thirteen years later, a new Gateship entered this second anomaly and discovered a G5 star with an almost Earth-like planet within its life zone. The planet, dubbed Caprice due to its eccentric orbit, was only marginally habitable. Its unusual orbit produced extreme seasonal temperature changes. A younger planet than Earth, it was still subject to strong tectonic activity and its jagged crust concealed mineral wealth beyond belief. Scientists flocked to study this new discovery and research stations mushroomed on the surface of Caprice.

Three years after the colonization of Caprice began, a ship surveying Caprice's solar system detected a second anomaly in the fabric of space, then a third and a fourth. By the end of the survey, over fifteen Tannhauser-type anomalies had been detected within 100 astronomical units (AU) of Loki, Caprice's sun. Suddenly, humanity had a host of new paths to the stars to explore.

After nearly one hundred years of exploration, a second colonizable world was found in early 4752 (Autumn -1 TN). Christened Terra Nova, the world completely flabbergasted the scientific community. Whereas Caprice had the beginnings of alien life, Terra Nova teemed with it. Terra Nova was a hot world with an atmosphere nearly identical to Earth's. Its diversity of biological organisms rivaled humanity's homeworld. With the discovery of Terra Nova and the subsequent colonization of Caprice, humanity began to regain faith in the future. Humanity's third great Golden Age was dawning.

1.2.5 - Colonization (5104-5237)



When a Tannhauser anomaly which connected Terra Nova and Caprice directly was discovered in 5102 (TN 490), plans for the full scale colonization of Terra Nova were set into motion. In 5104 (TN 493), the first dedicated colonization ship arrived on Terra Nova. It carried both exploration teams and settlers, all held in cold sleep in the ship's cargo holds to reduce the logistic requirements of the year-long voyage.

While the Human Concordat operated the Gateships that brought explorers and colonists to Terra Nova, it was consortiums of major corporations that footed the bill for the colonization effort. Titles to various regions of Terra Nova were sold to the consortiums to cover the enormous costs of constructing and operating Gateships. With Earth rapidly becoming overpopulated once more, millions of people volunteered to colonize a green, untouched planet. They would be put in cold sleep in large groups and boosted in orbit like stack logs to await patiently the next available transport. Not all survived the difficult voyage, but many were willing to take the risks to create a better life for them and their descendants.

Terra Nova became a symbol of hope for Earth. Originally, colonists would be rotated on 10-year shifts. Two space ports were built on Terra Nova to handle all the increased traffic. Port Aurora was established near the north pole, and Port Oasis was built far in the southern hemisphere on the shores of Lake Esperance, the planet's only large surface body of water. The space ports served as the center of trade and commerce for all colonists, regardless of their corporate, guild or consortium affiliations.

1.2.6 - The Outer Colonies (5373-5798)

With the development of second generation Tannhauser drive mechanisms in 5238, new frontiers were suddenly opened up to exploration. The newer drives, thanks to advance in plasma and sub-quantic physics, were more powerful and accurate than the previous models, being able to react faster and with more precision to minute changes in equilibrium within a Gate's energy state. Numerous weaker anomalies around Caprice, long mapped but previously unusable, could now be used as full-fledged Tannhauser Gates. The system began to serve as a gateway and way station for interstellar travelers, and by the mid 53rd century, a new phase of colonization of Caprice began in earnest.

The first stage of what would be called the second wave of exploration consisted of unmanned long-range Gatedrones launched from Caprice to investigate the numerous star systems linked to its many Tannhauser anomalies. These automated vessels were sent out to explore new star systems and find new Tannhauser anomalies (if any); after a few years of exploration, the Gatedrones returned to Caprice to report their discoveries. Whenever an Earth-like planet was discovered, a manned Gateship was sent to investigate.

In 5392, this systematic method of exploration led to the discovery of a fourth habitable planet. The new world was almost completely submerged under one massive ocean, making it impractical for colonization or mineral prospecting. One year later, the Kincaid Aquapharm Consortium made a bid to purchase the entire planet. Dubbing it Atlantis, Kincaid Aquapharm began an experimental terraforming project which by 5421 transformed the water world into a planet-wide aquatic farming colony. Two years after Kincaid's purchase of Atlantis, another habitable planet was found. By the end of the year, this new world had been purchased by Sandrakar-Xia Interworld and christened Home. After a short terraforming period, Home became the headquarters of the huge conglomerate. Within two hundred years, the planet was established as a completely autonomous colony.

◆ Colonial Expansion

Bolstered by these early successes, the Concordat and the corporations pushed for continued exploration. Fifteen years later, in 5410, a sixth habitable world was discovered. It would eventually be purchased in 5430 by the Church after a lengthy legal battle and renamed New Jerusalem before being open to colonization.

The 55th century saw the discovery and colonization of four more planets after that. Eden was discovered in 5428 and purchased by Udunar Corporation in the same year. In 5435, the Concordat Deep Space Explorer Corps discovered a young and barren rocky world whose surface seemed prime for terraforming. Purchased eight years later by the Wilder-Grosz Group, Utopia became a model colony. Discovered in 5442, Botany Bay was deemed to be only marginally habitable. After a ten-year hiatus, the Concordat gave up on selling the planet and focused on discovering other worlds to colonize, turning the lifeless rock into a prison planet. For centuries thereafter, the planet became a dumping ground for the undesirables of society, who were ferried aboard converted cargo vessels under miserable conditions.

Discovered in 5491, Jotenheim was the last planet colonized by humanity. Only one group, the Colonial Cooperative, was able to place a bid on the planet. Composed of dreamers and adventurers, Colonial used its remaining assets to transport and establish its shareholders on their new world. Wary of corporate attempts to acquire parts of their planet, Jotenheimians soon gained the reputation of being xenophobic, and few visited the system in the years following the establishment of the colony.

The Colonial Wars (5798-5846) - 1.2.7

While the colonial period is often seen in a heroic light, this period was very taxing on humanity's mother planet. The Human Concordat had subsidized the entire colonization effort for centuries. As the revenue from the sale of newly discovered worlds decreased, the average Concordat taxpayer was forced to shoulder an increasingly larger share of the expense of maintaining the Concordat's expensive fleet of Gateships and sub-light transport vessels. Compounding matters, an ever-increasing number of Earth citizens were emigrating to the various colonies to avoid Earth's crushing overpopulation and heavy taxation. This out-migration added to the transport burden of the existing Gateship fleet while reducing the taxpayer base paying for the system. By the mid 58th century, Earth's economy entered a massive depression.

In 5790 (TN 1454), Earth's political climate suddenly turned sour towards the colonies. Practically overnight, the massive subsidies that fueled interstellar shipping were cut, denying the colony-sponsoring companies their required transportation network. A series of legal maneuvers failed to reestablish the subsidies; becoming desperate, the colonial consortiums offered to buy a number of Gateships and establish their own transport system. The Concordat bowed to popular anti-colonial sentiment, rejecting all offers to purchase the Gateships by declaring them to be restricted military technology. While a few desperate companies managed to hijack a small portion of the Concordat Gateship fleet, the majority of the ships were mothballed in orbit around Jupiter, preserved for future needs.

The Age of Isolation (5791-6118) - 1.2.8

The colonies were cut off from Earth in nine short months. The last Gateships to Earth were crammed full of people who wanted to return at all costs. It was an ugly sight, as many used connections, blackmail, bribery and even outright force to secure themselves a place on the departing ships. Life would have been a never-ending struggle for those left behind if the departing ships had not cleared their cargo completely to make more room for people. This equipment, food and supplies, combined with the resources already on the colonies, enabled the ex-colonists to have a viable future.

With the collapse of the Human Concordat, Caprice nearly fell with the ensuing anarchy. High ranking officials, including political executives, abandoned their responsibilities and fled for Earth aboard the last ships. It was a time of stupid desperation: in one incident, a band of refugees tried to flee with three unfinished ships from the Monolith orbital shipyards. The planetary defense platforms orbiting Caprice had little choice but to shoot them out of the sky when the ships threatened to crash back down on the planet and its cities.

Just before all contact with Earth ceased, streams of refugee ships passed through Loki on their way to Sol. Many could not make the final leg of the journey because they lacked the finances to go further, others wanted to go elsewhere to escape the poverty gripping their world, while some simply missed the last Gateship. Whatever the reasons, Caprice experienced a sudden influx of several thousand refugees from other colonies.

The colonies did not give up on the idea of interstellar trade and contact, but local needs and several setbacks severely limited their actions. A little over a dozen Gateships were left in the colonial systems (or were rapidly completed after Earth's withdrawal), most of them under Caprician control. Unfortunately, the Capricians had to convert most of them to ship water from the local asteroid belt to their parched planet. When they did attempt to send an envoy to Earth a few decades later, paranoid Concordat forces crippled their ship. Despite this, limited trade continued with the other colonies, including Terra Nova. Utopia was visited at regular interval until a devastating war engulfed it, while Atlantis proved almost xenophobic in their dealings.

Caprice temporarily suspended trade with Terra Nova in 5988 (LC 231) when a Gateship crew inadvertently brought St. Vincent's Plague to the Loki system. The Plague was fortunately contained to the Liberty space station near Loki Gate XII. As Capricians had no natural defenses against Terranovan diseases, the corporations quarantined the station. Trade with Terra Nova would eventually resume (in a much more limited fashion), however, and ships traveled the gates between the two worlds (and between Caprice and Atlantis) every decade or so up until Earth reappeared.

The Earth Invasion: Caprice (6115-6118) - 1.2.9

While the former colonies evolved into distinct societies, Earth went thought a period of deep upheaval and strife. The New Eurasian Commonwealth (NEC) gained the upper hand in early 6101, uniting the planet and renamed itself the New Earth Commonwealth. Led by an expansionist neo-fascist government, the vat-grown army that finally secured the ailing planet had nothing better to do than pick a fight elsewhere. Over a decade was spent recommissioning and refitting the old mothballed Concordat Gateship fleet. Once the fleet was operational, the NEC crammed thousands of gene-engineered supersoldiers aboard new troop transports and, in 6116, carried out the surprise invasion of Caprice.

Unaware of the situation on Earth, the former colony was woefully unprepared for Earth's return. While the majority of the corporate government which controlled Caprice opted to collaborate, a few patriotic members formed partisan groups and began an underground guerrilla war. Eleven months later, the final embers of local resistance had been crushed and plans for the invasion of the remaining colonies were being laid. Caprice was to serve as a staging base for the invasions of the rest of the human-colonized worlds.

1.2.10 - The Earth Invasion: Terra Nova (6118-6120)

In 6118 (TN 1913), Terra Nova was in the final stages of a political phenomenon known as the "Judas Syndrome." Factions working on either side were about to sell out their own, and the two confederations that formed the main political power blocks were on a crash course towards a catastrophic world war. The Earth fleet waded into the middle of this snake pit, unaware of the extreme political instability present. Quickly, the same spies that were prepared to sell out their allies secured a truce to fight the Earthlings. The War of the Alliance had begun.

The plan of Earth's Colonial Expeditionary Force was simple. Sweep the skies of any remaining spacecraft left over from the colonial era; establish a base of operations in an unchallenged region, the Western Desert; then overrun the industrial cores of Terra Nova's poles, the Mekong Dominion and the United Mercantile Federation (UMF). In the summer of 1913 TN, the fleet landed over 400,000 troops near the equator with little early opposition from a shocked world below.

Lacking detailed information about Terranovan military installations, the CEF proceeded to bomb Terranovan cities from orbit in an attempt to demoralize the "rebellious colonists." This only succeeded in enraging the planet's populations, resulting in a North-South alliance and the launching of a massive counter-offensive against the Earth fleet. Thousands of killer satellites and tiny, well-armed drones were launched at the fleet, inflicting significant casualties and causing the CEF ships to vector away from Terra Nova towards Helios' farther planets. The battles in space would continue for several months, ships and battle drones executing attacks and deployments over a period of several weeks before a nuclear fireball would kill one side or the other.

1.2.11 - War of Attrition

Despite the fleet's setback, the Colonial Expeditionary Force's land troops completed their base camp within one week of their arrival. A day later, the CEF divided into two main attack forces. The Northern Expeditionary Force headed northwards towards Ashington, the nearest UMF city-state and the nation's primary energy production site. The Southern Expeditionary Force drove due south into the Mekong Dominion's petroleum-rich lowlands. While neither the CNCS nor the AST managed to prevent the invasion of their territory, they did manage to field enough troops to completely bog down the Earth advance by the end of 1914 TN.

Early in TN 1916, the Colonial Expeditionary Fleet returned to the planet after a long running battle with Terranovan ships and drones among the more distant reaches of Terra Nova's solar system. Early sensor scans and communiqués with their ground forces led the fleet's commanders to believe that the CEF was making slow progress and needed additional troops. Late in the winter, the fleet landed an additional 80,000 troops near the small Badlands city of Baja before being chased out of orbit by a second wave of Terranovan drones. Three weeks later, a combined CNCS-AST army group assaulted the city, engaging the CEF forces for nearly a season before the commander of the Earth forces surrendered. Baja was a hollow victory, leaving the city in smoldering ruins.

By late TN 1916, many Badlands residents had rallied under the unlikely banner of Peace River, a corporate settlement near the Western desert. The opening of a third front shifted the balance of power in favor of Terra Nova's defenders, and the Colonial Expeditionary Force was forced to pull troops back to defend their main base, leaving their Northern and Southern Expeditionary Forces dangerously understaffed and demoralized. In early winter of TN 1917, the joint high-command of Terra Nova's armed forces launched the final drive towards the CEF's Western Desert base. By the end of Winter, the Terranovans accepted the unconditional surrender of the Colonial Expeditionary Forces' ground troops. The invasion officially ended with the Treaty of Westphalia in 6120 (TN 1917).

The Earth fleet returned to Terra Nova and acknowledged the planet's independence. Having lost most of its ungainly troop transport vessels to the mass-produced Terranovan combat drones, the fleet was forced to abandon thousands of troops on Terra Nova when it left in late TN 1917. The war had lasted for two and a half grueling years, blasting some sections of the planet back into wasteland. The battles in space were even more brutal, leaving untold thousands dead and debris floating throughout the Helios system. Having traded so many lives for a common cause, these internecine squabbles of the space crews of both polar confederations never reached the same level of viciousness as in the past.

1.2.12 - The Present

On Caprice, the group of corporations known as the Coalition abdicated power rather than watch Gommorah die beneath massdriver rounds and anti-matter bombardment. They were not prepared to fight a war, but neither were they surrendering. They kept their ears open, ready to take opportunity whenever it presented itself.

The task force bound for Terra Nova returned, limping. Although the NEC hushed the matter up, Coalition spies reported that many ships — including two dreadnoughts — were gone, several thousand troops did not return and those who did were crammed into the remaining vessels. Their supplies were almost gone and many soldiers were badly wounded. By all accounts, Terra Nova successfully held off the CEF.

The Coalition knew that if it were to uproot the occupation force, it would need to know how Terra Nova succeeded. While it is secretly establishing lines of communications with Terra Nova, the Coalition is also observing the NEC, the bulk of whose forces are in orbit around Caprice. They know that the key to their salvation lies many light-years away, to a group of unlikely heroes.

The Helios System - 1.3

Terra Nova: the New Earth. A simple yet elegant name given to the planet by the explorers who first traveled to this distant cousin of the mother planet. Terra Nova was the first truly Earth-like planet found amongst the multitude of star systems accessible through the Gates, and its discovery sent waves of hope and excitement through the whole human race.

Terra Nova orbits a sub-giant, non-variable G5 (yellow) star officially catalogued as Eta Trimenia, but commonly referred to as Helios. Helios lies far away from Earth, nearly 3980 light years toward the northern galactic core. Although it is larger than the Sun, the star is colder (average surface temperature 5200 K) and can thus provide a suitable environment for humans in its "life zone." Helios glows a dull yellow, which places it in the same spectral class as the Sun (G class). Its spectrum reveals ionized and neutral metals, with some uncommon heavy metals.

Terra Nova is the second of six planets. The first one, Hermes, is a rocky dwarf that lies so close to Helios that its orbital period can be measured in mere days. The third and fourth planets are small blue-green gas giants named Zeus and Poseidon, respectively. The remaining two planets are small, cold balls of frozen gases: Ares and Hades. Asteroids accompany the two gas giants in their orbits, probably remnants of a captured celestial body or a failed seventh planet in the system; both planets feature significant asteroid clusters at their Trojan orbital points.

Gates - 1.3.1

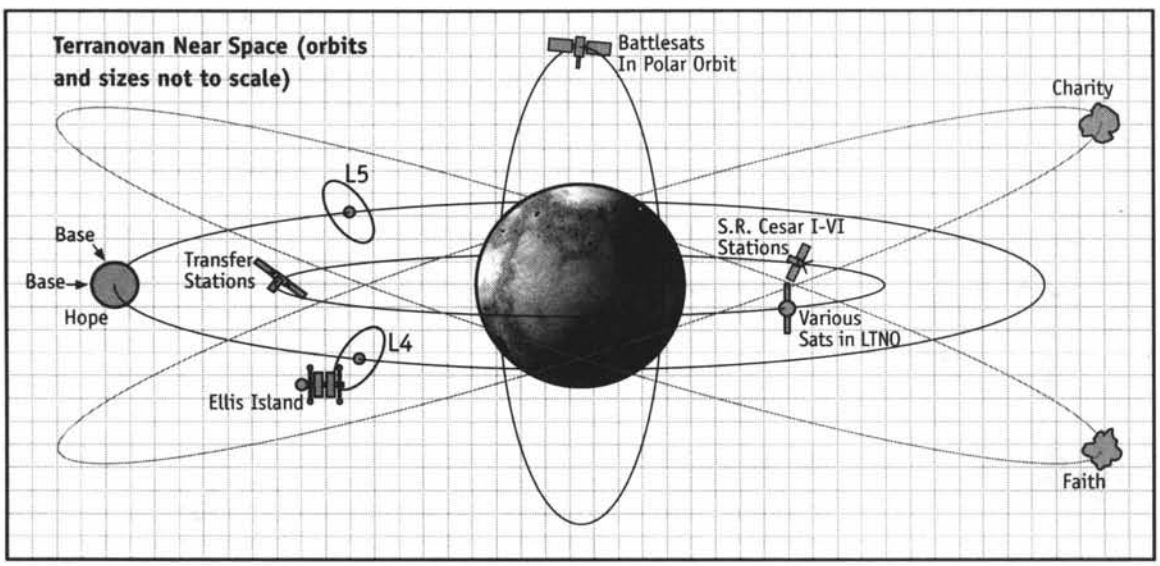
A surprising phenomenon came to light in the early days of the interstellar exploration. A Tannhauser Gate's origin and arrival points do not depend on the position of the points in space they join. Thus, a far-away star system could be far easier to reach than a close one, if its Gate required less energy to activate. This creates a sort of "travel web" in space, a cosmic subway of colossal proportions. The stations are scattered throughout the galaxy with little relation to their actual proximity to each other in space: one may have to crisscross the galaxy to actually reach a "neighboring" star system, an irony that is not lost on space travelers.

The Helios system has two main Gates, one leading directly to Caprice and the other to a desolate brown dwarf with no planetary body, which is part of the older "road" to Caprice. They both remain fixed in regard to the star and move with it around the Galaxy, though a slight precession movement can be observed along a long period of time.

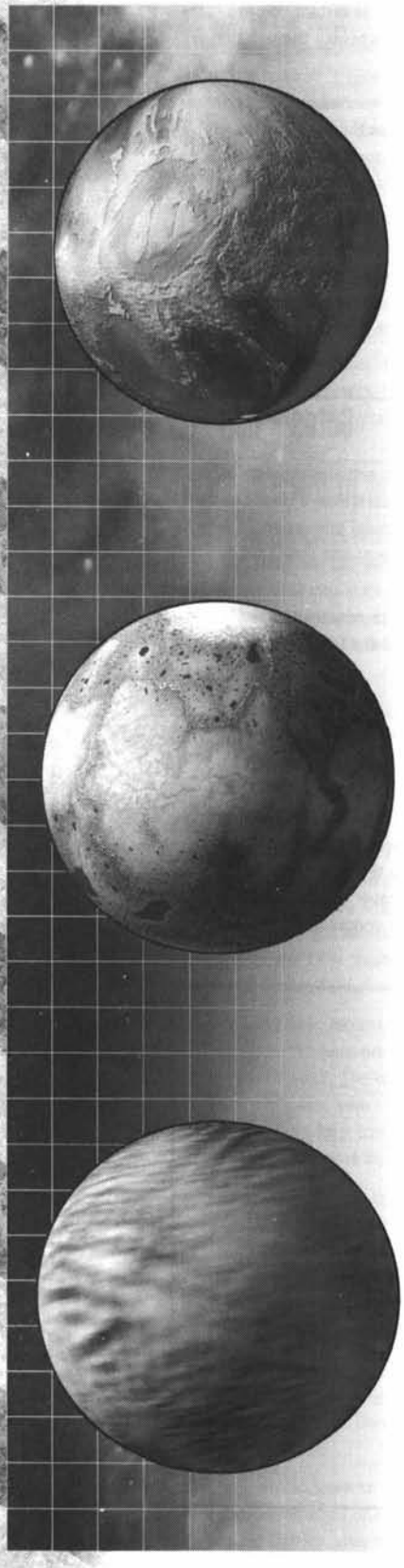
Gate Defenses

Gates to a given system are natural bottlenecks to interstellar travel and as such, they are always well-defended, with numerous ships and installations being stationed within a few tens of thousands of kilometers.

Following the War of the Alliance, the united Terranovan space forces seeded the volume of space around the Gates with nuclear mines and orbital weapons platforms. These form the primary line of defense against hostile ships and are backed by ten to twenty system defense gunships that will go after any vessel which tries to slip in. The gunships are always in motion to cover the possible exit vectors, though they cannot always guarantee a perfect coverage. A well-timed, high velocity spacecraft might conceivably clear the minefield and escape the defense force if its approach is fast enough.



1.3.2 - Hermes



The innermost planet of the Helios planetary system, Hermes bears a remarkable resemblance to Mercury — hence the name. Hermes is a burning ball of rocky material that is continuously scorched by hard radiation. It has no atmosphere save for the thin, transient blanket of hydrogen ions brought over by the solar wind. The pockmarked crust is composed of silicate and heavy metallic elements, but the difficult environmental conditions make mining operations unprofitable. Most of the surface is a rugged, dull gray-brown landscape crossed by the occasional long-cooled lava flow. Hermes does not have a moon. The planet is small and not very dense; its escape velocity is 4.1 km/s.

◆ Settlements

There are currently no permanent settlements on Hermes save for a few automated sensor stations that need periodic replacement. These are mostly for random area surveillance, scientific data gathering and solar flare warnings, the latter being beamed to human habitats further out-system.

1.3.3 - Terra Nova

The colony planet orbits along the inside of the star's life zone, making the temperature hot, but bearable in both hemispheres. Although the orbit is slightly ellipsoid in shape, its shape is barely sufficient to cause minor seasonal changes in temperature. The planet is about the same size but slightly denser than Earth; its escape velocity is 12,285 km/s.

Terra Nova is orbited by three moons (see diagram on the previous page). The largest, Hope, is only slightly smaller than Earth's Moon and completes an orbit once every 24 Terranovan days. The other two moons, Faith and Charity, are small chunks of ice and rock.

Though efforts have been made to clean up the air space around the planet, a significant amount of debris left over from the war is still in orbit. The biggests pieces range from entire hull sections of CEF cruisers all the way down to paint chips and minute particles from exploded ordinance, all of which poses a significant threat to the unwary space travelers.

◆ Settlements

Space around Terra Nova is the most heavily populated region in the Helios system. The orbital lanes around the planets are paced by numerous satellites, transfer stations (including the new Ceasar stations built by the Southern Republic) and a major way station at L4 called Ellis Island. The most recent additions are a series of offworld training facilities for teaching Gear pilots and infantrymen to fight in space.

The largest individual settlement remains Hope Moonbase, an interleague base created on the site of a previous installation not long after the end of the War of the Alliance. Hope is also home to scattered outposts and mines all over its surface, often separated by hundreds of kilometers. Hope is officially a neutral territory belonging to all Terranovans, but all sides watch one another very closely.

1.3.4 - Zeus

Zeus, third planet in the Helios system, has been named for its majesty and similar appearance to Sol system's gas giant. Slightly smaller and lighter than Jupiter, it is a typical jovian planet with a dense atmosphere composed mostly of light elements such as hydrogen and helium, with some traces of noble gases. Zeus is surrounded by twelve main satellites and a score of asteroid moonlets, with two more large asteroid groups in its Trojan points. The planet and its moon system form an important part of the off-world resources of Terra Nova. Zeus has a deep gravity well that is useful for gravity sling maneuvers; its escape velocity is 57.5 km/s.

◆ Settlements

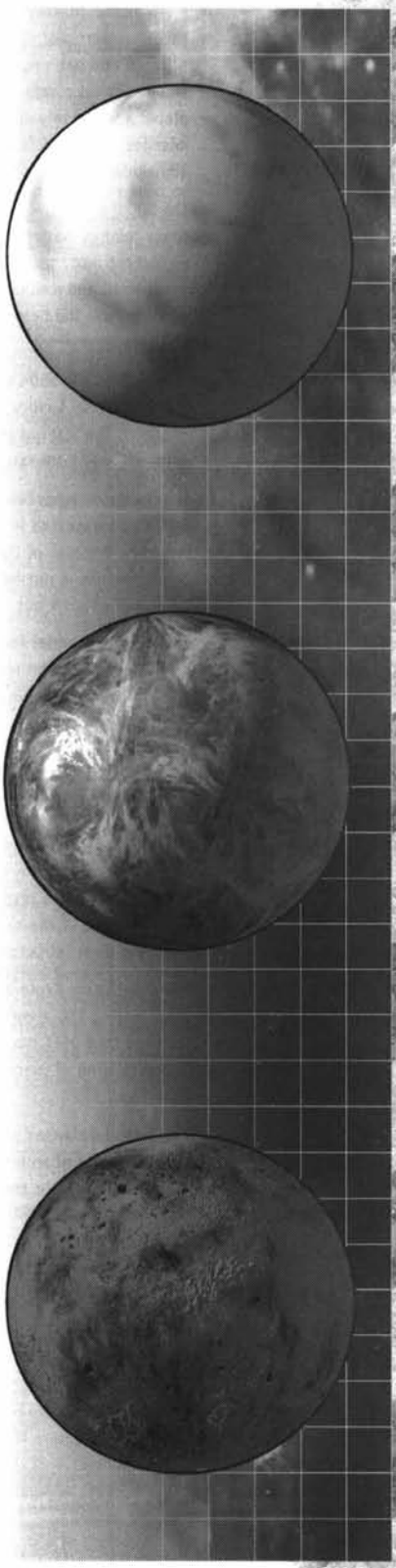
The Zeus sub-system houses a number of naval bases, shipyards and gas processing facilities in high orbit. The deep radiation belts of the planet have forced the use of thick shielding, which limits the mobility of the installations. The belts also make travel to and from the sub-system a dangerous proposition, undertaken only by well-shielded ships on fast runs through the worse regions.

Poseidon - 1.3.5

So named because of its bluish-green color, Poseidon is the second gas giant in the Helios system. It is very similar to Zeus but on a smaller scale, and is composed of much the same chemical elements. The planet has five main moons, none of which are interesting from a resource standpoint, being largely frozen balls. The ring around the planet was caused by the destruction of an errant ice moon long ago, and is frequently mined for water by deep space expeditions. Poseidon is also flanked by two asteroid groups in its Trojan points, but they are too far away for practical exploitation. The planet has a deep gravity well; its escape velocity is 22.2 km/s.

Settlements ◆

The United Mercantile Federation established the *Aquarius* observation station in orbit after the end of the War of the Alliance. The station is intended to provide an ultimate fall-back position for the UMF fleet in case of large scale space conflict, though its official role is to provide scientific and astronomical data. Most of the resource gathering in the Poseidon sub-system is done by automated mining stations that are anchored to a few of the larger ice blocks. Simple in design and robust in construction, these do little but move slowly, grinding the surface material to separate the water from the contaminants inside and storing the resulting material in oversized bladders.



Ares - 1.3.6

Ares is an anomaly within the Helios system. A frozen planet far from the warmth of the local star, it nonetheless exhibits signs that it may have once been much warmer. Its reddish color comes from long chain organic elements, much like those that were found on Titan (a moon of Saturn in the solar system). The presence of what looks like the remnant of an enormous impact crater suggests that the planet may once have occupied a position further into the Helios solar system, possibly as a satellite of Zeus. Its orbit, however, is far too circular to be the product of a recent collision, and it is more likely that the crater is the result of a large impact with a rogue Kuiper belt object. The organic molecules would thus have developed following the heat of the impact, which would have taken many centuries to be radiated away. The planet has a shallow gravity well; its escape velocity is 5.2 km/s.

Settlements ◆

There are no current settlement on Ares, apart from a few scattered science stations studying the curious landscape. Assignments to the desolate planet are unpopular, though many of the scientific staff are volunteers that relish the opportunity to unravel a cosmic geologic mystery. Traveling to and from Ares is not an easy proposal. Most often, ships come and go during very specific orbital windows during which they can make use of a gravity slingshot from one of the gas giants. This leaves the science bases isolated for long periods of time.

Hades - 1.3.7

Tiny Hades is the outermost planet of the Helios system. It may have formed from the gas remnants of the system, or have been a large asteroid that was captured so long ago its orbit has stabilized since. A deeply frozen ball of gases, it held little interest to the original colonists and to their Terranovan descendants. The icy soil is harder than rock, and the planet receives so little solar energy that nuclear generators are the only practical energy source. Hades is too far away to serve as anything but a deep space survey station, and as such is home only to a few scattered installations. The planet has a negligible gravity well; its escape velocity is 2 km/s.

Settlements ◆

Lonely Hades is host to a few hardy souls, explorers and soldiers that man the farthest reaches of the Terranovan home system. Immense radar receivers stretch out across the frozen plains, held in place by refrigerated mounts so that the temperature differential between the equipment and the soil do not cause catastrophic sublimation of underground gas pockets. The distances involved mean the teams are rotated out only once every few cycles, and the isolation is very hard to live with. Invariably, teams lose a few members to accidents or suicides.

1.4 - Northern Space Organizations

Most of the Northern space-based forces are affiliated with the United Mercantile Federation, though the Norlights are a close second in terms of ships and personnel. The Federation discovered its vulnerability to aerial or orbital attacks during the War of the Alliance and has since greatly increased its defensive systems. The UMF Space Defense Corps concentrates on locating and tracking enemy orbital assets, ready to eliminate them should they pose a threat. The Corps has access to linked sensor stations across the planet and can rely upon both ground-based systems, such as missiles and high-powered lasers, and orbital killer sats equipped with missiles and particle weapons. To prevent unnecessary expense, only a small number of such platforms orbit Terra Nova, with additional units launched as needed.

The SDC is not alone in its duties. Part of the Infrastructure Ministry, the Stellar Exploration Directorate (SED) oversees a wide range of space-related matters, from the Federation Astronomer Corps to the surface-to-orbit launch facilities used for getting people and equipment into space. Communication and ortillery satellites are the two main military uses of the Federation's lift facilities, the former using small and medium sized disposable launchers from the commercial facilities at Rapid City and Zagreb while the massive ortillery satellites use the heavy *Connestoga*-class launchers of the military port south of Lyonnesse.

Although the government owns all the Federation's launch facilities, the actual operation of most sites is carried out by commercial contractors. The SED's primary task is to oversee such operations, ensuring safety procedures are followed and launch schedules kept. The Lyonnesse facility is directly managed by the Directorate, handling the most sensitive launches as well as all manned UMFA missions. The SED has seeded the area around the Gate point with sensor satellites but they constantly deny any deployment of bomb-pumped X-ray laser satellites. They do, however, operate a number of space-based fighter craft.

The Northern Lights Confederacy operate most of their military space force as part of the regular Norlight Armed Forces. The main launch facilities are located in Port Aurora, though they also have access to a series of field spaceport located closer to the equator for heavy launches. Because of the War and its aftermath, the Norlights share much the same equipment as the Federation. The Norlight orbital assets include a number of gun platforms, defense satellites and factories. They also support a large segment of the deep space detection network put in place after the War.

The Western Frontier Protectorate is less present in space. Beyond some representations aboard Northern Guard-affiliated spaceships, a small fleet of orbital shuttlecraft and its *Martillo*-series orbital gunnery platforms, the Protectorate has no significant space assets. Though the clans abhor the idea, they rely extensively on their neighbors for space protection.

1.5 - Southern Space Organizations

As would be expected, most, if not all, of the military space forces of the South are under the control of the Southern Republic. Most of the other leagues' small space forces were absorbed after the creation of the Allied Southern Territories. Consequently, though the Space Defense Branch (SDB) is the smallest fighting branch of the Republican Army it oversees a complex network of sub-departments. The SDB is responsible for all military activity in orbit — with the exception of satellite-based communications — and beyond. Most of the branch's personnel consists of administrators, shuttle and interplanetary ship pilots, but three distinct corps exist within its structure.

The Deep Space Exploration Corps (DSEC) works closely in tandem with the Space Exploration Bureau (SEB). They are responsible for representing the army's interests in any space exploration mission and supply most of the pilots for SEB research missions. It is rumored that DSEC maintains a small Gateship pilot training facility in one of the asteroid groups in Zeus' orbit. They have a good understanding of space navigation and have well-trained pilots, and can even call on the necessary resources to build and maintain Gateships.

The Orbital Defense Corps (ODC) is another space-related division of the SRA. They are responsible for two things; first, they operate the small fleet of armed deep space fighters maintained by the SDB and are to defend all friendly assets while in orbit. Second, they launch and operate the Republican Army's ortillery system. Ortillery consists of space-based "artillery" used for precision strikes against ground targets. These powerful weapons platforms are expensive, scarce, and vulnerable to counterattack, making the Republic loath to use them unless desperate or at war. The ODC has experienced pilots, production facilities and tactical doctrine for fighting in space; if they can recruit some deepspace fighters, the SRA high command can probably expand this branch easily should the need arise.

The Colonial Defense Corps (CDC) is a small combined arms group that serves as both a police organization and a defense force for the Southern Republic's off-planet territories, such as the research base on Hope, the Caesar I through VI orbital stations, and the Republic's many asteroid mines. They have experience in operating in deep space, and are rumored to have sleeper agents implanted in all critical locations. To many, the Colonial Defense Corps serves as a grim reminder that no one is beyond the reach of the Southern Republic's firm grasp.

Port Arthur Space Corps - 1.6

Though they come from off-world, the Port Arthurians were left behind by their fleet and managed to salvage very little from the debacle at the end of the War of the Alliance. The small Port Arthur fleet is composed of five aging Sleipnir-class space planes (see **Black Talon Field Guide**, page 118), survivors of the CEF landing fleet that brought them to Terra Nova. They only managed to hold on to these vehicles by hiding them in underground hangars for a few cycles, pulling them out only after the new settlements and its neutral credibility were well established with the polar leagues.

The PA Space Corps is a relatively small group that works under the direction of the Science Bureau. They are also affiliated with Hermes Corporation, the company that oversees the Hermes 72 satellite constellation salvaged from the War. The Space Corps handle most of the maintenance, repairs and replacement for Hermes. Port Arthur does not have facilities for producing many "dumb" boosters, and thus must rely almost exclusively on the Sleipnirs. Since they also need the space planes for military operations, this has created a number of conflicts between the Space Corps and the rest of the Port Arthur armed forces, who resent having to share their primary means of strike transport.

Paxton Space Corps - 1.7

Paxton Arms never had more than a small foothold into space. They used to be able to field a total of ten fusion-powered shuttles and a number of reusable "dumb" boosters, but the destruction of their home city-state wiped out about half the fleet along with all the main launch and service installations. Never one to give up easily, Paxton has relocated the surviving space assets to a number of new spaceports in the deserts of the Badlands, all near the equator (giving them a significant advantage in terms of lifting power over their polar competitors).

About fifteen small orbital workshacks and automated space factories are owned directly by Paxton Arms, and twice that number through indirect subsidiaries and affiliates. None is very large, but they produce the high precision parts and electronics required for Paxton's better products. Two of these platforms are directly under the control of the PRDF, which uses them as bases to train its pilots in zero-gee operations.

CEO DuBeau-Slovensky is currently considering using the riches of space to help her rebuild her shattered empire. Despite Paxton's material losses, the company now has better space access than ever, thanks to the CEO's connections with the Westphalia Cabinet and the shadowy Black Talon program.

Other Factions - 1.8

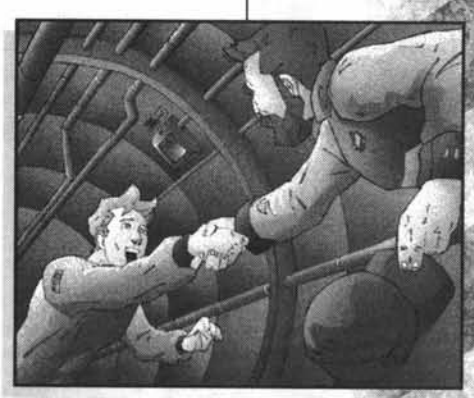
Outside of the two polar confederations and the two Badlands powers outlined above, practically no one has a foothold in space. NuCoal is too busy getting through the day and getting up from the results of the Interpolar War. Jan Mayen has been devastated by polar assaults, and its people are still scattered and in more need of a home than the stars. Proust and his men, or what is left of his forces, are not believed to have access to any orbital vehicle.

The most mysterious faction, however, is the one led by young Emir Rafael Bhravo, who commandeered the crashed Gateship *Eastern Sun*, refurbished it, and then launched it in a spectacular display that destroyed most of the city-state of Skavara on 19 Autumn 1941. Once the initial shock had passed, deep space tracking stations located the vessel as it started an orbital burn that took it into deep space. The ship disappeared from sensors a few weeks later; it either began to run in silent mode, or has fallen victim to its advanced age. Sensor sweeps are made regularly, but the ship has still not been located. The fate of Bhravo and his followers remain a mystery for the time being.

Friendship

Despite their differing allegiances, the people of the various Terranovan space corps have become fairly friendly over the cycles since the end of the War of the Alliance. They were already close before the conflict, being composed of exiles and misfits who had a natural affinity and a healthy respect for one another. Having fought side by side in much worse conditions than the people on the ground, they are now reluctant to engage one another in battle. They share common experiences and traditions, and have weathered experiences that most other humans will never understand.

This type of collaboration, along with their first hand witnessing of the brutality of the CEF, have made the space corps a perfect breeding ground for recruitment of Black Talon personnel. Currently, about 5 to 10% of the spacers are connected directy and indirectly to the project, most of them crew serving aboard one of the ships that support the Talons' war efforts.



Rock Hounds

The ship was little more than a speck of metal when compared to the asteroid, even if the latter was relatively small as far as planetoids go. It hovered a few hundreds of meters away from the rock, its sensor array collecting information on the cratered landscape below as the vessel lazily moved across its surface.

Joanna Duran, pilot and part owner of mining vessel SC-F-C675M (known to friends and family as *Hound Dawg*), checked the holographic readout before her. With practiced boredom, she ignored the exiguity of the tiny cockpit, the rank odor of sweat and ozone that repeated cleaning could not get out of the bulkheads, and the whining sound of the single air fan that was laboring to remove carbon dioxide from around her head. She read the results of the preliminary scan aloud, both for her own benefit and so that the rest of the crew could hear.

"We've started scanning; so far so good. Looks like the surface is a little dry — probably been shock-heated too often — but there seems to be a good hydrated clay content." She smiled to herself. "Water. Just like the long range spectroscope said. Jake, you'll have to go down and take a core sample to be sure."

"Sure." The voice of their resident EVA expert sounded scratchy in the tiny suit radio.

Pior, the other crewman of the vessel, poked his upper torso in the doorframe of the tiny bridge.

"Another water ball? Cripes, why can't we hit a high metal one for once?" Those brought back more money when they were brought to a shipyard.

"And who's going to pay for the advanced scans, you?" Pior was about to make a smart aleck retort when he suddenly became serious and pointed at the board.

"What's that — you got a contact down there." Out here, it was prudent to assume that anything out of the ordinary was a possible danger. No spacer joked around with the unknown.

She scanned the board and ran a brief diagnostic. "No, there's nothing. Probably a ghost. I thought you repaired that faulty databus connection yesterday."

"I did! Whaddya think I am, suicidal? No, the sensors are working perfectly."

"Then what did it — there it is again." She started the redundant sensor log. "I can't lock on it. Doesn't seem like an electronic ghost after all . . ."

"Maybe we should tell Jake to come take a look at this."

"He was about to go out. He won't be happy."

"Too bad. This is important. Get him out of the suit and back here."

Two minutes later, the spacer floated on the bridge, still half-encased in his suit. "Good thing I was listening in. Show me the log."

Joanna called up the sensor log again on the main screen. Jake paled noticeably.

"Prophet... I know what this is! Get us out! I've seen this before!"

"What?" But she was already rotating the ship, feeding reaction mass to the fusion tubes. She trusted her partners with her life, and knew he must have good reasons to worry.

"It's still in 'seek' mode, thank Mamoud, not 'lock.' Plant a warning buoy and get me Ground Control on the squawker — fast."

Pior looked at him with curious eyes. Jake nodded.

"Space mine. We just found an old leftover present from the '13 party."

Hardware - 2.1

In space, technology is vital and pervasive — human life is utterly and totally dependant on it for its survival in this hostile environment of hard vacuum and deadly radiation. In the darkness between planets, man and machine have evolved together rapidly under the deadly struggle for survival against the harshness of cold space. This is a relationship less like that of master and slave, as it is that of a symbiosis between equally complex organisms.

The marriage of human need and raw mechanical capability is balanced by the need for constant technological maintenance and innovation with pure human ingenuity and skill. It is therefore not surprising that the level of technology 'home grown' by spacers intimately familiar with the cruel coldness of death in space resembles less the monolithic complexity of the first Earth-orbital pioneers, so much as the welding of form and function, order and chaos, of a biological system permanently welding human and machine together.

This overall dependance on technology by spacers has a logical and inevitable corollary: these are a highly ingeneous, adaptable and technically-oriented people, in professions such as medicine as well as mechanical engineering. Those that are not, or do not wish to learn the rules of this last great survival game, are weeded out through the natural selection of the deadliest environment imaginable.

Sensors and Communication - 2.2

In the military environment of deep space, where stealth is the key to survival, using long-range active sensors systems is extremely dangerous. In many cases longwave 'pulse' systems used briefly, like the pinging of submarines from Earth's oceans, are much safer than laser or directed microwave 'sensor beams' which would require the system to be on and scanning for extended periods, giving the enemy a target virtually broadcasting its own position in space.

Specialized radar/lidar units or drones, operating in pairs or alone far from a well-stealthed mothership, are ideal for this sort of task. Most long-range sensor systems don't have the resolution necessary to accurately guide ballistic or direct beam weapons, leaving battles at great distances in space to automated self-seeking weapons. As it was once in the depths of Earth's great oceans, death in space is silent, swift, sudden and cold.

Visual Detectors ◆

Simple cameras can be used for primitive parallax-ranging of targets within a few kilometers of the vehicle. A wide-angle omnicamera produces a clear image in the center of the visual field, but progressively more distorted images towards the edges. These images can be reconstructed using a computer (though images towards the edge of the field will still seem more pixelated) to produce a fullfield of view. This kind of sensor is not appropriate for zoom-type applications; it is designed more for fixed-focus situational awareness.

Telescopic visual sensors are heavily baffled/shielded systems, preventing reflections bouncing off the ship itself from interfering with the observations of the scope. Longer-barreled systems are more robust and easier to focus in general, while shorter barreled systems make up in compactness what they lose in simplicity.

Image intensifying systems are basically the same as a standard visual systems, but are equipped with large light-collecting apertures tied into racks of photomultipliers or other amplifiers to boost faint signals from dark objects far away (or stealthed). These systems generally produce monochromatic output with very grainy resolution. Intensifiers are easily oversaturated by sudden bright sources in their field of view or (even worse) a laser sweeping across the array; therefore they are of limited usefulness on a military vehicle.

Infrared-band (IR) systems track targets via their heat signatures, be they from radiators or exhaust plumes. These systems are always employed in a passive scan-mode, but must be actively cooled to have a high signal-to-noise ratio. Ultraviolet (UV) sensors are largely useless in terrestrial environments; given the extremely high operation temperatures of fusion-plasma engines, however, UV detectors play a key role in long range space detection. Like IR systems, UV detectors can be easily blinded when looking to within 5-10 degrees of the system's star(s). UV systems are fairly easy to implement, but require some specialized optical components making them unusable for standard visual-spectrum operations.

Radar ◆

One of mankind's oldest long-range sensor systems, radar has not lost any of its utility in mankind's latest frontier. Low resolution simple radars are ubiquitous in space, from helping shuttles and transports maneuver into a docking berth, to tracking satellites and payloads, to monitoring for micrometeors and other debris. High-resolution millimeter radars are used on military vehicles for tracking and locking onto targets. A phased array radar system incorporated into either a set of radomes, a deployable network of radar booms, or built into the hull itself are very useful for the tracking of multiple targets, and the guidance of various forms of ordinance.

◆ LIDAR

Lidars, by their usage of tightly-focused laser beams, are excellent systems for locking onto, illuminating and identifying mobile targets within a few dozen kilometers of the sensing vehicle, especially when combined with positional information from a radar. The high signal bandwidth means that only a limited number of targets can be tracked at once, depending on the available computing resources. Lidar, however, allows the precise identification of the target, its type, speed, heading and damage status. By its nature, lidar defeats any stealthing that the emitter may have, making it an active target. Infared and red laser lidars are common inside terrestrial type atmospheres, while ultraviolet and blue laser systems are prefered for deep space systems.

