OTHER SUNS™

Book 2

Starships & World Building

DESIGN:

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FANTASY GAMES UNLIMITED

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This book is dedicated to Kathryn Shapero, by loving wife, who put up with me while it was being tested and written, and rewritten, and rewritten.

With thanks to the following playtesters and critics:

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CONTENTS – BOOK TWO

Players should note that the map for the sample world used in the sample scenario can be found on the back cover of this rulebook.

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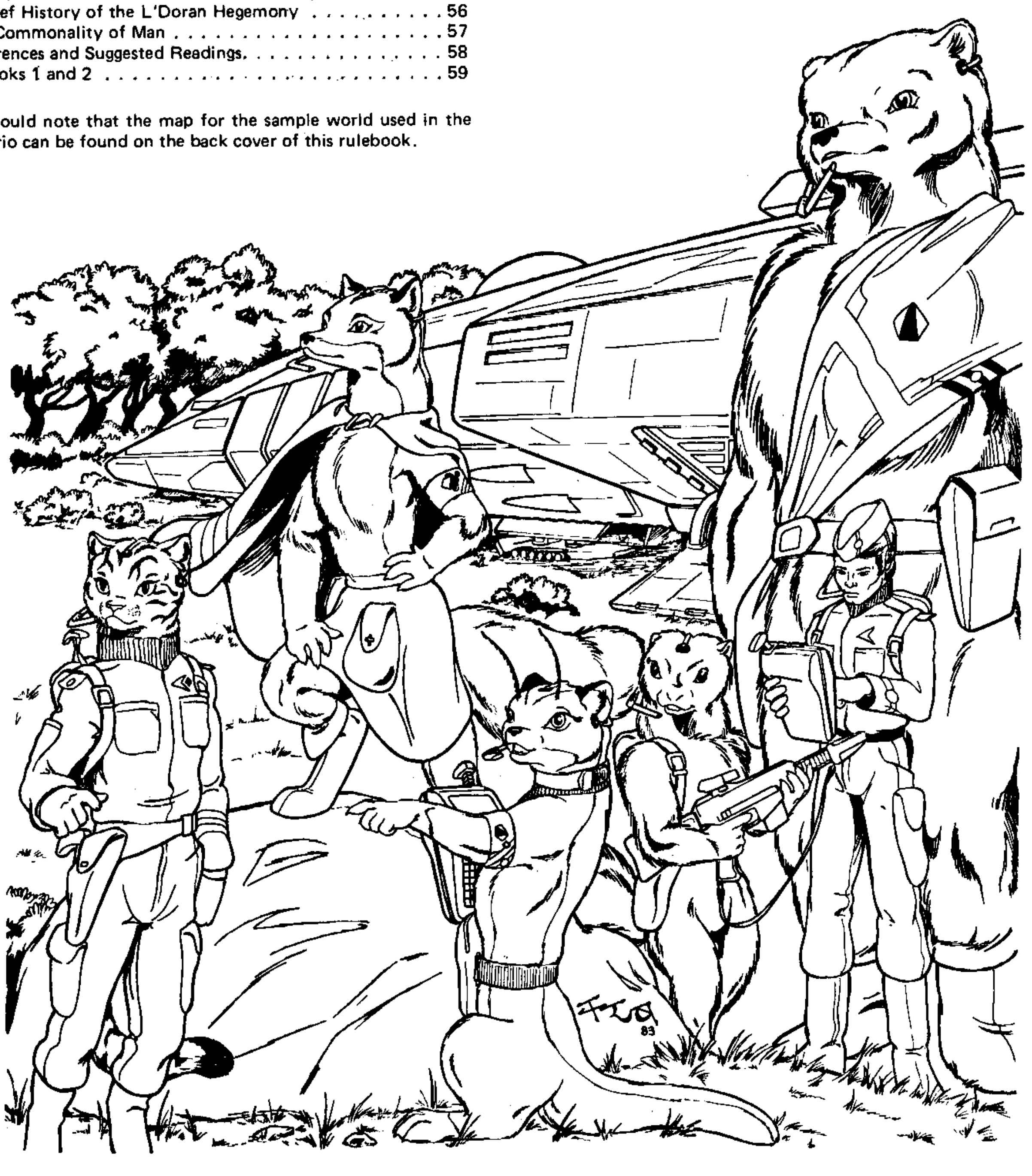


10. Starships & FTL Travel

10.1 INTRODUCTION

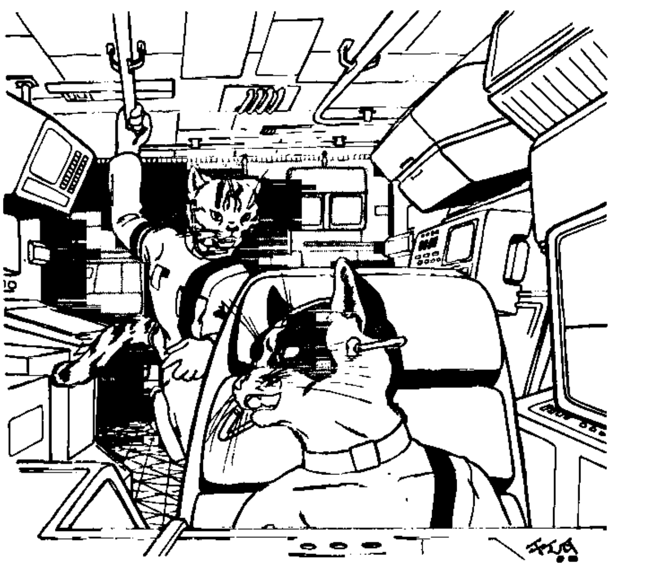
The starships of the Hegemony travel outside the boundaries of 'normal' four dimensional space-time in order to bypass the Einsteinian light speed limit. They are able to reach a different level in the seven dimensional jump space in which the so-called 'normal' space is embedded. In that higher dimensional space, removed from the commonplace universe of Einsteinian space-time, strange things happen to distance and time.

Motion in jump space is not governed by the same laws that apply to normal space – ships in jump must maintain power to their jump engines at all times or return to normal space. Thus there is no such thing as standing still or coasting in jump space. The minimum speed in jump space corresponds to a speed of approximately 1.414 c in normal space (where c = the speed of light in a vacuum, approximately 186,000 miles per second).

The distortion of distance in jump space and the Heisenberg Uncertainty Principle combine to randomize a ship's re-entry point in normal space from jump space. The error is between one and ten Astronomical Units (between 93 and 930 million miles). The course can be controlled, however, so that this represents an error in range only, not in bearing.

With an average separation of five light-years between stars, an error of between eight and eighty light-minutes is insignificant. And this error remains fairly consistently 1D10 AU over interstellar distances, so exit point in the target system can be determined by rolling 1D10 for distance from the primary (in AU), and by rolling D100, dividing by 100, and multiplying by 360, giving us the precise range and angle of the entry point relative to some fixed base line (base line determined by referee earlier for his convenience). For attempted in-system uses of the FTL stardrive the straight line course should be laid out, then ND10 rolled to determine the precise distance traveled.

The stardrive may not be activated while the spacecraft is closer to a body of stellar mass than two Astronomical Units (186 million miles) or closer to a body of planetary mass than twenty planetary diameters. Any ship that attempts to activate its stardrive within these limits is always totally destroyed. Ships entering normal space from jump space may, however, appear near objects of stellar or planetary mass – rolls that result in the spacecraft appearing inside the above limits do not imply destruction of the spacecraft (though the ship may not attempt to re-enter jump space until it is at a safe distance from the astronomical body in question). Ships entering normal space from jump space cannot re-appear within a planetary or stellar body, and rolls for re-entry points inside the atmospheres or bodies of same should be disregarded (reroll until a legitimate entry point is rolled).



For intra-system travel, spacecraft use a form of gravity control for propulsion. They accelerate for half the trip, then decelerate for the remaining half of the trip. The total trip time for an intrasystem voyage is given by the equation:

$$T = 2 \times (D/A)^{(1/2)}$$

(or, in English, the trip time is twice the square-root of the ratio of distance to the acceleration). At an acceleration of 1 g (=9.8 meters per second per second), the following is a brief table of trip times for voyages of varying distances:

Distance (in AU)	Trip time	Distance (in AU)	Trip time
0.5	49hrs	5.5	161hrs
1.0	69hrs	6.0	168hrs
1.5	84hrs	6.5	175hrs
2.0	97hrs	7.0	182hrs
2.5	109hrs	7.5	188hrs
3.0	119hrs	8.0	194hrs
3.5	129hrs	8.5	200hrs
4.0	138hrs	9.0	206hrs
4.5	146hrs	9.5	212hrs
5.0	154hrs	10.0	217hrs

These contragravity drives produce gravity waves which can be detected by other ships in normal space using passive sensor systems (described later in this section). Thus, a ship using its CG (contragravity) drive system may be located precisely by other ships sensing the gravity 'ripples' that its drive system produces. (Note: it is assumed that gravity waves travel at the speed of light in normal space).

Powering up the jump engines for entry into jump space requires 1D6 minutes per 100,000 metric tons of ship mass (1 metric ton = 2200 pounds in a 1.0 g gravitational field). Powering down for re-entry into normal space requires one second.

The transition from normal space-time to jump space (or vice-versa) is anything but pleasant. When a ship enters jump space (or returns to normal space-time from jump space) all characters on board must roll under their END on the same dice their END was originally rolled or be incapacitated for:

(1 + (rolled value) – END) minutes

Remember Mikhail? His END of 22 was rolled on 4D10. Every time that Mikhail goes from normal space to jump space (or vice-versa) he is subject to jump shock. The referee rolls 4D10 and if the result is 21 or less, Mikhail weathers the passage unharmed. If the roll is 22, he is incapacitated for 1 minute. If the roll is 30, he is incapacitated for (1 + 30 – 22) = 9 minutes.

During this period of incapacitation, the character is incapable of acting coherently. There are no lasting problems resulting from jump shock and it is never fatal (like seasickness, it makes the victim wish for death, but the wish is never granted). No END damage is done by jump shock and after the period of incapacitation (if any), the character returns to full capabilities with no further ill effects.

In addition to these physical effects on the passengers and crew of the starship, gravity waves are produced in normal space when a ship enters or leaves normal space. Thus, the precise location at which a ship entered (or left) normal space may be determined.

Ships in jump space can communicate with installations in normal space and other ships both in normal space and in jump space only via C+ transceivers, or by message drones (both described later in this chapter).

10.2 SHIP CONSTRUCTION

Choose the mass of the ship (in metric tons), including cargo capacity. The amount of hull material required for a structurally sound ship of this mass is 1/10 of the total desired mass of the ship. The hull will cost 100 smu per metric ton of final desired ship mass. Or, put in another way, hull material costs 1000 smu per metric ton. The hull provides 150 points of armor (both impact and energy protection).

The remaining mass of the ship is now allocated among the other major systems available (note: some systems, the more powerful weapons systems in particular, are available to civilians only through the black market).

The energy consumption figures for the various systems are given in terms of one standard energy unit per hour. 100 milligrams (or 1/10 gram) of matter totally converted to radiant energy will produce one standard energy unit. Units driven at less than their rated power levels will still operate, though at correspondingly reduced capacity.

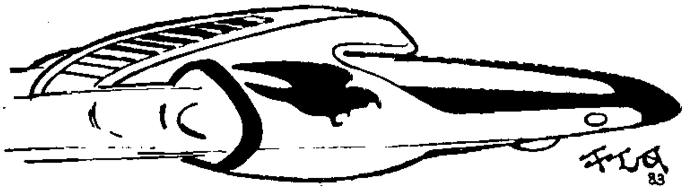
In addition an MTBF (mean time between failures) formula is given for most systems. This is the number of hours that the system might be expected to operate without breakdown, assuming routine maintenance. Where routing maintenance has been skipped, MTBF values should be halved for each maintenance period that passes. Those systems or ship components for which MTBF formulas are not given are assumed not to fail within game time scales. The normal maintenance period is one year.

Each system starts with a reliability of 100%. When a system's MTBF has elapsed, roll 1D100 and reduce that system's reliability to the value rolled. Thus, on a roll of 37, the system reliability would be reduced to 37%. For each hour (or each MTBF, whichever is less) that the system continues to operate, the system reliability or less must be rolled on percentile dice, or further decay occurs in the system. If further decay occurs, roll 1D100 and reduce system reliability again by the product of this roll divided by 100 and the previous system reliability. Thus, if we had a roll of 52 on D100 at the end of the first hour for a system that had already degraded to 37% reliability, it would degrade further – and if we rolled 46 for our system degradation, the system reliability would be reduced to 0.37 x 0.46 = 0.1702 (which we round down to the nearest .01) for a system reliability of 0.17, or 17%. Systems degraded to 0% reliability in this fashion become unrepairable.

A record should be kept by the referee of the rough amount of time each of the major systems are used each expedition, as the time between failures assumes that routine maintenance will be carried out. Thus though a given system may not fail on one expedition, it will eventually fail if the ship remains in use.

10.2.1 Life Support Systems

An LS–1 unit will provide for all the needs of up to 40 points in SIZ of beings. It costs 20,000 smu, masses 2 metric tons, and uses 0.001 energy units per hour. Larger units are available – an LS–N unit will provide all the life support needs (air, food, water, what have you) of up to 40 x N points in SIZ of beings. An LS–N unit costs 20,000 x N smu, masses 2 x ($N^{(1/3)}$) metric tons (rounded up to the nearest 0.1 tons), and uses 0.001 x N energy units per hour. The MTBF for this system is 4000+(1D1000) x 8 hours.



10.2.1.1 TYPICAL LIFE SUPPORT UNITS

Type	Size Points Supported	Mass (metric tons)	Energy Cost (units/Hr)	Cost of Unit (in 1000 smu)
LS–0.5	20	1.6	0.001	10
LS–1.0	40	2.0	0.001	20
LS–1.5	60	2.3	0.002	30
LS–2.0	80	2.6	0.002	40
LS–2.5	100	2.8	0.003	50
LS–3.0	120	2.9	0.003	60
LS–3.5	140	3.1	0.004	70
LS–4.0	160	3.2	0.004	80
LS–4.5	180	3.3	0.005	90
LS–5.0	200	3.5	0.005	100
LS–5.5	220	3.6	0.006	110
LS–6.0	240	3.7	0.006	120
LS–6.5	260	3.8	0.007	130
LS–7.0	280	3.9	0.007	140
LS–7.5	300	4.0	0.008	150
LS–8.0	320	4.0	0.008	160
LS–8.5	340	4.1	0.009	170
LS–9.0	360	4.2	0.009	180
LS–9.5	380	4.3	0.010	190
LS–10	400	4.4	0.010	200
LS–11	440	4.5	0.011	220
LS–12	480	4.6	0.012	240
LS–13	520	4.7	0.013	260
LS–14	560	4.9	0.014	280
LS–15	600	5.0	0.015	300

10.2.2 Power Generation Systems

A P–1 power plant will safely handle the generation of 750 energy units per hour. It costs one million smu, and masses one metric ton. Larger units are available, as are smaller ones. A P–N power plant will safely generate 750 x N energy units per hour, will cost N million smu, and will mass $N^{(1/3)}$ metric tons (rounded up to the nearest 0.1 tons). The MTBF for this system is 18,000+((1D1000) x 4) hours.

10.2.2.1 TYPICAL POWER GENERATION UNITS

Type	Mass (metric tons)	Energy Generated (units/hour)	Unit Cost (in 1000 smu)
P–0.125	0.5	93.75	125
P–0.25	0.7	187.50	250
P–0.375	0.8	281.25	375
P–0.5	0.8	375.00	500
P–0.625	0.9	468.75	625
P–0.75	1.0	565.50	750
P–0.875	1.0	656.25	875
P–1.0	1.0	750.00	1,000
P–1.25	1.1	937.50	1,250
P–1.5	1.2	1125.00	1,500
P–1.75	1.3	1312.50	1,750
P–2	1.3	1500.00	2,000
P–3	1.5	2250.00	3,000
P–4	1.6	3000.00	4,000
P–5	1.8	3750.00	5,000
P–6	1.9	4500.00	6,000
P–7	2.0	5250.00	7,000
P–8	2.0	6000.00	8,000
P–9	2.1	6750.00	9,000
P–10	2.2	7500.00	10,000

10.2.3 Contragravity Propulsion Systems

A CG–1 unit will accelerate 1000 metric tons of material at 1 g (i.e. 9.8 meters per second per second). It will accelerate M metric tons of material at (1000/M) gs (so it will accelerate a 400 ton craft at 2.5 gs). A CG–1 unit has a basic cost of 6000 smu, masses 2 metric tons, and uses one energy unit per hour at full power.

A standard CG–1 unit 'neutralizes' 90% of the acceleration's internal effects – though it would accelerate a 100 metric ton craft at 10 gs, all inside would only feel as though they were being accelerated at 1 g. If a different neutralization factor is desired (for CG–1 or CG–N units) a cost multiplier of 10/(100–neutralization factor) is applied. Thus a 90% neutralization factor (the standard case) yields a cost multiplier of 10/(100–90) = 1, and a 98% neutralization factor yields a cost multiplier of 10/(100–98) = 5.

A CG–N unit will accelerate M metric tons at (N x (1000/M)) gs, has a basic cost of N x 6000 smu, masses 2 metric tons, and uses N energy units per hour at full power.

Contragravity units may be used as to produce 'tractor' or 'pressor' beams with force equivalent to 1/10 the normal drive capacity (thus, a CG–1 may be used to accelerate a 100 ton body at 1 g). The range of tractor and pressor beams is 1000 kilometers (approximately 600 miles).

The MTBF for this system is 5000 + ((1D1000) x 10) hours.

10.2.3.1 TYPICAL CONTRAGRAVITY SYSTEMS

Type	Neutralization	Acceleration (1000 ton mass)	Internal effect	Cost (1000 smu)
CG–1	90%	1g	0.10g	6
CG–1	95%	1g	0.05g	12
CG–1.5	90%	1.5g	0.15g	9
CG–3	90%	3g	0.30g	18
CG–5	90%	5g	0.50g	30
CG–10	90%	10g	1.00g	60
CG–20	90%	20g	2.00g	120
CG–20	95%	20g	1.00g	240
CG–40	90%	40g	4.00g	240
CG–40	97.5%	40g	1.00g	960
CG–100	90%	100g	10.00g	600
CG–160	90%	160g	16.00g	960
CG–160	98%	160g	3.20g	4,800
CG–800	90%	800g	80.00g	4,800

The above listed accelerations are computed assuming that the craft masses 1000 metric tons.

10.2.4 Jump Drive Systems

A J–1 engine will handle 100 energy units per hour safely. The amount of energy required to maintain a spacecraft in jump space is given by the following equation:

$$\text{Energy} = (M/1000) \times V^2$$

where M is the mass of the spacecraft in metric tons, and V is the speed of the spacecraft in units of light-years per hour. A J–1 engine costs 250,000 smu and masses 100 metric tons. A J–N engine's characteristics are computed as follows:

Maximum safe energy used = N x 100 energy units per hour

$$\text{Cost} = N \times N^{(1/2)} \times 250{,}000 \text{ smu}$$

$$\text{Mass} = 100 \times N^{(1/2)} \text{ metric tons}$$

(round fractions up to the nearest 0.1 metric tons)

The MTBF for the engines, when run at their safe energy consumption rate (of N x 100 energy units per hour) is 4000 + (1D1000) x 2. When the craft is propelled above its maximum safe cruising speed (i.e. that speed which requires an energy expenditure equal to the safe energy handling capability of the engine) this MTBF is reduced. For each 10% increment of speed added above this maximum safe cruising speed, cut MTBF by a factor of two. Thus at 30% overspeed, each hour counts as eight hours against MTBF; at 50% overspeed, each hour counts as thirty two hours against MTBF, and so on.

10.2.4.1 TYPICAL JUMP DRIVE SYSTEMS

Type	Mass (metric tons)	Energy Handled (units/hour)	Jump Speed (in 1000 ton ship)	Cost (1000 smu)
J–0.25	50.0	25	5.00 1y/hr	31.3
J–0.50	70.8	50	7.07 1y/hr	88.4
J–0.75	86.6	75	8.66 1y/hr	164.4
J–1.00	100.0	100	10.00 1y/hr	250.0
J–1.25	111.8	125	11.18 1y/hr	349.4
J–1.50	122.5	150	12.25 1y/hr	459.3
J–1.75	132.3	175	13.23 1y/hr	578.8
J–2.00	141.5	200	14.15 1y/hr	707.2
J–2.25	150.0	225	15.00 1y/hr	843.8
J–2.50	158.2	250	15.82 1y/hr	988.3
J–2.75	165.9	275	16.59 1y/hr	1,140.1
J–3.00	173.3	300	17.33 1y/hr	1,299.1
J–3.25	180.3	325	18.03 1y/hr	1,464.8
J–3.50	187.1	350	18.71 1y/hr	1,637.0
J–3.75	193.7	375	19.37 1y/hr	1,815.5
J–4.00	200.0	400	20.00 1y/hr	2,000.0
J–4.25	206.2	425	20.62 1y/hr	2,190.4
J–4.50	212.2	450	21.22 1y/hr	2,386.5
J–4.75	218.0	475	21.80 1y/hr	2,588.1
J–5.00	223.7	500	22.37 1y/hr	2,795.1
J–5.25	229.2	525	22.92 1y/hr	3,007.4
J–5.50	234.6	550	23.46 1y/hr	3,224.7
J–5.75	239.8	575	23.98 1y/hr	3,447.0
J–6.00	245.0	600	24.50 1y/hr	3,674.3
J–6.25	250.0	625	25.00 1y/hr	3,906.3
J–6.50	255.0	650	25.50 1h/hr	4,143.0
J–6.75	259.9	675	25.99 1y/hr	4,384.3
J–7.00	264.6	700	26.46 1h/hr	4,630.1
J–7.25	269.3	725	26.93 1y/hr	4,880.4
J–7.50	273.9	750	27.39 1y/hr	5,134.9
J–7.75	278.4	775	27.84 1y/hr	5,393.8
J–8.00	282.9	800	28.29 1y/hr	5,656.9
J–8.25	287.3	825	28.73 1y/hr	5,924.1
J–8.50	291.6	850	29.16 1y/hr	6,195.4
J–8.75	295.8	875	29.58 1y/hr	6,470.8
J–9.00	300.0	900	30.00 1y/hr	6,750.0
J–9.25	304.2	925	30.42 1y/hr	7,033.2
J–9.50	308.3	950	30.83 1y/hr	7,320.3
J–9.75	312.3	975	31.23 1y/hr	7,611.1
J–10.0	316.3	1000	31.63 1y/hr	7,905.7

10.2.5 Shield Generator Systems

A D–1 shield generator can generate a defensive screen of defensive value 1 (see Ship-to-Ship Combat). It costs one million smu, masses 400 metric tons, and uses 1000 energy units per hour to maintain the defensive screens at value 1. In order to conserve power, shield generators may be used to generate screens with defensive value of 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, or 1.0 times the rated maximum for the given shield generator. Six action points must pass to increase or decrease defensive screen value by 10% (thus, to bring shields to 80% of rated maximum defensive value from 0% requires 48 action points – four melee rounds). A D–N shield generator can generate a defensive screen of defensive value up to N. A D–N shield generator's characteristics are computed as follows:

$$\text{Energy use} = 1000 \times N^2 \text{ units per hour}$$

$$\text{Cost} = N^2 \times 1 \text{ million smu}$$

$$\text{Mass} = 400 \times N \text{ metric tons}$$

The MTBF for this system is (4500 + 1D1000) hours.

Limitations of the Shield generator systems:

(1) Only one shield generator system may be in operation on board a ship at any given time.

(2) In an atmosphere, or anywhere save in a reasonably hard vacuum, the defensive value of the screens is virtually zero (reduce the defensive value of the screen by 0.5 points for each 0.001 atmospheres pressure in the surrounding medium).

(3) The screens extend out to a distance of 40 kilometers (approximately 25 miles) from the generator unit. They are not as effective in protecting against attacks generated within the field generated — reduce the defensive value of the screens to R/40 times the current effectiveness, where R is the distance to the attacker in kilometers (e.g. in an attack launched from a range of 20 kilometers against a ship with screens of defensive value 4, the defensive factor used in resolving that combat is 2).

10.2.5.1 TYPICAL SHIELD GENERATOR SYSTEMS

Type	Mass (in tons)	Energy Needed (units/hour)	System Cost (in 1000 smu)
D–0.1	40	10	10
D–0.2	80	40	40
D–0.3	120	90	90
D–0.4	160	160	160
D–0.5	200	250	250
D–0.6	240	360	360
D–0.7	280	490	490
D–0.8	320	640	640
D–0.9	360	810	810
D–1.0	400	1000	1,000
D–1.5	600	2250	2,250
D–2.0	800	4000	4,000
D–2.5	1000	6250	6,250
D–3.0	1200	9000	9,000
D–3.5	1400	12,250	12,250
D–4.0	1600	16,000	16,000
D–4.5	1800	20,250	20,250
D–5.0	2000	25,000	25,000
D–6.0	2400	36,000	36,000
D–7.0	2800	49,000	49,000
D–8.0	3200	64,000	64,000
D–9.0	3600	81,000	81,000
D–10.0	4000	100,000	100,000

10.2.6 Telepathic Screening Systems

A T–1 unit costs 10,000 smu, masses 0.1 metric tons, uses 0.001 energy units per hour, and will provide a minimum TPR base of 10 for all inside the screens against attacks originating outside the screens (or vice versa). Thus any telepathic attack or probe launched by anyone outside the ship's hull will face a TPR of at least 10, no matter how low the TPR of the actual target within the ship's hull.

