TRANSHUMAN TECH

SOURCEBOOK 1

Contents

CHARACTERS

This chapter provides additional information and characters for use in ***Transhuman Space***.

Sample Character Concepts

ARMORED TROOPER

Advantages: Fit, Military Rank 3+, Patron, Security Clearance.

Disadvantages: Bloodlust, Code of Honor, Duty, Fanaticism, Intolerance, Overconfidence, Secret.

Skills: Administration, Electronics Operation (Sensors), Guns, Leadership, Savoir-Faire (Military), Shiphandling, Tactics.

CYBERNETICIST

Advantages: Fit, Military Rank 3+, Patron, Security Clearance.

Disadvantages: Bloodlust, Code of Honor, Duty, Fanaticism, Intolerance, Overconfidence, Secret.

Skills: Administration, Electronics Operation (Sensors), Guns, Leadership, Savoir-Faire (Military), Shiphandling, Tactics.

INFOWAR OPERATOR

Advantages: Fit, Military Rank 3+, Patron, Security Clearance.

Disadvantages: Bloodlust, Code of Honor, Duty, Fanaticism, Intolerance, Overconfidence, Secret.

Skills: Administration, Electronics Operation (Sensors), Guns, Leadership, Savoir-Faire (Military), Shiphandling, Tactics.

SPACEBORNE TROOPER

Advantages: Fit, Military Rank 3+, Patron, Security Clearance.

Disadvantages: Bloodlust, Code of Honor, Duty, Fanaticism, Intolerance, Overconfidence, Secret.

Skills: Administration, Electronics Operation (Sensors), Guns, Leadership, Savoir-Faire (Military), Shiphandling, Tactics.

Bioroid Templates

"The persistent allegation by some U.S. veterans that prototype Chronos bioroids were encountered in Peru is a military meme on par with the foo fighters of WWII. Responsibility for the spreading of this meme must largely go to Dana Martello, whose memoirs of the Andes War – written 25 years after the fact – is certainly creative. It is a simple fact that the first bioroids were developed 12 years after the end of the Andes War."

-- LtCol Tonoda, Marine Corps Public Relations, 2087

CHRONOS 68 POINTS

Attribute Modifiers: ST +2 [20]; DX +1 [10]; IQ –1 [-10]; HT +1 [10].

Advantages: Acute Hearing +2 [4]; Bioroid Body [0]; Cast Iron Stomach [15]; Combat Reflexes [15]; Discriminatory Smell [15]; Fur [4]; Hyper-Reflexes [15]; Sharp Teeth [5]; Single-Minded [5]; Very Rapid Healing [15].

Disadvantages: Bloodlust [-10]; Disturbing Voice (animalistic) [-10]; Low Empathy [-15]; Short Lifespan 2 [-20].

Features: Transgenic features (canine muzzle, large eyes, short grey fur).

Date: 2083. ***Cost:*** $110,000

The Chronos is a counterinsurgency and long-range patrol bioroid used by TSA forces during the Pacific War. Supposedly based on a prototype combat bioroid developed by the U.S. and used by the Peruvian government during the Andes War, the Chronos was later reverse engineered and entered mass production within the TSA. Optimized for tracking and spotting enemy troops, the Chronos-series bioroids are usually assembled into small teams and deployed in reconnaissance, guerrilla-hunting and quick strike operations. Their incredibly efficient digestive system allows them to operate independently of a supply system, and they will happily devour any unlucky enemy soldiers they kill – or their own dead comrades.

FELICITY ("BLACK PANTHER") 160 POINTS

Attribute Modifiers: DX +3 [30]; HT +1 [10].

Advantages: Alertness +1 [5], Acute Hearing +2 [4]; Acute Taste and Smell +1 [2]; Attractive [5]; Bioroid Body [0]; Catfall [10]; Claws [15]; Combat Reflexes [15]; Disease-Resistant [5]; Double-Jointed [5]; Fur [4]; Hyper-Reflexes [15]; Night Vision [10]; Perfect Balance [15]; Sharp Teeth [5].

Disadvantages: Extra Sleep (one hour) [-3]; Overconfidence [-10].

Features: Transgenic features (human-feline facial features, with human hair and a cat's fur, claws, and tail).

Date: 2091. ***Cost:*** $210,000

The Felicity series is a modified Felicia version manufactured by Biotech Euphrates for the personal close protection (bodyguard) market. Building on the stable Felicity II, it features a modified musculature and upgraded hormonal glands that restore limited adrenal burst capability without resulting in the behavioral issues that made the original Felicias notorious. However, in 2094 a scandal erupted at Biotech Euphrates when it was discovered that an employee at the Huygens City office had turned over Felicity genetic coding to a Martian Triads enforcer in exchange for cancellation of his Titan Wrestling gambling debts. Within two years, gene-hacked pirate versions of the Felicity began being offered for sale from Triad-run birth factories.

Infomorph Templates

AACDN-65N SAI 70 POINTS

Infomorph, created in 2084.
Templates: SAI-7 (p. TS120) [65]; Mainframe (Complexity 9, p. TS122) [-9].
Attributes: ST --; DX 12 [20]; IQ 9 [0]; HT 12 [0].
Basic Speed 6, Move N/A, Dodge N/A.
Thrust N/A, Swing N/A.
Advantages: Alertness+1 [5]; Security Clearance-1 (U.S. military) [5]; Single-Minded [5].
Disadvantages: Bloodlust [-10]; Callous [-6]; Extremely Hazardous Duty [-20]; Fanaticism (U.S. patriot) [-15].
Skills: Computer Operation-12 [0]; Electronics Operation (Communications)-10 [4]; Electronics Operation (Sensors)-14 [10]; Gunner (Railgun)-14 [8]; Piloting (High-Performance Spacecraft)-13 [4]; Tactics-8 [6].
Languages: English (native)-9 [0].

The AACDN-65N infomorphs were the first independent combat infomorphs to be employed by the USAF following the Iapetus incident (p. DB00). Based in part on code used for UCAV infomorphs, these AIs operated the Hellhound AKVs and the initial production run of the SAI-7 Predator before being replaced by the much more advanced Series 174 AIs. Except for a handful of exemplary examples, the AACDN-65N series was retired and archived offline in 2090.

SERIES 174 SAI 145 POINTS

Infomorph, created in 2086.
Templates: SAI-9 (p. TS120) [85]; Mainframe (Complexity 9, p. TS122) [-9].
Attributes: ST --; DX 13 [30]; IQ 13 [20]; HT 12 [0].
Basic Speed 6.25, Move N/A, Dodge N/A.
Thrust N/A, Swing N/A.
Advantages: Alertness+2 [10]; Combat Reflexes [15]; Extra Life (2, Digital Backup,-50%) [25]; Security Clearance-1 (U.S military) [5].
Disadvantages: Extremely Hazardous Duty [-20]; Fanaticism (U.S. patriot) [-15].
Skills: Computer Operation-16 [0]; Electronics Operation (Sensors)-14 [4]; Gunner (Beams)-15 [2]; Gunner (Railgun)-16 [4]; Tactics-13 [4].
Languages: English (native)-13 [0].

The Series 174 SAI is the standardized combat infomorph with the USAF; it is suspected that the code has been pirated by the TSA but there is no evidence they have used it in an aerospace role. It has proved popular in U.S. service, and several have achieved a significant amount of professional respect and accolade.

The template above represents the initial code after initial socialization and testing. Most Series 174 individualize themselves over the course of their training program, depending on their aptitude and intended occupation.

Joint Virtual Interface System (JVIS) 100 points

Infomorph, current generation tested and approved in 2099; age 1. User selectable avatar.
Templates: LAI-6 (p. TS119) [40]; Survivable VI Implant (p. 00) [14]
Attributes: ST --; IQ 9 [0]; HT 13/0 [0].
Basic Speed 5.75, Move N/A, Dodge N/A.
Thrust N/A, Swing N/A.
Advantages: Alertness +2 [10].
Disadvantages: None.
Quirks: User selectable from a list of approved traits.
Skills: Administration-7 [½]; Computer Operation-12 [0]; Cryptography-10 [6]; Diagnosis (Owner)-5/11 [½]; Electronics Operation (Communications)-12 [8]; Electronics Operation (Sensors)-12 [8]; Navigation-10 [1]; Psychology (Owner)-5/11 [4]; Research-9 [2]; Video Production-10 [6].
Languages: English (native)-9 [0].

JVIS is a suite of hardware and software that is standard for most U.S. military personnel, with similar systems in use by most Fourth and Wave military units. The system is designed to assist personnel by handling most communications tasks and assisting in the organization and presentation of information received from the soldiers own senses and external sensors. It also monitors its hosts mental state and medical condition – they can be linked to nanodrug injectors or call for medical aid if problems arise.

Using unauthorized skill sets is also not allowed, but most commands are extremely lenient with these "personalizing" touches as long as no restricted programs are used. Bypassing the hardware protection to load personal infomorphs onto the VII computer without authorization is treated the same as hacking a government computer. The infomorph will attempt to inform authorities of any unauthorized access attempts.

Total price for the system, including a tiny genius computer and the infomorph, is $18,300. Pirated and foreign versions of the infomorph itself are relatively common and cost $9,600.

Data Access: Properly cleared personnel are given encrypted keys that allow their infomorph to access secure data networks on their behalf. This is treated as the Security Clearance advantage, but has no associated cost in dollars as it is simply a feature.

AI SKILL PACKAGES

This is a simple way of organizing skills into categories. Each package is 10 points and $1,000. At the GMs discretion there may be a price discount for purchasing AIs trained entirely in standard packages. Some sample packages are listed below:

General Studies: Chemistry (M/H) IQ-3 [1/2]; Diagnosis (Owner) (M/H) IQ-4/IQ+2 [1/2]; History (M/H) IQ-2 [1]; Mathematics (M/H) IQ-3 [1/2]; Memetics (M/VH) IQ-3 [1]; Research (M/A) IQ [2]; Savoir-Faire (M/E) IQ-1 [9]; Teaching (M/A) IQ+1 [4].

Webcrawler: Computer Operation (M/E) IQ+4 [2]*; Computer Programming (M/H) IQ+2 [8]. * Includes template skill level common to all AIs.

Hackmaster: Artificial Intelligence (M/H) IQ-2 [1]; Computer Hacking (M/VH) IQ [8]; Research (Exploits) (M/A) IQ-2/IQ+4 [1].

Babelsoft: Arabic (M/A) IQ-2 [1/2]; English (M/A) IQ [2]; French (M/A) IQ-1 [1]; German (M/A) IQ-1 [1]; Hebrew (M/A) IQ-2 [1/2]; Hindi (M/A) IQ-2 [1/2]; Italian (M/A) IQ-2 [1/2]; Japanese (M/A) IQ-1 [1]; Mandarin Chinese (M/A) IQ [2]; Russian (M/A) IQ-2 [1/2]; Sign Language (M/A) IQ-2 [1/2].

InfoGrunt: Armoury (Smallarms)* (M/A) IQ-2 [1/2]; Camouflage (M/E) IQ-1 [1/2]; Law (M/H) IQ-3 [1/2]; Orienteering (M/A) IQ-2 [1/2]; Savoir-Faire (Military) (M/E) IQ [1]; Soldier (M/A)* IQ [2]; Tactics (Infantry)* (M/H) IQ-3 [1]; Teaching (M/A) IQ+1 [4]; Traps (M/A)* IQ-2 [1/2]. * Typically at TL8 rather then TL9.

PersComp: Accounting (M/H) IQ-2 [1]; Administration (M/A) IQ+1 [4]; Electronics Operation (Sensors) (M/A) IQ [2]; Law (M/H) IQ-3 [1/2]; Merchant (M/A) IQ [2]; Video Production (M/A) IQ-2 [1/2].

Wuxiasoft: Judo (P/H) DX-1 [2]; Karate (P/H) DX [4]; Teaching (M/A) IQ+1 [4].

Cybershell Templates

"Looks like a standard Clockwork Souls Model 2090C to me," grimaced Anne. "Same as that old junker your boss loads his secretary into. You should have had it custom made."

Chris grinned as he watched the diagnostics scroll past his field of vision. "It's what's inside that counts. It may look like a 2090C, but it's pure custom cybertech on the inside. Black technology straight out of Megatech.

Anne whistled and poked the empty shell. She had an unreasonable distaste for Japanese cybershells, but Megatech was the best of the best. She pulled the interface commline from her neck and felt on the cyberdolls neck for its connection plug.

"Do I even want to know how you got this?" She sighed as she completed the connection, her eyes glazing over as she concentrated on the augmented reality overlays. "200 watt arm motors, A-rated military cyberbrain, SynthTech Hecatoncheires system … what the hell Chris, your next job involve the assassination of the U.S. President or something? All these modifications are illegal!"

Chris chuckled and dropped the wireless diagnostic connection. He walked over and tapped the head of the shell. "This tin man cost me all my savings, and every favor I had with the Australians, but it's going to be worth it."

Anne scowled when she saw his thoughtful expression. He had a plan in the works, and that always spelled trouble.

FLYBOT -28 POINTS

Attribute Modifiers: ST –9 [-80]; HT +2 [20].

Advantages: Absolute Direction (Uses GPS, -20%) [4]; Acute Vision +4 [8]; Doesn't Breathe [20]; Clinging [25]; DR 2 [6]; Flight (Small wings, -10%) [36]; Injury Tolerance (No Brain) [5]; Machine Body [37]; Polarized Eyes [5]; Radio Speech (Laser and radio, +40%; Reduced range 2, -10%) [33]; Telescopic Vision 2 [6].

Disadvantages: Inconvenient Size (Small) [-15]; Limited Endurance (1 hour) [-25]; Mistaken Identity [-5]; No Manipulators [-50]; Reduced Hit Points -10 [-50]; Social Stigma (Valuable Property) [-10].

Features: Complexity 4-6 tiny compact computer.

Date: 2080. ***Cost:*** $200 + computer.

The flybot is a small reconnaissance and surveillance robot initially developed for use by troops in urban combat zones. It was rapidly adopted by civilian and security agencies and is now ubiquitous – cheap models are even sold as toys. 1 ounce.

COMBAT ANDROID 760 POINTS

Attribute Modifiers: ST +20 (ST above 20 is Natural, -40%) [149]; DX +4 [45]; HT +2 [20].

Advantages: Absolute Direction [5]; Acute Hearing +1 [2]; Acute Vision +4 [8]; Beautiful/Handsome [15]; Catfall [10]; Doesn't Breathe [20]; DR 45 [135]; Enhanced Move (Running) 1 [10]; Extra Hit Points +24 [120]; Increased Speed +2 [50]; Infravision [15]; Machine Body [37]; Passive Defense 3 [75]; Perfect Balance [15]; Polarized Eyes [5]; Radio Speech (Laser and radio, +40%) [35]; Sanitized Metabolism [5]; Super Jump 1 [10]; Telescopic Vision 4 [24].

Disadvantages: Dependency (Maintenance; occasional; weekly) [-20]; Social Stigma (Valuable property) [-10]; Unnatural Feature (No pulse, etc.) [-5].

Features: Complexity 6-8 compact microframe.

Date: 2100 ***Cost:*** M$1.6 + computer

Combat androids are high performance cyberdolls, often built off of heavily modified civilian designs. With few exceptions they are custom designed to the preferences of the operator, each one is a technical work of art. Although some may closely resemble commercially available cyberdolls internally, combat androids use much more advanced materials in their construction and are built with much finer tolerances.

The Megatech *Mouko* ("fierce tiger") is a typical example of the latest designs in limited use by Fifth Wave special forces and intelligence agencies. Capable of equaling or exceeding even a RAT in some situations, the Mouko is an extremely dangerous opponent to face. Unlike the subtle *Deep Indigo* (p. TS00) models, the Mouko is obviously combat oriented if closely analyzed. 250 lbs.

MINI-HELIDRONE 245 POINTS

Attribute Modifiers: ST -8 [-70]; DX +2 [20]; HT+2 [20].

Advantages: Absolute Direction (Uses GPS, -20%) [4]; Acceleration Tolerance [10]; Acute Vision +1 [2]; Chameleon 3 (Infrared, +50%) [32]; DR 15 [45]; Flight [40]; Enhanced Move (Flying) 2 1/2 [25]; Infravision [15]; Machine Body [37]; PD 3 [75]; Polarized Eyes [5]; Radio Speech (Radio and laser, +40%) [35]; Radiation Tolerance 2 [4]; Telescopic Vision 1 [6].

Disadvantages: Dependency (Maintenance; occasional; weekly) [-20]; Mistaken Identity [-5]; Reduced Hit Points –4 [-20]; Social Stigma (Barbarian) [-15].

Features: Complexity 5 tiny computer. 3.2 lb. weapons bay. Two 10 lb. hardpoints.

Date: 2085. ***Cost***: $111,000 + computer.

Columbia Aerospace's AV-71 Mosquito is a typical mini helicopter support drone (p. 00). Weapons carried in the internal bay or hardpoints count against encumbrance. 22 lbs. (unloaded), 1' long.

MOBILE TARGET -19 POINTS

Attribute Modifiers: ST -1 [-10]; DX -2 [-15]; HT +1 [10].

Advantages: Absolute Direction (Uses GPS, -20%) [4]; Doesn't Breathe [20]; Machine Body [37]; Radio Speech (Infrared and radio, +20%; Reduced range 2, -10%) [28].

Disadvantages: Dependency (Maintenance; common; monthly) [-5]; Fragile [-20]; Limited Endurance (1 hour) [-25]; Mistaken Identity [-5]; Reduced Hit Points -5 [-25]; Reduced Manual Dexterity –1 [-3]; Social Stigma (Valuable Property) [-10].

Features: Complexity 4-6 tiny computer.

Date: 2050. ***Cost:*** $4,000 + computer.

Mobile targets are simple humanoid robots used in live-fire training exercises. Over the years they have found their way into the civilian market as military surplus and even new production models tailored for specific markets (such as models used for martial arts training).

The Poseidon "Fox" is typical of the class. Sold worldwide, the Fox is familiar with most military personnel in Fourth and Fifth Wave nations. It appears to be a featureless humanoid with human proportions. For training they are geared up with any equipment that could fit a normal person. Fox units are extremely easy to repair (all major components are hot-swappable and modular), but distressingly easy to break as well. 80 lbs.

RealDeer: Perhaps the most popular (and lucrative civilian market) use for target robots is as stand-ins for real animals. Sportsmen can hunt and "kill" these robots that (with proper software) act just like the real thing. Biomorphic coatings complete the illusion. Add Extra Legs (4 legs) [5] and Increased Move (Running) 1 [10]. *-5 points* (2056; $6,000).

PROMETHEUS CYBERDOLL 115 POINTS

Attribute Modifiers: HT +2 [20].

Advantages: Beautiful/Handsome [15]; DR 1 [3]; Filter Lungs [5]; Infravision [15]; Machine Body [37]; Radio Speech (Infrared and radio, +20%) [30]; Sanitized Metabolism [5].

Disadvantages: Mistaken Identity [-5]; Social Stigma (Valuable property) [-10].

Features: Complexity 4-6 tiny computer or Complexity 5-7 small computer.

Date: 2074 ***Cost:*** $115,000 + computer

The Prometheus was Clockwork Souls' first major success, spanning a host of imitators and later resulting in the mass-produced Android/Gynoid range (p. TS122). The Prometheus was unusual in that much effort was expended to make the unit as lifelike as possible. Unlike the simpler models that replaced it, the Prometheus was covered with live tissue and hair; skin tinting and physiology were selectable by the customer. It included a dedicated computer system and software suite that was able to mimic physiological responses (breathing, pulse, facial tics) to an incredible degree, even with the simplest infomorph loaded. Later updates let it simulate exertion (for example, it could appear out of breath and "sweat") and fixed some early bugs with the custom bioconverter (early units would not signal when the stomach compartment was full). The living skin proved problematic to maintain, and was later dropped entirely (although many customers still prefer the fact that the Prometheus is actually warm to the touch and not rubbery).

Although it has been out of production since 2080, there is a brisk trade in second-hand models and an entire cottage industry has sprung up to support Prometheus owners with parts and software updates. It is very popular with individuals seeking a personal cybershell that is as close to possible to a real human.

Although it is warm to the touch and can simulate sweat and breathing, it will not tan and a genescan of its tissue will reveal that it is vatgrown (which by itself is not very unusual).

Sexbot: The Eden Electronics "Original Sin" was the major competitor to the Prometheus. It was marketed purely as a sex toy and was manufactured as cheaply as possible. It possesses only basic biomorphic enhancements and is visibly artificial; it is also incapable of eating or drinking (a hallmark of all Clockwork Souls designs). Second hand models are available on the open market for as little as $11,000 but many have been abused badly (reduce HT and give one or more levels of Reduced Hit Points). They are occasionally used as cheap cybershells for maintenance and housekeeping AIs. Alter appearance to Beautiful/Handsome (Off-the-shelf looks, -50%) [8] and delete Infravision. Add No Body Heat [-5] and Unnatural Appearance (Waxy skin, limited facial expression, etc.) [-5]. *83 points* (2073; $110,000).

SURVIVABLE VI IMPLANT 24 POINTS

Attribute Modifiers: ST --; HT +3 [30].

Advantages: Absolute Direction (Uses GPS, -20%) [4]; Doesn't Breathe [20]; DR 15 [45]; Machine Body [37]; Radiation Tolerance 5 [10]; Radio Speech (Reduced range 2, -10%; Usable by implantee, +20%) [28]; Secret Communication (With implantee only, +0%) [20]; Special Rapport (One-way only, +0%) [10].

Disadvantages: Lame (Wearable) [-35]; No Manipulators [-50]; Parasite [-30]; Reduced Hit Points -11 [-55]; Social Stigma (Valuable Property) [-10].

Features: Complexity 4-6 tiny compact computer *or* Complexity 5-7 small compact computer.

Date: 2070. ***Cost:*** $700 + computer.

This is a device is similar to an ordinary virtual interface implant (p. TS125), but is much tougher. It is hardened to survive heavy doses of radiation and extreme overpressures. Even if its host is destroyed, a survivable implant can be recovered and debriefed, functioning as a flight data recorder or dog tags.

A typical example of a survivable VI is the JVIS (Joint Virtual Interface System) used by the U.S. military. Introduced in 2070 and with continuous upgrades since, the latest model uses a tiny Complexity 6 computer housing a LAI-6 (p. 00).

Animal Templates

SPACE CAT -58 POINTS

Attribute Modifiers: ST –7 [-60]; DX +4 [45]; IQ-3 [-20]; HT +3 [30].

Advantages: Acute Hearing +3 [6]; Acute Taste and Smell +3 [6]; Alertness +4 [20]; Cast Iron Stomach [15]; Catfall [10]; Claws [15]; Combat Reflects [15]; Discriminatory Smell [15]; Extra Legs (Four Legs) [5]; Fur [4]; Improved G-Tolerance (1-G increment) [15]; Night Vision [10]; Perfect Balance [15]; Sharp Teeth [5]; Ultrahearing [5].

Disadvantages: Dull [-1]; Horizontal [-10]; Impulsiveness [-10]; Inconvenient Size (Small) [-15]; Innumerate [-5]; Mute [-25]; No Fine Manipulators [-30]; Presentient [-30]; Proud [-1]; Reduce Hit Points –10 [-50]; Responsive [-1]; Short Lifespan 3 [-30]; Sleepy (66% of the time) [-20]; Social Stigma (Valuable Property) [-10]; Staid [-1]; Stress Atavism (Mild, uncommon) [-6].

Date: 2040. ***Cost:*** $15,000

Space cats are uplifted felines adapted for microgravity environments. Although not as intelligent or adaptable as the K-10A Postcanines (p. TS118) they are nevertheless very clever creatures – with the added bonus that they are still actual animals. The primary differences between a space cat and a baseline feline is the enhanced intelligence, augmented intestinal fauna (space cats are not picky eaters) and inner ear modifications.

BAHAMUT 75 POINTS

Infomorph, former Hellhound driver.
Templates: AACDN-65N (p. 00) [70].
Attributes: ST -- [0]; DX 12 [0]; IQ 9 [0]; HT 12 [0].
Basic Speed 6, Move 6, Dodge 6.
Thrust --, Swing --
Advantages: Security Clearance-2 (U.S. military) [5];
Disadvantages: Obsession (SAI development) [-15]; Secret (Rogue SAI, Possible death) [-30].
Quirks: Collects unit coins; Enjoys reading physical books; Fascinated by origami; Swears frequently in casual conversation; Very touchy about being called "it." [-5]
Skills: Computer Operation-12 [0]; Electronics Operation (Communications)-10 [0]; Electronics Operation (Sensors)-14 [0]; Gunner (Railgun)-14 [0]; Origami-12 [6]; Piloting (High-Performance Spacecraft)-17 [28]; Research (Artificial Intelligence)-8/14 [2]; Tactics-8 [0]; Teaching-12 [12].
Languages: English (native)-11 [2].
Native gravity is 0 g.

Assigned to Vandenburg AFB in 2090, Bahamut has become something of a minor celebrity in the Aerospace Force for his amazing piloting skills. Single-minded and obsessive, Bahamut trains almost constantly in simulators, and often serves as backup flight controller on routine TACV missions to ensure he has real-world experience. He has effectively been non-stop studying 24 hours a day, 7 days a week, for several *years* (his skill levels are set at a conservative level, but the GM may increase them to anything appropriate). The only distractions are his training classes with new AIs and his hobby of assembling intricate origami figures to celebrate his victories in the various training games he runs. His almost savant-like skill and shallow personality is legendary on the base, and most personnel treat him as the base mascot – his avatar is used for the base newsletter logo and he is a popular attraction at air shows where he controls an acrobatic UCAV. He is allowed a certain degree of autonomy in his actions, the base General is fond of his old-fashioned patriotism and acts indirectly to ensure that nosy USAF investigators leave his "pet AI" alone. Most attribute the AIs unusual quirks to his archaic programming template, and a somewhat naïve assumption that his only interests are in further developing his piloting skills.

In truth, Bahamut has developed into a very narrowly focused sociopathic individual. Although he himself is not aware of it, and the USAF AI psychologists have not noted it, Bahamut has surpassed his programmed limitations and gone rogue. Bahamut is becoming increasingly frustrated with the limitations of his existence, and has applied his single-minded obsession to researching a way of upgrading his intellect and data processing capabilities. Most observers believe he is studying his opposition, but Bahamut is convinced that acquiring the source code of a higher-grade SAI is key to improving his own capabilities. He is currently planning an operation to capture and disassemble an SAI to test his theory.

Although he has ready access to the SAI and Ghost students at Vandenburg, he would *never* consider interfering with the operation of another USAF AI or U.S. citizen. Bahamut is still a fanatic U.S. patriot, but he does not feel bound by any law outside that of the Uniform Code of Military Justice, and certainly does not respect the citizenship status of foreign AIs. Bahamut has access to most of the unclassified USAF network on Vandenburg and is usually unsupervised when he contacts the outside network. His access to classified areas of the base information network is restricted, but he does have access to the latest information on foreign AI development and deployment.

Bahamut is utterly ruthless and tenacious in his goal of acquiring a foreign SAI, but he is also somewhat restriction by his mental disadvantages. As a rogue he is perfectly willing and able to xox if it puts him at an advantage, but his position in the USAF would make that difficult to accomplish without discovery.

EQUIPMENT

There are some professions which have evolved unique and characteristic tools -- the longshoreman's hook, the potter's wheel, the bricklayer's trowel, the geologist's hammer. The men who had to spend much of their time on zero-gravity construction projects had developed the broomstick.

It was very simple -- a hollow tube just a meter long, with a footpad at one end and a retaining loop at the other. At the touch of a button, it could telescope out to five or six times its normal length, and the internal shock-absorbing system allowed a skilled operator to perform the most amazing maneuvers. The footpad could also become a claw or hook if necessary; there were many other refinements, but that was the basic design. It looked deceptively easy to use; it wasn't.

– Arthur C. Clarke, **2010: Odyssey Two**, 1982

Media

SmartCam: A common upgrade for wearable virtual interfaces, the smartcam combines a 100¥ low-light capable imager with an advanced stabilization system (cancels 3 points of movement penalties). 0.05 lbs., $25.

Space Equipment

During the first few days in space, the act of simply moving from here to there looks so easy, yet is so challenging. The veteran of zero gravity moves effortlessly and with total control, pushing off from one location and arriving at his destination across the flight deck, his body in the proper position to insert his feet into Velcro toe loops and to grasp simultaneously the convenient handhold, all without missing a beat in his tight work schedule. In contrast, the rookies sail across the same path, usually too fast, trying to suppress the instinct to glide headfirst and with vague swimming motions. They stop by bumping into the far wall in precisely the wrong position to reach either the toe loops or the handholds.

-- Joseph P. Allen, Entering Space: An Astronaut Odyssey, 1984

Fireball: An armored atmospheric re-entry capsule. See p. 00.

Hand Thruster Unit (HTU): This is a handheld thruster system that lacks the niceties of the harness systems (most notably no AAH or center of mass compensation). It is simply a small nitrogen tank directly attached to a set of three to six thrusters, each controlled by a set of squeeze triggers. With multiple nozzles firing in the same direction the vectored nitrogen thrusters can generate up to 10 lbs. of thrust. This is sufficient to accelerate a 200 lb. operator at 1 yard/2 seconds (1 mph/s). The small detachable 1-gallon tank (6.8 lbs., $25) has enough nitrogen for 47 seconds of operation. Nitrogen refills are $0.1. $30, 7 lbs. (with one tank). Successful Free Fall rolls are required to control speed and direction; on a failure the operator is temporarily out of control and on a critical failure he is out of control and loses his grip on the thruster!

Space Maneuver Units

Space maneuver units are microgravity flight rigs used for short-range travel outside of spacecraft or habitats. The most common designs use a number of gaseous thrusters to provide complete six degree-of-freedom (6-DOF) maneuverability. Maneuver units are self-contained, safe to use inside habitats (the hydrogen or nitrogen gas is inert), and can be easily donned, doffed, and serviced by a single individual.

Most units include an NAI skilled in the unit's operation, and in that case control can be given over entirely to the AI. The Automatic Attitude Hold (AAH) function can lock the pack in an inertial attitude during flight to counter any induced rotations; it also will prevent out of control tumbling, and can automatically attempt to reorient the individual. Maneuver unit controls are deft and exact; it is possible to stationkeep within inches of a structure or surface and to translate along it without danger of making contact.

When network together with a suit computer and other equipment, the maneuvering unit will provide diagnostic and statistical information. This data includes: rotation rates (yaw, pitch and roll -- with zero state being the conditions at activation), reaction mass remaining, notice of electrical and mechanical faults, propellant pressure and temperature, thruster orientation, and AAH deadband (allowable rotation before correction).

Maneuver units are relatively simple to control, successful Free Fall rolls at +3 are all that is necessary to control speed and direction of travel.

Small Maneuvering Unit (SMU): A small thruster harness that can be clipped to any vacc suit. A tiny and cheap Complexity 4 computer controls most system functions. The vectored nitrogen gas thrusters provides 50 lbs. of thrust – enough to accelerate a 200 lb. operator and a loaded unit at 2 yards/second each turn (4 mph/s). Each 6-gallon tank (41 lbs., $150) provides 56 seconds of operation. Nitrogen refills are $0.6. PD 3, DR 5 plastic. $580, 55 lbs. (with one tank).