2.2.1 - Sensor Signatures

From planets and stars to space stations, space junk and stealthed military craft, the truest test of a sensor system's capabilities is not just its ability to detect a target at a distance; it must accurately identify the target's position, nature and intent, and then pass that information to its crew. The wide variety of objects and phenomenon that can occur in deep space requires every sensor system used on spacecraft to be equipped with substantial signal processing capabilities, and most importantly, a very comprehensive database to identify and catalog what it detects.

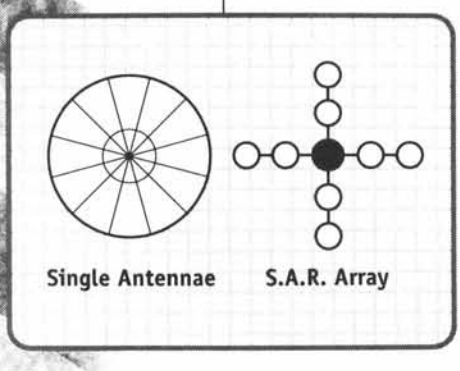
It is not surprising that most spacecraft employ sensor suites of various kinds rather than a single system. Planets and other celestial bodies are generally well catalogued in a spacecraft's database; simple star-scope sensors often use their unique spectral characteristics to help determine spacecraft orientation and heading. Various types of passive large-bandwidth sensor suites have been used for centuries helping asteroid miners and prospectors alike to find mineral and water deposits in asteroids and cometary cores.

Microwave radar (for long range detection) to lidar (for medium range tracking and identification) to visual cameras (for close range observation) supply the crew with progressively more detailed information as the target approaches. IR and UV imaging systems can detect the tell-tale spectrum of a spacecraft's chemical or fusion engines, as well as the heat signature of weapons fire, rocket flares and heat sinks. Radar can determine bearing, range and speed, while lidar can provide target identification and orientation for threat assessment.

Clearly, if sensor systems must deliver accurate and detailed information, their resolution and ranging abilities become critically important. The art of detection is a subtle one, balancing the size and sensitivity of the sensor system against its bulk, power requirements, and the narrowness of its field of view. In general, larger antennae or lenses are able to image/detect farther out or with greater resolution than smaller systems, at the cost of bulk, and with the narrowness of their field of regard; such systems operating alone might detect a target a great distance away at the expense of missing a closer target just barely out of the field of view of the sensor. Active sensor systems attempt to defeat this dilemma by pumping out a great amount of power in a wide cone to detect as many objects as possible, at the cost of making the sensor-vehicle itself an inviting target.

When a target is detected at the extremities of a spacecraft's sensor range, the game of detection and evasion begins in earnest. Long range sensor systems such as radar, while providing a crew with rapid information about a target's position and heading, lack anything near the level of resolution required to identify it, much less determine if it is a hostile spacecraft or an errant meteor. When this happens a judgment call is made, balancing the need to quickly identify the intruder with active systems and risk giving the sensor vehicle away, or to wait with passive systems for the possible aggressor to engage his engines, reflect starlight, or make a move to identify himself visually. Waiting too long could leave a spacecraft in danger of being targeted by an enemy's passive systems, while the dangers of acting too quickly are well publicized, as when warship accidentally open fire on civilian transports. Incomplete, inaccurate or poorly interpreted sensor information due to faulty or noisy sensors, a cluttered environment with spurious signal readings and false sensor lock-ons have resulted in many a tragedy in deep space. The stages of an encounter can be intensified in terms of range, in the case of a small spacecraft approaching and being scanned for threat assessment by another spacecraft. Clearly, the rule of thumb for sensor systems in space is "to see without being seen."

Antenna



In general, there are only two important types of antenna arrays; single antennae, and phased array synthetic aperture networks. Single antennae systems are cheap, easily maintained and are ubiquitous in space, appearing as anything from long antenna masts for omnidirectional detection, to giant swiveling parabolic dishes used for long-range tight-beam directional detection.

Phased array and synthetic aperture (SAR) systems avoid the large, ungainly antennae of typical radars and instead spread their emitter and detector elements over a much larger area. Phased-Array networks can be as simple as a group of tiny dishes mounted in the bow of a spacecraft, or as complex as an interconnected array of solid-state emitters built along the entire hull. In the case of synthetic aperture radars, smaller dishes widely separated along the keel (or suspended far away from the craft on booms) allow smaller, more compact systems to attain the same resolution as a radar dish the size of the separation between the detector elements. On some deep-space SAR networks, radar systems with effective receiver sizes on the order of tens to hundreds of kilometers are not uncommon.

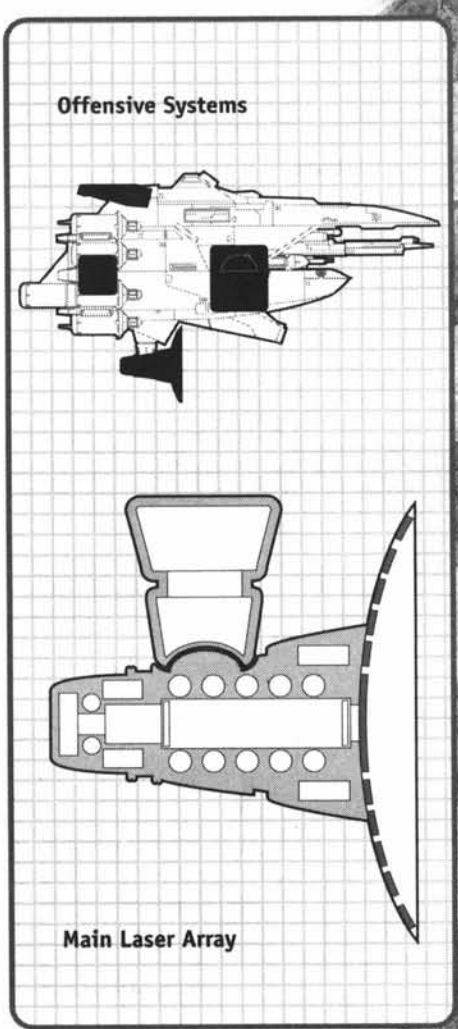
Offensive Systems - 2.3

Space is a very special environment for weaponry due to the absence of atmosphere and gravity. Some have even called it "the ideal environment" for these reasons. Specific weapon types have evolved over the years to answer the particular requirements of space combat, such as the vastly increased ranges over which combat may occur, and the lack of an atmospheric medium to slow a projectile with drag, or to disperse an energy weapon with scattering and absorption. The lack of gravity and wind resistance makes the use of small autonomous drone weapons that operate over extended periods of time and over great ranges both economical and deadly efficient. In many cases it is the sensor system and not the weapons system that determines the range of engagement, with the game of hide and seek played till the last possible moment before firing. Even after firing, the game can continue for seconds, minutes, and even hours with automated and guided weapons fighting their own battles on their way to their targets, evading point defense lasers, anti-missile-weapons and active countermeasures of an almost infinite variety. Even after a target is destroyed it may still strike back one last time as its automated drones and torpedoes continue a lost battle. In space, the price of survival is one of eternal vigilance.

Unlike their terrestrial cousins, space weapons are also capable of more than just simple destruction. Lasers are used for secure communication over very long distances, as well as sensor systems. Kinetic weapons use the same basic technology as a massdriver reaction engine or an asteroid refinery's slug-catapult. Giant laser arrays use technology analogous to those used by solar-sails and solar power stations. Particle beams can be used both to probe an asteroid for valuable minerals or to cut open a space-station's hull. A modified anti-ship missile can be used as a message torpedo, a sensor-probe, or in some famous cases, as an impromptu lifepod. In space, flexibility is key to survival and the nature of a warship's considerable arsenal is no exception.

Energy Weapons - 2.3.1

An acronym for Light Amplification by Stimulated Emission of Radiation, the laser has been widely used since its development both as a tool and as a weapon. Any laser, whether it is being used for guidance, ranging, sensing, illumination or as a direct-fire weapon has some basic characteristics shared by all lasers. To operate a laser, energy (electrical, photonic or chemical) must be 'pumped' into a gain medium (a gas, plasma, or solid crystal), generally held inside a resonating cavity. The resulting stimulated emission of radiation is channeled through the cavity and then through focusing optics on the other end and is output as a collimated shaft of coherent light. Most simple laser systems therefore resemble cylindrical housings attached to the back of reflective telescopes. Variations on this basic scheme are seen in small solid-state handheld lasers and in the Vertical-Cavity Semiconductor arrays used as part of a spacecraft's micrometeor defense screen, where thousands of microscopic semiconductor junctions emit bursts of electrically pumped, magnetic-field aimed laser energy.



In general, the larger the aperture of the focusing mechanism in front of the laser source (in most cases, a simple large reflecting-type Cassegrain or Gregorian telescope for high power systems, or a Newtonian refractor for low powered lasers), the better the collimation of the beam and the less geometric dispersion at long distances. At short ranges and in atmosphere, fairly small laser focusing systems are compact and light and provide good enough operation at range for most purposes. In deep space however, the situation change markedly because of the extreeme ranges involved. Even with the best quality and well focused optics possible, laser beams diverge and dissipate due to diffraction and other physical effects. The amount of dissipation depends both on the wavelength of laser light used and the size of the optics used to focus it: the shorter (bluer) the wavelength and the larger the optics, the less dissipation a beam will suffer.

For example, a red laser fired from a barrel half a meter in diameter (just a little larger than the barrel of an old Iowa-class battleship's cannons) will disperse out by almost a factor of four after just three hundred kilometers, spreading out the beam and dropping the power transmitted to a given target by 75%. Using a blue beam rather than red decreases this loss to 50% over the same range. Shorter wavelength lasers also have the advantage that they deliver more energy per photon, dumping more power on a given target than longer wavelength beams. Blue and ultraviolet beams are easily scattered, however, and absorbed by atmospheres. For this reason, spacecraft generally use green, blue and UV laser systems for defensive purposes, while using red and IR beams for navigation, meteorite defense, sensors and communications. Short-wavelength lasers, while powerful, require much more power to operate than red/IR lasers, and also produce a great deal more heat which must be dissipated. An overheating/overused laser can suffer a decrease in targeting efficiency, suffer permanent damage to its focusing optics, and may even (in certain special cases) destroy themselves and damage the ships they are mounted on.

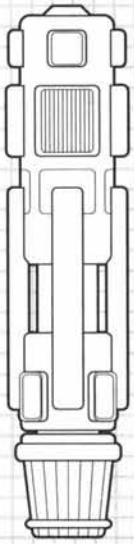
Many space vehicles are equipped with at least one type of laser cannon because of its practically unlimited shot supply and great accuracy. Lasers can also be used to send coded messages over very long distances (see page 62). In general, this is practical only for large installations or in emergency situations, since both the emitter and receiver must remain at the same velocity during the transfer.

◆ Particle Cannons

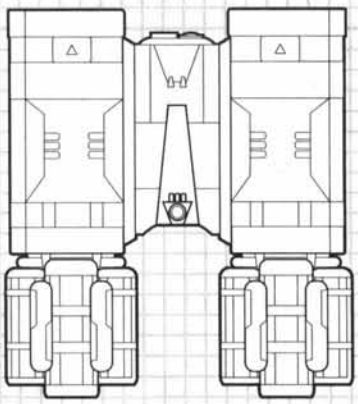
Particle cannons are magnetic acceleration devices designed to shoot high energy charged particle streams instead of a solid projectile. They cause damage through a combination of kinetic energy, heat and electrical induction. Often more powerful than lasers, they can cause a great deal of collateral damage by shorting out electronic circuitry in the target, as well as through radiation embrittlement of the target's hull and direct physical damage to its structure.

Neutral particle cannons, such as neutron guns, do their damage by propelling a tightly focused stream of particles at their target, damaging the very microscopic lattice structures holding the metal of a spacecraft together like a sandblaster cutting through rock. Generally, neutron guns are simple, robust systems that can be used at greater ranges than charged particle cannons. Charged particle cannons, alternately, fire a high-velocity (but rapidly dispersing) stream of ions at their target, warping the chemical structure of the target's hull (similar to high speed decomposition) in addition to super-heating the target and causing massive electrostatic disturbances in its electronics. Much more violent than the neutron guns, charged particle weapons are significantly more powerful, but closer-ranged, higher temperature, and higher maintenance weapons. A neutron gun failure generally results in a defunct weapon, while a charged particle gun failure can have catastrophic results, doing massive electrostatic damage to the structure supporting it.

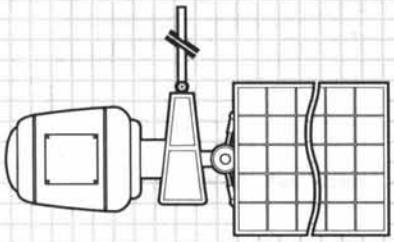
Missile



Heavy Drone



Towed Sensor Array



2.3.2 - ASATs and Missiles

Missiles are self-propelled, self-guided projectiles. Using sophisticated guidance computers and laser targeting technology, the missile is one of the most deadly weapons available to a space ship. There are no set standards; some designs call for a few accurate and powerful missiles, while others use hundreds of small unguided rockets to saturate the defenses of the target.

The most basic missile design is composed of a solid fuel booster for the initial launch, coupled with a liquid fuel rocket (which is colder and thus harder to detect than a fusion plume) for the main propulsion. The entire device is covered in stealth devices and use cold gas maneuver jets to be as discrete as possible.

The guidance system is composed for the most part of a sophisticated target acquisition package. A multi-frequency scanning device, using omnicameras and other detectors, utilize image scanning and recognition, heatseeking, signal homing and pattern matching techniques to find its quarry against the star field and home in on it.

Various types of warheads are used, from the simple shaped explosive to the low-yield tactical nuclear charge. Many common missiles rely entirely on kinetic impact, either crashing directly into the target or detonating a few kilometers from it to ensure a wider attack profile from the cloud of debris. Regardless of their warheads, missiles are among the deadliest space weapons: not only can they correct their trajectories in mid-flight (though at the risk of being detected), but their killing power does not drop with the distance.

2.3.3 - Projectile Weapons

Most of the space-based projectile armament is based on Gaussian effects, or magnetic acceleration technology. They require a lot of power to function, but thanks to superconducting technology they are fairly energy-efficient (which is good from a waste heat stand-point). Gaussian weapons cause damage by kinetic energy (i.e., impact) and are divided in two general classes: railguns and massdrivers.

A railgun uses a single projectile and accelerates it via twin rails supplying the necessary current along the length of the barrel. The projectile bridges the gap between the rails and closes the circuit, causing it to be accelerated ever faster along the rails until it is ejected for the gun. Because the projectile must be in contact with the rails, railguns suffer from high levels of wear.

Massdrivers use a similar principle in that a magnetic effect is used to accelerate a projectile. Massdrivers, however, employ a series of sequential magnetic rings to rapidly fire a hail of smaller shells. Each impact causes less damage overall, but the attack is generally spread over the whole of the target instead of just a spot. It also allows a greater rate of fire.

Classic projectile weapons, based on chemical technology, can be used in space with some modifications, but their low performances (at least compared to the other weapon classes available) restrict them to close-in defense roles.

Defensive Systems - 2.4

Space is one of the most hostile milieus ever encountered by man. It is a place where metal shatters from the cold, where oils and lubricants evaporate or break down, and where water, fuel and blood boil off almost instantly. Spacecraft rely on a number of special devices and systems to ensure their safety and continued existence as well as the lives of their crew.

Sensors - 2.4.1

A spacecraft's sensor systems are its first line of defense, allowing it to get out of the way of danger before it has a chance to harm the vessel. Radar probe ahead to detect incoming collisions, lidar arrays detect and burn off small particles, and remote probes warn of solar flares and other radiation perils. A ship with no sensor is not just blind, it is extremely vulnerable. Sensor systems have been discussed in greater detail on page 19.

Electronic Warfare Equipment - 2.4.2

Each modern fighting vehicle carries a host of defensive electronic modules. Some break up their radar signature, while others interfere with the opponent's targeting equipment. These modules are built-in, and no combat spacecraft would be designed without them. As a result, they usually have a sensor signature that has little relation to the size or power output of the ship and is more related to its intended purpose (civilian ships, for example, are always much "noisier").

Magnetic Field - 2.4.3

In space, even the smallest grain of sand is a deadly danger if moving at very high velocity. Any hit is likely to cause damage to the vessel. To prevent this, all ships are equipped with a deflector shield composed of two parts: an ionizing laser or magnetic field, and the magnetic shield proper. When the ship is moving at high velocity, the particles in its path are first ionized and then swept out of the way. This only works with small particles, though, and larger ones must be either destroyed by the defense lasers or completely avoided. The shield is of very little use against anything larger than a speck of dust and is completely useless against non-charged particles such as photons and neutrons.

Armor - 2.4.4

Space is not an empty void: micro-meteors, dust and solar radiation cause a slow degradation of all space constructs. This problem was lessened by the development of the magnetic screen, but small vehicles and spaceships must still be weather the elements, so to speak. This is why the outer hull of most modern ships is composed of tough armor plates: it is the very last line of defense.

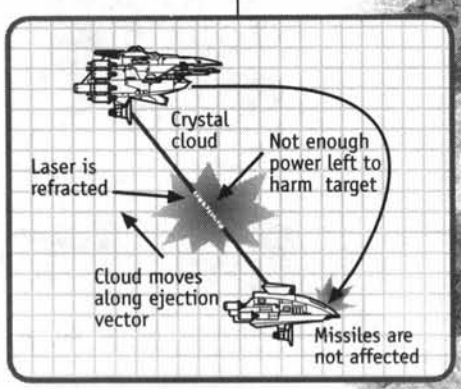
Armor is generally made from a special polymer-ceramite composite with good heat conduction and limited flexibility. This allows it to absorb superficial impacts by dispersing their energy across a wider surface. Additional layers, each with slightly different conductive and ductile characteristics, are sandwiched one above the other to improve the resistance of the panel. Sometimes, a special mesh of artificial diamond fibers is added for extra strength and durability, although this increases the cost of the material.

Special care is taken to include limited radiation-absorbing elements within the panels as well as making sure there are reduced possibilities of a catastrophic radiation cascade should the armor be hit by high energy cosmic rays. The inner foamed polymer layer is a combination spall absorber and radiation shield, and is separated from the hull's internal pressure vessel by yet another liner.

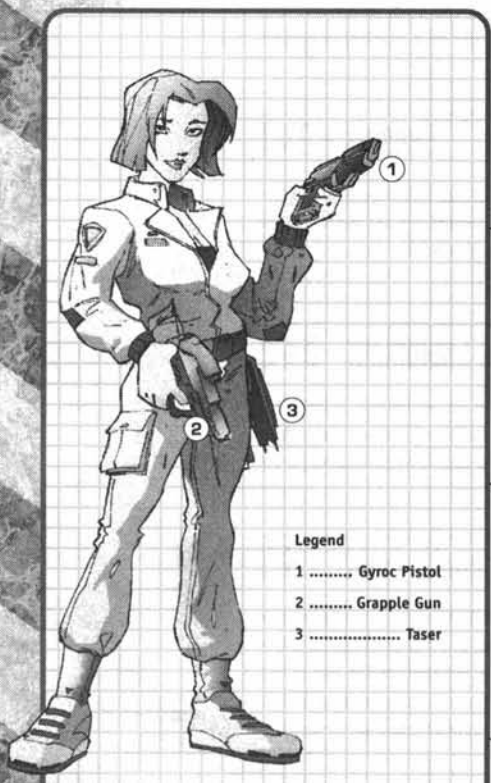
Fog Launchers

"Fog Launcher" is the common shared name for a number of defensive systems that work by releasing clouds of sand, crystals or dust at high velocity in the direction of the attack so that they refracts energy beams and ablate incoming projectiles. Incoming beams must expand energy to burn through the cloud, reducing and possibly even eliminating any effect on the ship's hull. Fogs also affect target designation but to a lesser extent, since by reflecting part of the designation laser they actually help the process.

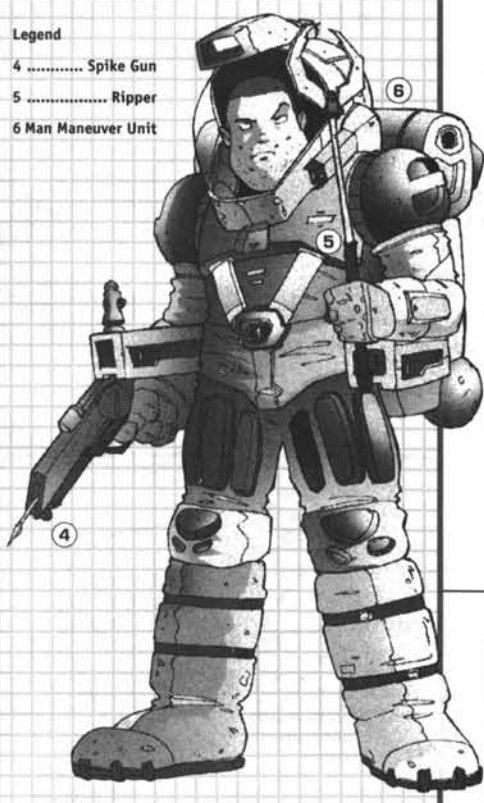
Having no propulsion system of its own, the fog cloud disperses as soon as the ship apply an acceleration. Experiments were made with ionized dust particles coupled to a magnetic field to force the fog to remain near the ship, but they have been only partially successful. This means that the available protection tends to diminish as the battle wears on and less and less material can be committed to the defensive cloud. See *Ablative Armor* in Chapter 4, page 60 for game rules.



2.5 - Tools and Equipment



Legend
1 ..... Gyroc Pistol
2 ..... Grapple Gun
3 ..... Taser



Legend
4 ..... Spike Gun
5 ..... Ripper
6 Man Maneuver Unit

Working in space presents a number of additional difficulties that make even the simplest job challenging. The absence of a gravity field means that tools and objects will tend to float away, and any action must be carefully checked for the inevitable reaction. Both repairs and equipment are made more difficult by the spacesuit gloves, which, although very fine, cannot offer the same dexterity as a naked human hand. To get around these problems, a number of special tools have been developed specifically for use in space. In addition to the ones listed below, any of the equipment shown in another Heavy Gear book can be found in a space-adapted version for twice the cost.

◆ Grapple Gun

Grapples and lines are simple tools that have saved the lives of many spacers. They are used to tether oneself to a spaceship or rock while working, so that a false move will not send the person tumbling into space. The compressed gas gun allows the grapple and line to be fired at a distant surface. The gun has the following stats: Accuracy 0, Base Range 10 meters, x2 Damage Multiplier, costs 40 marks or dinars and weighs half a kilogram. The gas canister is good for ten shots, and reloads are available for one mark/dinar (though the canister can be recharged by any standard pressure line).

◆ Man Maneuver Units (MMU)

In space, there is nothing to push on – any movement is based on jettisoning reaction mass in the opposite direction to the one in wich you want to go. A space-suited person must thus rely on an external apparatus to have movement or else be tethered to a large object (a ship or a space station). The MMU is a small hand-held or backpack-mounted unit that provides thrust, allowing the user to move about. The smaller MMU provides 0.2 g (2 MP) of thrust and has four Burn Points. The backpack version is more massive, can provide up to 0.6 g (6 MP) of thrust and has 60 BPs.

◆ Personal Weapons

All weapons and armors require a permit for carrying. In civilian areas, concealed weapons are illegal, as are heavy weapons. In the space settlements and ships, any weapon capable of damaging the installations is banned, though low-powered weapons can be carried with the required permits (generally only given to military personnel).

Gyrockets are handguns and rifles that fire small rocket-propelled bullets. These weapons are more efficient at medium and long range than from up close, as the bullet is still accelerating at short range. The first (lower) Damage Multiplier should be used if the target is at Short range; otherwise, the second one is used. Gyrockets have little or no recoil, making them perfect for use in space.

Ripper: this is little other than a spring-loaded, serrated shear that is designed to cut or rip open a spacesuit. It is mounted on the extremity of a tanto-like stick, giving it good reach.

Spike Gun: this is an unusual weapon/tool. The Spike Gun is a chemically powered, armor-piercing ram. A tiny explosion propels a hardened alloy spear forward with enough force to punch through spacesuit armor (halve the Armor value of the suit); the exhaust gases are vented to the rear to kill the momentum. The spear can usually be replaced with a chisel-like device for engineering work.

Taser: this weapon fires small electrically charged darts at their target. If the opponent is not wearing armor, he receives electrical damage equivalent to an Intensity 5 shock. No matter what the result, however, the victim will not suffer anything more than a Light Wound. When rolling for side effects, fatal results are ignored but the Margin of Success of the attack is added to the Intensity. Tasers use standard power packs.

Weapon Statistics

Weapon	ACC	DM	Range	ROF	Ammo	Cost	Wt.
Gyroc Pistol	+1	x15/25	10/20/40/80	0	15	675/15	1
Gyroc Rifle	+1	x22/32	80/160/320/640	0	15	950/15	3.5
Ripper	0	x15	Melee	0	N/A	700	3
Spike Gun	0	x10 (AP)	Melee	0	3	860/10	2
Taser	0	x3 (Elec.)	4/8/16/32	0	30	60/10	0.5

DRONES AND TELEOPERATORS - 2.6

"Drone" is the common name applied to a wide category of robot vessels that serve a variety of purposes in space. They are controlled by advanced computer brains that are capable of guiding them through a battle or surveillance mission with great precisionDue to their programming, however, they are quite predictable and must be backed by human decisions. Drones can be controlled either by their onboard computer or by teleoperation (remote control). Whenever possible, drones are remotely operated instead of being left to their own (limited) devices. This can be made impossible by several factors: distances (the speed of light imposing a lag on drone/operator communication), radiation belts, solar flares or electronic countermeasures (all of which make the data hard to exchange).

Game Effects - 2.6.1

Remote control equipment is a software modification of the Autopilot Perk, which is required for all drones regardless of their shape or function. In addition to directing the drone according to its internal programming, the Autopilot can receive instructions through the Communication system and sends back environmental data gathered by its Sensor array. Remotely-operable drone must thus be equipped with all three of the above systems. Drones are not affected by "Crew" hits, though Armor points are lost as usual.

If the drone is to perform actions (i.e., fire a weapon, make an Active Sensor sweep), it must be equipped with the Automation Perk to represent the mechanical systems (this is an exception to the rule stating that at least one crewman must be aboard for Automation to be used). A drone cannot perform more actions than those afforded by its Automation level; for example, Automation 4 would allow up to three actions per turn. If teleoperated, drones are also limited by the controller's own action total. In the above example, a single controller could perform three actions at -2 each, but not four at -3. Two controllers could handle the three actions with only a -1 penalty. A single person cannot control more than one vehicle at a time, though a drone can have multiple controllers.

Data Transmission and Lag ◆

Because of the associated data-encoding procedures and control lags, remotely piloted vehicles suffer a basic -1 modifier on all of their rolls. If the drone is controlled through a Satellite Uplink, the extra lag increases the penalty to -2. The vehicle must be within communication range or contact will be lost. ECM affects the control link normally, and must be tested against every turn when present. The Stealth Perk can be bought for a drone, but it becomes useless when the drone is under direct guidance, since the remote control two-way transmission always points to its general location.

If contact is lost, the software automatically switches to a predetermined program, just as if the drone was set for autonomous operation. The vehicle is then controlled by the Autopilot until contact is regained or the vehicle runs out of fuel, whichever comes first. The program should consists of a single line of text and should be written down when the drone is released.

Wire Guiding ◆

Drones may be wire guided; this is also used to represent towed sensor array. This removes the need for a communication system as well as the time lag, since wire transmission cannot be intercepted and are thus not encoded. Wire guiding also makes the drone immune to ECM, but it implies that the vehicle is trailing a very fine wire for control. A Piloting roll must be made every turn against the highest Movement Point cost for the hexes traveled to avoid snagging the cable. Flying drones must test also and use the overflown ground's MP cost. Failure means the cable is stuck and the drone must halt for the next round to free it. A fumble means the cable is severed. For simplicity's sake, it is assumed that the length of the control cable is equal to the Communication range of the drone.

ASATs and Planetary Defense Drones

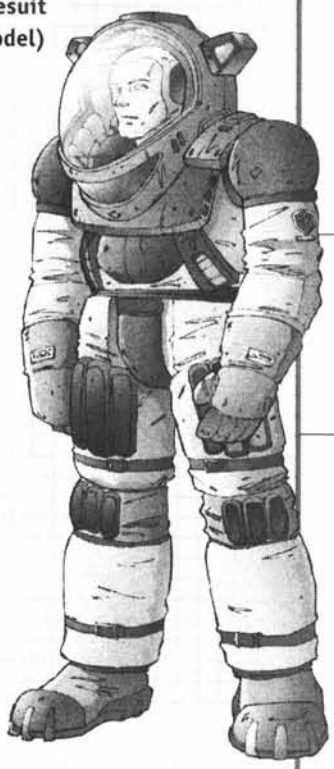
ASATs (Anti-SATellites) and drones form the bulk of modern space combat. Almost every ship carries a small squadron of these versatile little machines for use both offensively and defensively. The simplest models are little more than a tiny brain wedged between a sensor package and a large thruster and fuel tank, and cause damage by ramming at very high velocities. The more sophisticated models have their own onboard weapon systems, such as a gigawatt laser or a battery of nuclear missiles, and sufficient fuel to harass enemy spacecraft for weeks if need be.

Planetary defense drones formed the bulk of the space defense during the War of the Alliance. At the beginning of the conflict, each league was stockpiling a large number of those machines mounted on disposable booster rockets. In the event of interpolar conflict, these would have been launched as needed to clear the skies of hostile observation, C3 and fire support assets. As history showed, though, they were instead launched *en masse* against the CEF fleet as it entered orbit and began laying down suppressive fire for the descending troop carriers. Though casualties were high, they managed to drive the fleet into a retreat, followed by cat and mouse engagements over the next few cycles.

2.7 - Space Suits

Marine Suit (UMF's SDF Model)

Heavy Spacesuit (Civilian Model)



Space suits have not changed much over the millennia, though they have become vastly more efficient, less prone to leaks and are now mostly self-maintaining. Their basic function is to protect the wearer against the hard vacuum and excesses of temperatures of the space environment. They also provide a convenient mounting frame for tools, comm devices and survival equipment.

Terranovan space suits are self-adjusting: the wearer modifies the fit of the various parts rather than have a suit custom-designed. The various connectors and inner liners use memory plastics and various mechanical systems to ensure proper fit and movement range, regardless of who is wearing them. This does require a suit fitting to avoid penalty during use. A normal fitting takes about an hour to do properly, reduced by a Survival (Space) Skill test against a Threshold of 3; multiply the MoS by five to know how many minutes are saved. An unfitted suit (used in an emergency, for example) gives its wearer an Action penalty equal to 1d6/2 (roll at the beginning of each round), rounded up.

◆ Pressure Suit

Pressure suits are low-pressure light suits worn by crew in spacecraft. They offer little protection against radiation, temperature variations or impacts, but they are light and easy to move in, having few hard pieces. They are made of a self-sealing material that will repair a hole of up to 0.5 cm in diameter in one round. The air and power reserve usually contains up to six hours' worth. They offer total insulation against cold and temperatures of up to 250 degrees Celsius. They are sealed against NBC effects, like all spacesuits. They require (15 - Space Survival Skill roll) turns to put on.

A slightly different type of suit is used by marines and engineering crewmen. They have the same basic configuration as the basic pressure suits, but feature additional layers of puncture-resistant material as well as radiation shielding. Many have reinforced pads in heavy duty areas. They are equivalent to pressure suits, but have Flak (+10 Armor) and Rad armor (RPF 15) woven into them.

◆ Spacesuit

The "true" spacesuits are equipped with reinforced parts and components for extended stays in space. These suits are built around the basic structure of the lighter pressure suits, but they also feature reinforced "shell" sections for improved performance and reduced wear and tear. The torso is a one-piece hardshell and the limbs are encased in articulated armored sheaths. In game terms, they are equivalent to pressure suits, but have heavy padding (+20 Armor) built into them.

Hostile planetary worksuits are similar but equipped to deal with poisonous or heavy atmosphere. They feature reinforced boots and leg pads and can withstand higher pressure than other types of space suits. In game terms, they are equivalent to pressure suits, but have turtleshell armor (+40 Armor) built into them. They impart a -1 penalty to all actions in addition to preventing sprinting.

◆ Helmets

Helmets have an almost endless variety of design, but they share some common ground. All house a short range radio apparatus (Comm -5, range 10 km) and a headlight. A polarized anti-glare visor can be adapted to the faceplate. Some heavier models manufactured for worksuits feature drinking tanks, emergency oxygen microtanks (5 minutes), food tablets and powerful headlights.

◆ Life Support System

All spacesuits have connectors to attach a life support unit. Transfer LS packs are little more than a small oxygen reserve (20 minutes) to maintain the suit's functions when moving between pressurized environments or switching from one LS pack to the other. Transfer packs are usually quite small and worn on the belt or on the chest plate for easy access.

Short-term packs are the standard space suit packs. They contain the main radio equipment, oxygen tanks (six hours), recycling units and cooling equipment. Some feature an emergency jet option: there is enough fuel for a velocity change of up to 34 m/s (2 MPs, 2 BPs for tactical gaming). Long-term packs feature all the functions of a short-term life support backpack plus another ten hours of air, and have headlights, modular tool hardpoints and an integrated maneuver unit (140 m/s total velocity change, or 4 MPs and 8 BPs).

Survival Equipment - 2.8

Not all contingencies can be foreseen, but having the right tool at the right time can make the difference between life and death. Most of the spacer's emergency tools deal with pressure loss and radiation bursts, since these are the two most urgent problems that they can face.

Emergency Tools - 2.8.1

Bubble Shelters: though they are often cylindrical, bubble shelters are named because of the dome shape of the basic model. A shelter is an air-tight tent equipped with a basic cloth airlock. It is used to change out of a damaged spacesuit or as a more confortable means of waiting for help. Some bubble shelters come with a small explosive charge to dig a hole in the ground for the tent, effectively giving them the ability to act as a temporary rad shelter as well. Shelters have an average twelve man-hours of reserves.

Emergency Power Supply: this is a small power pack with universal connectors designed to supply power for a short time to critical systems. It will provide enough energy to fire a personal weapon once, or keep a suit active for another six hours.

Slap Patches: these ubiquitous polymer sheets are carried by every spacer and found in every room. They are made of a tough fabric coated on one side with molecular bonding glue. If a pressure environment suffers from a leak of up to 10 cm^2, a patch can be applied to the opening to seal it instantly for 1d6 hours. Each costs one mark/dinar.

Sealer Spray: this is a can-based polymer agent that has been designed to make secure links with most materials. Sprayed directly into a puncture or fissure, the spray quickly hardens and seals the opening. Each finger-sized can plugs up to a fist-sized hole (50 cm^2) and costs about 25 marks/dinars.

Sleep Tubes - 2.8.1

One of the most ancient technologies used for space flight, this relatively simple apparatus (by 62nd century standards) keeps a living being alive for long periods of time while requiring a minimum of supplies. Without it, large scale space colonization would have been impossible — no ship would have been able to carry the enormous life support system required by its passengers.

The average sleep tube is composed of a cylindrical transparent chamber about two meters in length by seventy-five centimeters in diameter. One extremity contains the life support mechanisms and the back-up power packs while the other is the access hatch. A composite mesh gurney fits within the tube and can be pulled out to allow easier ingress and egress.

A sleep tube does not properly freeze the voyager, for this would cause ice crystal to form within the cells and would quickly kill him. Rather, the principle used is similar to the hibernation process used by frogs and other creatures on Earth. The body is chilled to near freezing temperatures and immersed in an oxygen-rich liquid medium (this also serves to buffer the sleeper against acceleration).

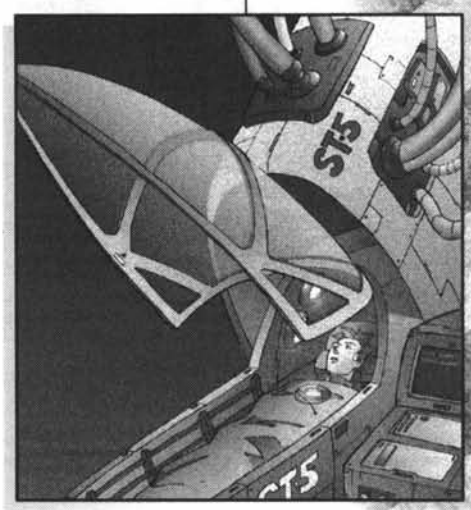
In game terms, a person can handle ten times as much acceleration as normal without ill effect while in the tube; they are not conscious of the passage of time, and neither can they act or react to outside stimuli. The aging process is slowed down by a factor of twenty, but the person cannot stay in cold sleep longer than the MoS of a Health roll (Fumbles count as a result of one) in cycles. If they do, each additional cycle causes one automatic Flesh Wound. A one-month rest period is required between uses.

Sleep Traveling

Traveling within a sleep tube is a preferable alternative to the extreme boredom of "awakened" transit, but the whole procedure is uncomfortable to say the least. It begins one month before the flight proper with a low residue diet, special medication and fluid injections. An exercise regiment, with emphasis on suppleness, is highly recommended but not vital.

The traveler must first strip naked and then attach medical sensor leads and the low temperature limb sleeves. Once the person is laying down on the tube's internal gurney, assistants secure the rest of the medical sensors, install relief tubes, secure restraining straps and attach cooling tubes to limb sleeves. The traveler is then injected with a sedative and a special mouthpiece is placed to ensure free fluid passage to the lungs. The gurney is pushed into the tube and secured, and the hatch is closed shut. Some designs use a canopy-like device; others have a drawer-like system which requires less room but is more claustrophobic. Once the patient is comfortable and numb, the tube is filled with the clear breathing fluid. After one hour, the fluid is gradually chilled to its flight temperature of 2° C, while the limbs go down to 1° C.

The patient will then remain in a fugue-like dream state for the duration of the trip. The metabolic processes are slowed down, but not stopped: the slowdown ratio is approximately 1:20, meaning that twenty months spent in hibernation will age the body one month. Emerging travelers will thus typically need a good shave and a manicure, and will feel weak for 1d6 day afterward.



BLACK SHUTTLES

For the third time in a week, Captain Collen Shapiro was arguing with a ground officer about allocations. And once more, the dirtsider wouldn't hear a thing she said.

"I keep telling you, we need more personnel and ships; we keep finding more and more relics left over from the War!"

She paused, waiting for the pulsed laser beam to carry her words through space to the relay satellite that would beam it down to the surface of the planet. For the umpteenth time, she inwardly cursed both Einstein and Tannhauser.

The answer came back after a few more seconds. Lt. Colonel Stuffer looked even more bloated than usual, she decided.

"You know there aren't more funds in the budget, captain. Rebuilding our ground forces, which I would like to remind you are the first line of defense of our league —"

"But!" she tried to interrupt, then stopped to let him finish. Try as she might, she couldn't interrupt him even with all the fury in the world. The laws of physics just didn't work that way.

" — is our main priority at the time." He droned on, oblivious to her outburst, then settled in to wait for her reply. *I'd swear he's retracting his head back into his collar, the fat...* Colleen ate her words and went back to the matter at hand. She tried another approach.

"We lost another crew just last week. They were trying to disable a leftover ceffie boobytrap. We got lucky that it was low yield and didn't take half the ship with it.

"Plus, there are rumors going around that we might be in for another round of CEF visits." She thumped the datapad she was holding against the palm of her hand. "If the Earth dawg ever came back for more, *we* would be your first line of defense, not your precious ground force... sir."

Great, she thought. *Even now, I can't restrain my temper. The very same temper that got me assigned here in the first place.*

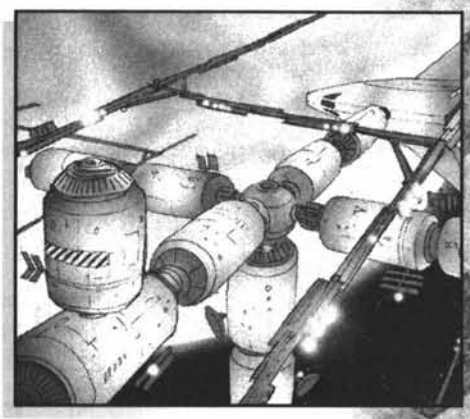
She used the communication delay to regain her composure. Fortunately for her, Stuffer had gotten distracted by an aide off-screen while waiting and had missed her last outburst. He patiently waited for her to go on.

"But I've kept the worst for last." She waved the datapad again. "I've got reports here of faint readings from high energy events detected on the edge of the system. Those were beamed over last week by both Ares and Hades bases. If I didn't know any better, I'd say those are Tannhauser Gates opening up, and you and I both know that's not a natural event!"

"Nothing to worry about, Captain." Stuffer seemed bored by the whole conversation. "Those rumors are unfounded. I've been personally assured of such by high command. One of our Gateships is out there studying this at this time; I've been led to understand that it might indeed be a natural phenomenon."

Colleen was not convinced. She had seen the remains of the strange whitish Gear that was discreetly transferred to a planet-bound black shuttle yesterday.

THE PHYSICS OF SPACE FLIGHT - 3.1



Space is mostly an empty vacuum, so the only forces at work on a spaceship are thrust and inertia. Since there is no atmosphere to bleed off kinetic energy through friction, an object launched along a vector will keep moving until another force is applied to it. Because of the absence of gravity, there is also no up/down reference. Artificial gravity is still a science-fiction concept, even in the 62nd century, so continuous acceleration and centrifuges are the only means of simulating gravity. In effect, the direction toward which an object travels is "up," as long as it keeps accelerating. In the case of centrifuges, the direction toward the axis is "up," while away from the axis is "down."

The lack of atmosphere and gravity means that moving around in space is very different from flying. A ship cannot cut power to its engines and lose speed or altitude, and nor can it push against the atmosphere to turn. According to the Third Law of Motion, a ship needs to create an action, in this case firing a rocket engine, to create a reaction, the ship changing trajectory. Likewise, to change the velocity of the vehicle, thrust needs to be applied in the direction of travel. This makes for a very non-intuitive and confusing environment for anyone born within the up/down frame of reference supplied by the gravity field of a planet.

The Laws of Motion - 3.1.1

Newton's Laws of Motion, as elaborated long ago by the English physicist Sir Isaac Newton, are at the base of sub-light, non-relativistic space flight and navigation, though the actual navigation number crunching requires the more advanced corrections elaborated by Einstein for accuracy. All three Laws apply at all times throughout the universe, but they are much more apparent in space where gravity and atmospheric and surface friction are not factors in movements.

These laws, along with a number of basic security procedures, are always in the mind of the experimented spacers. They are the rules of the game — a game that allows no cheating, no bending the rules, and no way to stop playing when the going gets tough (except permanently).

Inertia ◆

Law Number One: unless an external force is applied, a body at rest will tend to remain at rest and a body in motion will tend to remain in motion along the straight line it is following. A spaceship or other object will not move unless a force is applied to it. Likewise, a ship in motion will not stop or change direction unless a force is applied to it. This means that without a way to apply force on its own (in this case, by thrust or recoil), a spaceship is helpless and subject to external forces — a planet's gravity well, for example.

Inexperimented spacers are sometimes killed because they have not taken this law into account. Objects may be weightless in free fall, but they are not mass-less. Stopping a two-ton cargo container from crushing someone against the wall of the docking bay, even if the container is moving at a very slow pace, will require as much energy to stop as it did to start it moving.

Acceleration ◆

Law Number Two: the acceleration of a body is proportional to the force applied to it. Simply put, if there is more thrust, the ship will accelerate (and thus move) faster. The reverse is also true, as a deceleration is merely an acceleration in the opposite direction of the movement. This assumes that mass is constant; if it changes, it will directly affect the acceleration: for a given force, a mass half the size will accelerate twice as fast, and vice-versa. A spaceship that sheds mass, either by burning fuel or by leaving parts of itself behind (cargo, armor plates, crew) will accelerate faster.

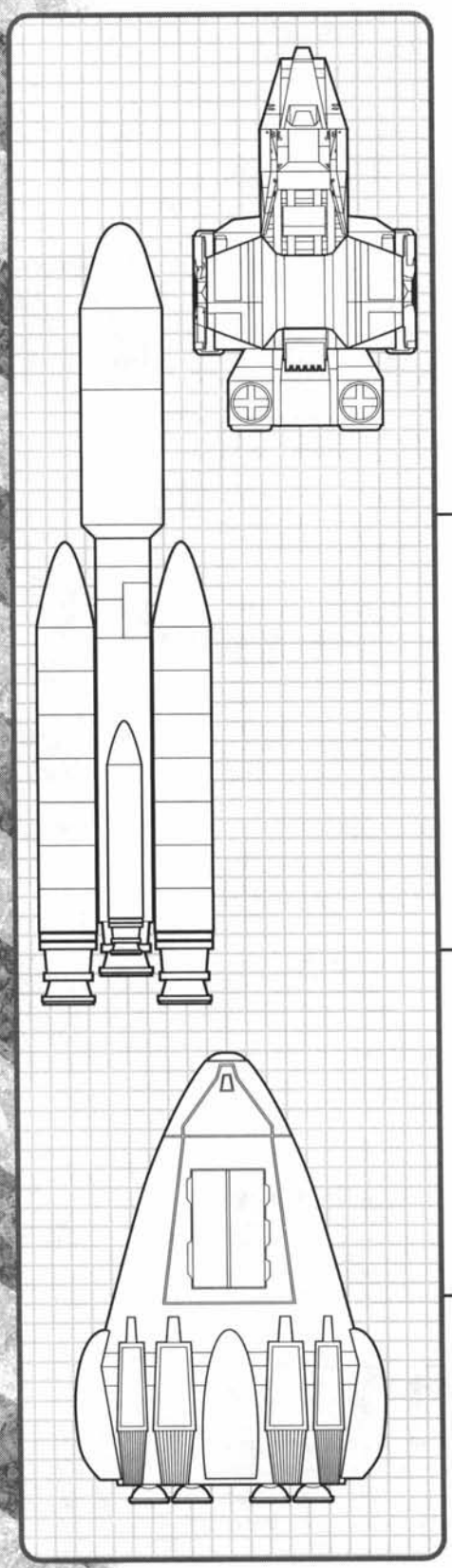
Action/Reaction ◆

Law Number Three: an action always has an equal and opposite reaction. Also known as the rocket principle, this is the basic concept on which spaceship thrusters are based. In this case, superheated gas or particles are ejected out (the action), and the ship moves forward (the reaction). This law also applies to everything in space: if a crewman kicks a wall (or somebody else), he will find himself flung toward the other side of the room.