A T–N unit costs N x 10,000 smu, masses N x 0.1 metric tons, uses N x 0.001 energy units per hour, and will provide a minimum TPR base of 10 x N for all those inside the screen against attacks originating outside the screen (or vice versa).

MTBF = (1000 + 10 x (1D100)) hours

10.2.6.1 TYPICAL TELEPATHIC SCREEN SYSTEMS

Type	Mass (in tons)	Energy Needed (units/hour)	TPR Added	Cost (1000s)
T–0.5	0.1	0.001	5	5
T–1.0	0.1	0.001	10	10
T–1.5	0.2	0.002	15	15
T–2.0	0.2	0.002	20	20
T–2.5	0.3	0.003	25	25
T–3.0	0.3	0.003	30	30
T–3.5	0.4	0.004	35	35
T–4.0	0.4	0.004	40	40
T–4.5	0.5	0.005	45	45
T–5.0	0.5	0.005	50	50
T–6.0	0.6	0.006	60	60
T–7.0	0.7	0.007	70	70
T–8.0	0.8	0.008	80	80
T–9.0	0.9	0.009	90	90
T–10.0	1.0	0.010	100	100

10.2.7 Primary Weapon System

An AF–1 battery with range R=1 launches an attack of offensive strength 1 (see Ship-to-Ship Combat). It will cost 1 million smu, mass 400 metric tons, and require a power plant capable of generating 1000 energy units per hour (though each firing of the battery will only consume 1.667 energy units).

An AF–N, R=M battery will launch an attack of offensive strength N out to a range of 4 x M light-years (in jump space) or 2 x M light-seconds (in normal space). The effectiveness of the weapon beyond the specified range is zero. The characteristics of the AF–N unit can be determined from the following equations:

$$\text{Energy Use} = N^2 \times M^2 \times 1000 \text{ energy units/hour}$$

$$\text{Cost} = N^2 \times M^2 \times 1 \text{ million smu}$$

$$\text{Mass} = N \times 400 \text{ metric tons}$$

Batteries may be fired at 6 second intervals.

Each time a battery is fired, roll 1D100 — if the result is 00, the unit has failed (treat as if the unit had reached its MTBF).

10.2.7.1 TYPICAL PRIMARY WEAPONS SYSTEMS

Type	Range Factor	Mass (tons)	Energy Needed (units/hour)	Cost (1000s)
AF–0.25	0.50	100	15.625	15.7
AF–0.25	0.75	100	35.157	35.2
AF–0.25	1.00	100	62.500	62.5
AF–0.25	1.25	100	97.657	97.7
AF–0.50	0.50	200	62.500	62.5
AF–0.50	0.75	200	140.625	140.7
AF–0.50	1.00	200	250.000	250.0
AF–0.50	1.25	200	390.625	390.7
AF–0.75	0.50	300	140.625	140.7
AF–0.75	0.75	300	316.407	316.5
AF–0.75	1.00	300	562.500	562.5
AF–0.75	1.25	300	878.907	879.0
AF–1.00	0.50	400	250.000	250.0
AF–1.00	0.75	400	562.500	562.5
AF–1.00	1.00	400	1000.000	1,000.0
AF–1.00	1.25	400	1562.500	1,562.5

10.2.8 Computer Systems

A Computer System Grade–1 costs 10,000 smu, masses 0.1 metric tons, and uses 0.001 energy units per hour. A Grade–N computer costs N x 10,000 smu, masses 0.1 metric tons, and uses 0.001 energy units per hour. The only difference between a Grade–1 computer and a Grade–N computer is in the complexity of the hardware, and in the raw computing capability of the system. In order to run a spacecraft safely, the flight computer must be at least grade W, where W satisfies the relation:

$$W = V^{(1/2)} + A^{(1/2)} + R$$

where V is the maximum possible speed in jump space for the spacecraft (in light-years per hour), A is the maximum acceleration of the spacecraft in normal space (in gs acceleration), and R is the range factor for the weapons battery with longest range of those on board.

Computers of grade 900 and above are 'self aware'. They are capable of acting intelligently and independently. The intelligence of such a computer is equal to the $(\text{Computer Grade}/100)^{(1/2)}$.

Self-aware machines are treated no differently from any other intelligent life form — and the ownership of intelligent life forms is definitely not permitted in Hegemonic society. This fact, coupled with the great expense involved in their manufacture has resulted in such machines being very uncommon in the Hegemony.

10.2.8.1 TYPICAL 'SELF AWARE' COMPUTERS

Grade	Intelligence	Mass (tons)	Energy Needed (units/hour)	Cost (in Millions)
900	3	0.1	0.001	9
1600	4	0.1	0.001	16
2500	5	0.1	0.001	25
3600	6	0.1	0.001	36
4900	7	0.1	0.001	49
6400	8	0.1	0.001	64

Grade	Intelligence	Mass (tons)	Energy Needed (units/hour)	Cost (in Millions)
8100	9	0.1	0.001	81
10000	10	0.1	0.001	100
12100	11	0.1	0.001	121
14400	12	0.1	0.001	144
16900	13	0.1	0.001	169
19600	14	0.1	0.001	196
22500	15	0.1	0.001	225
25600	16	0.1	0.001	256
28900	17	0.1	0.001	289
32400	18	0.1	0.001	324
36100	19	0.1	0.001	361
40000	20	0.1	0.001	400
44100	21	0.1	0.001	441
48400	22	0.1	0.001	484
52900	23	0.1	0.001	529
57600	24	0.1	0.001	576
62500	25	0.1	0.001	625

10.2.9 C+ Transceiver Systems

A C–1 transceiver costs 1 million smu, masses 1.0 metric tons and uses up to 750 energy units per hour. When operating at full power, it will broadcast to any and all operating C+ transceivers within 9 light-years.

A C–N transceiver costs N million smu, masses $N^{(1/3)}$ metric tons (round fractions up to the nearest 0.1 tons) and uses up to N x 750 energy units per hour of operation. When operating at full power, it will broadcast to any and all operating C+ transceivers within a range of $(750 \times N)^{(1/3)}$ light years (round fractions down to the nearest 0.1 light-years). When operated at reduced power levels the range is reduced to $M^{(1/3)}$ light years, where M is the number of energy units used per hour of operation.

MTBF = (50 + 1D100) hours

10.2.9.1 TYPICAL C+ TRANSCEIVER SYSTEMS

Type	Mass (tons)	Energy Handled (units/hour)	Range (in ly)	Cost (in Millions)
C–0.5	0.8	375	7.2	0.5
C–1.0	1.0	750	9.0	1.0
C–1.5	1.2	1125	10.4	1.5
C–2.0	1.3	1500	11.4	2.0
C–2.5	1.4	1875	12.3	2.5
C–3.0	1.5	2250	13.1	3.0
C–3.5	1.6	2625	13.7	3.5
C–4.0	1.6	3000	14.4	4.0
C–4.5	1.7	3375	15.0	4.5
C–5.0	1.8	3750	15.5	5.0
C–5.5	1.8	4125	16.0	5.5
C–6.0	1.9	4500	16.5	6.0
C–6.5	1.9	4875	16.9	6.5
C–7.0	2.0	5250	17.3	7.0
C–7.5	2.0	5625	17.7	7.5
C–8.0	2.0	6000	18.1	8.0
C–8.5	2.1	6375	18.5	8.5
C–9.0	2.1	6750	18.9	9.0
C–9.5	2.2	7125	19.2	9.5
C–10.0	2.2	7500	19.5	10.0

10.2.10 Normal Space Communications Systems

An Rd–1 unit has a range of 1 light-second (186,000 miles, roughly 300,000 kilometers), masses 0.1 metric tons, and costs 500 smu. An Rd–1 unit uses 0.001 energy units per hour.

An Rd–N unit has a range of N light-seconds (N x 300,000 kilometers), masses 0.1 metric tons, and costs N x 500 smu. An Rd–N unit uses 0.001 energy units per hour.

The maximum allowed range for a normal space communication unit is one million light-seconds. This is slightly more than eleven and a half light days, about 186 billion miles, and is roughly fifty-three times the mean orbital distance of Pluto from Sol.

MTBF = (9000 + (2 x (1D1000))) hours

10.2.11 Radar Systems

Radar is treated as a Grade 0 Active sensor (see Active Sensor systems, to follow). A radar unit costs 10,000 smu per light-second of range, uses 0.001 energy units per hour, and masses one metric ton.

MTBF = (1000 + 1D1000) hours

10.2.12 Active Sensor Systems

An active sensor module works by sending an energy pulse out to the target then observing and analyzing the reflected pulse. The systems in use in the Hegemony (other than radar) work equally well in both jump space and normal space (though the sensors may not detect ships in jump space from normal space or vice versa). In normal space, the light speed limit holds for the sensor's energy pulse; therefore, if the sensor module is scanning to detect an object in normal space that is two light minutes distant, it will take four minutes (two minutes for the pulse to reach the target, two minutes to return) before the data is available. The characteristics of a sensor module of GRADE N with range factor R are described by the following equations:

Energy Use = 0.1 x R x N energy units per hour

Cost = N^2 x R x 100,000 smu

Mass = 1 metric ton

The range factor R is in units of 2 light-seconds in normal space, and 4 light-years in jump space. Thus an active sensor module with range factor R = 5 can detect craft at a range of 10 light-seconds in normal space and, when the craft is in jump space, it can detect other bodies in jump space at a distance of 20 light-years. The Grade of the sensor module determines how effective the module is in detecting and tracking other craft with operational ECM (electronic counter measure) systems.

The maximum allowable range factor for an active sensor module is R = 50.

MTBF = (8000 + 2 x (1D1000)) hours

10.2.12.1 TYPICAL ACTIVE SENSOR SYSTEMS

Grade	Range	Energy Needed (units/hour)	Cost (1000s)
1	2.5	0.25	250
1	5.0	0.50	500
1	7.5	0.75	750
1	10.0	1.00	1,000
2	2.5	0.50	1,000
2	5.0	1.00	2,000
2	7.5	1.50	3,000
2	10.0	2.00	4,000
3	2.5	0.75	2,250
3	5.0	1.50	4,500
3	7.5	2.25	6,750
3	10.0	3.00	9,000
4	2.5	1.00	4,000
4	5.0	2.00	8,000
4	7.5	3.00	12,000
4	10.0	4.00	16,000
5	2.5	1.25	6,250
5	5.0	2.50	12,500
5	7.5	3.75	18,750
5	10.0	5.00	25,000

10.2.13 Passive Sensor Systems

A passive sensor module of Grade N costs N^2 x 50,000 smu, masses 10 metric tons, and uses 0.1 energy units per hour. Thus, a PS–8 unit (a passive sensor module of grade 8) would cost 400,000 smu, mass 10 metric tons, and use 0.1 energy units per hour. The Grade of the sensor module determines how effective the module is in tracking other craft with operational ECM systems.

The range for a passive sensor module is fixed at 10 light-hours in normal space and 100 light-years in jump space.

A passive sensor will, regardless of the grade of ECM of the target craft, report accurately the position and time of event of certain phenomena as follows:

(a) any massive energy discharge (such as would result from a nuclear detonation or from the firing of a ship's energy weapon),

(b) the gravity waves resulting (in both normal and jump space) from a ship entering or leaving jump space,

(c) any scan of the ship by any active sensor system by any other ship (though precise determination of the other ship's location depends upon relative grade of the passive sensor and the opposing craft's ECM).

In addition, depending upon the ECM Grade of the target craft, a passive sensor module may allow the operator to determine the location and time of event of any operation of a power module using the total mass-energy conversion system in use in the Hegemony, any event resulting in massive neutrino flux (as from a hydrogen fusion reaction), or any event resulting in gravity waves (such as operation of a ship's contragravity drive system).

MTBF = (12000 + 2 x (1D1000)) hours

10.2.14 Electronic Counter Measure (ECM) Systems

An ECM system, Grade 1, costs 2.5 million smu, masses 1 metric ton, and uses 1 energy unit per hour. An ECM–1 unit will confuse a sensor of Grade M on a roll of 10+1–M or less on 1D20 (roll once per full turn). If the required roll is 0 or less, the sensor in question always penetrates the electronic counter measures. If the ECM unit confuses the sensor, the sensor will either (a) not report the ECM cloaked ship at all, or (b) report erroneous location or power emission characteristics for the cloaked craft.

An ECM–N unit costs N^2 x 2.5 million smu, masses 1 metric ton, and uses N^2 energy units per hour of operation. An ECM–N unit will confuse a sensor of Grade M on a roll of 10+N–M or less on 1D20 (roll once per full turn) with effects of confusion of sensors as listed above. If required roll is 0 or less, the sensor always sees through the electronic counter measures; if it is 21 or more, the ECM will always fool the sensor.

MTBF = (2000 + 4 x (1D1000)) hours

10.2.15 Missile Launcher System

A launcher may fire one missile each 6 action points, costs 12 million smu, masses 100 metric tons, and requires 0.001 energy units per hour of operation. A launcher may handle any missile up to 1000 metric tons mass.

Each time a launcher merchanism is used, there is a 1% chance of degradation of system reliability. Roll 1D100 after each firing, and if the result is 00, the system has failed.

10.2.15.1 MISSILES

There are 5 types of missiles in use in **OTHER SUNS.**

10.2.15.1.1 Message Torpedoes

This type of missile carries an unshielded jump engine (which will kill any known life form that attempts to 'hitch a ride' by tagging along within the jump field of the torpedo), an unshielded power plant, an extremely well shielded (and primitive) guidance computer, a small C+ transceiver, and an Rd–10 unit. A message torpedo can carry a complete copy of a ship's log (plus any other desired messages) at 360 light-years per hour. This type of missile costs 6 million smu, and mass 65 metric tons. The C+ transceiver on board has a range of 4.5 light-years and begins broadcasting a homing signal upon arrival at destination (or re-entry into normal space – whichever happens first). Upon receipt of proper keying signal, the missile will then broadcast its complete memory store (in order of priorities set prior to launch). The MTBF for the drive of the missile is (125+1D100) hours. The C+ transceiver and Rd–10 MTBFs are as per standard units.

10.2.15.1.2 Normal Space Telemetry Drones

A telemetry drone costs 1,500,000 smu, is capable of 15000 gs acceleration, and masses 8 metric tons (4 tons of which are fuel). In addition, the telemetry drone carries an Rd–1000 unit, and an Active sensor system of grade 1, range factor 5.

10.2.15.1.3 C+ Telemetry Drone

A C+ telemetry drone is a normal space telemetry drone with an unshielded jump engine and a C–1 C+ transceiver added and the CG unit reduced in grade. It travels 88.5 light-years per hour in jump space, and accelerates at 100 gs in normal space. It masses 70 metric tons and costs 6 million smu.

10.2.15.1.4 Normal Space Attack Missile

This is a telemetry drone with a warhead carried in place of a portion of the fuel. It masses 5 metric tons, will accelerate at up to 10,000 gs, and does damage vs targets hit based upon the strength of the warhead. The attack missile costs 700,000 smu plus the cost of the warhead.

10.2.15.1.5 Warheads

a) W–1 warhead

This is a 1.6 megaton warhead which masses 1 metric ton and costs 1 million smu. It will produce an attack of offensive value 21.2 in Ship-to-Ship combat if a hit is scored.

b) W–N warhead

This is a (1.6 x N) megaton warhead which masses 1 metric ton and costs N million smu. It will produce an attack of offensive value 21.2 x $(N^{(1/2)})$ in Ship-to-Ship combat if a hit is scored.

10.2.15.1.6 C+ Attack Missiles

A C+ attack missile is a C+ telemetry drone with the C+ transceiver removed and a warhead put in its place. The C+ attack missile masses 70 metric tons (including warhead) and costs 4 million smu (not counting the cost of the warhead). Warheads for the C+ attack missile are as per those for the normal space attack missile.

10.2.16 Manned Canister Launcher System

Each launcher costs 10 million smu, masses 160 metric tons, and requires 0.1 energy units per hour of operation. Each launcher will fire up to 12 manned canisters each melee round (one per action point). Each canister has a mass of 2 metric tons, and provides 150 points of armor protection to the armored individual inside the canister (who must be wearing a spacesuit, preferably powered armor, as the canisters do not provide life support functions).

Canisters cost 1000 smu each.

Each time a launcher mechanism is used, there is a 1% chance of degradation of system reliability. Roll 1D100 after each firing, and if the result is 00, the system has failed.

10.2.17 Nova Weapon System

The Nova Weapon system masses 20,000 metric tons, costs 100 Billion smu, and uses 60 million energy units per hour (each charge/discharge cycle only takes one minute, and thus each time the weapon is fired only one million energy units are used).

The Nova weapon has a range of 80 million kilometers (49.7 million miles, 0.53 Astronomical Units). The Nova weapon projects an energy field (a cone 5 degrees wide) which induces spontaneous conversion of matter to radiant energy within the field. One unit is unable to project a sufficiently powerful field for the energy conversion effect to take place anywhere beyond the antenna array of the projector. Four projector systems must be activated simultaneously – and where the projected fields overlap and reinforce, a small percentage of the matter present will be converted into radiant energy. The weapon is totally ineffective against any body that is shielded by any form of defensive energy shield. Thus, the Nova weapon may only be used against planetary or stellar targets.

Where the proper number of projectors have been assembled and fired at a normal star, the result is a supernova explosion that will vaporize every planet in the given star system.

On each firing of the Nova weapon, roll 1D10. If the result is a 0, the weapon system has failed (treat as per MTBF time reached).

10.2.18 Standard Airlock Mechanism

Costs 10,000 smu, masses 2 metric tons.

10.2.19 Standard Cabin

The standard cabin masses 2 metric tons, and costs 2000 smu.

10.2.20 Science Lab Or Sick Bay

The lab or sickbay masses 10 metric tons costs 1 million smu and contains all standard equipment necessary to carry out a task relating to the given science, or to carry out standard medical procedures respectively.

A standard sick bay has beds for 6 patients, and has two operating rooms.

10.2.21 Low Power Ship Mounted Anti-Personnel Guns

These cost 15,000 smu, mass 0.2 metric tons, damage done = 90 +

1D20 points damage. These are 30 hit point weapons and the medium range for these weapons is 1000 meters. Treat as per type 5 blaster rifle for skill percentage.

10.2.22 Small Craft Storage Bay

The mass of the bay is equal to 1% of the mass of the small craft (cargo space equal to the mass of the small craft must also be allocated out of the total ship mass available) and the bay costs 1000 smu per metric ton mass.

10.2.23 Small Craft Launch Bay

The mass of the bay is equal to 10% (i.e. 1/10) of the mass of the largest craft to be launched and it costs 1200 smu per metric ton.

10.2.24 Some Notes On Starship Construction

Interior spacecraft walls provide 30 points of protection (both vs impact and energy attacks). These interior walls are strong enough to stand a static load equivalent to that produced by one atmosphere on one side, and hard vacuum on the other. The outer hull of the ship will provide 150 points of protection (again, vs both impact and energy attacks).

Civilian personnel are limited somewhat as to the systems they may purchase. The restrictions are as follows for civilian personnel:

(1) Shield generator systems may be no stronger than D5 grade.

(2) No civilian may purchase or own a weapon system more potent than AF–1, range factor 1.25.

(3) No civilian may purchase or own an ECM system better than Grade 1.

(4) No civilian may purchase or own any form of attack missile.

In general, each metric ton of ship mass corresponds to a 'block' within the ship of dimensions 1.5 meters x 3 meters x 2 meters (=9 cubic meters). Heavy equipment (shield generators and primary weapon systems modules) is somewhat denser – at 25 metric tons per 9 cubic meter 'block'. Thus, from the given mass of a ship (or from the mass of a component system thereof) it is possible to determine the approximate size (or volume) of the ship (or occupied by the given component system thereof).

10.2.25 Other Costs

Registration of the spacecraft costs civilian owners 1.5% of original ship construction cost. This is a one time only charge. Fuel costs 1.00 smu per gram (which will yield 10 energy units per gram) and the power modules are designed to take only one form of fuel (though a power systems engineer might attempt to 'retune' a particular unit to take some other fuel). Insurance is generally on a 'per run' basis for risk runs, on a yearly basis for milk runs, and costs 1D10% of assessed value. Yearly routine maintenance at a starport will cost 1D3% of ship original construction cost. Major overhauls of ship's systems are on a 'whatever the traffic will bear' basis – so the prospective shipowner will do well to develop his Streetwise skill in order to detect repair ripoffs.

The only remaining major cost for a new spacecraft is acquiring a Certificate of Spaceworthiness for the new craft. The cost of certification is 1-1.5% of the original ship construction cost (roll 1D6, divide by 10, and add 0.9).

In order to be certified as spaceworthy, a ship must meet the following criteria:

(1) All ships that will be carrying paid passengers must carry two or more armored flight recorders (paid for by the government). These recorders mass 100 kilograms (0.1 metric tons) each, and have the equivalent of 200 point armor. They record all ship instrumentation data and all communications between the ship and any other ship. The recordings made are not accessible to the ship's owners, and cannot be erased.

(2) The ship must have sufficient power generation capability to drive all systems on board at full load.

(3) The ship must be able to maintain an acceleration of at least 2.5 gs in normal space (i.e. 24.5 meters per second squared).

(4) The ship must have life support capability sufficient to handle all crew and passengers with at least a 20% excess life support capability remaining.

(5) The minimum sensor capability must be at least grade 1, range 1 light second.

(6) There must be C+ transceiver on board capable of transmitting at least 2 light years (i.e. a C–0.0167) and normal space communication unit capable of transmitting and receiving messages out to a range of at least ten light-seconds (3 million kilometers).

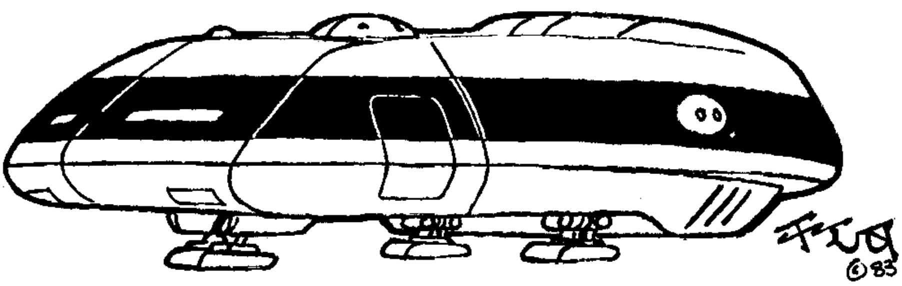
10.3 SHIP CONSTRUCTION EXAMPLES

10.3.1 Normal Space Combat Shuttle

This six passenger ship has a total mass of twelve metric tons and a maximum acceleration with full load of 166.67 gs (approximately 1.6 kilometers per second per second). This ship is not FTL capable.

Item	Mass (metric tons)	Energy Cost (units/Hr)	Unit Cost (1k=1000)	
Hull material	1.2	0.000	1k	smu
LS–8 unit	4.0	0.008	160k	smu
P–0.008	0.2	generates 6/hr	8k	smu
CG–2 (95% neut.)	2.0	2.000	24k	smu
T–1	0.1	0.001	10k	smu
Computer Grade 13	0.1	0.001	130k	smu
Rd–10	0.1	0.001	5k	smu
Radar (range=1 1–sec)	1.0	0.001	10k	smu
Anti-personnel guns (2)	0.2	0.000	30k	smu

Cargo capacity = 3100 kilograms (3.1 metric tons)
Total construction cost = 378,000 smu



10.3.2 In System Fighter

The mass of this ship is 2700 metric tons. It has a maximum acceleration with full load of 2500 gs (or 24.5 kilometers per second per second – able to reach Earth escape velocity of 11 kilometers per second in approximately half a second). Not FTL capable. Normal Crew of 2.

Total Cargo capacity = 7.1 metric tons. In combat, the fighter will (with shields up and guns blazing) use 2.086 kilos per hour fuel and 0.6 tons of its cargo capacity is devoted to fuel (which gives the fighter the capability of remaining in combat for 287 hours 37 minutes before running out of fuel). As fuel costs 1 smu per gram, the cost of one full load of fuel is 0.6 million smu. The two crewmen are assumed to be wearing combat space armor of some kind, and mass 6.5 metric tons or less total.

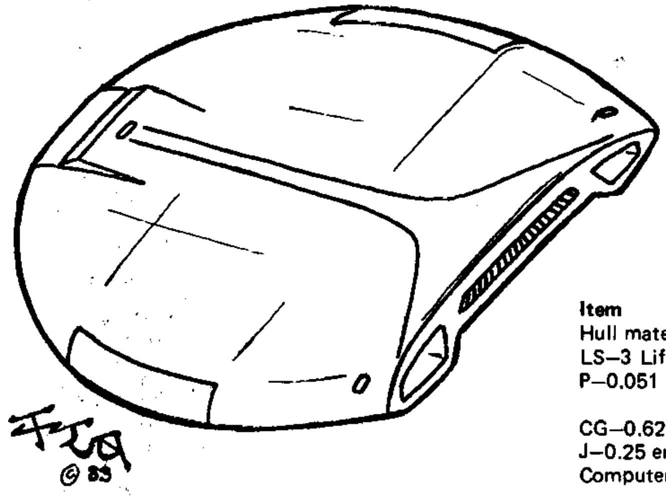
Total cost of this ship (including fuel load) is 892,509,500 smu (or just over 890 million smu).