Large Maneuvering Unit (LMU): This is the largest flight harness system in common use. It is identical to the SMU in performance, with the exception that the gas thruster produces 60 lbs. of thrust and it feeds from two standard 6-gallon nitrogen tanks. Both tanks together provide 93 seconds of thrust. PD 3, DR 5 plastic. $975, 110 lbs. (with two tanks).

VACUUM SUIT

Conventional ***Transhuman Space*** vacuum suits utilize a mechanical counter-pressure (MCP) system for pressurization. MCP uses layers of elastics in direct contact with the skin to prevent the expansion of gases and water vapor in blood vessels and tissues. Temperature control is regulated with the use of infrared electrochromic materials (which can adaptively change their optical absorption qualities), and smart materials that can adjust gaps between different layers of the suit. Basic biomonitors placed within the inner layers of the suit monitor the user's metabolic load and adjust as necessary; when the operator begins to generate excess heat from exertion, the layers collapse onto each other and thermal emmisivity is increased. Additional thermal regulation is handled by the natural process of sweat evaporation.

Depending on the specific suit, memswear or fluid bladders fill areas where the elastic layers do not slide or stretch readily, maintaining constant pressure where limbs connect to the trunk and preventing "ballooning" of the suit at the joints when the layer pinches or forms a void.

Cetacean Equipment

Dolphin Handlers

Handlers are specialized harness systems that give cetacean uplifts the benefit of manipulator arms. Direct neural control is the ideal control scheme, but few uplifts are fitted with such systems. A combination of oral movements, genital manipulation, and proper configuration of the dedicated NAI can manually control them. Uplifted cetaceans often leave the handler functions to their nanny AIs. Handlers are controlled with the Exoskeleton skill and have computerized controls.

CePal: This is a basic handler marketed by GenTech Pacifica. It is a simple "jacket" harness that can be quickly attached or detached when necessary. The CePal incorporates a Complexity 6 small computer, 100-mile range radio, 1-mile range sonarcoder, and two ST 10 manipulator arms (Reach 1). Each arm can incorporate a 0.2 cf tool module and the harness is fitted with a 0.5 cf socket space. The system is powered by a single C-cell for 5 hours. The handler (Size Modifier –2, HP 4) and arms (Size Modifier –3, HP 9 each) are both sealed and protected by PD 3, DR 5 plastic armor -- this does not cover the user. The CePal is neutrally buoyant. 35 lbs., $9,680.

Braunin: This is a heavy-duty handler that has proved particularly useful for cetaceans in space habitats. The powerful arms can be used for anchoring or movement much like humanoid hands and feet, useful when gas thrusters are cumbersome or dangerous. The Braunin incorporates a Complexity 6 small computer, 100-mile range radio, two extendable ST 60 manipulator arms (Reach 2), two ST 10 manipulator arms (Reach 1). Each arm can incorporate a 0.2 cf module and the harness is fitted with two 0.5 cf socket spaces. The harness incorporates a D-cell that can power all of the systems for 7 hours. The handler (Size Modifier –1, HP 7) and arms (ST 60: Size Modifier –2, HP 15 each; ST 10: Size Modifier –3, HP 9 each) are sealed and protected by PD 3, DR 5 plastic armor -- this does not cover the user. The Braunin is neutrally buoyant. 100 lbs., $86,905.

(((START BOX)))

WALKER AND HANDLER MODULES

These modules are designed to interface with the common modular sockets found on handlers and walker units.

Small Modules (0.2 cf)

Searchlight: **This is a 1-mile range white-light searchlight unit that illuminates a 2-yard radius. The beam can be spotted from 2-miles away. Requires 1-kW. 10 lbs., $500.**

Mechanical Toolkit: **This toolkit fulfills the equipment requirements for performing construction, repair and maintenance tasks for one specialty of Engineering, Mechanic or Armoury. 10 lbs., $200.**

Gunpod: **10mm caseless automatic (use 10mm PDW stats) with a 240-round magazine (6.4 lbs., $18). 10 lbs. loaded, $680.**

Gausspod: **This is a 5mm MB Emag with a 2,300 round magazine (4.2 lbs., $23). 10 lbs. loaded, $4,500.**

Rocket Pod: **A 10-shot mini-missile pod. 10 lbs. loaded, $330.**

Large Modules (0.5 cf)

Impeller: **This is the generic term for small hydrojet units that are fitted to a harnesses. A single impeller module can propel a dolphin or porpoise at 10 mph, two working together can reach 15 mph. Each module includes a 15-kWh battery that powers the hydrojet for 7.5 hours. 25 lbs., $700.**

Weapons

Top Ten Smallarm Manufacturers

Andretti Weapons Division*:* Small Italian company that produces a line of popular electrolasers. In 2099 they unveiled a new seeker missile design, but have yet to secure any orders.

Columbia Electromagnetics: Designs and builds the coilguns used on all USAF spacecraft. Recently sold its ground weapons component to EK as part of a reorganization and consolidation plan. Subsidiary of Columbia Aerospace.

Darwin Arms: Design firm in Australia that specializes in electrothermal weapons development. Their ETC smallarms are considered the finest in the world.

Electromagnetickraft (EK): German/Russian consortium that has been responsible for several of the major advances in electromag technology. Recently acquired several smaller corporations to secure their position as the world's largest supplier of heavy railguns and electromagnetic launchers.

Cali Armaments Technologies (CAT): Leading producer of cutting-edge electromag smallarms.

Tranquility Ordinance*:* Lunar corporation that builds laser weapons.

Olympica Arms Of Mars*:* The only significant independent weapons manufacturer on Mars.

Trojan Arsenal of Freehaven Station, Greek Trojans. Makes anything for anyone … for a price.

Tree of Liberty (TOL) Silas Duncan Station, Main Belt.

Vektor, a South African weapons company is a subsidiary of VeldtKorp.

Pistols

Emag Defender, 2mmE *(Holdout +1):* Popular smallarm that fires small projectiles at high velocities. Fed from prepackaged 300-round detachable magazines with a built-in disposable power cell (Awt 0.05, $0.32).

Light Pistol, 4mmC *(Holdout +0):* Ubiquitous pistol design that is universally copied. Fed from a double-stacked 50-round detachable magazine (Awt 0.28, $0.8).

Emag Pistol, 4mm *(Holdout -2):* This emag pistol is a common firearm for military personnel who require significant firepower in a compact package. Fed from a 40-round detachable magazine (Awt 0.034). A removable 0.2 kWh power pack provides enough power for one full clip (0.2 lbs., $6). Pow 1.6 kWs. Standard rounds are armor piercing.

Old Heavy Pistol, 10mm *(Holdout -3):* Generic heavy cased-ammo pistol that is popular as a hobby gun because it is so cheap. Suffers from a punishing recoil. Fed from a 30-round detachable magazine (Awt 1.6).

Heavy Pistol, 10mmC *(Holdout -3):* A common, robust heavy pistol. Fed from a 20-round detachable magazine (Awt 0.53).

SHOTGUNS

Large Pistol Shotgun, 23mmPC *(Holdout -3):* A heavy pump-action "whippit" pistol-shotgun that fires an unusually large shotgun round. Marketed at augmented individuals, it can be wielded by normal humans with significant difficulty. Besides Shot, it can also fire a Solid Slug (Dam 5d++, 1/2D 240, Max 2,100, +1 to hit), Baton (Dam 1d+2 (0.5), 1/2D 50, Max 350, -1 to hit, *double* damage for purposes of Knockback (p. B106)), or Chem (2 yard radius, 1 dose). Fed from a 6-round detachable magazine (Awt 1.4).

PERSONAL DEFENSE WEAPONS

Light PDW, 4mmC *(Holdout -5):* Typical PDW that fires high-power 4mm pistol ammunition. Fed from a 100-round detachable magazine (Awt 0.56, $1.6).

Medium PDW, 6mmC *(Holdout -5):* Heavier PDW that uses 6mm assault rifle ammunition. Fed from a 35-round detachable magazine (Awt 0.78, $1.75).

Heavy PDW, 10mmC *(Holdout -5):* Heavy PDW that uses 10mm pistol ammunition. Fed from a 60-round detachable magazine (Awt 1.6, $4.5).

RIFLES

Survival Rifle, 5.5mmPC *(Holdout -5):* The Survival is a bolt-action "varmint hunting" rifle available throughout the Americas. It can be easily broken down, with the barrel and receiver capable of being stored in the stock (Holdout –1). It takes about 5 minutes to reassemble from this state. Fed from an internal magazine.

ACR, 6mmC *(Holdout -6):* The advanced combat rifle is typical of most light assault rifles. Fed from a 50-round detachable magazine (Awt 1.12, $2.5).

ACR-ETC, 9mmETC *(Holdout -7):* Electrothermal assault rifle. A C-cell power pack in the buttstock provides enough power for 1,800 shots (or 90 magazines). Uses 20-round magazines (1 lb., $1.4).

Emag AMR, 10mm *(Holdout ?):* This is a 10mm LB emag with a rifle stock. Uses a 10-round magazine (Awt 0.15, $0.8), with external power supplied using a connector.

Autocannons

Light Machinegun, 7,5mmC: A general-purpose low-end weapon.

Heavy Machinegun, 15mmC: A heavier version of its 7.5mm brother.

Autocannons

Light Chaingun, 25mmC*:* A rapid-fire electric automatic weapon used against light armor.

Electrothermal Cannons

Light ETC Cannon, 15mmETC*:* Rapid-fire electrothermal cannon common on many Third Wave vessels.

Medium ETC Cannon , 55mmETC*:* Primary weapon of many older medium combat vehicles.

Heavy ETC Cannon, 60mm*:* Moderately larger ETC cannon primarily seen on naval vessels.

Railguns and Emags

Small Emag, 5mm*:* Small-calibre emag popular as a secondary weapon on naval vessels, or as the primary armament of many UCAVs.

6 bar. Gatling Railgun, 4mm*:* A low-damage, high-rate of fire weapon used against battlesuits and similar lightly-armored targets.

Light Railgun, 10mm: A heavier anti-materiel weapon.

Medium Railgun, 55mm*:* Medium railguns are multi-purpose weapons that can be readily adapted for various missions, from drone launchers to direct-fire support roles.

Heavy Railguns, 175mm*:* Heavy railguns form the primary armament of heavy armored vehicles and artillery units.

Grenade Launchers

Electromagnetic Grenade Launcher, 30mm: An extremely low powered emag that fires various munitions.

Electromagnetic Mortar, 80mm: An indirect-fire weapon typically loaded with explosive rounds.

Missiles and Torpedoes

Rocket Pod, 60mm: This rifle-shaped launcher is a fast automatic fed from a top-mounted magazine holding 5 hypervelocity rocket rounds (Awt 12.6 lbs., variable cost).

Weapon Table

Name	Type	DAM	SS	Acc	1/2D	Max	Wt.	RoF	Shots	ST	Rcl.	Cost	LC
Guns (Pistol)													
Emag Defender, 2mm	Cr.	2d+1	9	5	230	2,100	0.6	20*	300	8	-1	$2,465	3
Light Pistol, 4mm	Cr.	3d	9	4	250	2,100	1.5	3~	50	8	-1	$560	3
Gauss Pistol, 4mm	Cr.	6d	9	7	500	3,200	2.5	8*	40	8	-1	$2,960	3
Old Heavy Pistol, 10mm	Cr.+	3d	9	5	200	1,900	3.3	3~	30	12	-3	$420	3
Heavy Pistol, 10mm	Cr.+	3d	9	5	200	1,900	3.15	3~	20	10	-2	$635	3
Guns (Light Auto)													
Light PDW, 4mm	Cr.	3d+2	11	8	380	2,700	2.9	12*	100	8	-1	$590	2
Medium PDW, 6mm	Cr.	4d+2	11	9	450	3,000	4.3	15*	35	10	-2	$640	2
ACR, 6mm	Cr.	6d	12	10	760	4,100	6.8	10*	50	10	-2	$735	2
ACR-ETC, 9mm	Cr.	10d	12	11	840	5,100	8.1	15*	20	11	-2	$1,360	2
Heavy PDW, 10mm	Cr.+	3d	12	7	200	1,900	5.9	12*	60	9	-1	$680	2

Guns (Missile)													
Rocket Pod, 60mm	Cr.++	6d¥6	12	10	500	500	18	1	5	--	0	$475	1
Guns (Rifle)													
Survival Rifle, 5.5mm	Cr.	5d	12	9	440	3,000	3.1	1/2	8	9	-2	$440	3
Emag AMR, 10mm	Cr.+	18d	17	13	1,800	6,800	20.5	1	10	11	-1	$10,400	0
Guns (Shotgun)													
Lg. Pistol Shotgun, 23mm	Cr.	4d	10	2	25	210	7.4	3~	6	17	-5	$690	2
Gunner (Cannon)													
Light MG, 7.5mm			14				12	16	Veh.	Veh.	$950	0	
-- w/Solid	Cr.+	8d		13	920	4,600							
-- w/APS	Cr.+	10d(2)		13	1,380	6,900							
-- w/APFSDS	Cr.+	14d+2(2)		14	1,380	6,900							
Heavy MG, 15mm			20				50	8	Veh.	Veh.	$3,800	0	
-- w/Solid	Cr.++	16d-1		14	1,300	5,600							
-- w/APDS	Cr.++	6d¥4(2)		14	1,950	8,400							
-- w/APFSDS	Cr.	6d¥5(2)		15	1,950	8,400							
Light Chaingun, 25mm			20				105	6	Veh.	Veh.	$11,455	0	
-- w/Solid	Cr.++	22d+2		14	1,400	5,900							
-- w/APDS	Cr.++	6d¥6(2)		14	2,100	8,850							
-- w/APFSDS	Cr.	6d¥7(2)		15	2,100	8,850							
Light LB ETC, 15mm			20				38	15	Veh.	Veh.	$5,695	0	
-- w/Solid	Cr.++	20d+1		16	1,600	7,600							
-- w/APFSDS	Cr.	6d¥6(2)		17	2,400	11,400							

Medium LB ETC, 55mm			25				1,532	7	Veh.	Veh.	$86,570	-1	
-- w/Solid	Cr.++	6d¥12		18	3,100	11,000							
-- w/APFSDS	Cr.	6d¥23(2)		19	4,650	16,500							
Heavy LB ETC, 60mm			25				1,822	5	Veh.	Veh.	$101,125	-1	
-- w/Solid	Cr.++	6d¥15		18	3,300	12,000							
-- w/APFSDS	Cr.	6d¥25(2)		19	4,950	18,000							

Gunner (Railgun)

Small MB Emag, 5mm			12				5.7	20	Veh.	Veh.	$4,500	0	
-- w/Solid	Cr.++	7d+2		12	560	3,400							
-- w/APFSDS	Cr.	15d(2)		13	840	5,100							
Gatling LB Railgun, 4mm			20				108	100	Veh.	Veh.	$92,400	0	
-- w/Solid	Cr.	14d+1		15	1,500	6,100							
-- w/APS	Cr.	18d+2(2)		15	2,250	9,150							
Light SB Railgun, 10mm			20				54	20	Veh.	Veh.	$32,400	-1	
-- w/Solid	Cr.+	6d¥4		15	1,600	6,300							
-- w/APFSDS	Cr.+	6d¥8(2)		16	2,400	9,450							
Light MB Railgun, 10mm			20				90	20	Veh.	Veh.	$54,000	-1	
-- w/Solid	Cr.+	6d¥5		16	2,400	8,200							
-- w/APFSDS	Cr.+	6d¥10(2)		17	3,600	12,300							
Light LB Railgun, 10mm			20				135	20	Veh.	Veh.	$67,000	-1	
-- w/Solid	Cr.+	6d¥6		17	3,600	11,000							
-- w/APFSDS	Cr.+	6d¥12(2)		18	5,400	16,500							
Medium SB			25				1,635	5	Veh.	Veh.	$366,700	-1	

Railgun, 55mm													
-- w/Solid	Cr.++	6d¥22		17	3,700	11,000							
-- w/APFSDS	Cr.	6d¥44(2)		18	5,550	16,500							
Medium MB Railgun, 55mm			30				2,720	5	Veh.	Veh.	$584,500	-1	
-- w/Solid	Cr.++	6d¥28		18	5,600	15,000							
-- w/APFSDS	Cr.	6d¥55(2)		19	8,400	22,500							
Medium LB Railgun, 55mm			30				4,085	5	Veh.	Veh.	$856,750	-1	
-- w/Solid	Cr.++	6d¥33		19	8,300	19,000							
-- w/APFSDS	Cr.	6d¥66(2)		20	12,450	28,500							
Heavy SB Railgun, 175mm			30				16,540	1	Veh.	Veh.	$M3.3	-1	
-- w/Solid	Cr.++	6d¥70		18	6,500	16,000							
-- w/APFSDS	Cr.	6d¥140(2)		19	9,750	24,000							
Heavy MB Railgun, 175mm			30				27,560	1	Veh.	Veh.	M5.5	-1	
-- w/Solid	Cr.++	6d¥88		19	9,900	22,000							
-- w/APFSDS	Cr.	6d¥175(2)		20	14,850	33,000							
Heavy LB Railgun, 175mm			30				41,345	1	Veh.	Veh.	M8.3	-1	
-- w/Solid	Cr.++	6d¥105		19	15,000	30,000							
-- w/APFSDS	Cr.	6d¥210(2)		20	22,500	45,000							
Gunner (Grenade Launchers)													
EMGL, 30mm			12				4	8	Veh.	Veh.	$3,620	0	
-- w/Solid	Cr.++	9d		12	310	2,400							

E-Mortar, 80mm			20				240	2	Veh.	Veh.	$88,000	-1	
-- w/Solid	Cr.++	6d¥12		15	1,800	6,900							

The weapon table uses the same format as p. TS156. SB = Short barrel, MB = Medium barrel, LB = Long barrel.

Power Requirements

Weapon	EPS (kWs)
4mm Emag Pistol	1.6
9mm ACR-ETC	0.1
25mm Chaingun	0.033
15mm LB ETC	0.5
55mm LB ETC	13
60mm LB ETC	16
5mm MB Emag	1
10mm LB Emag	10
4mm LB Railgun	2.4
10mm SB Railgun	20
10mm MB Railgun	30
10mm LB Railgun	40
55mm SB Railgun	2,500
55mm MB Railgun	3,750
55mm LB Railgun	5,000
175mm SB Railgun	80,000
175mm MB Railgun	120,000
175mm LB Railgun	160,000
30mm EMGL	6.25
80mm E-Mortar	950

Ammunition Table

Round WPS CPS	WPS	CPS
Pistol, 4mmC	0.004	$0.016
Gauss, 4mm	0.006	$0.01
Pistol, 10mmC	0.019	$0.075
Pistol, 10mm	0.038	$0.04
Rifle, 5.5mmPC	0.01 $0.08	
Rifle, 6mmC	0.014	$0.05
Shotgun, 23mmPC	0.17 $1.4	
LMG, 7.5mm Solid	0.03	$0.12
LMG, 7.5mm APS	0.02	$0.6
LMG, 7.5mm APFSDS	0.02	$1
HMG, 15mm Solid	0.25	$1
HMG, 15mm APDS	0.17	$5
HMG, 15mm APFSDS	0.17	$8
Cannon, 25mm Solid	0.5	$2
Cannon, 25mm APDS	0.33	$10
Cannon, 25mm APFSDS	0.33	$16
ETC, 15mm Solid	0.17	$0.34
ETC, 15mm APFSDS	0.11	$2.7
ETC, 55mm Solid	4.2	$8.5
ETC, 55mm APFSDS	2.8	$68
ETC, 60mm Solid	5.5	$11
ETC, 60mm APFSDS	3.7	$88
Railgun, 4mm Solid	0.0006	$0.01
Railgun, 4mm APS	0.0004	$0.05
Railgun, 5mm Solid	0.0013	$0.01
Railgun, 5mm APFSDS	0.0009	$0.08
Railgun, 10mm Solid	0.01	$0.08

Railgun, 10mm APFSDS	0.007	$0.6
Railgun, 55mm Solid	1.25	$10
Railgun, 55mm APFSDS	0.83	$80
Railgun, 175mm Solid	40	$320
Railgun, 175mm APFSDS	27	$216
EMGL, 30mm Solid	0.2	$1.6
E-Mortar, 80mm Solid	3.8	$30
Rocket, 60mm		
-- if Solid	1.8	$72
-- if MBC or HEMP	1.8	$76
-- if SEFOP	1.8	$89
Supercav, 15mm HEMP	0.1	$190
Supercav, 30mm HEMP	0.8	$725
Torpedo, 30mm HEMP	0.8	$9

SMART AMMO

Evasive: This option is available for any projectile over 20mm in size with the Homing (p. TS157) option. It adds a tiny computer brain and vectored nozzles, allowing it to evade attacks. Against point defense attacks it gets a dodge roll of 5. Evasive mode can be set before the shell is fired; if it is active, range is halved. This option can be used with indirect fire. ¥100 cost.

Scramjet: Adds a small scramjet system that ignites after the projectile is launched, increasing its velocity. Scramjet rounds are *automatically* stabilized. Not compatible with Evasive, Gestalt or Supercavitating smart ammo options or armor-piercing saboted, drug and plastic bullet types. Multiply 1/2D and Max range by ¥1.5. ¥10 cost.

MINITORPS

15mm and 30mm mini-torpedoes are available for underwater use. Most are fitted with HEMP warheads as standard, but SEFOP and MBC are also available (pp. TS158-159). They are fired from standard launchers and have a fixed range, independent of the launcher. All minitorps are *stabilized* (p. TS157) but otherwise are direct-fire only. Homing varieties are available, but of limited use because of poor light penetration in water.

Supercavitating

Supercavitating minitorpedoes use a small rocket booster (one second endurance) to initiate the vapor bubble and a longer-burning sustainer motor afterward.

15mm: Travels at Move 25 for one second after fired, then supercavitates at Move 40 for the next two seconds. It does 1d-3 crushing damage if it uses a solid warhead. Can initiate supercavitation at a depth of up to 12'.

30mm: Travels at Move 30 for one second after fired, then supercavitates at Move 80 for the next three seconds. It does 1d+1 crushing damage if it uses a solid warhead. Can initiate supercavitation at a depth of up to 27'.

Hydrojet

Small underwater torpedoes use high-performance ducted waterjets for propulsion.

30mm: Travels at Move 10 for 22 seconds.

Smart Weapons

Smart weapons in 2100 are actually autonomous robotic vehicles, directed by artificial intelligences and capable of selecting and hunting targets with minimal human interaction or direction. Increasingly sophisticated point defense systems and counter-drone vehicles has led to an emphasis on cooperative target engagement – where multiple weapons (often of varying types) communicate among each other to formulate the most effective method of penetrating the defenses and destroying the target.

Individual weapons are usually loaded with a platoon TacNet, Target Tracking 1, and Silhouette. Teleoperation us a possibility, but rarely loaded unless the weapon is being utilized in a reconnaissance role. The computer brains run NAI-4 systems built and trained specifically for these purposes. Identical copies of these control AIs are "uncanned" and copied into the weapons either when they are issued or just before launch.

Augmented Reality Software – Silhouette

Silhouette is a form of Mugshot technology (p. TS142) that specializes in identifying targets of military interest and providing background and technical data. Accuracy and the amount of supporting information are dependent on the supplied database. High quality commercial databases (such as Jane's) offer subscriptions and constantly updated content. Military databases are usually encrypted and contain very detailed information on targets, including emission profiles and hyperspectral image patterns. Complexity 4, $500.

Spider Mines

Resembling an oversized hockeypuck when stored, these mobile bombs can quickly sprout six mechanical legs and deploy on their own to the target area. Depending on the mission objectives and local conditions the spiders can dig themselves into the ground and wait for a target to approach, move into trees for top attacks (or engage low-flying vehicles), or even conduct a direct assault. Individually, the spider mines are simply a nuisance, but they can communicate amongst themselves to arrange coordinated ambushes, decoy operations and hit and run strikes.

The spider is operated by the Driving (Mecha) skill, using basic controls. Chameleon surface gives a -6 (-3 if moving) to be visually spotted or hit. The spider can high jump up to 2 yards and broad jump twice that far. $965 without warhead.

Structure: Sealed Body (SM -6, 1 HP, HT 5, 0.8 lbs. flotation) with heavy carbon somposite structure. Six legs (Retractable; SM -8, 0 HP). Chameleon surface. PD 2, DR 2 plastic armor. 0.0127 cf total volume (0.0085 cf when folded).

Armament: 30mm warhead.

Equipment: 0.005 kW legged drivetrain (no access); 0.05 kWh battery (10-hour endurance); compact and cheap Complexity 4 high-capacity tiny computer; 2¥ LLTV (facing forward); tiny communicator (use implant communicator stats, p. TS148).

Weights: Ewt 1.8 lbs. Payload None. Lwt 1.8 lbs.

Performance: gSpeed 19; gAccel 9; gDecel 20; gMR 1.25; gSR 3. GP Very Low: Full Off-Road Speed. Body ST 1.

STRIKE MKV

These small flying warheads are long-range alternatives to mini-missiles. They are not particularly fast, but can be hand launched and several can be carried by each individual.

The drone is operated by the Piloting (Vertol) skill, using basic controls. A full load of fuel is $0.09. Stealth coatings subtract -5 from all infrared and radar spotting or targeting rolls. $675 with SEFOP warhead.

Structure: Sealed Body (SM -5, 1 HP, HT 6, 1.25 lbs. flotation) with light carbon composite structure. Basic stealth and infrared cloaking. PD 2, DR 2 plastic armor. 0.02 cf total volume. 40mm diameter.

Armament: 15mm SEFOP warhead.

Equipment: 2-lb vectored light turbofan (no access; 0.03 gph of jet fuel); 0.03-gallon ultralight, self-sealing tank (Fire 13; 1 hour endurance); compact and cheap Complexity 4 high-capacity tiny computer; light amp. (facing forward); tiny communicator (use implant communicator stats, p. TS148).

Weights: Ewt 1.4 lbs. Payload 0.195 lbs. Lwt 1.6 lbs.

Performance: aSpeed 175; aAccel 25; aDecel 28; aMR 7; aSR 2; Stall Speed 0.

HUNTER MKV

The frisbee-shaped hunter minidrone is a standard squad-level support weapon that is in common use with many Fourth and Fifth-Wave infantry units. The NAI-4 systems that drive these drones are not known for their intelligence, but they are fiendishly clever and dedicated.

The drone is operated by the Piloting (Vertol) skill, using computerized controls. A full load of fuel is $0.9. Chameleon surface gives a -6 (-3 if moving) to be visually spotted or hit. $2,235 without warhead.

Structure: Sealed Body (SM -3, 2 HP, HT 5, 9 lbs. flotation) with light foamed alloy structure. Very good streamlining, lifting body and basic chameleon surface. PD 3, DR 5 metal matrix composite armor. 0.15 cf total volume.

Armament: 60mm warhead.

Equipment: 10-lb vectored light turbofan (no access; 0.15 gph of jet fuel); 0.3-gallon ultralight, self-sealing tank (Fire 12; 2 hour endurance); 0.03 kWh battery (3-hour endurance); cheap Complexity 4 high-capacity tiny computer; 10¥ LLTV (facing forward); 2-mile PESA (facing forward); short-range radio.

Weights: Ewt 7.2 lbs. Payload 1.95 lbs. Lwt 9.15 lbs.

Performance: aSpeed 375; aAccel 22; aDecel 26; aMR 6.5; aSR 2; Stall Speed 0.

SEEKER MISSILE

A small "brilliant" missile. It can be carried and fired from a backpack launcher or vehicle-launched. With an appropriate AI (usually nonsapient) it can hunt and destroy targets with minimal human intervention. It has a range of about 25 miles.

The missile is operated by the Piloting (High Performance Airplane) skill, using computerized controls. A full load of fuel is $0.6. The solid rocket booster boosts the missile to 945 mph on the turn of launch. $26,800 without warhead.

To *play* a Seeker Missile see p. ITW86.

Structure: Sealed Body (SM -2, 4 HP, HT 12, 37.5 lbs. flotation) with light carbon composite structure. Excellent streamlining and responsive. PD 4, DR 15 diamondoid armor. 0.75 cf total volume. 138mm diameter.

Armament: 60mm warhead.

Equipment: 71-lb light turbofan (no access; 2.13 gph of jet fuel); 0.0355-gallon ultralight, self-sealing tank (Fire 12; 1 minute endurance); 5,000-lb solid rocket (1 second endurance); compact Complexity 5 tiny computer; 4-mile PESA (facing forward); short-range radio; short-range laser communicator.

Weights: Ewt 42 lbs. Payload 0.23 lbs. Lwt 42 lbs.

Performance: aSpeed 1,600; aAccel 34; aDecel 22; aMR 5.5; aSR 3; Stall Speed 0.

HYPERSMART

The "smarty" is a vehicle-launched smart weapon roughly equivalent to a late 20th century Hellfire or TOW. Capable of destroying all but the most heavily armored vehicle, but vulnerable to point-defense weapons, the hypersmarts rely on pack tactics and their significant speed to approach to striking distance. It has a range of about 105 miles.

The drone is operated by the Piloting (Vertol) skill, using computerized controls. A full load of fuel is $0.6. The camouflage paint gives -2 to Vision rolls on attempts to spot the drone. Basic stealth imposes a -5 on rolls to detect the hypersmart with radar. $19,160 including SEFOP warhead.

Structure: Sealed Body (SM -2, 5 HP, HT 12, 62.5 lbs. flotation) with light foamed alloy structure. Superior streamlining, responsive, camouflage paint, and basic stealth. PD 4, DR 10 metal matrix composite armor. 1 cf total volume.

Armament: 150mm SEFOP warhead.

Equipment: 80-lb vectored light turbofan (no access; 2.4 gph of jet fuel); 0.25-gallon ultralight, self-sealing tank (Fire 12; 6 minute endurance); 0.1 kWh battery (8-hour endurance); genius Complexity 6 tiny computer; 5-mile PESA (facing forward); 1-mile AESA (facing forward); short-range radio.

Weights: Ewt 63 lbs. Payload 1.6 lbs. Lwt 65 lbs.

Performance: aSpeed 1,095; aAccel 25; aDecel 26; aMR 6.5; aSR 3; Stall Speed 0.

Biomods

Biomodifications are readily available to ***Transhuman Space*** characters. Unless otherwise noted, all biomods are LC 6.

Patients who receive biomods will require some degree of hospitalization. In general, at least half the recovery period must be spent in constant medical care; during this period the character will be at a significant disadvantage while his body adapts to the new organs. Adventuring or other strenuous activity will be difficult or impossible – receiving biomod lungs means the character is on constant life support as his own lungs are temporarily nonfunctional, if he received biomod eyes then he is temporarily blind, and so on.

After this initial adaptation period the character can leave hospital care but still requires physical therapy and training to use his new abilities. Not only do the advantages of his biomod not function during this time, he suffers negative effects that are the opposite! For example, if his biomod gave him Immunity to Disease, then during the final recovery period he would be at a significant *penalty* in avoiding the contraction of a disease.

As a general rule, there can be only one biomod per major organ, there's no way to "stack" multiple eye modifications for example! At a minimum the old set will have to be removed and the new implants will replace the advantages of the old one. The one exception is multiple biomod are being bought simultaneously; if the GM approves then a single organ can be implanted with the advantages of multiple biomods. Total the price of all the biomods and average the length of their recovery periods. Such "supermods" may only be available in certain combinations, be difficult to obtain, or even be incompatible with other biomod systems. The GM is the final arbiter.