Space Navigation - 3.1.2

Though objects in movement tend to remain on the same trajectory, the gravity wells of the various bodies within a star system (and especially the one of the star or stars) curve these trajectories until they close on themselves, forming a circular shape called an orbit. Unless one can apply a significant amount of power, all trajectories will be composed of curves as the orbital velocity of the ship around the star must be changed to arrive at its new destination. This is why space navigation is never as simple as the above Laws would have one believe; see Chapter 4 for more on navigation and orbital maneuvers.

3.2 - Ground to Orbit Vehicles



As a general rule, the larger interstellar spaceships and Gateships in wide use in the 62nd century are too massive to descend onto a planet's surface. They can park themselves in low orbit, but that is about the extent of their capabilities. Most in-system spacecraft are not much better: very few are light and aerodynamic enough to be atmosphere-capable. Thus, ships need to carry interface vehicles capable of flying down to the ground and back up into orbit to transfer crew and cargo.

In addition to their shuttle duties, most interface vehicles can also be used for fast deployments of troops via sub-orbital flights. The vehicle simply climbs up to orbit altitude, makes the required fraction of an orbit necessary to bring it over the target site, and then re-enter the atmosphere to come down. If the site is close enough, a simpler sub—orbital parabola will suffice. With this method, no location on an Earth-sized planet is more than an hour's flight away (see the Advanced Space Movement rules on page 53 for more on this maneuver).

A wide variety of vehicles are used to fill the gap between orbit and ground. Their shape, size and method of propulsion depend on their function (cargo, passenger, military, etc.), but most modern vessels are based around an aerodynamic hull that provides some lift to supplement the thrust of the engines during atmospheric flight. Some older models are built around a rocket or spherical shape which, despite its increased internal volume, is completely dependent on its thrusters for lift and much more fuel-hungry.

3.2.1 - Shuttles and Scramjets

Shuttles and scramjets are the most common appellations for aerodynamic vessels capable of short orbital flights and subsequent reentry. They are mostly used for passenger and rapid cargo transport and military missions, ferrying everything from troops to ordinance to the target zone.

Most of the shuttles currently in service use a scaled-down version of the fusion tube used by spaceships, often supplementing it with intake venturi for diluting the pure fusion exhaust with cooler air. This create a cooler and quieter exhaust that is more manageable and less dangerous to the vessel's immediate environment. Many shuttles have additional ducting to allow the exhaust stream to be vented downward, providing them with vertical landing capability.

Civilian scramjets, lacking the expensive fusion thrusters, use more classic hybrid engines that are based on chemical rocket technology. Though less performant, they are easier to maintain and operate. Both the military and high-end civilian shuttles sometimes use solid fuel boosters to reach escape velocity faster, switching to chemical or fusion engines for final boost and orbital maneuver.

3.2.2 - Rockets and HLVs

Rockets and HLVs (Heavy Lift Vehicles) are used to boost large amount of cargo into space. Rockets are disposable, one shot vehicles that are discarded or dismantled for material once in orbit. HLVs are similar to rockets but are equipped for reentry and recuperation. Both of these are either remote or robot-controlled.

Rockets are often use to boost clusters of combat drones into orbit. The process is done by automation because there are always lots of casualties and multiple launches are generally required in very short delays (crew costs becomes an issue). Just as well, it is better to have twenty rockets lifting off from various points than one vulnerable shuttle (spacecraft can't dodge very well during climbout, no matter what engine they have, because of the acceleration and aerodynamic pressure).

3.2.3 - Clippers

Clippers are used for any surface-to-orbit or orbit-to-orbit task that requires high capacity and flexibility. These vessels are equipped with nuclear fusion thrusters and use air, hydrogen or water as reaction mass. They can thus travel great distances at high speed and acceleration, and have a longer range than chemically-propelled vehicles. They are also much more expensive and complex.

Clippers are built on a cylindrical or spheroid frame, looking either like a regular rocket or a gigantic metallic cone. A few rare designs are aerodynamic, taking the form of a large plane or flying wing. Both types of vessels are fully re-entry capable, as they use heat-resistant composites for their lower hull.

The Flight Out - 3.2.4

All orbital flights start at one of the Terranovan spaceports, which is often little more than a ferrocrete area with passenger processing and maintenance and fueling facilities. Once the identity of the passenger has been confirmed with a battery of tests ranging from fingerprinting to retinal scans, he is free to move to the main departure lounge.

Basic safety courses are given before boarding, and attendance is mandatory; even experienced spacers must get a refresher in emergency decompression, crash and collision protection, space sickness (nausea), space cough (accidental inhalation of floating liquids in the lungs), airlock operations (certified personnel only) and more. There are constant security checks and some locations even impose a basic quarantine. No one wants to bring dangerous weapons or micro-organisms in the closed environment of a spacecraft. Most commercial passengers are put under in sleep tubes at this point, both to reduce life support requirements and to avoid potential zero-gee sickness problems.

Once all the passengers are present or accounted for, they may board the vehicle (or be loaded into it). The hatch looks like a standard aircraft door, except that it is actually an airclock. The interior of the main cabin is a muted color and has well padded walls with recessed handholds everywhere. The seats are wide and deep; the adjustable harness covers most of the torso.

Launch ◆

The departure is always a dramatic moment. Though the flight control centers do not use countdowns anymore — those being replaced by pre-flight checklists — the tradition continues aboard the vessel itself. Just to make sure that no one is frightened by the sudden engine ignition, most crew will at least do a ten-point countdown on the public address system.

As the vehicle leaves the ground, its engines emit a deep bass sound muffled by the cabin's walls. Slight vibrations due to aerodynamic tensions can be felt. The acceleration isn't heavy, except on military craft: it rarely go higher than two or three gees (a gee is equal to one Earth gravity).

The sound and vibrations grow progressively deeper as the craft approaches Max-Q (the point in its flight where all forces, acceleration and dynamic tension, are at maximum); then the sounds gradually mute down but never completely disappear, even once in space (the hull itself transmits them).

Orbit ◆

The arrival in orbit is unmistakable. Once the final orbital burn is complete, the engines are shut down. The spacecraft then enters free-fall, falling toward the ground as it moves around the planet, but never reaching it. Commercial flight crew ask that travelers do not leave their seats at this point, with some rare exceptions; military crew generally just order their passengers to stay put. This avoids having problems with a cabin full of flailing, space sick people. Anti-nausea drugs are available, but their efficiency varies from individual to individual and is hard to predict.

Flight time depends on the final destination. A flight to low orbit will take about half an hour; one to a higher orbit can take up to half a day. There is little to do except read, watch a video or sleep. Very few crew let the passengers enjoy the novelty of zero-gee acrobatics: cabins are not that spacious to begin with, and it is very easy for an unexperimented pleasure seeker to bump (often with dramatic results) into something or someone.

Upon arrival, the vehicle dock with the ship or space station. There is a slight deceleration, followed by a gentle bump as the two mechanisms make contact. A few minutes go by while connections are checked and air pressures equalized. The travelers have ended their journey.

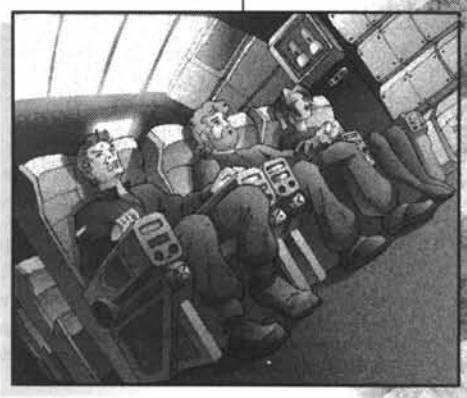
◧ Creature Comforts

"Unlike the earlier space travelers, who endured launches and reentries buried within a cumbersome pressure suit, most modern spacecraft allow their passengers to remain in shirt sleeves. You will thus not be required to go through a lengthy suit fitting and process, but you had better listen when they teach you how to use the emergency suits.

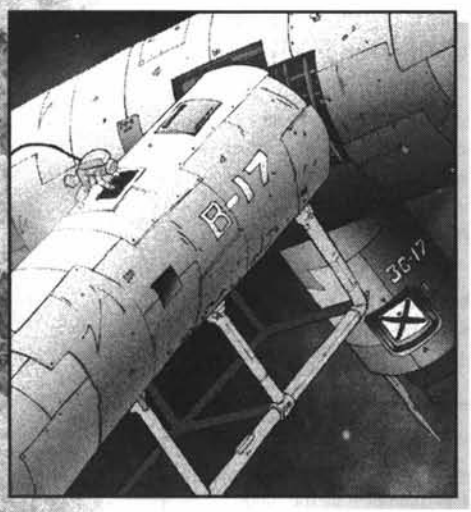
"They make you sit in those big padded chairs with the five-point seatbelts. They look a lot heavier than they are, but most of their bulk is foamed polymer on a light alloy armature. Sturdy as hell, though. Just find a confortable posture and relax. Take a deep breath. The sound levels are high, but there's not much we can do about this.

"Don't fret about the launch. The rumors of crushing acceleration are just that, rumors. It's actually a quite gentle climb. Well, in peace time operations, anyway. We'll see how you boys handle six gee of evasive maneuvers."

— Unidentified Recruitment Officer, NGSS



3.3 - Space Stations and Bases



The first bases were built to accommodate ships coming in system. They were often made of cast-of fuel tanks and vessels with disabled propulsion systems, though sometimes a pre-fabricated commercial station module was towed in-system through a Gate.

After Earth left, the stations of the Helios system made do with what they had, keeping contact with the world below. Aware of their precarious situation, they always remained fairly neutral in the conflicts that wracked the planet.

As leagues formed, they assimilated ground installations and their associated crew. In space, stations changed allegiances and went to specific leagues, but relations always remained more cordial up there than on the planet below (probably due to the difficult environment shared by spacers). During wars, there were very few actual combats, and most of them were between space-suited infantrymen. Once Gears were developed, a few were modified and vacuum-proofed to be posted in the surface installations and aboard ships as oversized marines, but they were never very useful space combat vehicles.

Half the orbital installations were destroyed during the War of the Alliance. After the conflict, many leagues put temporary stations and satellites in orbit to compensate for what they had lost. Some thought it simpler to take over the existing network deployed by the invaders, and the Hermes 72 satellite constellation was quickly co-opted.

3.3.1 - Design

The configurations of a 62nd century space outpost depends greatly on its intended use. The smaller stations are little more than a pressurized cylinder attached to a vacuum-dwelling machine-tool and the solar panel needed to power it all. Most are automated, others require a live-in technician/operator/repairman. These workshacks can be launched fairly easily and are inexpensive to maintain.

They are followed by the larger factories and orbital bases, which are similar in construction but on a grander scale, using long metal trusses to hold the modules together. Factories and bases generally have roomier living quarters as they have a semi-permanent staff. For this reason, most have at least one gravity simulation facility, such as a rotating wheel, to maintain muscle tone and bone strength. The larger space stations include Ellis Island and the Caesar series, which are designed around a cylindrical spinning model to generate simulated gravity at the rim. Ellis Island is the largest, being more than a kilometer in diameter (though a large section of Torus "A" is still missing, the hit that caused the station to surrender during the War of the Alliance).

Most modern Terranovan stations are built out of locally available material. Many of the autofacs are ore converters and solar smelters feeding off asteroid stock and supplying high quality metal and polymer blocks to the construction teams. The original colonial settlements have long since become obsolete or too worn out to safely inhabit, and have since been recycled.

All the modern space stations use a semi-closed cycle ecology to help in life support and reduce maintenance costs. Plants and solar-powered scrubbers supply the installation with circulating fresh air, and food is grown locally to avoid huge transport bills. The stations use either radiothermal generators or fusion plants for emergency and back-up power, but most of their energy needs are fulfilled by solar collectors. These cover most of the habitats' surfaces and extend like gossamer wings on areas hundreds of meters per side.

◆ Moon and Planetary Bases

The Helios system is home to several lunar bases, the largest of which being Hope Interleague Moonbase. This interleague city has been created on the site of a previous installation not long after the end of the War of the Alliance to serve as a meeting point for the various Terranovan fleets of the Joint Space Initiative. Hope is also home to scattered outposts and mines all over its surface, often separated by hundreds of kilometers. There are also installations on Ares (mostly science stations) and Hades (deep space surveillance network).

On Hope and most close celestial bodies, the buildings are mostly build underground to protect them from the radiation and occasional meteorite. On the more distant planets and moons, all the buildings have been built on refrigerated mounts so that the temperature differential between the equipment and the soil do not cause catastrophic sublimation of underground gas pockets.

The internal design of the base buildings is very similar to the one found aboard space stations, and indeed the two share many systems. The bases are composed of several clusters of buildings, each with its own life support system. They are linked by underground tunnels (some wide enough to accommodate vehicles and Gears). Pressure doors are found at every corridor junctions and every fifty meters elsewhere. Airlocks to the outside are restricted to a number of "white room" facilities, which are invariably coupled with a security station.

Daily Life - 3.3.2

It takes a special breed of people to live in space, the most hostile environment known to Man. The physical requirements and limitations of the space environment have forced the adoption of a set of specific rules designed to facilitate and safeguard the lives of people living in space. These rules are drilled into every traveler before they are allowed to set foot into space, for their safety and the safety of the people around them.

One of the oldest rules is that loose liquid, crumbling stuff and smoke are unwelcome in free fall. These float into the air conditioning system and foul it up, and can make breathing difficult or even hazardous as loose particles are absorbed into the lungs. Hair should be worn short or attached; loose clothes or jewelry can become entangled and so are normally shunned. Pockets, belts and Velcro straps are useful to keep personal possessions at hand, and visitors are encouraged to use them.

All corridors are normally lined with strips of bright colors, usually with arrows on them. Traffic should attempt to remain nearby the strip indicating their direction. All markings, such as shipboard indications, warning labels, etc. are printed twice, 180 degrees from one another. They can thus be easily read regardless of orientation. Each compartment generally also has its volume and rad shielding factor stenciled on the wall near the doors and hatches.

Visitors must keep one hand on a handrail or other fixed object at all time, or else be tethered; only trained crew are allowed free flight, and then only in specific areas and emergencies. Large gestures are discouraged in space: flailing around might send someone flying off, or hurt a passing fellow spacer. Regardless of the location, ship, hangar, station, etc., people on duty, such as crewmembers, have right of way in corridors and access shafts. They may need to get somewhere fast to respond to an emergency.

Typical costs ◆

All the requirements of life, such as air, water and food must be gathered and supplied to the spacers. As a result, the cost of living in space is extremely high, and most of the Terranovan spacers are there as employees of a corporation or as representatives of a given government. Very few private individuals can afford the day-to-day expenses of life in space, though they are very few restrictions on traveling: if you can afford it, you're welcome to stay.

Cost of Living

BASIC NEEDS	COST	BASIC NEEDS	COST
Air Tax	2/day	Clothes, Light, Upper-class	500*
Water Ration	1/liter	Shoes	50
Sleep Cubicle (2 m²)	25/day	Cap	10
Cabin (10 m²)	200/day	Audio Recorder	60
Private Quarters (100 m²)	1500/day*	Video Recorder	200
FOOD ITEM	COST	Trideo Recorder	2000*
Bottled water	3	Data Disk (box of 10)	20
Fruit Juice (Saguarro, Waterroot)	8	Personal Computer	400
Cawfee	10	Audio Receiver	20
Beer	10*	Video Receiver	120
Wine	20*	Trideo Receiver	350
Sapa gum	1	Personal Communicator	40
Algae Loaf	3	Throat/Ear Comm Set	70
Ross Lichen salad	3	Flashlight	15
Generic snack	6	Mechanical Tool Kit	600
Generic dinner	9	Electronics Tool Kit	800
Springer steak dinner	95	Geiger Counter	80
Barbecued hopper dinner	45	Metal Detector	80
PERSONAL ITEM	COST	Rope (50m)	10
Sleeping Bag	90	Cutting Torch	25 (Reload 10)
Clothes, Light, Jumpsuit	20	First Aid Kit	10
Clothes, Light, Medium-class	50	Medical Kit	100
*When available			

Supplies

The spacers' food is generally grown locally to help close the recycling cycle and to reduce shipping costs. Most spacers follow the Terranovan custom of four meals per day, though the portions tend to be smaller. The food is a bit on the bland side, being composed mostly of easy-to-grow vegetables and plants such as algae, soya and fungi. Sauces and spices are used to make the meals more palatable, and there are a limited quantity of more "exotic" food available for those with money or the right connections.

Though the abundance of ice-bearing planetoids and fusion power means that water is available in large quantities, it is very massive, and thus costly to ship around. Recycling is the preferred alternative: it is not perfect, but it does reduce the need for raw material. To prevent abuse, water is rationed out at the rate of one mark/dinar per liter (including both drinking and hygiene water). As a result, most drinks are somewhat more expensive than planetside. Shower rooms are often communal and metered to reduce recycling strain on the water supply.

Air is paid for by taxes, to the average tune of two marks/dinars per day, billed to any valid account. Corporations and armed forces cover this costs for personnel assigned to a space posting, but freelancers and individuals must pay the tax. No one is thrown out of an airlock for failing to pay; it's possible to reduce or even eliminate the cost if willing to serve as part-time maintenance crew, but the job of cleaning filters and checking tanks is a definitely unpleasant one.

All spacers are supplied with a sturdy jumpsuit when they are cleared to leave the planet. Some people prefer to use their own clothes but soon discover the usefulness of multiple pockets and no loose garment in micro-gravity. Patches and other decorations are often used to individualize clothing, especially amongst long time spacers. Uniforms are also common, since a great deal of the Terranovan space populace is composed of military personnel and ship crew.

Crew Areas

All stations have an Ops Control Center, generally located at the center of the installation. It is from there that the station's day-to-day operations are supervised. The duty personnel manages the maintenance schedules, act as flight controllers for spacecraft in their air space, and generally resolves crisis as needed. The sections of wall not made up of windows or computer screens are covered with hand-scribbled memos and announcements, though a computerized message board is also available.

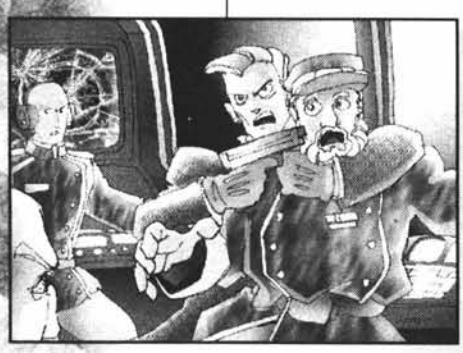
The Security Station is a heavily armored room. It is locked at all times, and can only be opened with the proper code or keycard. From there, the station's security officers can keep watch, assisted by a large network of small cameras routed to the room's multiple screens. The computer can also integrate the data from the ship's internal sensors and allows the security personnel to track intruders in real time as they move through the station. A locked weapon rack is on the far wall of the room. Protocol dictates that all personnel on duty must wear sidearms at all time, generally tasers.

It is fairly easy to find and rent a sleep cubicle, in fact little more than a coffin-sized room equipped with a mattress, basic hygiene equipment and a multi-purpose computer terminal. The cubicles can be made airtight and are equipped with an emergency life support system (similar to the ones used for spacesuits). If money is no object, it is sometimes possible to find a cabin or even a small suite, but those are few and generally occupied by permanent residents.

The station's various locations are linked by corridors that are wide enough to accommodate two people side by side. There are light fixtures behind translucent panels along the "ceiling" to help give an up/down orientation to the crew. Many of the onboard systems and conduits are located behind modular floor and wall panels to be easily accessible for maintenance and repair work. Some of the pipes are too large to be hidden behind panels and simply follow or cross the corridors wherever they happen to be installed. The corridors are painted in a neutral colors, with colored tags to indicate various locations and systems. Handholds and velcro pads are omnipresent.

The computer mainframes and other systems that maintain the station operational are housed in engineering bays. These are highly redundant and located in separate locations to augment the survivability of the station in case of combat damage or accident. Each bay is fully shielded against EMP effects and its walls are reinforced by extra plates and foamed spacers.

Security

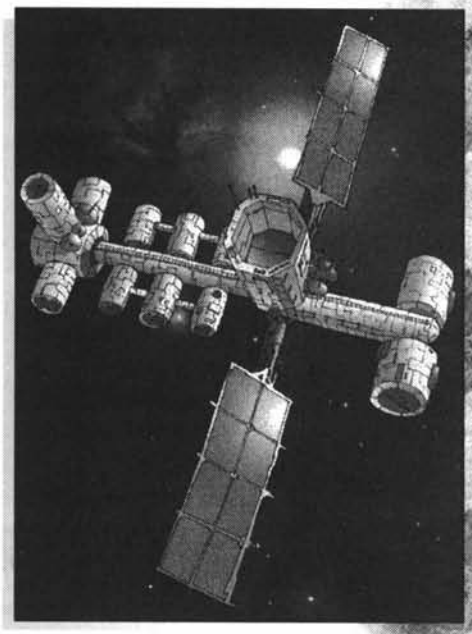


Security is always high in space. There are too many ways to endanger the lives of everyone on board to allow any kind of leeway where access and procedures are concerned. There are always restrictions and off-limit areas, and everyone is expected to respect the posted signs for their protection. Some mission-critical sections, such as command, engineering and life support, are restricted to ranking personnel and safety/maintenance people. Special badges tied into the internal security network are used to identify authorized visitors within a given area.

It is very hard to circumvent the safety measures. Visitors are carefully screened for weapons and other prohibited substances, and the station layout is planned in function of the security. For example, there are no airduct to scamper through: life support nodes are well distributed and isolated from one another to prevent contamination and accidental decompression.

Transfer Stations - 3.3.3

Space travel is a major undertaking, requiring considerable time and resources. For most people, it is simply out of reach, or is a "once in a lifetime" affair, unless they are part of a group or organization that is willing to foot the bill. Even if they manage to secure a ticket, it will only take them as far as one of the many transfer stations located in Terranovan orbit.



A trip to and from a Gate — never mind another star system — may take anywhere from one to three months, depending on the ships and the astronomical positions of the planets at the time of the travel. As a result, transfer stations have become nexus of travel where passengers can await until the celestial bodies are correctly aligned or a high speed ship goes in the same direction as the one they want to go. The station has extensive hangars and repair facilities where ships can dock and be maintained.

Station-side facilities are more spacious than those aboard spaceships, but they remain somewhat spartan and austere. Most of the nicer habitation facilities are reserved for the use of the permanent spacer staff, but there are always plenty of sleep cubicles to go around (see page 33 for sample prices). A series of small entertainment facilities are available to pass the time, but outside of a small gymnasium, library and "bar" (actually a combination of bar, meeting place, dance hall and restaurant), there is little to do but read and wait.

Transfer stations do tend to have fairly extensive greenhouses and hydroponic bays, which are often designed in such a way that they can accept visitors and let them enjoy the fresh air and peace and quiet without disturbing the normal operations of the facilities. These have another added benefit: the food on transfer stations is usually more palatable than the recycled algae glob served on orbital flights.

Finding Transport ◆

Getting off planet in the first place is not easy. There are only a few large spaceports on the planet, and most of the smaller ones are restricted military installations. People with a lot of money and the right connections will find it relatively easy to book a flight on a shuttle leaving for one of the space stations, but most of the time access to space is well controlled. People will want to know why you're going up there, and what you will do once you arrive. Life support equipment must be adjusted in function of the number of occupants, resources measured, etc. One does not visit the Terranovan low orbit on a whim.

Going beyond low orbit is an even more difficult proposition. Unless one has secured employment with a privately-owned spacecraft, the only way to visit one of the moon bases or deep space stations is to be assigned there. Some scientists manage, through research grants, to get sent to Ares or another of the outposts, but they are often bound by severe restrictions regarding the lengths of their stay and their duties. Getting to a Gateship is even more difficult, and for the time being, travel to another star system is impossible unless it is as part of a government-sponsored mission (for diplomacy, trade or combat).

Hiring On ◆

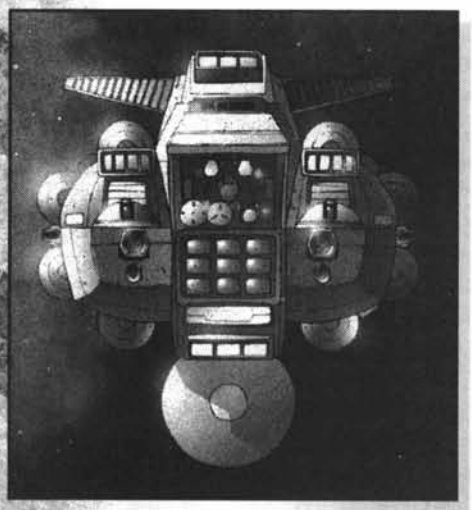
One method of getting to space without being a member of the armed forces is to hire on as a crewmember. Companies and governments are always looking for able people ready to learn a new set of skills, since the attrition rate among spacers (due both to accident and retirement) is fairly high. This doesn't mean they hire any joe showing up at their offices, however: applicants must possess useful skills and have a clean background, both of which are meticulously checked (though with enough ingenuity, it's possible to bluff one's way through).

Once hired, the new spacer will not get to orbit immediately. Companies and governments alike like to protect their investment and will put the characters through an extensive training regiment that includes both safety and zero-gee operations. Once the training program is completed, the characters receive the Survival (Space) and Zero-Gee Movement Skills, both at level 1, for free (existing Skills are not modified — the introductory program isn't extensive enough to boost existing knowledge).

Spacer Hiring Requirements

- **AGI +1, KNO +1, higher Attributes and Skills preferred;**
- **Ability to work well with people (INF 0 or higher);**
- **No outstanding psychose or medical problem (PSY 0, HEA 0 or higher);**
- **At least one useful specialty at Level 2 (Mechanical, Electronics, etc.).**

3.4 - Spaceships



Several types of spaceships are currently in use on and around Terra Nova. Many are artifacts from a more prosperous past when human beings explored the galaxy, yet many more are the product of a slowly re-emerging space industry.

Most spaceships are not equipped with the expensive and cumbersome Tannhauser Drive. Should a slower-than-light vessel need to move to another planetary system, it only has to move through an opened Gate to do so — as long as there is at least one Gateship in the fleet, the other spaceships do not require a Drive, just the proper shielding. The STL ships are mainly intended for in-system trade and transport, and sometimes warfare as well. There are as many designs for conventional spaceships as there are shipyards building them. Depending on their function and origin, they can take the shape of large planes, metallic spheres or cylinders, or a lattice of support beams to which the various modules are attached. Combat vessels often have a similar layout: drones and mines are stored in the aft bay to be easily dropped; missiles benefit from the ship's velocity and are located forward. Gun and laser turrets are located on the side, or in spinal mounts.

Each of the human colonies maintained at least one small shipyard in orbit to repair and build small transport vessels and make routine maintenance on visiting spaceships. Terra Nova currently has three functional shipyards remaining in orbit, along with two more on Hope. Construction and repair methods vary, but most are automated.

3.4.1 - Internal Layout

Bulkheads are massive structural walls that divide the interior of the ship in broad sections. These are thick loadbearing structures that are completely airtight. The resulting volumes are further divided by internal partitions, which are flimsier but also airtight. See page 69 for Armor Value and pressure-related rules.

Bulkheads are pierced at regular intervals by solid hatches called containment doors. These provide access between the sections but close automatically once their quadruple-redundant internal sensors detect a drop in pressure in one of the adjacent compartments. This can be overridden from the bridge. The door opens as soon as conditions stabilize and return to normal. Sometimes, standard hatches and containment doors are built close to one another to serve as a makeshift airlock as an added safety feature, giving access to depressurized areas.

All compartments have engineering hookup panels, at least two per room (one on either side). These panels contain standardized air feed, power hookups, emergency lights and environmental sensors, plus a small communication panel. Panels placed adjacent to a door also have a manual release lever to open the door when no power is available (requiring 1d6 turns, minus Space Survival Skill, to do so).

Floors are composed of metal grates held to the structure by quick release bolts. The shape of the grates interface with the soles of the boots worn by the crew, helping them move under microgravity. The area under the floor panels is filled with airducts, water and coolant lines, power conduits and fiber optic datalines, all color-coded and easy to access for fast repairs.

3.4.2 - Propulsion Systems

Most spaceships use a standard fusion thruster array called a fusion tube. These systems are efficient, well-understood, and can use almost any liquid or gas as reaction mass. They are based on the improved understanding of sub-atomic physics that came with the development of Tannhauser's theories, and use subquantic interactions to liberate massive amounts of energy. This energy is then used to superheat the reaction mass and throw it out the back of the ship at relativistic speeds, propelling the ship forward. Part of the waste heat is used to power the magnetic coils that collimate and contain the plasma.

Some vessels, mostly the smaller ones, rely on chemical propulsion, most often with liquid oxygen and hydrogen as fuel. Disposable solid fuel boosters are widely used to help reach higher velocity as they pose less problem than complex fuel pump systems and are less likely to break down. This is the case for small interstation shuttles and the smaller space utility vehicles.

◆ Engineering Aspects

Fusion tubes are fickle yet very powerful engines. The must undergo regular maintenance to clean the injectors and ensure that the containment coils are well aligned and free of micro-defects that could result in catastrophic failures later on. Fusion tubes contains plenty of safeguards, but if they are disabled the reaction soon goes critical, destroying the engine and the ship it is mounted on. Damage is equal to Size of the hull times 10, applied to everything in an area equal to (Size x 500 meters); damage is reduced by 10 points for every additional 500 meters of radius.

Sensor Systems - 3.4.3

A wide range of sensor systems are employed by most military vessels to locate and identify objects in their surroundings (see page 19). Gateships and spaceships carry similar sensor systems, although the latter vessels do not have the sophisticated Tannhauser detection unit of their larger brethren. Laser, radar and radiation sensors are mounted on all ships, regardless of their class. Most of these sensors are of the active type, that is, they probe the environment around them to get information back. Military ships also have theses, but double them with equivalent passive versions which do not give away the ship's position (or at least not as much). The onboard sensors cover all engagement ranges and most of the electromagnetic spectrum. The sensor systems are networked together to provide a coherent picture of the area of space that surrounds the vessel.

Disabling a ship's sensor systems is very difficult, even if one has access to the main computer. There are simply too many redundent systems and dumb terminals available to completely blind a vessel, though combat hits might reduce its capacity so that sensors are, for all purposes and intents, unavailable.

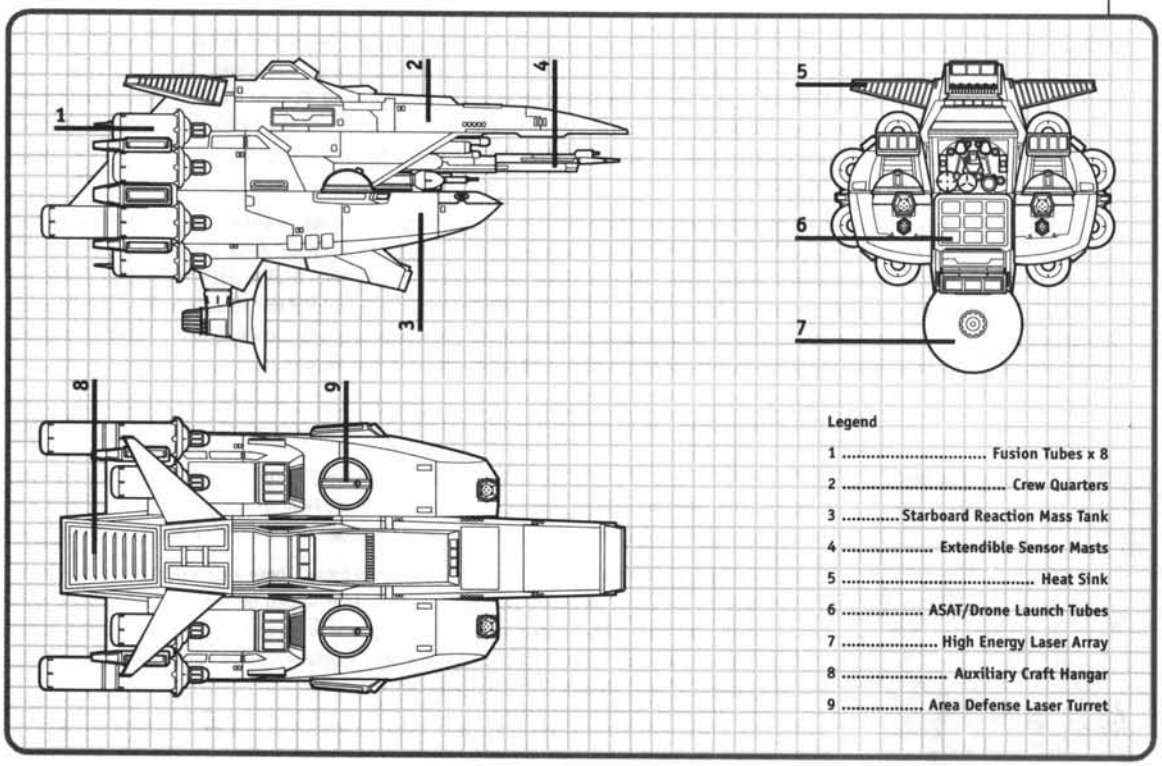
Engineering Aspects ◆

Although the particulars vary with the type of ship, the following descriptions are fairly representative of the types and locations of the main sensor receptors carried. The primary long range sensor system is composed of phased-array radar elements located on the sides and front hull, covering the entire space around the ship in a sphere extending between ten to fifty kilometers. Dish arrays and radomes are available for tracking multiple large strategic targets actively at very long range (a few thousands of kilometers).

Specialized radomes with tight beams and directional ranging abilities are a primary source of information for close-in combat, tracking targets and docking/launching/station-keeping operations. Hemispherical domes fore and aft house sensor systems used for active ranging and scanning at medium-ranges (under ten kilometers).

Close-up sensors are generally composed of concealed clusters of sensors omnicameras and other visual wavelength systems (such as infrared cameras and telescopic devices) for high- resolution use at close range. They are supplemented by very small parabolic recessed bell-antennae on extremities and hull extensions, generally millimeter-band radar systems for use in docking maneuvers and other delicate tasks. Thin reddish strips placed around the hull contain lidar arrays and are part of the ship's anti-collision system. These come in useful when the spacecraft is operating in crowded or cluttered areas.

Southern Republic Richelieu-class Destroyer



3.4.4 - Crew Quarters and Duty Stations

The main bridge, with the navigation, sensor and tactical crew stations all grouped together around the captain's chair, is at the heart of the ship. Large holographic displays and tactical screens fill the place, bathing the bridge in a ghastly electronic glow. Each station has a sturdy acceleration craddle placed on a movable mount. A small holotable is placed slightly off-center in the middle of the room, just beside the captain's station, for real-time battle reports.

The ship's weapons are controlled from gunnery stations located near the bridge. All of the reloading and pointing is done through automated systems, but human supervision is still required. The room is heavily padded and armored, and the gunner sits in a hardened acceleration craddle facing status report screens and waldo controls for the emergency repair equipment. An airlock allows access to the gunnery room, which is fully autonomous life support-wise.

The modular cabins are only a few cubic meters in volume. Each cabin has a storage locker and a foamed-mattress bed that can be isolated by an air-proof curtain for privacy and safety (if the ship suffers decompression while the occupant is sleeping, for example). The locker has modular subdivisions that can be easily reconfigured according to the gravity gradient. A small computer terminal is built into the foldaway desk, as well as an intercom with visual input/output functions. The room is painted in a neutral color; the conduits and power feeds that pass through the hull are concealed by removable panels. There is a private washroom per two cabins; it is reduced to the bare minimum, with only one small vacuum shower, a toilet and a sink with mirror.

3.4.5 - Offensive Systems

All spaceships carry at least one weapon system, most often a laser cannon of some sort, to defend themselves against meteors and other space debris. Many vessels mount more than one to cover all fire arcs. Military ships are equipped with a more diversified armament: in addition to lasers, they carry particle cannons, railguns and self-guided missiles (conventional, kinetic or nuclear). Particle cannons are useful to disable enemy ships, while railguns and missiles are used for more straightforward space combat. These weapons are often mounted in turrets for a wider fire arc, since it is often cumbersome to turn the entire bulk of the vessel rapidly.

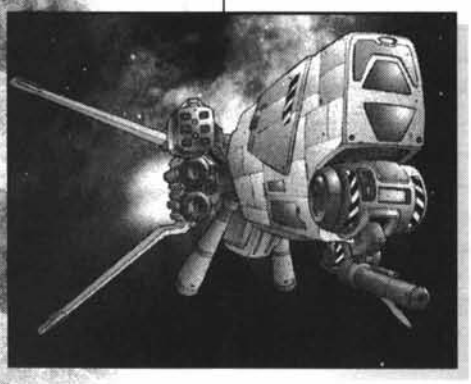
Many vessels have launch bays filled with drones of various types ranging from reconnaissance vehicles to automated combat craft. These bays can also accept deadly space mines and towed sensor arrays, both of which are useful to the intelligent commander. Some military ships also transport auxiliary combat vessels, fighters, gunboats and bombers; predictably, they are called carriers.

3.4.6 - Defensive Systems

Military vessels have several layered lines of defense. Avoidance, a combination of stealth, masker electronics, carefully selected radiating surfaces and emission control procedures, are the first and primary line of defense of a spaceship crew. Given that even a near miss with space-class weaponry is likely to harm a vessel, the best is often not to be seen at all. ECM, or electronic countermeasures, is mostly useful against guided missiles and weapon locks. They can also use flares, aerosols and chaff clouds, although these have limited effect since the ranges involved are so great. It is often better (and safer) to deploy a decoy drone and mislead the enemy completely about the ship's current position.

If the ship does get detected and attacked, and cannot avoid the hit, it must rely on its armored hull to either soak or stop damage. Fog launchers, which throw high velocity dust clouds against the attack (see page 23), are the first "armor" to be throw against the attack. A mixture of heavy composite sandwich of metal alloys, ablative resins, and foamed polymers with high radiation absortion profile are carefully layered within the skin of the vessel, each providing defense against a specific component of the assault. Internal defenses are few, mostly confined to passive systems such as automated door locks and a complex sensor web (which is part of the engineering monitoring network). In general, if opponents manage to get aboard, it is generally too late anyway.

Fighter Craft



"Fighter craft" is more of a class name that a specific ship type; in space, all vehicles share common characteristics, differing only by which one or ones they favor. Fighters are small space craft that put their emphasis on brute acceleration and firepower at the expense of endurance and armor protection.

The average fighter is built around a set of powerful fusion tubes. These are surrounded with "wings" or struts bearing maneuver thrusters. Fuel pods, sometimes mounted on gimbals to distribute mass around the thrust vectors, are located on either side. A large armored crew module is placed at the front and houses the pilot, weapon specialists and system operators. Some fighters are so large they require a captain as well, though this is a rare occurrence.

Fighters are armed with powerful weaponry, most often a chemical or free electron laser and pods of ASAT missiles. The laser is typically mounted in a turret and serves both as an offensive weapon and a mean of communication. Some fighters carry railguns or massdrivers as well; like the laser, these are mounted in articulated turrets for a maximum field of fire.

Spaceship Operating Procedures - 3.4.7

Over the centuries, a number of standardized procedures were developed to regulate life aboard spaceships. Though they differ slightly from one vessel to the next, they generally cover the same situations in much the same ways. Most crew rotate along a three-watch system to keep the ship at the ready. Each watch is monitored by one of the ranking officers, under the captain's direction.

All ships operate on "alert levels," which are displayed on panels on the ship's intercom system. White level is used when the ship is safely secured at a friendly port. During that time, only the life support systems are operational, the rest being either shut down for maintenance and diagnostics or simply removed for security and safety purposes. Mothballed vessels use an even lower alert level, which does not have an assigned color code.

Gray alert is the lowest readiness state under which a ship can be operated. Only a skeleton crew is present on board, and only essential maintenance is performed. This level is used when the ship is in friendly port or moving from one dry-dock to another. Weapons are only partially disabled so that the ship can be rapidly brought into action by a full crew.

Normal military cruise conditions have no associated alert level. The ship has its proper crew complement, which rotates under the normal watch system. A vessel may continue this pattern for months without abnormal affects. Off-duty crew members are allowed to move about non-restricted areas of the vessel. When underway, the ship's engines fire at a regular acceleration, giving a pseudo "down" orientation to the decks. To save reaction mass, most spaceships first accelerate and then coast to their destination, leaving the crew in free fall for most of the trip.

Combat ◆

Whenever the captain of the ship suspects a dangerous situation, he calls for a "yellow" alert level. The watches continue to rotate as usual, but the off-duty crew must remain on standby for rapid response. Loose items must be secured in lockers or otherwise tied-down. Spacesuits are worn continually, even while sleeping. Ships systems and weapons are on stand-by mode, ready to fire but unable to undergo routine maintenance tasks. This state of readiness can be maintained for a few days at most.

Red alert warns the crew that the ship is approaching combat. All hands report to their stations. Helmets are worn, compartments are depressurized, and non-mobile personnel (everyone except selected damage control teams) must be secure at their acceleration stations. Auxiliary craft are readied; some may be launched in provision for the upcoming battle. Weapons systems are loaded, charged and cleared for immediate firing. Passengers must go to their assigned secure location and strap down in preparation for the violent maneuvering that is coming. Gating procedures are similar to combat ones, though most civilians are in sleep tubes rather than spacesuits. Everyone is strapped down in preparation for the after-crossing nausea and illness.

Use and Distribution - 3.4.8

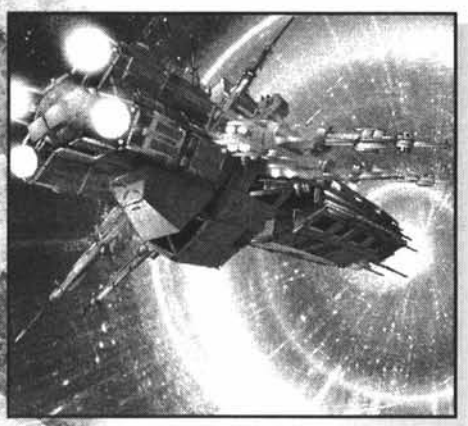
Space ships are a common sight. They are used by all factions, who usually maintain a small fleet for commercial and defense purposes. The most often encountered ships are the cargo and ore mining ships, followed by gas tankers (it is usually cheaper to "mine" gas and transport it to the space stations and Gateships than prepare it from planet-side resources).

Spaceships are built in the same shipyards as Gateships, using similar techniques and materials. Only a couple are built every few cycles as needs dictate. The chart below roughly outlines the space fleets of the leagues of Terra Nova. It is somewhat misleading, since all space-worthy vehicles, regardless of their size, are included, but it does provide a general portrait of the situation. The last column represents the estimated percentage of ships in use (i.e. not in dry-docks or mothballed) at any given moment.

Terra Nova's Spaceships

League	Civilian	Military	% Operational (Est.)
Northern Lights Confederacy	145	42	75
United Mercantile Federation	184	24	85
West Frontier Protectorate	40	35	60
Southern Republic	178	37	75
Humanist Alliance	137	22	90
Mekong Dominion	112	19	65
Eastern Sun Emirates	65	8	70
Independent	220	N/A	95

3.5 - Gateships



Most spaceships do not carry a Gate drive. The first and foremost reason is the cost and complexity of the system: a drive core is of monumental proportions and represents an engineering feat which, while not beyond modern technology, is nonetheless very taxing. Parts have to be manufactured to extreme tolerances, and very rare materials are often required.

Gateships are enormous, often a significant fraction of a kilometer in length. While they are equipped with an array of powerful fusion thrusters, the acceleration they can attain rarely surpasses 0.2 G, and even then the stress is enormous. Gateships are used to open the Gate for a fleet of smaller vessels — the cost in energy and manpower is far too great to spend on moving just one ship. These vessels wait until the Gate is opened and then simply cross over to the destination point.

Very few Gateships are used for travel, though they can do so. It is often much more efficient to send standard slower-than-light ships through a Gate than move the Gateship itself, though this of course requires that another Gateship be present on the other side for the return trip. Most people view Gateships as giant, yet mobile space stations.