Item	Mass (metric tons)	Energy Cost (units/Hr)	Unit Cost (1k=1000)	
Hull material	270.0	0.000	270k	smu
LS–2 unit	2.6	0.002	40k	smu
P–27.9	3.1	generates 20,925/hr	27900k	smu
CG–6750 (99.4% neut)	2.0	6750.000	675000k	smu
D–3 Shields	1200.0	9000.000	9000k	smu
AF–3, R–0.75 Weapon	1200.0	5062.500	5062.5k	smu
Computer Grade 51	0.1	0.001	510k	smu
Rd–50	0.1	0.001	25k	smu
Radar (range=10 1–sec)	1.0	0.001	100k	smu
Active Sensor G=8, R=10	1.0	8.000	64000k	smu
Passive Sensor G=20	10.0	0.100	20000k	smu
ECM Grade 6	1.0	36.000	90000k	smu
1 cabin	2.0	0.000	2k	smu

10.3.3 S Class Freighter

The total mass of this ship is 250 metric tons, and its maximum acceleration with full load is 2.5 gs. It is capable of traveling in jump space at a pseudo-velocity equivalent to 10 light-years per hour. Usual crew of 4. This is the workhorse of the starlanes – it is also the essential minimum certifiable configuration for an FTL starship.

Excess cargo capacity remaining (not counting mass of crew or of the personal gear of same) is 158,190 kilograms. Total construction and fueling cost for this ship is 327,325 smu.



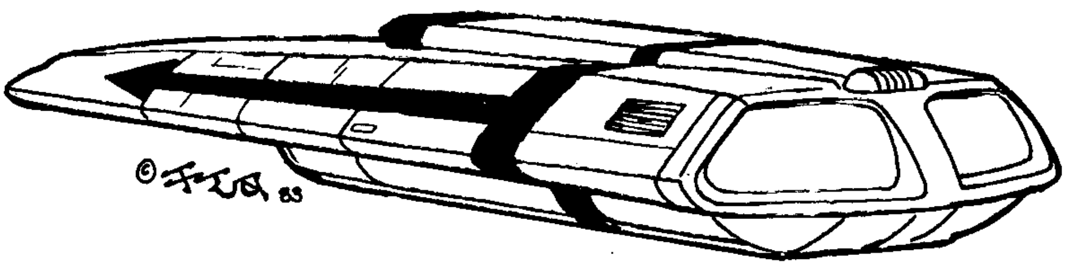
Item	Mass (metric tons)	Energy Cost (units/Hr)	Unit Cost (1k=1000)	
Hull material	25.0	0.000	25k	smu
LS–3 Life support unit	2.9	0.003	60k	smu
P–0.051 power plant	0.4	generates 38.250	51k	smu
CG–0.625 (0% neut.)	2.0	0.625	375	smu
J–0.25 engine	50.0	25.000	31.25k	smu
Computer (Grade 6)	0.1	0.000	60k	smu
C–0.0167	0.3	12.525	16.7k	smu
Rd–10 transceiver	0.1	0.001	5k	smu
Active Sensor G=1, R=½	1.0	0.050	50k	smu
2 cabins	4.0	0.000	4k	smu
Bridge (double cabin)	4.0	0.000	4k	smu
Airlock	2.0	0.000	10k	smu
10 kilos of fuel	0.01	0.000	10k	smu

10.3.4 Scattership

The total mass of this ship is 8000 metric tons, and its maximum acceleration with a full load is 1500 gs. It is capable of traveling in jump space at a pseudo-velocity equivalent to 60 light-years per hour. Crew size ranges from 1 to 8 depending upon mission assigned – usual crew of 4.

Excess cargo capacity remaining (not counting mass of crew or of the personal gear of same) is 29.5 metric tons. Total construction and arming cost for this craft is 4,339,762,500 or slightly over four and one-third billion smu.

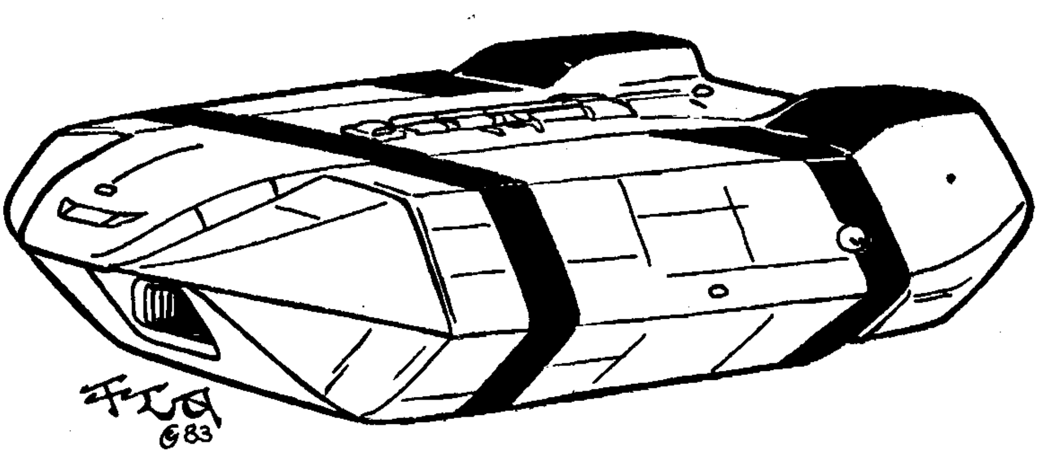
Item	Mass (metric tons)	Energy Cost (units/Hr)	Unit Cost (1k=1000)
Hull material	800.0	0.000	800k smu
LS–27 unit	6.0	0.027	270k smu
LS–27 unit	6.0	0.027	270k smu
P–125 power plant	5.0	generates 93,750/hr	125000k smu
P–125 power plant	5.0	generates 93,750/hr	125000k smu
P–125 power plant	5.0	generates 93,750/hr	125000k smu
P–125 power plant	5.0	generates 93,750/hr	125000k smu
P–125 power plant	5.0	generates 93,750/hr	125000k smu
CG–6000 (99 1/6% neut)	2.0	6000.000	432000k smu
CG–6000 (99 1/6% neut)	2.0	6000.000	432000k smu
J–288 jump engine	1697.1	28800.000	1,221,880.5k smu
D–5 Shields	2000.0	25000.000	25000k smu
T–10 telep. screen	1.0	0.010	100k smu
AF–5, R–1 Weapon	2000.0	25000.000	25000k smu
Computer Grade 48	0.1	0.001	480k smu
Computer Grade 48	0.1	0.001	480k smu
Computer Grade 48	0.1	0.001	480k smu
C–498 C+ transceiver (range=72 light-years)	8.0	373,500.000	498000k smu
Rd–100	0.1	0.001	50k smu
Radar (range=10 1–sec)	1.0	0.001	100k smu
Active Sensor G=10, R=30	1.0	30.000	300000k smu
Passive Sensor G=20	10.0	0.100	20000k smu
ECM Grade 12	1.0	144.000	360000k smu
Missile Launchers (8)	800.0	0.008	96000k smu
2 Airlocks	4.0	0.000	20k smu
8 cabins	16.0	0.000	16k smu
1 quad cabin (common room)	8.0	0.000	8k smu
1 quad cabin (bridge)	8.0	0.000	8k smu
Attack Missiles (24) (Normal Space)	120.0	0.000	16800k smu
W–8 warheads (27)	27.0	0.000	216000k smu
2 Message torpedoes	130.0	0.000	12000k smu
Attack Missiles (3) (C+ type)	207.0	0.000	12000k smu
Sick Bay	10.0	0.000	1000k smu
4 Scientific Labs	40.0	0.000	4000k smu
Fuel	40.0	–––	40000k smu



10.3.5 T Class Freighter

The total mass of this craft is 1000 metric tons, it has a maximum acceleration of 10 gs with a full cargo, and is able to maintain a spead of 10 light-years per hour in jump space. It is designed for a crew of 8.

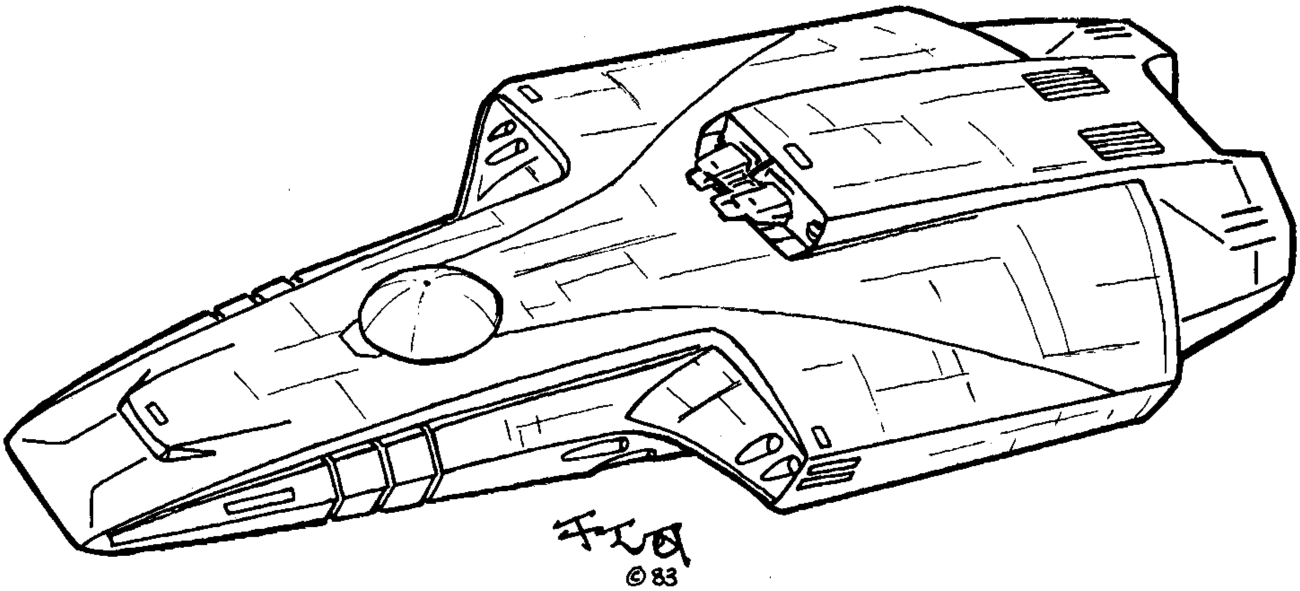
Item	Mass (metric tons)	Energy Cost (units/Hr)	Unit Cost (1k=1000)	
Hull material	100.0	0.000	100k	smu
LS–8 life support	4.0	0.008	160k	smu
LS–1 life support	2.0	0.001	20k	smu
LS–1 life support	2.0	0.001	20k	smu
P–0.185 power plant	0.6	generates 138.750	185k	smu
P–0.027 power plant (backup module)	0.3	generates 20.250	27k	smu
CG–5 contragrav unit (90% neutralization)	2.0	5.000	30k	smu
CG–5 contragrav unit (90% neutralization)	2.0	5.000	30k	smu
J–1 jump engine	100.0	100.000	250k	smu
D–0.1 shield generator	40.0	10.000	10k	smu
AF–0.1, R–0.75 (weapon system)	40.0	5.625	5625	smu
Computer (Grade 9)	0.1	0.001	10k	smu
C–0.0167 C+ comm.	0.3	12.525	16,700	smu
Rd–10 radio	0.1	0.001	5k	smu
Radar (range 10 1–sec)	1.0	0.001	100k	smu
Active Sensor G=1, R=½	1.0	0.050	50k	smu
2 Airlocks	4.0	0.000	20k	smu
6 regular cabins	12.0	0.000	12k	smu
4 double cabins (for Captain, First Mate, 1 common room, and the Bridge)	16.0	0.000	16k	smu
2 Low power AP guns	0.4	0.000	30k	smu
25 kilos of fuel	0.025	0.000	25k	smu



The excess cargo capacity remaining (not counting the mass of the crew or of the personal gear of same) is 672,175 kilograms. The total construction and initial fueling cost of this ship is 1,022,325 smu.

10.3.6 Armored Scout

The total mass of this ship is 15000 metric tons, and its maximum acceleration with full load is 1200 gs. It is capable of traveling in jump space at a pseudo-velocity equivalent to 30 light-years per hour. Crew size ranges from 6 to 20 depending upon mission assigned – usual crew of 14.



Excess cargo capacity remaining (not counting mass of either crew or their personal gear) is 985.1 metric tons. The total construction and arming cost for this craft is 7,736,565,700 smu.

Item	Mass (metric tons)	Energy Cost (units/Hr)	Unit Cost (1k=1000)
Hull material	1500.0	0.000	1500k smu
LS–64 unit	8.0	0.064	1280k smu
LS–64 unit	8.0	0.064	1280k smu
LS–64 unit	8.0	0.064	1280k smu
P–384 power plant	7.3	generates 288,000/hr	384,000k smu
P–384 power plant	7.3	generates 288,000/hr	384,000k smu
P–384 power plant	7.3	generates 288,000/hr	384,000k smu
P–384 power plant	7.3	generates 288,000/hr	384,000k smu
P–384 power plant	7.3	generates 288,000/hr	384,000k smu
CG–6000 (99% neut.)	2.0	6000.000	432,000k smu
CG–6000 (99% neut.)	2.0	6000.000	432,000k smu
CG–6000 (99% neut.)	2.0	6000.000	432,000k smu
J–135 jump engine	1161.9	13500.000	392,139.6k smu
D–10 Shields	4000.0	100000.000	100,000k smu
T–10 telep. screen	1.0	0.010	100k smu
AF–10, R–1.25 Weapon	4000.0	156250.000	156,250k smu
Computer Grade 43	0.1	0.001	430k smu
Computer Grade 43	0.1	0.001	430k smu
Computer Grade 43	0.1	0.001	430k smu
C–1920 C+ transceiver (range = 112 light-years)	12.5	1440000.000	1,920,000k smu
Rd–100	0.1	0.001	50k smu
Radar (range=10 1–sec)	1.0	0.001	100k smu
Active Sensor G=12, R=30	1.0	36.000	452,000k smu
Passive Sensor G=20	10.0	0.100	20,000k smu
ECM Grade 12	1.0	144.000	360,000k smu
Missile Launchers (8)	800.0	0.008	96,000k smu
4 Airlocks	8.0	0.000	80k smu
1 Quad size Airlock	8.0	0.000	80k smu
20 cabins	40.0	0.000	40k smu
2 quad cabins (common room and mess)	16.0	0.000	16k smu
1 quad cabin (bridge)	8.0	0.000	8k smu
Attack Missiles (24) (Normal Space)	120.0	0.000	16,800k smu
W–16 warheads (36)	36.0	0.000	576,000k smu
Message torpedoes (12)	780.0	0.000	12,000k smu
Attack Missiles (8) (C+ type)	552.0	0.000	32,000k smu
Telemetry drones (4) (C+ type)	280.0	0.000	36,000k smu
Telemetry drones (12) (normal space)	96.0	0.000	18,000k smu
Sick Bays (2)	20.0	0.000	2,000k smu
12 Scientific Labs	120.0	0.000	12,000k smu
Small Craft Storage (for 6 combat shuttles)	1.2	0.000	1.2k smu
Small Craft Launch Bay (for 2 combat shuttles)	2.4	0.000	2.9k smu
Combat Shuttles (6) (mission loaded)	72.0	0.000	2,268k smu
Fuel	300.0	–––	300,000k smu

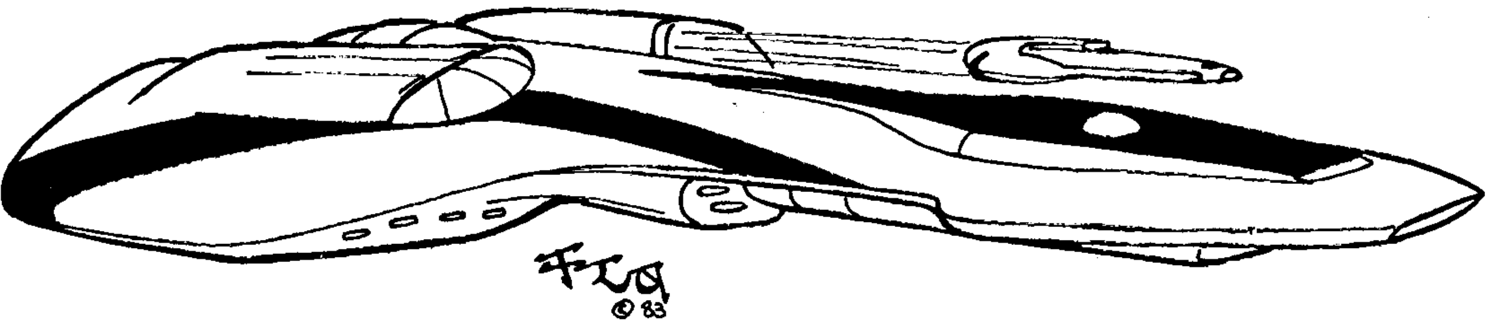
10.3.7 Frigate

The total mass of this ship is 30,000 metric tons, and its maximum acceleration with full load is 1100 gs. It is capable of traveling in jump space at a pseudo-velocity equivalent to 25 light-years per hour. Crew size ranges from 20 to 50 depending upon mission assigned – usual crew of 35.

Item	Mass (metric tons)	Energy Cost (units/Hr)	Cost (in 1000s)
Hull material	3000.0	0.000	300.0
LS–125	10.0	0.025	2500.0
LS–125	10.0	0.025	2500.0
LS–125	10.0	0.025	2500.0
P–1045 power plant	10.2	generates 783,750/hr	1,045,000
P–1045 power plant	10.2	generates 783,750/hr	1,045,000
P–1045 power plant	10.2	generates 783,750/hr	1,045,000
P–1045 power plant	10.2	generates 783,750/hr	1,045,000
P–1045 power plant	10.2	generates 783,750/hr	1,045,000
CG–5500 (99% neut.)	2.0	5500.000	330,000.0
CG–5500 (99% neut.)	2.0	5500.000	330,000.0
CG–5500 (99% neut.)	2.0	5500.000	330,000.0
CG–5500 (99% neut.)	2.0	5500.000	330,000.0
CG–5500 (99% neut.)	2.0	5500.000	330,000.0
CG–5500 (99% neut.)	2.0	5500.000	330,000.0
J–187.5 jump engine	1369.4	18,750.000	641,862.4
D–15 Shields	6000.0	225,000.000	225,000.0
T–100 telep. screen	10.0	0.100	1,000.0
AF–15, R–1.5 Weapon	6000.0	506,250.000	506,250.0
Computer Grade 41	0.1	0.001	410.0
Computer Grade 41	0.1	0.001	410.0
Computer Grade 41	0.1	0.001	410.0
Computer Grade 41	0.1	0.001	410.0
Computer Grade 41	0.1	0.001	410.0
C–4500 C+ transceiver (range = 150 light-years)	16.6	3,375,000.000	4,500,000
Rd–100	0.1	0.001	50.0
Rd–100	0.1	0.001	50.0
Rd–100	0.1	0.001	50.0
Active Sensor G=15, R=35	1.0	52.500	787,500.0
Active Sensor G=10, R=30 (alternate sensor system)	1.0	36.000	452,000.0
Passive Sensor G=30	10.0	0.100	45,000.0
Passive Sensor G=30	10.0	0.100	45,000.0
Passive Sensor G=30	10.0	0.100	45,000.0
ECM grade 15	1.0	225.000	562,500.0
ECM grade 15 (backup system)	1.0	225.000	562,500.0
Missile Launchers (12)	1200.0	0.012	144,000.0
12 Airlocks	24.0	0.000	240.0
4 Quad size Airlocks	32.0	0.000	320.0
48 standard cabins	96.0	0.000	96.0
2 double size cabins (for the Captain and the Executive Officer)	8.0	0.000	8.0
4 quad cabins (mess)	32.0	0.000	32.0
2 quad cabins (common rooms)	16.0	0.000	16.0
1 hex cabin (six times standard size – combined Bridge and combat information center)	12.0	0.000	12.0

Continued

Item	Mass (metric tons)	Energy Cost (units/Hr)	Cost (in 1000s)
Attack Missiles (48) (Normal Space)	240.0	0.000	33,600.0
W–16 warheads (48)	48.0	0.000	768,000.0
Message Torpedoes (16)	1040.0	0.000	16,000.0
Attack Missiles (18) (C+ type)	1242.0	0.000	72,000.0
W–36 warheads (18)	18.0	0.000	648,000.0
Telemetry drones (8) (C+ type)	560.0	0.000	72,000.0
Telemetry drones (24) (Normal Space)	192.0	0.000	36,000.0
Sick Bays (8)	80.0	0.000	8,000.0
18 Scientific Labs	180.0	0.000	18,000.0
Small craft storage (for 2 in-system fighters)	54.0	0.000	54.0
Small craft storage (for 10 combat shuttles)	2.0	0.000	2.0
Launch Bay No.1 (will accomodate either fighters or combat shuttles)	270.0	0.000	324.0
Launch Bay No.2 (will accomodate either fighters or combat shuttles)	270.0	0.000	324.0
Combat Shuttles (10) (mission loaded)	120.0	0.000	3840.0
In-System Fighters (2 – mission loaded)	5400.0	0.000	1,785,019.0
Fuel	600.0	0.000	600,000.0



Excess cargo capacity remaining (not counting mass of either the crew or their personal gear) is 1640.2 metric tons. The total construction and arming cost for this craft is 19,794,449,400 smu or slightly over nineteen and three-quarters billion smu.

10.4 CHARACTERISTICS OF COMMON SHIPS IN MILITARY USE (Or: Jane's All the Galaxy's Starships)

Type	AF	D	R	Accel	N	FTL cruise
System Fighter	3	3	0.75	2500 g	15.0 g	N/A
Scattership	5	5	1.00	1500 g	12.5 g	60 1y/hr
Armored Scout	10	10	1.25	1200 g	12.0 g	30 1y/hr
Frigate	15	15	1.50	1100 g	11.0 g	25 1y/hr
Destroyer	20	20	1.50	1000 g	10.0 g	25 1y/hr
Light Cruiser	60	40	1.50	900 g	9.0 g	25 1y/hr
Attack Cruiser	120	40	1.75	900 g	8.0 g	28 1y/hr
Heavy Cruiser	100	60	2.00	800 g	8.0 g	20 1y/hr
Carrier	20	100	2.00	800 g	8.0 g	25 1y/hr
Battlecruiser	140	80	2.25	700 g	7.0 g	20 1y/hr
Battleship	180	140	3.00	700 g	7.0 g	20 1y/hr
Superdreadnaught	240	120	4.00	750 g	7.5 g	20 1y/hr

AF = total offensive factors in primary weapon system
D = defensive value of shields
R = range factor of primary weapon system
Accel = maximum acceleration in normal space
N = acceleration felt internally when craft under max. accel.
FTL cruise = normal cruising speed in jump space

Type	Crew Range	Normal Crew	Mass (metric)
System Fighter	2	2	2,700 tons
Scattership	1-8	4	8,000 tons
Armored Scout	6-20	14	15,000 tons
Frigate	20-50	35	30,000 tons
Destroyer	40-80	60	60,000 tons
Light Cruiser	120-250	180	80,000 tons
Attack Cruiser	200-350	260	160,000 tons
Heavy Cruiser	500-1000	700	135,000 tons
Carrier	4500-5500	5000	500,000 tons
Battlecruiser	1200-1500	1400	180,000 tons
Battleship	2500-3500	3000	225,000 tons
Superdreadnaught	5000-7000	6000	300,000 tons

The Carrier has cargo space for 100 system fighters, as well as 10 fighter launch bays (capable of handling any craft up to 2700 metric tons), and storage bays for all 100 fighters.

Type	ECM Grade	Active Sensor Grade	Active Sensor R	Passive Sensor Grade
System Fighter	6	8	10	20
Scattership	12	10	30	20
Armored Scout	12	12	30	20
Frigate	15	15	35	30
Destroyer	15	15	40	30
Light Cruiser	15	15	45	30
Attack Cruiser	15	17	50	30
Heavy Cruiser	15	17	50	30
Carrier	20	20	50	35
Battlecruiser	15	17	50	35
Battleship	15	17	50	35
Superdreadnaught	20	20	50	40

R = range factor of active sensor system

10.5 SHIP–TO–SHIP COMBAT

The ship-to-ship combat in **OTHER SUNS** takes place in the same melee round time scale as hand-to-hand melee combat (each melee round taking up twelve seconds). In a ship-to-ship action, all weapon systems on each ship are fired independently — that is, the 1D100 roll to determine whether the shot hits is rolled independently for each weapon system and for each battery. Thus, even though a ship might have three AF–1 R–1 weapons batteries all under the control of the same weapons systems operator, the 1D100 roll will be made separately for each of the three batteries.

The following procedure should be followed for each melee round of ship-to-ship combat:

(1) The individual in command of each ship in the engagement has an opportunity to make a skill roll in Tactics. If a given commander's roll is successful, he need make no more rolls in Tactics during the current engagement and all attacks made by his ship have a +5% chance of success per 25% (or fraction thereof) skill level above 25%. Also, all attacks made on his ship will be at –5% chance of success per 25% (or fraction thereof) skill level above 25%, if the roll is successful. If the commander's roll is not successful, another attempt may be made in the skill the next melee round. This modifier is cumulative with all other combat modifiers.

EXAMPLE:

Tuu Ir Lieaou, commander of an Armored Scout, has a Tactics skill of 41%. His ship engages another Armored Scout, and in the first melee round, the 1D100 roll for his Tactics is 54. No luck the first round. The opposing commander also fails his Tactics roll, so no great harm done. In the second melee round, the Tactics roll is 40 — just making it. The ship commanded by Tuu Ir Lieaou will now be at +5% to hit (and –5% to be hit) for the remainder of the engagement. The opposing commander fails his roll during the second round. In the third round, the opposing commander tries again, and makes his Tactics roll. His skill is 52% — so his ship is now at +10% in attack, and Tuu Ir Lieaou's ship is –10% in attack, and the opposing commander may not attempt further Tactics rolls. So for the remainder of the engagement in this example, Tuu Ir Lieaou's ship will be at –5% in attack and the opposing ship will be at +5% in attack.