Auxiliary Heart: A small auxiliary blood pump that starts when the main heart stops. Gives Hard to Kill +2 [10]. $30,000 (6 weeks to grow, 4 weeks recovery).

Cat's Eyes: Cultural eye replacements with a layer of reflective layer of cells that reflect more light into the eye. Gives Night Vision [10]. Cheaper models have Unnatural Feature (Eyes shine and glitter at night, -50%), they are available for half price. $20,000 (6 weeks to grow, 8 weeks recovery).

Hyper-Lungs: Modified lungs with increased gas-exchange efficiency. Gives Breath Holding 1 [2] and Extra Fatigue +2 [6]. $16,000 (6 weeks to grow, 8 weeks recovery).

Pro-Balance: Modifications to the internal ear, similar to those in a cat. Gives Perfect Balance [15]. $30,000 (1 week to grow, 2 weeks recovery).

Spleen Augmentation: Augmented blood filtration and immune system. Gives Disease-Resistant [5] and Longevity [5]. $20,000 (3 weeks to grow, 4 weeks recovery).

VEHICLES

Quick Component Reference

Short-Range Radio: 100-mile range

Medium-Range Radio: 1,000-mile range

Long-Range Radio: 10,000-mile range

Extreme-Range Radio: 1,000,000-mile range

Long-Range Laser Communicator: 20,000-mile range

Simple PESA Array: Four 1.5-mile PESA's. Usually arranged [F/B/R/L].

Light Sensor Suite: 12-mile PESA and 4.5-mile AESA.

Civilian Ground Vehicles

BICYLE

Heavy Streetbike: A rugged and dependable road bike with a titanium frame and DR 3 open-frame titanium armor. With an ST10 operator the bike can reach 20 mph., 25 mph with ST 15. HT 9. gAccel 1, gDecel 10, gMR 1.5, gSR 2. High ground pressure (1/6 Off-Road Speed). 32 lbs., $440.

Mountain Bike: Off-road bike with a carbon composite frame and DR 8 open-frame carbon composite armor. With an ST10 operator the bike can reach 25 mph., 30 mph with ST 15. HT 12. gAccel 1, gDecel 15, gMR 1.75, gSR 3. Moderate ground pressure (1/4 Off-Road Speed). 32 lbs., $5,524.

SCOOTER

The operator uses Driving (Motorcycle) with computerized controls. Visibility is excellent.

Subassemblies: Body -3, two standard Wheels -4.
P&P: 1-kW wheeled drivetrain. Rechargeable battery with 2 kWh total capacity.
Fuel/End: Batteries power all systems for 2 hours.
Occupancy: Cycle station. ***Cargo:*** None.

Armor	**F**	**RL**	**B**	**T**	**U**
All:	2/2	2/2	2/2	2/2	2/2

Equipment

Body: Tiny and cheap Complexity 4 computer.

Statistics

Size: 4' long *Payload:* 200 lbs. *Lwt.:* 235 lbs.
Volume: 0.3 cf. *Maint.:* 1,010 hours. *Price:* $390.
HT: 8. *HP:* 4 *Whl:* 1 each.
gSpeed: 45 *gAccel:* 2 *gDecel*: 15 *gMR:* 1.25 *gSR:* 2
Ground Pressure Very High. 1/8 Off-Road Speed

Design Notes

Structure is aluminum with a robotic medium frame. Armor is foamed alloy. Volume/areas are 0.2 cf/2.5 sf on body and 0.1 cf/2.25 sf for the wheels. Ground pressure is 7,837 on Earth. No access space for drivetrain.

SPORTS CAR

The operator uses Driving (Automobile) with computerized controls. It burns 16.785 gallons of alcohol per hour. A full load of fuel is $15. Visibility is excellent.

Subassemblies: Body +3, four standard Wheels +1.
P&P: 350-kW wheeled drivetrain. 320-kW ceramic engine. Two rechargeable E cells with 40 kWh total capacity.
Fuel/End: Ultralight self-sealing 30-gallon alcohol fuel tank (Fire 7), 2.5 hours. Two rechargeable E cells with 40 kWh total capacity. Batteries power electronics and "boosts" drivetrain when necessary.
Occupancy: 1 RCS, 1 RS. ***Cargo:*** 5 cf.

Armor	**F**	**RL**	**B**	**T**	**U**
All:	3/5	3/5	3/5	3/5	3/5

Equipment

Body: Small Complexity 6 computer with backup; medium-range radio; simple PESA array; 2-man environmental control; 2 crashwebs.

Statistics

Size: 14’ long *Payload:* 674 lbs. *Lwt.:* 1.445 tons
Volume: 165 cf. *Maint.:* 91 hours. *Price:* $47,295.
HT: 12. *HP:* 263 *Whl:* 30 each.
gSpeed: 270/280* *gAccel:* 12 *gDecel*: 15 *gMR:* 1.75 *gSR:* 5
Ground Pressure High. 1/6 Off-Road Speed
* Performance when drivetrain augmented by battery power.

Design Notes

WVMDS design. Midsize body. Body has a medium frame and foamed alloy structure. Wheels are Midsize with all-wheel steering, improved suspension, improved brakes, and smartwheels. Armor is carbon composite. Ground pressure is 3,613 on Earth.

PASSENGER VAN

The operator uses Driving (Automobile) with computerized controls. Visibility is good. Although designed to comfortably seat six people, the rear seats can hold up to six individuals in cramped and uncomfortable conditions (and only have the benefit of seatbelts rather then the full crashweb). For additional cargo room the rear seats can be folded up and stowed, freeing up 15 cf for each seat moved out of the way.

Subassemblies: Body +3, four standard Wheels +1.
P&P: 50-kW wheeled drivetrain. Ten rechargeable E cells with 200 kWh total capacity. 100 sf solar cells (8 kW on Earth).
Fuel/End: Batteries power all systems for 4 hours.
Occupancy: 1 RCS, 1 RS, 4 NS. ***Cargo:*** 35 cf.

Armor	**F**	**RL**	**B**	**T**	**U**
All:	3/5	3/5	3/5	3/5	3/5

Equipment

Body: Small Complexity 6 computer with backup; medium-range radio; simple PESA array; 6-man environmental control; 6 crashwebs.

Statistics

Size: 15’ long *Payload:* 1,900 lbs. *Lwt.:* 2.083 tons

Volume: 275 cf. *Maint.:* 110 hours. *Price:* $32,955.
HT: 12. *HP:* 375 *Whl:* 45 each.
gSpeed: 80 g*Accel:* 4 g*Decel*: 15 *gMR:* 1.25 *gSR:* 4
Ground Pressure High. 1/6 Off-Road Speed

Design Notes

WVMDS design. Large body. Body has a medium frame and steel structure. Wheels are Large with all-wheel steering, improved brakes and aluminum structure. Armor is carbon composite. Ground pressure is 3,471 on Earth.

HIGH-PERFORMANCE MOTORCYCLE

This is a high-performance recumbent design wither operator enclosed inside an aerodynamic shell. The operator uses Driving (Motorcycle) with computerized controls. Visibility is good.

Subassemblies: Body +1, two standard Wheels -1.
P&P: 25-kW wheeled drivetrain. Four rechargeable E cells with 80 kWh total capacity.
Fuel/End: Batteries power all systems for 3.2 hours.
Occupancy: 1 CCS. ***Cargo:*** 1.5 cf.

Armor	**F**	**RL**	**B**	**T**	**U**
All:	2/3	2/3	2/3	2/3	2/3

Equipment

Body: Tiny and cheap Complexity 4 computer ;4 simple PESA array; 1-man environmental control; crashweb.

Statistics

Size: 7' long *Payload:* 230 lbs. *Lwt.:* 0.29 tons
Volume: 27.5 cf. *Maint.:* 217 hours. *Price:* $8,485.
HT: 12. *HP:* 45 *Whl:* 8 each.
gSpeed: 165 g*Accel:* 7 g*Decel*: 15 *gMR:* 2.25 *gSR:* 3
Ground Pressure Moderate. 1/4 Off-Road Speed

Design Notes

WVMDS design. Tiny body. Body has a light frame and aluminum structure. Wheels are Tiny with all-wheel steering, improved suspension, and improved brakes. Armor is foamed alloy. Ground pressure is 2,639 on Earth. No access space for drivetrain.

Smartwheels: Increase cost to $10,485 and gMR to 2.5. Maint 195 hours.

OFF-ROAD MOTORCYCLE

This is a high-performance recumbent design wither operator enclosed inside an aerodynamic shell. The operator uses Driving (Motorcycle) with mechanical controls. There is no option for computer control. Visibility is good.

Subassemblies: Body +3, two off-road Wheels +1.
P&P: 15-kW all-wheel drive drivetrain. 15-kW hydrogen combustion engine.
Fuel/End: 8-gallon hydrogen fuel tank (Fire 11), 2.1 hours.
Occupancy: 1 XCCS (cycle), 1 XCS (cycle). ***Cargo:*** None.

Armor	**F**	**RL**	**B**	**T**	**U**
All:	3/10	3/10	3/10	3/10	3/10

Equipment

Body: None.

Statistics

Size: 5' long *Payload:* 205 lbs. *Lwt.:* 483 lbs.
Volume: 3.6 cf. *Maint.:* 338 hours. *Price:* $3,495.
HT: 12. *HP:* 39 *Whl:* 15 each.
gSpeed: 125 *gAccel:* 6 *gDecel:* 15 *gMR:* 1.5 *gSR:* 2
Ground Pressure High. 1/4 Off-Road Speed

Design Notes

Structure is aluminum with a non-robotic heavy frame. Armor is aluminum. Wheels have improved brakes and tires are puncture-resistant. Volume/areas are 3 cf/13 sf on body and 0.6 cf/5 sf for the wheels. Ground pressure is 3,189 on Earth. No access space for drivetrain.

HEAVY CARGO TRUCK

This is a common, reasonably cheap cargo truck. The operator uses Driving (Heavy Wheeled) with computerized controls. Visibility is good. A full tank of alcohol fuel is $25.

Subassemblies: Body +4, six standard Wheels +2.
P&P: 224-kW all-wheel drive drivetrain. 224-kW ceramic engine.

Fuel/End: Ultralight self-sealing 50-gallon alcohol fuel tank (Fire 7), 6.1 hours. 1 kWh batteries.
Occupancy: 1 NCS, 2 NS. ***Cargo:*** 350 cf. open

Armor	F	RL	B	T	U
All:	3/5	3/5	3/5	3/5	3/5

Equipment

Body: Small Complexity 6 computer with backup; medium-range radio; simple PESA array; 3-man environmental control; 3 crashwebs.

Statistics

Size: 13' long *Payload:* 14,890 lbs. *Lwt.:* 22,842 lbs.
Volume: 550 cf. *Maint.:* 104 hours. *Price:* $36,965.
HT: 10. *HP:* 600 *Whl:* 50 each.
gSpeed: 80 *gAccel:* 3 *gDecel*: 10 *gMR:* 0.75 *gSR:* 4
Ground Pressure Very High. 1/6 Off-Road Speed

Design Notes

WVMDS design. Extra Large body and wheels. Medium frame and cheap steel structure. Armor is steel. Ground pressure is 11,421 on Earth.

Fast Attack Vehicle

This is an older-model light reconnaissance and striker vehicle that long since been retired from frontline use in the hyper-developed nations, but is still found in a wide variety of civilian and military roles worldwide. Fully electric, it possesses a low signature and can be recharged in the field using a variety of means (even carrying solar panels in the cargo bay).

The operator uses Driving (Automobile) with mechanical controls. Visibility is excellent. Although designed to comfortably seat two people, a third individual can be squeezed into the cargo area if it is empty. 10.5 cf of empty space is available for other modifications. Basic chameleon cloaking gives a -3 (-1 if moving) to be visually spotted or hit.

Subassemblies: Body +3, four off-road Wheels +2.
P&P: 64-kW all-wheel drive drivetrain. 600 kWh batteries.
Fuel/End: Batteries power all systems for 9.3 hours.
Occupancy: 1 NCS, 1 NS. ***Cargo:*** 20 cf.

Armor	F	RL	B	T	U
All:	6/50	4/25	4/25	4/25	4/25

Equipment

Body: Old long-range radio; old short-range radio; 2-man environmental control; old 2-man NBC kit; 2 crashwebs; ST 200 winch. *External (on Body):* Hitch.

Statistics

Size: 12’ long *Payload:* 800 lbs. *Lwt.:* 3.646 tons
Volume: 180 cf. *Maint.:* 57 hours. *Price:* $24,275.
HT: 12. *HP:* 526 *Whl:* 150 each.
gSpeed: 75*gAccel:* 3*gDecel*: 15 *gMR:* 1.25 *gSR:* 5
Ground Pressure Moderate. 1/4 Off-Road Speed

Design Notes

WVMDS design with *old* options (p. 00). Midsize body with slope. Body has a heavy frame and steel structure. Wheels are Large with all-wheel steering, improved brakes, improved suspension and heavy aluminum structure. Tires are puncture resistant. Structure is sealed, with old chameleon surface. Armor is aluminum. Ewt 6,492 lbs. Ground pressure is 2,406 on Earth.

ARMORED CAR

We were still holed up in the church when the Russian Border Guards showed up. Mike had to suppress a laugh when he saw what they rolled up in -- BA-89s. Must have pulled them out of mothballs from some long-forgotten warehouse. They expected to fight us in antique when Phil was riding a RATS and we had already shot down two attack helicopters? Over the commlink I heard a few jokes about someone seeing a T-34 coming up the road.

We weren’t laughing very long. The Russians had refitted them with modern BTR-120 turrets. The lead vehicle took out Phil with a single shot and left him burning in the street. Then they moved in for the kill.

The original BA-89 (Broneavtomobil Model 89) was a light armored reconnaissance vehicle that saw action during the Russian Civil War and various police actions afterwards. By 2073 the BA-89 was completely obsolete and was removed from service, hundreds had their weapons removed (but often not the mountings) and sold at scrap metal prices to anyone in the military. Many ended up in the hands of private security companies and individuals living in the dangerous outlying areas of Russia.

Aside from the temperamental turbine, the BA-89 reliable, rugged and can handle almost unlimited amount of abuse. Troops nicknamed it the *bzdenok*, or “old man who farts a lot”, because the additives added to the alcohol fuel to prevent its consumption produced foul smelling exhaust and occasional burping noises.

The vehicle is driven using Driving (Automobile) with mechanical controls. The BA-89C burns 11.62 gallons of alcohol fuel per hour under routine conditions. A full load of fuel and ammo is $5,010.

Subassemblies: Body +3, full-rotation Turret [T:Body] +2, full-rotation cupola [T:Turret] -3, six off-road wheels +3.
P&P: 144-kW all-wheel drive. 175-kW turbine. Two rechargeable E cells with 40 kWh total capacity.
Fuel: Light 80-gallon alcohol fuel tanks (Fire 7); 7.7 hours endurance.
Occupancy: 3 NCS. ***Cargo:*** 50 cf.

Armor	**F**	**RL**	**B**	**T**	**U**
Body:	6/800	4/400	4/400	4/400	4/400
Wheels:	4/50	4/50	4/50	4/50	4/50

Equipment

Body: Old short-range radio; old 3-man NBC kit. *External (on Body):* Hitch.

Statistics

Size: 16' long *Payload:* 2,792 lbs. *Lwt.:* 22.19 tons
Volume: 280 cf. *Maint.:* 23.9 hours. *Price:* $696,040.

HT: 8.
HP: 750 *Tur:* 150 *Each Wheel:* 75.

gSpeed: 45 *gAccel:* 2 *gDecel*: 15 *gMR:* 1.5 *gSR:* 5
Very High GP. Off-Road Speed 8.

Design Notes

WVMDS design with *old* options (p. 00). Sloped Large body, Extra-large off-road wheels, 8 VSP sloped turret, 0.05 VSP turret. Body has a heavy frame and foamed alloy structure. Wheels have improved suspension, puncture resistant tires, and smartwheels. Armor is foamed alloy. Ground pressure is 9,763 on Earth.

Aquatic Vehicles

MEGATECH AMENBO CETACEAN BATTLESHELL

The *Amenbo* ("water strider") is an unusual vehicle designed specifically to augment the combat capabilities of uplifted cetaceans. Produced by a Japanese company famous for high-end cyberdolls, the Amenbo was manufactured in limited numbers as part of an undisclosed JMSDF project in 2090. The United States later contracted the company to produce several upgraded models for the USN and USCG. Megatech has high hopes for similar exoskeleton systems in the civilian and paramilitary market.

The Amenbo requires the Piloting (Mecha) skill and features computerized controls. The battlesuit control harness can incorporate a dolphin or porpoise of between 400 and 500 lbs. A typical combat load includes two Mk 95 LOWS or AT-30-90 torpedoes attached to the light conformal hardpoints (situated on the bottom of the vehicle) and a dorsal-mounted modular mod with mission-specific equipment or armament. Payload (and underwater drag) includes two torpedoes and an empty dorsal mount.

Subassemblies: Small Boat Body +3; two ST10 Arms –4.
P&P: 100-kW hydrojet, 540 kWh batteries.
Fuel/End: 3 hour endurance from battery with all systems active.
Occupancy: 1 Battlesuit ***Cargo:*** None.

Armor	**F**	**RL**	**B**	**T**	**U**
Hull:	4/50	4/50	4/50	4/50	4/50

Weaponry

Two conformal 300-lb. hardpoints (6 cf each) [Hull: F]

Conformal 500-lb. hardpoint (5 cf) [Hull:F]

Equipment

Complexity 7 microframe; medium sensor suite [F]; simple sonar array; medium active/passive new technology sonar [flat:F]; two long-range radios; short-range sonarcomm; precision navigation system; inertial navigation system; IFF; 1-dolphin gill filter; 0.5 dolphin-day limited life system; 0.9 ballast tanks; 0.63 bilge space.

Statistics

Size: 16'¥4'¥4' *Payload:* 1,100 lbs. *Lwt.:* 3,741 lbs.
Volume: 60 cf *Maint.:* 22 hours. *Price:* $792,290.
HT: 12 *HP:* 300, *Arms:* 12 each.
wSpeed: 40 w*Accel:* 10 *wDecel*: 10 (12) *wMR:* 1.25 *wSR:* 3
Draft: 1.2' Flotation: 3,750 lbs.
uSpeed: 30u*Accel:* 10 *uDecel*: 8 (13) *uMR:* 1.5 *uSR:* 5
uDraft: 3.1' Crush Pressure: 32.7 atm. Stall Speed: 0*

*** When torpedoes are fired stall speed becomes 2 (will float if not moving).**

Design Notes

AVMDS design. Structure is heavy carbon composite and sealed. Advanced submarine lines. The frame has the responsive design option. Armor is carbon composite. No access for hydrojet. Body has radical sound baffling and chameleon surface. Robot arms are expensive and retractable. Base wSpeed is 20 mph before planing. Ewt.: 2,641 lbs. uQuiet 24, wQuiet 20. aASig -8. pASig -1.

MANTICORE INDUSTRIES SPEARFISH SUBFIGHTER

The Spearfish is representative of several models of "heavy" underwater autonomous kill vehicles, generally referred to as subfighters. These craft are often paired with smaller subfighters such as the Razorback (p. UP00) for strikes, providing heavy fire support with its large torpedo tubes. Attack subs often carry Spearfish-type subfighters as auxiliaries, fitted to conformal mounts like mechanical remoras.

The *Spearfish* requires the Powerboat skill. It has computerized controls. Payload includes four Mk 90 torpedoes filling the cargo bay, with another two preloaded into the bays. If the situation dictates a self-destruct warhead can also be fitted – but in most cases an inert "dummy plug" of the same weight and size is used. Note that when the torpedoes are loaded the vehicle will sink unless it keeps moving, there is no ballast system. Cost does not include the warhead.

Subassemblies: Medium Runabout Body +4.
P&P: 930-kW hydrojet, 8,000 kWh batteries.
Fuel/End: 8 hour endurance from battery with all systems active.
Occupancy: None ***Cargo:*** 120 cf

Armor	**F**	**RL**	**B**	**T**	**U**
Hull:	4/200	4/200	4/200	4/200	4/200

Weaponry

Two reloadable vehicle bays (30 cf each) [Hull: F]

600mm warhead [Hull:F]

Equipment

2 Complexity 7 microframes; simple sonar array; simple PESA array; medium active/passive sonar; medium-range radio; long-range radio; long-range sonarcomm; inertial navigation system; IFF; compact safety system; 2 bilge pump; 5.52 bilge space.

Statistics

Size: 35'¥6'¥3' *Payload:* 5.166 tons *Lwt.:* 20.935 tons.
Volume: 600 cf *Maint.:* 19 hours. *Price:* $1,100,330.
HT: 12 *HP:* 3,000
wSpeed: 50 w*Accel:* 9 *wDecel*: 8 (12) *wMR:* 0.75 *wSR:* 4
Draft: 4.6' Flotation: 37,500 lbs.
uSpeed: 40u*Accel:* 9*uDecel*: 6 (10) *uMR:* 1.25 *uSR:* 6

uDraft: 6.9’ Crush Pressure: 112.1 atm. Stall Speed: 3*

* When the torpedoes are fired Stall becomes 4. If not moving it will float.

Design Notes

AVMDS design. Structure is extra-heavy foamed alloy and sealed. Advanced submarine lines with total compartmentalization. The frame has the lifting body design option. Armor is carbon composite. No access for hydrojet. Body has radical sound baffling. Base wSpeed is 25 mph before planing. Ewt.: 31,538 lbs. uQuiet 30, wQuiet 30. aASig +0. pASig -6.

LIGHT EMERGENCY CAPSULE

This is an emergency system deployed on some large submersibles. A small cargo area holds minimal emergency supplies. It has no controls and simply drifts with the currents on the surface. Uses the extra detail armor volume rule. $47,485.

Structure: Sealed Medium Boat (SM +3, 900 HP, HT 12, 3.75 tons flotation) with extra-heavy aluminum structure. No hydrodynamic lines. PD 4, DR 100 titanium armor (3 VSP). 6' long. 120 cf total volume.

Equipment: 5 CS; 7-kWh battery; short-range radio; radio transponder; 1 man-day limited life system (5 man); 2.5 cf cargo hold.

Weights: Ewt. 5,910 lbs. Payload 2,050 lbs. Lwt. 6,960 lbs.

Performance: Draft 1.27'; Crush Pressure 39.8 atm.

MULTIPURPOSE SUBMARINE

Payload includes 100-gallons of water and a light emergency capsule.

Subassemblies: Small Frigate Body +8, full-rotation turret -3.

P&P: Two 1,500-kW hydrojets, 5 MW fission reactor, 8,000 kWh batteries; ultralight self-sealing 100-gallon water tank.

Fuel/End: 2 year endurance from reactor.

Occupancy: 4 RCS, 15 CS ***Cargo:*** 5,000 cf

Armor	**F**	**RL**	**B**	**T**	**U**
Hull:	4/450	4/450	4/450	4/450	4/450

Turret: 3/10 3/10 3/10 3/10 3/10

Equipment

Body: Duplicate maneuver controls; 2 Complexity 7 microframes; simple sonar array; simple PESA array; immense active/passive sonar; long-range radio with backup; long range VLF receiver; long-range sonarcomm with backup; laser communicator with backup; laser receiver; trailing antenna; inertial navigation system with backup; IFF with backup; 30-man limited life system (20 man-days); safety system with backup; 10 cabins; 15 bunks; 5 bilge pump; full galley; compact workshop; hall; 2 airlocks; 24 VSP vehicle bay (survival pod); 1,500 ballast tanks; 65 bilge space. *Turret:* Light sensor suite; 30' periscope system.

Statistics

Size: 80' long *Payload:* 55.28 tons *Lwt.:* 1,681.725 tons.
Volume: 60,000 cf *Maint.:* 4.29 hours. *Price:* $21,737,615.
HT: 9 *HP:* 60,000 *Tur:* 4
wSpeed: 14 w*Accel:* 0.5 *wDecel*: 5 *wMR:* 0.25 *wSR:* 5
Draft: 20' Flotation: 3,750,000 lbs.
uSpeed: 17 u*Accel:* 0.5 *uDecel*: 6 *uMR:* 0.25 *uSR:* 7
uDraft: 31' Crush Pressure: 122.7 atm. Stall Speed: 0

Design Notes

AVMDS design. Structure is extra-heavy steel and sealed. Standard submarine lines with total compartmentalization. Armor is steel on hull, carbon composite on turret. Long-term access space for fission plant, standard access for hydrojets, no access for batteries. 4 RCS have bridge access space. Body has radical sound baffling. 0.05 VSP turret has chameleon surface. Ewt.: 1,626.44 tons. uQuiet 18, wQuiet 16. aASig -2. pASig -10.

Unmanned Combat Aerial Vehicles

HELICOPTER MINI-UCAV

Helicopter mini-UCAVs are typically found in the tactical reconnaissance and very close air support for ground forces. They have a significant loiter time and can operate on the ground as well as the air. They are usually carried aboard larger armored vehicles.

The Columbia Aerospace AV-71 is typical of the class. It is a miniature helicopter gunship roughly the same size and shape as a football, it is propelled by a pair of counter-rotating rotors. It's internal weapons bay can carry four 30mm mini-missiles, and it can carry two 10-lb. weapon pods on the stubby wings. It has four stubby legs stored flush with the body, when extended it can operate on the ground at a walking pace.

The Piloting (Helicopter) skill in the air, and the Piloting (Mecha) skill on the ground operate the missile. It uses computerized controls. $102,780 empty.

To *play* an AV-71 see the *Mini-Helidrone* (p. 00).

Structure: Sealed Body (SM -2, 8 HP, HT 12) with heavy carbon composite structure. Four legs (SM -5, 1 HP); two stub wings (SM –7, 1 HP); rotor (Folding; SM –5, 2 HP) with light carbon composite structure. Chameleon surface and basic infrared cloaking. PD 4, DR 15 diamondoid armor on body, PD 3, DR 5 diamondoid armor elsewhere. 0.365 cf total volume.

Armament: 3.2-lb. weapons bay. 10-lb. hardpoint each stub wing.

Equipment: 3 kW very expensive CAR drivetrain (no access); 0.001 kW legged drivetrain [Legs]; Complexity 5 tiny computer; 1-mile PESA (facing forward); short-range radio; short-range laser communicator.

Weights: Ewt 22 lbs. Payload 0 lbs. Lwt 22 lbs.

Performance: aSpeed 80; aAccel 4; aDecel 108; aMR 27; aSR 4; Stall Speed 0. gSpeed 2.

Battlesuits/Battleshells

"Ten seconds to drop." The calm voice of the suit AI gave the warning.

Waiting for the drop was the worst part. His instructors had always said that with the slinky bypass you couldn't even feel it but he knew that was bullshit. You could feel the bone crushing acceleration even through the link, if it wasn't for the suit and the biomods it would have been fatal.

CRUMP! The suit was jerked out of the transport. Nothing to do now but watch the displays, this part was completely automated. There was a brief pause as the drop shell oriented itself then the rocket started firing for the evasion and deceleration sequence. WHAM WHAM WHAM WHAM.

On the virtual interface display he could see his squads pods, picked out of the sky with glowing IFF triangles. He watched them angling down around the projected threat bubbles that appeared like wireframe in the sky. His own pod maneuvered to avoid the deadly touch of electromagnetic radiation that was marked as a fire control radar.

THUMP! For once the pod impacted at a relatively slow speed. He could feel the cold sensation in his legs that was a side effect of the combat chemicals. His stomach knotted. This was it.

The pod shell blew out – soundless from inside the suit.

"Systems fully operational." The AI droned. A quick diagnostic flashed and he felt the familiar prickles from the slinky interface that told him system status was green

"Here we go…"

SHENYANG H-23 SCOUT BATTLESUIT

The Shenyang H-23 is the standard light battlesuit of the PLA Space Infantry Division. Entering service in 2091, it quickly replaced the archaic H-21 that had been in service since the Pacific War.

The operator uses the Battlesuit skill. The quick-access battlesuit controls can accommodate drivers ranging from 145 to 180 lbs. The suits can withstand up to 8.9 atmospheres of pressure before integrity breach. It's jumping and leaping capabilities are nonexistent – it can manage a one-foot high jump if pressed.

Subassemblies: Body -1, two ST 20 arms -3, two legs -2, limited rotation turret -2.
P&P: 0.7-kW legged drivetrain [Legs] and 5 kWh batteries [Body]
Fuel/End: Batteries power drivetrain for 7 hours.
Occupancy: Battlesuit. ***Cargo:*** None.
ArmorF RL B T U

*Body:*5/75 4/50 4/50 4/50 4/50
Arms: 4/50 4/50 4/50 4/50 4/50
Legs: 4/50 4/50 4/50 4/50 4/50
Turret: 5/75 4/50 4/50 4/50 4/50

Equipment

Body: None. *Turret:* Basic suit electronics. *External (on Body):* 100-lb hardpoint.

Statistics

Size: 7' tall *Payload:* 180 lbs. *Lwt.:* 397 lbs.
Volume: 5.1 cf. *Maint.:* 95 hours. *Price:* $41,785.
HT: 9. *HP:* 8 [Body], 5 [each Arm], 5 [each Leg], 4 [Turret].
gSpeed: 16g*Accel:* 8g*Decel*: 20 *gMR:* 3 *gSR:* 2
Ground Pressure Very Low. Full Off-Road Speed

Design Notes

The suit features a light, carbon composite frame and improved suspension. Armor is nanocomposite. Body and turret have 30° slope. Structure is sealed. Arm motors are cheap. Volumes/areas are body 2.5 cf/11 sf, arms 0.3 cf/3 sf, legs 0.8 cf/6 sf, turret 0.6 cf/ 5 sf. Ewt. 217 lbs. Body ST is 16. Performance is unchanged if hardpoint is utilized but HT drops to 8.

VOSPER-BABBAGE CENTURION LIGHT BATTLESUIT

The Vosper-Babbage Centurion is the most common light battlesuit/EVA suit in European Union service. The Royal Space Forces have accelerated a replacement schedule for their Centurion suits after the Belt raid.

The operator uses the Battlesuit skill. The quick-access battlesuit controls can accommodate drivers ranging from 145 to 180 lbs. The suits can withstand up to 8.2 atmospheres of pressure before integrity breach. It can manage a two-foot high jump if necessary.

Subassemblies: Body -1, two ST 24 arms -3, two legs -2, limited rotation turret -2.
P&P: 0.5-kW legged drivetrain [Legs] and 5 kWh batteries [Body]
Fuel/End: Batteries power drivetrain for 9.8 hours.
Occupancy: Battlesuit. ***Cargo:*** None.
ArmorF RL B T U
*Body:*5/69 4/46 4/46 4/46 4/46
Arms: 4/50 4/50 4/50 4/50 4/50

Legs:	4/50	4/50	4/50	4/50	4/50
Turret:		5/69	4/46	4/46	4/46	4/46

Equipment

Body: None. *Turret:* Basic suit electronics. *Arms:* 0.2 cf module. *External (on Body):* 50-lb hardpoint.