3.5.1 - Layout

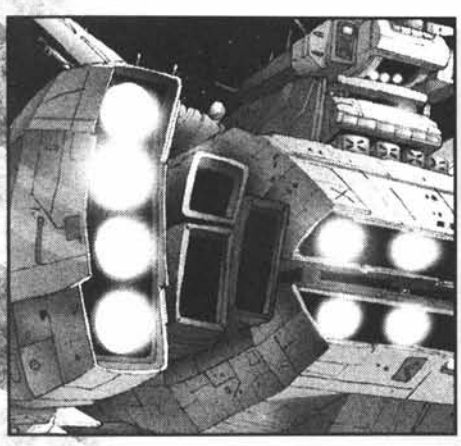
Gateships are usually cylindrical or rectangular in shape. Each vessel is custom-built, so no two are exactly alike, even members of the same general class. They can be roughly classified into three categories: Light, Medium and Heavy. Light Gateships are about 500 meters long (10 tactical hexes), medium ones about 700 to 900 meters (14 to 18 tactical hexes), and heavy being about a kilometer long (20 to 22 hexes). Only one Heavy-class Gateship was ever built: *Pride of Earth*. Its generators could open a Gate in minutes and allow a whole fleet to cross thousands of light-years in just an instant. Its current whereabouts are unknown, although it is safe to assume that it is mothballed somewhere in the Sol system.

The core of all Gateships houses the Gate drive, which is always placed parallel to the main thrust axis of the ship. The Gate Drive is usually the first item built and doubles as the ship's spine, the acceleration ladder supports being built directly into the bulkheads. Additional systems are then laid around it, forming a sturdy shell capable of soaking up considerable damage. Habitation modules are placed near the front, just behind the main deflector shield (see *Defensive Systems*), followed by cargo and fuel tanks (often fitted in modular rack-style mounts). The maneuver engines and reaction mass tankage occupy the rear of the ship.

All Gateships are equipped with one or more rotating decks to provide simulated gravity to the crew. These take the form of large wheels buried within the hull which slowly spin, providing up to 0.5 G to the people inside. The axis of the wheels are parallel with the ship's spine, and the wheels must thus be stopped if the Gateship is to accelerate at full power — standard acceleration is so low it generally only give a slight perceived slope to the living quarters, and is thus not worth bothering with. Many of the living quarters are located on these gravity decks, as are a number of exercise rooms and relaxation areas. The decks operate at all times, even when the ship is moving, since the acceleration of the thrusters is so small it is barely felt on the decks.

Gateships usually sport somewhat garish paint schemes, usually shades of gray along with the occasional patterns of bright color. These patterns are used by spaceships as a handy reference grid for calculating Gate entry vectors, but they also serve as identification markings. Due to the ships' ages, however, the colors have faded somewhat, given widely varied appearance to the fleets.

3.5.2 - Propulsion Systems



A large array of fusion powerplants are used to provide energy to the ship's various systems. The Gate drive itself usually has at least two dedicated powerplants. Solar arrays are also mounted on the hull, where they serve as auxiliary power supply.

Propulsion is taken care of by fusion tubes which superheats reaction mass (generally water) and ejects it at relativistic velocities out of the ship's nozzle. Needless to say, friendly vessels are advised to stand well clear of the Gateship's exhaust. Maneuvering thrusters use small plasma arc engines or, for some large Gateships, miniature versions of the main drive.

During the last few years of the expansion, experimental anti-matter engines were tested for Gate Drive power. This third generation of Gate Drive technology was never completed before the collapse of the Concordat, but the technology derived from its development provided additional knowledge about anti-matter and its possible uses.

Offensive Systems - 3.5.3

Gateships are not very good instruments of war. They are slow, cumbersome, and inherently fragile for their size. However, there were times when a Gateship found itself engaged in battle. Batteries of lasers and particle cannons are mounted on the hull, primarily for defense (see page 85 for turret stats). These are deadly against other ships because of their precision.

The Gate Drive itself can also be used as a weapon, although a grossly inefficient one (see page 59 for rules). The high energy beam can be targeted with extreme precision since it is normally used to find a microscopic point in space, but it is not very agile (i.e., able to respond fast to changing trajectories). It is restricted to a 30 degree fire arc in the front of the vessel, however, and since a Gateship is very cumbersome to maneuver, it is unlikely that the beam will be able to lock on any smart target.

Defensive Systems - 3.5.4

Due to their importance and the fragility of the systems inside, most Gateships are heavily armored and well-armed with lasers and particle cannons. While these mostly serve against asteroids and the like, they can be used very effectively as weapons.

The skin of the vessel is most often a ceramic/alloy composite, glazed in alternating layers to resist micro-meteor abrasions and minor surface collisions. Large plates are mounted on a honeycomb structure filled with radiation-absorbing gel, which is also used to quickly close any hull breach. The sheer bulk of the ship means that it is unlikely to take heavy or crippling damage from anything other than an asteroid collision or by being fired upon by another Gate Drive.

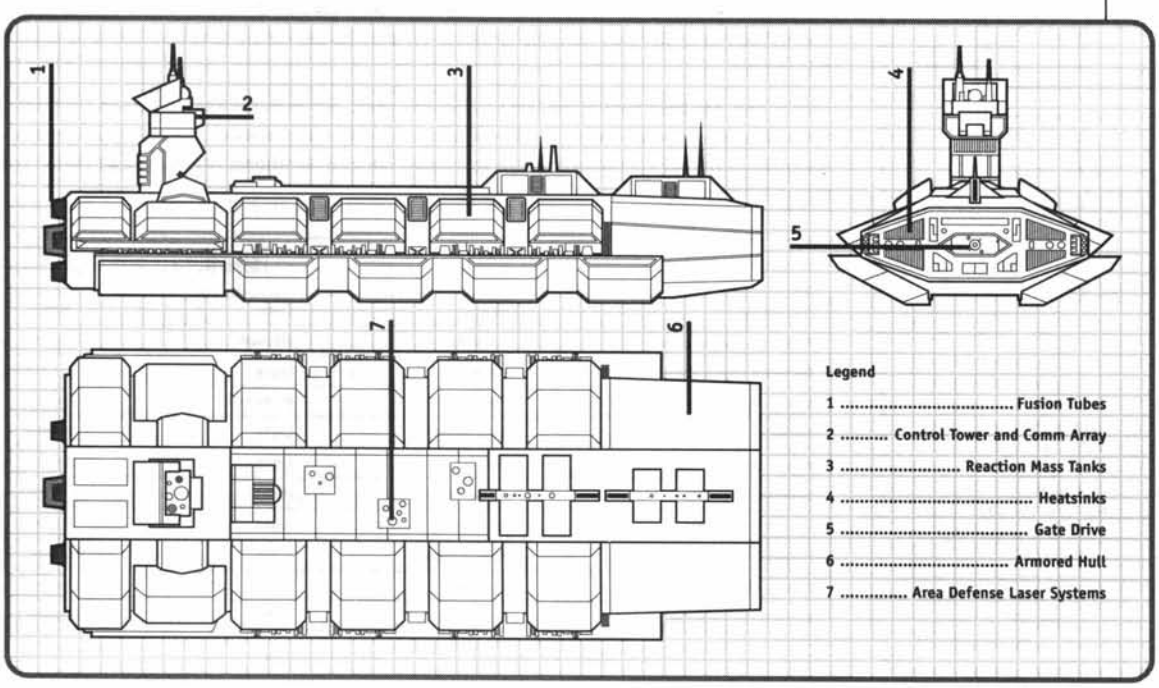
Gateships are also equipped with deflector shields, which are composed of an ionizing laser and a powerful magnetic screen. These serve to protect the ship from stray particles and space dust which could cause serious damage while the ship is moving. The laser probes ahead of the path of the ship and ionizes dust and debris, which are then swept aside by the magnetic field. This also had the added benefit of deviating charged particles.

A Typical Gateship: UMFGS Laban Emuros ◆

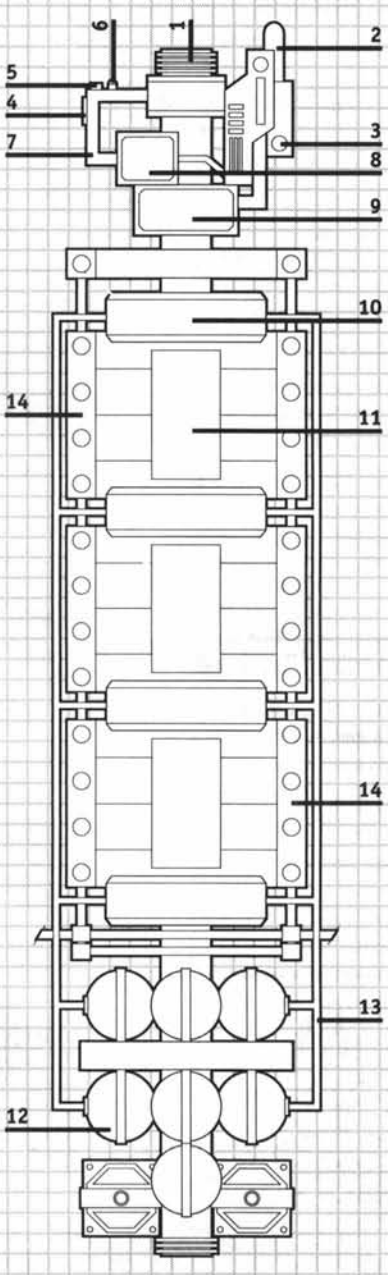
The *Laban Emuros* is the smallest of the two Gateships maintained by the United Mercantile Federation. Nearly half a kilometer long, the Pohlo is a remnant of the colonial and exploration period when interstellar ships routinely passed from one star system to the other. The ship is a huge burden on the economy of the Federation but is (or rather was) crucial to the limited out-system trade of the UMF.

The *Laban Emuros* is presently stationed 23 AU out from Terra Nova, near Gate II. It used to open the Gate every three months to allow commercial exchange with the other colonies, but hasn't done so since the war. It and a small fleet of military ships are now used to stand guard at the Gate in case another invasion is attempted by outsiders. The ship's crew is rotated planetside every six months.

Gateship UMFGS Laban Emuros



3.5.5 - Gate Drive



Gate Drive

1 ..... Beam Calibration Ring
2 ..... Optical Sensor Cluster
3 ..... Plasma Wave Detector Antennae
4 ..... Wide Band EM Sensor Cluster
5 ..... W and M Sub-atomic Detectors
6 ..... Low Energy Particle Detectors
7 ..... Plasma Wave Detector Antennae
8 ..... Neutrino Interaction Detector (NID) System
9 ..... Interaction Boosters
10 ..... Impulse Controller Coils
11 ..... Primary Acceleration Coils
12 ..... Fusion Powerplants
13 ..... Main Power Conduits
14 ..... He_2 Cooling Grid

The Gate drive itself is a massive particle accelerator, nearly a third of a kilometer long and fifty to sixty meters wide. Most of its mass is composed of powerful fusion plants, beam emitters and focusing mechanisms. The particle emission it produces is modulated by complex electronic systems which emit electromagnetic pulses of varying wavelengths and durations.

It must be said that the Gate drive does not create the Gate, but merely serves to open it. As stated before, Gates are natural, localized occurrences in space, which react to the pulse and the energy sent by the drive core. The particle stream "stabs" space around the Gate's coordinates until it finds the Gate proper; it is then used to supply the energy necessary to open it.

An opened Gate transforms itself into an elongated temporary wormhole which is projected to the target location and aimed by the pulses from the Gate drive. This must be constantly monitored and corrected, as the influences from various gravity wells, even distant ones, can affect the position of the emergence point, sometimes with catastrophic results.

3.5.6 - Sensors

Gateships mount a variety of sensors to enable them to relate to the outside world. Every portion of the electromagnetic spectrum in all directions is covered by at least one type of sensor. It is almost impossible to sneak up on a Gateship unannounced. Sensors include radar, ladar, madar, passive receivers on all bands and optical and movement-sensitive trackers. The sheer size of the hull means that the sensor network has a very wide ranging base and equally large detection surface, giving it both sensibility and resolution far greater than the equivalent systems used aboard standard spaceships.

A set of specialized high energy sensors is mounted on the forward bulkhead, to localize Tannhauser Gates and provide data to the control mechanisms in the Gate Drive. These sensors are a high priority target for hostile forces wishing to disable the ship and thus, are heavily armored and protected.

3.5.7 - Use and Distribution

Gateships are owned by almost all factions on Terra Nova. However, they are generally considered a fragile prize, since they represent an enormous investment of time, money and resources. Even Earth Forces only disabled the Terranovan ships during the invasion, perhaps hoping to use them later. All ships were later retaken by boarding actions, except two. One, the *Antam*, was destroyed in one of the early battles while the *Moskwa* was lost due to a main propulsion drive failure as it tried to evade the invasion fleet. Her crew managed to escape via shuttles and escape pods and later returned to Terra Nova.

No new ship has been built in the last two hundred years, although the knowledge and the facilities still exist. There are simply too few reasons to justify the enormous investment of time and resources. If the CEF continues to prove aggressive, however, additional vessels may be needed in the near future.

Terra Nova's Gateships

Affiliation	Ship	Class	Status
Northern Lights Confederacy	Leviathan	Medium	Drydock
Northern Lights Confederacy	Moskva	Light	Lost
United Mercantile Federation	Marcus Pohlo	Medium	Drydock
United Mercantile Federation	Laban Emuros	Light	Active
West Frontier Protectorate	Antam	Light	Destroyed
Southern Republic	Oasis' Pride	Medium	Drydock
Southern Republic	Illustrious	Light	Active
Humanist Alliance	Remar Vajra	Light	Drydock
Mekong Dominion	Tienlung	Light	Mothballed
Eastern Sun Emirates	Eastern Sun	Light	Unknown

Gateship Operating Procedures - 3.5.8

Gateship operational procedures are much the same as the ones in use aboard standard spacecraft, with the possible exception of Gating. These rules ensure the crew is ready to meet any situation which may present itself. Like other spacecraft crew, Gateship crews rotate along a three-watch, with each watch is monitored by one of the ranking officers.

Gateships operate on the same alert levels as their smaller brethren. White level is used when the ship is safely secured at a friendly port. Only the life support systems are operational, the rest being shut down for maintenance and diagnostics. Mothballed vessels do not have an assigned color code, since no one is aboard. Gray alert is the lowest readiness state under which a Gateship can be operated, and is used solely to move from one safe location to another. Only a skeleton crew is present on board, and only essential maintenance will be performed. Under no circumstance can a Gate be opened at Gray Alert or lower.

Normal operating conditions have no associated alert level. The ship has its proper crew complement, which rotates under the normal watch system. A vessel may continue this pattern for months or even cycles without abnormal affects. Off-duty crew members are allowed to move about non-restricted areas of the vessel. Because Gateships have low thrust to mass ratios, the crew is in free fall most of the time; regular visits to the centrifuges are scheduled to allow crew members the opportunity to exercise.

Whenever the captain of the ship suspects a dangerous situation, he calls for a "yellow alert" level. The watches continue to rotate as usual, but the off-duty crew must remain on standby for a rapid response. Spacesuits are worn continually, even while sleeping. Ships systems and weapons are on stand-by mode, ready to fire but unable to undergo routine maintenance tasks.

Red alert warns the crew that the ship is at risk. All hands report to their stations, helmets are worn and compartments are depressurized. Damage control teams move to their assigned posts. Auxiliary craft are launched as needed. Defense systems are cleared for immediate firing. Since the ship is too large to dodge or escape detection, much of the crew's attention is devoted to the sensor systems so that they can properly coordinate the defense craft and intercept incoming projectiles.

Gating ◆

A voyage to a distant star usually begins by traveling to the nearest Tannhauser Gate. At the height of the colonization effort, Gateships were often stationed near the Gates and sold their service to voyagers. A suitably large fleet was first assembled, though, to make sure that the opening of the Gate was a profitable operation.

Once all the spaceships of a fleet are in position (using the patterns on the hull of the Gateship as a reference grid), the Gateship fires up the main particle accelerator. Secondary quantum interactions manifest themselves as impressive but harmless bolts of lightning jumping about the hull in an awesome display of fireworks. Although it is technically inexact, crew call this effect St-Elmo's fire (a visually similar atmospheric effect).

Depending on the size and power output of the Gateship, the Gate opens in between two and twenty hours. The particle beam emitted by the Gateship expands into a cone of light which disappears into the pulsating glow which is the Gate proper.

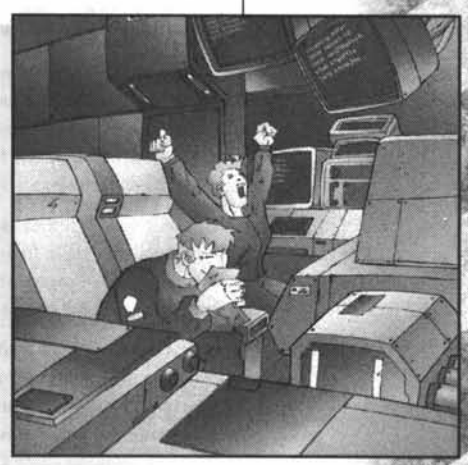
Once the engineers in charge of the drive deem that the Gate is stable, the spaceships activate their thrusters and pass through. The particle beam is regulated so as not to touch any ship as they "Gate" to their destination. If the Gateship must cross the Gate, it waits until all have gone through, then cuts off the beam and traverses the slowly closing Gate. A Gate closes a little faster than it is opened, the excess energy bleeding off as broad band EM energy in the surrounding space.

◧ Gate Sickness

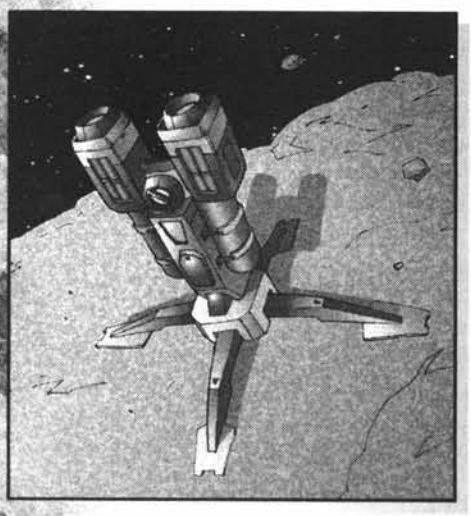
Although crossing the Gate is done in a matter of seconds, the experience is altogether unpleasant. The tidal stress within the Gate itself, although within human tolerance, provokes severe disorientation, hallucinations and limited physical pain as it overwhelms every cell of the body. In his report, Captain Elido Carlomagnes, the first Gateship commander, described the experience as being somewhat akin to hearing odors, seeing sounds and tasting colors while having a headache in his big toe. Although there are no lasting physical effects, most find the experience extremely perturbing, even mildly unpleasant. (see page 71 for game effects)

Most people prefer to be put in controlled hibernation to bypass the experience. Hibernation is also widely used to reduce the quantity of supplies needed by the crew and passengers during the flight to and from the Gate, and provides a solution to the boredom that often afflicts crew on long trips. Automated vehicles are obviously unaffected by Gate sickness.

A few persons actually like the sensations provided by the Gate. These people are often daredevils and explorers who prefer to stay awake during the whole experience. Depending on the energy threshold of the Gate, the sensations can vary from eerie to downright dangerous. "Gatebusters" can be found in many crews throughout human space, especially amongst fighter pilots.



3.6 - Space Mining



Space mining is one of the main activities of the Terranovan spacers. Their life style requires a constant source of supplies for the construction of new habitats and the maintenance of existing ones. Asteroids are one of the main sources of material. Not only are they readily available, they can be moved to the production site and processed *en-route*, saving both time and money. Asteroids provide metals, water, carbon and other volatiles depending on their type.

Asteroids come in many types. The most common are the C-type, of which two-thirds contain at least some trace water in the form of ice, usually frozen within the main body of the asteroid. A few are giant ice-balls (15% of C-types, 11% of all asteroids) composed of 50% to 80% water, the remainder being composed of mostly silicate rocks.

There are two methods to move the water and resources from asteroids to more convenient locations. The first and simplest is to tow the asteroid behind a spaceship (or have the ship push it), either going directly to the target, or slingshotting around a gravity well if one is in a convenient location. Sometimes, a habitation unit and a drive are fitted directly onto the asteroid, the ice itself being used to feed the propulsion system. The other method is to process the material directly on site and ship only the finished products. Asteroid mining factories are huge constructs, with giant ore crunchers at one end and a "slag heap" at the back. Their overall shape reminds many of a dumbbell. Products are picked up in docking bays located alongside.

3.6.1 - Comets & Gas Giants

Like many of the solar systems explored by humanity, the Helios system is surrounded by a large cometary halo, remnants of its formation. Time and again, gravitic perturbations (either natural or caused as a side effect of opening a Gate) throw a few comets in new orbits that fall toward the star and the planets surrounding it.

Comets are primarily mined for their high water content. Water is a precious commodity in space, since it can be used for life support or as a source of propellants. The only other sources of water are the thin rings of the gas giants and the occasional "juicy" asteroid, so called because of their high content in hydrated clays and other water rich compounds. Despite this, comet mining is a rare event because it takes a lot of fuel to match their delta-V. Unless the comet is on a suitable trajectory (or is in a collision trajectory, in which case interception is mandatory), comet mining is not always cost effective. The only place where comet-mining is done on a grand scale is in the Caprice system. The dry surface of the planet means that the water requirement of its large population can only be fulfilled byoutside sources. Fortunately, the Loki star system is home to a large cometary cloud and several asteroid clusters, all of which contains icy celestial bodies with a high percentage of water.

Gas giants are the primary source of many useful materials such as hydrogen, helium-3 (a fusion fuel) and noble gases. Both Zeus and Poseidon are enormous storehouses, but so far only Zeus is extensively exploited. Although it has a deeper gravity well, Zeus is closer to Terra Nova and the inner Helios system and thus is the preferred source. Most of the gas mining is accomplished by automated vehicles and hot hydrogen balloon platforms flying in and out of the atmosphere; every once in a while, one of them suffers a malfunction and is lost to the depths of Zeus' lower atmosphere. Pick-up is done by fusion rockets that use the local atmosphere as reaction mass for the first part of the journey, then burn part of their payload to finally escape the planet's deep gravity well.

3.7 - Shipyards and Orbital Factories

Many of the orbital installations in the Helios systems are industrial in nature. It is far more efficient to manufacture whatever is needed directly in space rather than have to haul it out of the planet's deep gravity well. A small number of shipyards have survived the War and have been kept in operation by various governments and corporations. The smaller ones are little more than workshops where parts are machined and assembled one by one; those are more often used as repair stations, leaving the construction of brand new ships to the better equipped facilities stationed near asteroid clusters.

Most of the orbital factories use similar procedures. Supplies and primary materials are brought over by freelance asteroid miners. Parts are then manufactured in free-flying autofacs orbiting near the main satellite. The main spars that will form the hull are extruded and assembled, and then everything is brought over and fit into place. If any are required, the fusion tubes are always manufactured in distant outposts to prevent catastrophic accidents.

The most common type of orbital factory is a large open framework with solar wings and a few enclosed areas for pressurized work and crew housing. Raw material is delivered by tenders at one end of the main spar, while finished products are expelled at the other end. Some factories have additional side modules where other components are manufactured and assembled. The larger factories are built on the same model but feature several spars attached together by transverses. Large "walkways" made of flat panels are available all along the structure, allowing space suits and vehicles equipped with molecular grip plates to move along the structure without the need for tethers or thrusters.

Power Supply - 3.7.1

All factories require massive amounts of energy to convert the raw ore they receive to usable material and to power the crafting and assembly lines. Solar power, free and available in large quantity, is the preferred source of energy. Large collectors are placed near the structure to supply the necessary power. Some stations, especially those requiring ore smelters, have large mirror arrays that reflect solar light into high temperature furnaces.

Many stations are also equipped with a small fusion reactor for auxiliary and emergency power. Should the solar arrays be damaged for any reason (collisions, combat or sabotage), the fusion reactor kicks in to preserve life support and essential manufacturing processes. This generates large amount of waste heat, which means it is only a temporary solution. The fusion reactor also serves to maintain/correct/change the orbit of the factory, superheating waste material and ejecting it to slowly make course corrections.

Escape and Survival Vehicles - 3.8

Though all spaceworthy vehicles can be turned into an escape raft, a complete class of vehicles has been designed expressively for this purpose. These small vehicles have only a very limited interplanetary capacity, and are designed to keep its crew alive and safe rather than take them somewhere else.

The standard escape pod is a small autonomous spacecraft designed to keep its passengers alive for the longest possible time. It has its own life support system, first aid equipment, propulsion and communication systems. The automatic transponders will relay the position of the pod to all ships in the area. Two-and four-man pods are the most common.

While mobile, it does not possess a large reserve of fuel and is generally incapable of making more than one or two major course change. Practically all escape pods have a built-in lightweight heat shield to allow them to aerobrake or to enter the atmosphere of a planet. Parachutes and floatation devices are then used to ensure a safe landing.

Lifeboats are larger versions of the escape pod. The larger life support gear includes scrubbers, water recycling and food supplies that greatly extend the endurance of the craft. An increased fuel supply gives the lifeboat some ability to avoid hazards while awaiting rescue. Depending on the details of the lifeboat, eight to thirty people may expect to survive several weeks.

Typical Escape Pod - 3.8.1

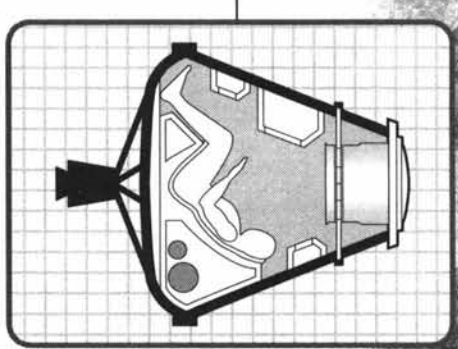
The typical escape pod is a small, conical-shaped vehicle docked to the side of the spacecraft and accessible through a small hatch from a peripheral corridor. It is intended for two persons, but a third one can be accommodated if need be. The access airlock takes up most of the nose; a cloth chamber can be extended to allow spacewalks without having to evacuate the inside atmosphere. A small disposable solid rocket motor is bolted on struts at the base of the pod for propulsion and de-orbiting; it is jettisoned once spent. Small cold-gas maneuver thrusters ring the base of the cone, just above the heat shield rim.

The pod has twelve man-days of air, mostly through the use of scrubbers. Minimum rations, consisting of food bars and a very limited water supply, can keep the occupant(s) alive for the same amount of time. Shaped plastic bags and germicide capsules are used for waste disposal. The pod's locker contains two light vacuum suits, one sealer can, three packs of chemical lights and a first aid kit. A high-power, one-way transmitter pulsing every ten minutes (range 10 km before modifiers) and a conventional radio (range 2 km on the ground, 200 in space, -5 Comm rating) are housed in the top section of the pod. Four radio flares may be ejected, to emit both a bright light and an emergency signal. The pod's hull has an Armor rating of 2, Size 1, and is Re-entry Capable and Airdroppable.

Escape Pod Operating Procedures

Using an escape pod is, by necessity, a very simple procedure. The location of all escape pods is clearly marked throughout the ship, with markers indicating the position of the nearest escape pod. Access is gained through a large pressure hatch that leads directly to the interior of the pod.

The controls of the escape pod are extremely simple and can be operated by anyone without the need for special training. Much of the actual piloting is taken care of by the onboard computer. A large red button, placed underneath a flip-open protective cover, seals the access hatch, activates the pyrotechnics that blow out the lifeboat bay's protective cover and release the craft from its berth. Civilian ships often feature a special computer routine that prevents the craft from leaving until full, with sub-routine watching for danger signs and indications that no remaining personnel are onboard. This safety feature can be disabled by any ranking officer on board, and often is removed from private ships.



Intruder

The sensor officer nodded once more, but his eyes never left the holographic display hovering above his work station.

"Yes sir — there's something out there. I can't get a fix on it, but the computers confirm that we registered a oh-point-one second, 600K burn on the starboard bow ten seconds ago. Nothing since."

First Officer Maurice Aubert cursed inwardly. After the daily boredom of spacecraft operations, a little action was welcome, but no spacer likes to be confronted with the unknown. All too often, the unknown hid nothing but an unpleasant and usually very sudden death. Better play it safe and keep an eye out.

The sensor operator touched another control, but the sensor sphere remained empty. "Should I deploy the towed array, sir?"

Aubert thought about it for a second. This would increase their detection power without giving them away, but it would inflict severe restrictions on their mobility. The array would have to be cut loose if they came under fire. For a brief second, Aubert debated calling the captain. The old man had a much better nose for this.

He was spared the decision when the captain appeared at the main bridge airlock. Aubert frowned and left the command seat to take his usual station. "Heard about her visitor, sir? You're not on duty for another two hours."

Captain Lothair Aleron pushed against the bridge airlock, the reaction sending him toward his duty station. "Couldn't sleep with all your bumpy driving." He grinned at his first officer.

A practiced flip landed him in the command seat where he carefully secured his flight harness. His demeanor immediately turned serious. "What have we got, mister Aubert?"

"Not sure yet, captain. We got a brief contact ten-thousand klicks on starboard, ten degrees down. No positive ID yet — it's running fairly clean in the IR and radio bands."

The sensor operator kept his eyes fixed on the holographic sphere suspended just above his duty station. The volume within represented the space around the ship, which occupied the exact center. A small yellow dot tipped a thin neon line at the outer edge, representing the bogie and its presumed current vector.

The captain frowned. No friendly ship was supposed to be in this region, nor were any registered celestial objects . . . "All hands, go to Condition Yellow."

"Captain! I've got a radar/ladar sweep from the bogey, straight at us!"

"Launch flash, launch flash! Captain, we've got incoming!"

"Condition Red! All hands, secure for emergency burn!"

Too late for the 'playing it safe' approach.

Tactical Space Combat System - 4.1

Space is vast, and most of the battles taking place there are deadly games of hide-and-seek. Ships equipped with gigawatt lasers and nuclear-tipped missiles glide silently through the void, surrounded by a formation of deadly combat drones, extending their sensors in the desperate hope of acquiring a lock-on their opponents before they are blown from the sky themselves.

Space combat in the **Heavy Gear** universe is thus a strange affair where long moments of sheer boredom are interrupted with brief flashes of pure terror and where the first captain to detect his opponent is often the winner, with death an almost sure result for the loser. Given this, it would make little sense to set up a board to simulate a tactical battle, since most of it will take place in secret. The Tactical Space Combat System is an abstract system that purposefully oversimplifies several aspects of space combat to make it manageable.

Because of the absence of atmosphere and gravity, space combat is very different from planet-bound conflict. There are two possible forms of space warfare. The most common situation is when two (or more) hostile groups wish to engage each other (or one side is defending a static installation) and all match overall velocities in order to make combat manageable. These battles occur around points of interest — almost always the orbit of an inhabited planet, a Tannhauser Gate or a resource-rich location, such as an hydrocarbon-bearing moon. The second type of space combat is the lightning strike, where two combat groups meet at high velocity to exchange a few seconds of sustained fire.

Units - 4.1.1

Because space combat relies primarly on stealth and deception, it is not practical to use a game board. This also abstracts the third dimension, simplifying the game while retaining the realism of the system. Moving everything into the abstract realm neatly addresses both of the requirements above. It might be necessary to define some units for range and duration, however, in some situations (to approximate sensor ranges, for example).

Space distance units (the equivalent of tactical hexes) are roughly 500 m across. The combat rounds represents about 30 seconds of real time, just like the normal tactical combat round (this allow an interface between ground and space combat). Note that unlike ground and air vehicles, spacecraft have "Thrust" and "Overthrust" MP scores; both are game equivalent to the basic tactical Combat and Top Speed MP scores, except that they represent acceleration rather than speed.

Range Considerations - 4.1.2

One important aspect of tactical game play is the distance between machines. This is the principal reason why hex maps are used. Here, however, range becomes secondary to secrecy, accuracy, maneuvering and tactics, which make abstract combat a better representation than a map-based rule set.

Three ranges are important in any type of combat: a) the distance which the attacker can move during the round; b) the attacker's weapon range; and c) the distance the defender can move to get out of range from the attacker. Furthermore, positioning is often crucial to gain a tactical advantage. To simulate this without the need for a tactical map, two attributes must be determined: the attacker's Offensive Range (OR) and the defender's Evasion Range (ER). An opposed Piloting test will determine if the attacking vehicle manages to properly position itself and establish a good lock on the enemy. The Offensive Range is equal to the attacking vehicle's current speed plus the selected weapon's range. The Evasion Range is equal to the defending vehicle's current speed (this is detailed later on).

Sequence of Events - 4.1.3

The sequence of events is similar to the one used in standard tactical ground combat. Declaration and Initiative are done as usual. Activation itself is split between Lock On and Firing. Lock On is a test where the attacker tries to acquire the exact location of the enemy vessel and position himself to better shoot the enemy from the desired range. Firing is the standard attempt to gun the enemy down and is modified according to positioning. The last phase, Miscellaneous, also follows the standard rules.

Combat Sequence

•	**Step Zero: Set-Up**
•	**Step One: Declaration Phase**
•	**Step Two: Initiative**
•	**Step Three: Activation (Lock On/Firing)**
•	**Step Four: Miscellaneous Events**

◆ Step Zero: Set-up Phase

A battle always begins with the Set-up Phase, which occurs only once. An overall commander must be chosen for each side, with a second in command. Their identities can remain secret, but must be noted down for future reference. If the commander becomes a casualty, he or she is replaced by the second in command. If both are put out of action, all future Leadership Skills are rolled at the Skill level of the next highest ranking officer present (by default, at level 1), except during integrated roleplaying/tactical games. The Player Character with the highest Leadership Skill may choose to replace the commander if the latter becomes a casualty. Obviously, robot vehicles like drones cannot be chosen as commander or second in command.

A Tactics (Space) Skill test is made by each side based upon the Skill level of the commander. Fumbles count as a die result of zero. Reroll ties. The winner chooses which Player will activate a unit first. If, during the first round, a unit is attacked before it has been activated, it is treated as if it were moving at a velocity equal to its Combat Thrust, for the purpose of defense rolls.

The die result of the Tactics roll should be recorded by each Player. Each point represents one Tactical Command point that can be played at any time during the game.

◆ Step One: Declaration Phase

Both sides declare any extra actions and individual evasive maneuvers for the round. If need be, a counter or token can be placed either near the record sheet to mark the unit(s) with extra actions, avoiding confusion during game play.

In normal tactical combat, Players have a visual situation to analyze and on which they can base their decisions. They can therefore select the option to Dodge before rolling for initiative. In space combat, however, they have no way to make that analysis, and selecting the option to Dodge prior to rolling initiative is a tactical decision. At this point, the characters must declare any extra action they wish to take, but do not have to state an intention to Dodge. If they do, the Dodge gives them a +3 defense modifier throughout the round. If they declare a Dodge when they are about to be attacked for the first time in the round (during Step Three), the Dodge only gives them a +2 modifier. Note that it is only possible to declare a Dodge during another Step if the Player who declares it has not spent any action so far.

◆ Step Two: Initiative

If the Player is alone, he makes a Piloting (Space) Skill test with his opponent(s). The Player with the highest result will activate first. Tied results are rerolled. If several Players are facing one or more enemies, the designated leader performs a Leadership test. The winning Player (or team) may activate one of his units first (see *Step Three* below). Once that unit has "moved" and fired, the next Player (or team) with the highest initiative may activate one of his units. The activation sequence goes down the initiative list until everyone has activated one unit. This process is repeated until all participants run out of units to activate.

◆ Step Three: Activation

When a unit is activated, the Player selects the weapon(s) he wants to use. The first part of the Activation phase is the Lock On. The Attacker states how many Movement Points or Thrust Points he wants to spend this round. These are added to the selected weapon's medium range. That gives the Offensive Range (OR). The Defender's current speed gives his Evasion Range (ER).

The difference between OR and ER gives a Lock-On distance which can be cross-referenced on the table below to obtain the Maneuvering Modifier. The opponents then need to perform a Piloting roll to determine who gets better positioning. The Maneuvering Modifier is applied to the Attacker's Piloting Roll versus the Defender. If the Attacker prefers, he may substitute his Tactics Skill to his Piloting Skill for the purpose of this particular roll, at no penalty. Every 2 points of MoS result in a +1 to the Attacker's Gunnery roll. Every 2 points of MoF result in a -1 to the Attacker's Gunnery roll. Just before the Gunnery test is made, however, the Attacker may optionally choose a special combat maneuver (see *Combat Maneuvers*, page 50) to get an additional advantage over the Defender.

Activation Procedure

• Attacker chooses a weapon.
• Attacker spends Movement Points (MPs).
• Attacker adds weapon's medium range to MPs; that's the Offensive Range.
• Defender's last expenditure of MPs becomes his Evasion Range.
• The Lock-On Distance equals OR - ER; cross-reference in the Maneuvering Modifier Table below.
• Roll the Attacker's Piloting Skill and compare it to a Piloting check for the Defender; use NO other modifiers.
• Compare this to the Accuracy Modifier table below.
• Optionally, the Attacker can select a combat maneuver.
• Use the resulting modifier on the Attacker's Gunnery roll. All standard vehicle Maneuver ratings and movement modifiers apply as usual. Resolve damage following the procedures on page 51.

Maneuvering Modifier Table

Distance	Maneuvering Modifier	Distance	Maneuvering Modifier
+32 to +63	+6	-1	-1
+16 +31	+5	-2 to -3	-2
+8 to +15	+4	-4 to -7	-3
+4 to +7	+3	-8 to -15	-4
+2 to +3	+2	-16 to -31	-5
+1	+1	-32 to -63	-6
0	0		

Accuracy Modifier Table

MoS/MoF	Accuracy Modifier	MoS/MoF	Accuracy Modifier
+6	+3	-1	0
+5	+2	-2	-1
+4	+2	-3	-1
+3	+1	-4	-2
+2	+1	-5	-2
+1	0	-6	-3
0	0		

Step Four: Miscellaneous Events

During this phase, any unusual events such as off-board attacks and special scenario-related events are resolved. Ejection rolls, wound checks and general bookkeeping procedures should also be done here. Any action not spent at this point is lost.

Repeat steps 1 to 4 until the battle is resolved or pre-planned objectives are met. A unit or combat group may only be activated once per combat round.

Avoidance - 4.1.4

Being unable to nimbly dodge incoming fire, ships must rely on deception and stealth to avoid being hit. All warships have extensive arrays of electronic countermeasures and decoy generators, designed to mask the ship's actual location and make targeting difficult for enemy gunners. While it is virtually impossible to make a ship truly invisible, all that is really required is to persuade an enemy that his target is a hundred meters or so from its true location, just enough to make any incoming fire miss.

A ship's Avoidance rating represents how well an enemy is able to target it. It is normally equal to zero; if the vessel is equipped with the Stealth Perk, then the base Avoidance is equal to the Perk's Rating. If the vessel has the Large Sensor Profile Flaw, its base Avoidance is equal to zero minus the Flaw's Rating.

Moving, firing weapons, or sending many comm transmissions lowers the ship's Avoidance, while reducing the preceding activities, or diverting more power to the electronic warfare systems (see *Spoof Maneuver*, page 50) increases the ship's Avoidance. Changes in Avoidance can be tracked with a die or noted on the stat sheet.

A spacecraft's Defense rolls are modified by its current Avoidance value. It is thus important to keep the Avoidance as high as possible until it is time to strike. Almost every Action a ship takes will affect its Avoidance. Avoidance returns to its base value at the end of each Miscellaneous Phase.

Avoidance Modifiers

1)	Thrust: -1 Avoidance if thrust is applied during the Turn. An additional -1 is applied if the ship uses Overthrust.
2)	Sensor Search: Each Sensor Search attempt results in -1 to the ship's Avoidance. If a ship is the target of a successful sensor search, it gets -2 to its Avoidance.
3)	Spoof: Every successful spoof attempt adds the roll's Margin of Success to the ship's Avoidance.
4)	Energy and Missile Weapon Attack: -1 Avoidance for each shot from a weapon of these types.
5)	Cover: Every time a ship enters a dust cloud, debris field or other cover, it gets +1 to its Avoidance. In the End Phase, every ship that is still in a dust cloud, debris field or other cover gets +1 to its Avoidance.

4.1.5 - Combat Maneuvers

It is often necessary to outmaneuver one's adversaries, sometimes putting the ship at risk. A wide range of maneuvers and actions are available to the wily spaceship captain.

Every spacecraft gets the opportunity to use its movement allowance (apply thrust) without expending Actions. The Space Movement Points can be spent at once or distributed to facilitate several attacks. Each time thrust is used, reduce the ship's Avoidance by 1, because the engine flares make the ship easier to spot.

◆ Last Minute Vector Changes

Captains often try to get into some "blind spot," an area where the enemy vehicle is more vulnerable and less able to properly defend itself (side, rear or "out of nowhere"). To simulate this, another roll is required just before the attack is rolled, but right after the Accuracy Modifier has been obtained.

The Attacker selects what kind of maneuver he expects to pull (Side: -1 to the roll; Rear: -2 to the roll; Surprise: -3 to the roll). Both Attacker and Defender make an opposed Piloting test, modified for the Attacker by his choice of maneuver and his vehicle's Maneuver rating, and for the Defender by his vehicle's Maneuver rating and any bonus for dodging (+3 if he declared a Dodge at the beginning of the round, +2 if he decides to declare one now). If the Attacker gets a MoS of +1 or better, the Defender will suffer the appropriate penalty on his defensive Piloting roll (see table).

◆ Spoof

The crew devotes power, resources and attention to misleading enemy targeting systems by various electronic and physical means (balloons, flares, etc.). The ship must be equipped with the ECM Perk in order to spoof. A Skill test is made using the ship's Crew Level plus the ECM Rating against a Threshold of 3. If the roll fails, nothing happens. If the roll succeeds, the ship's Avoidance is increased by the roll's Margin of Success. If the roll is fumbled, the spacecraft's Avoidance goes down by 1.

◆ Sensor Search

The ship turns on its active sensors for a few brief moments in an attempt to "light up" another ship. Select a target ship; the range of a Sensor Search is limited by the Sensor Range of the vehicle (the 100x space multiplier applies), and by line-of-sight (it is not possible to ping a ship that is hiding behind an asteroid, for instance).

Each vessel makes a Skill test, the attacker's roll modified by its Sensor Rating. If the defender wins, there is no effect. If the attacker wins, the defender's Avoidance is reduced by 2. No matter what the result of the roll is, the attacker's Avoidance is reduced by 1. If the attacker fumbles, its Avoidance is reduced by 2 instead of 1.

◆ Launching and Recovering Units

Many spacecraft are equipped with bays to carry smaller combat units such as fighters or drones. To leave a carrier, a unit simply drops out of an airlock at no Action cost. The unit appears on the battlefield as soon as it is launched and may move and act as normal.

To land on a carrier, a unit must spend one Action in physical contact with the carrier. At the end of the turn, the unit is taken aboard the carrier and may no longer be the target of any attacks. Missiles hunting the unit will target the carrier, instead.

Additional Combat Modifiers

ATTACKER	
Multiple Actions	**-1 to all rolls per additional action**
Top Speed/Overthrust	**-3 to Gunnery**
Failed Side Attack	**-1 to Gunnery and next initiative roll**
Failed Rear Attack	**-2 to Gunnery and next initiative roll**
Failed Surprise Attack	**-4 to Gunnery and next initiative roll**
DEFENDER	
Multiple Actions	**-1 to all rolls per additional action**
Multiple Attackers	**-1 to defensive roll for each attacker (not attack) past the first**
Successful Side Attack	**-1 to defensive roll**
Successful Rear Attack	**-2 to defensive roll**
Successful Surprise Attack	**-4 to defensive roll**

Spacecraft Damage - 4.1.6

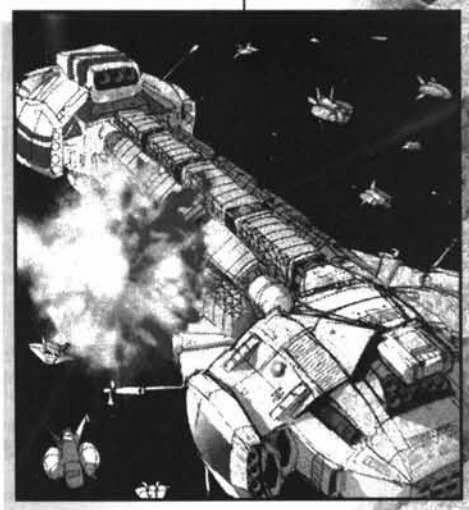
The large distances involved in space combat mean that only very powerful weaponry is likely to be of any use. Laser beams capable of vaporizing a house at close range will gradually disperse and lose their power over distances at the *square* of the range, quickly becoming no more dangerous than house flashlights. For this reason, all weapons mounted on spacecraft are considered to have the Mass Destruction characteristic, which modifies the basic weaponry listed on the spacecraft's game sheet.

All weapons of mass destruction have massive area effects, giving them a free tactical (50 meters hexes) AE, should anyone be foolish enough to fire them at tactical combat ranges, equal to half their unmodified Damage Multiplier. In that zone, their Damage Multiplier is ten times normal. In the area up to their unmodified DM, their Damage Multiplier is five times normal. In the area up to their unmodified DM x 1.5, their Damage Multiplier is normal.

To determine how close the attack hit in open space, an Opposed Tactics (Space) Skill test is made between the two crew, modified by the current Avoidance of the ship. If the attacker wins the test, the Margin of Success shows how precisely they determined the position of the enemy ship before firing: MoS 1, the DM is normal; MoS 2, the DM is five times normal; MoS 3 and higher, the DM is multiplied by ten.