(2) Roll for the Piloting skill for the pilots of each of the ships involved in the engagement. If successful, all attacks that melee round (and that melee round only) on the ship being piloted are reduced by 5% per 25% skill (or fraction thereof) above 25% of the successful pilot. This modifier is cumulative with all other combat modifiers.

EXAMPLE:

Tuu Ir Lieaou, in addition to being the commanding officer of his ship, is also the lead pilot. His skill as a pilot is 76% (he's obviously a much better pilot than tactician). And, in the first melee round he makes his piloting roll. So for the first melee round, the opposing ship is at –15% to hit his ship.

(3) The combat maneuver is selected for each ship involved in the engagement, and appropriate maneuver modifiers are added to the other combat modifiers. The allowed maneuvers are as follows:

(3a) Not maneuvering — no modifiers.

(3b) All out attack — +25% to the chance of that ship hitting its target, and +25% to the chance of that ship being hit by any other ship firing upon it.

(3c) Dodge and attempt to close — +5% to the chance of that ship hitting its target.

(3d) Dodge and attempt to maintain distance — –5% to the chance of that ship being hit by another ship.

(3e) Dodge and attempt to increase distance (i.e. controlled retreat) — –15% to the chance of that ship hitting its target, and –25% to the chance of that ship being hit by another ship.

(3f) Retreat — no modifiers.

(Missiles are always assumed to use maneuver 3b — All out attack).

(4) If ship is using maneuvers 3c, 3d, or 3e (one of the maneuvers involving a dodge) and if its acceleration is greater than that of a ship attacking it, the probability of that ship hitting is reduced by 1% per 10 gs difference in acceleration. This modifier only applies if the battle is taking place in normal space.

(5) If the ship is using maneuvers 3c, 3d, or 3e (one of the maneuvers involving a dodge) and its pseudo-velocity in jump space is greater than that of a ship attacking it, the ship attacking it its chance of hitting by 1% per ¼ light-year/hour difference in speeds. This modifier only applies if the battle is taking place in jump space.

(6) The base chance of hitting is modified by all appropriate preceeding situational modifiers. The base chance of a computer controlled weapon scoring a hit is 25%. The base chance of a character controlled weapon scoring a hit is equal to his skill of Weapon Systems Operation.

(7) All weapon attacks for the melee round are carried out on a action point by action point basis through the melee round. In order to determine damage, add up the offensive strength of all successful attacks against each individual ship, and compute the ratios of the com-

combined attack strengths to the defensive strength of the target ships' shields, then roll on the table following:

D10			Combined Offensive/Screen Defensive						
roll	1:3	2:5	1:2	2:3	1:1	3:2	2:1	5:2	3:1
1	5%	10%	10%	15%	20%	30%	40%	50%	75%
2	0%	10%	10%	10%	15%	25%	30%	40%	60%
3	0%	5%	10%	10%	15%	20%	30%	35%	50%
4	0%	0%	10%	10%	15%	20%	30%	30%	40%
5	0%	0%	5%	10%	15%	15%	25%	30%	35%
6	0%	0%	0%	10%	15%	15%	25%	30%	35%
7	0%	0%	0%	5%	10%	15%	20%	25%	30%
8	0%	0%	0%	5%	10%	10%	15%	20%	25%
9	0%	0%	0%	0%	5%	10%	10%	15%	25%
0	0%	0%	0%	0%	0%	5%	10%	15%	25%

When computing the ratios, roll on the column corresponding to the greatest ratio less than or equal to the computed ratio. Thus, for example, a ratio of 29/10 is rolled for on the 5;2 column.

Ratios below 1:3 are treated as 0% damage automatically.

Ratios above 3:1 are rolled for multiple times. Roll for as many 3:1 attacks as is necessary to reduce the overall ratio to below 3:1, and then roll the remaining as the appropriate ratio, and sum all the resulting damage percentages. Thus in the case of an offensive strength attack of 34 vs a shield strength of 5 we would roll twice on the 3:1 column, and once on the 2:3 column and total the percentage damage figures.

These percentages indicate the cumulative ship system damage. And in addition, these percentages indicate the probability of crew casualties.

In order to determine crew casualties, subtract the armor value of the suit worn by the crewman from the percentage damage figure that resulted from using the above chart. This is the probability that the given attack resulted in an instant kill of the character in question. Treat values of less than 1% as 1%, treat values greater than 99% as guaranteed kills!

As the ship damage increases, overall ship performance suffers accordingly. Thus, at N% damage, the maximum shielding is reduced by N% of its rated maximum, maximum acceleration is reduced by N%, offensive strength of weapons are reduced by N%, etc.

At 25% total ship damage, the ship is considered open to space (all personnel not in pressure/space suits will die within 20 + (1D4) x 10 seconds). At 100% damage, the ship is considered to be a ruined hulk (though it is still repairable and may still have living crew). At 200% damage, the ship is assumed to be totally annihilated (along with all crew). Needless to say, at the 200% damage level, the spacecraft in question is not repairable (there is, in fact, nothing left to repair).

After ship damage reaches the 50% level, any additional damage results in a possibility that various ship's systems (contragravity, shields, a given life support module, etc.) will fail (and the probability of failure is (damage level – 50) x 2, and each system must be checked for failure (and failure means complete loss of the system in question). Thus when the damage level reaches 65% from 45%, say, there would be a (65-50) x 2=30% chance of each system failing (check by 1D100 roll on each individual system immediately).

(8) Adjust the positions of all ships involved in the engagement. Ships in all out attack apply full acceleration (in normal space) or full pseudo-velocity (in jump space) towards closing on the designated target. Ships in evasive maneuvers (i.e. dodging) may only apply half acceleration (in normal space) or half pseudo-velocity (in jump space) towards either closing, retreating, or holding position. Ships in full retreat may apply full acceleration (in normal space) or full pseudo-velocity (in jump space) toward increasing range between themselves and designated opposing ships.

The ship-to-ship action continues until all ships on one side have either taken over 100% ship damage, surrendered, or fled the scene of the battle.

11. Hegemonic Technology

11.1 GROUND AND AIR VEHICLES

11.1.1 Ground Vehicles

Both wheeled and ground effect vehicles are common throughout the Hegemony.

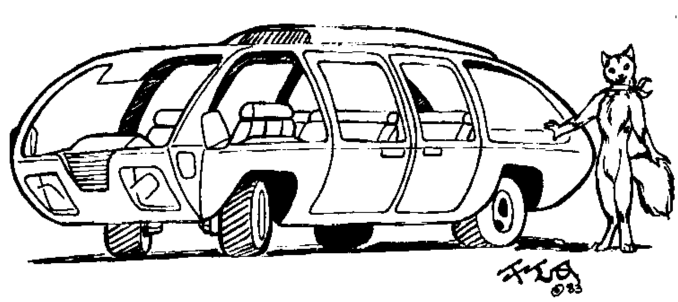
11.1.1.1 WHEELED VEHICLES

11.1.1.1.1 Electric Cars

Commonly used for intra-city transportation, these vehicles can operate unattended under computer control. They can carry six human sized passengers and up to 1.5 metric tons of cargo at 100 kilometers per hour up to 500 kilometers. They mass approximately 1 metric ton empty.

The body of the vehicle will provide 10 points of protection versus impact or energy damage. If 25 points of damage penetrate this armor, the electric car will be wrecked.

The typical unit sells for 650 smu, and a recharge of the batteries costs 0.10 smu and takes three full turns.



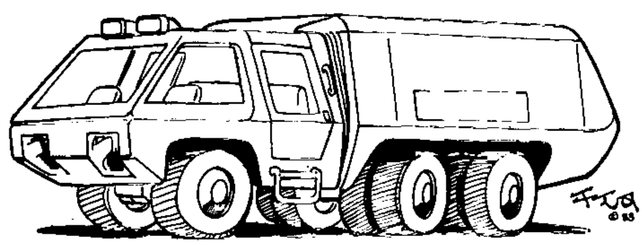
11.1.1.1.2 All Terrain Vehicles (ATVs)

The ATV is used for the exploration of rugged terrain or the hauling of heavy equipment for short distances where the cost of transport is important.

It can travel 50 kilometers per hour over rough ground, and 100 kilometers per hour over paved roads. It masses 2.5 metric tons, has a cargo capacity of 4 metric tons, and can travel 1500 kilometers without a battery recharge. A powered winch capable of lifting a 1.5 metric ton load in a 1 g field is standard equipment.

The body of the vehicle will provide 20 points of protection versus impact or energy damage. If 35 points of damage penetrate this armor, the vehicle will be destroyed.

The typical unit sells for 1200 smu, and a recharge of the batteries costs 0.30 smu and takes three full turns.



11.1.1.2 GROUND EFFECT VEHICLES (GEVs)

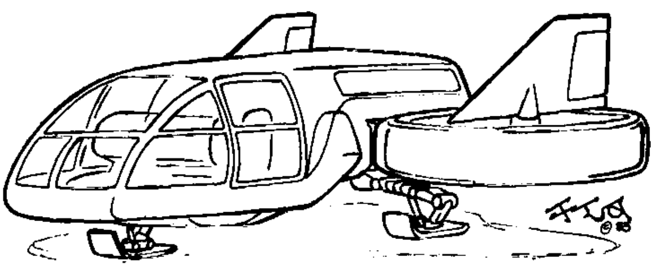
Large fans are used to develop both the lift and the drive forces of ground effect vehicles. GEVs float serenely over any terrain. And the forward speed of a GEV is strongly influenced by wind speed.

11.1.1.2.1 Civilian GEVs

The typical civilian GEV masses 5 metric tons, has a cargo capacity of 10 metric tons, and can cruise with a full cargo load and 6 human-sized passengers at its maximum speed of 200 kph (airspeed) for a period of six hours.

The GEV frame provides 30 points of protection versus impact and energy damage. If 25 points of damage penetrate this armor, the vehicle will be destroyed.

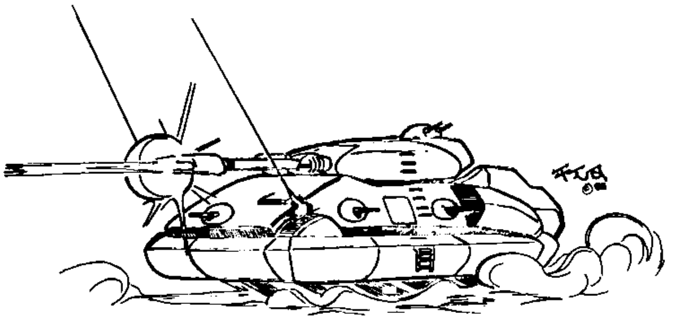
The typical unit sells for 1800 smu, and a recharge of the batteries takes 10 turns and costs 12 smu (2 smu/hour of operational charge).



11.1.1.2.2 Military GEVs

The military GEV, commonly referred to as a hovertank, masses 10 metric tons, has a crew of four (a commander, two gunners and one combined driver and engineer) and can cruise at 300 kilometers per hour for 1200 hours on 1.2 kilograms of fuel. Unlike the civilian GEV, the military GEV relies upon a spacecraft type power plant rather than storage batteries for power. The sensors on board are Grade 8 with a range of 100 kilometers, the ECM is Grade 5, and the hovertank's computer can operate the vehicle in a totally unmanned and unattended mode.

The hovertank's main armament is an energy cannon with a 40 kilometer range (line of sight). This main gun does 1D100+250 points of energy damage to all targets within 25 meters of the point hit (halve the damage for each additional 5 meters distance from a target to ground zero). This weapon is operated using the Weapons System Operation skill. The hovertank's secondary weapons are mortars, four of them (typical ammunition load – 20 rounds for each mortar). Finally, for antipersonnel defense, the hovertank is armed with 6 low power AP guns (see Chapter 10, Starships and FTL Travel, Starship Construction).



The hovertank's armor provides 120 points of impact and energy protection. If 100 points of damage penetrate this armor, the hovertank will be destroyed.

The standard hovertank costs 190,000 smu, but it will be available to civilians only on the black market.

11.1.2 Air Vehicles

11.1.2.1 AIR CARS

The air car is a battery powered light jet aircraft, massing four metric tons. It can carry one metric ton of cargo (passengers and luggage) for three hours at 1400 kph (airspeed).

The body of the air provides 10 points of energy and impact protection to the passengers. If 25 points of damage penetrate this armor, the vehicle will be destroyed.

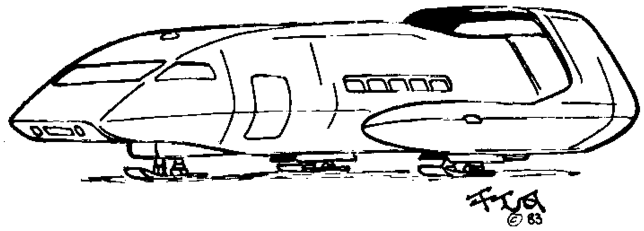
The typical air car sells for 10,000 smu, and a recharge of the batteries costs 90 smu (30 smu/hour of operational charge) and takes fifteen full turns.

11.1.2.2 GRAV CARS

The grav car, an economy model shuttle craft, masses 10 metric tons, and can carry 5 metric tons of cargo at 5000 kph at altitudes of up to 60 kilometers (180,000 feet). It relies upon a spacecraft type power plant and its range is limited only by the amount of fuel on board. The grav car uses one gram of fuel per hour of operation.

The computerized navigational and automatic piloting aids of the grav car allow it to fly by itself under all save the most unusual of circumstances. The grav car's hull provides its passengers with 40 points impact and energy protection. If 40 points of damage penetrate this armor, the vehicle will be destroyed.

The typical grav car costs 30,000 smu.



11.1.2.3 GRAV TANKS

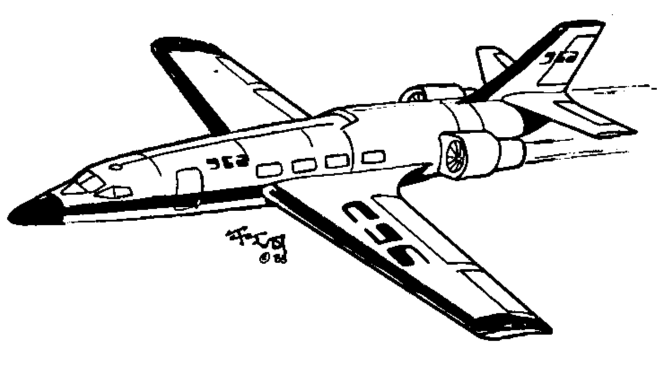
The grav tank masses 25 metric tons, has a crew of six (commander, pilot, engineer, and three gunners), and can cruise at 5000 kph with a cargo of up to 15 metric tons at altitudes of up to 90 kilometers (295,000 feet). A grav tank has a standard design spacecraft power plant, so its range is limited only by the amount of fuel available. It uses four grams of fuel per hour.

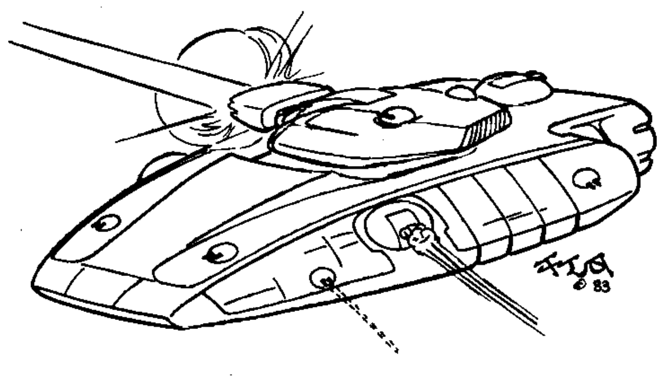
Grav tanks typically have ECM grade 5 and a Grade 8 range 2500 kilometer active sensor. The on board computer can operate the vehicle in a totally unmanned and unattended mode.

The grav tank's main armament is an energy cannon with 500 kilometer range (line of sight). This main gun does 2D20+300 points of energy damage to all targets within 25 meters of the point hit (halve the damage for each additional 5 meters from a target to ground zero). This weapon is operated using the Weapon Systems Operation skill. The energy cannon of a grav tank is treated as having an offensive value of 0.01 for the purpose resolving fire on shielded spacecraft. The grav tank's secondary weapons are three independently targetable high speed cannon. The cannon have a range of 10 kilometers, and fire 20 rounds per second (roll 1D20 after a successful attack roll to determine how many rounds of the one second burst were on target). Each round does 2D6+40 points damage to all targets within 5 meters of the point hit (roll once for the general strength of that burst, and then multiply by the number of rounds that were actually on target in order to determine total damage done; halve the damage for each additional meter from the target to the point hit). A grav tank has 200 rounds of ammunition per cannon. Shells for the cannon cost 500 smu. Finally, for antipersonnel defense, the grav tank is armed with 12 low power AP guns (see Chapter 10, Starships and FTL Travel, Starship Construction).

The grav tank's armor provides 350 points of impact and energy protection. If 150 points of damage penetrate this armor, the vehicle will be destroyed.

Grav tanks cost 500,000 smu, and are available to civilians only on the black market.





11.2 MEDICAL TECHNOLOGY

11.2.1 Drugs And Their Effects

The amount of a given drug that must be administered to a SIZ 20 individual in order to produce that drug's characteristic effect is defined as one standard dose for that drug.

11.2.1.1 DRUG DOSE TABLE

SIZ	Effective Dose	Standard Dose
1	0.001	8000.0
2	0.001	1000.0
3	0.003	296.3
4	0.008	125.0
5	0.015	64.0
6	0.027	37.0
7	0.042	23.3
8	0.063	15.6
9	0.091	11.0
10	0.124	8.0
11	0.167	6.0
12	0.216	4.6
13	0.274	3.6
14	0.343	2.9
15	0.421	2.4
16	0.511	2.0
17	0.614	1.6
18	0.729	1.4
19	0.857	1.2
20	1.000	1.0
21	1.157	0.9
22	1.331	0.8
23	1.520	0.7
24	1.728	0.6
25	1.953	0.5
26	2.197	0.4
27	2.460	0.4
28	2.744	0.4
29	3.048	0.3
30	3.374	0.3
31	3.723	0.3
32	4.096	0.2
33	4.492	0.2
34	4.913	0.2
35	5.359	0.2
36	5.832	0.2
37	6.331	0.2
38	6.859	0.1
39	7.414	0.1
40	8.000	0.1
41	8.615	0.1
42	9.261	0.1
43	9.938	0.1
44	10.648	0.1
45	11.390	0.1
46	12.167	0.1
47	12.977	0.1
48	13.824	0.1
49	14.706	0.1
50	15.624	0.1
51	16.581	0.1
52	17.576	0.1
53	18.609	0.1
54	19.682	0.1
55	20.796	0.1
56	21.951	0.1
57	23.149	0.1
58	24.389	0.1
59	25.672	0.1
60	27.000	0.1

Explanation of Headings

SIZE: The SIZ characteristic of the character to whom the drug is being administered.

EFFECTIVE DOSE: This is the number of standard doses of the drug that must be administered to a character of the specified size in order to produce the effects described in the time described for the given drug.

STANDARD DOSE: This is the number of effective doses for the given size contained in one standard dose of the drug. Fractional values given provide the probability that one standard dose of the drug will take affect in any given melee round. For example, a SIZ 23 individual given one standard dose of a drug would roll 1D10 each melee round; the drug would take affect in the first melee round in which he rolled a 7 or less (rolling once per melee round in Action Point 1). Values above 1 indicate the proper multiplier for effects to be applied immediately. For example, a SIZ 13 individual given one standard dose of a drug would experience effects equivalent in all respects to those of a SIZ 20 individual to whom 3 doses of the drug had been administered, and in the first melee round in which he rolled a 6 or less on 1D10 he would experience effects equivalent to an additional dose of the drug (rolling once per melee round in Action Point 1).

The effective dose required for a given size character is $SIZ^3/8000$. The number of effective doses in one standard dose is the inverse of the effective dose.

11.2.2 Poisons

Poisons are given potency ratings to indicate the amount of physical damage one standard dose will do to victims. The damage actually done by the poison is determined by the dosage received and by the potency of the poison.

One standard dose of a poison of potency N will do N points of damage to a SIZ 20 subject if the potency N overcomes the resistance of the CON of the subject, and N/2 points of damage (round fractions up) otherwise. This damage is done to hit points and to CON.

Damage done by poisons take affect in the record keeping phase of the melee round of exposure.

Poison damage can only be restored through time, through the use of the Empathic healing talent (see Chapter 6, Psionics and the Use of Will) or through the use of the toxicology skill (to neutralize the poison) followed by a use of the medical skill to restore damage done. Poison damage heals naturally at a rate of 1 point per game week.

11.2.2.1 ANTIDOTES

An antidote must typically be specific to the poison. If administered to a poisoned character within 15 turns (or 30 minutes) of the poisoning, a standard dose of potency N antidote given to a SIZ 20 subject will reduce poison damage done by N points. The actions of antidotes are affected by the SIZ of the subject exactly as are the poisons for which they are counteragents.

The manufacture of counteragents to specific poisons requires the successful application of either the pharmacology, toxicology or chemistry skill. The cost of manufacturing the counteragent is equal to the cost of manufacture of the original agent.

11.2.3 Acid And Base Poisons

These poisons rely upon their corrosive nature to do damage. A potency N corrosive agent will do N points of damage to any material subjected to the agent. This damage is localized to the hit locations exposed, and does not need to overcome resistance of the CON of the subject to do damage. In addition, the damage is done once for each turn of contact with the caustic agent until the antidote is applied or until the destruction of tissue results in destruction of that hit location. The antidote for a potency N acid is an equal quantity of potency N base and vice versa.

Any chemist (of any variety) may make acids or bases of potency up to N, where N is the skill level of the chemist divided by 6 (rounding fractions down). Thus a chemist with 47% skill level could produce a potency 8 acid with one successful use of his skill (provided that he had a laboratory to work in). Such a use of his skill would require 1 hour per potency level of poison per 100 milliliters of corrosvie material. Reducing the amount of material produced reduces the time required, increasing the amount of material increases the time required on a linear basis.

A chemical engineer can design a production facility capable of 2-12 (roll 2D6) times this production level in an unattended mode, said design process (and assembly of the production line) requiring only two uses of the skill and 2D6 hours total time.

The cost of materials for such corrosives is 1 smu per point of potency per 100 milliliters.

11.2.4 The Hegemonic Pharmacopoeia

Any known drug may be prepared by an exercise of the skill Pharmacology where the species to take the drug is one that the pharmacologist has studied (thus the Pharmacology skill is reduced to the skill level of the medical skill for the species in question, or the skill in xenobiology, whichever is higher). The pharmacologist may, however, work together with a medical doctor or xenobiologist and be limited only by the doctor's or the xenobiologist's skill.

A failed skill roll during the preparation of a drug results in a dose of the drug which will not have the desired effect (at the same time, there should be no unpleasant side effects). If the skill roll is fumbled, however, the resulting dose should have different effects from those intended (e.g., a poison antidote becomes a poison itself, or remains an antidote to the intended poison but also becomes a potent hallucinogen, etc.).

For each 30% (or fraction thereof) in pharmacology, the drug preparer will prepare one dose of the drug per successful skill use. Each attempt takes one hour.

Preparation of any of the listed drugs from simple chemical raw materials requires a full biomedical laboratory (cost = 1 million smu for lab, virtually nothing for chemical raw materials). Preparation of the listed drugs from basic ingredients (for which costs are given below) requires only a simple chemical lab setup (costing 1500 smu).

The available drugs, and the effects of one standard dose on a size 20 individual for these drugs are as follows:

11.2.4.1 ANABLEED

Anableed acts as a coagulant. When applied topically, this drug will stop external bleeding in one location. When injected this drug will stop internal bleeding; however, when used in this mode, 1D4 damage is done to total hit points. When taken orally, this drug will stop abdominal internal bleeding 40% of the time, but will do 1D10 damage to total END.

Injected, this drug acts in 2 action points; taken orally it acts in 4 action points. When applied topically, it acts in 6 action points.

Unlike most drugs, anableed will work on any known warm blooded iron based blood system life form in the Hegemony. One standard dose of this drug costs 6 smu over the counter and materials for four standard doses of this drug cost 4 smu.

11.2.4.2 BOOSTER

One effective dose of Booster increases a character's END by 1D10 (up to species' maximum) for 1D4 hours. When the drug wears off, the added END is lost and the character loses an additional 1D12 END per effective dose of the drug administered. If END is brought below zero as a result, the same penalties apply as per reduction of END through injuries in battle.

Injected, Booster acts in one action point; taken orally it acts in 1D6+1 melee rounds. Booster has no effect when administered topically.

Each species must use a slightly different form of this drug. One standard dose of this drug costs 45 smu over the counter and materials for 4 standard doses of this drug cost 18 smu.

Before a battle on a high G world, Mikhail is injected with 3 standard doses of Booster, and his END is increased by 3D10 for 1D4 hours. The 3D10 roll yields 27. Mikhail's END is already 22, and Human maximum for END is 44, so we can only add 22 points to Mikhail's END. The 1D4 roll yields 3. So for three hours at least, Mikhail feels like superman despite the heavy gravity.

Every silver lining has its cloud, and three hours after his booster injection (an hour after the battle's end) Mikhail discovers the side effects of booster first hand. He loses the 22 END points gained through the booster, and as he lost no END points during the course of the battle (lucky Mikhail) his END drops back to 22. He loses an additional 3D12 END. The 3D12 roll is 26, his END drops to 22 – 26 = –4, and a 4/2 = 2 point attack is made vs Mikhail's CON. The attack fails to overcome the resistance of his CON, and he only loses 1 hit point and 1 point of CON. And he remains unconsciousness until his END is positive (probably 20 turns). In a week, the hit point damage heals, and after another week the point of CON lost to the drug is recovered.