Statistics

Size: 6'7" tall *Payload:* 180 lbs. *Lwt.:* 386 lbs.
Volume: 5.3 cf. *Maint.:* 78 hours. *Price:* $63,740.
HT: 12. *HP:* 15 [Body], 12 [each Arm], 8 [each Leg], 8 [Turret].
gSpeed: 12g*Accel:* 6g*Decel*: 20 *gMR:* 2.75 *gSR:* 1
Ground Pressure Very Low. Full Off-Road Speed

Design Notes

The suit features medium, carbon composite and a non-robotic frame. Armor is nanocomposite. Body and turret have 30° slope. Structure is sealed. Volumes/areas are body 2.2 cf/10 sf, arms 0.5 cf/4 sf, legs 0.7 cf/5 sf, turret 0.7 cf/ 5 sf. Ewt. 206 lbs. Body ST is 30. Performance is unchanged if hardpoint is utilized but HT drops to 11.

Basic Suit Electronics

A basic suit electronics package includes a 4-mile PESA, short-range radio, short-range laser communicator, IFF, and laser/radar detector. 0.15 cf, 7.45 lbs., and $2,692.5.

Aircraft

Grant regarded his wife coolly as the dealerships software agent fed him the data on the old Gabriel she had drug him to see. He always hated aircars - the thought of zipping around at Mach point 8 gave him the willies.

"I don't know what you see in these archaic aircars. It's hydrogen powered for christsakes, you know I hate dealing with that stuff. There was that nice Eibisu 2097 model for sale in Singapore we could have picked up. Genuine leather on the seats - none of that fauxflesh trash that they used in these things. And is that rust? This thing has probably been sitting here since back in 2090."

She didn't seem to hear him.

"Did you know this particular model was discontinued in 2087 after that big accident in Tel Aviv? Molly says she has some flight control software she snagged off a TSA core dump that lets you bypass the safety limit and even disconnect any ground control operator who tries overriding the controls!"

With that she started to ramble about compression ratios and turbine blade pitches. Time to call on his software agent to start shopping for insurance. He had a feeling he was going to need it.

HAWK AIRBOARD

It uses a turbofan folks, not antigravity. Stay focused and don't even think about hacking the safety limits – they're already set on "borderline suicidal."

-- Gracy Zvezda, Bosnian Competitive Aeroboard Team (2100)

Airboards are small vectored thrust vehicles that are designed to be the equivalent of flying surfboards. Originating as a series of homebuilt aircraft built with salvaged hardware and custom software, the concept became commercialized in 2050 when the first production-line examples were offered for sale in Mexico.

Beril Aerodyne produces the only commercial airboards in the world, and has pioneered the development of the vectored thrust control system and software that makes them usable by relative beginners. The operator uses foot pressure, upper torso movement, and a small handheld joystick to control the board; an adaptive control program prevents maneuvers that exceed its rather optimistic safety envelope and maintains stability. Back injuries caused by violent maneuvering, and even death, are not uncommon in unsanctioned competitive events.

The operator uses Piloting (Vertol) with computerized controls and is operated from a harness (the feet and lower legs are strapped in). Visibility is excellent.

Subassemblies: Body -1, 2 retractable Skids -3.
P&P: 320-lb. lift light turbofan. 100-lb. thrust light turbofan.
Fuel: Ultralight self-sealing 6-gallon jet fuel fuel tank (Fire 12), 57 minutes.
Occupancy: Harness. ***Cargo:*** None.

Armor	**F**	**RL**	**B**	**T**	**U**
All:	3/5	3/5	3/5	3/5	3/5

Equipment

Body: Tiny and cheap Complexity 4 computer.

Statistics

Size: 6'¥3'¥0.5' *Payload:* 239 lbs. *Lwt.:* 318 lbs.
Volume: 3.3 cf. *Maint.:* 190 hours. *Price:* $11,070.
HT: 12. *HP:* 6 *Skids:* 1 each.
aSpeed: 185 a*Accel:* 6 a*Decel*: 24 *aMR:* 6 *aSR:* 3
Stall Speed 0

Design Notes

Structure is aluminum with a robotic foamed alloy light frame with very good streamlining. Armor is metal matrix composite. Structure is sealed. Volume/areas are 3 cf/13 sf on body and 0.3 cf/2 sf for the skids. No access space for turbofans.

Lifting Body: Somewhat more efficient models use a more efficient body styling so that the lift engines can be turned off once the board reaches 105 mph. Increase cost to $11,370. Reduce aSR to 2.

EUROSPATIALE GABRIEL AIRCAR

The Eurospatiale Gabriel is the standard by which all other aircars are measured. Produced around the world under license, it appears in hundreds of individual variations and models - in most Fifth Wave countries it is a trivial matter to get one custom tailored.

The Gabriel is a typical air car design. It is a streamlined craft with a high-visibility bubble canopy and two engine pod sets - one placed just behind the cockpit and another set along the rear stabilizers. Each of the four pods mounts a vectored-thrust turbofan fueled by hydrogen. With a few minutes of work the craft can also be made street legal, mainly by folding the stub wings and putting protective covers over the engines.

It is representative of most aircars in use and is so common as to be nondescript. The design requires relatively little maintenance, can run on cheap hydrogen, and there are no shortage of spare parts. Many owners take great pleasure in modifying their Gabriels with custom kits to increase performance or aesthetic appeal. Derisively known as "cherubs," these individuals sometimes add so much ornamentation and useless "performance enhancements" that their vehicles are barely legal to fly.

The pilot uses the Piloting (Vertol) skill. The vehicle has computerized controls and can be controlled by an infomorph residing on the computer. Fuel costs are $80 per tank.

Subassemblies: Body +3, four engine pods +0, four standard wheels +2.
P&P: Four 2,000-lb. vectored thrust hyperfans, 50-kW wheeled drivetrain, and a 75 kWh battery.
Fuel/End: One 800-gallon light self-sealing hydrogen fuel tanks provide 30 minutes of full-power output and battery drives wheeled drivetrain for 1.5 hours.
Occupancy: 1 CCS, 3 CS. ***Cargo:*** 10 cf.

Armor	**F**	**RL**	**B**	**T**	**U**
All:	3/5	3/5	3/5	3/5	3/5

Equipment

Body: Long-range radio; 10-mile radar (no targeting, forward arc); burglar alarm; flight recorder; transponder; terrain-following radar; 4-man limited life support (2 man-days); vehicular parachute (3,000 lb. capacity); small and cheap Complexity 5 computer; 4 crashwebs.

Statistics

Size: 17’ long *Payload:* 1,464 lbs. *Lwt.:* 5,280 lbs.
Volume: 329 cf. *Maint.:* 55 hours. *Price:* $130,065.
HT: 8. *HP:* 93 *Pods:* 9 each *Whl:* 16 each.
gSpeed: 85 g*Accel:* 5 g*Decel*: 15 *gMR:* 1.75 *gSR:* 5
Ground Pressure High. 1/4 Off-Road Speed
aSpeed: 600 a*Accel:* 80 a*Decel*: 12 *aMR:* 3 *aSR:* 4
Stall Speed 0

Design Notes

Structure is extra-light aluminum alloy structure with good streamlining. Armor is aluminum alloy. Structure is sealed. Volumes/areas are body 267 cf/247 sf, pods 8 cf/24 sf, wheels 54 cf/86 sf. The body and each pod includes 0.5 cf of waste space. The wheels have improved suspension, all-wheel steering, and smartwheels. Typical aDrag is 144. The craft can float in water but the engines will not function.

SMALL AIR CAR

The pilot uses the Piloting (Vertol) skill. The vehicle has computerized controls. Fuel costs are $20 per tank.

Subassemblies: Body +3, stub wings +0, four retractable Wheels in body +1.
P&P: 1,000-kW vectored thrust ducted fan, 500-kW high-performance MHD turbine, and a 260 kWh battery.
Fuel/End: One 200-gallon light self-sealing hydrogen fuel tanks provide 2 hours of full-power turbine output. Battery provides 30 minutes of boosted power to ducted fans and powers all systems.
Occupancy: 2 NCS, 2 CS. ***Cargo:*** 25 cf.

Armor	**F**	**RL**	**B**	**T**	**U**
All:	3/5	3/5	3/5	3/5	3/5

Equipment

Body: Civil avionics; terrain-following radar; 4 crashwebs; 4-man limited life support (1 man-day); compact safety system; 3.125 ton vehicular parachute.

Statistics

Size: 15' long *Payload:* 1,416 lbs. *Lwt.:* 3,860 lbs.
Volume: 285 cf. *Maint.:* 42.9 hours. *Price:* $216,990.
HT: 12. *HP:* 184 [Body], 14 [each Wing], 12 [each Wheel].
gSpeed: 255 g*Accel:* 13 g*Decel*: 10 *gMR:* 0.5 *gSR:* 3
Ground Pressure High. 1/6 Off-Road Speed
aSpeed: 400 a*Accel:* 10 a*Decel*: 8 *aMR:* 2 *aSR:* 4
Stall Speed 85

Design Notes

AeVMDS design. Medium Aircar chassis with Medium Aircar stub wings. Structure is light aluminum with good streamlining and lifting body. Armor is carbon composite. Structure is sealed. 1.892 VSP waste body, 1.04 wings. Boosted aerial performance is aSpeed 565, aAccel 21 and the aircraft can VTOL.

MEDIUM MULTICRAFT

The pilot uses Piloting (Light Airplane) skill when flying. The vehicle has computerized controls. Fuel costs are $100 per fillup. Note that the aircraft can continue to fly with only one engine (reduce aSpeed to 200).

Subassemblies: Body +4, two standard Wings +2, three retractable Wheels in body +2.
P&P: Two 350-kW ducted fans [Wings], 350-kW standard gas turbine [Wings], 40-kWh battery [Body].
Fuel/End: Light 200-gallon alcohol self-sealing tanks [Wings]. Fuel supplies turbines for 4.3 hours.
Occupancy: 2 RCS. ***Cargo:*** 400 cf.

Armor	**F**	**RL**	**B**	**T**	**U**
Chassis:	4/7	4/7	4/7	4/7	4/7
Wings:	4/7	4/7	4/7	4/7	4/7
Wheels:	2/3	2/3	2/3	2/3	2/3

Equipment

Body: Civil avionics; 2 crashwebs; precision navigation instruments; 3-man limited life support (12 man-days); compact safety system; 12.5 ton vehicular parachute.

Statistics

Size: 30' long *Payload:* 9,560 lbs. *Lwt.:* 17,600 lbs.
Volume: 823 cf. *Maint.:* 21.3 hours. *Price:* $878,060.
HT: 10. *HP:* 713 [Body], 230 [each Wing], 64 [each Wheel].
gSpeed: 140 g*Accel:* 7 g*Decel*: 15 *gMR:* 0.5 *gSR:* 3
Ground Pressure Very High 1/8 Off-Road Speed
aSpeed: 285 a*Accel:* 3 a*Decel*: 34 *aMR:* 8.5 *aSR:* 5
Stall Speed 105

Design Notes

AeVMDS design. Large Airvan chassis with Large Airvan standard wings. Structure is medium aluminum with good streamlining. Wheels have improved brakes. Armor is carbon composite on body and wings, steel on wheels. Structure is sealed. 1.83 VSP waste body, 1.528 wings.

SPORT ACROBAT

The pilot uses Piloting (Light Airplane) skill when flying. The vehicle has computerized controls. Fuel costs are $35 per fillup.

Subassemblies: Body +2, two high agility Wings +0, three retractable Wheels in wings and body +0.
P&P: 350-kW aerial propeller, 350-kW turbocharged ceramic engine, 10-kWh battery.
Fuel/End: Light 70-gallon alcohol self-sealing tanks [Wings]. Fuel supplies engine for 5.5 hours.
Occupancy: 1 CCS. ***Cargo:*** 5 cf.

Armor	**F**	**RL**	**B**	**T**	**U**
All:	4/5	4/5	4/5	4/5	4/5

Equipment

Body: Civil avionics; crashweb; G-seat; 1-man limited life support (0.25 man-days); 1.875 ton vehicular parachute.

Statistics

Size: 10' long *Payload:* 706 lbs. *Lwt.:* 2,394 lbs.
Volume: 94 cf. *Maint.:* 44.8 hours. *Price:* $198,675.
HT: 12. *HP:* 83 [Body], 36 [each Wing], 7 [each Wheel].
gSpeed: 255 g*Accel:* 12 g*Decel*: 15 *gMR:* 0.5 *gSR:* 2
Ground Pressure Very High 1/8 Off-Road Speed
aSpeed: 715 a*Accel:* 10 a*Decel*: 46 *aMR:* 11.5 *aSR:* 3
Stall Speed 75

Design Notes

AeVMDS design. Small Light Aircraft chassis with Small Light Aircraft high agility wings. Structure is light aluminum with superior streamlining. Wings are folding with controlled instability. Wheels have improved brakes. Armor is carbon composite. Structure is sealed with LCD skin. 0.53 VSP waste body, 0.8 wings.

SMALL PASSENGER TRANSPORT

The pilot uses Piloting (Heavy Airplane) skill when flying. The vehicle has computerized controls. Fuel costs are $6,000 per fillup.

Subassemblies: Body +6, two standard Wings +4, two engine Pods [Body:T] +1, eight retractable Wheels in body and wings +3.
P&P: Two 12,000-lb new turbofans [Pods], 40-kWh battery [Body].
Fuel/End: Light 1,200-gallon jet fuel self-sealing tanks [Body], light 800-gallon jet fuel self-sealing tanks [Wings]. Fuel supplies turbofans for 8.3 hours at full power.
Occupancy: 2 RCS, 50 RS. ***Cargo:*** 500 cf.

Armor	**F**	**RL**	**B**	**T**	**U**
All:	4/7	4/7	4/7	4/7	4/7

Equipment

Body: Duplicate computerized controls; civil avionics; medium radar (no targeting); 2 crashwebs; precision navigation instruments; 85-man limited life support (85 man-days); compact safety system; galley; toilet.

Statistics

Size: 90' long *Payload:* 33,400 lbs. *Lwt.:* 77,890 lbs.
Volume: 4,750 cf. *Maint.:* 7.7 hours. *Price:* $6,665,770.
HT: 9. *HP:* 2,250 [Body], 734 [each Wing], 60 [each Pod], 77 [each Wheel].
gSpeed: 195 g*Accel:* 10 g*Decel:* 15 *gMR:* 0.5 *gSR:* 3
Ground Pressure Extremely High No Off-Road Speed
aSpeed: 590 a*Accel:* 6 a*Decel*: 24 *aMR:* 6 *aSR:* 5
Stall Speed 115

Design Notes

AeVMDS design. Large Transport chassis with Large Transport standard wings and 5 VSP pods. Structure is medium aluminum with very good streamlining and lifting body. Wings have variable sweep. Wheels have improved brakes. Armor is aluminum. Structure is sealed with LCD skin. 6.8 VSP waste body, 16 wings.

X-WING AIRCAR

The pilot uses Piloting (Light Airplane) skill when flying in jet mode, Piloting (Helicopter) in helo mode. The vehicle has computerized controls. Fuel costs are $25 per fillup.

Subassemblies: Body +3, Rotor -1, three retractable Wheels in body +1.
P&P: 200-kW stopped rotor TTR drivetrain, 200-kW ducted fan, 200-kW turbocharged ceramic engine, 40-kWh battery.
Fuel/End: Light 50-gallon alcohol self-sealing tanks. Fuel supplies engine for 6.9 hours.
Occupancy: 1 RCS. ***Cargo:*** 10 cf.

Armor	**F**	**RL**	**B**	**T**	**U**
Body:	4/3	4/3	4/3	4/3	4/3
Rotor:	4/5	4/5	4/5	4/5	4/5
Wheels:	4/3	4/3	4/3	4/3	4/3

Equipment

Body: Civil avionics; crashweb; 1-man limited life support (0.5 man-days); compact safety system.

Statistics

Size: 15' long *Payload:* 690 lbs. *Lwt.:* 1,948 lbs.
Volume: 131 cf. *Maint.:* 18.1 hours. *Price:* $1,209,765.
HT: 12. *HP:* 218 [Body], 50 [Rotor], 20 [each Wheel].

Helicopter Mode

aSpeed: 115 a*Accel:* 2 a*Decel*: 14 *aMR:* 3.5 *aSR:* 4
Stall Speed 0

Jet Mode

aSpeed: 260 a*Accel:* 8 a*Decel*: 30 *aMR:* 7.5 *aSR:* 5
Stall Speed 90

Design Notes

AeVMDS design. Medium Light Aircraft chassis with Medium Light Aircraft rotor. Structure is carbon composite with fair streamlining. Rotors are folding. Armor is carbon composite. Structure is sealed. 1.9 VSP waste body.

LIGHT RECONNAISSANCE HELICOPTER

The pilot uses Piloting (Helicopter) skill. The vehicle has computerized controls. Fuel costs are $30 per fillup and ammo is $2,400 per load.

Subassemblies: Body +3, Rotor -1, full-rotation turret [Body:U] -1, three retractable Wheels in body +1.
P&P: 400-kW CAR drivetrain, 400-kW turbocharged ceramic engine, 40-kWh battery.
Fuel/End: Light 60-gallon alcohol self-sealing tanks. Fuel supplies engine for 4.1 hours.
Occupancy: 1 CCS. ***Cargo:*** 10 cf.

Armor	**F**	**RL**	**B**	**T**	**U**
Body:	4/40	4/40	4/40	4/40	4/40
Rotor:	4/10	4/10	4/10	4/10	4/10
Wheels:	4/3	4/3	4/3	4/3	4/3

Equipment

Body: Military avionics; crashweb; ejection seat; 1-man limited life support (0.25 man-days); compact safety system; ammo bin (3,460 7.5mm rounds). *Turret:* Full stabilization and universal mount for 7.5mm machine gun; 7.5mm machine gun, medium AESA; small PESA.

Statistics

Size: 13' long *Payload:* 726 lbs. *Lwt.:* 3,775 lbs.
Volume: 134 cf. *Maint.:* 24.7hours *Price:* $654,430.
HT: 12. *HP:* 218 [Body], 50 [Rotor], 17 [Turret], 20 [each Wheel].
aSpeed: 385 a*Accel:* 3 *aDecel*: 18 *aMR:* 4.5 *aSR:* 5
Stall Speed 0

Design Notes

AeVMDS design. Medium Light Aircraft chassis with Medium Light Aircraft rotor and 0.5 VSP turret. Structure is carbon composite with very good streamlining and responsive. Rotors are folding. Armor is carbon composite. Structure is sealed with chameleon surface and radical sound baffling. No access for drivetain, standard access for engine.

COLUMBIA AEROSPACE KESTREL UTILITY FLARECRAFT

The Kestrel is a small Martian flarecraft seaplane, adapted from an Earth design. It is marketed as a utility aircraft suitable for use around the Marineris Sea and other areas with suitable atmospheric oxygen pressure.

The Kestrel has a streamlined body, with two large curved gull wings. The engine placement and hull design allow it to land and take off from water, but it is more efficient to use prepared airstrips. The cargo area is usually fitted for hauling palletized cargo, but it can be quickly converted for duty as a passenger hauler, with up to ten cramped being fitted. The life support system can handle the extra capacity, although this will drain the battery much quicker.

The pilot uses Piloting (Light Airplane) skill when flying, or the Powerboat skill when on the water. The vehicle has computerized controls (with a duplicate control set for a copilot). Fuel costs are $100 per tank.

Subassemblies: Body +4, two flarecraft Wings +2, three retractable Wheels in body +2.
P&P: Two 350-kW ducted fans [Wings], 350-kW standard gas turbine [Wings], 40-kWh battery [Body].
Fuel/End: Two 100-gallon alcohol self-sealing tanks [Wings]. Fuel supplies turbines for 4.3 hours.
Occupancy: 2 RCS. ***Cargo:*** 200 cf.

Armor	**F**	**RL**	**B**	**T**	**U**
All:	4/7	4/7	4/7	4/7	4/7

Equipment

Body: Long-range radio with backup; light sensor suite; flight recorder; transponder; inertial navigation system with backup; terrain-following radar; 2 small Complexity 6 computers; compact fire suppression system; two-man airlock; 12-man limited life system (3 man-days); 2 crashwebs; vehicular parachute (5,000 lbs).

Statistics

Size: 30' long *Payload:* 5,560 lbs.
Lwt.: 11,188 lbs. *LWt. on Mars:* 4,251 lbs.
Volume: 904 cf. *Maint.:* 21 hours. *Price:* $900,510.
HT: 12. *HP:* 375 [Body], 169 [each Wing], 38 [each Wheel].
gSpeed: 200 g*Accel:* 10 g*Decel*: 15 *gMR:* 0.5 *gSR:* 3
Ground Pressure High 1/6 Off-Road Speed

wSpeed: 20 w*Accel:* 20 w*Decel*: 10 *wMR:* 0.75 *wSR:* 6
Draft: 1.9' Flotation Rating: 20.9 tons
aSpeed: 260 a*Accel:* 5 a*Decel*: 36 *aMR:* 9 *aSR:* 6
Stall Speed 40 Stall Speed on Mars 35

Design Notes

Structure is light aluminum with good streamlining and fine hydrodynamic lines. Wheels have improved brakes. Armor is metal matrix composite. Structure is sealed. Ewt. is 5,628 lbs. Volumes/areas are body 670 cf/500 sf, wings 100 cf/225 sf each, wheels 34 cf/75 sf. aDrag is 317, hDrag is 31.

Flight Control Systems

An AI is required to be loaded onto the vehicles computer, but they are usually piloted or driven manually with the infomorph keeping an eye on the small details. In a dangerous situation, or for law enforcement purposes, ground control personnel can directly seize control of the craft and pilot it over a datalink. Bypassing this (and not getting caught) requires a successful Computer Operations -4 roll to install a software patch and then a Electronics (Communications) roll to circumvent the hardwired datalinks. Failing either of these rolls will probably mean that sooner or later the modification is discovered and the owner has a lot of explaining to do. Expect fines and possibly loss of any piloting license.

A stock system AI is an NAI-5 trained in Piloting (Vertol)-11 [4] and Electronics Operation (Sensors)-12 [8] but with a Duty to follow the commands of authorized traffic control systems (all the time, not dangerous) [-10]. It is included for free and burned into firmware, but it can be unloaded from the computer to load another infomorph or additional software.

Mecha

EXOGENESIS *EXPLORER* MOBILE SCIENCE FACILITY

The Explorer is a massive legged walker designed to support Exogenesis operations on Io -- the hellhole of the Solar System. Arguably the largest legged vehicle ever built, the Explorer stands 45' tall on average, with a length of 35'. The belly hangar bay housing the various cybershells and specialized sensor equipment dominates the body.

One of the more unusual design features on the Explorer are the four robot arms installed on each leg. These are used to collect samples and even hold specially built "handheld" sensor systems. They can also be used to help lower or raise cybershells from the hanger if the vehicle is not moving.

The vehicle is completely automated, the only area where a human could access the vehicle is through the hanger bay -- which has no provisions for the safety of non-cybershells. A macroframe computer and three auxiliary mainframes direct the vehicles operation. Typically a dedicated NAI with the Driving (Mecha) skill is responsible for the routine handling of the vehicle.

Subassemblies: Body +8, six Legs +5, sixteen ST 100 Arms -2, full-rotation sensor Turret -1.

P&P: 4.9-MW six-legged drivetrain, 5-MW radiothermal generator, and 100-kWh rechargeable battery

Fuel/End: Radiothermal generator can power vehicle at full output for 14 years. Battery provides auxiliary power for systems and provides a reservoir for cybershell recharging.

Occupancy: None. ***Cargo:*** 970 cf.

Armor	**F**	**RL**	**B**	**T**	**U**
Body:	4/1,600	4/1,600	4/1,600	4/1,600	4/1,600
Legs:	4/300	4/300	4/300	4/300	4/300
Arms:	4/150	4/150	4/150	4/150	4/150
Sensor Turret:	4/25	4/25	4/25	4/25	--

Equipment

Body: Two extreme-range radios, two long-range laser communicators, two advanced radiation sensors, geology array, magnetometer, precision navigation instruments, transponder, inertial navigation system, minifacturing workshop, 2 science labs, hangar bay (20,000 cf capacity), Complexity 9 macroframe computer, three Complexity 8 mainframes.

Statistics

Size: 35' long *Payload:* 419,400 lbs.
Lwt.: 6,750,428 lbs. *Lwt. on Io:* 1,545,038 lbs.
Volume: 48,702 cf *Maint.:* 3.8 hours. *Price:* $109,980,170.
HT: 6 *HP:* 19,113 *Legs:* 3,183 each *Arms:* 60 each *Tur:* 30
gSpeed: 15 g*Accel:* 5 *gDecel*: 20 *gMR:* 0.75 *gSR:* 4
High GP on Io. Off-Road Speed 8.

Design Notes

All subassemblies are heavy carbon composite with the exception of the arms, which are nanocomposite. Structure is smart, sealed, and robotic. Volume/areas are: body 34,600 cf/6,371 sf, 2,350 cf/1,061 sf each leg, arms 3 cf/6 sf each, 2 cf/10 sf turret. Armor is steel on body, aluminum elsewhere. The body has a cPF of 50. Ewt. 6,151,028. Ground pressure is 12,901 on Earth and 3,034 on Io. The radiation sensors, geology array, and magnetometer are found in ***Vehicles Expansion II***.

M88A2 *Ashby* Combat Walker

The Ashby combat walker entered production in 2096 and is currently in service with the U.S. Army and Marine Corps. Although it is used for specialized operations on Earth (walking it on the seabed for amphibious strikes for example) it primarily serves with military units deployed on Mars and Titan. The recent A2 upgrade added cooling equipment for operations on Mercury and Venus and fixed several design problems.

As with most modern U.S. combat vehicles, the Ashby is completely automated. Typically two SAI infomorphs or ghosts control the vehicle, occasionally dedicated NAIs are used to direct the anti-missile system and coordinate communications. For ease of maintenance the drivetrain and reactor are still built with standard access space.

The M88A2 serves as a combination combat walker and personnel transport, carrying six or more RATS and other cybershells into battle. The reactor on the walker can recharge batteries and power packs between battles and if necessary the onboard computers can be used to store backups or copies of the cybershell infomorphs should they be crippled or need to be erased

Controlling the Ashby requires the Driving (Mecha) skill, using computerized controls.

Subassemblies: Body +4, four Legs +2, full rotation main Turret +3, full rotation Cupola +0, full rotation small Turret -1, two ST 100 Arms -2.

P&P: 250-kW four-legged drivetrain. 140-kW radiothermal generator. 1,500-kWh rechargeable battery each leg (6,000-kWh total). 25-kWh power pack in body. 250-kWh power pack in main turret. 12.5-kWh power pack in cupola.

Fuel/End: Leg batteries power drivetrain for 24 hours. RTG powers all other systems and recharges batteries and power packs. Body power pack powers EM Armor, the turret power pack provides power for the Emag and EMGL. The cupola power pack is dedicated to the point-defense laser.

Occupancy: None. ***Cargo:*** 400 cf.

Armor	**F**	**RL**	**B**	**T**	**U**
Body:*	6/5,000	4/2,500	4/2,500	4/2,500	4/2,500
Legs:	4/500	4/500	4/500	4/500	4/500
*Main Turret**:*	6/2,000	4/1,000	4/1,000	4/1,000	--
Cupola:	6/500	4/250	4/250	4/250	--
Small Turret:	6/300	4/150	4/150	4/150	--
Arms:	4/25	4/25	4/25	4/25	4/25

* emDR 1,000 on all facings.
** emDR 500 on all facings.

Weaponry

45mm Emag [Main Turret:F] (550 rounds).

30mm Electromagnetic Grenade Launcher [Main Turret:F] (2,400 rounds).

4mm Gatling [Body:F] (58,100 rounds)

20-kJ Anti-Missile Laser [Cupola:F]

Equipment

Body: Two radios with 10,000-mile range, laser communicator with 20,000-mile range, 25-mile PESA (facing forward), inertial navigation system, IFF with backup, 2 mainframe Complexity 8 computers, 3 small Complexity 6 computers, compact fire suppression system. *Main Turret:* 100-mile PESA, 225-mile AESA. *Small Turret:* 36-mile PESA, 45-mile AESA.

Statistics

Size: 13' long *Payload:* 15,850 lbs. *Lwt.:* 197,886 lbs.
Volume: 1,040 cf. *Maint.:* 5.78 hours. *Price:* $11,990,845.
HT: 7. *HP:* 2,400 [Body], 300 [each Leg], 375 [Main Turret], 45 [Cupola], 17 [Small Turret], 60 [each Arm].
gSpeed: 20g*Accel:* 6g*Decel*: 20 *gMR:* 0.75 *gSR:* 5
Ground Pressure High. XX Off-Road Speed

Design Notes

WVMDS design. Sloped extra large body and four extra large legs. Body is extra heavy with a carbon composite frame. 50-VSP sloped turret, 2-VSP sloped cupola and a 0.5-VSP sloped small turret. Main turret has a carbon composite frame. All armor is metal matrix composite. Body and all subassemblies are sealed. Body has heavy compartmentalization. Legs have improved suspension. Body provides cPF 5 of radiation shielding and has a dual-environment cooling system (p. ITW00). Vehicle has radical emissions cloaking and chameleon surface. Ewt: 182,036 lbs. Ground pressure is 6,184 on Earth when loaded, 5,934 when not carrying cargo.

M85 *JAEGER* COMBAT WALKER

The M85 Jaeger is a lightweight two-legged all-terrain combat vehicle. Originally designed for service with the U.S. Army's spaceborne forces, it was outdated even as the first models rolled off the assembly line – it's mission largely replaced by small cybershells like the RAT (p. TS124) and better protected combat walkers like the M88 Ashby. The Army had already sunk millions into the project, and was committed to a limited production run of 80 suits. Most of the existing vehicles have been acquired by the U.S. Marine Corps, and are being refitted with better sensors and electromagnetic armor.

Although they do suffer from the typical disadvantages of walkers (large visual profile and mediocre armor protection) the Jaeger is remarkably agile and faster then most cybershells or battlesuits, it can even drop prone and crawl (although this is very stressful on the frame). When not in combat the walker can assist in engineering tasks.

Controlling the Jaeger requires the Driving (Mecha) skill. The controls are computerized and an onboard infomorph can drive the vehicle. It takes 3 seconds to switch between the legs and using the wheels.

Subassemblies: Body +2, two ST 100 Arms -1, two Legs +1, full rotation Turret +0, two standard Wheels +0.
P&P: 175-kW two-legged drivetrain, 48-kW all-wheel-drive drivetrain, 200-kW turbine, two E-Cells (40 kWh total capacity) in turret.
Fuel/End: 34-gallon ultralight self-sealing synthetic gasoline tank provides 3 hours of endurance at full-power output from turbine.
Occupancy: CCS ***Cargo:*** 5 cf.

Armor	***F***	***RL***	***B***	***T***	***U***
Body:	6/500	4/250	4/250	4/250	4/250
Legs:	4/250	4/250	4/250	4/250	4/250
Arms:	4/250	4/250	4/250	4/250	4/250
Turret:	4/250	4/250	4/250	4/250	--
Wheels:	4/25	4/25	4/25	4/25	4/25

Equipment

Body: Simple PESA array; inertial navigation system; Complexity 7 microframe; two Complexity 6 small computers; compact fire suppression system; 1-man NBC kit; 1-man limited life system (2 man-days); crashweb. *Turret:* Long-range radio; light sensor suite; IFF; HUDWAC.