Damage Example

1	***A spacecraft with an Armor rating of 50 is attacked by another ship armed with a laser cannon (DM x15). The ship gets hit full on at Short Range, so a Tactics (Space) roll is made. If the attacker's Margin of Success is 3 or higher, they have pinpointed the enemy vessel, which will take 150 points of damage multiplied by the original MoS of the hit (probably vaporizing the vessel).***
2	***If the range was longer, the damage would be reduced because of the -2 DM per Range Band of the laser, which applies before the Mass Destruction modifier. Say the ship gets hit at Long Range; a Tactics (Space) roll is made. If the attacker's Margin of Success is 2, the enemy vessel will take (15-2-2 x 5 =) 55 points of damage multiplied by the original MoS of the hit. Crippling, but survivable, as long as the Gunnery (Space) MoS was not too high.***
3	***Say the target ship gets hit full on at Extreme Range; again, a Tactics (Space) roll is made. If the attacker's Margin of Success is 1, the enemy vessel, will take only (15-2-2-2 x 1=) 9 points of damage multiplied by the original MoS of the hit. It merely heats up the outer skin of the vessel a bit.***



Spacecraft as Props

In order to further simplify combat and recordkeeping during roleplaying sessions, the Gamemaster may wish to reduce the various enemy spacecraft to the role of simple props. After all, a detailed record sheet is only advantageous when playing a full tactical game, or when dealing with the heroes. Since the GM is expected to run a fast game, he can't be bothered with heavy recordkeeping.

When a spacecraft or auxiliary vehicle, such as Gears or drones, take combat damage, simply roll a six-sided die when the vehicle gets a Light Damage or a Heavy Damage (the results for Overkill are pretty straightforward). If the die result for a Light Damage is 1, the vehicle is destroyed (or, more properly, out of the game). If the die result for a Heavy Damage is 1-3, the vehicle is destroyed. Otherwise, it survives unscathed — even its armor is not dented (to avoiding the need to keep track of damage and modifiers).

RPG Interface with Space Combat

In general, space travel in **Heavy Gear** roleplaying campaigns will be rare; it is expensive, dangerous, and it takes time. It will be used mostly to bring the campaign to an entirely new chapter by moving the characters to a new world. Due to the high mortality level of space combat, it is dangerous to put the characters' ship through the above rules. To avoid eleminating the entire party in one fell swoop, it is better to use a suitably choregraphed space battle scenario instead, where any "kill" hit is converted to something more dramatic and survivable, like a hull breach. The trick is not to kill the character, but to use the opportunity to submit them to sheer terror and anxiety.

Submarine movies such as **Das Boot** or **Crimson Tide** are gold mines of idea. Though the internal layout will be somewhat different (submariners do not have to worry about a crushing five gees of acceleration), the ambiance is similar: red-hued emergency lighting, electronic displays everywhere, crew speaking in hushed tones then shouting warnings, tense expectations about inbound missiles or drones, etc.

4.1.7 - Boarding Actions

In space, infantry can be used as marines to board enemy ships. Boarding actions are rare and difficult to do. Even if marines can be sent over, they must face deadly close combat with their defensive counterparts in the tight confines of space ship access corridors, or even crewmen pressed into action with inadequate weaponry.

In order to dock, the engines of the target ship must first be disabled. The attacking ship must then match velocity and heading and end in the same hex as the target. Alternatively, winch weapons may be used to "harpoon" the target and bring it close enough to disgorge troops. Once on the hull, the marines can attack external subassemblies, enter via airlocks or pierce the surface. If the last option is chosen, a number of Damage Points equal to the Armor rating of the ship hull will make a hole big enough to admit a Size 2 unit (double for each additional two Size points). Armor Crushing weapons do double damage.

Combat takes place as normal, with each 50 meters of the hull counting as a separate Dense Urban hex (see page 154 of the **HG Rulebook**, 2nd ed.); it is thus possible for the attackers to hold only part of a large vessel. The defending Player can assign as many crewmen as desired to the defense, grouping them in ad-hoc infantry squads, but they will not contribute to the ship's Action total anymore. The defenders have an additional one point of Concealment at all time due to their knowledge of the ship's layout and their defensive position, two if the attacker come in via the airlocks.

4.1.8 - Lightning Strike Combat

Lightning strike combat occurs when two opposing groups of spacecraft are streaking past each other at speeds that are measured in thousands of kilometers per second. If the combined total velocity vectors of the combat units are greater than the maximum range of the longest ranged weapon available, the vehicles enter and exit the battlefield in a single turn, enough for only one attack. The resulting battle has much in common with the knightly jousting contests of the Middle Ages, where both combatants have but one single and very short opportunity to deal a crippling blow to their opponent.

This combat consists of a single round which is divided into three stages. Once the encounter is resolved, the inertia of each fleet take them out of range and possible retaliation.

◆ Stage 1: Tactical Advantage

As they hurtle toward or across each other, both factions try to change their vectors in such a way that they will be at an advantageous distance when they pass by each other. An opposed Space Navigation Skill test is required. Each side adds their group's lowest Thrust rating to their Skill roll. The side with the highest roll chooses the range at which the vehicles will engage. Ties are rerolled.

The faction that wins the tactical advantage can easily choose a range that optimizes its own armament while hindering its opponent's weapons. A group with the tactical advantage may also simply choose a range that is greater than their opponent's weapon ranges and avoid conflict altogether. This is a popular tactic when attempting to ferry in ground troops using space ships. If the carrier is destroyed in space combat, the troops it carries will never arrive on the planet.

◆ Stage 2: Attacks

Any and all weapons that are in range may attack once and only once. ROF points may only be used in tight bursts (added to the Damage Multiplier) or for Saturation Fire.

Attacks are rolled as normal. Defense rolls are Piloting Skill rolls to which two numbers are added: the defender's Maneuver score and half of the defender's lowest Thrust rating (round down).

All attacks are simultaneous. Both sides get to roll all attack and defense rolls before any damage is allocated.

◆ Stage 3: Damage Allocation

Allocate damage from all the attacks and determine systems damage and other losses. Whether or not either side is destroyed, the confrontation is now over. It will take many hours of maneuvering by one side or the other to attempt another engagement. Depending on the orbit and velocities, this time is highly variable. 1d6 + lowest Thrust, rounded down, is suggested as the number of hours required.

Spacecraft Operation - 4.2

Spacecraft can perform a variety of special maneuvers and operations due to the nature of their movement system and the milieu in which they operate. The following rules apply to all vehicles operating in space, though some restrictions might apply (for example, special equipment is required for fuel skimming or re-entry).

Flight/Space Interface - 4.2.1

To reach orbit, a vehicle must be capable of reaching orbital velocity by itself (see formula in sidebar). Required Velocity is equal to the planet's orbital velocity minus the vehicle's starting velocity (generally zero, but can be positive — a flying aircraft, for example). If the vehicle starts from the equatorial region and uses the planet's rotation to boost itself, the required velocity is reduced by ten percent. To keep the game simple, planets have been divided in broad categories and typical escape velocities have been given for each.

Acceleration is the vehicle's acceleration in meters/second. Vehicles without the Flying movement system must subtract the planet's gravity from their acceleration before entering it in the formula. Flying vehicles can start from a higher altitude and only use half the planet's gravity.

Time to Orbit shows how long the engine must operate to reach orbit, in turns (divide by two to get the number of minutes). The vehicle must carry enough Reaction Mass to allow the thrusters to operate that long at the required thrust level.

Additional booster vehicles can be added to "tow" the vehicle to the required velocity. Purists may wish to calculate the performances of the vehicle using the modified mass due to the consumption of reaction mass and shedding of booster units. It is suggested to divide the climb in increment of 10% and work from there.

Reaching Orbit

•	square root of (Orbital Velocity / Acceleration) = Time to Orbit (turn)
•	Orbital Velocity is equal to (Escape Velocity / 1.4), in meters/second.

Escape Velocity

Planet Size	Esc. Vel. (km/s)	Example
Asteroid	0.1	Faith, Charity
Moon	2	Hades, Pluto, Hope, Luna
Small Rocky	4	Hermes, Mercury
Medium Rocky	5	Ares, Mars
Large Rocky	11	Terra Nova, Earth, Venus, Caprice
Small Gas Giant	22	Poseidon, Neptune
Medium Gas Giant	36	Saturn
Large Gas Giant	60	Zeus, Jupiter

Re-entry ◆

Re-entry procedures are somewhat different. A vehicle only needs thrust to come out of orbit, not for the re-entry proper. For game purposes, re-entry is assumed to last ten minutes, or 20 tactical game turns. The vehicle *must* be equipped with the Re-entry Perk, either a one-shot system (ablative heat shield) or a permanent feature (aerodynamic design with built-in shielding). If such a system is not present, the vehicle suffer a Fire attack every turn during the descent. The Intensity of the attack is equal to the velocity (in MPs) of the vehicle times 20. Once the re-entry is finished, the vehicle is considered to be at Altitude 12 (Air War) and must have some other way of stopping its fall, either a flight system, extra reaction mass for its thrusters or a parachute.

Aerobreaking ◆

Aerobreaking consists of dipping into a planetary atmosphere to shed velocity, the spacecraft's kinetic energy being converted to heat. This means that the vehicle needs less fuel to brake, either decreasing transit time or increasing cargo payload.

The vehicle must have a re-entry system in order to aerobrake. The pilot must make a Piloting roll against a Threshold of 2 to keep the craft correctly oriented or suffer one Fire attack as per normal reentry rules. Modifiers due to damage apply in full. For each successful Piloting roll, the craft loses ten percent of its speed. If there is no re-entry system present, one can still aerobrake in the tenuous upper atmosphere for a one percent reduction of speed and only half damage.

Coasting

Many of the ships don't have enough fuel or reaction mass to keep on accelerating throughout a long trip, since some must be kept as combat reserve. Fortunately, a spacecraft will keep coasting even if no acceleration is applied. The following formula shows the travel time of a spacecraft based on the amount of Burn Points the captain or pilot is willing to use during the trip. For simplicity, the actual acceleration time is ignored since it will account for only a short part of the total trip time.

Coasting

- **Travel Time = Distance/(BPs x 15)**
- **Time is in seconds (divide by 3600 for the result in hours), Distance is in meters, BPs is the total Burn Points spent.**

Fuel Skimming

Fuel skimming is a maneuver where a scoop-equipped vehicle plunges through a planetary atmosphere and uses its speed to force gases into its holding tanks. Fuel skimming is a relatively complex maneuver, with a Piloting roll versus a Threshold of 4. If failed, the vehicle takes on only 1d6 x 10% of the intended load. A fumble damages the scoop.

Game-wise, the retractable scoop is a Tool Arm that cannot punch. Its Size rating is cross-referenced with the Size-to-Mass table (page 125 of the **Heavy Gear 2nd edition rulebook**) to determine how many tons of gases can be scooped up per turn. These are sent to a dedicated cargo bay. The table on page 58 shows the volume per mass — the gases are counted as Helium for BP calculation purposes. The raw gases can be delivered to a processing facility or processed onboard. It takes one hour to process a number of cubic meters equal to twice the vehicle's Size. Each cubic meter of raw gases yield 0.01 cubic meter of usable hydrogen fuel.

Fractional Orbital Transfer

This is a fancy name for a relatively straightforward maneuver in which a vehicle takes off, climbs above the atmosphere, makes a partial orbit and comes down again. This allows the vehicle to reach a much higher speed than flying through the atmosphere and thus provides rapid transfer between two points on a planetary surface.

To do so, a vehicles must be capable of reaching at least a fraction of the orbital velocity by itself (see *Flight/Space Interface*, page 53) and be equipped with a re-entry system. The same rules apply as for a full orbital climb. The required velocity depends on the distance between departure and destination; determine the fraction of distance between the two points, and apply double of it to the orbital velocity. For example, if a shuttle takes off from a point on the equator to fly to a point located a quarter of the distance away (again on the equator for simplicity), the required velocity would be half the full velocity required to reach orbit for that planet. Going halfway around the world is the same as going to low orbit.

Gravity Whip

The term "gravity whip" is used to describe the maneuver by which a planet's momentum is used to accelerate (or decelerate) a spacecraft. Many space probes used this effect to save fuel and travel time, notably the Voyager space probes. A gravity whip can only be used in an orbital system — the spacecraft gains or loses speed when viewed from the entire system, not the body around which it whips. If the spacecraft is slower than the celestial body, it will accelerate; if faster, it will decelerate.

A Space Navigation Skill test is made against a Threshold equal to the target's velocity in km/s, divided by ten (round up). If failed, the spacecraft gains or loses only half the speed it would normally have. If fumbled, the spacecraft misses its orbital rendezvous completely. Find the speed of the vehicle and the orbital speed of the celestial body used (making sure the measure units are the same). The spacecraft gains twice the difference between its own (pre-whip) speed and the celestial body's orbital speed. For example, a spacecraft moving at 5 km/s whips near Zeus (13 km/s); it gains 2(13-5) = 16 km/s, for a final speed of 21 km/s. A revised travel time based on the new speed can then be recalculated if precision is required.

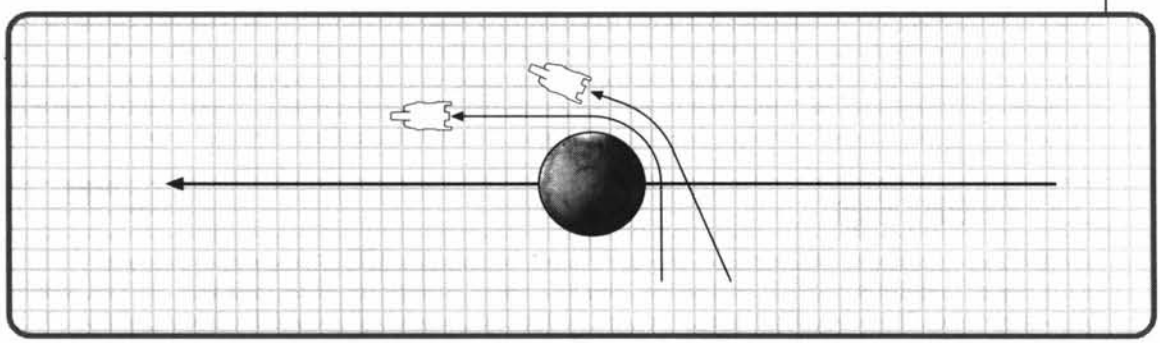
If the spacecraft intersects the orbit at an angle, only its parallel speed vector will be affected. In the interest of playability, the actual equations are ignored. Simply multiply the spacecraft's final speed by the angle multiplier.

Angle Multiplier

Planet Position	Angle*	Multiplier
Far	15	x 1.05
Average	30	x 1.1
Close	45	x 1.3

*Angle between spacecraft's trajectory and body's orbital trajectory.

Gravity whip diagram



Hyperthrusting

Hyperthrusting is a risky maneuver in which the safety parameters of an engine are widely exceeded in order to provide increased thrust. Such a maneuver is very dangerous, as the thrusters may be damaged by overheating, or even explode. When hyperthrusting is selected, the engine immediately supplies twice its maximum Overthrust, at a cost of 3 BPs per MP spent. A Piloting Skill test versus a Threshold of 5 is required. If failed, the thruster permanently loses a number of MPs equal to the Margin of Failure because of heat damage. Should the total reach -5, the thruster explodes, causing one die times the Overthrust rating (in MP) worth of damage points to the vehicle, with any damage applied to the Space Movement system first.

Towing

All types of space vehicles are assumed to be capable of towing or propelling objects. A vehicle has no maximum towing capacity; its velocity is directly dependent on the vehicle's thrust output and the mass (in kilograms) of the object being towed.

The effective acceleration of the thruster array diminishes as the total mass of the vehicle increases. The mass of the vehicle (in kg) should be multiplied by the acceleration (in m/s) to get the available thrust. The mass of any cargo or towed items is then added to the mass of the vehicle, then the thrust is divided by the total mass to get the new acceleration. This is rounded down to the nearest whole MP value.

Players wanting a more realistic representation of space movement may use this method to recalculate the new performances of their vehicle when fuel is consumed and extra mass is dropped. Just subtract the mass dropped from the mass of the vehicle and recalculate the acceleration normally.

Space Environment - 4.3

The environment of space presents a number of unique characteristics that makes it very different from everything humans have had to face before. New rules had to be learned, and new type of danger faced.

Vacuum - 4.3.1

Only vehicles that are specially equipped for vacuum (i.e. have the Perk Hostile Environment Protection: Space) can function in a vacuum. If the vehicle lacks life support, the crew must be equipped with vacuum suits. In that case, treat all vac-suited crew injuries as if they were one damage effect higher. For example, if a Light Damage result produces a crew effect (Stunned), it is replaced with the Heavy Damage result (10% casualties). Likewise, if the vehicle takes Heavy Damage and suffers a crew hit, the damage is increased to the same as Overkill: the crew is dead or incapacitated by the decompression, leaving the vehicle crewless.

Shadows - 4.3.2

Unlike most planetary environments, where objects and atmosphere both reflect light so that it shines on several sides at once, in space light comes from a single source, the Sun. Even though there are some reflective surfaces, most of the time light comes from only one direction, creating deep shadows. These shadows, in addition to being very cold (since there is no heat transfer), make most visual sensors useless. Shadow combat functions as normal combat except that the Night Detection Score of a vehicle is used instead of its Daytime Detection Score. If the unit remains in shadow for longer than a number of turns equal to its Size, it will need the HEP: Extreme Cold Perk or suffer the penalties listed in *Extreme Temperatures* (see next page).

4.3.3 - Extreme Temperatures

Extreme cold (-150°C or lower) or extreme heat (+150°C or higher) is very detrimental to the functioning of vehicles. Any vehicle that lacks the appropriate Hostile Environment Protection Perk automatically suffers Light damage whenever pushed to Top speed. In addition, such vehicles must roll one die at the beginning of each combat round. On a roll of one, the vehicle breaks down for a number of rounds equal to the roll of one die. In space, high temperatures are found only when exposed to the Sun, while shadows are extremely cold. Vehicles can rotate to spread the heat on their hull and thus avoid the temperature problems mentioned above.

4.3.4 - Planetary Rings

Many planets are surrounded by rings, collections of small debris and rock that are trapped by the gravity well and end up in orbit. Because they are composed of millions of small particles, rings pose a travel hazard for fast moving space ships. There are, however, reasons to brave them. They make excellent hiding places, are a good deterrent to pursuit, and can yield ice and other valuable volatiles to a stranded vessel.

Unless the ship is moving at a very high velocity, collisions will generally cause only minor abrasion damage, generally not worth checking for. The *Planetary Ring* table below assigns a Density to typical ring systems (the various ring densities within each system are ignored for playability). The current spacecraft's speed (in MPs/turn) is multiplied by the Density to yield the number of damage point applied to the spacecraft. The Density also show the amount of water, material or volatiles that can be collected within the ring, per turn (in kilogram).

Planetary Rings

Type	Density	Obscurement	Composition
Tenuous	0.00000001	0	Rock, some Ice
Average	0.000001	0	Ice, Frozen Gases, Hydrocarbons
Dense	0.1	2	Ice, Frozen Gases

4.3.5 - Radiation Belts

Many planets have strong magnetic fields, caused by liquid movement within their core. These fields trap incoming charged particles before they can hit the surface, creating multiple radiation belts around the planet (the stronger the field, the more numerous belts there are). These belts are a significant radiation hazard, though most spaceships have shielding strong enough to face them without any problem.

For playability purposes, radiation belts have been abstracted into general types. When a ship crosses a belt, it receives a certain amount of rads and damage points per turn, as indicated.

Radiation Belts

Planet	Rads	Damage	Effects
Small Rocky	1d6 x 5	10	Haywire
Large Rocky	1d6 x 10	15	Haywire
Small Gas Giant	1d6 x 50	15	Haywire
Medium Gas Giant	1d6 x 500	15	Haywire
Large Gas Giant (inner)	1d6 x 1700	25	Haywire
Large Gas Giant (outer)	1d6 x 700	15	Haywire

4.3.6 - Space Constructs

Space stations and Gateships are truly enormous and as such, they are mainly locations in which (or around which) the game will take place. They are much too big to be destroyed outright, although they can be damaged (see page 85 for typical Gateship components). Each 50 x 50 meter section (or hex) of hull has 200 points of ablative Structure (150 for the smaller stations, 100 for any glass panels). For collision purposes, each section is considered to be the equivalent of a vehicle of Size equal to their current Structure.

Depleting half the point total of a given section will result in a hull breach and slow loss of interior atmosphere (a fist-sized hole would take decades to completely empty a large station). Special "goop balls" (Structure value = 5) will appear in 1d6 roleplaying turns (30 seconds to 3 minutes) to start blocking the hole until a repair crew arrives. Completely depleting the Structure points in one turn cause an explosive blow-up which propel schrapnels all around (x50 damage to anything within 100 meters, dropping off by 5 every 100 meters of additional radius).

Terrain Effects - 4.3.7

For the purpose of the rules, "planetary" refers to any place that has gravity, may it be a moon, the interior of a spinning space station, or an actual planet. The effects of the local gravity level and other environmental conditions are detailed further on. Some terrains are found only in space, such as Moon Dust and Liquid Gases, and affect locomotion methods negatively. Unless there is a tangible atmosphere (0.8 atm and more) present, vehicles without the proper environmental protection, aircraft and hovercraft will not be able to function there.

Terrain Costs

Terrain Type	Walker	Ground	Hover	Obscurement
Moon Dust	2	2	1	-
Liquefied Gases	2*	3*	1	**
Frozen Gases	2	2	1	-

Gravity

The speed and acceleration of a vehicle are not very affected by gravity, since they have more to do with mass (which does not change) than weight. It is, however, harder to maneuver in low-g environments because of reduced ground pressure. If the local gravity is lower than 0.8 gee, apply a -1 Maneuver penalty to all rolls; if higher than 1.2 gee, apply a +1 bonus per additional gee (or part thereof).

The maximal jumping distance is, of course, increased or lowered. See *Jumping*, below, for the actual effects. Falling damage is calculated as usual, then multiplied by the local gravity (in gee).

Jumping

Thrusters may be used as a kind of jump jets. The distances covered while jumping depends on the angle of the jump and the speed (in meter/second) of the vehicle. If the vehicle has thrusters (Space movement system), it may subtract their thrust (in g) from G in the formula. Walker vehicles may pick any jump angle, even when using other movement types. Other will need a ramp of some sort (elevation levels count as 30 degrees).

Jumping

Angle of Jump	Max. Distance (m)
15 degrees	(speed squared/19)/G
30 degrees	(speed squared/11)/G
45 degrees	(speed squared/9)/G

Speed in m/s is equal to speed in kph divided by 3.6. / G is the gravitation of the body on which the vehicle is, in g.

Flying with Thrusters

If the vehicle is equipped with a Space movement system that develops more thrust than the local gravity, the vehicle can use any extra thrust to fly. The following formula shows the extra speed supplied by the thrusters, assuming a generic, moderately streamlined vehicle. This can be added to the speed of another movement system, but if the resulting speed is greater than one and a half the normal Flight speed, the vehicle suffers a -1 penalty to Maneuver.

- Thrust = Mass (tons) x (Acceleration (m/s) - local gravity (m/s))
- Drag = (Size - 0.5) cubed/2
- Thruster Flight Speed = square root of (50 x (thrust / drag))

Battles on Hulls

Walker vehicles and spacesuits can be equipped with special sole plates that contain a molecular grip pad. This pad is coated with an advanced polymer compound that adhere to any plane surface when a current of a specific frequency and intensity is passed through it; it is essentially a very sophisticated memory plastic. The cost for this equipment is included in the HEP: Vacuum Perk for simplicity.

This allows walkers and infantry to walk on the surface of a space station or ship as if they were on the ground. If they need to make a Skill roll to remain upright (excessive damage, area effect explosions), they are flung into space at the rate of 1d6 MP instead and will have to make their way back on their own. If they have Jump Jets, they can use them at a rate of 1 Jump MP = 1 Space MP.

4.4 - Spacecraft Design

Spacecraft design is somewhat a lost art to the Terranovans. Most of the vessels they are using date back to the colonial era in design and sometimes construction. They see little need to invest energy improving systems that have proven themselves over many decades of use. In many ways, the Terranovan philosophy toward technology — simplicity and reliance over bells and whistles — applies in space as well as on the ground.

Terranovan spacecraft thus share many characteristics. They tend to be blocky and rugged, their forms dictated more by function than by aesthetics. They use a "brute force" approach, multiplying proven fusion tubes and weapon systems rather than attempting to improve current technology beyond the limits of what it was designed to do. Still, there is always room for innovation, and once in a while a spacer proudly fields a customized spacecraft.

4.4.1 - Space Movement System

The Space movement mode includes all manner of thrust-based movement. The movement mode does not discriminate between chemical and fusion drives. As usual, precise description of how the vehicle functions is left to the designer.

Space Combat MPs represent acceleration rather than speed: about 1 m/s^2 each (0.1 g), instead of 6 kph for vehicles in the basic tactical game. Fractional MPs are possible for vehicles with very low acceleration (solar sails, ion drives).

Space vehicles obviously cover far larger distances than ground-bound vehicles and, thanks to inertia, may not even need to expend fuel to do so. When in space, each hour of operation is treated as one kilometer of Deployment Range. Thus, a spacecraft with a Deployment Range of 500 km can fly in space for 500 hours before requiring maintenance.

◆ Reaction Mass

Some kind of reaction mass (or fuel, in the case of older chemical engines) must be provided in order to propel the vehicle forward. The Reaction Mass rating shows how many Burn Points (BPs) of reaction mass may be carried internally. The weight of the reaction mass is added to the final weight of the vehicle; the *Burn Points Per Ton* table is used to determine its weight. It is important to note that the acceleration of the spacecraft already takes the reaction mass' weight into account.

The amount of Burn Points per ton will depend on the type of reaction mass used. Fusion engines are extremely efficient, while primitive fuel rockets will often carry many times their empty weight in fuel. Reaction Mass and Deployment Range are the twin factors that will determine the autonomy of a space vehicle. It is useless to carry more reaction mass than can be used in the vehicle's entire deployment range, though the reverse is possible (the vehicle can always coast partway to its destination).

If the vehicle has ground-to-orbit capacity, it must carry enough Reaction Mass to allow its thrusters to operate long enough at the required thrust level to get to escape velocity. Refer to *Reaching Orbit*, page 53.

Burn Points Per Ton

RM Type	Weight Multiplier	Volume per Weight
Hydrogen	0.00001 x total BP	0.071 ton/m3
Helium	0.00002 x total BP	0.142 ton/m3
Water	0.0002 x total BP	1 ton/m3
High Efficiency Rocket Fuel	0.01 x total BP	2 ton/m3
Low Efficiency Rocket Fuel	0.05 x total BP	5 ton/m3

Multiply the above number by the empty weight of the craft to know the weight of the reaction mass. The Volume per Weight is given for transporting Reaction Mass as cargo.

4.4.2 - Electronics

All spacecraft are equipped with Sensors and Communication, which they need to navigate and contact other vessels. Spacecraft-mounted sensors have a great environment to work in, since there is no atmosphere or obstruction to distort the readings, allowing them to reach further with the same power. The range of a spacecraft's sensor array is multiplied by one hundred. Thus, if a spaceship had a base 2 km Sensor range, it would be able to passively detect other objects up to 200 kilometers away *while in space*. This base range can be extended by supplying more power to the system (see page 151 of the main rulebook and page 62 of this book for more), but this makes the emitter quite visible to hostile sensors.

Because there are less obstacles to get in the way of radio waves, communication systems have a better range in the air and in space. Communication range is automatically multiplied by a hundred at no cost, *while in space*, for a space-based communication system.

Lemon Rolls - 4.4.3

Due to the meticulous design and construction of spacecraft, they tend to have fewer defects than other types of vehicles. In addition to the basic model Lemon dice, add one die for every ten (10) Perks the vehicle has, instead of the usual 5. Roll once on the Lemon Defect table per defect. If multiple options are available, only one should be selected.

Space Weapons - 4.4.4

Space is a very special environment for weaponry due to the absence of atmosphere and gravity. Specific weapon types have evolved to answer the peculiar requirements of space combat, such as increased range and lack of an atmospheric medium. Unlike their ground-side cousins, space weapons are also capable of more than destruction. Lasers can be used for secure communication over very long distance; kinetic weapons use the same basic technology as a massdriver reaction engine; a modified missile can be used as a kind of message torpedo.

Any of the existing Heavy Gear weapons (with a few exceptions, see below) can be used in the design of a new spacecraft. These will automatically, by virtue of operating in space, be upgraded to "Mass Destruction" status (else they would be completely ineffective, given the ranges involved). If the spacecraft can land on a planetary surface, it has the choice of firing its weapons in either normal or MD mode (though given the resulting area effect, such a move may well be suicidal).

Using Thrusters as Weapons ◆

By definition, a good engine makes a good weapon: superheated plasma is extremely dangerous up close, though it loses power rapidly with distance. The Damage Multiplier of thrusters is equal to the Space MPs spent, times half the Size of the vehicle. The Accuracy of the thruster is equal to the Maneuver of the vehicle. Burn Points are spent as normal. The plasma diffuses rapidly, losing half its DM per hex of range, including the first one.

Unavailable Weapons ◆

Not all weapon types are capable of functioning in space. Some depend on a gravity field in order to work, others cannot operate in a vacuum. If a vehicle does not have the HEP: Vacuum Perk, its weapons cannot function at all in space, regardless of their type.

Mortars depend on the presence of a gravity field to curve the trajectory of their projectile and thus cannot function in space. Other types of weapons with the "Indirect Fire" characteristics can fire but only in direct fire mode. Flamers are too short ranged to be really effective, and they must include their own oxidant to burn their fuel; as a result, they are practically never used in space. Melee weaponry cannot be supercharged to mass destruction levels, and is thus never used. Of course, none of the underwater ammunition types of weaponry can function in space.

The Gate Drive as a Weapon ◆

Due to the staggering amount of energy required, a Gate Drive can normally fire only once per twelve hours. It can be fired prematurely, but will automatically fail to open a Gate (if one is present). It will, however, inflict damage as described below.

Gate Drives are not designed as weapons and cannot track rapidly moving vehicles, but they are still quite accurate since they must hit a very small target (the Gate point). They have a 0 Accuracy and a ROF of +3. However, the ROF can only be used to attack multiple targets, and is never added to the damage. Because of the limited movements of the emitter, the Drive can only be brought to bear on targets within the Gateship's Fixed Forward arc.

A fully-charged Gate Drive used as a weapon has a Damage Multiplier equal to the damage rating of the Gateship's main hull (i.e., between 150 and 300). A partially-charged Drive will cause proportionally less damage — a three-hour charge (one fourth normal) will inflict only 25% of the usual damage (round down if need be). Regardless of when it is fired, the energy capacitors are entirely drained and the charging process must start anew. At least one hour is required to build up a charge large enough to fire the Drive.

Gate Drives emit such a staggering amount of energy that they destroy the structural integrity of an object at the atomic or subatomic level. In game terms, a Gate Drive will completely and utterly destroy anything it achieves a Light Damage result (or more) against. If the Gate Drive fails to do Light Damage but still hits, every point of damage it inflicts reduces the Armor Rating of its target by one point. Targets other than vehicles, which use Damage Points (such as asteroids and structures), take five times normal damage from Gate Drive attacks.

4.4.5 - Perks and Flaws

Many vehicles have special characteristics called Perks and Flaws. Perks are systems or design features that give additional capabilities to the vehicle, and Flaws are design shortcomings or defective systems that impair the vehicle. Remember that it is always assumed that basic equipment is included within the more general attributes. For example, Hostile Environment Protection: Vacuum Perks comes with a sufficient number of airlocks.

The following is a list of spacecraft-related Perks and Flaws. Perks whose name is followed by AUX are defined as Auxiliary Systems for damage purposes. Perks whose name is followed by R have a Rating.

ABLATIVE ARMOR R

One (or more) facing of the vehicle is covered with a special armor plating which shatters under kinetic stress or vaporizes when hit. Spacecraft can also be equipped with launchers that throws a "fog" of charged crystals/metal particles to shred incoming projectiles and diffuse laser and particle beams. The effect is much the same, and they are thus covered by the same Perk. This absorbs incoming damage, but the ablative armor must be replaced after each battle. The maximum amount of ablative armor that may be carried is equal to half the Armor rating of the vehicle, rounded down. Each defensive arc (Front, Sides and Rear) must be protected separately.

When the vehicle is hit, the current Perk Rating is added to the Armor of the vehicle. Ablative armor automatically looses 1 point from its Rating per ten points of damage every time it is hit, in addition to any normal Armor damage suffered, if applicable. The Ablative Armor loses points on every hit of ten or more points of damage, whether the attack inflicts a damage result to the vehicle or not.

- **Cost = Rating/2 (per Defense Arc)**

BACKUP SYSTEMS

This is a package deal which contains one of each of the followings: Backup Communications, Backup Fire Control, Backup Life Support and Backup Sensor. The usual rules for these apply in full.

- **Cost = 12**

DECOY SYSTEM AUX R

A Decoy system allows a vehicle to project phantom images of itself or another object by using inflatable decoys, holography or electronic signal imaging technologies. In tactical game terms, the Decoy system can create as many false images as its Rating. The attacker must make a Notice Skill check against the Rating with a modifier of -3 in order to hit the correct target. Both Sensors and active ECCM system add their Rating to this roll.

Visual decoys only affect visual detection and are automatically identified as decoys by Active Sensor rolls. False sensor targets with no visual images are automatically identified as phantoms once in visual range, but have their Rating boosted by the Rating of active friendly ECM. More advanced decoys can imitate both the visual aspects and the sensor signature of the vehicle they emulate. Guided, Smart and Sensor-homing weapons are just as likely to go for a sensor decoy, though they won't be fooled by a visual one.

- **Cost = Rating (Visual or Sensor), Rating² (both Visual and Sensor)**

HOSTILE ENVIRONMENT PROTECTION

The vehicle is specially designed for prolonged exposure to some hostile environmental conditions. This Perk is noted "HEP: <chosen environment>" on the vehicle sheet. The following options are available.

Extreme Heat: the vehicle is designed to withstand exposure to scorching temperatures, often well into the hundreds of degrees Celsius, without taking severe damage. If combined with the Fire Resistance Perk, the vehicle is effectively immune to incendiary attack. Cost = 4

Extreme Cold: the vehicle is designed to endure freezing cold temperatures, such as those found in Earth's Arctic and Antarctic regions, without freezing up or otherwise breaking down. Heaters, special lubricants and other modifications are part of this Perk. Cost = 1

High Pressure: the vehicle is designed to endure the great pressures of locations like ocean depths and the upper layers of gas giants. A variant of this Perk (Extreme Pressure) allows the vehicle to endure even the most extreme pressures, such as those found in the deepest of ocean depths or within the atmosphere of gas giants. Cost = 4 or 10

High Gravity: the vehicle is designed to withstand very high gravity environments (3 gee+) for extended periods. This does not, however, guarantee that the crew can do the same. Cost = 1

Vacuum: the vehicle is designed to withstand the lack of pressure found in vacuum environments. This means airlock hatches, pressurized hull, and so on (a life support system must still be bought separately). This Perk does not, however, grant a vehicle the ability to perform atmospheric re-entry. Cost = 1

Vehicles which have the "Hostile Environment Protection: Vacuum" Perk can freely operate in space and other airless environments such as the various moons and planets of the Helios system. The Perk seals all the openings and replaces the various oils and lubricants with vacuum-proof versions, as well as ensuring that the powerplant can function effectively. Vehicles without the Perk cannot operate in space at all. In fact, every hour the crew must make a Mechanical Test; if failed, the vehicle takes a random Light Damage effect as fluids boil away, mechanisms undergo vacuum-welding and parts melt or freeze up.

Radiation: the vehicle is designed to withstand high radiation levels. Foamed armor, rad-absorbing gel layers and additional shielding protects the vehicle's sensitive systems (especially the crew). The rad protection level, in rads/hour, is equal to ten to the power of the rating (e.g., a rating 3 system would give 10^3 rads/hour of protection). Cost = Rating

All Purposes: the vehicle is designed to withstand *anything* thrown at it. It can go over land, in space, underwater, etc. It possesses all the HEP abilities at no additional point cost, except Radiation and Extreme Pressure protections. Cost = 12

NO FUEL REQUIRED

The vehicle's main powerplant does not require regular fill-ups with fuel or reaction mass. It draws its energy from the environment around it (a solar-powered or sail vehicle, for example). The vehicle still has to undergo basic maintenance from time to time, though. This is what the Deployment Range rating represents in this case.

• **Cost = 10 (permanent) or 6 (cut off)**

REDUCED G-EFFECT

Aircraft and spacecraft with this Perk have been modified to reduce the strain of acceleration on its crew, either through special cockpits, G-seats or advanced flight suits. Crew have a +1 bonus whenever they have to make a FIT roll due to the effects of acceleration. Only Flying and Space vehicles can take this Perk.

• **Cost = 4**

AUX

REENTRY SYSTEM

The vehicle has been specially reinforced to withstand the high temperature and stress of atmospheric reentry. Every five turns, the pilot must make a Piloting roll against a Threshold of 2 to keep the craft correctly oriented or suffer one Fire attack as per normal reentry rules (see p. 53). Modifiers due to damage apply in full.

• **Cost = 4 (single use), 8 (permanen.)**

STRATOSPHERIC FLIGHT

An aircraft with this Perk can climb past the habitual ceiling of 12 km (altitude level 48), going into the stratosphere up to 50 km (altitude level 200). The Space movement mode is required in order for the vehicle to move into orbit, however. Flying vehicles in the stratosphere double their Flight MP at no cost because of the rarefied atmosphere. Only Flying vehicles can take this Perk.

• **Cost = 8**

STREAMLINING

The vehicle is shaped to present minimal resistance to the medium through which it moves. It gets +1 MP when moving at Top Speed. Streamlining has no effect on space movement, but reduces the amount of thrust required to fly within an atmosphere (see page 148 of the rulebook). Aircraft are already considered to be streamlined, but taking this option makes them even more so.

• **Cost = 2**

AUX

EXTERNAL POWER

The vehicle does not have a powerplant and does not require regular fill-ups with fuel or reaction mass. It draws its energy from wired or beamed power. Basic maintenance is derived from the Deployment Range rating. External power can be beamed in, a collector receiving the energy and converting it for use by the vehicle's systems. The vehicle must remain in line-of-sight with the power supplier. If the Perk is destroyed, the vehicle will suffer total power failure.

The energy may be wire-fed instead, the vehicle trailing a wire for power. A Piloting roll must be made every turn against the highest MP cost for the hexes traveled to avoid snagging the cable. Flying drones must test also and use the overflown ground's MP cost. Space drones are not affected. Failure means the cable is stuck and the drone must halt for the next round to free it. A fumble means the cable is severed. The cable has a Damage Point Capacity equal to the vehicle's Size, per hex.

• **Cost = -2**

4.5 - Advanced Rules

Beyond combat and maneuvering, there are a number of things that requires rules but do not fit in the above categories. These include mostly uncommon events and special abilities that require some explanations in order to be used in the game. All of them are based on scientific principles that may or may not be known to the Players.

The options below will not unbalance the game, nor will they slow it down too much. They will, however, bring an additional element of complexity that may not be appreciated by all playing groups. Their use is thus optional and subject to the veto of the Gamemaster.

The following section contains all the rules related to the technology described in this sourcebook. In order to avoid lengthy searches through the book every time a certain item is used, the rules are grouped here for the Gamemaster's convenience. The topics are listed in alphabetical order; additional cross-referencing is available both in the Index (page 96) and throughout the text itself.

4.5.1 - Advanced Sensor Operation

Large space craft can dedicate part of their computer power and crew to work with the sensor arrays and correlate the data they receive, increasing the vessel's detection potential. While this requires relatively little computing and manpower, it does require the ship to reduce its own electronic and heat emissions in order to get a better reading. This somewhat limits its ability to take actions during the round.

The sensor bonus depends largely on the size of the vessel, both because its computers will be more powerful and because there is more sensor surface to receive the incoming signals. The vessel receives a +1 bonus for each full 30 points of Size, provided an action is spent. Bonus can be accumulated by spending multiple actions in order to detect very far away (or faint) targets.

A unit also receives a Sensor bonus when trailing antennae behind it (see page 20). The vessel receives a +1 bonus for each kilometer of distance with a wire-guided recon drone (see page 86), but cannot expand thrust without loosing the drone.

◆ Passive Sensor Arrays

Following the War of the Alliance, the Terranovans have built a network of large early warning antennae throughout the system. These huge constructs are gossamer-thin structures that extend for many kilometers but are utterly incapable of withstanding acceleration. They typically have an Armor value equal to a tiny fraction of their Size, but compensate with huge Communication and Sensor ranges (see the *Advanced Sensor Operation* at the head of this section). These arrays use the low-grav structure rules found on next page.

4.5.2 - Anti-missile Fire

Any ranged weapon can be used to defend against a missile attack, but most do poorly unless they have been specifically designed for this task. All weapons suffer a -6 modifier to hit when used in Anti-Missile (AM) mode. Weapons with rapid-fire capacity can use ROF points to reduce or eliminate this penalty. The amount of shots spent each time the weapon is fired in AM mode is equal to five minus the MoS, with a minimum cost of 1. If ROF points are used, multiply the previous result by five (2 for missiles). If there isn't sufficient ammunition, the result still stands. At least five shots or two missiles are required for Anti-Missile fire.

The weapon completely destroys the missile when successfully used versus a single shot attack. When used to defend versus a missile cluster (ROF attack), burst fire *must* be used. Each point of MoS reduces the incoming cluster's ROF bonus by one. If the ROF bonus drops to zero, all of the incoming missile flight has been effectively destroyed. Because it is a wild attack, anti-missile fire do not use up actions and may be rolled versus every incoming missile or missile cluster, provided the player is willing to spend the ammunition.

4.5.3 - Communication

Even though signals travel at near light speed, space communications almost always suffer from delays due to the large distances involved. In addition, many factors can cause interference with radio waves (strong magnetic fields, solar flares, planets on opposite sides of the sun, etc.). The time lag can be determined by dividing the distances by 300, if they are in thousands of km, or by 18, if they are in millions of km (this will give the delay in minutes rather than seconds).

A conversation between the Moon and Earth is almost in real time (average distance of 384 000 km, gives 384 divided by 300, gives a 1.3 second delay). A call sent from the Inner Belt to Mars, however, would take 5.6 minutes to reach its destination (average distance of 101 million km, gives 101 divided by 18). Any reply from Mars would take the same time to get back.

Lasers can also be used to send coded messages over very long distances (see table). In general, this is practical only for large installations or in emergency situations, since both the emitter and receiver must remain at the same velocity during the transfer.

Laser Communicator Ranges

TOTAL MODIFIERS	BASE RANGE MULTIPLIER	TOTAL MODIFIERS	BASE RANGE MULTIPLIER
+5	700	-1	0.5
+4	120	-2	0.333
+3	24	-3	0.25
+2	6	-4	0.2
+1	2	-5	0.167
0	1		

Total Modifiers = Fire Control + any applicable modifiers / Base Range = 100,000 km per point of Damage Multiplier

Continuous Fire - 4.5.4

By spending two actions instead of one, a ship can play its energy weapons continuously on the surface of its target, rather than go for a millisecond burst. If the attacker can pump energy into the defender faster than the latter can get rid of it, the accumulated heat will start to cause damage by warping hull plates, boiling away fluids and generally sending systems into overheat. This tactic comes in useful at long or extreme range when the beam is not concentrated enough and is too weak to cause damage right away.

Only laser and particle accelerators are capable of using this advanced rule. If the weapon hit but fails to cause at least Light damage, the damage points accumulate anyway; keep track of them on a scrap of paper. As soon as the damage points, now referred to as heat points, beat the Light damage Threshold, the vehicles takes a Light damage result to a random location.

The attack must be rolled every turn to maintain the beam on target, though at the cost of a single action, not two. If the defender wins a defense roll at any point, it will break the lock and no more damage will be pumped into it. If the contact is broken, the accumulated heat points dissipate at a rate equal to half the Size of the affected unit every turn, rounded down. Keeping a beam on target makes one fairly visible; if it is fired upon by the defender while locked on, the attacker has a -2 penalty on his Avoidance for that attack only.

Low-gravity Structures - 4.5.5

Incredibly large structures can be built in space since they do not have to support their own mass, unlike their ground-bound cousins which have to resist a constant 10 m/s^2 acceleration. In game terms, this means it is possible for a vehicle to go below the Size/5 minimum for their Armor Attribute. Such a construct or vehicle, however, will begin to collapse when submitted to an acceleration, either due to a gravity field or movement. Everytime their limit is exceeded, the unit takes Light damage to its Structure. If the acceleration is greater than twice the maximum, Heavy damage, and if three times as great, the unit collapses on itsef completely.

The maximum acceleration that can be withstood by such a construct is inversely proportional to their Size to Armor ratio. For example, a Size 30 ship with an Armor value of 3 (Size/10) cannot move faster than half a gee (5 m/s^2). A Size 150 antenna array with an Armor value of 5 (Size/30) cannot withstand more than one-sixth of a gee (1.6 m/s^2).

Weapons against Known Trajectory - 4.5.6

Trajectories are fairly easy to predict in space. This allows targeting of weapons at extreme ranges, especially if the target is immobile, unaware or not dodging. Any targeting error, however, is more likely as well, since even a micro-radian mistake in aiming will eventually translate into several kilometers errors down the line. Such attacks are serve better as plot tools in a roleplaying campaign, given that they involve limited tactical decision-making.

All kinetic weapons, such as railgun slugs and missiles, keep their velocity and thus killing power at long range. Unless they are guided, however, the slightest course change will cause them to miss their target. Energy weapons lose power fairly fast, but may still cause damage by slowly heating up surfaces (see *Continuous Fire*, above).