11.2.4.3 CUREX

Injected into a damaged location, it will restore 2 Hit points and 3 END points in that location in 5 seconds. It will also stop any bleeding (external or internal) in the indicated location, just like anableed.

Curex may not be used more than once per location per hour. For each additional dose of the drug administered to a single location, the player must roll at or under CON x 3 on 1D100 or the character goes into shock.

Curex has no effect when applied topically or taken orally.

Each species must use a slightly different form of this drug. One standard dose of this drug costs 15 smu over the counter and the materials for four standard doses of this drug cost 3 smu.

11.2.4.4 HALO–D

This drug is the only known effective antidote for Halo-L. Injected or administered orally it takes effect in 1 second, applied topically, it acts with the same speed as a dose of Halo-L. It will neutralize an equal dose of Halo-L, though it will not restore any damage done by Halo-L.

One standard dose of this drug costs 12.5 smu over the counter and materials for four doses of this drug cost 5 smu.

11.2.4.5 HALO–L

Halo-L is a nerve poison that acts on all known carbon based life forms in the Hegemony. It can penetrate the skin covering of every known species – it normally requires 2 action points to penetrate Human skin (allow 1 additional action point delay in penetration per point of impact protection of the natural armor of other species).

Unless the Halo-L is neutralized by a proper dose of Halo-D, the victim takes a strength 10 attack vs CON each melee round. In the first melee round, the attack is resolved one action point after the drug penetrates the skin, or the same action point that the drug is either inhaled or injected. In later melee rounds, the attacks are resolved at action point 6 within the round.

One standard dose of this drug costs 250 smu over the counter and the materials for four standard doses of this drug cost 100 smu. This drug and its chemical building blocks are not available to civilians except on the black market (roll 4D6 to determine the cost multiplier for these commodities).

11.2.4.6 HARDIMAN

This drug adds 1D4 to a character's CON and total hit points for 1D4+1 hours. When the drug wears off the added CON and hit points are lost and the character loses 1D12 END and 1D4 CON and hit points per effective dose administered. If END is brought below zero as a result, the same penalties apply as per reduction of END through injuries in battle.

Injected, the drug acts in one action point; taken orally, it acts in 1D6+1 melee rounds. The drug has no effect when applied topically.

Each species must use a slightly different form of this drug. One standard dose of this drug costs 24 smu over the counter and the materials for four standard doses of this drug cost 6 smu.

Given two standard doses of Hardiman in a training exercise, Mikhail's CON and Hit points increase by 2D4 (rolled once for both CON and hit points) to 14 and 20 respectively. And for 3 hours Mikhail is of much sterner stuff than usual.

During the exercise, Mikhail is accidentally exposed to a poison gas and loses 4 hit points and 4 points of CON.

When the drugs wear off the five Hit points and points of CON are lost. But Mikhail took four points of damage to hit points and to CON during the exercise, so his CON is 5 and he has 6 hit points remaining when the Hardiman wears off. Mikhail takes 2D4 damage to CON and hit points and 2D12 damage to END. The 2D4 roll is 2, and the 2D12 roll is 18 proving that Mikhail sometimes has good luck. And Mikhail's CON is reduced to 3, his END to 4 and his hit points to 4.

Mikhail expects to recover his lost END points in two hours (at 1D6 points per 20 minutes). And he recovers his lost hit points in 11 weeks (at 1 point per week of rest). Only when all hit point damage has healed will his CON begin to recover. And he recovers his lost CON points in 11 additional weeks of rest (1 point per week).

11.2.4.7 HAMMER

One effective dose of this drug will increase a character's STR by 1D8 (up to species' maximum) for 1D4 hours. When the drug wears off, the added STR is lost and the character loses 1D12 END and 1D4 CON and Hit Points per effective dose administered. If END is brought below zero as a result, the same penalties apply as per reduction of END through injuries in battle.

Injected, the drug acts in one action point; taken orally the drug acts in 1D6+1 melee rounds. Hammer has no effect when applied topically.

Each species must use a slightly different form of this drug. One standard dose of this drug costs 30 smu over the counter and the materials for four standard doses of this drug cost 12 smu.

11.2.4.8 PICKUP

Pickup is an anti-shock drug, and one standard dose will bring a size 20 individual out of shock in 2D4 seconds (when taken orally) or in one second (when injected). This drug is not effective when applied topically. The maximum dose rate is one effective dose per five melee round period. Overdose results in a 2D4 attack vs CON.

Each species must use a slightly different form of this drug. One standard dose of this drug costs 6 smu over the counter and the materials for four standard doses of this drug cost 4 smu.

11.2.4.9 PSISTIM

One effective dose of this drug will triple a character's TSC and TPR for 15 turns. This drug's effect is cumulative – two effective doses will produce a nine-fold increase in TSC and TPR, three effective doses will produce a twenty-seven-fold increase, etc.

After the drug wears off, TSC and TPR return to normal and an attack is made vs TPR is made of strength ((NDM) + 4) x (number of effective doses administered), where the species normally rolls for TPR on NDM. The character's TSC and TPR are reduced permanently by this amount if the attack succeeds, and by half this amount if the attack does not succeed (round fractions up). If TSC and TPR both drop below zero, the character is reduced to a mindless vegetable.

If injected, Psistim acts in 1 action point; if taken orally, it acts in 1D6+1 melee rounds. This drug has no effect if applied topically.

Each species must use a slightly different form of this drug. One standard dose of this drug costs 1250 smu over the counter and the materials for four standard doses of this drug cost 500 smu. This drug and its chemical building blocks are not available to civilians except on the black market (roll 2D6+2 to determine the black market cost multiplier).

11.2.4.10 SKIM

One effective dose of Skim will double a character's current DEX (up to twice species' maximum) for 1D3 hours. The effects of this drug are cumulative; two effective doses will quadruple the character's normal dexterity, three effective doses will increase the character's normal dexterity by a factor of eight, etc. (up to a limit of twice normal species' maximum).

When the drug wears off, the character's DEX drops to species' minimum (lost DEX points are recovered at a rate of 1 point per day of rest). In addition, the character loses 1D12 END and 1D6 CON for each effective dose of the drug administered. If END is brought below zero as a result the same penalties apply as per reduction of END through injuries in battle.

If it is injected, Skim acts in one action point; if administered orally, it acts in 1D6+1 melee rounds. This drug has no effect if applied topically.

Each species must use a slightly different form of this drug. One standard dose of this drug costs 24 smu over the counter and the materials for four standard doses of this drug cost 10 smu.

Mikhail's DEX is 18. One standard dose increases his DEX to 36. A second dose applied at the same time increases his DEX to 42 (twice species' maximum). And Mikhail becomes speed incarnate for 2 hours (rolled on 1D3).

But when the drug wears off, his DEX drops to 3 and he loses 2D12 END and 2D6 CON. This costs him 13 END and 6 CON. He recovers the 13 END lost in less than two hours, but it takes 15 days of rest before his DEX returns to normal. And it takes six weeks of rest to recover points of lost CON (at one per week).

11.2.4.11 SLOWTIME

One effective dose of Slowtime will reduce the rate of all body functions by a factor of 180.

For example, if slowtime is injected directly into the brain of a character whose heart has just been stopped, brain death would not occur for 4 x 180 minutes = 720 minutes = 12 hours.

Slowtime acts immediately when injected, in 1D6+1 action points when applied topically, and in 1D3 action points when administered orally.

Each species must use a slightly different form of this drug. One standard dose of slowtime costs 5 smu over the counter and materials for four standard doses of this drug cost 2 smu.

11.2.5 Cryogenic Chambers

A cryogenic chamber is a five metric ton device capable of 'freezing' an individual without causing irrepairable damage, and maintaining him in a state of suspended animation virtually indefinitely. The unit is completely self contained, and can be programmed to 'thaw' the frozen individual at any arbitrary future time. The freezing process takes one action point, the thawing process takes 1D3 action points.

While frozen all biological processes are temporarily halted. Thus, a seriously injured individual who would otherwise die may be frozen to allow the injured individual to be taken to a medical facility for appropriate treatment.

A cryogenic suspension chamber costs 1.5 million smu, and has an MTBF of (2000 + 1D1000) years.

11.2.6 Cyborging Operations

Cyborging is the only method by which a character may increase his characteristics above theoretical species' maxima on a permanent basis. There are four different series of operations involved in the cyborging process.

SERIES A:

This series of operations will increase the character's END and STR to species' maxima for these two characteristics. The cost of this series is 1 million smu, and the time required is 1 day per point of characteristic added. In order to survive the operation series, a roll of 5 x (CON+5) or less must be made on 1D100.

SERIES B:

This series of operations will increase the character's END and STR to 1.5 times the species' maxima for these characteristics (round fractions up) and increases DEX to species' maximum. This series of operations costs 5 million smu, and requires 1.5 days per point of characteristic added. In order to survive the operation series, a roll of 4 x CON or less must be made on 1D100.

SERIES C:

This series of operations will increase the character's END and STR to twice species' maxima for these characteristics, increase DEX to 1.5 times species' maximum (round fractions up) and increase CON to species' maximum. This series of operations costs 25 million smu, and requires 2.5 days per point of characteristic added. In order to survive the operation series, a roll of 3 x CON or less must be made on 1D100 (this roll is based on the character's CON at the beginning of the operation series, however, not on the CON after the operation series is complete).

SERIES D:

This series of operations will add effective armor underneath the surface skin tissue (up to a maximum of 12 points armor). This series of operations costs 500,000 smu and two months time per point of armor added. A roll of 4 x CON or less must be made on 1D100 after each point of armor is added or the character dies.

Operation series A through C are not compatible – that is, it is not possible to begin one series after having completed one of the other two. A character may, however, have an operation series reversed, removing all of the bionic augmentation used by the given series (this takes just as long as the original series, and is just as dangerous). After doing so, his characteristics revert to their former values and he may then undergo one of the other operation series.

Operations series D is compatible with the other series.

11.2.7 Medikits

The portable medikit is more than just a collection of drugs and injector needles. It is a sophisticated integrated computer and medical telemetry system.

It can administer any drug in its stock on command. It can also administer any programmed sequence of drugs under user specified conditions. And it can monitor all life functions of one individual and react in response to the data gathered together with its user supplied programming.

The medikit can detect onset of shock, loss of blood, cessation of heart action, loss of consciousness, or presence of a poison and administer whatever treatment the user has previously programmed for each situation. The injector unit is typically worn at the base of the skull (thus permitting direct injection of slowtime into the brain in the event of the destruction of the rest of the body).

The portable medikit masses 4.5 kilograms complete with all sensors and carrying straps.

A medikit costs 1800 smu. Drugs are not included in this cost. And the medikit unit may be programmed for only one species at a time. The cost for the basic programming for one species is included in the cost of the medikit (the species is specified at the time of purchase). Program modules for additional species are available for medikit computers at a charge of 120 smu per species. Without the proper programming, only manually controlled injections are possible. The battery unit for the medikit costs 100 smu, masses 0.3 kilograms, and will power the medikit for 1000 hours. A recharge of the battery unit costs 10 smu and takes three turns.

11.2.8 Regrowth Chambers

A regrowth chamber will regrow limbs or repair maimed limbs and major body parts (excluding the brain, of course) at a rate of 1 point per month. Regrowth starts from undamaged body parts and continues outward as other body parts are completely repaired.

Suppose a 15 point human had both legs, abdomen and chest destroyed. Once safely in a regrowth tank, he wouldn't die. After seven months in the regrowth tank, his chest would have regrown completely and his abdomen would begin to heal. After six months more his abdomen would be healed and both of his legs would begin to heal simultaneously. After yet another six months, both legs would be healed. Total time elapsed: 19 months.

An R–1 regrowth chamber will hold any individual up to size 40. It masses 5 metric tons, costs 1 million smu, and uses 0.01 energy units per hour.

An R–N regrowth tank will hold any individual up to size 40 x N. The mass of an R–N regrowth tank is 5 x N metric tons. The cost of an R–N regrowth tank is N million smu. And an R–N regrowth tank uses 0.01 energy units per hour of operation.

In addition to the cost of the hardware, there is a software cost associated with the regrowth tanks. In order to handle regrowth of an individual, the unit must be programmed with data on the individual's species. Program data packages exist for each of the known species, and are available at a cost of 125,000 smu per species (the cost of the regrowth unit includes the cost of one program data package for one species – purchaser's choice of species).

The MTBF for this unit is 30+1D12 months.

Use of a regrowth unit at a medical facility on a civilized world costs 10,000 smu per month.

11.3 GADGETS

11.3.1 Hand Held Computer

Using the same memory crystals employed by large ship computers for mass storage, the hand held computer unit is the equivalent of a computer of grade 0.1. It can be used in place of a larger computer, or as an intelligent input/output device to connect the user to a larger computer system. It has a self contained holographic display unit and is capable of handling voice commands (and in providing vocal responses on request).

The hand held computer unit masses 3 kilograms, and is battery powered. Its battery is responsible for 0.3 kilograms of the unit's mass. The battery costs 50 smu and can be recharged in one turn at a cost of 1 smu. A fully charged battery will power the unit for 1000 hours.

This unit is armored to provide the internal electronics with twenty points of impact protection and fifteen points of energy protection. A total of four points of damage penetrating the armor will destroy the unit.

The hand held computer unit costs 1200 smu.

11.3.2 Hand Held Disintegrator

This is the ultimate sculptor's tool, massing two kilograms. It is battery powered; the battery masses 0.2 kilograms, costs 40 smu, and can be recharged in five minutes at a cost of 0.5 smu. A fully charged battery will provide sufficient power to operate the unit for sixty turns (2 hours).

It drills holes and shapes matter by temporarily altering the strength of interatomic bonds. It can powder, compress or disintegrate 480 cubic centimeters of material in one melee round (40 cc/action point). Matter compressed increases in density by a factor of ten; once compressed matter cannot be compressed further using this unit. The maximum range of the unit is 5 centimeters (about two inches). It resembles a simple flashlight in shape, and is sometimes referred to as a 'firmer'.

This unit is armored to provide the internal electronics with six points of impact protection and five points of energy protection. A total of five points of damage penetrating this armor will destroy the unit.

The hand held disintegrator unit costs 2200 smu.

11.3.3 Portable Generator

The portable generator masses 20 kilograms and can provide power to recharge any battery for any device. The portable generator runs on the same fuel as the standard spaceship power plant. It is not as efficient a generator of power, however, and consumes 1 gram of fuel per hour. It can generate 125 kilowatts.

This unit is armored to provide the internal electronics with ten points of impact protection and twelve points of energy protection. A total of ten points of damage penetrating this armor will destroy the unit.

The portable generator unit costs 250 smu.

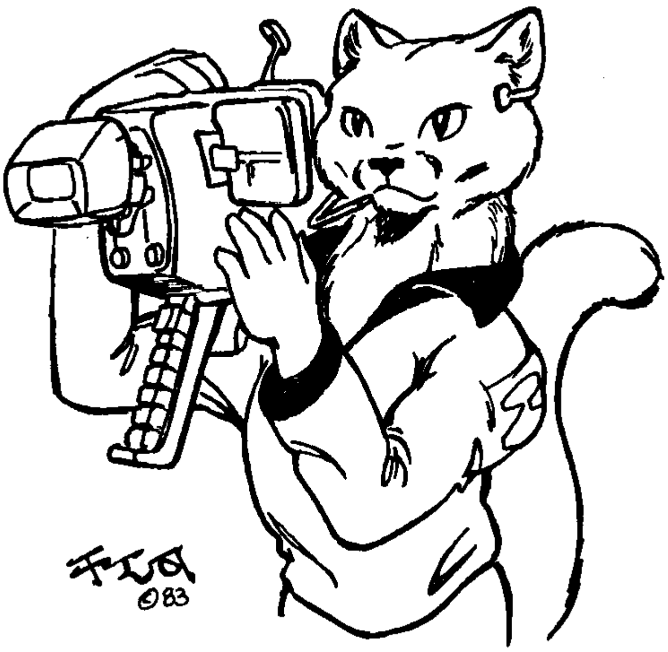
11.3.4 Portable Video Unit

This unit masses 5 kilograms and is a self contained camera, monitor, video recorder and transceiver. It is self stabilizing, and can provide a clear picture even while moving. It can transmit to remote monitors (range 500 kilometers) and it can operate in low light levels and near complete darkness (working off available ultraviolet or infrared light, or by using image intensification equipment contained in the unit).

The battery for this unit masses 0.4 kilograms, costs 25 smu, and will drive the unit for 12 hours. A recharge typically costs 0.3 smu and takes two minutes. When mounted on a suit for EVA use, it can be set to draw power off the suit, thus prolonging its battery life indefinitely.

This unit is armored to provide the internal electronics with twelve points of impact protection and ten points of energy protection. A total of ten points of damage penetrating this armor will destroy the unit.

This device costs 1250 smu.



12. World Building

12.1 STAR SYSTEM

The first task for a new referee is to build a few star systems for his intrepid Adventurer's to explore.

Roll 1D100 and consult the following table to determine the type of system:

1D100 roll	Type of System
01	Quaternary — four stars in system (no planets)
02-08	Trinary — three stars in system (no planets)
09-54	Binary — two stars in system (no planets)
55-67	Black dwarf companion to a main sequence star — again, no planets.
68-89	Single primary — but only planetesimals (space junk, asteroids) and no real planets.
90-00	Single primary — with 2D8+1 planets.

Once the system type has been determined, roll on the following table to determine the broad classification of star for each star in the system:

1D100 roll	Star Type
01-03	F type main sequence
04-12	G type main sequence
13-29	K type main sequence
30-00	M type main sequence

Next, the exact spectral class of each star in the sytem is determined on the following tables:

F TYPE MAIN SEQUENCE STARS

1D100 roll	Exact Spectral Class
01-17	F5
18-36	F6
37-57	F7
58-78	F8
79-00	F9

G TYPE MAIN SEQUENCE STARS

1D100 roll	Exact Spectral Class
01-08	G0
09-16	G1
17-24	G2
25-33	G3
34-42	G4
43-51	G5
52-61	G6
62-73	G7
74-86	G8
87-00	G9

K TYPE MAIN SEQUENCE STARS

1D100 roll	Exact Spectral Class
01-08	K0
09-16	K1
17-24	K2
25-33	K3
34-42	K4
43-52	K5
53-63	K6
64-74	K7
75-86	K8
87-00	K9

M TYPE MAIN SEQUENCE STARS

1D100 roll	Exact Spectral Class
01-04	M0
05-09	M1
10-15	M2
16-22	M3
23-32	M4
33-47	M5
48-70	M6
71-00	M7

12.2 STELLAR CHARACTERISTICS

The following list of stellar parameters is for main sequence stars:

Spectral Class	Mass	Radius	Luminosity	No. per Cubic Parsec
F5	1.30	1.24	2.70	0.000320
F6	1.28	1.22	2.32	0.000366
F7	1.24	1.19	2.07	0.000392
F8	1.14	1.10	1.55	0.000412
F9	1.06	1.05	1.22	0.000425
G0	1.02	1.02	1.20	0.000436
G1	1.01	1.01	1.04	0.000443
G2	1.00	1.00	1.00	0.000448
G3	.985	0.99	.956	0.000452
G4	.955	0.97	.814	0.000455
G5	.910	0.95	.720	0.000499
G6	.900	0.92	.610	0.000535
G7	.870	0.90	.525	0.000640
G8	.850	0.88	.501	0.000690
G9	.825	0.86	.408	0.000760
K0	.800	0.84	.363	0.000790
K1	.775	0.82	.316	0.000835
K2	.750	0.80	.282	0.000874
K3	.730	0.78	.252	0.000914
K4	.705	0.76	.216	0.000972
K5	.680	0.74	.200	0.001010
K6	.655	0.72	.162	0.001110
K7	.630	0.70	.145	0.001190
K8	.600	0.68	.123	0.001300
K9	.570	0.65	.105	0.001470
M0	.540	0.64	.0912	0.001650
M1	.505	0.61	.0726	0.001980
M2	.470	0.58	.0596	0.002420
M3	.435	0.56	.0486	0.003000
M4	.380	0.52	.0317	0.004310
M5	.330	0.49	.0232	0.006390
M6	.270	0.45	.0152	0.009500
M7	.220	0.42	.0120	0.012300

The stellar parameters (mass, radius, and luminosity) are given in terms of Sol (Earth's sun) units. Thus, for example, Luminosity of 0.0120 (luminosity for an M7 main sequence star) means that the star is only 1.2% as bright (as luminous) as Earth's sun, Sol. One parsec is equal to approximately 3.26 light-years.

12.3 PLANETS

If the star system has planets, the distribution of the planets within the system must be determined. For this purpose, a modified Titus-Bode rule is employed.

Let A = (6D10)/100. Let B = (6D12)/100. Then the distance from the primary to planet N in the system is given by the following formulae:

$$R = B + A \times 2^{(N-2)} \quad \text{(for } N > 1\text{)}$$
$$R = B \quad \text{(for } N = 1\text{)}$$

where the distance R is in Astronomical Units (1 AU = 93 million miles).

The orbital period $T = (R^3/\text{Mass of primary})^{(1/2)}$, where M is in units of Sol masses, R is in AU, and T is in years.

As a simple approximation, we also assume that we can determine the mean day temperature of a planetary body in a star system by the following formula:

$$\text{Temperature} = [295 \times (L/R^2)^{(1/4)}]$$

Temperature being in degrees Kelvin, L being the stellar luminosity in Sol units, R being the mean orbital radius in AU. In order to convert from degrees Kelvin to degrees Centigrade, subtract 273. In order to convert from degrees Centigrade to degrees Fahrenheit, multiply by 9/5 and add 32.

Computing the above values can be tedious, so as an aid to the prospective world builder, orbital periods and mean day temperatures have been pre-calculated for planetary orbits of radius 0.1 through 5.0 Astronomical Units (at intervals of 0.1 AU) for primary stars of each of the main sequence spectral classes.