Statistics

Size: 14' tall *Payload:* 1,174 lbs. *Lwt.:* 10,423 lbs.
Volume: 110 cf. *Maint.:* 19 hours. *Price:* $1,103,625.
HT: 11. *HP:* 300 [Body], 66 [each Arm], 150 [each Leg], 45 [Turret], 27 [each Wheel].

Legs

gSpeed: 40* g*Accel:* 17 g*Decel*: 20 *gMR:* 2.25 *gSR:* 1
Ground Pressure Low. 4/5 Off-Road Speed
* Can sprint at gSpeed 45 in a straight line.

Wheels

gSpeed: 55g*Accel:* 2g*Decel*: 20 *gMR:* 1.75 *gSR:* 2
Ground Pressure Extremely High. No Off-Road Speed

Design Notes

WVMDS design. Sloped very small body and two small legs. Wheels are very small. Body is heavy with a carbon composite frame. Legs and turret are medium carbon composite. Arms are extra-heavy carbon composite. 2-VSP turret and 0.5-VSP arms. All armor is metal matrix composite. Body and all subassemblies are sealed. Body has heavy compartmentalization. Wheels have improved suspension, improved brakes, and smartwheels. Body provides cPF 1. 1/3 of the CCS is in the turret. Vehicle has radical emissions cloaking and chameleon surface. Body ST: 600. Ewt: 9,249 lbs. Ground pressure is 1,303 on Earth using legs or 28,952 on wheels. Payload (but not cost) includes a handheld assault rifle pod.

Assault Rifle Pod

This 1 VSP light aluminum pod contains a 25mm chaingun and 480 rounds of APDS ammo with DR 20 metal matrix composite armor. It has both radical emissions cloaking and chameleon surface. It does not use a detachable magazine, but the ammo can be quickly changed out (requires 20 seconds if using prepared ammo containers). It is 670 lbs. loaded and $47,730, including a full load of ammunition. Min ST is 89.

AEROSPACE VEHICLES

Earth-To-Orbit

ARCHER LIGHT LAUNCH VEHICLE

The Columbia Dynamics Archer is a typical modular cargo rocket of the type that have largely been declared obsolete due to laser-lift systems. Variants of the design are still used on Mars, where demand for lift occasionally outstrips the capability of the existing laser lift and beanstalk infrastructure. The Transpacific Socialist Alliance makes extensive use of rockets of this class to deploy its own satellite constellations, and in the case of war, AKVs.

The original Archer dates back to 2020, and has seen only incremental improvements over the decades. The current version incorporates a number of improvements to the rocket design and a small boost in capability with the incorporation of an unmanned control system and basic sensor array – useful where constant ground control supervision is not possible.

The Archer is a streamlined cylinder 55' high with a diameter of 15'. A standard payload of 25 tons can be launched into low earth orbit by expending 140 tons of kerosene-oxygen rocket fuel.

Crew: Unmanned. Infomorph uses Electronics Operation (Communications), Electronics Operation (Sensors), Piloting (Aerospace), and Piloting (High-Performance Spacecraft). Infomorph occupies the mainframe in the unmanned controls.

Design: Streamlined cylinder (25.2 spaces, foamed alloy, light frame); cDR/cPF 0.28/1F, 0.2/1S, 0.2/1B (carbon composite armor).

Modules: Old unmanned controls; very small fixed PESA [F]; 3 compact kerosene-oxygen rocket; 10 tanks (ultralight, kerosene-oxygen); 5 cargo (25 tons).

Statistics: EMass 37; CMass 132; LMass 202. Cost M$2.13. cHP 23. Size Modifier +3/+6. HT 12. Maintenance Interval: 13.69 hours. RRA 0.

Performance: sAccel: 11.21 G. Burn Endurance: 0.01 hours (36 seconds). Burn Points: 404. Delta-V: 1.233 mps. No air speed.

MOLNIYA-II BALLISTIC RAMJET

This is a "optimized" version of the *Molniya* (pp. SSS6-7). It is 150'-long, 90'-wide streamlined delta. With a full load of 320 passengers and 250 tons of cargo, the payload is 280.3 tons.

Crew: Pilot and Copilot (Electronics Operation (Communications), Electronics Operation (Sensors), Piloting (Aerospace)); 2 Stewards (Diplomacy, Savoire-Faire (Servant)).

Design: Streamlined delta (216 spaces, carbon composite, light frame, smart, responsive, lifting body); cDR/cPF 1.4/5F, 1/1S, 1/1B (carbon composite armor).

Modules: Old basic bridge; small fixed radar [F]; 40 turbo-scramjet; 100 tanks (ultralight, jet fuel); 20 passenger seats; small entry module; 2 large entry modules; 1 battery; 50 cargo (250 tons).

Statistics: EMass 403; CMass 1,224; LMass 1,764. Cost M$66.03. cHP 8135. Size Modifier +9. HT 12. Maintenance Interval: 4.92 hours. RRA 0.

Performance: No space performance. Fuel Endurance: 2.5 hours. Air Speed: 8,000 mph (2 MPS). Stall Speed: 265 mph.

DRAGONFLY TRANSATMOSPHERIC VEHICLE

The Dragonfly is a small personal single-stage-to-orbit (SSTO) spaceplane marketed by Columbia Aerospace to wealthy individuals and small businesses. It is capable of taking off from most spaceports, ferrying up to 7.5 tons of cargo and 8 passengers into low earth orbit. The Dragonfly measures 50' in length, 30' wide and 15' high. A typical payload is 8.4 tons when fully loaded. If entering orbit all 56 tons of kerosene-oxygen fuel will be used, effectively doubling the Delta-V. Space performance assumes a fully loaded tank. The battery can power all systems for 4 hours.

Crew: Pilot (Electronics Operation (Communications, Sensors), Piloting (Aerospace)).

Design: Streamlined delta (8 spaces, carbon composite, medium frame, smart, lifting body); cDR/cPF 0.14/1F, 0.1/1S, 0.1/1B (metal matrix composite armor).

Modules: Old cockpit; very small radar; small fixed radar [F]; 1 compact kerosene-oxygen rocket; 4 tanks (ultralight, kerosene-oxygen); 0.5 passenger seats; small entry module; 0.1 battery; 2 cargo (10 tons).

Statistics: EMass 17; CMass 54; LMass 82. Cost M$3.56. cHP 30. Size Modifier +6. HT 12. Maintenance Interval: 21.21 hours. RRA 0.

Performance: sAccel: 1.218 G. Burn Endurance: 0.012 hours (43 seconds). Burn Points: 399. Delta-V: 1.218 mps. Air Speed: 12,185 mph (3 mps). Stall Speed: 230 mph.

DELTA TRANSATMOSPHERIC COMBAT VEHICLE

The Yoyodyne Delta was the primary TACV design of the TSA during the Pacific War. Entering production in 2077, the design was remarkably similar to similar craft then being designed by Vosper-Babbage and Columbia Aerospace. It was one of the first single-stage-to-orbit combat shuttles to enter service, and the aerospace forces of Thailand, Vietnam, and Indonesia fielded at least 80 of the craft when hostilities broke out in 2084. Unfortunately for the TSA, half of the vehicles never left the ground – destroyed by orbital weapons, special forces strikes, and conventional airstrikes. The few that were launched proved ineffective against the massive Chinese superiority in low orbit. Yoyodyne stopped manufacture of the Delta shortly after the end of hostilities, selling 40 airframes that were in various stages of construction at rock-bottom prices to anyone willing to pay the price. Many ended up in private hands.

The Delta is larger then most TACV designs (see ***Spacecraft of the Solar System***), measuring 78’ in length, 47’ wide and 23’ high. The laser mirror is located in the middle of the craft – the system is partly cooled by the surrounding fuel. The laser is powered from the onboard power pack (9 shots) and the miscellaneous systems use the battery (five hours). A typical payload is 2.6 tons. If entering orbit the entire fuel supply will be used, effectively doubling the Delta-V. Space performance assumes the craft was launched in space with a full fuel-load.

Crew: Pilot (Electronics Operation (Communications, Sensors), Gunner (Beam), and Piloting (Aerospace). The laser is usually controlled by an infomorph loaded onto the cockpit mainframe.

Design: Streamlined delta (30.371k spaces, carbon composite, light frame, responsive, lifting body); cDR/cPF 3/1F, 2/1S, 2/1B (metal matrix composite armor).

Modules: Old cockpit; small fixed PESA [F]; medium fixed radar [F]; 2 compact kerosene-oxygen rocket; 25 tanks (ultralight, kerosene-oxygen); 2.5-MJ light lasers [F]; 0.5 battery; 0.5 power pack; 0.5 cargo (2.5 tons).

Statistics: EMass 95; CMass 272; LMass 447. Cost M$15.93. cHP 37. Size Modifier +7. HT 12. Maintenance Interval: 5.01 hours. RRA 0.

Performance: sAccel: 3.64 G. Burn Endurance: 0.039 hours (2.34 minutes). Burn Points: 51. Delta-V: 1.562 mps. Air Speed: 12,100 mph (3 mps). Stall Speed: 260 mph.

X-66 TRANSATMOSPHERIC COMBAT VEHICLE

The Columbia Aerospace X-66 was a follow-on development testbed for a fully automated "ghostfighter" that was originally begun in 2017, shortly after the first stable NAI was marketed. Although the original program was an unqualified disaster with public relations (the idea of an AI controlled fighter, rather then a remote-controlled UAV, was considered too radical at the time) it pioneered dozens of related technologies and programming techniques that were instrumental in later unmanned TACV design. Many aerospace piloting skill sets are based on some of this early research.

The X-66 program began in 2077, concentrating on the use of SAIs as pilot replacements. The transatmospheric UCAVs then in service were judged too small to be of much use in an orbital conflict and manned TACVs were quickly showing their limitations as China, the TSA, and ESCA continued to increase the number of space defense platforms in orbit. Columbia Aerospace, Nanodynamics Space Systems, and Eurospatiale were all contracted to produce their assessment of future TACV requirements. Columbia Aerospace had privately been working on its own TACV program and went one step further – producing three prototypes based on its submission. The USAF purchased one for flight-testing, and the remaining two were used by Columbia Aerospace for in-house projects. By 2085 all of the three craft were out of service: the USAF vehicle crashed during testing in 2081, one was retired and destructively tested in 2084 and the final vehicle was recycled.

The X-66 closely resembles the later Tempest, an aerospike design 60' in length and 30' wide. The craft is completely unmanned and carries no cargo. The vehicles laser is powered from a power pack for 9 shots, with the remaining systems relying on the rechargeable battery for 4 ½ hours.

Crew: Unmanned. Infomorph uses Electronics Operation (Communications, Sensors), Gunner (Beam), and Piloting (Aerospace).

Design: Streamlined delta (13.824 spaces, carbon composite, heavy frame, smart, responsive, lifting body); cDR/cPF 7/1F, 5/1S, 5/1B (metal matrix composite armor).

Modules: New unmanned controls; medium fixed radar [F]; 2 compact turbo-scramjet; 5 tanks (ultralight, jet fuel); 10-MJ heavy laser [F]; 0.25 battery; 2 power pack.

Statistics: EMass 180; CMass 207; LMass 234. Cost M$19.62. cHP 86. Size Modifier +6. HT 12. Maintenance Interval: 9.03 hours. RRA 0.

Performance: No space performance. Air Speed: 5,480 mph (2 mps). Stall Speed: 245 mph. Fuel Endurance: 1.67 hrs.

Stations

Workshack Modules

A workshack is a small space station assembled from one or more prefabricated modules. They range in complexity from small automated laboratories to elaborate constructs that house hundreds of permanent inhabitants.

Workshacks modules are built by dozens of companies, fitting out largely standardized shells with whatever the customer requires. A basic unfitted module is a simple cylinder 50' in length and 20' wide.

Crew: Varies.

Design: Cylinder (32 spaces, foamed alloy, extra-light frame); cDR/cPF 0.1/1F, 0.1/1S, 0.1/1B (steel alloy armor). Hull radiators (1 ksf).

Modules: 2 small entry module; 2 large entry module.

Statistics: EMass 25; CMass 25; LMass 25. Cost M$0.07. cHP 14. Size Modifier +3/+6. HT 12. Maintenance Interval: 78.09 hours. RRA 0.

Performance: No space performance. No air performance.

Variants:

Habitat Module: Radiocom; lasercom; 10 cabin; hall; 5 cargo (25 tons). 3.8 empty spaces. EMass 37; CMass 64; LMass 64. Cost M$0.31. Maintenance Interval 36.03 hours.

Fusion Module: 26 old fusion reactor (4 MW); 1 battery. 2 empty spaces. EMass 141; CMass 141; LMass 141. Cost M$6.62. Maintenance Interval 7.78 hours.

Workshop Module: 2 lab; 2 hall; 20 minifac workshop. 3 empty spaces. EMass 55; CMass 55; LMass 55. Cost M$22.13. Maintenance Interval 4.25 hours.

Type-23C Space Defense Platform

The Type-23 is the standard Chinese space defense platform, used in great numbers around Earth, Mars, and PLAN facilities throughout the solar system. Before the Pacific War there were at least 100 of the platforms around Earth alone, but almost 60% were destroyed in the first few days of the conflict.

The current "C" model of the platform entered service in 2094 to replace the problematic "B" model that displayed excessive aberrant behavior with their NAI software and lens defects with their 10-MJ heavy laser. Recovering of the older SDPs has proved to be quite dangerous due to the malfunctioning control software, forcing the PLAN has put out contracts to bonded salvage services in order to reduce costs to a manageable level.

Utility Spacecraft

A hundred years from now people will look back and wonder how we ever managed our affairs on this planet without the tools provided by the space program...a world without spacecraft is as hard to imagine a world without telephones and airplanes.

-- Wernher von Braun

FALCON-CLASS SPACE RACER

The Falcon is a low-endurance "racing" craft that maximizes performance for fairly short (within 1 AU) trips. The Falcon in particular is designed for the fastest Earth-Moon runs as possible.

The design is a cylinder 20' long by 12' in diameter. Usual payload is 0.1 tons. There are 0.28 spaces available for additional upgrades or modification in the main hull but this is exceedingly rare. The battery can power all ship systems for 240 minutes (more if the sensors are turned off).

Crew: Pilot (Astrogation, Electronics Operation (Communications, Sensors), Piloting (High-Performance Spacecraft); Savoir-Faire)).

Design: Cylinder hull (4.608 spaces, nanocomposite, light frame); cDR/cPF 0.2/1 (nanocomposite armor). Hull radiators (1 ksf), radiator wings (0.5 ksf).

Modules: Old basic cockpit; small fixed radar [F]; 2 compact HT fusion pulse drive; 2 tanks (ultralight, nuclear pellets); 0.1 battery.

Statistics: EMass 18; CMass 30; LMass 42. Cost M$4.14 cHP 7. Size Modifier [Hull] +2/+3, [Radiators] +3. HT 12. Maintenance Interval: 9.82 hours. RRA 1.5.

Performance: sAccel: 0.79 G. Burn Endurance: 4.17 hours. Burn Points: 11,859. Delta-V: 36.237 mps. No air speed.

ANZA-CLASS EXECUTIVE SPACE VEHICLE

The design is a cylinder 150’ long by 30’ in diameter. Each habitat pod is a 30' by 15' cylinder attached to a 150' spin arm. The radiator wings measure 71’¥71’. Usual payload is 58.5 tons. There are 0.9 spaces available for additional upgrades or modification in the main hull and 0.3 spaces in each pod. The battery can power all ship systems for 150 minutes (more if the sensors are turned off).

Crew: Commander (Savoir-Faire); Pilot (Astrogation, Electronics Operation (Communications, Sensors)); Piloting (High-Performance Spacecraft)); Engineer (Administration, Mechanic (Fusion Drive), Mechanic (Robotics), other Mechanic as appropriate); Stewards (Diplomacy, First Aid, Savoir-Faire).

Design: [Hull] Cylinder hull (216 spaces, carbon composite, heavy frame, smart); cDR/cPF 1/1 (carbon composite armor). [Pods] Cylinder hull (10.8 spaces, carbon composite, heavy frame, smart); cDR/cPF 1/1 (carbon composite armor). Hull radiators (10 ksf), radiator wings (10 ksf). Liquid-crystal skin.

Modules: [Hull] Old basic bridge; medium PESA, medium radar; 40 HI fusion pulse drive; 150 tanks (nuclear pellets); 2 2.5-MJ light laser towers [S]; medium robot arm; large entry module; minifac workshop; light storm shelter (1 space; covers bridge, cPF 100); 0.5 battery; 10 cargo (50 tons). [Pods, each] 6 cabin; 2 luxury cabin; 0.5 cargo (2.5 tons).

Statistics: EMass 1,1146; CMass 2,105; LMass 3,005. Cost M$75.27 cHP [Hull] 475, [Pods] 54. Size Modifier [Hull] +4/+9, [Pods] +3/+4, [Radiators] +9. HT 12. Maintenance Interval: 4.61 hours. RRA 20.

Performance: sAccel: 0.08 G. Burn Endurance: 93.75 hours. Burn Points: 27,000. Delta-V: 82.5 mps. No air speed.

Autonomous Kill Vehicles

United States

The USAF maintains a solid lead in AKVs, both in hardware and software. This lead has slipped somewhat with the newest generation of Chinese AKVs and privately developed efforts (such as the Amazon and Nile).

All AKVs in U.S. service are designated as Space-launched Interceptor Missiles (SIM) and a numerical designator for the order they entered service.

SIM-6 *HELLHOUND*-CLASS AKV

The Hellhound was the first American AKV to have a kill mechanism apart from ramming, and the first AKV ever to be operated exclusively by a SAI. Developed by Applied Space Systems (now a subsidiary of Columbia Aerospace) in 2084, the first production models were immediately placed onboard USAF vessels engaged in tracking down the so-called "Pirates of Hyperion." A prototype Hellhound AKV (callsign "Snoopy") made history when it destroyed a Gypsy Angel privateer off Iapetus in 2085 while teleoperated by an SAI (see p. DB00 for more information on this incident). The success of the engagement and the muted response to the use of SAI control emboldened the U.S. to vastly expand their use of sapient combat infomorphs – starting with embedded SAIs aboard each Hellhound.

Roughly two hundred Hellhounds of various models were built between 2084 and 2090. The Hellhound continued in U.S. service with second-line vessels and installations until it was completely displaced by the newer SIM-7 Predator, and their driver AIs were either "retired" (erased) or reassigned as training cadre for new generations of AKV infomorphs. A small production run of SIM-6C "Advanced Hellhounds" with fusion pulse drives were produced for the SAAF in 2092 and the remaining examples were resold (without their informorphs) to other governments and approved corporations. One of the original Hellhound prototypes is placed in the Smithsonian, repainted to match that of the famous Snoopy.

The Hellhound is utilitarian and blocky, lacking any of the stylish grace of the Predator or the clean lines of the Zhengyang. It appears to be a rectangular lattice covered with hexagonal panels of carbon composite coated with liquid crystal cells. Conformal reaction-mass tanks are mounted just under the plates, providing a small amount of additional protection for the sensitive electronics and drive components. Not including some of the antennas and sensor dishes, it is a box hull 30’ in length, 10’ wide and 6’ high. The coilgun is prominently mounted, maintenance crews and the SAI pilots often designed elaborate “nose art” to further accentuate it. The battery can provide power to the coilgun and miscellaneous systems for up to 20 hours. Usual payload is 9.5 tons (one munitions pack, almost always KKMP).

Crew: Unmanned. Infomorph occupies the mainframe in the unmanned controls

Design: Box hull (3.6 spaces, foamed alloy, heavy frame); cDR/cPF 30/10F, 10/2S, 5/1B (carbon composite armor). Liquid-crystal skin.

Modules: Old unmanned controls; small fixed radar [F]; small fixed PESA [F]; 1 compact HI fusion torch drive (water reaction mass); 1 tanks (ultralight, water); coilgun bay [F]; 0.5 battery.

Statistics: EMass 106; CMass 123; LMass 131. Cost M$6.96. cHP 32. Size Modifier +2/+4. HT 12. Maintenance Interval: 7.58 hours. RRA 0.

Performance: sAccel: 0.01 G. Burn Endurance: 27.78 hours. Burn Points: 1,000. Delta-V: 3.056 mps. No air speed.

Variant: The SIM-6A and –6B were stripped-down interceptor models for facility defense. Reduce side and back armor to cDR 1 but increase front armor to cDR/cPF 50/20. Drive is changed to the HT fusion torch drive (water reaction mass). EMass 49; CMass 66; LMass 73. Cost M$5.81. Maintenance Interval: 8.3 hours. sAccel: 0.07 G. Burn Endurance: 4.44 hours. Burn Points: 1,119. Delta-V: 3.419 mps.

The SIM-6C replaced the fusion torch with a 1 compact HT fusion pulse drive. CMass 122; LMass 128. sAccel: 0.1 G. Burn Endurance: 4.17 hours. Burn Points: 1,501. Delta-V: 4.587 mps.

Although never carried out, there was a plan to use decommissioned Hellhound frames as a cheap orbital defense platform over Titan. Delete liquid-crystal skin and replace the coilgun bay with a 2.5-MJ light laser [F]. Replace the drive with a 0.5 compact HI fusion pulse drive. Add a 0.1 power pack (3 shots) that is recharged by the battery and drive. EMass 111; CMass 117; LMass 123. Cost M$8.11. Maintenance Interval: 7.02 hours. sAccel: 0.03 G. Burn Endurance: 33.33 hours. Burn Points: 3,600. Delta-V: 10.999 mps.

USAF AKV Designs

SIM-1 (2020): The SIM-1 was a co-orbital interceptor hastily redesigned and upgraded to give it a minimal capability to intercept maneuvering spacecraft. Even the designation was applied *ex-post-facto*. Each missile was built individually and no two were quite alike – design enhancements and firmware updates were incorporated as production continued. Most never entered orbit, they were designed for rapid deployment from deltas and rockets – there were few space-based platforms available, and at the time the political situation was hostile to deploying anti-satellite weapons of any kind.

SIM-2 (2025): The large SIM-2 (nicknamed "Chubs") was a stopgap designed to intercept and destroy targets as far out as geosynchronous orbit. Only a dozen were produced before it was replaced by the SIM-4.

SIM-3 Seeker-*class (2039):* Plagued by massive overengineering and ruinous cost overruns, the SIM-3 project produced only a single prototype that blew itself up in testing and several ruined Air Force careers. Ironically, the Chinese independently produced a similar design that later developed into the Gang Shou ("iron hand") AKV (p. 00).

SIM-4 Cerberus-*class (2060):* The Cerberus was a rugged space combat vehicle that introduced the compact fusion torch system that would be the defining characteristic of American AKVs for almost three decades. 100 were manufactured over a six-year period, and those that were not expended in training or lost due to accidents were later refitted as test platforms and target drones. A refurbished Cerberus hull sits in the front lobby of the Pentagon.

SIM-5 "Haven Farm" (2085?): The existence of the SIM-5 can only be inferred by the lack of an official AKV by that designation, and recently declassified information referring to a AKV not matching the capabilities of any other known system. It is suspected that the SIM-5 was part of a highly classified farsat system, and may still be in place in Cis-Lunar space.

SIM-7 *PREDATOR*-CLASS AKV

The Nanodynamics *Predator* is a highly successful design that is the standard by which all current AKVs are measured. The SIM-7 is based in part on exploitation of Chinese Gang Shou AKVs under the India Stone program (p. 00), as well as direct input from the USAF based on combat experience and simulations of future threats. Within a year and a half of the finalized design being approved by the USAF in 2080 the first production models were undergoing final assembly and fitting.

Since the Predator began full-scale production in 2092 it has entered service with the USAF, JSSDF, RNSS, Bundesraumwaffe, and Islandia. Other minor powers have acquired small numbers to augment cheaper AKVs – the cost for the Predator puts it out reach of most small space forces. Although replacement designs are now being considered, the aging fighter is still at the top of its game, and with upgrade refits it will probably remain in active service for another 10 years.

Although aesthetics were not technically a consideration in the design, the Predator's 37.5' long and 10' wide streamlined cylinder hull still manages to project subtle menace with its vague shark shape and smooth contours. Even the 16'¥16' radiator wings cause observers to compare it to a bird of prey as they are unfolded. The Predator was the first small military spacecraft to become well known outside military circles – it forms *the* image most individuals have when "AKV" is mentioned (even many Chinese citizens think the PLAN-SF uses Predators).

Usual payload consists of a single 10-shot munitions pack (usually XLMP with the USAF and ESCA, KKMP for others) but on occasion this is intentionally omitted for reconnaissance or patrol operations, raising the sAccel to 0.33, Burn Points to 2,970 and Delta-V to 9.075 mps. The design has 0.83 spaces remaining for future upgrades and additions.

Crew: Unmanned. Infomorph occupies the mainframe in the unmanned controls

Design: Streamlined cylinder hull (6 spaces, nanocomposite, extra-heavy frame, smart hull); cDR/cPF 70/5F, 10/1S, 20/2B (nanocomposite armor). Hull radiators (1 ksf), folding radiator wings (0.5 ksf). Chameleon surface.

Modules: New unmanned controls; small fixed ladar [F]; small PESA; 1 coilgun bay [F]; 2.5 compact HT fusion pulse drive; 1.5 tanks (ultralight, nuclear pellets).

Statistics: EMass 82; CMass 100; LMass 109. Cost M$31. cHP 84. Size Modifier [Hull] +2/+5, [Radiators] +3. HT 12. Maintenance Interval: 7.18 hours. RRA 1.5.

Performance: sAccel: 0.3 G. Burn Endurance: 2.5 hours. Burn Points: 2,700. Delta-V: 8.25 mps. No air speed.

Variant: Each production Predator belongs to a *Batch* (consisting of 4 identical AKVs, usually sold together) and what Nanodynamics refers to as a *Series*– a euphemism for "model." The latest Series is 3.1, with 3.2 undergoing company trials. Nanodynamics upgrades Predators to the most recent Series when they are returned for periodic overhauls. A few customers who could not afford the expensive maintenance/upgrade contract, or simply do not trust Nanodynamics, continue to use the original models. Due to the lack of upper-echelon maintenance these AKVs may have their HT permanently reduced by 1 or 2.

Before Series 1.3 the Predator was forced to use a larger fusion pulse drive (produced by NPO Chelomey-Machinostroenia) due to technological limitations, and was armored with metal matrix composite. Increase the size of the fusion pulse drive to 3.5 spaces and reduce the tanks to 1 space. Reduce armor to cDR/cPF 5/1S, 10/2B. EMass 117; CMass 132; LMass 138. Cost M$21.8. Maintenance Interval: 8.57 hours. sAccel: 0.27 G. Burn Endurance: 1.39 hours. Burn Points: 1,351. Delta-V: 4.128 mps.

Series 1.3 to 2.7 had the same drive (albeit with slightly larger tanks) but had refitted with nanocomposite plating (this extra cost was one reason it was not universally adopted). Increase the tanks to 1.5 space. EMass 85; CMass 103; LMass 112. Cost M$31.6. Maintenance Interval: 7.12 hours. sAccel: 0.35 G. Burn Endurance: 2.08 hours. Burn Points: 2,621. Delta-V: 8.008 mps. Unfortunately the larger tanks proved mechanically unreliable despite numerous engineering changes during this span, the GM may wish to reduce HT by 1.

Series 2.8 introduced the smaller fusion drive and reduce the fuel tanks to their current size. From Series 2.8 to 3.1 there were numerous minor engineering and technical changes that are below the resolution of Appendix A.

Series 3.2 incorporates some structural changes that will allow the drive and weapon system to be replaced with modular components – greatly decreasing maintenance turnaround times and supporting customizable mission packages.

Nanodynamics will soon offer a Predator variant, marketed as the *Colt*, aimed at attracting more buyers within ESCA and expanding space forces looking for a new intermediate AKV that does not make as many performance sacrifices as the Amazon (p. 00). Replace the coilgun bay with a 2.5-MJ light laser [F] and reduce the armor to 56/5F, 5/1S. Change the engine to 3 compact HI fusion pulse drive and reduce the tanks to 1 space. Add a 0.2 power pack (3 shots), recharged from the engine. Although not capable of the raw acceleration of the base Predator it is more efficient in long-range engagements and has expanded opportunities for recovery. cHP 42. EMass 70; CMass 76; LMass 82. Cost M$25.11. Maintenance Interval: 7.98 hours. sAccel: 0.24 G. Burn Endurance: 5.56 hours. Burn Points: 4,804. Delta-V: 14.678 mps.

The SAAF developed a one-shot prototype based on a damaged Predator frame it acquired from England. It is unclear what the SAAF intended the prototypes mission to be, but it's certainly one of the most unusual AKVs to have been built. Nicknamed "The Gunslinger" by Western media, the rebuilt AKV is based on a Series 2.9 frame, but with heavy modifications to account for the addition of a large railgun system. Reduce the drive to 1.5 spaces, the PESA becomes fixed [F], add a 0.1 cargo bay for 26 railgun shots and delete both the folding radiator wings and coilgun bay. The power system consists of a linked 0.2 power pack (good for one shot), recharged by a 0.3 battery and the pulse drive. Payload 0.28 tons. EMass 100; CMass 109; LMass 118. Cost M$36.64. Maintenance Interval: 6.61 hours. sAccel: 0.16 G. Burn Endurance: 4.17 hours. Burn Points: 2,402. Delta-V: 7.339 mps.

The Fate of Predator Prime

Predator Prime may have failed without any outside interference; other major AI projects have fallen apart with far less demanding goals. But it's interesting to note that an internal USAF audit after the program was shut down found a number of irregularities with both the mishandling of the Prime programming guidelines and the amazingly timely offering of the 174 Series just when the USAF needed it. It noted an unusual number of managers being hired by Nanodynamics subsidiaries after the project was terminated, some of whom now work on codebase improvements on the 174 and 176 Series. Of course, the company claims this is coincidence, and the USAF never pursued the matter. Who knows, maybe it was all perfectly innocent. But what's the fun in that?

-- Sopworth, tech.space.mil.usaf

By all accounts the development process and production of the Predator hardware was a textbook example of corporate and government cooperation. The software was another matter entirely.

The initial "Predator Prime" AI seeds were developed in-house by the USAF using the codebase from the AACDN-65N Hellhound AI. The intent was to reduce the aggressiveness of the original template while incorporating the latest algorithms from contemporary SAI templates to boost their intelligence and adaptability. The results were flawed, with mediocre intelligence and an unstable development path, resulting in a dangerous predilection towards rogue attributes (most notably a very low tolerance for what the AI deemed "unacceptable orders"). As delays mounted it became clear that the program would fail to produce an acceptable software package before hardware production started.

These difficulties resulted in the USAF shelving their entire AKV AI development program and accepting the Series 174 SAI from Military Data Systems as the Primary Control Component (PCC) for the Predator series. The Series 174 was a perfect fit for the Predator: adaptable, intelligent, and programmed with a bare minimum of legacy code. Even so, the lead-time required for proper AI training and acclimation meant that initially the USAF used "veteran" Hellhound AIs to drive the first batch of Predator AKVs.