Such a long range attack (from well out of sensor range — many thousands of kilometers) requires that the trajectory of the target be known precisely, either through espionage or other source of information (such as an ephemeride table). The attack uses the Navigation (Space) Skill for the attack roll instead of Gunnery (Space). Range bands are irrelevant for projectiles and missiles, but Accuracy applies; energy weapons use their basic unmodified Damage Multiplier, with no Mass Destruction effect.

The basic Threshold is 5 for a ship-sized target, 3 for a Gateship or station, and 1 for an asteroid. The target is allowed a defense roll only if they are aware of the attack (during declared hostilities, they are always aware, thanks to regular sensor sweeps).

4.5.7 - Orbital Artillery

Also known as orbital support or strikes (or, more poetically, "death from above"), orbital support is probably one of the most feared tools of war. Orbital weapon platforms, fitted with railguns, high-powered lasers and particle beams, can be called to fire by forward observer units with the Satellite Uplink Perk.

Ortillery can be placed in any desired orbit; theoretically, all orbits can be shifted to place the platform over a troubled region within hours. Orbits are tricky, however: in order to cover the entire planet, ortillery platforms are generally placed in polar orbits which precess around the planet as it turns. A satellite will thus only pass over any given target for a few minutes every two weeks. A huge number of platforms would be required to have assets available at a moment's notice.

Because orbital fire support must punch through the atmosphere and face severe targeting difficulties, most fire support missions will take place from ships or satellites placed in low orbits. However, low orbits mean high speed, and so the craft will only fly over the battlefield for a short time before going over the horizon. In game terms, this means that orbital fire support will only be available on selected turns.

◆ Technology

All ortillery platforms orbit within a fairly low zone around the target planet. The standard LTO (Low Terranovan Orbit) is approximately 150 to 250 kilometers in altitude. Ortillery weapons are somewhat customized because they have to fire through two very different — and mostly opposed — milieus, vacuum and atmosphere. There is no friction to slow down or deviate projectiles in vacuum, there is a lot in atmosphere; particle beams act differently (see page 22 for more information); laser energy is absorbed. In fact, even the interface between the two has the potential to skew the beam or trajectory off target.

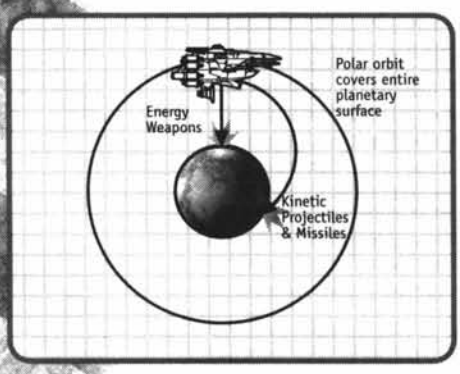
Very few weapons have the kind of range and power this requires. Those that do will be capable of deployment into even higher orbits, or be more accurate at lower ones. Most of the energy-based ortillery platforms usually have only enough energy for a single shot, but their capacitors can be recharged either by solar collectors or on-board fusion reactors (see page 67). Although kinetic projectile-based platforms carry more ordnance than their counterparts, the energy-based types do not need to be resupplied by ship and when given time, have an almost unlimited firing endurance.

The advantage of an orbiting weapon platform are enormous. It is conceivable that a powerful attack can be launched anywhere, on any hot spot on the planet below, given that the orbital mechanics are worked out. The incoming attack, especially if kinetic in nature, will easily penetrate any reasonably-sized bunker and devastate large tracks of land.

Ortillery, however, also has its limitations. It is much too slow to react to the changes of direction of a mobile unit, and can thus only target ground features. It may not function well under cloud cover or during sandstorms when the launching vehicle cannot see its target or communicate reliably with the forward observer. Ortillery require a ground targeting system for good accuracy and precision strikes, or it will fire so blindly as to be equally dangerous to its own side and the enemy. In any case, it is preferable to have reliable intelligence about the target beforehand.

Another disadvantage of ortillery is that one has to wait for the firepower (except in the case of energy weaponry, obviously). Switching orbits is not something that is done lightly or rapidly. One must also spends enormous amounts of money and resources getting the platforms into orbit, given that a relatively large number of platforms is required for effective coverage and a practical military strategy. Given that spacecraft are very vulnerable, there is always a risk that all those expensive orbital assets could be lost in the first minutes of a pre-emptive enemy strike.

◆ Ortillery Weapon Trajectories



The simplest form of Ortillery is an ICBM-like weapon that achieves a borderline, decaying orbit, dropping back down onto its target. Ortillery kinetic attacks require a significant amount of time and energy to de-orbit and head for their targets, plus substantial guidance systems to control themselves during their fall. An ortillery strike on a particular target often has to be launched from the other side of the planet, taking up to a half-hour to reach its target. The rounds will leave blazing comet-like ion-trails as they fall, making their approach and nature very obvious.

For simplicity, ortillery does not take into account the horizontal distances involved as those are dealt with through orbital mechanics (for kinetic ortillery), or are much smaller than the vertical distances involved (for energy ortillery).

Game Effects

Any space weapon (see page XX for the restrictions) can be used as the basis for an ortillery weapon, though it cannot be used against space targets. Energy weapons' DM is reduced as if they were five Range Bands away (-5 multiplied by whatever -xRB they suffer from). Projectile and missile weapons fire as if they were at Extreme Range. Ortillery, like other space-based weapon, is a Mass Destruction weapon system. Even a small SLC-based ortillery system will inflict a x70DM, AE=8 attack (after range reduction and including Mass Destruction modifications). Kinetic projectile-based ortillery will produce even higher damage (using a LAG system will give x120DM, AE=13). Due to its nature, ortillery ignore the Open Sheaf/Closed Sheaf scatter rules.

Players can buy as many ortillery strikes as they desire (and can afford). Each strike comes from a different orbital weapon platform, since their orbits take them out of sight of the battlefield much too fast for more than one attack. The cost for *each* strike is equal to the base TV cost of the weapon system, multiplied by one hundred.

Target Acquisition

Orbital support can be called by ground-based forward observer units with the Satellite Uplink Perk. Although orbital communicators can be quite small, only the dedicated Sat Uplink is accurate and powerful enough to pierce through the battlefield electronic fog and accurately request orbital fire. The ground observer who is calling in the Strike must have the Forward Observer Skill, an operating Satellite Uplink and have LOS to the terrain feature to be targeted (vehicles are too nimble to be used as a targeting goal).

Unlike regular tube artillery, ortillery does not get to use Ranging Shots; it can, however, gain the same game benefits if the forward observer maintains communications with the ortillery battery (and LoS to the target terrain feature) for more than one tactical turn. For example, an observer unit spends 1 turn communicating to call in a strike; the battery will make its attack with a +0 modifier. If he spent 4 turns communicating, the battery would attack with a +3 modifier.

Due to the extremely precise gunnery required, most ground observers will try to spend more than the minimum necessary time "painting" the desired target so as to minimize the margin of error in the strike. Since ortillery is firing from the weapon's Ultimate Range (-5 to hit due to range penalties) this can be extremely important. The maximum time that an observer can spend is 8 tactical turns (4 minutes); any extra time spent beyond this does not confer any additional bonus.

The accuracy of ortillery is only as good as the coordinates received from the ground. When making Gunnery Tests for ortillery, the lower of either the ortillery's Gunnery Skill (+ Attribute if manned) or the observer's Forward Observer Skill + Attribute when making the attack roll. For example, a ground observer with a Forward Observer Skill of 1d+2 calls for a strike from a manned ortillery battery with a Gunnery Skill of 3d+1. All Gunnery Tests are made at 1d+1.

All communications with the ortillery satellite must take place before the weapon fires. The satellite need not fire immediately upon receiving firing coordinates if it has not yet reached its fire window. Gunnery bonuses for additional observer time are not lost during the interim, however.

Fire Procedures

Ortillery must make a Gunnery Test with a Threshold of 8 to hit the desired target. Ortillery is considered to be Stationary (+2 to hit) and it will often have the Sniper Perk (+1 to hit). Failures scatter in a random direction; roll one die to determine hex side. The scatter distance is a quarter of a kilometer (5 tactical hexes) per point of MoF.

Energy weapons will strike almost instantly. Projectile weapon strikes, however, will take anywhere from ten to thirty minutes to reenter and align themselves, depending on their launch window. These thus have to be called before the battle proper (the player must specify in writing on which turn the strike will land), though the target(s) can be designated when the attacks actually arrives.

The Delay Time in tactical turns from firing of the weapon to ground impact for Kinetic Ortillery is equla to the orbital altitude of the firing satellite in kilometers divided by five (round fractions up). This means that a Kinetic Battery at an altitude of 300km would have a delay of 60 tactical turns (30 minutes) between firing and impact. Energy Ortillery Strikes arrive at lightspeed and are resolved during the Miscellaneous Phase of the Turn in which the weapon fires.

Terminal Guidance

Ortillery missiles can be given further guidance instructions just before impact, if they have the "Guided" characteristic. The ground observer (not necessarily the same one as before launch) still needs the Forward Observer Skill, a Satellite Uplink and LOS of the original terrain feature targeted. At any time during the four turns (2 minutes) prior to the Strike arriving, the observer can spend up to two turns communicating additional information to the incoming missile to gain up to an additional +2 (which can exceed the eight turn bonus limit previously mentioned). Ortillery Missiles arrive too fast to benefit from target designators, though this capability adequately replaces it.

4.6 - Maintenance

There are many "weathering" effects occuring in space that cause wear and tear on machinery, especially those that periodicaly visit the atmosphere. Irregular heating, as during re-entry or combat, will cause one section to expand more rapidly than others. Irregular cooling will cause one section to contract in like fashion. Parts will warp, exposing surfaces that would otherwise be protected to reactions for which they were not designed. Radiation from the sun, from ultraviolet all the way to X-rays, will bleach surfaces and break down atomic bonds over the long term. Some particulate matter spontaneously bonds in vacuum — a process called vacuum welding — which can result in stuck mechanisms and damaged parts. Irregularities thus created in the surfaces of the hull may turn into regions of atmospheric drag. Many materials that are solid under pressure liquefy or sublime into gas. Even vehicles that never come down into the atmosphere must face "rust." Rust need not be oxidation; it could also be fluoridation or chlorination or hydrogenation or any other chemical reaction between an exposed surface and a highly reactive fluid, such as many rocket fuels. Electric and electro-chemical reactions are a constant worry. Any juncture of dissimilar metals can cause problems if they galvanize. A spacecraft moving through a magnetic field will generate an electric charge and possibly some quite powerful discharges throughout the vehicle. Filters will clog and get fouled up.

Constant maintenance is thus crucial to the continued good operations of both machinery and vehicles. Indeed, without it, continued existence in space would become impossible.

4.6.1 - Basic Maintenance

A minimum number of man-hours equal to the Size of the vehicle times the Maintenance Multiplier(s) must be allocated every Terranovan week for general routine maintenance. Skipping this might lead to mechanical breakdowns later. Each vehicle is also assigned a Condition rating that quantifies its mechanical status. Condition goes from 1 (mint, factory fresh) to 6 (barely functional hulk). Whenever a new vehicle is introduced during the campaign, roll one die to determine its actual Condition. Note that a vehicle currently employed by an army will never have a Condition rating worse than 3 (reroll any result above 3).

Maintenance Multiplier Table

VEHICLE'S CHARACTERISTICS	MULTIPLIER	VEHICLE'S CHARACTERISTICS	MULTIPLIER
Testbed Prototype	x10	Scratch-Build	x3
Early Prototype	x5	Flying Vehicle	x3
Late Prototype	x4	Space Vehicle	x5
Early Production	x3	Easy to Modify Perk	x0.5
Limited Production	x2	Heavy Combat*	x2
Mass Production	x1	*The vehicle has been used in at least one battle per day.	

4.6.2 - Breakdowns

Before any battle or after a complete Deployment Range cycle, the player must make a Piloting (or Drive) skill roll against a Threshold equal to the Condition rating of the vehicle. If the vehicle did not receive its minimum amount of maintenance the week before, the Threshold is increased by 2 for each week missed.

If the test is failed, the vehicle suffers from a potential problem: strange noises will be heard, smoke and/or oil will leak out, electronics will blink, etc. Fumbles are ignored and count as a result of one. A number of man-hours equal to the Size of the vehicle is required to correct the situation, or the next check for breakdown will be at +2 (cumulative with the +2 for missed maintenance, if applicable). If the vehicle did not receive its minimum amount of maintenance the week before, it automatically suffers a breakdown.

If the vehicle does suffer a breakdown, roll one die to determine the location of the damage: the vehicle takes Light Damage to its Movement System (1-2), Auxiliary System (3-4) or Structure (5-6). If the roll is fumbled, the vehicle takes Heavy Damage instead of Light.

◆ Wear

All these breakdowns will take their toll on the vehicle after a while. After 10 breakdown (no matter which system is affected), the vehicle's Condition goes up by one point. If the Condition goes above 6, the vehicle cannot be repaired further — it is completely worn out and may only be salvaged for parts. Even then, it only yields half as many Mechanical or Electronic salvage points as normal.

Reserves and Power- 4.6.3

Extra reaction mass can be carried in cargo bays, if defined as such during the construction process. Note that the fuel contained inside cannot be used by the engine unless the vehicle stops and refuels its own tank from the cargo bay.

The ship's engine(s) can produce extra electrical power to recharge systems as required. This is measured in Energy Points (see **Tech Manual 2**, page 153); the number of Eps supplied per hour is equal to the Size of the ship multiplied by its Overthrust Space MP multiplied by one thousand.

Some vehicles use solar panels to supplement their internal power sources. These are thin polymer films that can be applied to any surface, or be deployed out on a thin metal frame massing 10% of the total film mass deployed. Polymer films attached to the hull are destroyed on any AUX hit; deployable films is destroyed only when deployed, but it cannot take any acceleration and requires one minute per square meter to stow properly.

Kinetic generators are small heat pumps that use the heat differential between the ship and the vacuum to generate power. They are included in the stats of most vessels, but can be removed and jury-rigged if need be.

ENERGY GENERATION

NAME	TYPE	WEIGHT (KG)	ENERGY/HR
Solar Panel	1 m2	5	200
	10 m2	55	2300
	100 m2	550	25,000
Kinetic Generator (Heat Pump)	Small	15	1,500
	Medium	50	5000
	Large	100	10,000

Recharging energy weapons

A standard vehicle powerplant (or the above mentioned solar panel) can be used to recharge the batteries of an energy weapon. Although the process is not very efficient, it permits "reloading" in the field, albeit over a long period of time.

Energy Weapon Recharge

WEAPON	ENERGY REQUIRED PER SHOT	WEAPON	ENERGY REQUIRED PER SHOT
Sniper Laser	1,200,000	Heavy Pulse Laser Cannon	19,000,000
Gatling Laser	3,600,000	Light Particle Accelerator	600,000
Light Laser Cannon	3,600,000	Heavy Particle Accelerator	3,000,000
Heavy Laser Cannon	9,000,000	Light Railgun	2,400,000
Light Pulse Laser Cannon	9,000,000	Heavy Railgun	98,000,000

Weapon Maintenance - 4.6.4

Any weapon with moving or electronic parts also needs to be maintained to keep operating at peak performance. Each weapon requires weekly maintenance equal to its Damage Multiplier plus its ROF bonus, times 5, in man-minutes. Personal weapons should use the Personal Scale damage multiplier and vehicular weapons use the Vehicle Scale damage multiplier for calculation purposes.

If the weapon does not receive its weekly maintenance, it may breakdown during use. Whenever a fumble is rolled when firing the weapon, the weapon jams and must be cleared before firing again. One die should be rolled to determine the problem: 1-2, the weapon requires one action to clear; 3-4, the weapon requires one action to clear and one die's worth of ammo is lost; 5-6, the weapon is useless and must be repaired. Add two to this die roll for each week of maintenance missed.

Multipliers To Weapon Maintenance Time

Weapon/Ammo has the Guided or Haywire perk	x2
Weapon is a Laser, Particle Cannon or Railgun	x5
Weapon has Mass-Destruction ammo	x10
Weapon has been used in more than one battle per day	x2
Weapon has not been used during the week	x0.5

4.7 - Life Support

Life Support is a catch-all category for all the rules related to the basic needs of the human body in the environment of a spacecraft. There are three basic areas that have to be seen to: atmosphere, gravity and radiation.

Atmosphere is the first and most important. Without adequate pressure, the blood and moisture of the body will boil off, and the oxygen will not be able to enter the bloodstream. The right mixture of gases is critical as well, as it might not be apparent right away that there is something wrong until someone loses consciousness from the lack of oxygen. Monitoring the condition of the atmosphere within a space habitat thus soon becomes second nature to most spacers.

The second factor is gravity, or rather its absence. The human body requires that a certain amount of stress be placed upon it every day to keep it in shape. In the weightlessness of space, it is important to follow a strict exercise regime and visit a gravity enviroment (centrifuge, ship under acceleration) once in a while. The last factor is radiation, which is insidiously dangerous. It consists of tiny atomic level particles moving rapidly through the human body, ravaging any stray cell they happen to strike. Radiation comes from a number of sources, both natural and artificial. Just like atmospheric pressure, radiation levels need to be closely monitored to avoid suffering from its far ranging effects (cancer, mutation or even death).

4.7.1 - Atmosphere

The contents and pressure of the artificial atmosphere are crucial in space — if either is improperly monitored and controlled, people can and will die. Obviously, lack of oxygen is detrimental to the continuation of human life. There can be several causes of oxygen deficiency: an excess of carbon dioxide in the atmosphere, defective air reserves or decompression. If the air supply is compromised, characters suffer as their body tries to make do with insufficient resources.

If the atmosphere degrades due to lack of clean air, characters will suffer from physical and mental penalties. Penalties start ten minutes after fresh oxygen is last supplied. Characters have a -1 to all mental Attributes (CRE, INF, KNO, PER, PSY, WIL) as their concentration decreases due to lack of oxygen. All mental Attributes drop at a rate of -1 per two minutes. All characters in the location must make a Fitness roll against a Threshold of four to avoid unconsciousness, with a penalty equal to the mental Attribute penalty. In Cinematic campaigns, the Player can chose to use WIL if it is higher than FIT.

Twenty minutes after fresh oxygen is last introduced, the character automatically loses consciousness. A random mental Attribute drops by one every turn. If any of them reaches -5, the character dies.

This rule assumes a normal oxygen content of 20%. If the oxygen content of the air is higher or lower, the durations are multiplied accordingly (e.g. twice as much oxygen means Attributes drop every four minutes instead of every two).

◆ Pressure

A loss of pressure means that although the atmosphere has the proper oxygen content, there is not enough of it or not enough pressure to force the oxygen into the bloodstream. Loss of pressure can come from several sources, from a faulty regulator to a leak or hole in the hull of the spacecraft. The *Atmosphere Loss sub-table* (see next page) shows the average amount of time it takes for the pressure to completely degrade in a given location. At each stage of decompression (three-quarter pressure, half, quarter) all characters in the location must make a Fitness roll to avoid unconsciousness, with a penalty of -1 to the roll for each level of degradation. They also suffer from the effect of lack of oxygen (-1 to all Mental Attributes per stage).

If the pressure drops a quarter or less, the character suffers the same effects as if there were no oxygen (see the *previous section*).

◆ Losing Pressure

There are two ways to lose pressure: slowly, through a leak, and all at once, through explosive decompression. The latter is much more dangerous as the body does not have time to adjust and often reacts very badly (see *Exposure to Vacuum*, below).

The table below gives Armor ratings and volumes for typical locations; these can be modified by the Gamemaster by up to 50%, depending on the situation's requirements. The Armor rating shows how many damage points the walls have. This is listed in Personal Damage Scale (see page 126 of the **rulebook**). Doors generally have lighter effective Armor because of their opening mechanisms, and structural bulkheads are much tougher. If the Armor is exceeded by the damage received, a one-centimeter hole is made (for simplicity, assume the hole is roughly square). The dimension increases by one centimeter for every additional time the Armor is exceeded by (for example, 35 points of damage, applied to an Armor 10 wall, will cause a 3 centimeters wide hole, or 9 cm^2). If desired by the Gamemaster, these rules can also apply to spacecraft and spacesuits.

Pressurized Area Information

Location	Wall Armor	Door Armor	Bulkhead Armor	Volume (m^3)
Airlock	15	15	20	20
Room	15	10	25	200
Hangar	20	20	40	5000
Station	500	350	1000	4×10^{11}
ATMOSPHERE LOSS				
Hole/Location	Airlock	Room	Hangar	Station
Leak-Sized (1 cm^2)	1 day	4 days	12 days	300 years
Fist-Sized (100 cm^2)	2 turns	8 turns	24 turns	100 years
Man-Sized (1 m^2)	1 turn	4 turns	12 turns	20 years
Vehicle-Sized (100 m^2)	Instant	2 turns	8 turns	1 day
Ship-Sized (1000 m^2)	Instant	Instant	1 turn	1 hour

Hole is the approximate size of the air evacuation duct or hole;

Location is the approximate comparative volume of the pressurized area.

Exposure to Vacuum

Contrarily to what most people believe, exposure to the vacuum of space does not kill instantly. An unprotected human being can survive up to three minutes before his brain dies from oxygen starvation, though there are some severe side effects from other sources.

First, the lack of pressure on the body will cause any internal gases to try and escape. Capillaries close to the skin will burst, resulting in one giant bruise across the entire body. If the person tries to hold his breath, severe damage will result to the lungs and inner body membranes (automatic Deep Wound). If possible, it is better to try and hyperventilate to charge the blood with oxygen, then exhale as vacuum is entered. The second major side effect comes from the temperature. Space is cold, except where a space body can provide heat. In the case of the solar system, this would be the Sun. A person exposed to vacuum will thus be roasted on the Sun-facing side will freezing on the other. In general, burns will be the least of a survivor's worries, but a Flesh wound is generally the result of more than one minute of direct space exposure.

For game purposes, a character can remain conscious for a number of 6-second turns equal to twelve plus his Fitness Attribute. In Cinematic campaigns, the Player can add the character's WIL to his FIT. After this period is elapsed, the character automatically loses consciousness. A random mental Attribute drops by one every turn. If any of them reaches -5, the character dies.

Gravity - 4.7.2

What is casually referred to as gravity is in fact a constant acceleration applied to the body by the gravitational field of a large mass. There is no practical difference between the acceleration provided by a gravity field and other types of accelerations, as demonstrated by the famous "elevator experiment" (refer to any basic physic textbook). Gravity is easily simulated in space by firing thrusters or rotating a living section, thereby creating centrifuge acceleration.

The following rules apply to zero-gee conditions, which should more accurately be called free-fall. Indeed, all objects in the solar system are subject to the gravitic pull of the Sun, and only the orbital speed prevents them from falling on the surface of the star. Everything is, in effect, perpetually falling.

Space Adaptation Syndrome (SAS)

The first astronauts reported the presence of a strange kind of sickness that affected them when they reached orbit. They would feel sick and nauseous, with any sudden motion making all other symptoms worse. It was soon discovered that more than half to two-thirds of the people going into space would suffer from what was termed the Space Adaptation Syndrome: the inability of the body to reconcile the various sensory signals received. There is no way to predict who will be affected and for how long, though certain exercises and chemical compounds have been developed to help the transition.

When the character first enters micro-gravity conditions, two die should be rolled. If he has received either motion training or drugs, add a +1 to the die roll (+2 if both are used). On a five or more, the character is completely immune to the SAS effects. Otherwise, the character suffers from an action penalty equal to five minus the roll of the dice. A HEA roll versus five is made at the end of every day to see if the character recovers. Once recovered, the character is fine and gains a +1 to the roll the next time he enters microgravity. The majority of mundane people, however, are incapable of adapting and are perpetually ill in free fall.

◆ Moving in Low Gravity

Movement under low gravity conditions (between 1 and 0.1 gee) is similar to standard movement. The exception is, obviously, that the person will be able to take much greater leaps and will have a harder time controlling the direction of the movement due to the reduced traction. A penalty of -1 is applied to all movement-related Agility tests. Movement rates are divided by the local gravity (in gee). Falling damage is multiplied by the local gravity (in gee).

Thus, an average person (FIT 0, no Athletic Skill) would be able to jog up to (12 / 0.16 =) 75 meters per round on Hope, though he would do so in great bounding leaps and would have trouble controlling his direction. Should he fall, though, he would receive only one sixth of the normal falling damage.

◆ Movement in Free Fall

Moving in space is a totally different experience than moving under gravity. Masses in space keep their inertia at all times, meaning that no effort need be expended to move except when changing direction or velocity. Inertia also has unfortunate side effects, such as the impossibility to changing direction in mid-air.

The speed that can be reached by a person is directly related to their strength. The stronger the person, the greater the initial impulsion can be. Obviously, characters can chose to move slower, if so wished. If pushing objects, or carrying them, multiply speed by basic body mass, then divide by new mass. One must not forget that action equals reaction of equal value: if pushing off another person, he will also float away.

Free Fall Movement Speed

- **Maximum Speed (m/s) = ((Mstr x 4)/Mbld) squared**
- **Mstr is the maximum mass lifted by the character in one gee (see rulebook, p. 54).**
- **Mbld is the character's body mass (see rulebook, p. 54).**

◆ Collisions

Collisions are the main danger in micro-gravity movement. Since there is no way to change direction or velocity without some kind of reaction, inexperienced freefallers often collide with objects in their path, powerless to prevent the collision. This can result in bruises, contusions and even broken bones. In the most extreme cases, collisions can kill.

Two dice are rolled and the result multiplied by the speed, in meter/second, of impact. This is the damage taken by the individual. If the floating person was purposefully launched in a manner that would cause him to impact head first, add ten to the die roll. A conscious person may attempt to soften the reception.

To do so, the character must roll a Zero-G Movement Skill test. The number rolled is subtracted from the speed for the purpose of damage calculations. If the number rolled is equal to or greater than the actual speed, the person "lands" unharmed. If the roll fumbles, the person hits head-first and takes the extra damage associated (+ten to the die roll). If the character does not manage to land, he will rebound from the collision and float away — assume half his pre-collision speed for simplicity.

Base damage assumes that a moderately solid surface will be impacted. Unusually hard surfaces, such as armor, can double the effective speed for damage and rebound speed purposes. Soft surfaces such as water halve the effective speed. Special crash pads or nets can divide the collision speed by up to ten to twenty times (Gamemaster's decision).

◆ Combat

Personal combat in space is mostly of the hand-to-hand type. The limited confines of many habitats mean there is little room to use ranged weapons. Moreover, the extreme danger caused by straiying shots hitting the life-supporting bulkheads and recycling systems is too great to ignore.

Ranged weapon fire is possible, though the recoil must be taken into account by the firer. For this reason, nearly recoiless weaponry such as gyroguns and lasers are preferred. Many weapons have recoil and will push back the user at a certain velocity unless he is braced. In space combat, an acceleration equal to 0.01 g (0.1 MP) is applied *opposite* the firing direction per point of Damage Multiplier (to translate this into meter/second speed, simply divide the MP value by ten — a good enough approximation).

Close combat should use the normal rules, except that any hit will cause the combatants to fly apart unless they are braced. Use the above rules to calculate kickback speeds, remembering that both combatants are pushed in opposite direction.

Gravity and Health ◆

Zero and micro-gravity conditions cause a variety of health problems. The human body has been designed to function under gravity, and while removing it does confer some short-term benefit, complications will occur in the long run.

Bone decalcification, whereas the calcium literally "oozes" out of the skeleton, occurs after a few weeks of zero-gravity. Certain compounds have been developed to help fix calcium into the bones to alleviate the problem. Taken with calcium supplements, they are generally enough to take care of the problem. Since the compounds are mass-produced, the cost is negligible and they are available practically anywhere.

Loss of muscle tone is a more common and serious problem. Regular exercise sessions and visits to the centrifuge are recommended to prevent it. Electrical stimulators are also available; these are often used by spacefarers who do not have the time or the living space for a complete exercise regiment. If this is not taken care of, health problems can occur and the person will soon be incapable of tolerating acceleration, not able to visit other worlds.

In game terms, one point of FIT is loss on the first month spent without exercising. Another is lost after two months, another at four months, and so on, doubling the interval everytime. At least two hours per day of vigorous exercises are required to avoid this effect, increasing by one hour every three months spent in free fall until it reaches six hours per day. One point of BLD is lost per two points of FIT, and both HEA and STR are recalculated to take any losses into account.

Gate Sickness ◆

During the trip through a Tannhauser Gate, the human body is submitted to strange conditions which affect its normal operation. People suffer the following effects: -1d6 to the following Attributes: AGI, BLD, FIT, CRE, INF. All return to normal 1d6 x 10 seconds after emerging from the Gate. PER automatically goes down to -5 during the trip, regardless of the actual Attribute value. It returns to normal 1d6 seconds after exiting the Gate.

Unless they are unconscious or in sleep tubes at the time of the crossing, characters must make a PSY roll against a Threshold of 4; a +1 bonus per transit previously experienced is added for veteran travelers. On a success, the character suffers from mild and pleasant hallucinations. On a failure, the hallucinations are quite unpleasant. A Fumble causes such horrible nightmares that the character refuses to Gate again for the next 1d6 months, unless he passes a WIL check against a Threshold of 4. If a fumble occurs again during this period, the character will not willingly go awake through a Gate ever again.

Radiation - 4.7.3

If only for the nearest star, every character is constantly subjected to subatomic bombardment — radiation — though temporary and permanent damage is rare. Such circumstances usually involve nuclear power (reactors, plants, bombs) or space travel (cosmic rays, solar flares, etc.). The results are usually pretty ugly, even though it often takes a few days or weeks before the silent killer completes its work.

Like the rest of the game system, the radiation rules are a compromise between simplicity and realism; some scientific accuracy has been set aside to make them more playable. This was especially necessary in dealing with such an insidious ailment as radiation poisoning, whose effects on the human body are more complex than the average gamer cares to include in his game.

Rads ◆

One rad (Roentgen Absorbed Dose) is the effect of one roentgen – the standard unit for measuring radiation – on a living organism. Absorbed rads are cumulative: a tally of the character's current irradiation level must be kept. These rads are included in effect calculation until they are eliminated by the organism, which can take quite some time. Every week, a character can purge a number of rads equal to the amount given by a Health roll, as long as he was not further exposed to radiation during that period. A character can never fully purge them out and will always retain a number of rads equal to one-tenth the largest number ever accumulated.

The following table gives sample rad contamination values from various sources. The values are either absolute numbers, for one-shot radiation bursts, or rates, for prolonged exposure.

Sample Radiation Levels

1-kiloton air burst at 1 km	100 rads
1-megaton air burst at 2 km	6,000 rads
1-megaton air burst at 10 km	500 rads
1-megaton air burst at 25 km	100 rads
Neutron bomb air burst at 3 km	500 rads
Fallout at ground zero, 1-megaton ground burst	
after 1 hour	1d6 rads/minute
after 2 hours	1d3 rads/minute
after 6 hours	1d6 x 5 rads/hour
after 1 day	1d6 rads/hour
Nuclear Reactor Meltdown	1d6 x 10 rads/minute
Solar Flare	1d6 x 5 rads/minute
Background Cosmic Rays	1d6 x 0.001 rads/hour

◆ Protective Equipment

Lead and NBC suits protect against radiation and radioactive fallout. Anti-radiation suits are given a Radiation Shielding Factor (RSF) in rads/hour. This amount is subtracted from individual bursts or from hourly rad rates for prolonged exposure. This value is divided by 60 to get the protection in rad per minute.

Protection can also be derived from a large mass, which will absorb most of the energy of the radiation. Water is one of the best radiation shield there is, but other inert material, such as rock, also provide respectable protection if there is enough of it. Non-shielded vehicles provide a minimum amount of protection equal to their Armor rating squared, in millirads (0.001 rad) per minute. Buildings, constructs and large natural objects follow the same formula, but double their Structure points before squaring.

In addition, many vehicles are equipped with screen generators, devices that absorb or deflect incoming radiation. This is noted as HEP: Radiation in their statistics. The rad protection level, in rads/hour, is equal to ten to the power of the rating of the system (e.g., a rating 3 system would give 10^3 rads/hour of protection).

Radiation Protection

Type	RSF
NBC Suit	5 rads/hour
Space Suit (any type)	5 rads/hour
Rad Suit	10 rads/hour
Water (one centimeter)	Equivalent to 25 points of Structure
Rock (one centimeter)	Equivalent to 15 points of Structure
Metal* (one centimeter)	Equivalent to 15 points of Structure

*Powerful radiations cause secondary cascade effects in metal if the thickness of the shielding is insufficient. If the total RSF provided by the metal is lower than half the incoming radiation, the shielding is ignored and the radiation level is doubled.

◆ Radiation Effects

The first time a character's accumulated rads exceed 50, or at any time the character receives at least 1 rad thereafter, secretly roll his or her Health against a Threshold set by the Irradiation Table, below. Do not roll more than once a day and do not apply more than one effect at a time (pick the worst). The Gamemaster should not tell the player the result of the roll, but rather describe the symptoms as they manifest themselves.

If the character succeeds the roll, he is totally unaffected by the radiation, though his level of accumulated rads stays the same. Failed rolls have a variety of effects, as detailed below. On a fumbled roll, apply the corresponding Fumble effect as dictated by the table, then the normal failure effects. Make a further Health roll in the case of a fumble: the result gives the number of minutes before the effect takes place.

Irradiation Table

Rads	Threshold	Fumble effect
50-99	6	none
100-199	7	Flesh wound
200-299	8	Flesh wound
300-399	9	Flesh wound
400-499	10	Flesh wound
500-599	11	Deep wound
600-699	12	Deep wound
700-799	13	Deep wound
800-899	14	Deep wound
900-999	15	Deep+Flesh wounds
1000-1099	16	Deep+Flesh wounds
1100+	17	death

The values on this table are higher than most studies have shown. This was done to both increase character survivability and take into account the fact that some parts of the body may escape irradiation, thus lowering the overall effects.

Short-Term Effects

A roll failed by 1 to 4 produces mild radiation sickness. Symptoms will appear in a number of hours equal to the result of a Health roll by the character. He will be fatigued and nauseous, incurring a action penalty equal to the Margin of Failure. Reduce the penalty by one every 12 hours. There are no other short and medium term effects, though later complications are possible; see *Long Term Effects* section below for more details.

A Margin of Failure between 5 and 7 will have effects similar to those of a mild radiation illness, described above, with a penalty of -4. Secondary symptoms will appear after a number of days equal to the character's Health roll: lingering fatigue, muscle pain, loss of hair. The character will be at -1 to all activity, except Health rolls which are at -2. The character must make a daily Health roll vs. 4 to recover from the sickness. Success means that the character completely recovers in 10 days, minus his or her System Shock rating (minimum of 1). A fumble will inflict a Flesh wound on the character.

A Margin of Failure of 8 or 9 is similar to one between 5 and 7, described above, except that the secondary symptoms are more severe. The general action penalty is -2, -3 for Health rolls. A failure on the daily recovery roll will inflict a Flesh wound, a Deep wound in the case of a fumble.

A roll failed by 10 to 14 gives results similar to those detailed above, but graver still: the action penalty is -3, -4 for Health rolls. A failed recovery roll delivers a Deep wound, while a Fumble means that the character succumbed to the radiation. On a successful result roll again, with no penalties this time: a second success means that the character miraculously recovered, as explained above.

A roll failed 15 or more kills the character in a number of hours equal to a Health roll.

Long Term Effects

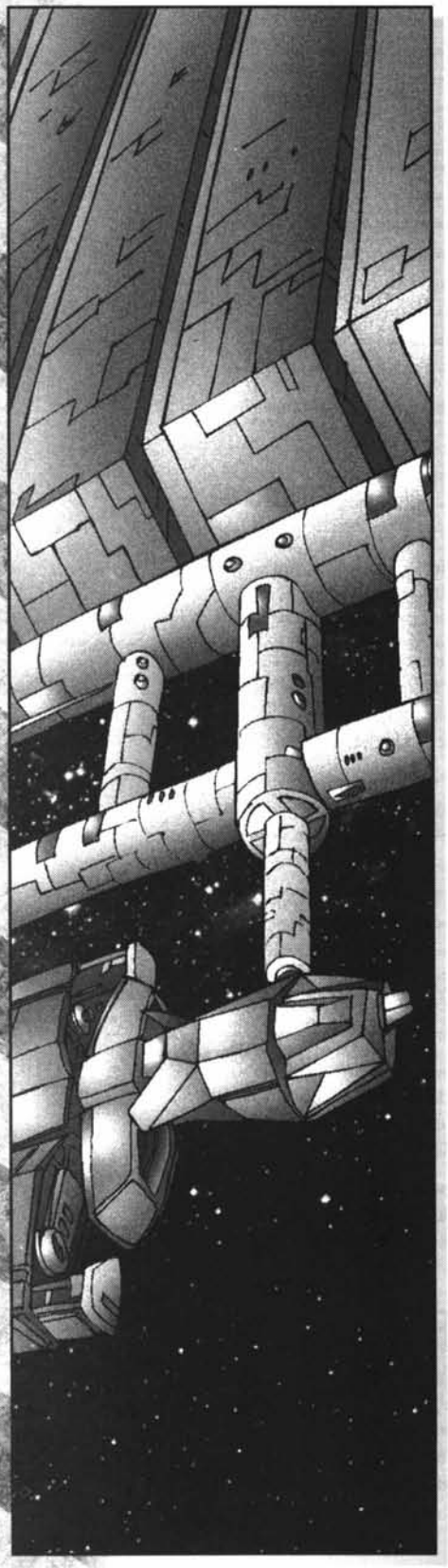
The effects of radiation on human DNA are very subtle and it can take years before the full effects manifest themselves. People who have been subjected to large doses of radiation are more prone to develop cancers and other troubles in their later years. Other unpleasant legacies of radiation effects, such as sterility or offspring mutations, are left to the Gamemaster to use as plot devices.

To simulate the long term effects, the GM may decide to have a character who suffered from radiation sickness make a yearly Health roll against half the highest Margin of Failure he ever had in resisting the effects of radiation, rounded up. Failure means that the character has contracted a life-threatening cancer — which may or may not be detectable and treatable, depending on the timeframe and the style of the campaign.

Treating Radiation Sickness

Depending on the campaign's level of scientific development, it may or may not be possible to treat characters suffering from radiation poisoning. If treatment is available, it will probably come in two steps: recovery from the sickness proper, and accelerated purging of accumulated rads. Depending on the technology, a +1 to +4 bonus can be added on the recovery roll, and the purging rate may be multiplied by a factor of 2 to 8. If the character receives regular check-ups, the recovery bonus is applied for Long-Term Effects' Health rolls. Once again, depending on the location, the treatment may range from relatively cheap and commonly available to extremely expensive and rare.

TALON RISING



The noise of the launch had died down, only to be replaced by a concert of moans and muffled lamentations. The newly appointed 76th Black Talons were being given their space christening, and not all of them appreciated the experience.

"The simulation was nothing like this." Sergeant Bill Touger closed his eyes and tried to forget his inner ear.

His seatmate, Caporal Jaenine Elk, did not seem to share his discomfort. She was already trying to loosen the straps of her G-seat and was avidly peering into the tiny plexglass viewport beside her. "Are you kidding? This is way better than the sim! We're really weightless now, not just hanging from wires!"

Touger just groaned and tried to shut her out. He dearly wished he hadn't been so macho as to refuse the medication tablet. "Won't agree with my stomach, sir," he had said, grinning. Dumb, dumb, dumb.

Their orientation officer appeared at the front of the cabin, feet toward the ceiling.

"Listen up, dirtsiders! Welcome to space. We now begin your first two-week acclimatization and orientation period. Right now, you must be excited but also a bit apprehensive: it's the first time in space for most of you. "

He glared at them. "You'll be fine as long as you remember one thing: listen to what I say and do it right away. It's a dangerous place out there. Make one mistake, one insubordination, and you'll be dead. I won't even have to punish you - the universe will take care of it for me."

He pushed lightly against the bulkhead, the movement sending him floating slowly between the rows of acceleration couches.

"We're entering a realm where the laws are the same but where they apply differently. Remember that at all time. Stay sharp - forget to bring something with you, or don't check the gauges, and you're dead. Can't repair a malfunctioning piece of equipment - you're dead. Hesitate one second too long - you're dead. When in doubt, assume that everything will kill you, and plan accordingly."

The officer's regular movement took him near the row of seats where Touger and Elk where sitting. He saw the young pilot grasping his seat with both hands, eyes closed, and smiled.

"So, how's the stomach, mister Touger? Still a bit tender? Want some anti-acid, perhaps?" He pivoted lightly to face the rest of the team. His hard voice softened somewhat. "Here's a perfect example of what I was talking about. We've been up here for a long time. We know what we're talking about. Follow our instructions closely, and you'll be fine. Else..."

Caporal Elk interrupted with a small cry of surprise. The orbital shuttle was now floating beside the main transfer station, the bulk of which was slowly revealed as the shuttle turned to align itself toward its assigned docking pier. Elk pointed at the Fury-class assault ship docked nearby.

"Excuse me, sir, but is that our ship? I mean, we'll be assigned a Fury, yes?"

The instructor laughed.

"Getting ahead of ourselves slightly, aren't we? If you manage to survive the training, I may let you visit it."

Life in Space - 5.1

In the 62nd century, most of humanity live on Earth-type planet. Those that ply the spacelanes are a different breed of humans, able to stand the isolation, the claustrophobic surroundings, and the stress of living day to day in an environment where death is the only outcome of mistakes. Like the mariners of old, they provide the vital links between the colonized islands that dot the skies, providing both prosperity and defense to their earthbound brethren. And, again like the mariners, they form their own society, bound by its special rules and traditions.

In the **Heavy Gear** universe, space is like the oceans of old: a void to cross to get from one place to the other, a place to exploit natural resources, and occasionally a battlefield. Space travel for its own sake is a dream that long succumbed to reality: there is nothing romantic about spending a month cooped up in a small cabin while the ship makes its way to a station orbiting the next planet over. Yet, space can be the location of some fantastic adventures in their own merits.

Spacer Philosophy - 5.1.1

Spacers, as a rule, tend to be neat and tidy. They constantly look after the states of thing and are almost obsessive about cleaning up. Most "groundhuggers" find this exasperating — it is hard to speak to a spacer for more than five minutes without him interrupting to check a system. This is not insanity: messy spacecraft and habitats are a constant danger. Items floating about may become deadly missiles under acceleration, loose dirt may foul up the air conditioner, or a ripped pocket may spill the tools needed to repair a critical system. An unkempt spacer is a dangerous individual, and is often shunned by others.

Spacers are also known to rarely make unnecessary gestures, an habit developed because of the confined space in which they live. The less extra gestures made, the less chances of bumping into someone or something, or hitting dangerous controls. They make extensive use of hand signals to emphasize their instructions, however, just in case a radio failure prevents communication between two workers in space suits.

The unforgiving environment of space means that spacers are very serious about their duties, especially when it comes to maintenance, and they despise laziness above all. Each individual represents a pool of knowledge and technical skills that are vital to the communities and ships. Experts are rare (crosstraining is a survival trait), and all spacers are computer-literate.

Spacers value loyal friendship and family bonds. They feel somewhat uncomfortable around total strangers, though they do not shun them. Families are rare and highly regulated, both to prevent overcrowding and because low-gravity pregnancies require special attention that may not be available during certain periods.

Spacers cannot produce all they need by themselves, and thus depend on other settlements or the planet down below to a certain extent. Spacers have few personal belongings, but are protective of what they do have. Tools and instruments are generally well looked after. Resources are also precious, especially water, which is found only locked in certain types of asteroids.

Spacers

The Terranovan that lives in space is a slightly different breed than its ground-based counterpart. The spacers have their own philosophy and traditions, and many seem very strange to the average groundpounder — until they stop and look at them closely.

For example, experienced spacers are easy to recognize by their careful gestures and economy of movement. Broad or quick movements are a sure way to lose control and spin out in micro-gravity, and both are likely to result in damaged equipment or hits on crewmates. All spacers like to tell the story of the cadet who liked to emphasize his words with slashes of the arm — until the day he accidentally hit the airlock emergency release button. All spacers are very serious about space emergency procedures, and will look coldly upon anyone ignoring basic safety rules or taking brash risks.

Spacers must by necessity spend a great deal of time close to one another, and it has become natural for each member of the crew to have a private place of his own. They are likely to have good educations (there is little to do but read and talk out there) and most have average or above average human relation abilities (a survival trait in such a confined space).

Spacers tend to be resourceful people, and nearly all of them have at least some kind of technical or computer-related skill. A space-based character should be fairly skilled in zero-gravity operations, and some will have been physically affected by their extended stay in freefall (low BLD or FIT). All will have at least a good education (average KNO or better) and tend to be bright and level headed, as carelessness kills in space (slightly above average CRE and WIL).

5.1.2 - Cabin Fever

Space travel forces people to live in very close quarters for long periods of time. Once a ship is underway, there is often nowhere to go to gain some privacy and this lasts for up to a few months at a time. In such close groups of people, there are generally few secrets - or else there is a lot of trouble. If a crime is committed the culprit is likely to still be on board, with all the drama and suspicion that then ensues. Combat is never a very good option aboard spaceships or other pressurized environments. Disagreements and conflicts have to be solved using other methods. Space travel is thus good for intrigue campaigns and for players who like a high level of personal interaction.

◆ Starting Point: Murder on the High Frontier

Someone has been murdered aboard the ship or station. His lifeless body has been found floating in the engineering bay, surrounded by a cloud of blood globules. The station being a closed environment, the killer *must* be one of the people present. A crime campaign, or even an isolated "incident," is great for inducing paranoia among Players. In general, they will create plot complications for themselves as they play the detective game, trying to find the real killer before they are framed for the deed. Perhaps the killer is willing to eliminate many other people to cover his tracks - who will be next? And what if it was not a murder? After all, accidents do happen...