MEAN DAY TEMPERATURES AND ORBITAL PERIODS AS A FUNCTION OF SPECTRAL TYPE OF PRIMARY AND MEAN ORBITAL RADIUS

Spectral Class F5

Orbit	Temperature	Length of Year
0.10	1196	0.03
0.20	846	0.08
0.30	690	0.14
0.40	598	0.22
0.50	535	0.31
0.60	488	0.41
0.70	452	0.51
0.80	423	0.63
0.90	399	0.75
1.00	378	0.88
1.10	361	1.01
1.20	345	1.15
1.30	332	1.30
1.40	320	1.45
1.50	309	1.61
1.60	299	1.78
1.70	290	1.94
1.80	282	2.12
1.90	274	2.30
2.00	267	2.48
2.10	261	2.67
2.20	255	2.86
2.30	249	3.06
2.40	244	3.26
2.50	239	3.47
2.60	235	3.68
2.70	230	3.89
2.80	226	4.11
2.90	222	4.33
3.00	218	4.56
3.10	215	4.79
3.20	211	5.02
3.30	208	5.26
3.40	205	5.50
3.50	202	5.74
3.60	199	5.99
3.70	197	6.24
3.80	194	6.50
3.90	191	6.76
4.00	189	7.02
4.10	187	7.28
4.20	185	7.55
4.30	182	7.82
4.40	180	8.09
4.50	178	8.37
4.60	176	8.65
4.70	174	8.94
4.80	173	9.22
4.90	171	9.51
5.00	169	9.81

Spectral Class F6

Orbit	Temperature	Length of Year
0.10	1151	0.03
0.20	814	0.08
0.30	665	0.15
0.40	576	0.22
0.50	515	0.31
0.60	470	0.41
0.70	435	0.52
0.80	407	0.63
0.90	384	0.75
1.00	364	0.88
1.10	347	1.02
1.20	332	1.16
1.30	319	1.31
1.40	308	1.46
1.50	297	1.62
1.60	288	1.79
1.70	279	1.96
1.80	271	2.13
1.90	264	2.31
2.00	257	2.50
2.10	251	2.69
2.20	245	2.88
2.30	240	3.08
2.40	235	3.29
2.50	230	3.49
2.60	226	3.71
2.70	222	3.92
2.80	218	4.14
2.90	214	4.37
3.00	210	4.59
3.10	207	4.82
3.20	204	5.06
3.30	200	5.30
3.40	197	5.54
3.50	195	5.79
3.60	192	6.04
3.70	189	6.29
3.80	187	6.55
3.90	184	6.81
4.00	182	7.07
4.10	180	7.34
4.20	178	7.61
4.30	176	7.88
4.40	174	8.16
4.50	172	8.44
4.60	170	8.72
4.70	168	9.01
4.80	166	9.30
4.90	164	9.59
5.00	163	9.88

Spectral Class F7

Orbit	Temperature	Length of Year
0.10	1119	0.03
0.20	791	0.08
0.30	646	0.15
0.40	559	0.23
0.50	500	0.32
0.60	457	0.42
0.70	423	0.53
0.80	396	0.64
0.90	373	0.77
1.00	354	0.90
1.10	337	1.04
1.20	323	1.18
1.30	310	1.33
1.40	299	1.49
1.50	289	1.65
1.60	280	1.82
1.70	271	1.99
1.80	264	2.17
1.90	257	2.35
2.00	250	2.54
2.10	244	2.73
2.20	239	2.93
2.30	233	3.13
2.40	228	3.34
2.50	224	3.55
2.60	219	3.76

Orbit	Temperature	Length of Year
2.70	215	3.98
2.80	211	4.21
2.90	208	4.43
3.00	204	4.67
3.10	201	4.90
3.20	198	5.14
3.30	195	5.38
3.40	192	5.63
3.50	189	5.88
3.60	186	6.13
3.70	184	6.39
3.80	182	6.65
3.90	179	6.92
4.00	177	7.18
4.10	175	7.46
4.20	173	7.73
4.30	171	8.01
4.40	169	8.29
4.50	167	8.57
4.60	165	8.86
4.70	163	9.15
4.80	162	9.44
4.90	160	9.74
5.00	158	10.04

Spectral Class F8

Orbit	Temperature	Length of Year
0.10	1041	0.03
0.20	736	0.08
0.30	601	0.15
0.40	520	0.24
0.50	466	0.33
0.60	425	0.44
0.70	393	0.55
0.80	368	0.67
0.90	347	0.80
1.00	329	0.94
1.10	314	1.08
1.20	300	1.23
1.30	289	1.39
1.40	278	1.55
1.50	269	1.72
1.60	260	1.90
1.70	252	2.08
1.80	245	2.26
1.90	239	2.45
2.00	233	2.65
2.10	227	2.85
2.20	222	3.06
2.30	217	3.27
2.40	212	3.48
2.50	208	3.70
2.60	204	3.93
2.70	200	4.16
2.80	197	4.39
2.90	193	4.63
3.00	190	4.87
3.10	187	5.11
3.20	184	5.36
3.30	181	5.61
3.40	179	5.87
3.50	176	6.13
3.60	173	6.40
3.70	171	6.67
3.80	169	6.94
3.90	167	7.21
4.00	165	7.49
4.10	163	7.78
4.20	161	8.06
4.30	159	8.35
4.40	157	8.64
4.50	155	8.94
4.60	153	9.24
4.70	152	9.54
4.80	150	9.85
4.90	149	10.16
5.00	147	10.47

Spectral Class F9

Orbit	Temperature	Length of Year
0.10	980	0.03
0.20	693	0.09
0.30	566	0.16
0.40	490	0.25
0.50	438	0.34
0.60	400	0.45
0.70	371	0.57
0.80	347	0.69
0.90	327	0.83
1.00	310	0.97
1.10	296	1.12
1.20	283	1.28
1.30	272	1.44
1.40	262	1.61
1.50	253	1.78
1.60	245	1.97
1.70	238	2.15
1.80	231	2.35
1.90	225	2.54
2.00	219	2.75
2.10	214	2.96
2.20	209	3.17
2.30	204	3.39
2.40	200	3.61
2.50	196	3.84
2.60	192	4.07
2.70	189	4.31
2.80	185	4.55
2.90	182	4.80
3.00	179	5.05
3.10	176	5.30
3.20	173	5.56
3.30	171	5.82
3.40	168	6.09
3.50	166	6.36
3.60	163	6.63
3.70	161	6.91
3.80	159	7.19
3.90	157	7.48
4.00	155	7.77
4.10	153	8.06
4.20	151	8.36
4.30	150	8.66
4.40	148	8.96
4.50	146	9.27
4.60	145	9.58
4.70	143	9.90
4.80	142	10.21
4.90	140	10.54
5.00	139	10.86

Spectral Class G0

Orbit	Temperature	Length of Year
0.10	976	0.03
0.20	690	0.09
0.30	564	0.16
0.40	488	0.25
0.50	437	0.35
0.60	399	0.46
0.70	369	0.58
0.80	345	0.71
0.90	325	0.85
1.00	309	0.99
1.10	294	1.14
1.20	282	1.30
1.30	271	1.47
1.40	261	1.64
1.50	252	1.82
1.60	244	2.00
1.70	237	2.19

Orbit	Temperature	Length of Year
1.80	230	2.39
1.90	224	2.59
2.00	218	2.80
2.10	213	3.01
2.20	208	3.23
2.30	204	3.45
2.40	199	3.68
2.50	195	3.91
2.60	191	4.15
2.70	188	4.39
2.80	185	4.64
2.90	181	4.89
3.00	178	5.14
3.10	175	5.40
3.20	173	5.67
3.30	170	5.94
3.40	167	6.21
3.50	165	6.48
3.60	163	6.76
3.70	161	7.05
3.80	158	7.33
3.90	156	7.63
4.00	154	7.92
4.10	152	8.22
4.20	151	8.52
4.30	149	8.83
4.40	147	9.14
4.50	146	9.45
4.60	144	9.77
4.70	142	10.09
4.80	141	10.41
4.90	139	10.74
5.00	138	11.07

Spectral Class G1

Orbit	Temperature	Length of Year
0.10	942	0.03
0.20	666	0.09
0.30	544	0.16
0.40	471	0.25
0.50	421	0.35
0.60	385	0.46
0.70	356	0.58
0.80	333	0.71
0.90	314	0.85
1.00	298	1.00
1.10	284	1.15
1.20	272	1.31
1.30	261	1.47
1.40	252	1.65
1.50	243	1.83
1.60	236	2.01
1.70	228	2.21
1.80	222	2.40
1.90	216	2.61
2.00	211	2.81
2.10	206	3.03
2.20	201	3.25
2.30	196	3.47
2.40	192	3.70
2.50	188	3.93
2.60	185	4.17
2.70	181	4.41
2.80	178	4.66
2.90	175	4.91
3.00	172	5.17
3.10	169	5.43
3.20	167	5.70
3.30	164	5.97
3.40	162	6.24
3.50	159	6.52
3.60	157	6.80
3.70	155	7.08
3.80	153	7.37
3.90	151	7.66
4.00	149	7.96
4.10	147	8.26
4.20	145	8.56
4.30	144	8.87
4.40	142	9.18
4.50	140	9.50
4.60	139	9.82
4.70	137	10.14
4.80	136	10.46
4.90	135	10.79
5.00	133	11.12

Spectral Class G2

Orbit	Temperature	Length of Year
0.10	933	0.03
0.20	660	0.09
0.30	539	0.16
0.40	466	0.25
0.50	417	0.35
0.60	381	0.46
0.70	353	0.59
0.80	330	0.72
0.90	311	0.85
1.00	295	1.00
1.10	281	1.15
1.20	269	1.31
1.30	259	1.48
1.40	249	1.66
1.50	241	1.84
1.60	233	2.02
1.70	226	2.22
1.80	220	2.41
1.90	214	2.62
2.00	209	2.83
2.10	204	3.04
2.20	199	3.26
2.30	195	3.49
2.40	190	3.72
2.50	187	3.95
2.60	183	4.19
2.70	180	4.44
2.80	176	4.69
2.90	173	4.94
3.00	170	5.20
3.10	168	5.46
3.20	165	5.72
3.30	162	5.99
3.40	160	6.27
3.50	158	6.55
3.60	155	6.83
3.70	153	7.12
3.80	151	7.41
3.90	149	7.70
4.00	147	8.00
4.10	146	8.30
4.20	144	8.61
4.30	142	8.92
4.40	141	9.23
4.50	139	9.55
4.60	138	9.87
4.70	136	10.19
4.80	135	10.52
4.90	133	10.85
5.00	132	11.18

Spectral Class G3

Orbit	Temperature	Length of Year
0.10	922	0.03
0.20	652	0.09
0.30	533	0.17
0.40	461	0.25
0.50	413	0.36
0.60	377	0.47
0.70	349	0.59
0.80	326	0.72

Orbit	Temperature	Length of Year
0.90	307	0.86
1.00	292	1.01
1.10	278	1.16
1.20	266	1.32
1.30	256	1.49
1.40	247	1.67
1.50	238	1.85
1.60	231	2.04
1.70	224	2.23
1.80	217	2.43
1.90	212	2.64
2.00	206	2.85
2.10	201	3.07
2.20	197	3.29
2.30	192	3.51
2.40	188	3.75
2.50	184	3.98
2.60	181	4.22
2.70	178	4.47
2.80	174	4.72
2.90	171	4.98
3.00	168	5.24
3.10	166	5.50
3.20	163	5.77
3.30	161	6.04
3.40	158	6.32
3.50	156	6.60
3.60	154	6.88
3.70	152	7.17
3.80	150	7.46
3.90	148	7.76
4.00	146	8.06
4.10	144	8.36
4.20	142	8.67
4.30	141	8.98
4.40	139	9.30
4.50	138	9.62
4.60	136	9.94
4.70	135	10.27
4.80	133	10.60
4.90	132	10.93
5.00	130	11.27

Spectral Class G4

Orbit	Temperature	Length of Year
0.10	886	0.03
0.20	627	0.09
0.30	512	0.17
0.40	443	0.26
0.50	396	0.36
0.60	362	0.48
0.70	335	0.60
0.80	313	0.73
0.90	295	0.87
1.00	280	1.02
1.10	267	1.18
1.20	256	1.35
1.30	246	1.52
1.40	237	1.70
1.50	229	1.88
1.60	222	2.07
1.70	215	2.27
1.80	209	2.47
1.90	203	2.68
2.00	198	2.89
2.10	193	3.11
2.20	189	3.34
2.30	185	3.57
2.40	181	3.80
2.50	177	4.04
2.60	174	4.29
2.70	171	4.54
2.80	167	4.79
2.90	165	5.05
3.00	162	5.32
3.10	159	5.59
3.20	157	5.86
3.30	154	6.13
3.40	152	6.42
3.50	150	6.70
3.60	148	6.99
3.70	146	7.28
3.80	144	7.58
3.90	142	7.88
4.00	140	8.19
4.10	138	8.50
4.20	137	8.81
4.30	135	9.12
4.40	134	9.44
4.50	132	9.77
4.60	131	10.10
4.70	129	10.43
4.80	128	10.76
4.90	127	11.10
5.00	125	11.44

Spectral Class G5

Orbit	Temperature	Length of Year
0.10	859	0.03
0.20	608	0.09
0.30	496	0.17
0.40	430	0.27
0.50	384	0.37
0.60	351	0.49
0.70	325	0.61
0.80	304	0.75
0.90	286	0.90
1.00	272	1.05
1.10	259	1.21
1.20	248	1.38
1.30	238	1.55
1.40	230	1.74
1.50	222	1.93
1.60	215	2.12
1.70	208	2.32
1.80	203	2.53
1.90	197	2.75
2.00	192	2.96
2.10	188	3.19
2.20	183	3.42
2.30	179	3.66
2.40	175	3.90
2.50	172	4.14
2.60	169	4.39
2.70	165	4.65
2.80	162	4.91
2.90	160	5.18
3.00	157	5.45
3.10	154	5.72
3.20	152	6.00
3.30	150	6.28
3.40	147	6.57
3.50	145	6.86
3.60	143	7.16
3.70	141	7.46
3.80	139	7.77
3.90	138	8.07
4.00	136	8.39
4.10	134	8.70
4.20	133	9.02
4.30	131	9.35
4.40	130	9.68
4.50	128	10.01
4.60	127	10.34
4.70	125	10.68
4.80	124	11.02
4.90	123	11.37
5.00	122	11.72

Spectral Class G6

Orbit	Temperature	Length of Year
0.10	824	0.03
0.20	583	0.09
0.30	476	0.17
0.40	412	0.27
0.50	369	0.37
0.60	337	0.49
0.70	312	0.62
0.80	291	0.75
0.90	275	0.90
1.00	261	1.05
1.10	249	1.22
1.20	238	1.39
1.30	229	1.56
1.40	220	1.75
1.50	213	1.94
1.60	206	2.13
1.70	200	2.34
1.80	194	2.55
1.90	189	2.76
2.00	184	2.98
2.10	180	3.21
2.20	176	3.44
2.30	172	3.68
2.40	168	3.92
2.50	165	4.17
2.60	162	4.42
2.70	159	4.68
2.80	156	4.94
2.90	153	5.21
3.00	151	5.48
3.10	148	5.75
3.20	146	6.03
3.30	144	6.32
3.40	141	6.61
3.50	139	6.90
3.60	137	7.20
3.70	136	7.50
3.80	134	7.81
3.90	132	8.12
4.00	130	8.43
4.10	129	8.75
4.20	127	9.07
4.30	126	9.40
4.40	124	9.73
4.50	123	10.06
4.60	122	10.40
4.70	120	10.74
4.80	119	11.09
4.90	118	11.43
5.00	117	11.79

Spectral Class G7

Orbit	Temperature	Length of Year
0.10	794	0.03
0.20	561	0.10
0.30	458	0.18
0.40	397	0.27
0.50	355	0.38
0.60	324	0.50
0.70	300	0.63
0.80	281	0.77
0.90	265	0.92
1.00	251	1.07
1.10	239	1.24
1.20	229	1.41
1.30	220	1.59
1.40	212	1.78
1.50	205	1.97
1.60	199	2.17
1.70	193	2.38
1.80	187	2.59
1.90	182	2.81
2.00	178	3.03

Orbit	Temperature	Length of Year
2.10	173	3.26
2.20	169	3.50
2.30	166	3.74
2.40	162	3.99
2.50	159	4.24
2.60	156	4.49
2.70	153	4.76
2.80	150	5.02
2.90	147	5.29
3.00	145	5.57
3.10	143	5.85
3.20	140	6.14
3.30	138	6.43
3.40	136	6.72
3.50	134	7.02
3.60	132	7.32
3.70	131	7.63
3.80	129	7.94
3.90	127	8.26
4.00	126	8.58
4.10	124	8.90
4.20	123	9.23
4.30	121	9.56
4.40	120	9.90
4.50	118	10.23
4.60	117	10.58
4.70	116	10.92
4.80	115	11.27
4.90	113	11.63
5.00	112	11.99

Spectral Class G8

Orbit	Temperature	Length of Year
0.10	785	0.03
0.20	555	0.10
0.30	453	0.18
0.40	392	0.27
0.50	351	0.38
0.60	320	0.50
0.70	297	0.64
0.80	277	0.78
0.90	262	0.93
1.00	248	1.08
1.10	237	1.25
1.20	227	1.43
1.30	218	1.61
1.40	210	1.80
1.50	203	1.99
1.60	196	2.20
1.70	190	2.40
1.80	185	2.62
1.90	180	2.84
2.00	175	3.07
2.10	171	3.30
2.20	167	3.54
2.30	164	3.78
2.40	160	4.03
2.50	157	4.29
2.60	154	4.55
2.70	151	4.81
2.80	148	5.08
2.90	146	5.36
3.00	143	5.64
3.10	141	5.92
3.20	139	6.21
3.30	137	6.50
3.40	135	6.80
3.50	133	7.10
3.60	131	7.41
3.70	129	7.72
3.80	127	8.03
3.90	126	8.35
4.00	124	8.68
4.10	123	9.00
4.20	121	9.34

Orbit	Temperature	Length of Year
4.30	120	9.67
4.40	118	10.01
4.50	117	10.35
4.60	116	10.70
4.70	114	11.05
4.80	113	11.41
4.90	112	11.76
5.00	111	12.13

Spectral Class G9

Orbit	Temperature	Length of Year
0.10	746	0.03
0.20	527	0.10
0.30	430	0.18
0.40	373	0.28
0.50	333	0.39
0.60	304	0.51
0.70	282	0.64
0.80	264	0.79
0.90	249	0.94
1.00	236	1.10
1.10	225	1.27
1.20	215	1.45
1.30	207	1.63
1.40	199	1.82
1.50	193	2.02
1.60	186	2.23
1.70	181	2.44
1.80	176	2.66
1.90	171	2.88
2.00	167	3.11
2.10	163	3.35
2.20	159	3.59
2.30	155	3.84
2.40	152	4.09
2.50	149	4.35
2.60	146	4.62
2.70	143	4.88
2.80	141	5.16
2.90	138	5.44
3.00	136	5.72
3.10	134	6.01
3.20	132	6.30
3.30	130	6.60
3.40	128	6.90
3.50	126	7.21
3.60	124	7.52
3.70	123	7.84
3.80	121	8.16
3.90	119	8.48
4.00	118	8.81
4.10	116	9.14
4.20	115	9.48
4.30	114	9.82
4.40	112	10.16
4.50	111	10.51
4.60	110	10.86
4.70	109	11.22
4.80	108	11.58
4.90	107	11.94
5.00	105	12.31

Spectral Class K0

Orbit	Temperature	Length of Year
0.10	724	0.04
0.20	512	0.10
0.30	418	0.18
0.40	362	0.28
0.50	324	0.40
0.60	296	0.52
0.70	274	0.65
0.80	256	0.80
0.90	241	0.95
1.00	229	1.12
1.10	218	1.29

Orbit	Temperature	Length of Year
1.20	209	1.47
1.30	201	1.66
1.40	194	1.85
1.50	187	2.05
1.60	181	2.26
1.70	176	2.48
1.80	171	2.70
1.90	166	2.93
2.00	162	3.16
2.10	158	3.40
2.20	154	3.65
2.30	151	3.90
2.40	148	4.16
2.50	145	4.42
2.60	142	4.69
2.70	139	4.96
2.80	137	5.24
2.90	134	5.52
3.00	132	5.81
3.10	130	6.10
3.20	128	6.40
3.30	126	6.70
3.40	124	7.01
3.50	122	7.32
3.60	121	7.64
3.70	119	7.96
3.80	117	8.28
3.90	116	8.61
4.00	114	8.94
4.10	113	9.28
4.20	112	9.62
4.30	110	9.97
4.40	109	10.32
4.50	108	10.67
4.60	107	11.03
4.70	106	11.39
4.80	105	11.76
4.90	103	12.13
5.00	102	12.50

Spectral Class K1

Orbit	Temperature	Length of Year
0.10	699	0.04
0.20	495	0.10
0.30	404	0.19
0.40	350	0.29
0.50	313	0.40
0.60	286	0.53
0.70	264	0.67
0.80	247	0.81
0.90	233	0.97
1.00	221	1.14
1.10	211	1.31
1.20	202	1.49
1.30	194	1.68
1.40	187	1.88
1.50	181	2.09
1.60	175	2.30
1.70	170	2.52
1.80	165	2.74
1.90	160	2.97
2.00	156	3.21
2.10	153	3.46
2.20	149	3.71
2.30	146	3.96
2.40	143	4.22
2.50	140	4.49
2.60	137	4.76
2.70	135	5.04
2.80	132	5.32
2.90	130	5.61
3.00	128	5.90
3.10	126	6.20
3.20	124	6.50
3.30	122	6.81

Orbit	Temperature	Length of Year
3.40	120	7.12
3.50	118	7.44
3.60	117	7.76
3.70	115	8.08
3.80	113	8.41
3.90	112	8.75
4.00	111	9.09
4.10	109	9.43
4.20	108	9.78
4.30	107	10.13
4.40	105	10.48
4.50	104	10.84
4.60	103	11.21
4.70	102	11.57
4.80	101	11.95
4.90	100	12.32
5.00	99	12.70

Spectral Class K2

Orbit	Temperature	Length of Year
0.10	680	0.04
0.20	481	0.10
0.30	392	0.19
0.40	340	0.29
0.50	304	0.41
0.60	278	0.54
0.70	257	0.68
0.80	240	0.83
0.90	227	0.99
1.00	215	1.15
1.10	205	1.33
1.20	196	1.52
1.30	189	1.71
1.40	182	1.91
1.50	176	2.12
1.60	170	2.34
1.70	165	2.56
1.80	160	2.79
1.90	156	3.02
2.00	152	3.27
2.10	148	3.51
2.20	145	3.77
2.30	142	4.03
2.40	139	4.29
2.50	136	4.56
2.60	133	4.84
2.70	131	5.12
2.80	128	5.41
2.90	126	5.70
3.00	124	6.00
3.10	122	6.30
3.20	120	6.61
3.30	118	6.92
3.40	117	7.24
3.50	115	7.56
3.60	113	7.89
3.70	112	8.22
3.80	110	8.55
3.90	109	8.89
4.00	107	9.24
4.10	106	9.59
4.20	105	9.94
4.30	104	10.30
4.40	102	10.66
4.50	101	11.02
4.60	100	11.39
4.70	99	11.77
4.80	98	12.14
4.90	97	12.52
5.00	96	12.91

Spectral Class K3

Orbit	Temperature	Length of Year
0.10	661	0.04
0.20	467	0.10
0.30	382	0.19
0.40	330	0.30
0.50	296	0.41
0.60	270	0.54
0.70	250	0.69
0.80	234	0.84
0.90	220	1.00
1.00	209	1.17
1.10	199	1.35
1.20	191	1.54
1.30	183	1.73
1.40	177	1.94
1.50	171	2.15
1.60	165	2.37
1.70	160	2.59
1.80	156	2.83
1.90	152	3.07
2.00	148	3.31
2.10	144	3.56
2.20	141	3.82
2.30	138	4.08
2.40	135	4.35
2.50	132	4.63
2.60	130	4.91
2.70	127	5.19
2.80	125	5.48
2.90	123	5.78
3.00	121	6.08
3.10	119	6.39
3.20	117	6.70
3.30	115	7.02
3.40	113	7.34
3.50	112	7.66
3.60	110	7.99
3.70	109	8.33
3.80	107	8.67
3.90	106	9.01
4.00	105	9.36
4.10	103	9.72
4.20	102	10.07
4.30	101	10.44
4.40	100	10.80
4.50	99	11.17
4.60	97	11.55
4.70	96	11.93
4.80	95	12.31
4.90	94	12.70
5.00	93	13.09

Spectral Class K4

Orbit	Temperature	Length of Year
0.10	636	0.04
0.20	450	0.11
0.30	367	0.20
0.40	318	0.30
0.50	284	0.42
0.60	260	0.55
0.70	240	0.70
0.80	225	0.85
0.90	212	1.02
1.00	201	1.19
1.10	192	1.37
1.20	184	1.57
1.30	176	1.77
1.40	170	1.97
1.50	164	2.19
1.60	159	2.41
1.70	154	2.64
1.80	150	2.88

Orbit	Temperature	Length of Year
1.90	146	3.12
2.00	142	3.37
2.10	139	3.62
2.20	136	3.89
2.30	133	4.15
2.40	130	4.43
2.50	127	4.71
2.60	125	4.99
2.70	122	5.28
2.80	120	5.58
2.90	118	5.88
3.00	116	6.19
3.10	114	6.50
3.20	112	6.82
3.30	111	7.14
3.40	109	7.47
3.50	107	7.80
3.60	106	8.14
3.70	105	8.48
3.80	103	8.82
3.90	102	9.17
4.00	101	9.53
4.10	99	9.89
4.20	98	10.25
4.30	97	10.62
4.40	96	10.99
4.50	95	11.37
4.60	94	11.75
4.70	93	12.14
4.80	92	12.52
4.90	91	12.92
5.00	90	13.32

Spectral Class K5

Orbit	Temperature	Length of Year
0.10	624	0.04
0.20	441	0.11
0.30	360	0.20
0.40	312	0.31
0.50	279	0.43
0.60	255	0.56
0.70	236	0.71
0.80	221	0.87
0.90	208	1.04
1.00	197	1.21
1.10	188	1.40
1.20	180	1.59
1.30	173	1.80
1.40	167	2.01
1.50	161	2.23
1.60	156	2.45
1.70	151	2.69
1.80	147	2.93
1.90	143	3.18
2.00	139	3.43
2.10	136	3.69
2.20	133	3.96
2.30	130	4.23
2.40	127	4.51
2.50	125	4.79
2.60	122	5.08
2.70	120	5.38
2.80	118	5.68
2.90	116	5.99
3.00	114	6.30
3.10	112	6.62
3.20	110	6.94
3.30	109	7.27
3.40	107	7.60
3.50	105	7.94
3.60	104	8.28
3.70	103	8.63
3.80	101	8.98
3.90	100	9.34
4.00	99	9.70

Orbit	Temperature	Length of Year
4.10	97	10.07
4.20	96	10.44
4.30	95	10.81
4.40	94	11.19
4.50	93	11.58
4.60	92	11.96
4.70	91	12.36
4.80	90	12.75
4.90	89	13.15
5.00	88	13.56

Spectral Class K6

Orbit	Temperature	Length of Year
0.10	592	0.04
0.20	418	0.11
0.30	342	0.20
0.40	296	0.31
0.50	265	0.44
0.60	242	0.57
0.70	224	0.72
0.80	209	0.88
0.90	197	1.05
1.00	187	1.24
1.10	178	1.43
1.20	171	1.62
1.30	164	1.83
1.40	158	2.05
1.50	153	2.27
1.60	148	2.50
1.70	144	2.74
1.80	139	2.98
1.90	136	3.24
2.00	132	3.49
2.10	129	3.76
2.20	126	4.03
2.30	123	4.31
2.40	121	4.59
2.50	118	4.88
2.60	116	5.18
2.70	114	5.48
2.80	112	5.79
2.90	110	6.10
3.00	108	6.42
3.10	106	6.74
3.20	105	7.07
3.30	103	7.41
3.40	101	7.75
3.50	100	8.09
3.60	99	8.44
3.70	97	8.79
3.80	96	9.15
3.90	95	9.52
4.00	94	9.88
4.10	92	10.26
4.20	91	10.64
4.30	90	11.02
4.40	89	11.40
4.50	88	11.80
4.60	87	12.19
4.70	86	12.59
4.80	85	12.99
4.90	85	13.40
5.00	84	13.81

Spectral Class K7

Orbit	Temperature	Length of Year
0.10	576	0.04
0.20	407	0.11
0.30	332	0.21
0.40	288	0.32
0.50	257	0.45
0.60	235	0.59
0.70	218	0.74
0.80	204	0.90
0.90	192	1.08