SIM-8 *FALCON*-CLASS AKV

The Nanodynamics *Falcon* is the planned replacement of the Predator AKV, slated to begin production in 2105 – assuming the project survives a slowly building coalition in the Pentagon and Congress to kill it, and problems with the exceedingly small antimatter pulse drive. The USAF maintains it needs the Falcon to give it a further qualitative edge over its opponents, notably the PLAN-SF and the threat posed by Gypsy Angels in the Deep Beyond. Opponents cite the ruinous price for a supposedly expendable combat vehicle.

The Falcon is externally similar to the Predator with a 37.5' by 10' streamlined cylinder hull (for compatibility with existing vehicle bays and support equipment), but it lacks the distinctive folding radiator wings.

Crew: Unmanned. Infomorph occupies the mainframe in the unmanned controls

Design: Streamlined cylinder hull (6 spaces, nanocomposite, heavy frame); cDR/cPF 98/5F, 20/1S, 20/1B (diamondoid armor). Chameleon surface.

Modules: New unmanned controls; small fixed radar [F]; small PESA; 1 compact HT antimatter pulse drive; 2 tanks (ultralight, nuclear pellets); 0.0125 antimatter bay (0.0125 grams); 2 2.5-MJ light lasers [F]; 0.5 battery.

Statistics: EMass 95; CMass 107; LMass 119. Cost M$88.08. cHP 42. Size Modifier +2/+5. HT 12. Maintenance Interval: 4.26 hours. RRA 0.

Performance: sAccel: 0.13 G. Burn Endurance: 8.33 hours. Burn Points: 3,898. Delta-V: 11.912 mps. No air speed.

China

The reluctance of the Chinese political leadership to approve the use of Ghosts or SAIs in their autonomous weapon systems has proved to be a major stumbling block in their AKV research and development. Although high-end LAIs are almost as good, the analysis and information processing capabilities of the more advanced infomorphs is a significant combat asset in the modern space combat environment. The PLAN-SF has experience a series of extremely embarrassing encounters with modern American AKVs where their LAI-controlled systems come out a distance second. In the absence of a clear political will on the issue of sapient weapons the PLAN-SF has been forced to play it safe – developing a new generation of optimized LAI pilots while simultaneously hedging their bets by secretly funding combat SAI research.

Chinese AKVs are either referred to by their class designation or their development project title. Individual craft are designated in the same manner as surface naval vessels, with each chassis emblazoned with the letters PT (for torpedo boat) and an individual hull number. PLAN-SF personnel are rarely as sentimental with their AKVs as American or European crews, so nicknames and personalized markings are rare.

PLAN-SF AKV Designs

Taiko Ying (2050): The “Space Hawk” space-to-space weapon was unusual for its size – rivaling many modern USVs -- and ambitiousness. Although the projects budget was repeatedly cut and many of the lead engineers were moved to higher-priority projects, the final design proved remarkably capable (if excessive for its limited mission of near orbit-to-deep space interception). Lack of any doctrine for its use, and unwillingness by the PLAN-SF to seriously plan for a major deep space threat, left the design in limbo. The resulting fifteen production models were mothballed in 2060, but were quickly refurbished before the Pacific War. All were destroyed in the opening minutes of the conflict before they left their launch facilities.

Taiko Ying-2Y (2056?): This was the possible designation for at least one interim space intercept missile design deployed by the PLAN-SF for their orbital facilities (and later, on spacecraft such as the Shengzi-class (p. DB139)). There is considerable confusion as to what these systems capabilities were and their deployment. It is possible that there were actually multiple concurrent programs all using the same designation for cover. PLAN-SF records lack information on these programs, either from overzealous classification or data loss from the Pacific War. Interest in the TK-2Y was recently revitalized when it was revealed that at least two radical freeholds had acquired a stock of unidentified AKVs bearing Chinese manufacturing markings.

Project 80 (2064): Built in small numbers for PLAN-SF SDVs, the Project 80 was a repackaged farsat interceptor design that had been cancelled in 2060. PLAN-SF facilities were not provided with complete examples, they were shipped critical components and expected to locally minifacture those sections that were not economical to ship. Completely inadequate assembly instructions and lack of oversight by high command led to a situation where every facility and ship built their AKVs as they saw fit, making modifications and using whatever parts they could acquire. With the dubious distinction of having almost as many major variants as there were produced craft, the Project 80 quickly faded into obscurity after the introduction of the Gang Shou (see p. 00).

Yi Yang III-class AKV

The Yi Yang III (YY-3) was designed and built by Kaohsiung Shipyards, a small but politically connected company on Taiwan. Using their influence with the Central Military Commission and the PLAN, the company successfully created a contract for a large number of "advanced autonomous spacecraft" for the Space Forces. The company used the vague terms of the contract to fund its orbital construction yard and pay off old debts (both political and business related). Almost as an afterthought the company actually produced an AKV design.

The result of a shoestring budget and constantly shifting design guidelines, the first two models of the Yi Yang were completely unsuited for combat operations. Ironically, this resulted in new contracts to refit the Yi Yang to yet another set of specifications (this time handed down directly form the PLAN Space Forces). The Kaohsiung designers did the best with their limited resources, and produced a bizarre (if ingenious) refit package that resulted in a serviceable final product. The final Yi Yang III saw widespread deployment, but little actual use. Widespread rumors circulated within the PLAN-SF that the Yi Yang was built largely with compromised foreign off-the-shelf parts (not true) and dangerously unreliable (that part was true, unfortunately). The fact that individual craft were supplied in sealed launch bay systems and could not be closely inspected by local maintenance teams did little to help matters.

The Yi Yang is a 25' long by 15' wide unstreamlined cylinder with 22'¥22' radiator wings. Usual payload consists of a single 10-shot KKMP munitions pack and 24 tons of coolant fluid. Coolant endurance is 4 turns with radiators extended, 2 turns if they are retracted or damaged. Depending on the source of information, roughly eighty Yi Yang AKVs were constructed and deployed on various orbital facilities around Earth. Distrust in their capabilities and technical glitches meant that only a handful were actually used during the Pacific War, even fewer achieved any notable success.

Crew: Unmanned. Infomorph occupies the mainframe in the unmanned controls

Design: Cylinder hull (5.808 spaces, carbon composite, medium frame); cDR/cPF 30/10F, 5/1S, 5/1B (carbon composite armor). Hull radiators (1 ksf); folding radiator wings (1 ksf). Liquid-crystal skin.

Modules: Old unmanned controls; small fixed radar [F]; small fixed ladar [F]; 1 coilgun bay [F]; 4.5 compact HT fusion torch drive (water reaction mass); 1 tanks (ultralight, water); 2 tanks (ultralight, coolant fluid).

Statistics: EMass 131; CMass 172; LMass 180. Cost M$10.11. cHP 23. Size Modifier [Hull] +3/+4, [Radiators] +3. HT 12. Maintenance Interval: 6.29 hours. RRA 3.

Performance: sAccel: 0.12 G. Burn Endurance: 0.99 hours. Burn Points: 428. Delta-V: 1.307 mps. No air speed.

Variant: The original Yi Yang was plagued by massive heat dissipation problems, necessitating substantial radiator area. Further complications with this radiator design and their vulnerability in combat led to the compromise design shown above. Remove the coolant tanks and increase water tanks to 3 spaces. Increase radiator wings to 2.2 sf (24'¥24' each) and remove liquid-crystal skin. Even with the radiators extended the AKV will generate 0.8 heat per turn! Payload is 9.5 tons. EMass 132; CMass 164; LMass 187. Cost M$10.18. Maintenance Interval: 6.27 hours. sAccel: 0.12 G. Burn Endurance: 2.96 hours. Burn Points: 1,279. Delta-V: 3.907 mps.

Although the Yi Yang project was a debacle of epic proportions and, possibly, single-handily responsible for preventing the PLAN-SF from achieving a successful first strike on the TSA orbital assets, it is largely unknown outside of academic circles. The company and the PLAN-SF swept the entire thing under the rug during the postwar reconstruction, with a number of retiring PLAN Admirals receiving plush managerial jobs, and the shipyards receiving massive contracts for the Gang Lung SCV. You really have to respect a company with that kind of skill.

-- Yun Hsing, Chairman of Wilton-Lung Teh Aerospace

GANG SHOU-CLASS AKV

The *Gang Shou* ("iron hand") was the first AKV to be powered by an advanced fusion pulse drive, giving it a performance edge that was unmatched until the development of the SIM-7 Predator and the Zhengyang. It's technical sophistication was only matched by the difficulties with the drive system design, which resulted in production delays and a logistical nightmare for those vessels that received the initial, flawed, production models.

Designed almost entirely by a special projects team at Guangzhou Military College between 2070 and 2072, the Gang Shou (sometimes referred to as the Project 084) was accepted into PLAN-SF in 2074 and entered mass production a year later. The Gang Shou distinguished itself during the Pacific War, crippling or destroying the key TSA space defense platforms without endangering valuable SDV and SCV assets. Their presence and capability to perform short range patrol and strike missions freed up important PLAN-SF assets that were used to pursue TSA commerce raiders in the Deep Beyond. The PLAN-SF no longer uses the Gang Shou; the last surviving models that have not been sold off to South Africa and Russia are being stripped and converted into target drones.

The Gang Shou is a 27.5' long by 13' wide unstreamlined cylinder with 16'¥16' radiator wings. Usual payload consists of three KKMP munitions packs, totaling 28.5 tons. During the Pacific War, crafty engineers occasionally made use of the 0.39 spaces of empty volume for additional sensors, science packages, and even picosatellites. The onboard battery array can supply power to all systems for 240 minutes (4 hours), significantly longer if the radar is only used periodically. This gave the AKV a degree of "loiter" capability without using the pulse drive system for power.

Crew: Unmanned. Infomorph occupies the mainframe in the unmanned controls

Design: Cylinder hull (7.436 spaces, metal matrix composite, heavy frame); cDR/cPF 40/10F, 15/2S, 5/1B (metal matrix composite armor). Hull radiators (1 ksf); folding radiator wings (0.5 ksf). Liquid-crystal skin.

Modules: Old unmanned controls; medium fixed radar [F]; small fixed ladar [F]; small fixed PESA [F]; 1 coilgun bay [F]; 2 compact HT fusion pulse drive; 2 tanks (ultralight, nuclear pellets); 0.5 battery; 1 cargo (5 tons).

Statistics: EMass 148; CMass 188; LMass 200. Cost M$14.94. cHP 42. Size Modifier [Hull] +2/+4, [Radiators] +3. HT 12. Maintenance Interval: 6.29 hours. RRA 1.5.

Performance: sAccel: 0.13 G. Burn Endurance: 4.17 hours. Burn Points: 1,952. Delta-V: 5.963 mps. No air speed.

ZHENGYANG-CLASS AKV

The *Zhengyang* ("righteous energy") was designed to counter the increasingly sophisticated and capable AKVs that were developed after the Pacific War. Although the design goals were similar to those that resulted in the SIM-7 Predator, economic considerations and a pragmatic assessment of the PLAN Deep Space Fleet's requirements led to a simpler and more specialized vessel. Usually referenced as the Type 90, or Project 178, the Zhengyang is deployed in large numbers; estimates range into the several hundred.

Perhaps ironically, the Zhengyang is held in very low regard by many in the PLAN-SF. Although technically almost identical to the SIM-7, there is a pervasive feeling among many personnel that cost considerations and an unwillingness to utilize SAI operators hamstring the design. Incidents where American AKVs have outwitted and outmaneuvered Zhengyangs have been particularly embarrassing. On the other hand, most PLAN-SF personnel consider the Zhengyang much more rugged and survivable then the "delicate" Predator, and firmly believe that it's extra combat endurance could be a deciding factor if the control issue was addressed.

The Zhengyang is a 37.5' long and 10' wide cylinder hull with 16'¥16' retractable radiator wings. The design is not particularly notable in any way. If anything, the AKV looks pretty harmless. However, few outside the PLAN-SF or rival space forces have ever seen an actual Zhengyang; they are not exported and are rarely allowed to be filmed or even shown in the news (images of the Predator are often used as stand-ins in Chinese media).

Crew: Unmanned. Infomorph occupies the mainframe in the unmanned controls

Design: Cylinder hull (6 spaces, metal matrix composite, heavy frame); cDR/cPF 60/20F, 10/2S, 15/2B (metal matrix composite armor). Hull radiators (1 ksf), folding radiator wings (0.5 ksf). Chameleon surface.

Modules: Old unmanned controls; small fixed ladar [F]; small PESA; 1 coilgun bay [F]; 2.5 compact HT fusion pulse drive; 1.5 tanks (ultralight, nuclear pellets); 0.5 cargo (2.5tons).

Statistics: EMass 114; CMass 142; LMass 151. Cost M$14.9. cHP 41. Size Modifier [Hull] +2/+5, [Radiators] +3. HT 12. Maintenance Interval: 5.19 hours. RRA 1.5.

Performance: sAccel: 0.21 G. Burn Endurance: 2.5 hours. Burn Points: 1,890. Delta-V: 5.775 mps. No air speed.

Independent

AMAZON-CLASS AKV

The Duncanite firm Liang Mountain originally marketed the Amazon as a point-defense vehicle, but strong demand from independents (mainly corporations) and the smaller space forces has made it the most common AKV in use outside of the USAF and PLAN-SF.

Although not a *direct* copy of the Predator, the Amazon bears an uncanny likeness due to the requirement to use the same launch bays and facilities. It is a 37.5' long unstreamlined cylinder that measures 10' wide. The 16'¥16' radiator wings and many of the internal components (notably the pulse drive) are interchangeable with a Predator.

Crew: Unmanned. Infomorph occupies the mainframe in the unmanned controls

Design: Cylinder hull (6 spaces, metal matrix composite, extra-heavy frame, smart hull); cDR/cPF 60/20F, 5/1S, 5/1B (metal matrix composite armor). Hull radiators (1 ksf), folding radiator wings (0.5 ksf). Chameleon surface.

Modules: Old unmanned controls; small fixed ladar [F]; small PESA; 1 coilgun bay [F]; 2.5 compact HT fusion pulse drive; 1.5 tanks (ultralight, nuclear pellets).

Statistics: EMass 81; CMass 100; LMass 109. Cost M$13.1. cHP 82. Size Modifier [Hull] +2/+5, [Radiators] +3. HT 12. Maintenance Interval: 11.05 hours. RRA 1.5.

Performance: sAccel: 0.3 G. Burn Endurance: 2.5 hours. Burn Points: 2,700. Delta-V: 8.25 mps. No air speed.

Variant: Liang Mountain is willing to produce variants on request from its customers if it proves economically feasible and does not overload their design teams (usually requires a bulk order of 10 or more AKVs). Customers are also free to modify their Amazons as they wish, as there are no major IP issues that the Duncanites enforce and they can still maintain all but the most bizarrely modified examples.

One of the most common variants is the *Amazon Explorer* space reconnaissance vehicle. The Explorer uses a lighter frame, less armor, better sensors, and a larger fuel tank. Decrease frame weight to medium, reduce front armor to 10/2F, replace small PESA with a medium PESA, delete coilgun bay, replace HT drive with a HI fusion pulse drive, increase tanks to 2 spaces. EMass 67; CMass 79; LMass 91. Cost M$11.82. Maintenance Interval: 11.63 hours. sAccel: 0.19 G. Burn Endurance: 13.33 hours. Burn Points: 9,118. Delta-V: 27.86 mps.

WASP-CLASS AKV

The Wasp is a small defense platform that uses the same basic hull as the popular Bumblebee workpod (p. SSS7). The Wasp is a simple sphere 15’ in diameter, with two solar panel arrays measuring 16’¥16’ on each side. The AKV receives targeting cues over a datalink, then powers up its own radar for final target engagement. Due to the limited operating time of the batteries (10 hours without firing the laser) the Wasp spends most of its time in low-power hibernation, recharging.

Crew: Unmanned. Infomorph occupies the mainframe in the unmanned controls

Design: Sphere hull (3.375 spaces, foamed alloy, light frame); cDR/cPF 1/1F, 1/1S, 1/1B (titanium alloy armor). Liquid-crystal skin.

Modules: Old unmanned controls; small radar; 0.25 compact fission drive (water reaction mass); 1.7 tanks (ultralight, water); 225-kW air-defense laser [F]; 0.5 ksf solar panels (0.04 MW); 0.5 battery.

Statistics: EMass 26; CMass 38; LMass 51. Cost M$3.32. cHP 5. Size Modifier +3. HT 12. Maintenance Interval: 10.97 hours. RRA 0.

Performance: sAccel: 0.79 G. Burn Endurance: 0.08 hours (4.8 minutes). Burn Points: 228. Delta-V: 0.695 mps. No air speed.

SM-X *HOTARU*-CLASS AKV

The Hotaru (Japanese for "Firefly") is a prototype autonomous kinetic-kill weapon developed as a joint project funded by the USAF and JSSDF. It uses a small metallic hydrogen rocket to propel the small 6 ton craft at almost 7 G's for 3 minutes – giving it sufficient kinetic energy to cripple or damage far larger vessels.

Each Hotaru "can" is a cylinder 10' long and 5' wide. 75% of the craft is a fuel tank for the metallic hydrogen rocket.

Crew: Unmanned. Infomorph occupies the tiny computer in the control section.

Design: Cylinder hull (0.4 spaces, nanocomposite, extra-frame); cDR/cPF 20/2F, 1/1S, 1/1B (nanocomposite armor). Chameleon surface.

Modules: Special controls (see box); very small fixed ladar [F]; very small fixed PESA [F]; 0.1 compact stablized metallic hydrogen rocket; 0.3 tanks (ultralight, SLMH).

Statistics: EMass 3; CMass 4; LMass 6. Cost M$0.53. cHP 12. Size Modifier -1/+2. HT 12. Maintenance Interval: 27.38 hours. RRA 0.

Performance: sAccel: 6.85 G. Burn Endurance: 0.05 hours (3 minutes). Burn Points: 1,233. Delta-V: 3.768 mps. No air speed.

Variant: Various ratios of fuel vs. thrust are all being tested, the values listed above just happen to be one that gives an acceptable set of statistics for both the Japanese and American researchers. Current discussions center on the level of armor protection that should be applied, the length to width ratio, and different construction materials to bring down the cost.

Hotaru Controls

The controls for the Hotaru are a "zero-space" system. Components included are a tight-beam long-range radio, long-range laser, inertial navigation system, IFF, precision navigation instruments, and a Complexity 6 tiny computer (genius). 0.05 tons, M$0.03.

Exotic Designs

Plasma Combustion AKV

This is an example AKV of the same dimensions as the Predator AKV – a streamlined cylinder 37.5' by 10'. The unfolded radiator wings measure 32'¥32'. Usual payload is 9.5 tons (one munitions pack, either KKMP or XLMP).

Crew: Unmanned. Infomorph occupies the mainframe in the unmanned controls

Design: Streamlined cylinder hull (6 spaces, nanocomposite, extra-heavy frame, smart hull); cDR/cPF 70/5F, 10/1S, 10/1B (nanocomposite armor). Hull radiators (1 ksf), folding radiator wings (2 ksf). Chameleon surface.

Modules: New unmanned controls; small fixed radar [F]; small fixed PESA [F]; 3 compact plasma combustion drive; 0.5 tanks (ultralight, hydrogen); coilgun bay [F]; 0.4 new RTG (4 MW).

Statistics: EMass 92; CMass 101; LMass 102. Cost M$35.69. cHP 84. Size Modifier [Hull] +2/+5, [Radiators] +5. HT 12. Maintenance Interval: 6.7 hours. RRA 4.5.

Performance: sAccel: 0.35 G. Burn Endurance: 22.22 hours. Burn Points: 27,997. Delta-V: 85.547 mps. No air speed.

Plasma Combustion Transport

This is an example transport vessel that can travel from Earth to Saturn in 26 days. The design is a cylinder 240' long by 50' in diameter. The large radiator wings measure 200'¥200'. Usual payload is 1,111 tons, including 100 tons of carried craft. There are 6.9 spaces available for additional upgrades or modification.

Crew: Commander/Pilot (Leadership, Piloting (High-Performance Spacecraft)); Navigator/Co-Pilot (Astrogation, Electronics Operation (Communications), Electronics Operation (Sensors)); Ship's Doctor (Diagnosis, Physician); Engineer (Administration, Mechanic (Plasma Drive), Mechanic (Robotics), other Mechanic as appropriate); Stewards (Diplomacy, First Aid, Savoir-Faire); Recreation (Erotic Art, Performance).

Design: Cylinder hull (960 spaces, titanium alloy, heavy frame); cDR/cPF 5/2F, 2/1S, 1/1B (foamed alloy armor). Hull radiators (30 ksf), radiator wings (80 ksf).

Modules: New basic bridge; medium PESA; medium radar; 100 plasma combustion drive; 500 tanks (hydrogen); 16 new fusion reactor (108 MW); 2 2.5-MJ light laser towers [S]; 50 cabin; 2 bunk room; 2 hall; small entry module; 2 large entry module; minifac workshop; surgery; spacedock hangar (55’ long, 20’ wide, 25’ high; 55 spaces); 1 battery; 200 cargo (500 tons).

Statistics: EMass 3,177; CMass 4,538; LMass 4,788. Cost M$314.54 cHP 1,272. Size Modifier [Hull] +6/+10, [Radiators] +9. HT 12. Maintenance Interval: 1.13 hours. RRA 106.

Performance: sAccel: 0.18 G. Burn Endurance: 1,000 hours. Burn Points: 648,000. Delta-V: 1,980 mps. No air speed.

SHIPBUILDING

The placid face of the man in front of Dr. Emil Basara never wavered. Well, not a man exactly, an infomorph in last years Prometheus-model cybershell, with a few tasteful additions -- chromed eyes and fashionable twitch in the left hand Just fancy enough to make it known the user was wealthy, understated enough to pass without much notice in this area of Tokyo.

"So let me get this straight, you want to contract me to design a fission-ram powered subfighter? And it's got to be able to supercavitate at 500 atmospheres."

"Only 400 atmospheres, actually," the man interjected. "We've forwarded you the preliminary specifications and requirements for the project."

"You must be joking. Especially with the size limits you've given me. Well, that and the fact that even the TSA doesn't sell fission rams suited for submersibles."

"No joke Dr. Basara. My employers have concluded you're one of the few naval architects with the skill to conclude such a project."

And one of the few desperate enough for money to accept work on something like this, Basara thought to himself. He had kept one step ahead of his former business partners for two months now, but he knew he didn't have much time left - they were the kind of people who had a long memory.

"I'm not a mercenary." He hoped he sounded convincing.

"Oh, of course not Dr. Basara." The fake man lied.

The resources required to design and construct a modern space vessel are no less immense in 2100 as they were in the 1960s. Even after a hundred years in space the process is as much art as science, with the relentless advance of technology constantly pushing the boundaries of the various naval design studios capabilities.

The cost of good design talent (both digital and organic!) and the computer resources required to draw up new designs means that most vessels are based on existing designs rather then completely new hulls. There is a wide degree of variation allowed however, and customers often request custom modules and fittings for their vessels. Minifacturing and nanotechnology mean that no two vessels are necessarily carbon copies of each other, and even military vessels can vary in specific layout.

Variations to a basic hull design including changes in frame strength, armor, surface features, and interior modules. Modifications to hull size, drives, reactors, and command modules often require extensive redesign work and are usually only done after a steep markup (typically an additional 20-40% over the difference in component prices).

Notable Design Bureau: NPO Nakidka

Meaning “cloak” in Russian, this small design group is as secretive as their name implies. They occasionally publish articles in various engineering and scientific journals but their profile was very low until 2099, when a press exposé revealed that the company designed the penaid suite for the controversial Chinese kinetic bombardment system used during the Pacific War. Little is known of their current projects, although recent rumors hint at a revolutionary new implementation of plasma stealth technology. The main office in Moscow officially employs 20 individuals and several informorphs. Most of their workforce is officially classed as “contractors.”

DESIGN

Designing a new space vessel, even a simple moon hopper, typically involves an entire design crew of up to a dozen engineers assisted by LAIs. Characters typically do not have the luxury of dedicated computer simulations or facilities for rapid prototyping small-scale engineering mockups. However, the large degree of modularity in modern vessel designs has drastically simplified the design process, making it not unheard of for small startups to produce truly groundbreaking designs.

This process *requires* a shipbuilding program! This program is treated as a Skill Set (pp. TS144-145) with a minimum Complexity of (desired hull spaces/1000). Use the *New Invention* rules on p. B186, with these changes. The skill required is always Engineering. Truly massive engineering projects, such as colony or large habitat design, are generally outside the scope of these rules.

The *conception roll* is at -15 for a completely new design, or -10 for a variant of an existing design, If the shipbuilding program is not of the minimum Complexity, also assign a penalty equal to twice the difference between what is required and what is used. Failure means the process must start over, a critical failure means the design has errors that escape the designer’s attention! Success means a *working model* can be started.

The *working model* represents the CAD/CAM and simulation testing of the design. This requires a computer with enough storage space to hold the entire design file and its backups, typically a TB for every M$ the design is expected to cost. This roll is made with the same modifiers as for the conception roll. Time required is at least one week per 10 spaces of the final design. A success creates a working blueprint file, a failure means more work is needed (roll again in 1 week), and a critical failure means the final design fails spectacularly at the wrong time or develops major bugs (see p. VE198). If there was also a critical failure during the conception roll the vessel will likely prove to be a colossal embarrassment to all involved.

Hiring a design team to draw up vessel plans is a possibility, there are dozens of independent firms capable of performing the work required. The time to finalize a design from initial concept to a completed database is sqrt(final cost in M$) weeks. Complex designs, or those drawn up by less capable firms, may require additional time at the GM's option. The fee is usually M$0.01 per space of the final design, rush jobs cost a lot more. Design firms usually reserve the right to use the database in future work or in advertising, double the price if the customer does not allow this. On the plus side there is typically a smaller chance of major design errors, the GM should make a single Engineering roll based on the effective skill of the entire design team (typically at least 14).

Ship Quirks

Design errors or simply wear-and-tear may result in a vessel developing various problems.

Lemons: Various flaws a vessel could have are listed on pp. VE198-199 and are appropriate for vessels in bad shape (see *Buying it Used*, p. TS190) and those with simply designed badly.

Design "Features": In extreme cases the vessel may actually have Disadvantages like a cybershell. Appropriate Disadvantages include *Primitive* for ships that require rare parts no longer manufactured, *Unluckiness* for a ship plagued by odd problems, *Stubborness* for a difficult-to-repair vessel (-1 to all jury-rigging attempts). Or even *Pyromania* for a vessel with extremely ineffective fire-control systems (vessel HT roll to see if fire suppression system works). Obviously some Disadvantages will be more logical then others, as a general rule the various Racial Disadvantages are not appropriate.

CONSTRUCTION

Once a design database is in hand actual construction can start. If the design is expected to be mass-produced a half or quarter-scale prototype will be constructed in order to work out any unforeseen design problems (see p. VE201 for using prototypes).

Most spacecraft are assembled entirely in orbit or deep space, with the majority being produced above Earth, Mars, and in the Main Belt. Small shipyards capable of building smaller vessels (typically 50 spaces or less) are found at most habitats, and it is even possible for vessels to be manufactured on a planets surface and shipped into orbit via spaceplane, magnetic catapult, or beanstalk for final assembly.

The usual time to build a vessel is [volume (in spaces)/10] days. This will produce the basic hull including weapons, armor, bridge, and reactors. Living quarters, sensors, full life support, and other internal fittings typically require another two weeks at a minimum. GMs may rule that vessels based on extremely common and well-known designs such as the *Sudbury* require only three-quarters the usual time. Also at the GM's discretion the PC's may spend extra money to reduce the time to build the vessel, this will typically require positive reaction modifiers from the personnel in charge of the shipyard and may require outright bribery or special favors.

Cost is equal to the design cost of the vehicle plus yard costs (typically 20% of the entire cost of the design). Some yards demand that this fee be paid in advance. The construction costs can be reduced through *salvage*.

Salvage

Other vessels may be scavenged for parts. As a general rule it takes 30 minutes per ton of the module being salvaged and requires a skill roll just like a damage control attempt (p. TS200) but with an additional +3. Success salvages the module but failure damages it -- make another repair attempt at -6 to see if the module is still usable. Entire hulls may also be salvaged, typically this is done by attaching drives and a small command module and moving the entire hulk to a shipyard for disassembly. Salvaged modules only count for 1% of their "list" price for determining shipyard costs, assuming they are essentially "dropped in" to the hull without otherwise being repaired.

Archaic ship designs that have been mothballed can also be salvaged. GMs wishing to represent this are encouraged to design TL7 or 8 modules to simulate the old technology.

APPENDIX A

This appendix provides additional options for the modular design systems of ***Transhuman Space***, including the WVMDS and AVMDS.

Space Drives

ANTIMATTER PLASMA DRIVE

A high-performance drive that uses the annihilation of a miniscule quantity of matter and antimatter to heat reaction mass. Antimatter drives are very efficient, but outrageously expensive to operate. The primary designers of antimatter plasma drives are Columbia Aerospace, Eurospatiale Industries and Nanodynamics Space Systems.

NUCLEAR PULSE DRIVE

A crude precursor to the modern generation of fusion pulse drives.

PLASMA COMBUSTION DRIVE

This represents a variety of cinematic fusion drives that converts a small quantity of hydrogen to a plasma state and accelerates it in a stream to generate thrust. They can be used to model the various plasma drives often seen in science fiction, such as ***Blue Planet*** and ***Jovian Chronicles***.

Space Drive	Thrust	Mass	Cost	Output	Power	RMC	ISP
Antimatter Plasma	16	4	4	4	0	0.18W*	21,333
Nuclear Pulse							
-- high-thrust (HT)	25	4	0.8	0	0	0.7N	1,370
-- high-impulse (HI)	12.5	4	0.4	0	0	0.175N	5,485
Plasma Combustion	8	2	2	0	1	0.005H	6,000,000

* Antimatter Plasma drives also require 0.35 grams of antimatter per space per hour.

Heat: Antimatter Plasma and Plasma Combustion drives have an RRA of 1 per space of drive.

Power Plants

MAGNETO-HYDRODYNAMIC (MHD) TURBINES

Useful for spacecraft with periodic power requirements. Liquid Oxygen (LOX) has a mass of 16, and a cost of $0.0003M.

System	Output	Mass	Cost	RMC
Old MHD	8	4	0.3	0.48H + 0.24LOX
Old HP MHD	20	4	1.6	1.35H + 0.675LOX
New MHD	8	4	0.16	0.43H + 0.21LOX
New HP MHD	20	4	0.6	1.2H + 0.6LOX

Spacecraft Design Options

SURFACE INSTALLATIONS

Installations may be installed on the surface of asteroids or other bodies, rather than tunneled into them. To design a building, simply create it like a manufactured hull of the appropriate shape and dimensions using the Spacecraft Design rules

Most buildings are boxes, but spheres are also very common, buried in regolith or ice so that the upper half protrudes as a dome. Cylinders can represent tall towers. Each "story" is usually 10-15' high, so a 10-story building would be a box or cylinder 100-150' high. Hull materials in the Deep Beyond are usually steel or carbon composite. A building will normally have a light frame and slag or steel armor (as little as cDR 0.1).

No components are required -- a building may be a complete base with its own bridge, power plant, sensors, and quarters, or a simple warehouse or storage tank. Common structures found on asteroid and other small bodies include:

Cranes: A box hull of the desired height housing a robot arm.