Possible Campaign Variations

Variation	Description
1	One of the crew is a mole on a secret assignment.
2	One of the crew has developed a psychosis that threatens the safety of others.
3	Some strange malfunctions keep occurring; could there be a saboteur aboard?
4	The Players uncover some piece of information they were not meant to know.
5	The Players accidentally overhear a threatening conversation.
6	One of the PCs narrowly escapes a life-threatening situation.

5.1.3 - Starship Troopers

A large segment of the Terranovan spacer population is constituted of the armed forces personnel that assure the defense of the Helios system. They man the ships and stations that are the first line of defense against invading off-world fleets. Because they are the only ones with the means to do so, the spacers must also deal with minor invading forces, such as CEF infiltration teams, in remote locations. It is a dangerous life, made up of long periods of boredom with the occasional moment of sheer terror. Despite the current peace talks, the space troops might still get caught up in battles, perhaps against reactivated drones left over from the War of the Alliance. The rapid intervention teams that protect Terra Nova against small infiltration units are likely to be part of the Black Talon program, but other space forces are in existence (see page 16).

◆ Smuggler Run

Life in space is dangerous, but once the routine maintenance and check-ups are done, and the computers oversee everything, it becomes somewhat boring. Many spacers will do almost anything to spice up their daily routine: alcohol, drugs, promiscuity, and other things of that sort. Alcohol is fairly easy to make — after all, there is plenty of vacuum just outside the viewport for several thousand stills. Authorities close their eyes as long as it does not become a problem, and most spacers are responsible enough to take safety precautions while they are drinking. Other material, however, is more frowned upon and needs to be smuggled in. Since security in space is very tight, this requires imagination, determination and a wide web of contacts.

Possible Campaign Variations

Variation	Description
1	A fugitive comes into contact with the Players.
2	A new drug supplier, backed by an earthbound cartel, tries to muscle into the territory.
3	The Players come across a vacuum still during a routine spacewalk.
4	An unrelated search turns up prohibited material in one of the PCs' cabin.
5	The Players fall into the middle of a Military Police sting operation.
6	The Players are asked by a friend to help him defend his bar/ship/business.

Mighty Space Miners

Not all Terranovan spacers are soldiers. Many of them are rock hounds, making a daily living out on the frontier by investigating and scavenging ghost ships or mining asteroids for their water and metal content. Others are technicians and support crew aboard the space stations and bases scattered throughout the system. Without them, spacer society would grind to a halt. The rock hounds are hardy souls, able to rely only on themselves to face down nature and its dangers. Sometimes, the dangers are man-made — CEF boobytraps, old combat drones, and so on — but that does not make them any less threatening. Most of their day-to-day lives are filled with exploration and action.

Starting Point: Ghost Ship ◆

There are lots of ships out there dating back from the War of the Alliance. Most of them are derelict hulks, victims of drones and other high-powered weaponry. Some are ships that malfunctioned or worse, ran out of fuel, and are now locked on the last trajectory they acquired. These debris turn around the sun in an endless dance, sometimes disappearing at the edge of the system only to come back, seemingly out of nowhere, many months or even cycles later. For the brave souls willing to board these flying mausoleums and disturb the eternal rest of their doomed crew, there is a lot of money to be made in salvage and new technology acquisition (especially aboard CEF ships). Not all hulks are entirely dead, however, and may reserve many unpleasant surprises...

Possible Campaign Variations

Variation	Description
1	A new team arrives in the vicinity to compete for exploitation rights.
2	The new outpost director is a puritan who intends to shut down the bar.
3	An incredibly rich asteroid is discovered.
4	The internal security systems on a derelict CEF cruiser are still operational.
5	A derelict ship is encountered, its crew still alive but locked in sleep tubes.

Blow Out!

Space is the most hostile environment known to Man. It's impossible to survive more than a few minutes unprotected, and virtually all life functions must be supported by machinery. This makes it an ideal setting for emergency/high tension scenarios designed to scare the Players out of their wits without having to pit them against opponents.

The laws of physics are an implacable adversary. They cannot be pleaded with or argued against; weapons and other tools of war, unless used creatively, are totally useless. The Players must find a way to use the equipment around them in creative ways in order to fulfill their needs.

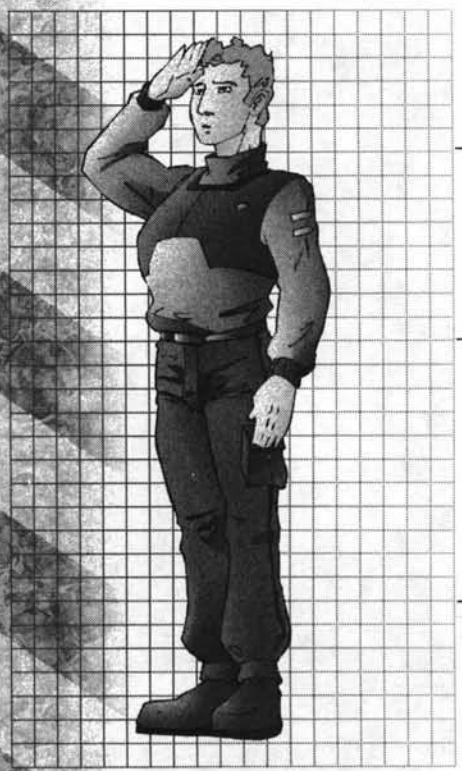
Starting Point: Stranded! ◆

All was going well until the fusion tube malfunctioned and had to be ejected. Now the Player Characters are stuck on the derelict ship, with no way to slow down to enter a proper orbital trajectory. They must find some way to contact rescuers and then survive until friendly forces can reach them.

Possible Campaign Variations

Variation	Description
1	A ship has suffered a critical malfunction and is on a collision course with a station.
2	A micrometeor has punctured the main oxygen reserve.
3	The ship has developed a leak, but half the spacesuits are currently under maintenance.
4	The ship is on a collision course; the crew needs to secure everything before the avoidance burn.
5	A freak radiation storm has fried the main comm array.
6	The Players must limp home on a damaged ship, cutting as much mass loose as possible.

CREWMAN



The crew and staff of the Terranovan space assets are a breed apart. They are highly intelligent people who are able to handle isolation and boredom well, and who can keep a cool head during emergencies. Many of them have lived through the brutal battles of the War of the Alliance and are reticent to fight for mere political motives.

Attributes

AGI	0	APP	0	BLD	0	CRE	0	FIT	0
INF	1	KNO	1	PER	0	PSY	1	WIL	0
STR	0	HEA	0	STA	25	UD	3	AD	3

Skills

Skill	Level	Attr.	Skill	Level	Attr.	Skill	Level	Attr.	Skill	Level	Attr.
Athletics	1	0	First Aid	1	2	Physical Sciences	1	1	Tinker	2	1
Communications	1	1	Mechanics	2	1	Survival (Space)	1	1	Zero-G Mvmt.	2	0
Computer	1	1	Navigation (Space)	1	1						

*Optional Additional Skills: Business, Computer, Electronics, Gunnery (Space)

Typical Equipment

Tool kit, coveralls or uniform, personal datapad, 1d6 x 100 credits

MARINE

Marine stand somewhat apart from the other spacers. They are the ones that find themselves thrust directly into the thick and ugly of vacuum hand-to-hand fighting rather than the clean, "instant kill" world of a ship's crew. The dangers inherent in their job give them a fatalistic, almost devil-may-care attitude. They remain spacers, however, and will not tolerate incompetence or foolishness. Because they also fulfill security duties, the marines tend to be carefully screened by the powers-that-be planetside before being assigned to a space facility.

Attributes

AGI	1	APP	0	BLD	1	CRE	0	FIT	1
INF	0	KNO	1	PER	1	PSY	0	WIL	1
STR	1	HEA	0	STA	30	UD	7	AD	6

Skills

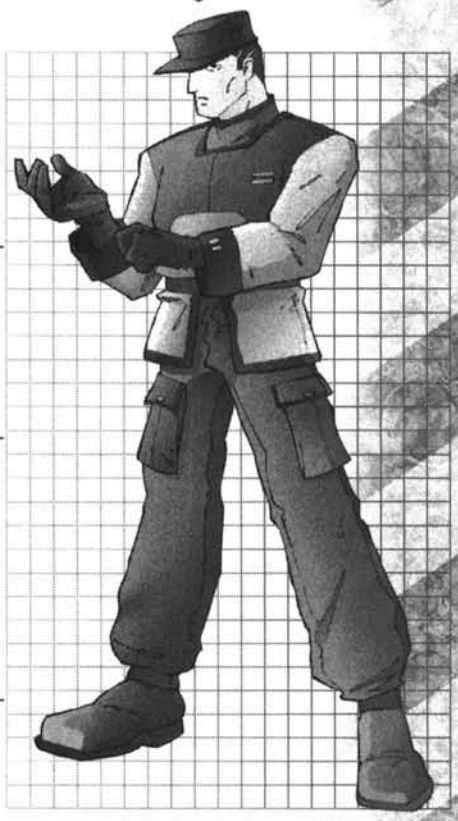
Skill	Level	Attr.	Skill	Level	Attr.	Skill	Level	Attr.	Skill	Level	Attr.
Athletics	1	1	Hand-to-Hand	2	0	Notice	2	1	Survival (Space)	1	1
Combat Sense	2	1	Intimidate	1	1	Security	2	2	Zero-G Combat	2	1
Dodge	1	0	Melee	1	0	Small Arms	2	0	Zero-G Mvmt.	2	1

*Optional Additional Skills: Camouflage, First Aid, Navigation, Pilot (Space), Streetwise

Typical Equipment

Spacesuit, sidearm, uniform, comm gear

OFFICER



Spacer officers come in two general types, volunteers and exiles. The former have requested assignments to one of the off-world bases, either because they like space travel or because they feel they will have a greater effect on things up there (such is the case with many officers affiliated with the Westphalia Cabinet). The latter have received this assignment to take them out of the way, either because they prove incompetent or too rebellious or outspoken. In general, however, the incompetent do not live long.

Attributes

AGI	1	APP	0	BLD	0	CRE	1	FIT	1
INF	1	KNO	2	PER	1	PSY	0	WIL	1
STR	0	HEA	0	STA	25	UD	3	AD	3

Skills

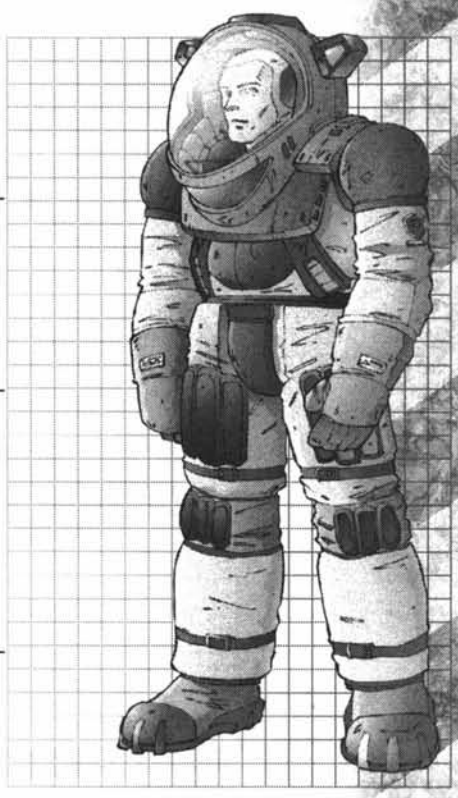
Skill	Level	Attr.	Skill	Level	Attr.	Skill	Level	Attr.	Skill	Level	Attr.
Bureaucracy	1	0	Electronic Warfare	1	0	Notice	1	1	Tactics (Space)	2	2
Combat Sense	2	1	Leadership	2	0	Small Arms	1	1	Zero-G Movement	1	1
Computer	1	2	Navigation (Space)	1	0	Survival (Space)	1	2			

*Optional Additional Skills: Hand-to-Hand, Navigation (Air), Zero-G Combat

Typical Equipment

Datapad, access to military vehicles and bases, 1d6 x 500 credits

SPACER



Not all people living in space are military; some hardy souls have decided to make a living among the stars and ply the space lanes of the Helios system, filling most of the support positions that the Terranovan space society needs to function. They are the technicians, the asteroid miners or the bartender/cook aboard the space stations. All are uniformly intelligent and level-headed; natural selection (and, sometimes, human selection) rapidly takes care of those that are not.

Attributes

AGI	0	APP	0	BLD	0	CRE	0	FIT	0
INF	1	KNO	1	PER	0	PSY	1	WIL	1
STR	0	HEA	0	STA	25	UD	3	AD	3

Skills

Skill	Level	Attr.	Skill	Level	Attr.	Skill	Level	Attr.	Skill	Level	Attr.
Athletics	1	0	Electronics	1	2	Pilot (Space)	1	1	Tinker	1	0
Communications	1	2	Notice	1	0	Survival (Space)	2	1	Zero-G Movement	2	0
Computer	1	2									

*Optional Additional Skills: Business, Bureaucracy, Human Perception, any science or technical Skill

Typical Equipment

Spacesuit, datapad or tool collection, 1d6 x 100 credits

VALERIA-CLASS DESTROYER

The Valeria-class destroyer is one of the most common space combat unit in service with the northern fleets. The ship has a fairly compact stubby design, being about 50 m high by 50 wide by 70 long (not counting extendable antennae array). Eight fusion tubes, all based on the same modular design, are clustered at the rear, providing the ship with a crushing five gravities of acceleration at maximum thrust (up to six or even seven are possible by overloading the engines, though they risk exploding). The small crew, eight people, is provided with acceleration craddles at all the duty stations to help them endure the ordeal of battle. The ship is heavily armed with two side-mounted rapid-fire laser panel arrays for close-in defense and one main laser cannon mounted on a turreted mount under the hull. The main weapon, however, remain the heavy gauss accelerator built int the spine of the ship, which can tear most other vessels to pieces with a single hit. The armament is complemented by a forward firing drone/missile hangar and a rear drop bay for mines and towed sensor pods.

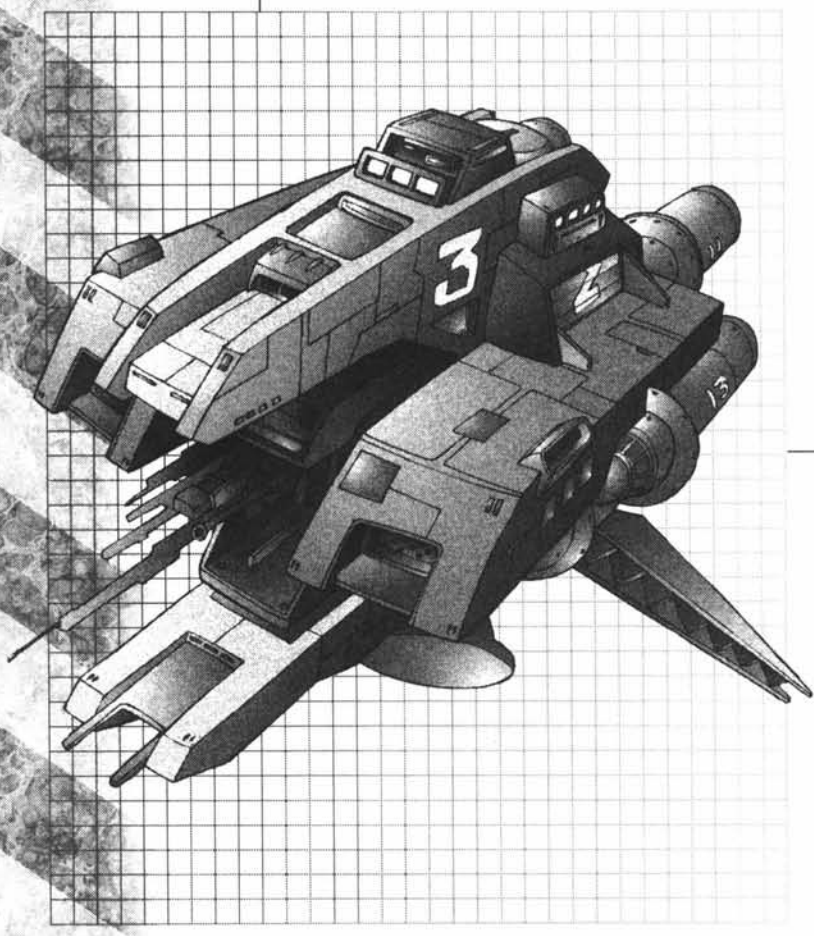
◆ Service Record

The Valeria-class vessels survived the War of the Alliance in greatest number, mostly thanks to their well-trained crew and their willingness to use guerilla-inspired hit-and-run tactics. They did earn the title of "most drones lost in battle" from Space Command after the War, however; many crew are perversely quite proud of this, and publicized the matter with shirts and badges with logos such as "We're Over Here, Stupid!" Valeria-class destroyers now form the bulk of the Northern space forces, being stationed around Terra Nova, Hope and the main system Gate. Valeria-class ships are named after Northern city-states and major towns and villages, generally the one from which the greatest number of crewmen hail from.

Game Statistics

Threat Value:	9606	**Offensive:**	4269	**Defensive:**	3560	**Miscellaneous:**	20,989	**Lemon Dice:**	3

Vehicle Specifications

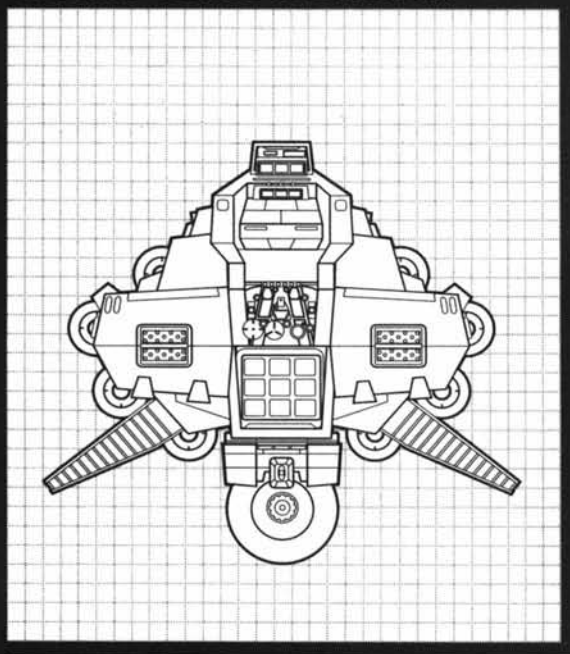


Name:	Valeria-class
Origin:	Terra Nova
Manufacturer:	Orbital Shipyards
Type:	Destroyer
Crew:	8
Length:	70 m
Width:	50 m
Height:	50 m
Empty Weight:	1700 tons
Loaded Weight:	1800 tons
Main Drive:	8 x Fusion Tubes
Reaction Mass:	45 tons (2500 BPs)
Total Thrust:	8 x 1,200 tons

Weapon Payload

Name	Ammunition Payload
1 x Laser Cannon	40
2 x Area Defense Laser Emitters	40
1 x Heavy Spinal Railgun	40
2 x Drone Bays	40
Assorted Drones	-

VALERIA-CLASS DESTROYER



ARMOR DAMAGE

0 ▢▢▢▢▢ ▢▢▢▢▢

20 ▢▢▢▢▢ ▢▢▢▢▢

40 ▢▢▢▢▢ ▢▢▢▢▢

60 ▢▢▢▢▢ ▢▢▢▢▢

80 ▢▢▢▢▢ ▢▢▢▢▢

CREW INFORMATION

- PILOT NAME:
- RANK:
- SQUADRON:
- AFFILIATION:

PILOT (LV/AT): ▢▢ GUNNERY (LV/AT): ▢▢ ELEC. WAR. (LV/AT): ▢▢

CREW DATA

VEHICLE CREW

• CREW:	8
• BONUS ACTIONS:	4

CREW DAMAGE

VEHICLE CREW

▢ CREW •

▢ BONUS ACTIONS •

SYSTEMS DATA

MOVEMENT

• PRIMARY COMBAT SPD:	25	2.5g
• PRIMARY TOP SPD:	50	5g
• SECONDARY COMBAT SPD:		
• SECONDARY TOP SPD:		
• MANEUVER:	-3	
• DEPLOYMENT RANGE:	1800 hrs	

ELECTRONICS

• SENSORS:	1	6
• COMMUNICATION:	2	50
• FIRE CONTROL:	0	

ARMOR

• LIGHT DAMAGE:	80
• HEAVY DAMAGE:	160
• OVERKILL:	240

SYSTEMS DAMAGE

MOVEMENT

▢ COMBAT SPD •

▢ TOP SPD •

▢ COMBAT SPD •

▢ TOP SPD •

▢ MANEUVER •

▢ FUEL SPENT •

ELECTRONICS

▢ SENSORS •

▢ COMM •

▢ FIRE CONTROL •

ARMOR

▢ LIGHT DAMAGE •

▢ HEAVY DAMAGE •

▢ OVERKILL •

GENERAL SPECIFICATIONS

• THREAT VALUE: 9606 • SIZE: 40 • COST: 10,101,300 marks

WEAPONS

NAME	CODE	FIRE ARC	S	M	L	EX	Acc	Dam	Qty	ROF	Special
LLC		T	3	6	12	24	+1	x20	1	0	-1RB
HGLC		L	3	6	12	24	+1	x25	1	0	-2RB
HGLC		R	3	6	12	24	+1	x25	1	0	-2RB
HRG		FF	5	10	20	40	0	x35	1	0	-

AMMO

FULL	LEFT
40	
40	
40	
40	

WEAPONS

▢ WEAPON 01 •

▢ WEAPON 02 •

▢ WEAPON 03 •

▢ WEAPON 04 •

▢ WEAPON 05 •

▢ WEAPON 06 •

▢ WEAPON 07 •

▢ WEAPON 08 •

▢ WEAPON 09 •

▢ WEAPON 10 •

PERKS

NAME	RATING	GAME EFFECT	AUX
Ablative Armor	20	Front	
Automation	8	Bonus Actions	
Autopilot	-	Acts as Level 1 pilot	AUX
Backup Systems	-	Absorbs one hit for all systems	
Cargo Bay	-	1000 m^3	
Crew Accomodations	-	Military, 8 people	
Ejection System	-	Escape Pods	
Emergency Medical	-	Absorbs one crew stun; medical support	
High Capacity Computer	-	-	
Hostile Environment Protections	-	Extreme Cold, Radiation 4, Vacuum	
Life Support	-	Full	AUX
Micro-Lab: Athletics	-	Helps maintain crew gravity tolerance	
Reduced G-Effect	-	Acceleration Seats, give +1 FIT checks	
Satellite Uplink	-	Allows long range contact and ortillery fire	AUX
Sick Bay	2	Infirmary (2 beds)	
Stealth	3	Adds to Concealment	AUX
Trideo Link-Up	-	Send tactical pictures back to HQ	AUX
Vehicle Bay	18	Drone/Aux. Craft Housings (170 tons)	
Vehicle Bay	11	Drone/Mine Housing (40 tons)	

PERKS

▢ PERK 01 •

▢ PERK 02 •

▢ PERK 03 •

▢ PERK 04 •

▢ PERK 05 •

▢ PERK 06 •

▢ PERK 07 •

▢ PERK 08 •

▢ PERK 09 •

▢ PERK 10 •

▢ PERK 11 •

▢ PERK 12 •

▢ PERK 13 •

▢ PERK 14 •

▢ PERK 15 •

▢ PERK 16 •

▢ PERK 17 •

▢ PERK 18 •

▢ PERK 19 •

FLAWS

NAME	RATING	GAME EFFECT
Sensor Dependent	-	Must have Sensors to operate

HEAVY GEAR

RICHELIEU-CLASS DESTROYER

The Richelieu-class destroyer is sometimes confused with the similar-sized Valeria Northern destroyer. Both ships do share many similarities in design, mostly because they were intended to fulfill the same tasks. Like its Northern brethren, the ship has a fairly compact and stubby design, though its hull is more curved and graceful. Eight modular fusion tubes are clustered around the rear hull. They can accelerate the ship at up to five gravities of acceleration at maximum thrust, more if the engines are overloaded. This gives them a similar operating profile to the Valeria. Acceleration craddles are built into each duty station to protect the crew during combat maneuvering. The ship is heavily armed with two side-mounted rapid-fire laser turrets for close-in defense and one main laser cannon mounted on a turreted mount under the hull. Though the Richelieu carry less weapons, its fire control systems are far superior to those of the Valeria, allowing it to effectively hit more often and at longer ranges. The armament is complemented by a forward firing drone/missile hangar and a rear drop bay for mines and towed sensor pods.

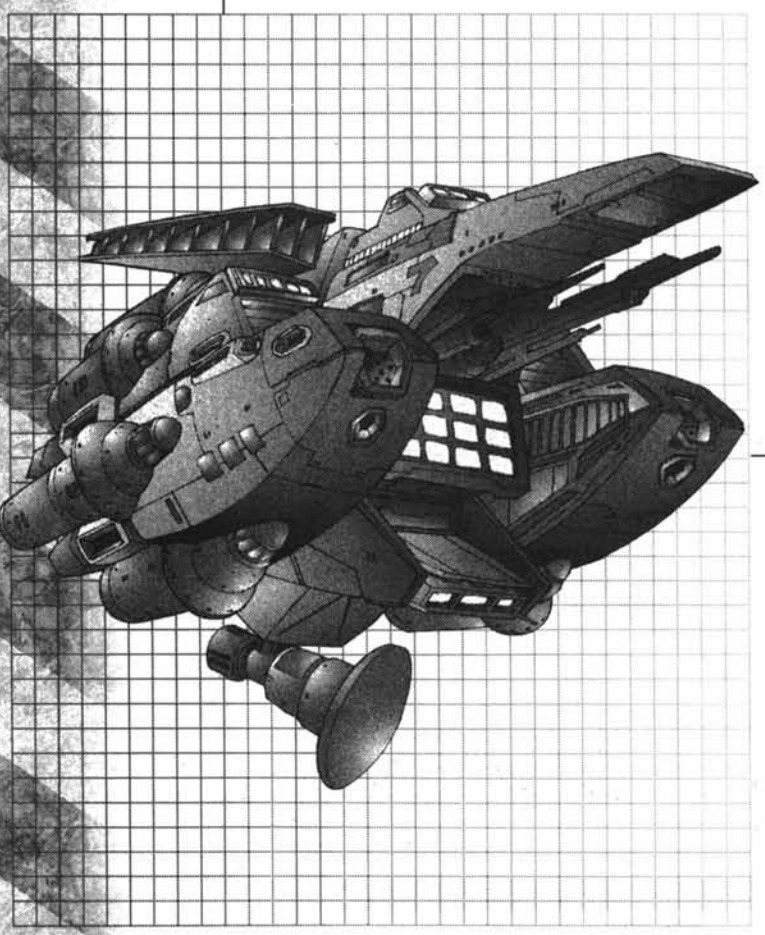
◆ Service Record

Though nearly half the total southern fleet was lost during the War of the Alliance, the innovative tactics and unorthodox approachs that the spacers employed during the conflicts spared most of the Richelieus. The ships earned a reputation for sneakiness and accuracy, often striking CEF vessels at long range and fading back into the folds of space before any retaliatory attack could be mounted. The Richelieu-class are currently the most common ships among the combined Southern space forces, outnumbering other vessel types almost two-to-one. Richelieu-class ships are named after famous military and political personnae of the past, many of them from classic imperial periods.

Game Statistics

Threat Value:	**9338**	**Offensive:**	**3463**	**Defensive:**	**3560**	**Miscellaneous:**	**20989**	**Lemon Dice:**	**3**

Vehicle Specifications

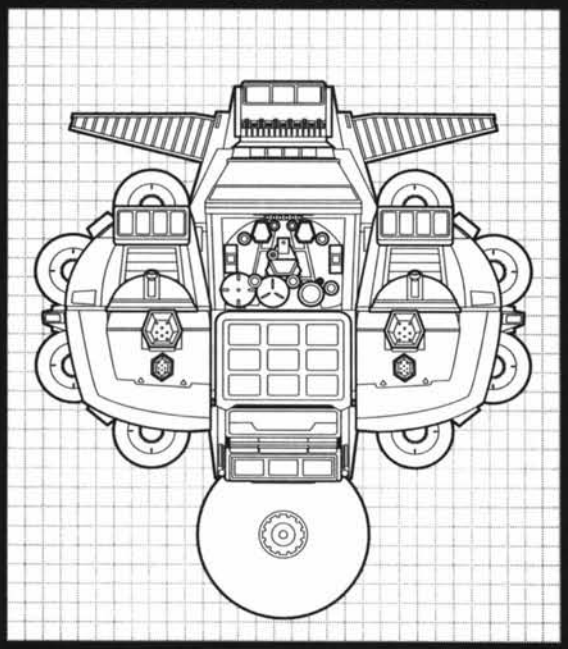


Name:	**Richelieu-class**
Origin:	**Terra Nova**
Manufacturer:	**Orbital Shipyards**
Type:	**Destroyer**
Crew:	**8**
Length:	**70 m**
Width:	**50 m**
Height:	**50 m**
Empty Weight:	**1700 tons**
Loaded Weight:	**1800 tons**
Main Drive:	**8 x Fusion Tubes**
Reaction Mass:	**45 tons (2500 BPs)**
Total Thrust:	**8 x 1200 tons**

Weapon Payload

1 x Laser Cannon	**40**
2 x Area Defense Laser Emitters	**40**
2 x Drone Bays	**40**
Assorted Drones	**-**

RICHELIEU-CLASS DESTROYER



ARMOR DAMAGE

0 | 20 | 40 | 60 | 80

CREW INFORMATION

- PILOT NAME:
- RANK:
- SQUADRON:
- AFFILIATION:

PILOT (LV/AT): GUNNERY (LV/AT): ELEC. WAR. (LV/AT):

CREW DATA

VEHICLE CREW

• CREW:	8
• BONUS ACTIONS:	4

CREW DAMAGE

VEHICLE CREW

CREW •
BONUS ACTIONS •

SYSTEMS DATA

MOVEMENT

• PRIMARY COMBAT SPD:	25	2.5g
• PRIMARY TOP SPD:	50	5g
• SECONDARY COMBAT SPD:		
• SECONDARY TOP SPD:		
• MANEUVER:	-3	
• DEPLOYMENT RANGE:	1800 hrs	

ELECTRONICS

• SENSORS:	+1	6
• COMMUNICATION:	+2	50
• FIRE CONTROL:	+1	

ARMOR

• LIGHT DAMAGE:	80
• HEAVY DAMAGE:	160
• OVERKILL:	240

SYSTEMS DAMAGE

MOVEMENT

COMBAT SPD •
TOP SPD •
COMBAT SPD •
TOP SPD •
MANEUVER •
FUEL SPENT •

ELECTRONICS

SENSORS •
COMM •
FIRE CONTROL •

ARMOR

LIGHT DAMAGE •
HEAVY DAMAGE •
OVERKILL •

GENERAL SPECIFICATIONS

• THREAT VALUE: 9338 • SIZE: 40 • COST: 9,819,900 dinars

WEAPONS

NAME	CODE	FIRE ARC	S	M	L	EX	Acc	Dam	Qty	ROF	Special
LLC		T	3	6	12	24	+1	x20	0		-1RB
HGLC		L	3	6	12	24	+1	x25	0		-2RB
HGLC		R	3	6	12	24	+1	x25	0		-2RB

AMMO

FULL	LEFT
40	
40	
40	

WEAPONS

WEAPON 01 •
WEAPON 02 •
WEAPON 03 •
WEAPON 04 •
WEAPON 05 •
WEAPON 06 •
WEAPON 07 •
WEAPON 08 •
WEAPON 09 •
WEAPON 10 •

PERKS

NAME	RATING	GAME EFFECT	AUX
Ablative Armor	20	Front	
Automation	8	Bonus Actions	
Autopilot	-	Acts as Level 1 pilot	AUX
Backup Systems	-	Absorbs one hit for all systems	
Cargo Bay	-	1000 m^3	
Crew Accomodations	-	Military, 8 people	
Ejection System	-	Escape Pods	
Emergency Medical	-	Absorbs one crew stun; medical support	
High Capacity Computer	-	-	
Hostile Environment Protections	-	Extreme Cold, Radiation 4, Vacuum	
Life Support	-	Full	AUX
Micro-Lab: Athletics	-	Helps maintain crew gravity tolerance	
Reduced G-Effect	-	Acceleration Seats, give +1 FIT checks	
Satellite Uplink	-	Allows long range contact and ortillery fire	AUX
Sick Bay	2	Infirmary (2 beds)	
Stealth	3	Adds to Concealment	AUX
Trideo Link-Up	-	Send tactical pictures back to HQ	AUX
Vehicle Bay	16	Drone/Aux. Craft Housings (120 tons)	
Vehicle Bay	13	Drone/Mine Housing (65 tons)	

PERKS

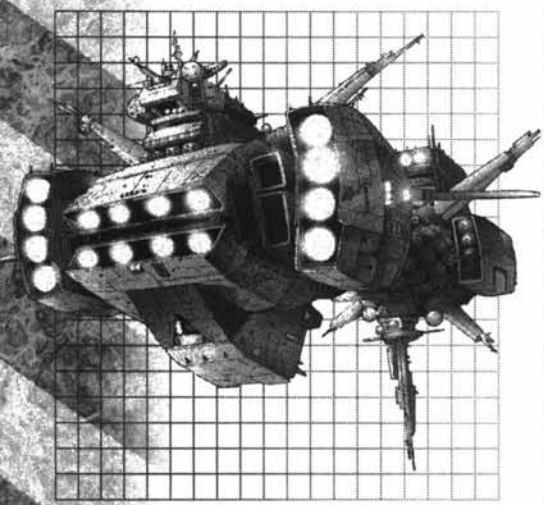
PERK 01 •
PERK 02 •
PERK 03 •
PERK 04 •
PERK 05 •
PERK 06 •
PERK 07 •
PERK 08 •
PERK 09 •
PERK 10 •
PERK 11 •
PERK 12 •
PERK 13 •
PERK 14 •
PERK 15 •
PERK 16 •
PERK 17 •
PERK 18 •
PERK 19 •

FLAWS

NAME	RATING	GAME EFFECT
Sensor Dependent	-	Must have Sensors to operate

HEAVY GEAR

GATESHIP



"Gateship" is the name given to the gigantic vessels that allow an entire fleet to leap thousands of light-years in a single instant by opening the naturally-occuring interstellar portals known as Tannhauser Gates. Indeed, most spaceships do not carry a Gate Drive. The cost and complexity of the main accelerator drive core are of monumental proportions and represent a superb engineering feat. Parts have to be manufactured to extreme tolerances, and very rare materials are often required.

Gateships are enormous, often being a significant fraction of a kilometer in length. While they are equipped with an array of powerful fusion thrusters, the acceleration they can attain rarely surpass 0.2 G, and even then the stress is enormous. Gateships are used to open the Gate for a fleet of smaller vessels — the cost in energy and manpower is far too great to spend on moving just one ship. For this reason, very few Gateships are used for travel, though they can do so. It is often more efficient to send standard slower-than-light ships through a Gate than move the Gateship itself, though this of course requires that another Gateship be present on the other side for the return trip. Most people view Gateships as giant, yet mobile space stations.

Gateships are truly enormous and as such, they are mainly locations in which (or around which) the game will take place. They are much too big to be destroyed outright, although they can be damaged. The only way to completely destroy a Gateship is to nuke it from the inside, slice it apart with another Gate drive, or slam it at high velocity against a celestial object (asteroid or what not).

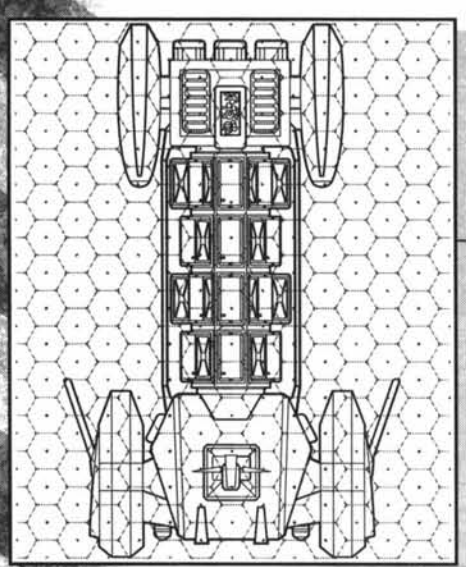
Game Stats

Each 50 x 50 meter section (one tactical hex) of hull has 200 points of ablative Structure (150 for the smaller Gateships of the "Light" class), just like a building. For collision purposes, each section is considered to be the equivalent of a vehicle of Size equal to their current Structure.

Depleting half the point total of a given section will result in a hull breach and slow loss of interior atmosphere (a fist-sized hole would take decades to completely empty a large station). Special "goop balls" (Structure value = 5) will appear in 1d6 roleplaying turns (30 seconds to 3 minutes) to start blocking the hole until a repair crew arrives. Completely depleting the Structure points in one turn cause an explosive blow-up which propel schrapnels all around (x50 damage to anything within 100 meters, dropping off by 5 every 100 meters of additional radius).

If the Structure Points of an hex are completely depleted, that hex is considered to become Woodlands for movement and firing purposes; obviously, trees do not grow there, but the floating debris and tangled mass of wreckage have much the same effects. The Gateships cannot be destroyed even if all its hexes are ravaged. Only a contact nuclear hit or a Gate Drive attack by another Gateship will do the trick, and even then the sheer mass of the vessel will ensure that the hull will merely be broken apart and not vaporized.

◆ Surface Features



The right hand page contains five small data sheets, each detailing a gun turret or other "system on the hull of the ship, fitting into a single hex. Unlike the hull of the ship itself, these can be independently targeted and destroyed. There are placed much like buildings on a traditional hex map. The various Gateship features are built using the Emplacement rules (see **Tech Manual 2nd edition**, p. 138), with a maximum Size of 25. All Gateships are large and powerful enough for their energy turrets to be considered Anti-Aircraft Laser Platforms (see **Tech Manual 2nd edition**, p.138) with unlimited ammunition.

◆ Combat Map

The hex map below is for combat between Gears and spacesuited marine forces on the surface of a typical Gateship (note that similar maps can be used for space stations). The map wraps around the hull of the ship. Since there is no gravity and the combatants are moving with the help of adhesive soles, they can move anywhere on the map. The line of sight is blocked from one side to the other, obviously; only units standing on the row of hexes that forms the side of the vessel can see both above and below the hull.

Main hull elements, such as the conning towers and drive housings, can be considered Elevations (levels 1 or 2). The various systems listed on the right hand page can be placed on the map as needed; removed them when destroyed.

Part:	Conning Tower
Threat Value:	8581
Size:	25 (450 tons)
Crew:	35
Bonus Actions:	5
Piloting :	/
Gunnery:	/
Leadership:	/
EW:	/
Tactics:	/
Sensors:	+3/20 km
Communications:	+3/100km

Speed	
Combat/Top:	/
Speed	
Combat/Top:	/
Maneuver:	-10
Fire Control:	-5
Armor:	50/100/150

Weapons:

Unit ID #:

Name	Fire Arc	S	M	L	EX	Acc.	Dam.	ROF	Special	Ammo/Left
							x			/
							x			/
							x			/
							x			/
							x			/

Perks & Flaws: Anti-Missile Systems (R3, 200 rnds), Backup Systems, Ejection Systems, ECM (R5), ECCM (R5), Emergency Medical, Haywire Resistant, HEAT-Resistant Armor (R20), High Cap. Computer, HEP (Ext. Cold, Radiation R5, Vacuum), Lab (Leadership R1), Life Support (Full), Satellite Uplink, Trideo Link-up, Large Sensor Profile (R2), No Engine, Sensor Dependent

Round Notes:

0: 1: 2: 3: 4: 5: 6: 7: 8: 9: 10:

Part:	Railgun Turret
Threat Value:	3050
Size:	25
Crew:	4
Bonus Actions:	3
Piloting :	/
Gunnery:	/
Leadership:	/
EW:	/
Tactics:	/
Sensors:	1/2 km
Communications:	-3/10 km

Speed	
Combat/Top:	/
Speed	
Combat/Top:	/
Maneuver:	-10
Fire Control:	0
Armor:	30/60/90

Weapons:

Unit ID #:

Name	Fire Arc	S	M	L	EX	Acc.	Dam.	ROF	Special	Ammo/Left
Light Railgun	T	5	10	20	40	0	x14	+2	-	400/
Light Railgun	T	5	10	20	40	0	x14	+2	-	400/
Light Railgun	T	5	10	20	40	0	x14	+2	-	400/
							x			/
							x			/

Perks & Flaws: Automation (R4), Backup Systems, Ejection Systems, Emergency Medical, HEAT-Resistant Armor (R10), HEP (Ext. Cold, Radiation R5, Vacuum), Life Support, Reinforced Crew Compartment, Shielded Weapons, Weapon Link, Large Sensor Profile (R2), No Engine, Sensor Dependent

Round Notes:

0: 1: 2: 3: 4: 5: 6: 7: 8: 9: 10:

Heavy Laser Turret	
Threat Value:	3235
Size:	25
Crew:	4
Bonus Actions:	3 Actions
Piloting :	/
Gunnery:	/
Leadership:	/
EW:	/
Tactics:	/
Sensors:	+1/2 km
Communications:	-3/10 km

Speed	
Combat/Top:	/
Speed	
Combat/Top:	/
Maneuver:	-10
Fire Control:	0
Armor:	30/60/90

Weapons:

Unit ID #:

Name	Fire Arc	S	M	L	EX	Acc.	Dam.	ROF	Special	Ammo/Left
Hvy Laser Can.	T	5	10	20	40	+1	x20	0	-3RB	Inf.
Hvy Laser Can.	T	5	10	20	40	+1	x20	0	-3RB	Inf.
							x			/
							x			/
							x			/

Perks & Flaws: Automation (R4), Backup Systems, Ejection Systems, Emergency Medical, HEAT-Resistant Armor (R10), HEP (Ext. Cold, Radiation R5, Vacuum), Life Support, Reinforced Crew Compartment, Shielded Weapons, Weapon Link, Large Sensor Profile (R2), No Engine, Sensor Dependent

Round Notes:

0: 1: 2: 3: 4: 5: 6: 7: 8: 9: 10:

Part:	Gatling Laser Turret
Threat Value:	3492
Size:	25
Crew:	4
Bonus Actions:	3 Actions
Piloting :	/
Gunnery:	/
Leadership:	/
EW:	/
Tactics:	/
Sensors:	+1/2 km
Communications:	-3/10 km

Speed	
Combat/Top:	/
Speed	
Combat/Top:	/
Maneuver:	-10
Fire Control:	0
Armor:	30/60/90

Weapons:

Unit ID #:

Name	Fire Arc	S	M	L	EX	Acc.	Dam.	ROF	Special	Ammo/Left
G. Laser Can.	T	2	4	8	16	+1	x16	+1	-3RB	Inf.
G. Laser Can.	T	2	4	8	16	+1	x16	+1	-3RB	Inf.
							x			/
							x			/
							x			/

Perks & Flaws: Automation (R4), Backup Systems, Ejection Systems, Emergency Medical, HEAT-Resistant Armor (R10), HEP (Ext. Cold, Radiation R5, Vacuum), Life Support, Reinforced Crew Compartment, Shielded Weapons, Weapon Link, Large Sensor Profile (R2), No Engine, Sensor Dependent

Round Notes:

0: 1: 2: 3: 4: 5: 6: 7: 8: 9: 10:

Part:	Missile Turret
Threat Value:	4274
Size:	25
Crew:	4
Bonus Actions:	3 Actions
Piloting :	/
Gunnery:	/
Leadership:	/
EW:	/
Tactics:	/
Sensors:	+1/2 km
Communications:	-3/10 km

Speed	
Combat/Top:	/
Speed	
Combat/Top:	/
Maneuver:	-10
Fire Control:	0
Armor:	30/60/90

Weapons:

Unit ID #:

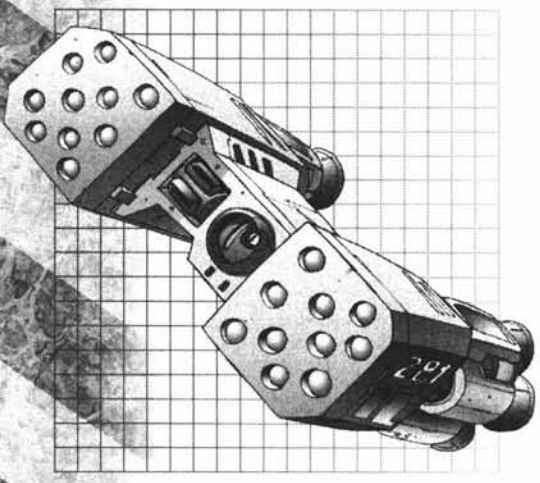
Name	Fire Arc	S	M	L	EX	Acc.	Dam.	ROF	Special	Ammo/Left
Hvy AT Missiles	T	5	10	20	40	+1	x30	0	G, IF	60/
							x			/
							x			/
							x			/
							x			/

Perks & Flaws: Automation (R4), Backup Systems, Ejection Systems, Emergency Medical, HEAT-Resistant Armor (R10), HEP (Ext. Cold, Radiation R5, Vacuum), Life Support, Reinforced Crew Compartment, Shielded Weapons, Weapon Link, Large Sensor Profile (R2), No Engine, Sensor Dependent

Round Notes:

0: 1: 2: 3: 4: 5: 6: 7: 8: 9: 10:

DRONES



Drones are the foot soldiers of modern space combat. All ships will carry several of these little robot vessels, both for offensive and defensive purposes. They are controlled by advanced computer brains that are capable of guiding them through a battle or surveillance mission with great precision, but which generally lack the spontaneity and randomness of human pilots. Most are actually better pilots and shooters than humans, primarily because they neither question their own abilities nor take unnecessary risks; they are, however, quite predictable and must thus be backed by human strategies and intuition.