Orbit	Temperature	Length of Year
1.00	182	1.26
1.10	174	1.45
1.20	166	1.66
1.30	160	1.87
1.40	154	2.09
1.50	149	2.31
1.60	144	2.55
1.70	140	2.79
1.80	136	3.04
1.90	132	3.30
2.00	129	3.56
2.10	126	3.83
2.20	123	4.11
2.30	120	4.39
2.40	118	4.68
2.50	115	4.98
2.60	113	5.28
2.70	111	5.59
2.80	109	5.90
2.90	107	6.22
3.00	105	6.55
3.10	103	6.88
3.20	102	7.21
3.30	100	7.55
3.40	99	7.90
3.50	97	8.25
3.60	96	8.61
3.70	95	8.97
3.80	93	9.33
3.90	92	9.70
4.00	91	10.08
4.10	90	10.46
4.20	89	10.84
4.30	88	11.23
4.40	87	11.63
4.50	86	12.03
4.60	85	12.43
4.70	84	12.84
4.80	83	13.25
4.90	82	13.67
5.00	81	14.09

Spectral Class K8

Orbit	Temperature	Length of Year
0.10	552	0.04
0.20	391	0.12
0.30	319	0.21
0.40	276	0.33
0.50	247	0.46
0.60	226	0.60
0.70	209	0.76
0.80	195	0.92
0.90	184	1.10
1.00	175	1.29
1.10	167	1.49
1.20	159	1.70
1.30	153	1.91
1.40	148	2.14
1.50	143	2.37
1.60	138	2.61
1.70	134	2.86
1.80	130	3.12
1.90	127	3.38
2.00	124	3.65
2.10	121	3.93
2.20	118	4.21
2.30	115	4.50
2.40	113	4.80
2.50	110	5.10
2.60	108	5.41
2.70	106	5.73
2.80	104	6.05
2.90	103	6.38
3.00	101	6.71
3.10	99	7.05.
3.20	98	7.39
3.30	96	7.74
3.40	95	8.09
3.50	93	8.45
3.60	92	8.82
3.70	91	9.19
3.80	90	9.56
3.90	88	9.94
4.00	87	10.33
4.10	86	10.72
4.20	85	11.11
4.30	84	11.51
4.40	83	11.92
4.50	82	12.32
4.60	81	12.74
4.70	81	13.15
4.80	80	13.58
4.90	79	14.00
5.00	78	14.43

Spectral Class K9

Orbit	Temperature	Length of Year
0.10	531	0.04
0.20	375	0.12
0.30	307	0.22
0.40	266	0.34
0.50	237	0.47
0.60	217	0.62
0.70	201	0.78
0.80	188	0.95
0.90	177	1.13
1.00	168	1.32
1.10	160	1.53
1.20	153	1.74
1.30	147	1.96
1.40	142	2.19
1.50	137	2.43
1.60	133	2.68
1.70	129	2.94
1.80	125	3.20
1.90	122	3.47
2.00	119	3.75
2.10	116	4.03
2.20	113	4.32
2.30	111	4.62
2.40	108	4.92
2.50	106	5.24
2.60	104	5.55
2.70	102	5.88
2.80	100	6.21
2.90	99	6.54
3.00	97	6.88
3.10	95	7.23
3.20	94	7.58
3.30	92	7.94
3.40	91	8.30
3.50	90	8.67
3.60	89	9.05
3.70	87	9.43
3.80	86	9.81
3.90	85	10.20
4.00	84	10.60
4.10	83	11.00
4.20	82	11.40
4.30	81	11.81
4.40	80	12.22
4.50	79	12.64
4.60	78	13.07
4.70	77	13.50
4.80	77	13.93
4.90	76	14.37
5.00	75	14.81

Spectral Class M0

Orbit	Temperature	Length of Year
0.10	513	0.04
0.20	362	0.12
0.30	296	0.22
0.40	256	0.34
0.50	229	0.48
0.60	209	0.63
0.70	194	0.80
0.80	181	0.97
0.90	171	1.16
1.00	162	1.36
1.10	155	1.57
1.20	148	1.79
1.30	142	2.02
1.40	137	2.25
1.50	132	2.50
1.60	128	2.75
1.70	124	3.02
1.80	121	3.29
1.90	118	3.56
2.00	115	3.85
2.10	112	4.14
2.20	109	4.44
2.30	107	4.75
2.40	105	5.06
2.50	103	5.38
2.60	101	5.71
2.70	99	6.04
2.80	97	6.38
2.90	95	6.72
3.00	94	7.07
3.10	92	7.43
3.20	91	7.79
3.30	89	8.16
3.40	88	8.53
3.50	87	8.91
3.60	85	9.30
3.70	84	9.69
3.80	83	10.08
3.90	82	10.48
4.00	81	10.89
4.10	80	11.30
4.20	79	11.71
4.30	78	12.13
4.40	77	12.56
4.50	76	12.99
4.60	76	13.43
4.70	75	13.87
4.80	74	14.31
4.90	73	14.76
5.00	72	15.21

Spectral Class M1

Orbit	Temperature	Length of Year
0.10	484	0.04
0.20	342	0.13
0.30	280	0.23
0.40	242	0.36
0.50	217	0.50
0.60	198	0.65
0.70	183	0.82
0.80	171	1.01
0.90	161	1.20
1.00	153	1.41
1.10	146	1.62
1.20	140	1.85
1.30	134	2.09
1.40	129	2.33
1.50	125	2.59
1.60	121	2.85
1.70	117	3.12
1.80	114	3.40
1.90	111	3.69
2.00	108	3.98
2.10	106	4.28
2.20	103	4.59

Orbit	Temperature	Length of Year
2.30	101	4.91
2.40	99	5.23
2.50	97	5.56
2.60	95	5.90
2.70	93	6.24
2.80	92	6.59
2.90	90	6.95
3.00	88	7.31
3.10	87	7.68
3.20	86	8.06
3.30	84	8.44
3.40	83	8.82
3.50	82	9.21
3.60	81	9.61
3.70	80	10.02
3.80	79	10.42
3.90	78	10.84
4.00	77	11.26
4.10	76	11.68
4.20	75	12.11
4.30	74	12.55
4.40	73	12.99
4.50	72	13.43
4.60	71	13.88
4.70	71	14.34
4.80	70	14.80
4.90	69	15.26
5.00	68	15.73

Spectral Class M2

Orbit	Temperature	Length of Year
0.10	461	0.05
0.20	326	0.13
0.30	266	0.24
0.40	230	0.37
0.50	206	0.52
0.60	188	0.68
0.70	174	0.85
0.80	163	1.04
0.90	154	1.25
1.00	146	1.46
1.10	139	1.68
1.20	133	1.92
1.30	128	2.16
1.40	123	2.42
1.50	119	2.68
1.60	115	2.95
1.70	112	3.23
1.80	109	3.52
1.90	106	3.82
2.00	103	4.13
2.10	101	4.44
2.20	98	4.76
2.30	96	5.09
2.40	94	5.42
2.50	92	5.77
2.60	90	6.12
2.70	89	6.47
2.80	87	6.83
2.90	86	7.20
3.00	84	7.58
3.10	83	7.96
3.20	81	8.35
3.30	80	8.74
3.40	79	9.14
3.50	78	9.55
3.60	77	9.96
3.70	76	10.38
3.80	75	10.81
3.90	74	11.23
4.00	73	11.67
4.10	72	12.11
4.20	71	12.56
4.30	70	13.01
4.40	69	13.46

Orbit	Temperature	Length of Year
4.50	69	13.92
4.60	68	14.39
4.70	67	14.86
4.80	67	15.34
4.90	66	15.82
5.00	65	16.31

Spectral Class M3

Orbit	Temperature	Length of Year
0.10	438	0.05
0.20	310	0.14
0.30	253	0.25
0.40	219	0.38
0.50	196	0.54
0.60	179	0.70
0.70	166	0.89
0.80	155	1.08
0.90	146	1.29
1.00	139	1.52
1.10	132	1.75
1.20	126	1.99
1.30	121	2.25
1.40	117	2.51
1.50	113	2.79
1.60	110	3.07
1.70	106	3.36
1.80	103	3.66
1.90	100	3.97
2.00	98	4.29
2.10	96	4.61
2.20	93	4.95
2.30	91	5.29
2.40	89	5.64
2.50	88	5.99
2.60	86	6.36
2.70	84	6.73
2.80	83	7.10
2.90	81	7.49
3.00	80	7.88
3.10	79	8.28
3.20	77	8.68
3.30	76	9.09
3.40	75	9.51
3.50	74	9.93
3.60	73	10.36
3.70	72	10.79
3.80	71	11.23
3.90	70	11.68
4.00	69	12.13
4.10	68	12.59
4.20	68	13.05
4.30	67	13.52
4.40	66	13.99
4.50	65	14.47
4.60	65	14.96
4.70	64	15.45
4.80	63	15.94
4.90	63	16.45
5.00	62	16.95

Spectral Class M4

Orbit	Temperature	Length of Year
0.10	394	0.05
0.20	278	0.15
0.30	227	0.27
0.40	197	0.41
0.50	176	0.57
0.60	161	0.75
0.70	149	0.95
0.80	139	1.16
0.90	131	1.39
1.00	124	1.62
1.10	119	1.87
1.20	114	2.13
1.30	109	2.40

Orbit	Temperature	Length of Year
1.40	105	2.69
1.50	102	2.98
1.60	98	3.28
1.70	95	3.60
1.80	93	3.92
1.90	90	4.25
2.00	88	4.59
2.10	86	4.94
2.20	84	5.29
2.30	82	5.66
2.40	80	6.03
2.50	79	6.41
2.60	77	6.80
2.70	76	7.20
2.80	74	7.60
2.90	73	8.01
3.00	72	8.43
3.10	71	8.85
3.20	70	9.29
3.30	69	9.72
3.40	68	10.17
3.50	67	10.62
3.60	66	11.08
3.70	65	11.55
3.80	64	12.02
3.90	63	12.49
4.00	62	12.98
4.10	61	13.47
4.20	61	13.96
4.30	60	14.46
4.40	59	14.97
4.50	59	15.49
4.60	58	16.00
4.70	57	16.53
4.80	57	17.06
4.90	56	17.60
5.00	56	18.14

Spectral Class M5

Orbit	Temperature	Length of Year
0.10	364	0.06
0.20	257	0.16
0.30	210	0.29
0.40	182	0.44
0.50	163	0.62
0.60	149	0.81
0.70	138	1.02
0.80	129	1.25
0.90	121	1.49
1.00	115	1.74
1.10	110	2.01
1.20	105	2.29
1.30	101	2.58
1.40	97	2.88
1.50	94	3.20
1.60	91	3.52
1.70	88	3.86
1.80	86	4.20
1.90	84	4.56
2.00	81	4.92
2.10	79	5.30
2.20	78	5.68
2.30	76	6.07
2.40	74	6.47
2.50	73	6.88
2.60	71	7.30
2.70	70	7.72
2.80	69	8.16
2.90	68	8.60
3.00	66	9.05
3.10	65	9.50
3.20	64	9.96
3.30	63	10.44
3.40	62	10.91
3.50	62	11.40

Orbit	Temperature	Length of Year
3.60	61	11.89
3.70	60	12.39
3.80	59	12.89
3.90	58	13.41
4.00	58	13.93
4.10	57	14.45
4.20	56	14.98
4.30	56	15.52
4.40	55	16.07
4.50	54	16.62
4.60	54	17.17
4.70	53	17.74
4.80	53	18.31
4.90	52	18.88
5.00	51	19.46

Spectral Class M6

Orbit	Temperature	Length of Year
0.10	328	0.06
0.20	232	0.17
0.30	189	0.32
0.40	164	0.49
0.50	146	0.68
0.60	134	0.89
0.70	124	1.13
0.80	116	1.38
0.90	109	1.64
1.00	104	1.92
1.10	99	2.22
1.20	95	2.53
1.30	91	2.85
1.40	88	3.19
1.50	85	3.54
1.60	82	3.89
1.70	79	4.27
1.80	77	4.65
1.90	75	5.04
2.00	73	5.44
2.10	71	5.86
2.20	70	6.28
2.30	68	6.71
2.40	67	7.16
2.50	66	7.61
2.60	64	8.07
2.70	63	8.54
2.80	62	9.02
2.90	61	9.50
3.00	60	10.00
3.10	59	10.50
3.20	58	11.02
3.30	57	11.54
3.40	56	12.07
3.50	55	12.60
3.60	55	13.15
3.70	54	13.70
3.80	53	14.26
3.90	52	14.82
4.00	52	15.40
4.10	51	15.98
4.20	51	16.57
4.30	50	17.16
4.40	49	17.76
4.50	49	18.37
4.60	48	18.99
4.70	48	19.61
4.80	47	20.24
4.90	47	20.87
5.00	46	21.52

Spectral Class M7

Orbit	Temperature	Length of Year
0.10	309	0.07
0.20	218	0.19
0.30	178	0.35
0.40	154	0.54
0.50	138	0.75
0.60	126	0.99
0.70	117	1.25
0.80	109	1.53
0.90	103	1.82
1.00	98	2.13
1.10	93	2.46
1.20	89	2.80
1.30	86	3.16
1.40	83	3.53
1.50	80	3.92
1.60	77	4.31
1.70	75	4.73
1.80	73	5.15
1.90	71	5.58
2.00	69	6.03
2.10	67	6.49
2.20	66	6.96
2.30	64	7.44
2.40	63	7.93
2.50	62	8.43
2.60	61	8.94
2.70	59	9.46
2.80	58	9.99
2.90	57	10.53
3.00	56	11.08
3.10	55	11.64
3.20	55	12.20
3.30	54	12.78
3.40	53	13.37
3.50	52	13.96
3.60	51	14.56
3.70	51	15.17
3.80	50	15.79
3.90	49	16.42
4.00	49	17.06
4.10	48	17.70
4.20	48	18.35
4.30	47	19.01
4.40	47	19.68
4.50	46	20.35
4.60	46	21.03
4.70	45	21.72
4.80	45	22.42
4.90	44	23.13
5.00	44	23.84

Explanation of Headings

SPECTRAL CLASS: The spectral class of the main sequence primary star.

ORBIT: The mean planetary orbital radius in Astronomical Units.

TEMP.: The mean day surface temperature in degrees Kelvin.

YEAR: The length of the year, in terrestrial years.

12.3.1 Planetary Characteristics Generation

Planetary Radius (RP) = (2D10 – 1)/10
Planetary Density (DP) = (12D8 – 4)/50

If (gp) is the surface acceleration on the planet, we know that (gp) = G x m / $(RP)^2$, where G is the universal gravitational constant, RP is the radius of the planet, and m is the mass of the planet (all in appropriate units, of course).

Now, m = (DP) x $(RP)^3$ x 4 x PI/3 (where PI is approximately 3.141592), so (gp) = G x PI x (RP) x (DP), so in terms of one terrestrial g (or 980 cm per second per second) the gravitational acceleration at the surface of the planet will be given by:

(gp) = (DP) x (RP)

where (DP) and (RP) are in units of normal Earth density and Earth radii respectively, and (gp) is in units of one terrestrial g acceleration.

From basic physics, we know that the escape velocity from a body is given by the following equation:

$$v_{esc} = (2 \times (gp) \times RP)^{(1/2)}$$

Substituting our earlier equation for (gp) and converting to units of Earth escape velocity, we see that the following equation must hold:

$$v_{esc} = ((DP)\times(RP)\times(RP))^{(1/2)}$$

where the velocity of escape is in units of Earth escape velocities (so that an escape velocity of 1 means that the escape velocity of the planet from the surface is the same as for Earth – 7 miles per second, or roughly 11 kilometers per second, roughly 25,000 miles per hour).

As an aid to referees, a table of escape velocities indexed by radius and density of planet follows:

TABLE OF ESCAPE VELOCITY VALUES FOR GIVEN PLANETARY RADIUS (RP) AND DENSITY (DP) VALUES

	RP																		
DP	**0.10**	**0.20**	**0.30**	**0.40**	**0.50**	**0.60**	**0.70**	**0.80**	**0.90**	**1.00**	**1.10**	**1.20**	**1.30**	**1.40**	**1.50**	**1.60**	**1.70**	**1.80**	**1.90**
0.16	0.04	0.08	0.12	0.16	0.20	0.24	0.28	0.32	0.36	0.40	0.44	0.48	0.52	0.56	0.60	0.64	0.68	0.72	0.76
0.18	0.04	0.08	0.13	0.17	0.21	0.25	0.30	0.34	0.38	0.42	0.47	0.51	0.55	0.59	0.64	0.68	0.72	0.76	0.81
0.20	0.04	0.09	0.13	0.18	0.22	0.27	0.31	0.36	0.40	0.45	0.49	0.54	0.58	0.63	0.67	0.72	0.76	0.80	0.85
0.22	0.05	0.09	0.14	0.19	0.23	0.28	0.33	0.38	0.42	0.47	0.52	0.56	0.61	0.66	0.70	0.75	0.80	0.84	0.89
0.24	0.05	0.10	0.15	0.20	0.24	0.29	0.34	0.39	0.44	0.49	0.54	0.59	0.64	0.69	0.73	0.78	0.83	0.88	0.93
0.26	0.05	0.10	0.15	0.20	0.25	0.31	0.36	0.41	0.46	0.51	0.56	0.61	0.66	0.71	0.76	0.82	0.87	0.92	0.97
0.28	0.05	0.11	0.16	0.21	0.26	0.32	0.37	0.42	0.48	0.53	0.58	0.63	0.69	0.74	0.79	0.85	0.90	0.95	1.01
0.30	0.05	0.11	0.16	0.22	0.27	0.33	0.38	0.44	0.49	0.55	0.60	0.66	0.71	0.77	0.82	0.88	0.93	0.99	1.04
0.32	0.06	0.11	0.17	0.23	0.28	0.34	0.40	0.45	0.51	0.57	0.62	0.68	0.74	0.79	0.85	0.91	0.96	1.02	1.07
0.34	0.06	0.12	0.17	0.23	0.29	0.35	0.41	0.47	0.52	0.58	0.64	0.70	0.76	0.82	0.87	0.93	0.99	1.05	1.11
0.36	0.06	0.12	0.18	0.24	0.30	0.36	0.42	0.48	0.54	0.60	0.66	0.72	0.78	0.84	0.90	0.96	1.02	1.08	1.14
0.38	0.06	0.12	0.18	0.25	0.31	0.37	0.43	0.49	0.55	0.62	0.68	0.74	0.80	0.86	0.92	0.99	1.05	1.11	1.17
0.40	0.06	0.13	0.19	0.25	0.32	0.38	0.44	0.51	0.57	0.63	0.70	0.76	0.82	0.89	0.95	1.01	1.08	1.14	1.20
0.42	0.06	0.13	0.19	0.26	0.32	0.39	0.45	0.52	0.58	0.65	0.71	0.78	0.84	0.91	0.97	1.04	1.10	1.17	1.23
0.44	0.07	0.13	0.20	0.27	0.33	0.40	0.46	0.53	0.60	0.66	0.73	0.80	0.86	0.93	0.99	1.06	1.13	1.19	1.26
0.46	0.07	0.14	0.20	0.27	0.34	0.41	0.47	0.54	0.61	0.68	0.75	0.81	0.88	0.95	1.02	1.09	1.15	1.22	1.29
0.48	0.07	0.14	0.21	0.28	0.35	0.42	0.48	0.55	0.62	0.69	0.76	0.83	0.90	0.97	1.04	1.11	1.18	1.25	1.32
0.50	0.07	0.14	0.21	0.28	0.35	0.42	0.49	0.57	0.64	0.71	0.78	0.85	0.92	0.99	1.06	1.13	1.20	1.28	1.34
0.52	0.07	0.14	0.22	0.29	0.36	0.43	0.50	0.58	0.65	0.72	0.79	0.87	0.94	1.01	1.08	1.15	1.23	1.30	1.37
0.54	0.07	0.15	0.22	0.29	0.37	0.44	0.51	0.59	0.66	0.73	0.81	0.88	0.96	1.03	1.10	1.18	1.25	1.32	1.40
0.56	0.07	0.15	0.22	0.30	0.37	0.45	0.52	0.60	0.67	0.75	0.82	0.90	0.97	1.05	1.12	1.20	1.27	1.35	1.42
0.58	0.08	0.15	0.23	0.30	0.38	0.46	0.53	0.61	0.69	0.76	0.84	0.91	0.99	1.07	1.14	1.22	1.29	1.37	1.45
0.60	0.08	0.15	0.23	0.31	0.39	0.46	0.54	0.62	0.70	0.77	0.85	0.93	1.01	1.09	1.16	1.24	1.32	1.39	1.47
0.62	0.08	0.16	0.24	0.31	0.39	0.47	0.55	0.63	0.71	0.79	0.87	0.94	1.02	1.10	1.18	1.26	1.34	1.42	1.50
0.64	0.08	0.16	0.24	0.32	0.40	0.48	0.56	0.64	0.72	0.80	0.88	0.96	1.04	1.12	1.20	1.28	1.36	1.44	1.52
0.66	0.08	0.16	0.24	0.32	0.41	0.49	0.57	0.65	0.73	0.81	0.89	0.97	1.06	1.14	1.22	1.30	1.38	1.46	1.54
0.68	0.08	0.16	0.25	0.33	0.41	0.49	0.58	0.66	0.74	0.82	0.91	0.99	1.07	1.16	1.24	1.32	1.40	1.48	1.57
0.70	0.08	0.17	0.25	0.33	0.42	0.50	0.59	0.67	0.75	0.84	0.92	1.00	1.09	1.17	1.25	1.34	1.42	1.51	1.59
0.72	0.08	0.17	0.25	0.34	0.42	0.51	0.59	0.68	0.76	0.85	0.93	1.02	1.10	1.19	1.27	1.36	1.44	1.53	1.61
0.74	0.09	0.17	0.26	0.34	0.43	0.52	0.60	0.69	0.77	0.86	0.95	1.03	1.12	1.20	1.29	1.38	1.46	1.55	1.63
0.76	0.09	0.17	0.26	0.35	0.44	0.52	0.61	0.70	0.78	0.87	0.96	1.05	1.13	1.22	1.31	1.39	1.48	1.57	1.66
0.78	0.09	0.18	0.26	0.35	0.44	0.53	0.62	0.71	0.79	0.88	0.97	1.06	1.15	1.24	1.32	1.41	1.50	1.59	1.68
0.80	0.09	0.18	0.27	0.36	0.45	0.54	0.63	0.72	0.80	0.89	0.98	1.08	1.16	1.25	1.34	1.43	1.52	1.61	1.70
0.82	0.09	0.18	0.27	0.36	0.45	0.54	0.63	0.73	0.81	0.91	1.00	1.09	1.18	1.27	1.36	1.45	1.54	1.63	1.72
0.84	0.09	0.18	0.27	0.37	0.46	0.55	0.64	0.73	0.82	0.92	1.01	1.10	1.19	1.28	1.37	1.47	1.56	1.65	1.74
0.86	0.09	0.19	0.28	0.37	0.46	0.56	0.65	0.74	0.83	0.93	1.02	1.11	1.21	1.30	1.39	1.48	1.58	1.67	1.76
0.88	0.09	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.84	0.94	1.03	1.13	1.22	1.31	1.41	1.50	1.59	1.69	1.78
0.90	0.09	0.19	0.28	0.38	0.47	0.57	0.66	0.76	0.85	0.95	1.04	1.14	1.23	1.33	1.42	1.52	1.61	1.71	1.80
0.92	0.10	0.19	0.29	0.38	0.48	0.58	0.67	0.77	0.86	0.96	1.06	1.15	1.25	1.34	1.44	1.53	1.63	1.73	1.82
0.94	0.10	0.19	0.29	0.39	0.48	0.58	0.68	0.78	0.87	0.97	1.07	1.16	1.26	1.36	1.45	1.55	1.65	1.75	1.84
0.96	0.10	0.20	0.29	0.39	0.49	0.59	0.69	0.78	0.88	0.98	1.08	1.18	1.27	1.38	1.47	1.57	1.67	1.76	1.86
0.98	0.10	0.20	0.30	0.40	0.49	0.59	0.69	0.79	0.89	0.99	1.09	1.19	1.29	1.39	1.48	1.58	1.68	1.78	1.88
1.00	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50	1.60	1.70	1.80	1.90
1.02	0.10	0.20	0.30	0.40	0.50	0.61	0.71	0.81	0.91	1.01	1.11	1.21	1.31	1.41	1.51	1.62	1.72	1.82	1.92
1.04	0.10	0.20	0.31	0.41	0.51	0.61	0.71	0.82	0.92	1.02	1.12	1.22	1.33	1.43	1.53	1.63	1.73	1.84	1.94
1.06	0.10	0.21	0.31	0.41	0.51	0.62	0.72	0.82	0.93	1.03	1.13	1.24	1.34	1.44	1.54	1.65	1.75	1.85	1.96
1.08	0.10	0.21	0.31	0.42	0.52	0.62	0.73	0.83	0.94	1.04	1.14	1.25	1.35	1.45	1.56	1.66	1.77	1.87	1.97
1.10	0.10	0.21	0.31	0.42	0.52	0.63	0.73	0.84	0.94	1.05	1.15	1.26	1.36	1.47	1.57	1.68	1.78	1.89	1.99
1.12	0.11	0.21	0.32	0.42	0.53	0.63	0.74	0.85	0.95	1.06	1.16	1.27	1.38	1.48	1.59	1.69	1.80	1.90	2.01
1.14	0.11	0.21	0.32	0.43	0.53	0.64	0.75	0.85	0.96	1.07	1.17	1.28	1.39	1.49	1.60	1.71	1.82	1.92	2.03
1.16	0.11	0.22	0.32	0.43	0.54	0.65	0.75	0.86	0.97	1.08	1.18	1.29	1.40	1.51	1.62	1.72	1.83	1.94	2.05
1.18	0.11	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.09	1.19	1.30	1.41	1.52	1.63	1.74	1.85	1.96	2.06
1.20	0.11	0.22	0.33	0.44	0.55	0.66	0.77	0.88	0.99	1.10	1.20	1.31	1.42	1.53	1.64	1.75	1.86	1.97	2.08
1.22	0.11	0.22	0.33	0.44	0.55	0.66	0.77	0.88	0.99	1.10	1.21	1.33	1.44	1.55	1.66	1.77	1.88	1.99	2.10
1.24	0.11	0.22	0.33	0.45	0.56	0.67	0.78	0.89	1.00	1.11	1.22	1.34	1.45	1.56	1.67	1.78	1.89	2.00	2.12
1.26	0.11	0.22	0.34	0.45	0.56	0.67	0.79	0.90	1.01	1.12	1.23	1.35	1.46	1.57	1.68	1.80	1.91	2.02	2.13
1.28	0.11	0.23	0.34	0.45	0.57	0.68	0.79	0.91	1.02	1.13	1.24	1.36	1.47	1.58	1.70	1.81	1.92	2.04	2.15
1.30	0.11	0.23	0.34	0.46	0.57	0.68	0.80	0.91	1.03	1.14	1.25	1.37	1.48	1.60	1.71	1.82	1.94	2.05	2.17
1.32	0.11	0.23	0.34	0.46	0.57	0.69	0.80	0.92	1.03	1.15	1.26	1.38	1.49	1.61	1.72	1.84	1.95	2.07	2.18
1.34	0.12	0.23	0.35	0.46	0.58	0.69	0.81	0.93	1.04	1.16	1.27	1.39	1.50	1.62	1.74	1.85	1.97	2.08	2.21
1.36	0.12	0.23	0.35	0.47	0.58	0.70	0.82	0.93	1.05	1.17	1.28	1.40	1.52	1.63	1.75	1.87	1.98	2.10	2.22
1.38	0.12	0.23	0.35	0.47	0.59	0.70	0.82	0.94	1.06	1.17	1.29	1.41	1.53	1.64	1.76	1.88	2.00	2.11	2.23
1.40	0.12	0.24	0.35	0.47	0.59	0.71	0.83	0.95	1.06	1.18	1.30	1.42	1.54	1.66	1.78	1.89	2.01	2.13	2.25
1.42	0.12	0.24	0.36	0.48	0.60	0.71	0.83	0.95	1.07	1.19	1.31	1.43	1.55	1.67	1.79	1.91	2.03	2.14	2.26
1.44	0.12	0.24	0.36	0.48	0.60	0.72	0.84	0.96	1.08	1.20	1.32	1.44	1.56	1.68	1.80	1.92	2.04	2.16	2.28
1.46	0.12	0.24	0.36	0.48	0.60	0.72	0.85	0.97	1.09	1.21	1.33	1.45	1.57	1.69	1.81	1.93	2.06	2.17	2.30
1.48	0.12	0.24	0.36	0.49	0.61	0.73	0.85	0.97	1.09	1.22	1.34	1.46	1.58	1.70	1.82	1.95	2.07	2.19	2.31
1.50	0.12	0.24	0.37	0.49	0.61	0.73	0.86	0.98	1.10	1.22	1.35	1.47	1.59	1.71	1.84	1.96	2.08	2.20	2.33