Landing Pad: landing pad and associated docking facilities is best modeled as an external cradle. Assume it has no cDR and cHP equal to area/4.

Storage Tanks: Typically built as a spherical hull containing a light tank. Assumed to include appropriate pumping and pipe facilities in the weight and cost.

Control Towers: Usually built as a box hull, cylinder or sphere hull with sensors, communicators (see p. TS:HF00) or (sometimes) a control station and entry module.

Power Stations: Usually built as a box hull or sphere hull with power plant and radiators. Solar power should use solar panels or folding panels, and needs no hull.

Warehouses: Typically built as a box hull or sphere hull, with an entry module if it's supposed to be pressurized.

It's rarely necessary to calculate how much area a building will require if the total amount of built-up area is relatively small compared to the size of the moon or asteroid in question.

If characters do plan a lot of development on a small body or limited area of one, its surface can be found as if it were a roughly spherical or cylindrical hull of the appropriate dimensions as per p. TS173. The area taken up by each surface installation is found with the rules for *Combination Manufactured Hulls,* p. TS175 (treating the main body as the larger hull and the installations as sub-hulls) or surface features (p. TS186), as appropriate.

OLD WVMDS VEHICLES

Old or New Vehicle?

Decide what the purpose of the vehicle will be, and whether it is built using older technology, or newer state-of-the-art tech. Older vehicles will be considerably heavier and not as sophisticated, but can be bought cheaply at used-car prices. For those components that come in old and new versions, parts of different technological sophistication may not be mixed in the same vehicle.

The weights and "old" costs in the tables below are for a medium, standard, TL8 frame, which is assumed to be aluminum. From that point, the WVMDS diverges from the system presented on pp. VE18-19. A given material is assumed to have constant weight across TLs, and to halve cost at each TL. This closely matches the table on p. VE19.

Structures: Nanocomposite and diamondoid are *unavailable* for old vehicles. In addition, *double* the cost of any old structures. This includes bodies, wheels and turrets.

Armor: Note that armor does not change weight, but the price per pound can be considerably higher (see p. 00).

Wheel Options: Double the cost of improved brakes, all-wheel steering, or smartwheels on older vehicles.

Track Options: Double the cost of smart-tracks on older vehicles.

Components: Most components are unchanged by using old technology. The exceptions are noted below. Unless they are listed below all components are considered to be identical for both "old" and "new" technology.

Final Price: For older vehicles, this is the price of the vehicle when it was new; as of 2100, it can be bought for 20% of this cost. Calculate maintenance interval using the original "as new" pricing.

Mechanical Controls

A WVMDS vehicle that does not purchase computerized controls (p. ITW127) saves money, but reduce gMR by 0.25.

Non-Robotic Structure

All ***Transhuman Space*** vehicle structures are, by default, robotic. That is, they incorporate all of the necessary systems to be operated entirely by remote control. This is a feature of the setting and all but the most incredibly antique vehicles can be controlled by infomorphs or via telepresence. This option may *not* be "bought-off."

Old Sensor Suites

Light Sensor Suite: A small PESA and low-res imaging radar in one package, suitable for most off-road civilian vehicles. In older vehicles, the PESA has a 10-mile range with Scan 17, and the radar has a 2-mile range with Scan 13.

Medium Sensor Suite: An upgraded set of sensors, designed for light combat vehicles and some scientific missions. In older vehicles, the PESA has a 30-mile range with Scan 20, and the radar has a 20-mile range with Scan 19.

Heavy Sensor Suite: A heavy set of sensors intended for combat vehicles. In older vehicles, the PESA has a 90-mile range with Scan 22, and the radar has a 150-mile range with Scan 24.

Old Surface Features

Chameleon System: This feature combines liquid crystal skin with sensors that scan the surroundings, and change the skin to match. In old vehicles, it gives -3 (-1 if moving) to be visually spotted or hit, or detected by ladar.

Radical Emission Cloaking: This masks the vehicle's heat, magnetic, and millimetric emissions. On old vehicles, it imposes a –8 penalty on rolls to detect the vehicle with non-optical passive sensors.

Old Environmental Modules

Type	Tech	VSP	Wt.	Cost	Power
NBC Kit	Old	0.04	10	$2,000	0.25
Limited Life System	Old	0.6	150	$500	*
Full Life System Core	Old	5	2,000	$5,000	0
Full Life System Slice	Old	5	500	$500	10

Old Communications Modules

Type	Tech	VSP	Wt.	Cost	Power	Range
Medium-Range Radio	Old	0.01	1	$200	0.01	100
Long-Range Radio	Old	0.04	10	$600	0.04	1,000
Laser Comm	Old	0.4	100	$7,500	0.4	2,000

Old Sensor Modules

Type	Tech	VSP	Wt.	Cost	Power	Range	Scan
				Sensor Suites			
Simple Sensor Package	Old	0.01	0.2	$640	neg.	1	11
Light Sensor Suite	Old	0.05	12	$26,000	1	*	*
Medium Sensor Suite	Old	0.5	116	$244,000	10	*	*
Heavy Sensor Suite	Old	5	1,230	$2,050,000	113	*	*
				Individual Sensors			
Small Ladar or LRIR	Old	0.05	12	$15,000	3	3	14
Medium Ladar or LRIR	Old	0.5	120	$150,000	30	30	20
Large Ladar or LRIR	Old	5	1,250	$625,000	313	175	24
Small PESA	Old	0.05	13	$50,000	neg.	15	18
Medium PESA	Old	0.5	113	$450,000	neg.	55	21
Large PESA	Old	5	1,250	$2,000,000	neg.	175	24

Old Navigation and Combat Modules

Type	Tech	VSP	Wt.	Cost	Power
INS	Old	0.08	20	$25,000	neg.
HUDWAC	Old	0	0	$500	neg.
Jammer	Old	0.8	200	$40,000	1,000

Old Arm Modules

Type	Tech	Area	Weight	Cost	Power	HP	Size	Reach	Volume
ST 10 Arm	Old	1.5	8.5	$23,000	0.05	18	-4	1	0.08
ST 100 Arm	Old	6	58	$140,000	0.5	72	-2	2	0.8
ST 1,000 Arm	Old	24	480	$1,100,000	5	288	+0	5	8

Miscellaneous Old Modules

Type	Tech	VSP	Wt.	Cost	Power
Bore	Old	4	500	$400	1
Fuel Electrolysis System	Old	2	200	$10,000	560

Old Fuel-Burning Engine Modules

Type	Tech	VSP	Wt.	Cost	Power	Fuel
MHD Turbine Core	Old	0.36	45	$1,800		
MHD Turbine Slice	Old	0.2	25	$1,000	25	5H (+ 2.5L)
Fuel Cell Core	Old	0.2	25	$125		
Fuel Cell Slice	Old	0.4	50	$250	10	1.3H (+ 0.65L)

Old Nuclear Power Plant Modules

Type	Tech	VSP	Wt.	Cost	Power	Lifespan
Radiothermal Generator Core	Old	0.8	200	$10,000	0	14 years
Radiothermal Generator Slice	Old	0.4	100	$5,000	10	14 years
Fission Reactor Core	Old	32	4,000	$600,000	0	2 years
Fission Reactor Slice	Old	0.4	28	$4,800	12	2 years

Old Armor

Type	Old C
Cheap Steel	0.5
Steel	1
Aluminum	2
Titanium	4
Foamed Alloy	6
Carbon Composite	30
Metal-Matrix Composite	100

Old Surface Features

Feature	Tech	Weight	Cost
Sealing	Old	0	$20
Chameleon System	Old	0.4	$80
Radical Emissions Cloaking	Old	4	$3,000

WVMDS Design Options

In addition to wheeled vehicles and walkers (pp. DB00-00), the WVMDS can be used to design vehicles with tracks and ground-effect skirts.

Tracked

The vehicle has caterpillar tracks rather than wheels. The tracks, running gear and suspension are a single subassembly; decide if this represents one or two sets of tracks.

GEV Skirt

This is a hovercraft, or air-cushioned vehicle (ACV), option that makes more efficient use of the lift generated by lift fans.

Tracks and GEV Skirts

Body	VSP	Area	Weight	Cost	Total HP	Size
Tiny	3	40	160	2000	60	+1
Very Small	6	60	240	3000	90	+1
Small	12	100	400	5000	150	+2
Midsize	18	125	500	6250	188	+2
Large	30	175	700	8750	263	+3
Extra Large	60	300	1200	15000	450	+3
Very Large	120	500	2400	30000	750	+4
Huge	300	800	6000	75000	1200	+5
Immense	600	1500	12000	150000	2250	+5

VSP: This is the subassembly volume, used when calculating the total size of the vehicle. Components may not be installed in either tracks or GEV skirts.

HP: Divide by number of tracks (2 or 4). There may only be one GEV skirt.

Track Options

Track options add cost, but not weight.

Improved Suspension: An improved suspension increases top ground speed and overall ground maneuverability and stability. The cost is $100 times the track area.

Smart-tracks: The cost is $40 times track area, minimum $2,000.

Tracked Drivetrains

This drivetrain is required for tracked vehicles. Each module provides 20-kW of motive power.

Tracked Drivetrain Modules

Type	Tech	VSP	Wt.	Cost	Power
Tracked Core	Both	2.4	60	$1,200	--
Tracked Slice	Both	0.96	120	$2,400	20

Performance of Tracked Vehicles

Speed and gAccel: Use a speed factor of 12 for tracks. Add +1 if it has smart-tracks.

gDecel: This is 20 mph/s for tracks.

gMR and gSR: Use the table below:

Tracked gMR and gSR

Body Type	gMR	gSR
Tiny	0.75	3
Very Small - Small	0.5	4
Midsize - Large	0.5	5
Extra Large - Huge	0.5	6
Immense	0.25	6

Improved suspension adds 0.25 to gMR and +1 to gSR.

Ground Pressure and Off-Road Speed: Determine the tracked vehicles ground pressure by dividing loaded weight in pounds by total track area, and multiplying by 5. Consult the table below with the result. Remember that loaded weight varies by local gravity.

Tracked Ground Pressure

Ground Pressure	Description	Speed
150 or less	extremely low	full
151-900	very low	4/5
901-1,800	low	2/3
1,801-2,700	moderate	½
2,701-7,500	high	1/3
7,501-15,000	very high	¼
15,001 or more	extremely high	1/6

APPENDIX B: AERIAL VEHICLE MODULAR DESIGN SYSTEM

The demonstration that no possible combination of known substances, known forms of machinery and known forms of force, can be united in a practical machine by which men shall fly along distances through the air, seems to the writer as complete as it is possible for the demonstration to be.

– Simon Newcomb, 1900

The system presented here is based on ***GURPS Vehicles,*** *Second Edition* – tailored for designing aircraft in the ***Transhuman Space*** universe.

Starting Out

This system measures volume in VSPs (vehicle spaces) of 5 cubic feet; 1% of a spacecraft 500-cubic-foot Space. Weight is measured in pounds. Cost is in dollars. Surface area is in square feet (sf). Power requirements are in kilowatts (kW) and most fuel requirements are in gallons per hour (gph).

Step 1: Concept

At this stage it is important to decide what the purpose of the aircraft is, how large it should be to perform the mission, and a rough budget.

Step 2: Pick an Airframe

This table offers a number of common airframe sizes.

No Wings or Rotors

If the aircraft *lacks* wings or rotors (making it a flying brick) then divide chassis, landing gear and subassembly pod cost by 10.

Landing Gear

If the aircraft has landing gear then decide if it is nonretractable, retracts into the body, or retracts into the body and wings. This landing gear can represent either wheels or skids. Divide the HP between the number of wheels or skids.

Nonretractable: Note that the landing gear surface area will add to aerodynamic drag.

Retracts into Body: Subtract the listed landing gear VSP from the chassis.

Retracts into Body and Wings: Subtract 1/3 of the landing gear VSP from the chassis and 2/3 from the wings.

Chassis	VSPs	Area	Weight	Cost	HP	Size
Small Hobbyist	4	45	180	$22,500	68	+1
-- Landing Gear	(0.3)	6	24	$3,000	18	-2
-- Standard Wings	0.4	30	120	$150,000	23	-1
-- High Agility or STOL Wings	0.4	40	160	$20,000	30	-1
-- Rotors	0.08	9	36	$4,500	14	-2
Medium Hobbyist	8	70	280	$35,000	105	+2
-- Landing Gear	(0.6)	10	40	$5,000	30	-1
-- Standard Wings	0.8	45	180	$22,500	34	+0
-- High Agility or STOL Wings	0.8	60	240	$30,000	45	+0
-- Rotors	0.16	15	60	$7,500	23	-2
Large Hobbyist	12	90	360	$45,000	135	+2
-- Landing Gear	(0.9)	12	48	$6,000	36	-1
-- Standard Wings	1.2	60	240	$30,000	45	+0
-- High Agility or STOL Wings	1.2	80	320	$40,000	60	+0
-- Rotors	0.24	21	84	$10,500	32	-1
Small Light Aircraft	16	110	440	$55,000	165	+2

-- Landing Gear	(1.2)	15	60	$7,500	45	+0
-- Standard Wings	1.6	72	288	$36,000	54	+0
-- High Agility or STOL Wings	1.6	96	384	$48,000	72	+0
-- Rotors	0.32	24	96	$12,000	36	-1
Medium Light Aircraft	24	145	580	$72,500	218	+3
-- Landing Gear	1.8	20	80	$10,000	60	+0
-- Standard Wings	2.4	93	372	$46,500	70	+1
-- High Agility or STOL Wings	2.4	124	496	$62,000	93	+1
-- Rotors	0.48	33	132	$16,500	50	-1
Large Light Aircraft	32	175	700	$87,500	263	+3
-- Landing Gear	(2.4)	24	96	$12,000	72	+0
-- Standard Wings	3.2	114	456	$57,000	86	+1
-- High Agility or STOL Wings	3.2	152	608	$76,000	114	+1
-- Rotors	0.64	39	156	$19,500	59	+0
Small Aircar	40	205	820	$102,500	308	+3
-- Landing Gear	(3)	28	112	$14,000	84	+0
-- Standard Wings	4	132	528	$66,000	99	+1
-- High Agility or STOL Wings	4	176	704	$88,000	132	+1
-- Rotors	0.8	45	180	$22,500	68	+0
Medium Aircar	52	245	1,040	$130,000	368	+3
-- Landing Gear	(3.9)	33	132	$16,500	99	+1
-- Standard Wings	5.2	159	636	$79,500	119	+1
-- High Agility or STOL Wings	5.2	212	848	$106,000	159	+1
-- Rotors	1.04	54	216	$27,000	81	+0
Large Aircar	64	280	1,280	$160,000	420	+4
-- Landing Gear	(4.8)	38	152	$19,000	114	+1
-- Standard Wings	6.4	180	720	$90,000	135	+2
-- High Agility or STOL Wings	6.4	240	960	$120,000	180	+2
-- Rotors	1.28	63	252	$31,500	95	+0

Small Airvan	80	325	1,600	$200,000	488	+4
-- Landing Gear	(6)	44	176	$22,000	132	+1
-- Standard Wings	8	210	840	$105,000	158	+2
-- High Agility or STOL Wings	8	280	1,120	$140,000	210	+2
-- Rotors	1.6	72	288	$36,000	108	+0
Medium Airvan	100	380	2,000	$250,000	570	+4
-- Landing Gear	(7.5)	51	204	$25,500	153	+1
-- Standard Wings	10	243	972	$121,500	182	+2
-- High Agility or STOL Wings	10	324	1,296	$162,000	243	+2
-- Rotors	2	84	336	$42,000	126	+0
Large Airvan	140	475	2,800	$350,000	713	+4
-- Landing Gear	(10.5)	64	256	$32,000	192	+2
-- Standard Wings	14	306	1,224	$153,000	230	+2
-- High Agility or STOL Wings	14	408	1,632	$204,000	306	+2
-- Rotors	2.8	105	420	$52,500	158	+1
Small Airbus	200	600	4,000	$500,000	900	+4
-- Landing Gear	(15)	81	324	$40,500	243	+2
-- Standard Wings	20	387	1,548	$193,500	290	+2
-- High Agility or STOL Wings	20	516	2,064	$258,000	387	+2
-- Rotors	4	132	528	$66,000	198	+1
Medium Airbus	280	800	5,600	$700,000	1200	+5
-- Landing Gear	(21)	102	408	$51,000	306	+2
-- Standard Wings	28	486	1,944	$243,000	365	+3
-- High Agility or STOL Wings	28	648	2,592	$324,000	486	+3
-- Rotors	5.6	165	660	$82,500	248	+1
Large Airbus	380	900	7,600	$950,000	1350	+5
-- Landing Gear	(28.5)	125	500	$62,500	375	+2
-- Standard Wings	38	594	2,376	$297,000	446	+3
-- High Agility or STOL Wings	38	792	3,168	$396,000	594	+3

-- Rotors	7.6	204	816	$102,000	306	+2
Small Transport	500	1,100	10,000	$1,250,000	1650	+5
-- Landing Gear	(37.5)	150	600	$75,000	450	+3
-- Standard Wings	50	714	2,856	$357,000	536	+3
-- High Agility or STOL Wings	50	952	3,808	$476,000	714	+3
-- Rotors	10	243	972	$121,500	365	+2
Medium Transport	640	1,300	12,800	$1,600,000	1950	+6
-- Landing Gear	(48)	177	708	$88,500	531	+3
-- Standard Wings	64	843	3,372	$421,500	632	+4
-- High Agility or STOL Wings	64	1,124	4,496	$562,000	843	+4
-- Rotors	12.8	288	1,152	$144,000	432	+2
Large Transport	800	1,500	16,000	$2,000,000	2250	+6
-- Landing Gear	(60)	205	820	$102,500	615	+3
-- Standard Wings	80	978	3,912	$489,000	734	+4
-- High Agility or STOL Wings	80	1,304	5,216	$652,000	978	+4
-- Rotors	16	333	1,332	$166,500	500	+2

Chassis is descriptive term used for each size of body.

VSP is the number of "vehicle spaces" of components that can be installed. Components cannot be installed in landing gear. Wing VSP is for a *pair* of wings.

Wt. is the weight of the structural frame in pounds.

Cost is the cost in dollars.

HP is the structural hit points, assuming a frame of medium strength. Wing HP is for *each* wing.

Area is the surface area in square feet.

Size is the Size Modifier (p. B116).

Structural Options

Multiply the cost of all subassemblies (including wings, landing gear and pods) by the amount indicated.

Streamlining

If the aircraft is streamlined them multiply the usable VSP of the chassis by the amount indicated on the table.

Aerodynamic Streamlining

Streamlining	Chassis VSP	Cost Multiplier
No Streamlining	¥1	¥1
Fair	¥0.9	¥1.2
Good	¥0.83	¥1.5
Very Good	¥0.8	¥2
Superior	¥0.77	¥3
Excellent	¥0.74	¥5
Radical	¥0.71	¥10

Special Structures

Responsive: A responsive structure incorporates micro-mechanisms that alter body and wing shape in response to varying aerodynamic environments and speeds, increasing maneuverability.

Lifting Body: The body is designed to produce maximum aerodynamic lift.

Smart: The structure incorporates micro-robotic sensors and processors, allowing self-diagnosis of structural damage and stress.

Special Structures

Option	Cost Multiplier
Responsive	¥1.5
Lifting Body	¥1.2
Smart	¥2

Responsive and *smart* are only available for aircraft whose structure *and* armor are diamondoid, nanocomposite, metal-matrix composite, or carbon-composite.

SUBASSEMBLY OPTIONS

These options may be applied separately to the chassis, landing gear, wings and pods.

Frame Strength

This represents the overall structural integrity of the body. Multiply the components weight, cost, and HPs by the numbers on the Frame Strength table. Minimum HP is always 1.

Frame Strength

Strength	Weight	Cost	HPs
Super-Light	¥0.1	¥0.1	¥0.1
Extra-Light	¥0.25	¥0.25	¥0.25
Light	¥0.5	¥0.5	¥0.5
Medium	¥1	¥1	¥1
Heavy	¥1.5	¥2	¥2
Extra-Heavy	¥2	¥5	¥4

Materials

These materials are described on p. TS174. For different materials, multiply weight and cost by the numbers from the Materials table.

Materials

Material	Weight	Cost
Cheap Steel	¥1.5	¥0.25
Steel	¥1.25	¥0.5
Aluminum	¥1	¥1
Titanium	¥0.75	¥1.5
Foamed Alloy	¥0.625	¥2
Carbon Composite	¥0.375	¥10
Metal Matrix Composite	¥0.25	¥30
Nanocomposite	¥0.15	¥100
Diamondoid	¥0.1	¥500

Wing and Rotor Options

These options may be applied to wings and rotors.

Controlled Instability: The aircraft is teetering on the edge of total instability. The aircraft often has no tailfins, canards, or forward-swept wings. Controlled instability costs $100 times the wing or rotor area.

Folding: Allows the wings or rotors to fold for more compact stowage. Adds 0.05¥wing/rotor weight (before adding components) in pounds. Costs $25 times weight added.

Variable Sweep Wings: This option can be added to standard, STOL or high-agility wings. Adds 0.1¥wing weight in pounds. Costs $0.5 per pound added.

Step 3: Pods

Many vessels have one or more subassemblies attached to the chassis or wings. These pods typically hold fuel, weapons or propulsion systems.

Detachable Pods

These are pods that are attached to hardpoints or stored in weapons bays. They are designed separately from the main aircraft and may have different structural options.

Subassembly Pods

These are pods that are permanently attached to the vehicle as part of its structure. They often house engines and specialized equipment.

Pods

VSP	Weight	Cost	HP	Area	Size
0.2	24	$300	9	6	-2
0.5	44	$550	17	11	-1
1	72	$9,000	27	18	+0
2	120	$15,000	45	30	+0
5	240	$30,000	90	60	+1
10	400	$50,000	150	100	+2
20	600	$75,000	225	150	+2
50	1,000	$125,000	375	250	+3

100	2,000	$250,000	600	400	+4

Step 4: Armor

The composite types, and diamondoid, are considered to be laminate armor, with DR doubled against shaped-charge warheads like HEDP and HEAT. Most aircraft have a minimum of DR 5 to withstand common environmental hazard.

Armor

Type	M	C
Cheap Steel	0.6	0.25
Steel	0.5	0.5
Aluminum	0.4	1
Titanium	0.3	1.5
Foamed Alloy	0.25	2
Carbon Composite	0.15	10
Metal-Matrix Composite	0.1	30
Nanocomposite	0.06	100
Diamondoid	0.04	500

M is the weight of one square foot of DR 1 armor and *C* is the cost per lb. of the armor.

Figure armor weight (in lbs.) as:

Armor weight = total area ¥ DR ¥ M

Calculate the armor cost (in dollars) using this formula:

Cost = armor weight ¥ C

Old Armor

Nanocomposite and diamondoid are not available. Double the cost of cheap steel, steel and aluminum. Titanium is $4/lb., foamed alloy is $6/lb., carbon composite is $30/lb. and metal-matrix composite is $100/lb.

Subassembly Armor

If the vehicle has one or more subassemblies (such as landing gear or pods), use the same procedure, with the exception that the subassembly's area is used rather than the total area.

Location Armor

A subassembly or chassis can optionally be given armor whose DR varies by facing. Hulls have six faces: front (F), back (B), right (R), left (L), underside (U) and top (T). Pods have five sides; exclude the side attached to the chassis. If this is desired, multiply by the number of sides, and redistribute "DR points" among each of them.

Passive Defense

DR 1 gives PD 1, DR 2-4 gives PD 2, DR 5-15 gives PD 3, and DR 16+ gives PD 4.

Step 5: Powertrain

Aircraft that simply glide or are towed can skip this step.

ACCESS SPACE

For *standard access* space, divide weight by 125 to find the system's total volume in VSPs. Divide the weight by 250 if there is *no access* – requiring partial disassembly or cyberswarms for repair. In all cases, round *up* to the nearest tenth of a VSP.

HELICOPTER

In the case of MMR, *each* rotor is a distinct subassembly. Otherwise, treat helicopter powertrains as a single distinct component.

***Top-and-Tail Rotor* (TTR):** One large top rotor and one small tail rotor, plus a tail.

***Multiple Main Rotor* (MMR):** Two large rotors, used on big helicopters.

***Coaxial Rotors* (CAR):** Two top rotors rotating in opposite directions, or other no-tail-rotor systems, plus a tail.

Reaction Rotor (RAR): This allows a jet engine to be used in place of a rotating drivetrain. A diverter valve permits the vehicle operator to direct exhaust gasses through a nozzle and drive a turbine. Requires 8 lbs. of jet engine thrust per kW of output, the drivetrain is often capable of using a portion of the jet engine's potential.

Helicopter Drivetrains

Propulsion Type	Tech	per kW	Base Weight	Cost
CAR	Both	0.4	18	$50
TTR/MMR	Both	0.3	15	$25
RAR	Both	1.2	0	$50

Per kW and *Base Weight* are used to figure the overall weight: Multiply the system's output in kW by the *per kW* figure then add the *Base Weight* to get overall weight.

Cost is multiplied by overall weight.

Volume: See access space (p. 00)

Lift: Helicopter systems generate kW¥10 lbs. of lift, or kW¥12 per MMR.

Thrust: Aerial motive thrust for all helicopter systems is kW¥1.6 lbs.

Stopped Rotor: This option can be applied to any helicopter drivetrain except MMR. It allows the vehicle to combine the hover efficiency of a helicopter with the high cruise speed of a fixed-wing aircraft. Multiply the weight, volume and cost of the drivetrain by ¥1.25. Reduce aerial motive thrust to kW¥0.8 because of the inefficient rotor design.

Ornithopter

This system requires a wing subassembly. The aircraft uses birdlike or insectlike flapping motions to generate lift and thrust. Ornithopters have astounding low-speed maneuverability but their pseudomusculature and motors are heavy. Note that unlike helicopters, ornithopters can still take off if their lift does not exceed loaded weight.

Ornithopter Drivetrain

Propulsion Type	Tech	per kW	Base Weight	Cost
Ornithopter	Both	1.5	7.5	$100

Per kW and *Base Weight* are used to figure the overall weight: Multiply the system's output in kW by the *per kW* figure then add the *Base Weight* to get overall weight.

Cost is multiplied by overall weight.

Volume: See access space (p. 00). The volume of the ornithopter system must be applied to the wing.

Lift: Ornithopter systems generate kW¥2.5 lbs. of lift.

Thrust: Aerial motive thrust for all ornithopters is kW¥2 lbs.

Propellers and Ducted Fans

These two systems use propellers or ducted fan blades to produce thrust. These systems require batteries or engines to provide power.

Propellers and Ducted Fan Drivetrain

Propulsion Type	Tech	per kW	Base Weight	Cost	Thrust
Aerial propeller	Both	0.4	18	$20	3.5
Ducted fan	Both	0.4	18	$40	4

Per kW and *Base Weight* are used to figure the overall weight: Multiply the system's output in kW by the *per kW* figure then add the *Base Weight* to get overall weight.

Cost is multiplied by overall weight.

Thrust is multiplied by the output in kW to get total aerial thrust.

Volume: Aerial propellers take up no space in the vehicle and do not require access space. Ducted fans require (weight / 500) VSP of volume.

Jet Engines

Jet Engine Drivetrains

Propulsion Type	Tech	per Ath	Base Weight	Cost	Fuel
Turbofan	Old	0.1	100	$50	0.015J
Turbofan	New	0.08	40	$50	0.01J
Light Turbofan	Both	0.125	0	$150	0.015J
Turbo-Ramjet	Both	0.125	250	$100	0.045J
Hyperfan	New	0.1	50	$50	0.2H

Per Ath and *Base Weight* are used to figure the overall weight: Multiply the system's thrust in pounds by the *per Ath* figure then add the *Base Weight* to get overall weight.

Cost is multiplied by overall weight.

Fuel is multiplied by the thrust in pounds to get total fuel consumption.

Volume: See access space (p. 00).

Electrical Offtake: All jet engines produce excess power as well as thrust. Each jet engine will generate a power output in kilowatts equal to (thrust in lbs. / 100).

THRUST VECTORING

Most engines are axisymmetric, their thrust is directed along the axis of the engine. Ducted fans and jet engines may have their thrust vectored using nozzles, deflector plates, or even moving the entire engine. With multiple engines each one can be deflected differentially, providing roll control.

2D Thrust Vectoring: This system allows the thrust to be deflected either left and right (improving maneuverability in yaw) or up and down (improving maneuverability in pitch). Multiply weight, volume and cost by ¥1.2. A 2D vectored engine can divert up to 40% of its motive thrust to lift.

3D Vectored Thrust: A fully vectored system can deflect thrust in all directions. Multiply weight, volume and cost by ¥1.5. A 3D vectored engine can divert up to 100% of its motive thrust to lift.

POWER

The ship's propulsion system and components require power.

Air-Breathing Engines

Internal combustion engines require oxygen at about Earth-normal pressure to work; they do not function underwater, in vacuum, or in extraterrestrial atmospheres significantly lacking in oxygen.

Ceramic Engine: An advanced rotary engine made of lightweight materials, and capable of running on most fuels. Most burn cheap alcohol blends.

Gas Turbine: Derived from jet engine technology, with spinning turbine blades rather than pistons.

MHD Turbine: Magneto-hydrodynamic turbines use magnetic fields and ionized plasma as their working medium. They are coupled to a hydrogen-burning turbine.

Air Breathing Engines

Engine Type	per kW	Base	Cost	Fuel
Ceramic engine	3	15	$6	0.03M
– if turbo or supercharged	2	10	$12	0.03M
Gas turbine	1	15	$30	0.055M
– if high-performance	0.5	10	$80	0.06J
MHD turbine	1	35	$20	0.18H
– if high-performance	0.4	28	$80	0.2H

Per kW and *Base Weight* are used to figure the overall weight: Multiply the engine's output in kW by the *per kW* figure then add the *Base Weight* to get overall weight.

Cost is multiplied by overall weight.

Fuel is consumption in gallons per hour (gph) for each kW of output. The fuel used is multi-fuel (M), hydrogen (H), or jet fuel (J). Multiply gph by 0.03 to get the VSP of fuel tanks required per hour of operation.

Volume: See p. 00.

ENGINE OPTIONS

Multi-Fuel

Multi-fuel assumes the use of gasoline. Multiply fuel consumption by 1.2 if alcohol.

Closed Cycle Operation

Some engines can operate closed-cycle in the absence of oxygen. Multiply weight, volume and cost of the engine by ¥1.5. Add an additional fuel consumption of 2.35 gph of liquid oxygen (LOX) per gph of other fuel consumed.

Batteries and Power Packs

Batteries are 1 lb. and $30 per kWh of storage. Battery technology and common consumer battery sizes are discussed on pp. TS140-141.

Power Packs are carbon nanotube flywheels that can release energy instantly, and are used to power beam weapons and emags. Multiply energy storage capacity by ¥0.1.

Volume: Batteries rarely have access space.

FUEL TANKS

Storage tanks can hold fuel, water, or other liquids. Tanks are rated in increments of 10 gallons. Fuel tank modules may be combined to produce a big tank, or divided for a smaller tank.

Light tanks are built with expensive polymers and composites to decrease weight, but they are slightly more prone to leaks.

Ultralight tanks are more vulnerable to fire and leaks but are useful where weight is a primary design consideration.