The computers that control drones are made of dense electronic data storage and computer processors linked to a neural net that handles decision-making tasks. The result is an unfailingly competent soldier with extremely basic self-preservation instincts and virtually none of the complex emotional problems that can plague human pilots. Unlike Gear neural nets, however, drone brains, being quickly and cheaply mass-produced, have only the most basic intuition and instinct, and generally do not have the time to learn more complex behaviors.

Most drones are about car-sized since they must fit into a spaceship's launch bay(s) but still carry enough fuel and equipment to fulfill their assigned missions. Drones are divided into sub-categories depending on their functions.

◆ Recon

Small and maneuverable, Recon and Electronic Warfare drones carry enough fuel and power to operate independently of their mother unit for extended period of time. They can be recovered, but the difficulty of performing a successful recovery increases exponentially with time and distance. Sometimes, one of these drones is released on a towed tether to increase sensor range by triangulation.

Recon drones actually have some sense of self-preservation, though they are still considered highly expendable. While they are unarmed and poorly-defended, observation and electronic warfare drones can wreak havoc on an enemy force by supporting friendly attacks and drawing fire away from more important units. Recon drones have no weaponry but can kamikaze themselves if needed.

◆ Combat

Combat drones, often referred to as "seekers," are larger drones with firepower. The decision-making processes of combat drones are advanced enough such that they can be trusted with weapons and the discretion to use them on the battlefield. The drone is assigned a particular task upon launch, such as harassment, defense or direct assault. The seeker can be fitted with various energy weapons but can also kamikaze itself if needed or when running out of maneuver fuel. A similar variant uses hypervelocity kinetic missiles with high yield warheads instead. Combat drones are generally not considered expendable on the battlefield; they are difficult to obtain and somewhat expensive to replace.

◆ Decoys

Decoy drones are small and agile units that are considered utterly expendable. They carry no weapon other than electronics (and sometimes, inflatable ballutes) that simulate the sensor signature of a larger ship, right down to exhaust temperatures and broadband emissions. Their job is to attract the attention of any enemy vessel in the area and force them to reveal themselves. All commanders must carefully weight whether or not to attack a sensor contact, never knowing if it is the true target or a bait that will doom them. Like all other drones, the decoy can kamikaze itself if needed or when running out of maneuver fuel.

◆ Mine

Mine drones are typically just dropped behind the ship. It then lies in wait until an enemy ship comes into range, then launches itself toward it in one frantic burst of activity to attack and detonate. Small, it carries just enough fuel and power to operate independently of its mother unit for the duration of the battle and is generally not recovered. The mine can be fitted with various warheads, including kinetic kill cloud burst, nukes, or even fusion bomb-pumped X-Ray laser arrays.

Vehicle: Recon/EW Drone	
Threat Value:	389
Size:	3
Crew:	0 (Drone)
Bonus Actions:	0
Piloting :	/
Gunnery:	/
Leadership:	/
EW:	/
Tactics:	/
Sensors:	+2 (5 km)
Communications:	+2 (20 km)

Space Mouvement	
Combat/Top:	20 / 40
Reaction Mass:	100BP (H. Eff. Fuel)
Dep. Range:	50 hours
Maneuver:	-2
Fire Control:	0
Armor:	3/6/9

Weapons: | Unit ID #:

Name	Fire Arc	S	M	L	EX	Acc.	Dam.	ROF	Special	Ammo/Left
							x			/
							x			/
							x			/
							x			/
							x			/

Perks & Flaws: Automation (R1), Autopilot (AUX), ECM (R3), ECCM (R3), High Capacity Computer, HEP: Extreme Cold, HEP: Radiation (R4), HEP: Vacuum, Stealth (R5, AUX)
Annoyance: Ancient Operating System Language, Exposed Auxiliary Systems, Exposed Fire Control Systems, Exposed Movement System, Fragile Chassis, Sensor Dependent, Vulnerable to Haywire

Round Notes:
0:
1:
2:
3:
4:
5:
6:
7:
8:
9:
10:

Vehicle: Decoy Drone	
Threat Value:	389
Size:	3
Crew:	0 (Drone)
Bonus Actions:	0
Piloting :	/
Gunnery:	/
Leadership:	/
EW:	/
Tactics:	/
Sensors:	+2 (5 km)
Communications:	+2 (20 km)

Space Mouvement	
Combat/Top:	20 / 40
Reaction Mass:	100BP (H. Eff. Fuel)
Dep. Range:	50 hours
Maneuver:	-2
Fire Control:	0
Armor:	3/6/9

Weapons: | Unit ID #:

Name	Fire Arc	S	M	L	EX	Acc.	Dam.	ROF	Special	Ammo/Left
							x			/
							x			/
							x			/
							x			/
							x			/

Perks & Flaws: Automation (R1), Autopilot (AUX), Decoy System (Sensor, R4), Decoy System (Visual, R4), Emergency Power Surge (R2, AUX), High Capacity Computer, HEP: Extreme Cold, HEP: Radiation (R4), HEP: Vacuum, Stealth (R5, AUX), Vulnerable to Haywire
Annoyance: Ancient Operating System Language, Exposed Auxiliary Systems, Exposed Fire Control Systems, Exposed Movement System, Fragile Chassis, Sensor Dependent

Round Notes:
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7:
8:
9:
10:

Vehicle: Mine Drone	
Threat Value:	see Weapons
Size:	3
Crew:	0 (Drone)
Bonus Actions:	0
Piloting :	/
Gunnery:	/
Leadership:	/
EW:	/
Tactics:	/
Sensors:	+1 (2 km)
Communications:	+1 (10 km)

Space Mouvement	
Combat/Top:	20 / 40
Reaction Mass:	100BP (H. Eff. Fuel)
Dep. Range:	50 hours
Maneuver:	-2
Fire Control:	0
Armor:	3/6/9

Weapons: | Unit ID #:

Name	Fire Arc	S	M	L	EX	Acc.	Dam.	ROF	Special	Threat Value
SDG	F	0	0	0	0	0	x25	0	-	TV 303
HHG	F	0	0	0	0	0	x20	0	-	TV 290
HG	F	0	0	0	0	0	x15	0	-	TV 287
HWG	F	0	0	0	0	0	x10	0	Haywire	TV 287
							x			/

Autopilot (AUX), Emergency Power Surge (R2, AUX), High Capacity Computer, HEP: Extreme Cold, HEP: Radiation (R4), HEP: Vacuum, Stealth (R5, AUX)
Annoyance: Ancient Operating System Language, Exposed Auxiliary Systems, Exposed Fire Control Systems, Exposed Movement System, Fragile Chassis, Sensor Dependent

Round Notes:
0:
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3:
4:
5:
6:
7:
8:
9:
10:

Vehicle: Seeker Drone - Gun	
Threat Value:	see weapon
Size:	5
Crew:	0 (Drone)
Bonus Actions:	0
Piloting :	/
Gunnery:	/
Leadership:	/
EW:	/
Tactics:	/
Sensors:	+1 (2 km)
Communications:	+1 (10 km)

Space Mouvement	
Combat/Top:	20 / 40
Reaction Mass:	100BP (H. Eff. Fuel)
Dep. Range:	50 hours
Maneuver:	-2
Fire Control:	0
Armor:	3/6/9

Weapons: | Unit ID #:

Name	Fire Arc	S	M	L	EX	Acc.	Dam.	ROF	Special	T. V./Ammo
HGLC	FF	3	6	12	24	+1	x25	0	-2RB,	TV 454/40
LLC	FF	3	6	12	24	+1	x20	0	-1RB,	TV 470/5
HLC	FF	3	6	12	24	+1	x15	0	-2RB,	TV 499/5
HPLC	FF	3	6	12	24	+1	x10	0	-2RB,	TV 503/5
							x			/

Automation (R1), Autopilot (AUX), Emergency Power Surge (R2, AUX), High Capacity Computer, HEP: Extreme Cold, HEP: Radiation (R4), HEP: Vacuum, Stealth (R5, AUX)
Annoyance: Ancient Operating System Language, Exposed Auxiliary Systems, Exposed Fire Control Systems, Exposed Movement System, Fragile Chassis, Sensor Dependent

Round Notes:
0:
1:
2:
3:
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5:
6:
7:
8:
9:
10:

Vehicle: Seek Drone - Missile	
Threat Value:	485
Size:	5
Crew:	0 (Drone)
Bonus Actions:	0
Piloting :	/
Gunnery:	/
Leadership:	/
EW:	/
Tactics:	/
Sensors:	+1 (2 km)
Communications:	+1 (10 km)

Space Mouvement	
Combat/Top:	20 / 40
Reaction Mass:	100BP (H. Eff. Fuel)
Dep. Range:	50 hours
Maneuver:	-2
Fire Control:	0
Armor:	3/6/9

Weapons: | Unit ID #:

Name	Fire Arc	S	M	L	EX	Acc.	Dam.	ROF	Special	Threat Value
MRP/36	FF	3	6	12	24	-1	x18	+3	IF	36
							x			/
							x			/
							x			/
							x			/

Automation (R1), Autopilot (AUX), Emergency Power Surge (R2, AUX), High Capacity Computer, HEP: Extreme Cold, HEP: Radiation (R4), HEP: Vacuum, Stealth (R5, AUX)
Annoyance: Ancient Operating System Language, Exposed Auxiliary Systems, Exposed Fire Control Systems, Exposed Movement System, Fragile Chassis, Sensor Dependent

Round Notes:
0:
1:
2:
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5:
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AEROSPACE SHUTTLE

The Shuttle is a sturdy workhorse designed to take off from a ground base, accelerate to high altitude and then boost itself to orbit. It is almost unremarkable in its design. A stout body is placed between two engines pods. Air intakes for the first part of the flight are placed just above the leading edge of the pods. The two-man crew looks out from large windows that afford them excellent visibility during all phases of the flight. Most of the fuselage is available for cargo or passengers, since the engines and fuel tanks are found within the pods. There are various models of shuttles in service, but most are similar in appearance and capabilities. Many are older design left over from the colonization days that are continuously repaired and refurbished; these are easy to spot because of their blunt, flat-faced forward hull and oversized atmospheric control fins.

◆ Service Record

They are fielded by all spacefaring factions in varying numbers. Shuttles are widely used for common hauling of people and material not only to and from orbit but also across long distances using fractional orbital flights. The older models are used in this fashion mostly in the south, where their versatility is greatly appreciated in the jungle.

Game Statistics

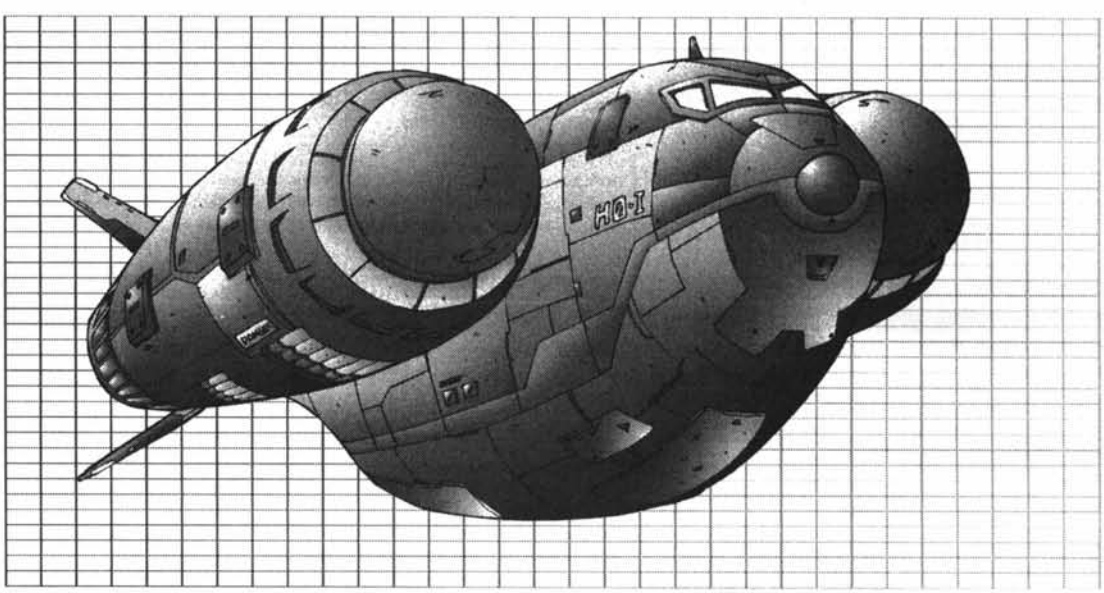
Threat Value:	979	Offensive:	0	Defensive:	548	Miscellaneous:	2388	Lemon Dice:	1

Vehicle Specifications

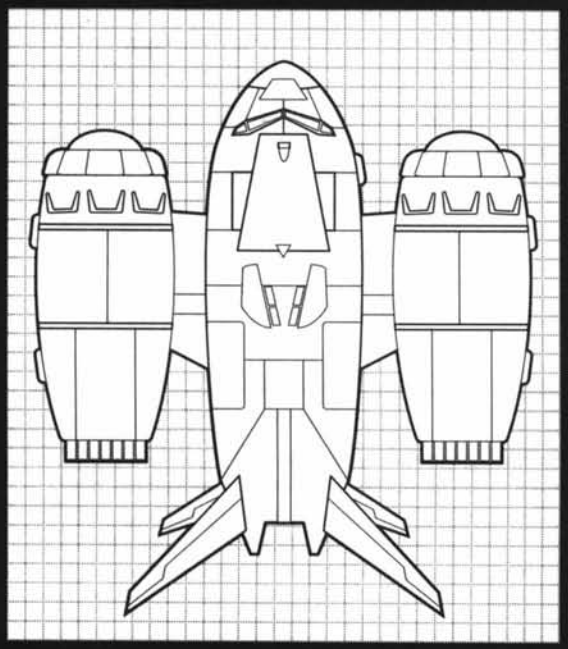
Code name:	Aerospace Shuttle	Height:	12 m
Production code:	Various	Empty Weight:	150 tons
Production Type:	Mass Production	Loaded Weight:	200 tons
Cost:	1,030,527 marks/dinars (Limited Production)	Main Drive:	2 x Fusion Tubes
Manufacturer:	Various	Reaction Mass:	800 BP
Use:	Aerospace Shuttle	Space Movement:	15/30 MPs (1.5g - 3.0g)
Length:	30 m	Max Towing Capacity (VTOL Flight Mode):	100 tons
Width:	28 m	Total Thrust:	2 x 350,000 kg

Weapon Payload

Name	Ammunition Payload	Name	Ammunition Payload
-	-	-	-



AEROSPACE SHUTTLE



ARMOR DAMAGE

0 ☐☐☐☐☐ ☐☐☐☐☐

10 ☐☐☐☐☐ ■■■■■

20 ■■■■■ ■■■■■

30 ■■■■■ ■■■■■

40 ■■■■■ ■■■■■

CREW INFORMATION

- PILOT NAME:
- RANK:
- SQUADRON:
- AFFILIATION:

PILOT (LV/AT): ☐☐ GUNNERY (LV/AT): ☐☐ ELEC. WAR. (LV/AT): ☐☐

CREW DATA

VEHICLE CREW

• CREW:	2
• BONUS ACTIONS:	1

CREW DAMAGE

VEHICLE CREW

☐ CREW •

☐ BONUS ACTIONS •

SYSTEMS DATA

MOVEMENT

• PRIMARY COMBAT SPD:	F	0,15
• PRIMARY TOP SPD:	F	30
• SECONDARY COMBAT SPD:	N	2
• SECONDARY TOP SPD:	N	3
• MANEUVER:		-4
• DEPLOYMENT RANGE:		1000

ELECTRONICS

• SENSORS:	-1	2
• COMMUNICATION:	-2	10
• FIRE CONTROL:		0

ARMOR

• LIGHT DAMAGE:	15
• HEAVY DAMAGE:	30
• OVERKILL:	45

SYSTEMS DAMAGE

MOVEMENT

☐ COMBAT SPD •

☐ TOP SPD •

☐ COMBAT SPD •

☐ TOP SPD •

☐ MANEUVER •

☐ FUEL SPENT •

ELECTRONICS

☐ SENSORS •

☐ COMM •

☐ FIRE CONTROL •

ARMOR

☐ LIGHT DAMAGE •

☐ HEAVY DAMAGE •

☐ OVERKILL •

GENERAL SPECIFICATIONS

• THREAT VALUE: 979 • SIZE: 19 • COST: 1,030,527 marks/dinars

WEAPONS

NAME	CODE	FIRE ARC	S	M	L	EX	Acc	Dam	Qty	ROF	Special

AMMO

FULL	LEFT

WEAPONS

■ WEAPON 01 •

■ WEAPON 02 •

■ WEAPON 03 •

■ WEAPON 04 •

■ WEAPON 05 •

■ WEAPON 06 •

■ WEAPON 07 •

■ WEAPON 08 •

■ WEAPON 09 •

■ WEAPON 10 •

PERKS

NAME	RATING	GAME EFFECT	AUX
Autopilot	-	Acts as level 1 pilot	AUX
Backup Communications	-	Absorbs first Comm hit	
Backup Life Support	-	Absorbs first Life Support hit	
Cargo Bay	-	2000 m³ [20m x 10m x 10m]	
Easy to Modify	-	+2 to Repair and Modify	
Hostile Environment Protections	-	Desert, Radiation 3, Vacuum	
Life Support	-	Limited	AUX
Re-entry System	-	Permanent	AUX
Stratospheric Flight	-	Double Flight MPs in stratosphere	

PERKS

☐ PERK 01 •

☐ PERK 02 •

☐ PERK 03 •

☐ PERK 04 •

☐ PERK 05 •

☐ PERK 06 •

☐ PERK 07 •

☐ PERK 08 •

☐ PERK 09 •

■ PERK 10 •

■ PERK 11 •

■ PERK 12 •

■ PERK 13 •

■ PERK 14 •

■ PERK 15 •

■ PERK 16 •

■ PERK 17 •

■ PERK 18 •

■ PERK 19 •

FLAWS

Cannot Glide		Not enough wing surface
Fragile Chassis	-	Structure hits are one step worse
Large Sensor Profile	2	Subtracted from Concealment

HEAVY GEAR

TRANSFER SHIP

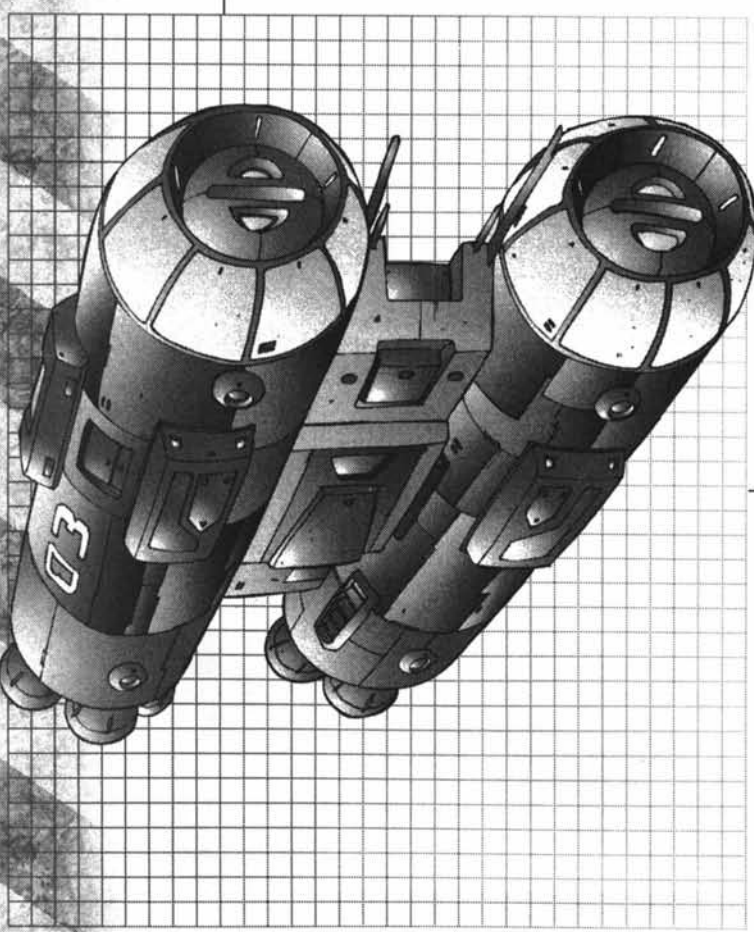
The transfer ship shown below is fairly representative of the class of medium range utility vehicles designed to fulfill a variety of tasks in space; they have been used as tugs, freighters, and even explorer ships. Their mechanical simplicity, as well as their low prices, have ensured their presence in the entire space-based society. The structure is composed of a strong alloy backbone to which the various components are grafted: these include the crew compartment, reaction mass tanks, hardpoints for lashing cargo boxes and various numbers of rocket engines. Many mount some kind of manipulator arm to assist in docking and the loading/unloading of material, and all have numerous hardpoints for lines to tow other vessels or objects. Its only weakness is that the powerful engines are voracious user of reaction mass. Unless additional tanks (such as collapsible bladders) are carried externally, the transfer vessel lacks sufficient reaction mass to undertake long-range hauling unless a convenient source, such as a towed ice asteroid, is available nearby.

◆ Service Record

Transfer ships are used by most spacefaring factions in different configurations, though they all have similar operating profiles. Most of the independent civilian vessels are of this type, since the design is relatively simple (as spacecraft go) and easy to maintain. Many serve as salvage ships and asteroid miners, where their high powered drives are put to good use. During the War of the Alliance, transfer ships were used mostly as supply and salvage vessels, but a few, among which the fabled *Bebe Hi-there* was the best know, were hastily converted into drone and fighter carriers, tying down on makeshift docking berths located around the hull. Very few of these vessels survived the War, and all survivors were either put into museums or sold for scrap.

Game Statistics

Threat Value:	**1878**	**Offensive:**	**0**	**Defensive:**	**1585**	**Miscellaneous:**	**4049**	**Lemon Dice:**	**1**



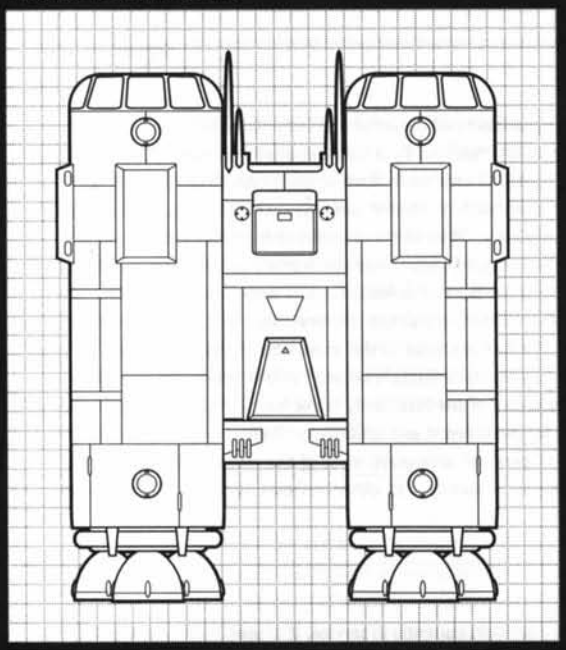
Vehicle Specifications

Code name:	**Transfer Vessel**
Production code:	**Various**
Production Type:	**Mass Production**
Cost:	**2,372,211 marks/dinars (Limited Production)**
Manufacturer:	**Various orbital shipyards**
Use:	**General Utility Ship**
Length:	**30 m**
Width:	**30 m**
Height:	**10 m**
Empty Weight:	**165 tons**
Loaded Weight:	**200 tons**
Main Drive:	**2 x Fusion Tubes**
Reaction Mass:	**4200 BP**
Total Thrust:	**2 x 620,000 kg**

Weapon Payload

Name	Ammunition Payload
-	-

TRANSFER SHIP



ARMOR DAMAGE

0 10 20 30 40

CREW INFORMATION

- PILOT NAME:
- RANK:
- SQUADRON:
- AFFILIATION:

PILOT (LV/AT): GUNNERY (LV/AT): ELEC. WAR. (LV/AT):

CREW DATA

VEHICLE CREW

• CREW:	1
• BONUS ACTIONS:	0

CREW DAMAGE

VEHICLE CREW

CREW •
BONUS ACTIONS •

SYSTEMS DATA

MOVEMENT

• PRIMARY COMBAT SPD:	30	3g
• PRIMARY TOP SPD:	60	6g
• SECONDARY COMBAT SPD:		
• SECONDARY TOP SPD:		
• MANEUVER:	-	
• DEPLOYMENT RANGE:	250 hrs	

ELECTRONICS

• SENSORS:	-1	2
• COMMUNICATION:	0	10
• FIRE CONTROL:	0	

ARMOR

• LIGHT DAMAGE:	19
• HEAVY DAMAGE:	38
• OVERKILL:	57

SYSTEMS DAMAGE

MOVEMENT

COMBAT SPD •
TOP SPD •
COMBAT SPD •
TOP SPD •
MANEUVER •
FUEL SPENT •

ELECTRONICS

SENSORS •
COMM •
FIRE CONTROL •

ARMOR

LIGHT DAMAGE •
HEAVY DAMAGE •
OVERKILL •

GENERAL SPECIFICATIONS

• THREAT VALUE: 1878 • SIZE: 19 • COST: 2,372,211 marks/dinars

WEAPONS

NAME	CODE	FIRE ARC	S	M	L	EX	Acc	Dam	Qty	ROF	Special

AMMO

FULL	LEFT

WEAPONS

WEAPON 01 •
WEAPON 02 •
WEAPON 03 •
WEAPON 04 •
WEAPON 05 •
WEAPON 06 •
WEAPON 07 •
WEAPON 08 •
WEAPON 09 •
WEAPON 10 •

PERKS

NAME	RATING	GAME EFFECT	AUX
Airlift Ready	-	Quick connect hardpoints	
Automation	1	Needed for min crew, and can be run by remote	
Autopilot	-	Acts as level 1 pilot	AUX
Backup Communications	-	Absorbs first Comm hit	
Backup Life Support	-	Absorbs first Life Support hit	
Easy to Modify	-	+2 to repair and modify	
Hostile Environment Protections	-	Radiation 4, Vacuum	
Life Support	-	Limited AUX	
Reinforced Crew Compartment	-	Absorbs first Crew hit	
Searchlight	-	Swivel, 200 meters	AUX
Tool Arm	15	Cargo Manipulator, cannot punch	

PERKS

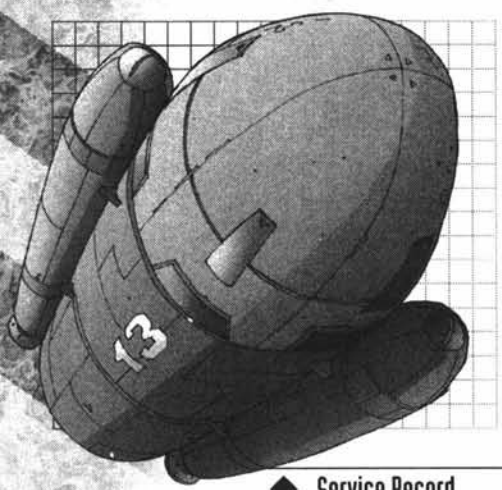
PERK 01 •
PERK 02 •
PERK 03 •
PERK 04 •
PERK 05 •
PERK 06 •
PERK 07 •
PERK 08 •
PERK 09 •
PERK 10 •
PERK 11 •
PERK 12 •
PERK 13 •
PERK 14 •
PERK 15 •
PERK 16 •
PERK 17 •
PERK 18 •
PERK 19 •

FLAWS

NAME	RATING	GAME EFFECT
Large Sensor Profile	3	-

HEAVY GEAR

CONESTOGA HEAVY LAUNCH VEHICLE



Despite the comparativey wide-tanging availablity of powerful and fully reusable fusion shuttles, there are times and tasks that remain better fulfilled by a conventional chemical-based rocket booster. Tasks include boosting "dumb" payload into orbit (such as mass quantities of spare parts and supplies), expendable military missions (such as combat drone launches), and anything that does not really require direct human supervision. Most of these rocket designs can lift around 200 tons to low orbit, sometimes more. The standard combat load for military rockets is an amazing fifty heavy combat drones, providing a virtual fleet of defense vessels with a single launch. The launcher is basically one large single-stage rocket, composed of a one-piece body with two flanking boosters that contain the engines. The fuel is stored in the lower half of the central hull in a pair of lightweight conformal tanks, just above the inflatable re-entry shield (when one is present) for recovery and eventual reuse. The upper half of the main body is the roomy payload bay and the mechanisms that open the sealed cowl for deployment and unloading. Thanks to the use of lightweight building material such as carbon fibers and armoplast, most of the rocket's mass on launch is fuel; only about ten percent is payload, structure and other systems such as guidance and telemetry packages.

◆ Service Record

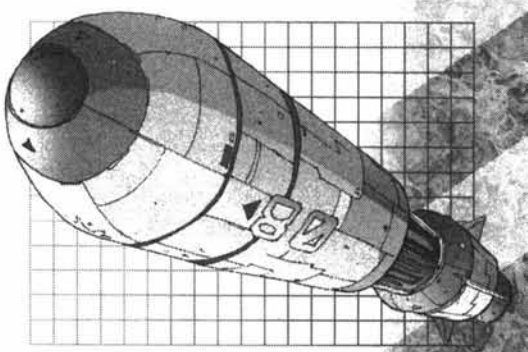
The Conestoga-class rocket shown here is representative of the various heavy boosters currently in service. It is used mostly by the UMF-based Northern space defense services, but the design has been licensed to many client-states worldwide. The Conestoga requires a basic launch gantry and support equipment, but can theoratically be launched from field positions.

Game Statistics

Threat Value:	378	**Offensive:**	0	**Defensive:**	1004	**Miscellaneous:**	128	**Lemon Dice:**	1
Crew:				Drone	**Actual Size:**			26 (465 tons empty)	
Default Size:				7	**Fueled Reaction Mass Weight:**			4650 tons High Efficiency Rocket Fuel	
Limited Production Cost:		203,538 marks(Limited Prod.)			**Armor:**			13/26/39	
MOVEMENT DATA									
Movement mode		Combat Speed				Top speed		Maneuver	
Space:		31/3.1g				62/6.2g		-6	
Reaction Mass:				1000 BP	**Deployment Range:**			50 hrs	
ELECTRONIC DATA									
Sensors:								-1 (2 km)	
Communications:								0 (10 km)	
Fire Control:								0	
PERKS & FLAWS									
Name				**Rating**				**Game Effect**	
Ammo/Fuel Containment System				-				+1 on Fire Control table	
Automation				1				Remote controlled drone vehicle	
Autopilot				-				Acts as level 1 pilot (AUX)	
Backup Communications				-				Absorbs first Comm hit	
Cargo Bay				-				2200 m^3 (44m long x 8m diameter)	
Hostile Environment Protections				-				Desert, Radiation 3, Vacuum	
Re-entry System				-				Single Use (AUX)	
Exposed Movement System				-				Movement hits are one step worse	
Fragile Chassis				-				Structure hits are one step worse	
Highly Flammable				-				Halve Armor vs. Fire	
Sensor Dependent				-				Must have Sensors to operate	
Large Sensor Profile				3				Subtract from Concealment	
Traceable Emissions				3				-	
NOTES:								Nominal Load: 50x Block 2 Drones (Size: 5, Required Volume: 2143.75m^3)	
•								Required Throw Weight: 50 x 4.4tons = 220 tons	
•								Loaded Thrust: 465 / (465+220) x 3.1g = 2.1g lift power = 1.0g climb	
•								Burn for TN Escape Velocity: 900 sec at 31 MP = 930 BP	

FRELON LIGHT LAUNCH VEHICLE

Sometimes, a shuttle flight is too expensive, or the task at hand is too dangerous, to justify risking human lives, but the payload is not large enough to require one of the big boosters. A line of small, agile orbital launchers has thus been developed to fill this need; the Southern Republic's Frelon is a good representative of this class of lightweight traditional chemical rocket launchers. The vehicle is powerful enough to lift a pair of heavy combat drones (or three smaller ones) up to low orbit, and where used in that fashion extensively throughout the War of the Alliance, but light enough to be easily carried and deployed in the field with a minimum of equipment. The launcher is basically a one piece body constructed out of spun carbon fibers. Most of the space is taken up by the rocket engine and the conformal fuel tanks, leaving the top nose cone for the payload. Light launchers are occasionally reusable (using a one-shot, re-entry deployable ballute mounted within the nose cone), but their low cost means that most of the time they are considered expendable and left to burn up on re-entry.



Service Record

The Frelon's popularity can certainly be attributed to its simple construction and great portability. Indeed, it can be fired from a number of mobile installations, such as landships and armored trucks, or from a simple emplaced launch stand. The Frelon was used to great effect as a communication/recon satellite and drone launcher throughout the War of the Alliance, attracting more than its share of CEF eneminity.

Game Statistics

Threat Value:	372	**Offensive:**	0	**Defensive:**	968	**Miscellaneous:**	146	**Lemon Dice:**	1
Crew:				Drone		**Actual Size:**			9 (18.5 tons empty)
Default Size:				7		**Reaction Mass Weight:**			185 tons High Efficiency Rocket Fuel
Mass Production Cost:				144,667 dinars		**Armor:**			5/10/15
MOVEMENT									
Movement Mode		**Combat Speed**				**Top Speed**			**Maneuver**
Space:		31/3.1g				62/6.2g			-6
Deployment Range:				50 hrs		**Reaction Mass:**			1000 BP
ELECTRONIC DATA									
Sensors:									-1 (2 km)
Communications:									0 (10 km)
Fire Control:									0
PERKS & FLAWS									
Name				**Rating**					**Game Effect**
Ammo/Fuel Containment System				-					+1 on Fire Control table
Automation				1					Remote controlled drone vehicle
Autopilot				-					Acts as level 1 pilot (AUX)
Backup Communications				-					Absorbs first Comm hit
Cargo Bay				-					90 m^3
Hostile Environment Protections				-					Desert, Radiation 3, Vacuum
Re-entry System				-					Single Use (AUX)
Exposed Movement System				-					Movement hits are one step worse
Fragile Chassis				-					Structure hits are one step worse
Highly Flammable				-					Halve Armor vs. Fire
Sensor Dependent				-					Must have Sensors to operate
Large Sensor Profile				1					Subtract from Concealment
Traceable Emissions				1					-
NOTES:									Nominal Load: 2x Block 2 Drones (Size: 5)
•									Required Volume: 2 x 3.5^3 = 85.75m^3
•									Required Throw Weight: 2 x 4.4tons = 8.8 tons
•									Loaded Thrust: 18.5 / (18.5+8.8) x 3.1g = 2.1g lift power = 1.0g climb
•									Burn for Terra Nova Escape Velocity: 900 sec at 31 MP = 930 BP

DROP SHUTTLE

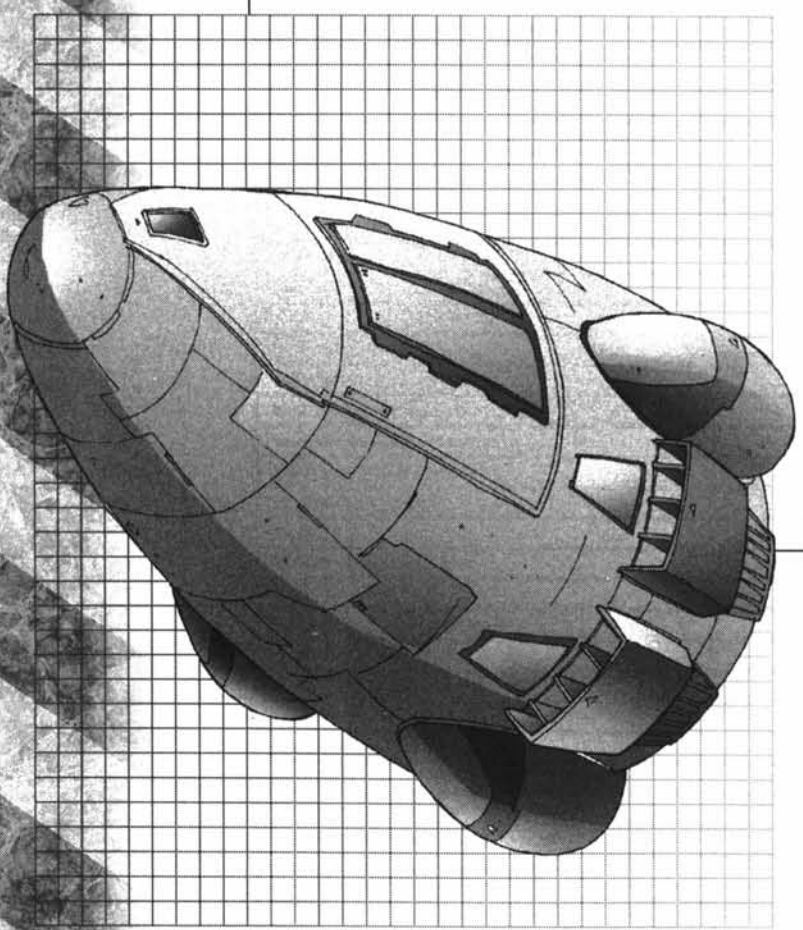
Drop shuttles are a type of ground-to-orbit launcher which is used mostly to haul cargo to and from the surface of a planet or moon. Most of their cylindrical or ovoid hull is taken up by a roomy cargo bay that can accommodate a wide variety of payload, opening up to the exterior through wide barn-style doors. The crew area is small and located in the nose of the ship, just above the payload bay, to which it is linked by an airlock tunnel. The internal accomodations are spartan, but adequate for short range hauls (translunar flights are possible but uncomfortable). The craft derives its entire thrust and electrical power from one or, more rarely, two, fusion powerplant(s) located in the bottom half of its large cylindrical body. The powerful thrusters can be fed indifferently from the atmospheric vents that ring the lower hull or the onboard reaction mass reserve, extending the range of the vehicle even when fully loaded. The drop shuttle receives its name from the way it re-enters the atmosphere blunt end first, just like if it was falling back down to the surface.

◆ Service Record

Most of the shuttles currently in service are older designs left over from the colonization days. Though they are still produced locally, the factories generally produce just enough to replace vehicles that most be retired due to accidents or old age. Unlike aerospace shuttles, which are prefered for Terranovan-bound traffic, drop shuttles are mostly assigned as ferries for the lunar bases and outposts. Their wide bay and rugged construction makes them popular with the base personnel, which also appreciate them because the arrival of a drop shuttle means new supplies and new faces to cut the boredom with.

Game Statistics

Threat Value:	2048	Offensive:	0	Defensive:	2368	Miscellaneous:	3775	Lemon Dice:	3



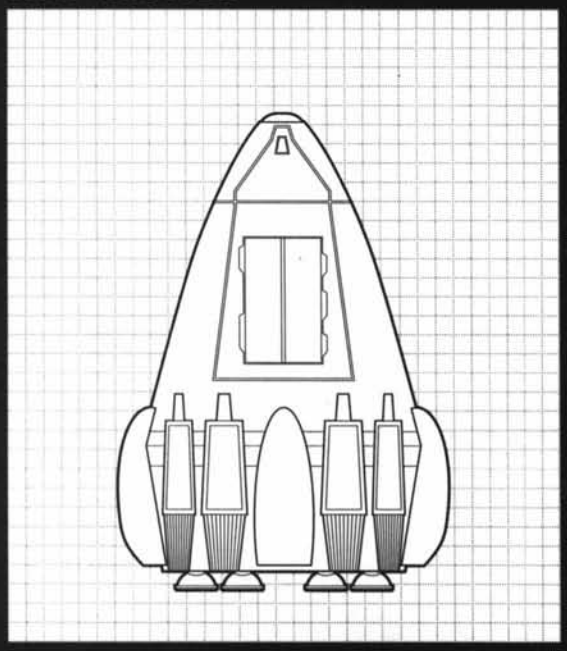
Vehicle Specifications

Code name:	Drop Shuttle
Production code:	Various
Production Type:	Mass Production
Cost:	1,331,200 marks/dinars (Limited Production)
Manufacturer:	Various
Use:	Ground-to-Orbit Transport
Length:	25 m
Width:	25 m
Height:	48 m
Empty Weight:	1500 tons
Loaded Weight:	1800 tons
Main Drive:	4 x Fusion Tubes
Space Movement:	15/30 MPs (1.5g - 3.0g)
Reaction Mass:	800 BP
Total Thrust:	4 x 1,400,000 kg
Notes:	Max. Carrying Capacity (VTOL Flight Mode): 900 tons

Weapon Payload

Name	Ammunition Payload
-	-

DROP SHUTTLE



ARMOR DAMAGE

0 | 20 | 40 | 60 | 80

CREW INFORMATION

- PILOT NAME:
- RANK:
- SQUADRON:
- AFFILIATION:

PILOT (LV/AT): GUNNERY (LV/AT): ELEC. WAR. (LV/AT):

CREW DATA

VEHICLE CREW

• CREW:	4
• BONUS ACTIONS:	2

CREW DAMAGE

VEHICLE CREW

CREW •
BONUS ACTIONS •

SYSTEMS DATA

MOVEMENT

• PRIMARY COMBAT SPD:	F	0,15
• PRIMARY TOP SPD:	F	20
• SECONDARY COMBAT SPD:	N	2
• SECONDARY TOP SPD:	N	3
• MANEUVER:		-3
• DEPLOYMENT RANGE:		700 km

ELECTRONICS

• SENSORS:	0	3
• COMMUNICATION:	0	15
• FIRE CONTROL:		0

ARMOR

• LIGHT DAMAGE:	70
• HEAVY DAMAGE:	140
• OVERKILL:	210

SYSTEMS DAMAGE

MOVEMENT

COMBAT SPD •
TOP SPD •
COMBAT SPD •
TOP SPD •
MANEUVER •
FUEL SPENT •

ELECTRONICS

SENSORS •
COMM •
FIRE CONTROL •

ARMOR

LIGHT DAMAGE •
HEAVY DAMAGE •
OVERKILL •

GENERAL SPECIFICATIONS

• THREAT VALUE: 2048 • SIZE: 40 • COST: 1,331,200 marks/dinars

WEAPONS

NAME	CODE	FIRE ARC	S	M	L	EX	Acc	Dam	Qty	ROF	Special
LLC		T	3	6	12	24	+1	x20	0		-1RB
HGLC		L	3	6	12	24	+1	x25	0		-2RB
HGLC		R	3	6	12	24	+1	x25	0		-2RB

AMMO

FULL	LEFT
40	
40	
40	

WEAPONS

WEAPON 01 •
WEAPON 02 •
WEAPON 03 •
WEAPON 04 •
WEAPON 05 •
WEAPON 06 •
WEAPON 07 •
WEAPON 08 •
WEAPON 09 •
WEAPON 10 •

PERKS

NAME	RATING	GAME EFFECT	AUX
Autopilot	-	Acts as level 1 pilot	AUX
Backup Life Support	-	Absorbs first LS hit	
Cargo Bay	-	8000 m³ [20m x 20m x 20m]	
Hostile Environment Protections	-	Desert, Radiation 3, Vacuum	
Life Support	-	Limited	AUX
Re-entry System	-	Permanent	AUX
Stratospheric Flight	-	+1 Flight MP in Stratosphere	
Vehicle Bay	15	100 tons	

PERKS

PERK 01 •
PERK 02 •
PERK 03 •
PERK 04 •
PERK 05 •
PERK 06 •
PERK 07 •
PERK 08 •
PERK 09 •
PERK 10 •
PERK 11 •
PERK 12 •
PERK 13 •
PERK 14 •
PERK 15 •
PERK 16 •
PERK 17 •
PERK 18 •
PERK 19 •

FLAWS

NAME	RATING	GAME EFFECT
Cannot Glide	-	-
Large Sensor Profile	1	-

HEAVY GEAR

INDEX

SPACE COMBAT RULES

HEAVY GEAR™

SPACE WARFARE

Captain Lothair Aleron pushed against the bridge airlock, the reaction sending him toward his duty station. A practiced flip landed him in the seat where he immediately secured his flight harness. "What have we got, mister Aubert?"

"Not sure yet, captain. I've got a contact ten-thousand klicks off the starboard bow, ten degrees down. No positive ID yet - it's running fairly clean in the IR and radio bands."

The sensor operator kept his eyes fixed on the holographic sphere suspended just above his duty station. The volume within represented the space around the ship, which occupied the exact center. A small yellow dot tipped a thin neon line at the outer edge, representing the bogie and its presumed current vector.

The captain frowned. No friendly ship was supposed to be in this region, nor were any registered celestial objects... "All hands, go to Condition Yellow."

"Captain! I've got a radar/ladar sweep from the bogey, straight at us!"

"Launch flash, launch flash! Captain, we've got incoming!"

"Condition Red! All hands, secure for emergency burn!"

Space is the final frontier, the river of night that separates the tiny islands of rock and oxygen inhabited by Mankind. Like their ancestors before them, the people of Terra Nova ply the space lanes around their planet. The Tactical Space Support contains additional rules, equipment and background material for Dream Pod 9's exciting Heavy Gear mechanized science fiction game.

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- Details on the Tannhauser Gates
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