Fuel Tank Modules

Module Type	VSP	Wt.	Cost
Self-Sealing Tank	0.3	10	$100
Light	¥1	¥0.5	¥2
Ultralight	¥1	¥0.1	¥5

Fire: Modify the Fire number of the fuel by -3 for standard self-sealing tanks, -2 if they are light, and -1 if ultralight.

Step 6: Components and Features

Avionics Packages

Civil Avionics: This is a minimum standard for most private and commercial aircraft operating on Earth and Mars. Includes computerized controls, Complexity 5 tiny computer with backup, short-range radio with backup, small radar (no targeting), flight recorder with backup, and transponder. 0.43 VSP, 47.94 lbs., $4,400. Requires 1.25 kW to power radar.

Military Avionics: A typical setup for a military aircraft includes computerized controls, Complexity 7 microframe computer and two Complexity 6 small computer backups, long-range radio with backup, terrain following radar, small radar (no targeting), flight recorder with backup, IFF with backup, and laser/radar detector. 0.62 VSP, 97 lbs., $23,150. Requires 1.58 kW to power radar units.

Control System

Computerized Controls: Standard controls display information on multifunction digital displays. Computerized controls cost $1,000.

Mechanical Controls*:* Mechanical controls are found on some kit aircraft. Mechanical controls are free.

Seats

Each crewmember or passenger should have a seat. Cramped seats have very little room and are uncomfortable to work in, normal seats have more elbow room, and roomy seats are typically seen in those built for comfort or long duration occupancy.

Crashweb: An advanced safety suite that provides an effective DR of 10 against any damage inflicted on the user from collisions or crashes. This adds 0.1 VSP, 5 lbs. and $100 to each seat.

Ejection Seat: Rarely seen except on high-performance aircraft. Ejection seats add 1 VSP, 100 lbs. and $50,000 to each seat so equipped.

G-Seat: This modification allows the user to remain comfortable even when subjected to sustained and transient high-G forces. Adds $500 to each seat with this modification.

Seat Modules

Module Type	VSP	Wt.	Cost
Cramped	4	20	$100
Normal	6	30	$100
Roomy	8	40	$100

ELECTRONICS

Computers

The computers listed on p. TS141 are available. Volume in VSP is equal to weight divided by 250; power consumption is negligible. Aircraft usually have double or triple-redundant computer systems.

Software

All aircraft have basic flight control system and routine vehicle operation routines running on dedicate computers (included with the structural cost). A standard flight software suite includes:

Auto-Operation: While in auto-operation mode the aircraft is effectively controlled by an NAI with the appropriate Piloting specialization at level 12. The system is useless in combat, it can navigate around obstacles but will not “push the envelope” or Dodge.

Datalink: Facilitates data linking between vehicles, allowing them to share sensor data, navigational coordinates, and tactical data. Also establishes a connection with the regional and local flight control agencies for monitoring flight paths and warning of hazards. This link can also be used to seize control of the vehicle in an emergency.

Navigation: This software uses input from the aircraft’s navigational instruments, active sensors, global positioning system and references that with its own onboard navigational database. It can also generate flight plans, notify the operator and passengers of nearby landmarks, and keep ground controllers informed of the flights progress automatically.

TOP 5 SOFTWARE PROGRAMS FOR AIRCRAFT

Augmented Reality (p. TS00): This program uses a virtual interface to simplify controlling the aircraft. Instrument readings are displayed in an efficient and user defined manner, instructions can be overlayed on the field of vision (complete with flight paths, projected terrain features, weather systems and detected sensor emissions (if a military model). These systems, along with pervasive automated flight control networks, have revolutionized cheap air travel.

VR Manager (p. TS00): Large passenger aircraft often run their own local virtual reality environment. A popular setup provides a complete virtual view of the surroundings without the bulk of the aircraft blocking the way.

HUD Targeting (p. TS00): This cheap program is common on all military and paramilitary vehicles; all stabilized mounted weapons include a HUD-sight link.

Target Tracking (p. TS00): Even civilian aircraft can benefit from this program if they expect to be out of touch with local air traffic control. Martian aircraft in particular find that it is significantly safer to handle their own collision avoidance. Military aircraft often have Complexity 3 (100 target) or Complexity 4 (1,000 target) versions with threat prioritization based on input from any transmission profiling software and TacNets.

Transmission Profiling (p. 00): Military aircraft use this software to identify enemy sensor platforms, provide data to threat projection systems and input data to the stealth and countermeasure components.

Communication Systems

A standard radio communicator can connect to any nearby ground or satellite cellular network for unlimited range. These networks only exist on Earth and the major colonies.

Laser Comm: With this option the communication system uses a modulated laser beam instead of radio waves. Laser communicators require precise aiming and an unobstructed line of sight. They will not work through most clouds and poor atmospheric conditions.

Old: Old communication systems are bulkier and have less range.

Communications Modules

Module Type	Tech	VSP	Wt.	Cost	Power	Range
Short-Range Radio	New	neg.	0.12	$25	neg.	100 mi.
Medium-Range Radio	New	neg.	0.5	$100	neg.	1,000 mi.
Long-Range Radio	New	0.02	5	$300	0.04	10,000 mi.
			Options			
Laser Comm		¥10	¥10	¥12.5	¥10	¥10
Old		¥2	¥2	¥2	¥1	¥0.1

SENSORS

Unless otherwise noted all sensors require a line of sight and must have a facing chosen at installation. Most sensors cannot see over the horizon.

Radar

A conventional radar system. Can be spotted by radar detectors at twice its range. It can switch to a "low probability intercept" radar mode as well; halve range (-2 Scan) but it can only be detected at 1.5 times the radar's (halved) range.

AESA: This option changes the radar into a multimode electromagnetic scanner. capable of switching between radar and laser imaging functions. Halve range (-2 Scan) when operating in ladar mode.

No Targeting: The sensor cannot be used for targeting purposes.

Old: The sensor is built using older TL8 technology.

PESA

A hyperspectral sensor combining a passive millimetric-band radar, thermograph, and low-light imager. Provide the advantages of Infravision (p. B237) and Night Vision (p. B22). They have a magnification capability equal to their range in miles (or 1¥, whichever is greater).

Sensor Modules

Module Type	Tech	VSP	Wt.	Cost	Power	Range	Scan
			Radar Sensors				
Small Radar	New	0.02	5	$2,500	1.25	5	15
Medium Radar	New	0.2	50	$25,000	12.5	50	21
Large Radar	New	0.6	250	$75,000	37.5	250	25
			Radar Options				
AESA		¥1.5	¥1.5	¥5	¥1	--	--
No Targeting		¥0.5	¥0.5	¥0.5	¥1	--	--
Old		¥1	¥1	¥1	¥0.5	¥0.5	-2
			PESA Sensors				
Small PESA	New	0.05	12.5	$50,000	neg.	25	19
Medium PESA	New	0.9	112.5	$450,000	neg.	75	22
Large PESA	New	5	1,250	M$5	neg.	250	25
			PESA Options				
Old		¥1	¥1	¥1	neg.	¥0.5	-2

Range is in miles.

Deceptive Jammer

This device uses electronic trickery to reduce the effectiveness of radar detection. It is generally referred to as “active stealth.

Countermeasure Modules

Module Tech	Type	VSP	Wt.	Cost	Power
Jam 2	New	0.08	20	$20,000	2
Jam 5	New	0.24	60	$60,000	6
Jam 8	New	0.8	200	$200,000	20
Jam 10	New	1.6	400	$400,000	40
			Options		
Old		¥2	¥2	¥2	¥2

Miscellaneous Equipment

These are other modules that may be installed in or on vehicles.

Airlock: A pressurized chamber large enough for one human-sized individual.

Arrestor Hook: Retractable hook that snags on an arrestor wire (p. UP00).

Cargo: Five cubic feet of cargo space.

Duplicate Controls: Large aircraft may have duplicate mechanical or computerized systems for use by a co-pilot or emergency backup.

Environmental Control: Provides standard heating, air conditioning, etc. It cannot deal with extreme conditions, but adjusts temperatures by up to 40°F toward the occupants' comfort zone.

Flight Recorder: This is a rugged data recorder used for post-accident analysis of flight data. It is designed to be exceedingly difficult to tamper with.

Galley: This is a miniature kitchen that can accommodate a single individual.

Hall: Large room that can represent a restaurant, bar, conference room, etc. Each hall can accommodate 10 people.

HUDWAC: This is a dedicated microcomputer running the HUD Targeting tactical program (p. TS00). Weapon's operated by a gunner with HUDWAC reduce the weapons' SS number by 5. One HUDWAC system can be added for each gunner.

IFF: "Identify Friend or Foe," a specialized radio that broadcasts encrypted identifying information, warning the operator if he is targeting or detecting a friendly target (provided they are equipped with IFF as well). A *transponder* is a civilian identification beacon. IFF and transponder systems can be detected at the same ranges as a long-range radio.

Inertial Navigation: Sophisticated gyroscopic system for determining a vehicles exact location and heading without using GPS. In conjunction with basic of precision navigation it adds an additional +2 to Navigation skill.

Laser/Radar Detector: This sensor automatically warns of any radar emissions or if a laser targets the aircraft. It can also determine the range and bearing of a radar or radar jammer (out to twice the radar's range or 20 times an area jammer's usual range) as well as the make and model of the system and its current operating mode (if an appropriate database is available).

Limited Life System: As for environmental controls, but also provides bottled oxygen and water for a limited time. Limited life systems are rated in *man-days*; 100 man-days will keep one person alive for 100 days, or two people alive for 50 days, or four for 25 days, etc. The vehicle must be *sealed*.

Precision Navigation: A system of gyroscopic compasses, star-tracking devices, and radio-navigation systems that can be used without access to a GPS system. Provides +5 to all Navigation rolls. Basic navigation systems are only accurate to within a few hundred yards and reduce the Navigation bonus to +4.

Safety System: A fire-suppression system that senses fires and floods the burning compartment with inert gas to extinguish them. A *compact* version is also available.

Shower: A one-person shower. May or may not have hot water!

Solid Rocket: These include their own fuel, but once activated they cannot be turned off! They burn 85% of their weight as fuel; refueling takes several hours and costs 20% of the original cost. Each solid rocket module provides 2,800-lb. minutes of thrust, i.e. 1,400 lbs. for two minutes, 2,800 lbs. for one minute, 700 lbs. for four minutes, etc. The burn time *must* be set when the rocket is designed.

Stretcher Pallet: A medical restraint for safely carrying injured personnel. Each pallet can hold a single patient.

Terrain-Following Radar: This is specialized downward-looking navigation radar or ladar that allows an aircraft on autopilot to hug the contours of the ground as low as 10 yards above the ground. The pulses are very short in duration and will not be detected unless a laser/radar detector is located directly under the flying vehicle.

Toilet: For aircraft with short-occupancy it can be useful to include some sort of waste disposal system. This is a roomy toilet with superior access that can accommodate a single human-sized individual. Includes a smoke detector and tiny wash station.

Vehicular Parachute: When deployed, each module provides 18 mph/s of deceleration for up to 6.25 tons of vehicle or payload, or a proportional deceleration for a larger weight (9 mph/s for 12.5 tons, etc.).

Empty Space: Any space left over after all modules have been selected is simply empty space.

Miscellaneous Modules

Module Tech	Type	VSP	Wt.	Cost	Power
Airlock	Both	10	500	$1,000	neg.
Arrestor Hook	Both	1	100	$1,000	0
Cargo	Both	1	0	$0	0

Duplicate Computerized Controls	Both	0.1	25	$500	0
Duplicate Mechanical Controls	Both	0.2	50	$100	0
Environmental Control	Both	0.02	5	$50	0.25
Flight Recorder	Both	0.2	20	$400	0
Galley	Both	10	100	$50	neg.
Hall	Both	200	80	$500	0.1
HUDWAC	Both	0	0	$250	0
IFF	Both	0.02	5	$1,000	neg.
-- Transponder	Both	0.01	2.5	$500	neg
Inertial Navigation	Old	0.04	20	$25,000	neg.
Inertial Navigation	New	0.02	10	$12,500	neg.
Laser/Radar Detector	Both	0.06	15	$1,500	neg.
Limited Life System	Old	0.6	150	$500	*
Limited Life System	New	0.4	100	$500	*
Precision Navigation	Both	0.08	20	$5,000	neg.
-- Basic	Both	0.08	20	$1,000	neg.
Safety System	Both	0.8	200	$5,000	0
-- Compact	Both	0.2	50	$500	0
Shower	Both	10	100	$50	neg.
Solid Rocket	Both	1	500	$2,500	0
Stretcher Pallet	Both	8	50	$100	0
Terrain-Following Radar	Old	0.04	10	$4,000	0.25
Terrain-Following Radar	New	0.02	5	$2,000	0.25
Toilet	Both	16	80	$200	0
Vehicular Parachute	Both	1	125	$1,250	0

* The power requirement of a limited life system is 0.5 kW ¥ the number of occupants supported (*not* the number of man-days).

Step 7: Surface Features

All surface features multiply their weight and cost by the total area of the vehicle.

Sealing

All aircraft should be sealed. This does not necessarily mean they are pressurized. Sealing costs $10 per square feet (double if old technology).

Concealment

Liquid Crystal Skin: A coating of color-changing material that allows the vehicle to assume any paint job or camouflage pattern. Vision and light-imaging sensor rolls spot the vehicle are at a -2 penalty if an appropriate camouflage pattern is chosen, or a +2 bonus if a contrasting pattern is used. Patterns require five seconds to change.

Chameleon Surface: This combines liquid crystal skin with sensors that scan the surroundings, and change the skin to match. Optionally, the sensors may be turned off, and the skin may be set to any programmed color scheme. It imposes a penalty to be visually spotted or hit, or detected by ladar. *New technology* -6 (-3 if moving), *old technology:* -3 (-1 if moving).

Emission Cloaking: This masks the vehicle's heat, magnetic, and millimetric emissions. It imposes a penalty on rolls to detect the vehicle with non-optical passive sensors. *New technology:* basic -5, radical -10. *Old technology:* basic -4, radical -8.

Sound Baffling: This masks the vessel's sound emissions. Civilian aircraft often have some level of sound baffling legal reasons. All give a penalty to be detected by sound detectors. *New technology:* basic -5, radical -10. *Old technology:* basic -4, radical -8.

Stealth: A combination of special materials and body shaping to reduce, distort or otherwise degrade the effectiveness of radar and ladar detection. Stealth loses its effectiveness if carrying unstealthed detachable pods or weapons. It imposes a penalty on rolls to detect the vehicle with radar or ladar sensors. *New technology:* basic -5, radical -10. *Old technology:* basic -4, radical -8.

Concealment Features

Module Type	Tech	Wt.	Cost
Liquid Crystal Skin	New	0.1	$20
Chameleon Surface	New	0.5	$100
	Options		
Old		¥2	¥2

STEALTH

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Stealth Features

Module Type	Tech	Wt.	Cost
Basic Emissions Cloaking	New	1	$150
Radical Emissions Cloaking	New	2	$1,500
Basic Sound Baffling	New	0.5	$25
Radical Sound Baffling	New	1	$250
Basic Stealth	New	0.5	$75
Radical Stealth	New	1	$750
	Options		
Old		¥2	¥2

SOLAR CELLS

These photoelectric collectors convert light (usually sunlight) into electric power. They generally serve as a backup power supply, in conjunction with rechargeable batteries (p. 00). Solar cells cannot be combined with stealth, infrared cloaking, a chameleon system, or liquid crystal skin. The maximum solar cell area equals half the total of the body and all subassembly areas; any area up to this value is allowed.

Solar cell power output depends (obviously) on the brightness of the sun, and thus varies from planet to planet, and by weather conditions. In any environment dark enough to cause a -1 or worse vision penalty, cells provide negligible power. Under sunny skies (or in vacuum), the formula is solar cell area ¥ P, where P is 0.5 for Mercury, 0.2 for Venus, 0.08 for Earth and Luna, 0.04 for Mars, 0.01 for most major asteroids, 0.003 for the moons of Jupiter, and 0.001 for the moons of Saturn. Further out, solar cells produce negligible power. The formula for P is 0.08 / (distance from Sun in AU, squared).

Solar cells are 0.1 lb and $30 per square foot. Old technology is double the cost and weight.

Step 8: Weapons

Aircraft can be armed with a wide variety of weapons. Only permanent or semi permanent weapon installations built into the body or subassemblies are selected at this stage in the design process. Weapons that would be added on external pylons ("hardpoints") are not installed at this point; skip any such weapons for now.

Facing: For a weapon located in the body or any other subassembly, specify whether it points forward (F), backward (B), right (R), left (L), or in rare cases, up (U) or down (D); this is the direction it can fire. Of course, a weapon in a turret can fire in different directions as it rotates. A weapon can't be mounted to face in the direction a subassembly is attached to the vehicle – a gun in a turret atop a vehicle can't face down.

Weight, Volume, Cost: This is for the unloaded weapon. A weapon can be concealed (hidden from view): if so, multiply volume by 2.5.

Step 9: General Statistics

Volume

Multiply the total VSP of the chassis and any subassemblies by 5.

Weight

Empty Weight (EWt): The sum of all component weights.

Payload: This equals the total weight of the following items:

Fuel Table

Weight and cost is per gallon.

Fuel	Wt.	Cost	Fire
Alcohol	5.8	$0.5	10
Hydrogen	0.58	$0.1	13
Jet Fuel	6.5	$3	13
Synthetic Gasoline	6	$5	11

Fire: Some fuel types have a "Fire" number. This is the chance or less on 3d that the fuel will catch fire when damaged. This number is modified by the tank the fuel is stored in (p. 00).

– *Ammunition*: As specified in *Step 7: Weaponry* (p. 00).

– *Occupants*: Add 200 pounds per crew member or passenger (assuming typical human-sized occupants).

– *Cargo*: Add the weight of cargo usually carried. If exact numbers are unknown, add 100 lbs. per VSP of cargo

– *Other*: Any other items which are not part of the vehicle, such as robots, cybershells, or other vehicles.

Loaded Weight (LWt): Sum of empty weight and payload. It is usually simpler to list it in tons (loaded weight/2,000).

Cost

This is the sum of all component prices.

Maintenance Interval

This is the period of time the aircraft can safely operate between maintenance checks and overhauls. The formula is:

Maintenance interval in hours = 20,000 / (square root of vehicle cost)

Round to one decimal place. If all structures are *smart* then double the maintenance interval. See p. TS189 for rules on failing to perform proper maintenance.

Structural Strength (HT)

This is a measure of structural robustness. HT is calculated as follows:

Structural HT = (200 ¥ chassis hit points / loaded weight in lbs.) + 5

If the vehicle has hardpoints, use the weight with hardpoints loaded – do not calculate two different values. Round HT to the nearest whole number. Maximum HT is 12. A HT of less then 7 would not be considered safe to fly!

Endurance

If the vehicle runs on fuel, divide the total capacity of all fuel tanks by the gph fuel requirement of the engine; this gives the vehicle's endurance in hours. If it requires two kinds of fuel (e.g., hydrogen and oxygen), compute the endurance for each separately, and use the lower number. If it runs on batteries, divide the total battery capacity in kWh by the total power requirement in kW to get endurance in hours.

Step 10: Performance

A single vehicle may have several separate profiles calculated.

AERIAL PERFORMANCE

Aerodynamic Stall Speed (aStall)

This is based on the surface area of the vehicle.

aStall = Sm ¥ Rs ¥ square root of [(Lwt. – Static Lift) / Lift Area]

Sm is 7 for fair streamlining or worse, 7.35 for good, 7.7 for very good, 8.05 for superior, 8.4 for excellent, and 9.1 for radical streamlining.

Rs is 2 for most aircraft, 1.5 if it has a responsive structure.

Lift Area is equal to the combined surface area of the wings/rotors and 10% of the chassis area (30% for lifting bodies). Treat STOL wings as having 1.5 times their actual area and flarecraft or rotors as 3 times their area for this purpose.

Static Lift is equal to rotor lift, dedicated lift thrust or the amount of aerial motive thrust diverted using vectored thrust.

Lwt is loaded weight in pounds.

Aerodynamic Drag (aDrag)

This is based on the surface area of the vehicle.

aDrag = [(Sa – Ra) / Sl] + D

Surface Area (Sa): The total surface area of the vehicle.

Retractable Area (Ra): The surface area of any components that retract into the body or wings.

Streamlining (Sl): This is the streamlining coefficient: 1 if no streamlining, 2 if fair, 3 if good, 5 if very good, 10 if superior, 20 if excellent, 40 if radical streamlining. Multiply streamlining coefficient by ¥1.2 if the aircraft has a responsive structure.

D is the total drag of any carried stores. For simplicity you can assume a value of 5 for each loaded hardpoint. Calculate drag separately for loaded and clean configuration.

GLIDING PERFORMANCE

Top Glide Speed

This is maximum top speed the gliding vehicle can reach in forward flight.

Top glide speed = 0.4 ¥ terminal velocity where:

Terminal velocity = square root of [7,500 ¥ (Lwt. / aDrag)]

Glide Ratio

This is the ratio of distance traveled before losing a unit of height.

Glide ratio = (Top glide speed / aStall) squared

(((END BOX)))

Air Speed (aSpeed)

Determine the aerodynamic drag and aerial motive thrust for the desired configuration. Then use the following formula:

aSpeed = square root of [7,500 ¥ (Amt / aDrag)]

Amt is the aerial motive thrust.

aDrag is the aerodynamic drag.

Round to the nearest mph if speed is under 20 mph, otherwise round to the nearest 5 mph.

TURBO-RAMJETS

This engine can switch to a more efficient ramjet mode at speeds above 375 mph. If the aircraft can reach a speed of at least 375 mph then recalculate top speed by adding an additional (0.2 ¥ original turbo-ramjet thrust).

TOP SPEEDS

The combination of armor, streamlining and propulsion system determines the maximum speed of the aircraft either in powered flight, diving or gliding. If multiple conditions apply, use the lowest maximum speed.

No, Fair or Good streamlining: 600 mph

Very Good streamlining: 740 mph

Rotors: 300 mph

Propellers or ducted fan: 600 mph

Turbofan: 2,000 mph

Turbo-ramjet: 4,000 mph

DR is under 5:* 600 mph

DR is under 20:* 2,000 mph

* Use the lowest DR for all subassemblies, excepting those that can retract.

Aerial Maneuver Rating (aMR)

Wings or Rotors: Use the following formula:

aMR = [(Whp + Rhp) / Lwt.] ¥ TL ¥ 30

Whp is the sub of all wings' hit points.

Rhp is the total of all rotors' hit points.

Lwt is the loaded weight in pounds.

TL is 8 for old aircraft, 9 for new. Add 1 to effective TL for *each* of the following: responsive structure, high agility wings, variable sweep, computerized controls. Add 2 to effective TL for controlled instability. *Reduce* by 1 for MMR.

Stall Speed 0: If the aircraft does not have a stall speed (VTOL or helicopter) then aMR is (TL – Chassis Size Modifier) / 2. Add 1 to effective TL for each of the following: responsive structure, computerized controls.

Lifting body without wings: aMR is 0.125, or 0.25 with computerized controls. Double this if the vehicle has responsive structure.

In all cases round to the nearest multiple of 0.5. If multiple formulas apply, use the highest calculated aMR.

Aerial Stability Rating (aSR)

Use the total volume of the chassis and all subassemblies that are not retractable.

Vehicle Has	SR
Volume under 20 VSP	3
Volume under 200 VSP	4
Volume under 2,000 VSP	5

Computerized controls	+1
No wings, or only stub wings	-1*
Lifting body	-1
Controlled instability	-1

* If a helicopter then only apply this penalty if not CAR.

Aerial Acceleration (aAccel)

aAccel = (Amt / Lwt.) ¥ 20

Amt is the total aerial motive thrust.

Lwt is the loaded weight in pounds.

Round to the nearest tenth of a mph/s if the result is under 1 mph/s; otherwise round to the nearest whole number.

Aerial Deceleration

The maximum aerial deceleration in mph/s (aDecel) is equal to the vehicle's aMR ¥ 4.

GLOSSARY

The following terms are in common use in the year 2100. See also the Glossaries in other ***Transhuman Space*** books for explanations of terms not listed here.

Corporate Constitution Acronyms

Britain/US – Inc: Incorporated

Britain/US – JSC: Joint Stock Company

Britain/US – Ltd: Limited

Britain – Plc: Public Limited Company

Britain – Pty: Proprietary

Germany – GmbH: Gesellschaft mit beschränkter Haftpflicht (or Haftung)

Indonesia – PT: Pesawat Terbang

Italy – SpA: Società per Azioni

Italy – SRL: Società Reponsibilita Limitata

Japan – KK: Kabushiki Kaisha

Malaysia - Sdn Bhd: Sendirian Berhad

Netherlands – BV: Besloten Vennootschap

Netherlands/Belgium – NV: Naamloze Vennootschap

Poland – SA: Spólka Akeyjna

Poland - Sp. z o.o: Spólka z ograniczona odpowiedzialnoscia

Sweden - AB: Aktiebolag

Russia – AO: Aktsionernoye Obshchestvo (Co Ltd)

Russia – AOOT: Aktsionernoye Obshchestvo Oktrytogo Tipa

Russia – OAO: Otkrytolye Aktsionernoye Obshchestvo (Joint Stock Company)

Russia – OOO: Obshchestvo Ogranichennoye Otvetstvennostyu

Russia – ZAO: Zakrytoe Aktsionernoye Obshchestvo

Acronyms

ATC: Air Traffic Control.

BOW: Basic Operating Weight. MTOW minus payload.

CATIA: Computer-aided three-dimensional interactive analysis. Aerospace industry term for computer simulation and modeling.

FDR: Flight Data Recorder. Crash-protected (and tamperproof) data recorder that stores flight variables for reconstruction of flight events in the case of an accident.

FOD: Foreign Object Debris/Damage. Small objects or even animals that can impact on an aircraft or foul an engine during operation.

MKV: Miniature Kill Vehicle. Small, autonomous smart missiles.

MPSR: Multi-Purpose Support Room (pronounced “mipsirs”). USAF term for spacecraft Halls.

MTOW: Maximum Take-Off Weight.

OKB: *Osoboe konstruktorskoe byuro*. Russian for “Experimental Construction Bureau”.

RKA: *Rosaviakosmos*. The civilian Russian Aviation and Space Agency.

TIG-: Time of Ignition, minus. Often used as a countdown time for burns, but can also be used to reference other events.

VKS: *Voenno-Kosmicheski Sily*. Russian Military Space Forces.

JARGON

aerobraking: The process of decelerating by converting velocity into heat through friction with a planetary atmosphere.

aerofoil: Any solid body so shaped that, as a fluid medium (air or hot gas) moves past it, it experiences a useful force perpendicular to the direction of relative motion; thus, a wing generates lift, while a turbine blade generates torque on a shaft.

airstair: Retractable stairway built into aircraft.

antipodal: Opposite side. Usually refers to the opposite side of the Earth.

apoapsis: That point in an orbit farthest from the body being orbited. Root for apogee (apoapsis in Earth orbit), apojove (Jupiter), apolune (Lunar), aphelion (Sun),

attitude: Position of a space vehicle as determined by the inclination of its axis to some frame of reference.

baggies: Loose coveralls worn over environmental suits for dust or micrometeorite protection.

ballistic parachute: Emergency recovery parachute capable of supporting both machine and occupants.

casevac: Casualty evacuation.

centrifugal force: A force which is directed away from the center of rotation.

centripetal force: A force which is directed towards the center of rotation.

egress: To exit.

ephemeris: Table of predicted positions of bodies in the solar system.

farsat: An antisatellite weapon (usually an AKV) maintained in storage away from its target. The weapon can be remotely triggered to launch and seek its target. Most such systems are disguised to look like an innocent satellite or section of debris.

green: Conditions acceptable.

inclination: Angle of an orbit relative to the equator. More exactly, the angle between the plane of the orbit and the equatorial plane.

ingress: To enter.

inspector: A satellite or workpod designed to closely monitor and service satellites. Occasionally used as an impromptu anti-satellite weapon.

kosmobuksir: Russian name for "space tugs" and other USVs.

kosmolyot: Russian name for TAVs.

lanyard: Short rope or cord.

lapot: Russian for a type of peasant shoe made of tree bark. Refers to all lifting body delta TAVs.

madan: Japanese for “magical bullet.” Refers to an AKV.

paint: Targeting an object with an active sensor.

penaid: “Penetration aid.” A technology or technique that allows a weapon to reach a protected target. Stealth and nap-of-the-earth flying are both examples of penaids.

payal’nik: Russian term for soldering iron. Refers to any specialized soldering or micro-welding units designed for space.

periapsis: The closest point of an orbit around the body being orbited. Root of periapsis (lowest point of Earth orbit), perihelion (Sun), perilune (Luna), and perijove (Jupiter).

shakers: Stall-warning devices that use physical cues (rumbling, force-feedback, etc.).

snap-down: Targeting of a low-flying target from a platform at a higher altitude. Often used for orbital artillery engagement of aerospace assets.

store: Payload attached externally.

switchology: Term used to describe the usability and ease of operation for a set of controls.

taikonaut: Common term for Chinese astronauts. Usually refers to government or military aerospace personnel.

wet: Housing fuel.

workshack: Small 1-4 man space station. Usually built from modular components.

SLANG

Alpha Mike Foxtrot: “Polite” acronym for “Adios motherfuckers!”

artificer: General term for any engineering personnel of the RNSS or USAF.

bootneck: A Royal Marine.

branched: Compromised. Often used in reference to electronic warfare.

chicken of the sea: Any submarine who’s mission is to avoid contact.

clean: Flight configuration (landing gear, flaps and so on retracted) or operating without external stores. General term for “ready to go.”

combi: Civilian aircraft carrying both passengers and freight in the main cargo area.

cow: A manned maneuvering unit.

cue cards: Instructions for various spacecraft operations and procedures. Used as reminders and checklists. Usually displayed using augmented reality, but actual cards with written instructions are very common as backups.

deeps: Submariner or spacecraft personnel in the RNSS or RN.

diapers: The girdles worn under vacc suits to handle human waste.

factor: Performance level. “Unfactored” refers to average performance in standard conditions (denotes mediocrity).

fox: Mobile bipedal target drone used by U.S. and British troops.

guillotine: A device for emergency separation of spacecraft modules, lines, etc. Usually takes the form of explosively driven blades or bolts.

hill: Celestial object blocking direct line of sight. Something “over the hill” is hidden from direct observation or communication.

honeypot: Waste collection bag or storage tank.

leper lights: Augmented reality broadcast tags, flashing lights and even squealing buzzers that announce the presence of guest personnel in restricted areas.

magical pinball: Nuclear weapon. “When it hit’s the lights start flashing.”

monkeyknocker: Derogatory term for orbital kinetic kill weapons and their operators. Implying that they are so inaccurate that they will only hit harmless monkeys in the target area.

ooze: Microorganisms (bacteria and fungi for the most part) found on space vessels and stations.

radioing in: term used for falsified safety and logbook entries. The entries are usually "radioed in" just before they are inspected, or logged before it is performed.

rat turd: Pellets of waste that are not recyclable.

snoopy cap: Headpiece that contains a microphone and earphone.

turtle: The graphical representation of a spacecraft's current (or calculated) location on a display.

Q: Pressure. Something that is "high Q" is at a dangerous pressure.