DP	RP 0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50	1.60	1.70	1.80	1.90
1.52	0.12	0.25	0.37	0.49	0.62	0.74	0.86	0.99	1.11	1.23	1.36	1.48	1.60	1.73	1.85	1.97	2.10	2.22	2.34
1.54	0.12	0.25	0.37	0.50	0.62	0.74	0.87	0.99	1.12	1.24	1.37	1.49	1.61	1.74	1.86	1.99	2.11	2.23	2.36
1.56	0.12	0.25	0.37	0.50	0.62	0.75	0.87	1.00	1.12	1.25	1.37	1.50	1.62	1.75	1.87	2.00	2.12	2.25	2.37
1.58	0.13	0.25	0.38	0.50	0.63	0.75	0.88	1.01	1.13	1.26	1.38	1.51	1.63	1.76	1.89	2.01	2.14	2.26	2.39
1.60	0.13	0.25	0.38	0.51	0.63	0.76	0.89	1.01	1.14	1.26	1.39	1.52	1.64	1.77	1.90	2.02	2.15	2.28	2.40
1.62	0.13	0.25	0.38	0.51	0.64	0.76	0.89	1.02	1.15	1.27	1.40	1.53	1.65	1.78	1.91	2.04	2.16	2.29	2.42
1.64	0.13	0.26	0.38	0.51	0.64	0.77	0.90	1.02	1.15	1.28	1.41	1.54	1.66	1.79	1.92	2.05	2.18	2.31	2.43
1.66	0.13	0.26	0.39	0.52	0.64	0.77	0.90	1.03	1.16	1.29	1.42	1.55	1.67	1.80	1.93	2.06	2.20	2.32	2.45
1.68	0.13	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.17	1.30	1.43	1.56	1.68	1.81	1.94	2.07	2.20	2.33	2.46
1.70	0.13	0.26	0.39	0.52	0.65	0.79	0.91	1.04	1.17	1.30	1.43	1.57	1.69	1.83	1.96	2.09	2.22	2.35	2.48
1.72	0.13	0.26	0.39	0.53	0.66	0.79	0.92	1.05	1.18	1.31	1.44	1.58	1.70	1.84	1.97	2.10	2.23	2.36	2.49
1.74	0.13	0.26	0.40	0.53	0.66	0.79	0.92	1.06	1.19	1.32	1.45	1.58	1.71	1.85	1.98	2.11	2.24	2.37	2.51
1.76	0.13	0.27	0.40	0.53	0.66	0.80	0.93	1.06	1.19	1.33	1.46	1.59	1.72	1.86	1.99	2.12	2.26	2.39	2.52
1.78	0.13	0.27	0.40	0.53	0.67	0.80	0.93	1.07	1.20	1.33	1.47	1.60	1.73	1.87	2.00	2.13	2.27	2.40	2.53
1.80	0.13	0.27	0.40	0.54	0.67	0.80	0.94	1.07	1.21	1.34	1.48	1.61	1.74	1.88	2.01	2.15	2.28	2.42	2.55
1.82	0.13	0.27	0.40	0.54	0.67	0.81	0.94	1.08	1.21	1.35	1.48	1.62	1.75	1.89	2.02	2.16	2.29	2.43	2.56
1.84	0.14	0.27	0.41	0.54	0.68	0.81	0.95	1.09	1.22	1.36	1.49	1.63	1.76	1.90	2.03	2.17	2.31	2.44	2.58

12.3.2 Planetary Atmospheres

Let L be the luminosity of the primary (in units of Sol luminosity — look it up in the table earlier in this section) and let R be the mean orbital distance between the planet and the star. Now in order to determine the possible atmospheric components of the planet, it is necessary to calculate the value (v x v x R)/L. Let us call this value S. Depending upon the values of S, the planet will (or will not) be able to retain certain gases indefinitely. And this will allow us to determine whether the world will be a gas giant (Helium and Hydrogen retained) or a terrestrial world, potentially another Earth, or a barren hunk of airless rock.

CASE 1:

($S > 2.40$) In this case, the planet is a gas giant, and the values RP and DP only describe the characteristics of the rocky core. The planet in this case resembles Jupiter, Saturn, Uranus, or similar type gas giant (described by one individual as atmospheres in search of planets). Roll 2D12 for number of moons in this case.

CASE 2:

($2.40 > S > 0.32$) In this case, Oxygen, Nitrogen, and water vapor will be retained, and the world is a potentially Earthlike world (though in our own solar system, Mars, Venus, and Earth all fall in this case). Roll 1D4–1 for number of moons in this case. NOTE: [for] $S < 0.56$, water vapor will not be retained, so such worlds will not have water oceans!

CASE 3:

($0.32 > S$) For small values of S we assume an airless world — a barren rock, with possibly only metallic vapor for an atmosphere. Roll 1D2–1 for number of moons in this case.

12.4 PLANETARY LIFE DETERMINATION

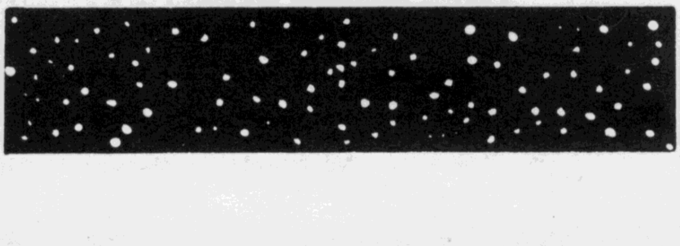
Once the type of world has been determined (Gas Giant — Case 1, Terrestrial — Case 2, or Barren — Case 3) the next step is to determine whether intelligent life (or any life at all) exists on the planet.

For Gas Giants, roll 1D100 and consult the following table:

GAS GIANT LIFE DETERMINATION TABLE

1D100 roll	Result
01-10	Intelligent Life
11-50	Life forms, none intelligent
51-00	No life present

For terrestrial type worlds, there is a much larger percentage chance of life than on the gas giants. However, there is also a possibility of a Venus-like terrestrial world. In order to determine if the world is a cytherean (Venus-like) world, the referee must first determine the atmospheric pressure on the surface of the world. Roll 3D6 to determine density of gaseous atmosphere and consult the following table:



ATMOSPHERIC PRESSURE TABLE

3D6 roll	Atmospheric pressure (in units of 1 atmosphere)
3	0.1
4	0.2
5	0.3
6	0.4
7	0.5
8	0.6
9	0.8
10	1.0
11	1.2
12	1.35
13	1.5
14	1.8
15	2.1
16	2.5
17	2.9*
18	3.3*

* = On rolls of 17 or 18, if the mean day temperature is above 270 Kelvin or 275 Kelvin respectively, the result is a cytherean world. Cytherean atmospheres are primarily carbon dioxide — the atmospheric pressure is 80-120 atmospheres at the surface (roll ((1D100/100) x 41) + 79 and round fractions up to the nearest 0.1), and the greenhouse effect has increased the absolute mean surface temperature by a factor of 2. The cytherean atmosphere will typically contain strong acids. Such worlds have life forms present as follows:

CYTHEREAN LIFE DETERMINATION TABLE

1D100 roll	Result
01	Intelligent life forms present
02-04	Life, but no intelligent life
05-00	No life forms present

For non-Cytherean terrestrials use the following table:

TERRESTRIAL (NON–CYTHEREAN) LIFE DETERMINATION TABLE

1D100 roll	Result
01-10	Intelligent Life forms, Oxygen-Nitrogen atmosphere
11-20	Intelligent Life forms, Methane-Ammonia atmosphere
21-55	Life, but no intelligent life forms, atmosphere is Oxygen-Nitrogen mixture
56-90	Life, but no intelligent life forms, atmosphere is Methane-Ammonia mixture
91-00	No life forms present, Methane-Ammonia atmosphere

12.4.1 Determining Capabilities Of Intelligent Life Forms

If intelligent life is present, it is necessary to determine the level of society which has developed on the planet.

Each society is classified based upon: (1) the most advanced mode of travel developed by the inhabitants, (2) the major, or most advanced source of power used by the inhabitants, and (3) the population level of the world.

Transportation Mode	Classification Code
Foot/self	A
Animal	B
Ground or Sea vehicle (not self powered)	C
Ground or Sea vehicle (self powered)	D
Lighter than Air craft	E
Heavier than Air craft (non-jet powered)	F
Heavier than Air craft (jet powered)	G
Orbital Rocket	H
Deep Space Rocket	I
Ion Engine	J
Bussard Ramjet (interstellar slowboat)	K
Contragravity system	L
Faster than Light stardrive	M
Cross-time travel	N
Linear (forward/backward) time travel	O

Major/Most Advanced Practical Power Source	Classification Code
Muscle (self)	A
Animal	B
Water/Wind	C
Steam	D
Internal Combustion	E
Atomic Fission	F
Nuclear Fusion	G
Direct Mass-Energy conversion	H

Population Level	Classification Code
0 to 1000	A
1001 to 10,000	B
10,001 to 100,000	C
100,001 to 1,000,000	D
1 million to 10 million	E
10 million to 100 million	F
Population greater than i*100 million, but less than (i+1)*100 million	Gi
Population greater than i*1 billion, but less than (i+1)*1 billion	Hi
Population greater than i*10 billion, but less than (i+1)*10 billion	Ii
Population greater than i*100 billion, but less than (i+1)*100 billion	Ji

Given the classification codes, the code for the world is given by the three letter (and possibly one digit) of the transport mode code, power source code, and population code, in that order. Humanity of 20th century C.E. Earth would, for example, be classed as IFH4 or IFH5, or possibly JFH4 or JFH5 (if you believe that the current experiments with the ion engine qualify Earth for the indicated jump in classification).

In order to determine the overall classification code for the world, it is first necessary to determine the transportation code. For this, roll 1D1000 and consult the following table:

TRANSPORT MODE DETERMINATION TABLE

1D1000 roll	Transport Mode		
001-200	A	801-840	I
201-340	B	841-880	J
341-460	C	881-920	K
461-560	D	921-950	L
561-630	E	951-975	M
631-690	F	976-988	N
691-750	G	989-000	O
751-800	H		

Once the transportation mode has been determined, it is then possible to determine the major power source. Simply examine the following cases:

Transport Mode A: Power source A or B only (½ chance each)
Transport Mode B: Power source A thru C only (1/3 chance each)
Transport Mode C: Power source A thru C only (1/3 chance each)
Transport Mode D or E: Power source D thru H only: roll 1D100 on 1-60: power source D, 61-90: power source E, 91-97: power source F, 98-99: power source G, 00: power source H.
Transport Mode F thru I: Power source E thru H only (¼ chance each)
Transport Mode J: Power source F thru H only (1/3 chance each)
Transport Mode K thru O: Power source G thru H only (½ chance each)

Population for pre-DD class societies should be no more than 100 million. For post-JG societies, the sky (so to speak) is the limit. Between these two levels, the population for omnivore or herbivore intelligences should be higher than that for carnivore intelligences, and population should be no more than 10 billion in any case.

12.4.2 Determining The Societal Types For Intelligent Species

Having determined the general technological level, it is then necessary to determine the general societal type of the major culture (or cultures) of the planet.

The societal type is defined by three characteristics: (1) the attitude toward the State (is it the ultimate good, the ultimate evil, or somewhere in between), (2) the attitude towards rationalism (or the idea that society has problems that can be solved by reasoned action), and (3) the attitude towards the bearing of firearms. (This system derived from a similar system developed by Jerry Pournelle).

Roll 3D6 to determine the first two characteristics of the society.

Statism Roll	Meaning
17-18	The State is the ultimate good. It is the object of idolatry. The State is God (and, naturally enough, it will typically be a jealous god). If an action is contemplated by the State (i.e. the rulers) it must, by definition, be a good thing. It is not permitted to question actions by the central authority. Only some form of totalitarian dictatorship will be possible with societal attitudes of this type. Russian Communists would fall into this category.
13-16	The State is a positive factor – it is a definite good thing, but there are some things that it cannot be permitted to do. The State is looked upon as a good, though sometimes dangerous tool. The European socialists would, for the most part, fall into this category.
9-12	The State, as such, is neither looked upon as good or evil. The general attitude towards the government is somewhat neutral. Both American liberals and most American conservatives would fall in this category, though both would be towards the high end of the range.
5-8	The State is a necessary evil, to be tolerated at best, ignored or defied at worst. There are definitely actions that cannot be tolerated by the State, and one and all will rise in rebellion if the State exceeds its questionable authority. Most American Libertarian groups would belong here, along with the American counterculture of the late 1960s.
3-4	The State is the ultimate evil, to be opposed at all times in all possible ways. The State is the Anti-God, to be opposed by all thinking reasoning beings. Some form of anarchy will be the result in any society holding this view – a highly organized government is an impossibility. This is the position of the classical anarchist (among others).

Rationalism Roll	Meaning
17-18	The general attitude is that all social problems have solutions that a rational individual can find. The general populace 'knows' that all problems can be solved. And no evidence to the contrary will be accepted, or tolerated. The Russian Communists fall as a group in this category.
13-16	Here, though the populace thinks most social problems can be solved rationally, there is the belief that there may be some problems which will defy rational analysis. European socialists would fall into this category, for example.
9-12	Some problems are thought to be solvable, and others

not. The split is thought by groups of this type to be roughly 50-50. American liberals would fall towards the high end of the range, American conservatives would fall towards the low end of the range.

5-8 Few, if any, problems are amenable to rational solution in the opinion of societies in this category. Mysticism begins to govern the actions of the group. The American counter culture of the 1960s falls into this category, as do many Fascist states.

3-4 No problems are expected to be amenable to rational solution. Intuition and mysticism replace rational thought. Both the classical anarchists and the Nazis fall into this category.

As examples, the current social type of the USSR would be S17R17, that of the US would be S11R9, and that of Great Britain would be S15R13. Using this nomenclature, the OverGovernment of the Hegemony would be S16R15 in philosophy. The H'Reli would typically be S6R8, the Altani S18R17, and the Humans of the Commonality would be S9R15.

The availability of firearms is taken as a final indicator of the social type. There are three classes of firearm use and availability.

In Class A societies, the only individuals allowed to possess and carry firearms are members of the state security forces (police, FBI equivalents, etc.,) and military personnel on active duty. Further, no one really needs to possess a firearm in a Class A society in order to survive day to day life. Great Britain is one of the better examples of a Class A society on Earth today.

Class B societies are somewhat more rough and tumble. In a Class B society, weapons are a necessary part of life outside the few civilized towns. There are great stretches of wilderness territory in which firearms are necessary possessions for survival, but life in the cities does not require firearms. In Class B societies, the individual typically possesses two types of firearms: the display, or dress model (for formal wear, where appearance is more important than functional characteristics), and the use model (for those times when the individual must venture into the dangerous outback). Individuals who spend their entire life in the city might have only a dress weapon, or possibly no weapon at all. The American wild west may be used as an example of a typical Class B society.

In Class C societies, the individual who wishes to survive will remain armed at all times. A sane individual carries a pistol with him when he goes to take a bath, or to visit the bathroom (and he will keep the pistol in his lap, with the safety off, while he attends to his business). The society of the planet Pyrrus, in Harry Harrison's DEATHWORLD is a perfect example of a Class C society.

The last characteristic of the society should not be determined randomly, but should instead be based upon the general technological level of the society and the extent of untamed wilderness on the world in question. More technologically advanced worlds, with little remaining wilderness should have a preponderance of Class A and B societies on the world. Only the more primitive (or extremely harsh environment) worlds should have large class C societies.

All the central worlds of the Hegemony hold exclusively Class A societies with the sole exception of L'Dyen III, holding Class C societies. Most of the remaining worlds of the Hegemony are either Class A or Class B worlds that are on the verge of becoming Class A. Only the most recently established colonies of Hegemonic worlds (or lost colonies only recently rediscovered by Hegemonic civilization) are still Class C.

12.5 HOW TO POPULATE A WORLD (A STUDY ON ECOLOGY)

Once the physical world has been designed, the referee must then design the non-intelligent life forms (if any) that inhabit it. Preparing a detailed study of the various ecologies of an entire world would, of course, be the work of many lifetimes and would fill thousands of volumes. So the prospective world builder must limit himself to filling only a few of the ecological niches in selected geographical regions on his new world, and slowly filling in details as time and inclination permit.

There is no creature created that cannot be used in one expedition or another (preferably several). The work devoted to populating one world is never wasted, after all; creatures can be duplicated with only minor variation on a dozen terrestrial worlds. And the referee who wishes to truly astonish the players in his campaign need only transplant some of the stranger terrestrial animals (virtually intact, save for minor differences in coloration and the like to camouflage his use of 'common' creatures). The dedicated referee will find that a few introductory texts on vertebrate and invertebrate biology will prove invaluable.

The Referee should first determine the characteristics of the base elements of the ecological pyramids — the photosynthetic organisms, the plants. With some of the major plant forms determined, the smaller (and then larger) herbivores should be created. Finally, only after all the prey animals have been created should the world builder create his carnivores and omnivores.

The amount of biological mass in the planet layer is far greater than that in the herbivore layer, which in turn is far greater than the amount of mass in the carnivore layer. As a rough rule of thumb, allow a 20:1 mass ratio at each layer of the pyramid.

12.5.1 A Sample World 'Ecology' (Novaya Amerika)

Novaya Amerika, a moonless terrestrial world, orbits a G0 main sequence star at a mean distance of 1.02 astronomical units. The mean day temperature is roughly 306 degrees Kelvin (about 92 degrees Fahrenheit). There is an oxygen-nitrogen atmosphere and the pressure at sea level is 1.2 times that of Earth. The surface gravity is 1.01 times that of Earth, and the mean density of the planet is identical to that of Earth.

Novaya Amerika was colonized shortly before the first Hegemony-Empire War (see the timeline in Chapter 14). H. sapiens is firmly established on this world with a native population of 500 million. But mankind has by no means completely tamed Novaya Amerika, for a planet is a very large place and even a thousand years a very short time to tame one completely.

A map showing the major geographic features, together with the locations of major human habitation sites has been included. What follows is a brief description of a very selected sample of the life forms of this world.

The number of carnivorous and omnivorous species presented would appear to violate the 20:1 ratio mentioned earlier; the total number of representatives of herbivorous species is large even though the number of species described is not and the ratio still holds on a basis of mass.

The knowledgeable reader will also recognize several species drawn fairly obviously from terrestrial species. This will be true in any such species, as there are few animal designs imaginable that have not appeared somewhere in nature already. For example, the motion detection sense organ given many of the nocturnal predators of Novaya Amerika has its equivalent in the lateral line of sharks, and the sonar sense given many Novaya Amerikan animals exists in bats and dolphins.

12.5.1.1 PLANTS

12.5.1.1.1 Burst Bush

The burst bush plant is common in the dry sub-desert areas of Novaya Amerika. It can be found, for example, in the chaparral at the fringes of the Anvil of God (the major desert in South Continent) and along the fringes of the Devil's Valley (to the Northeast of Magri Station on South Continent). All the water accumulated by the bush is stored in the root system, and during the dry season the crown of the bush becomes quite dry (and very flammable). During the dry season the slightest spark can cause a burst bush to explode in flame (2D6 fire damage to everything within a 2 meter radius). Only the dry crown burns; the root system survives the flames. In fact, the seeds of the burst bush have such thick shells that fire is needed to burn off the excess shell in order that they germinate properly.

12.5.1.1.2 Newgrass

A xanthophyll based photosynthetic organism, and red in color as a result, newgrass is similar in many respects to several of the commoner terrestrial grasses. It is hardier than its terrestrial equivalents, however, and all attempts at replacing it with terran grasses have been unsuccessful. Fortunately, terrestrial herbivores are able to draw sustenance from this hardy plant.

Newgrass is able to fix nitrogen directly from the air, rather than reying upon microorganisms to do the job. It is the rock hard base upon which the great North Continent plains' ecology is based.

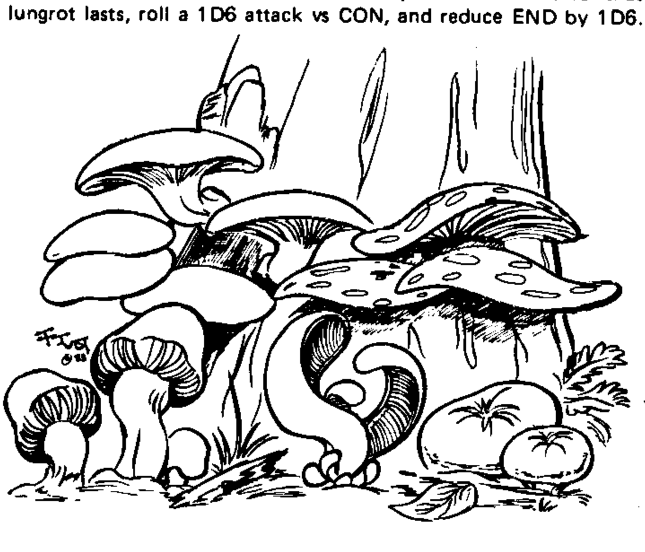
The newgrass pollen (released during the spring) causes minor allergy problems in 10-12% of the general Human population (sneezing, itching, eye irritation) and severe allergy problems in 0.1 – 0.2% of the general Human population (severe breathing problems, shock, death in some untreated cases). The colonists of Novaya Amerika have, over the centuries, been selected for resistance to the severe allergy problems of newgrass pollen. As a result, only 1-2% of the Novaya Amerikan natives suffer minor allergy problems from the pollen, and none suffer severe allergy problems.

Newgrass pollen forms the chemical basis for two drugs exported by Novaya Amerika. One is an analgesic (pain killer) used by the Korli, the other is an aphrodisiac aerosol used in a perfume by the H'Reli.

12.5.1.1.3 Rotfungus

Rotfungus is the common name for a variety of native mushrooms (some poisonous, some not – just as with terrestrial mushrooms). The local herbivores are able to consume all of the varieties, but some are highly toxic to Humans (potency of poison ranging from 0-14 – roll 2D12–10 for potency of poison for each patch of fungus, treating potencies of less than 1 as non-poisonous batches).

If inhaled, the spores of most of the rotfungus family cause an influenza-like affliction among Humans. The 'disease' (common name Lungrot) is actually a fungus growth in the lungs. The first onset of symptoms occurs 1D10 days after exposure, and the disease lasts 1D10 days from onset of symptoms. For each 3 days or fraction thereof that the lungrot lasts, roll a 1D6 attack vs CON, and reduce END by 1D6.



For example, if the growth remained for 5 days, the patient would suffer a 2D6 attack vs CON, END would be reduced by 2D6. Both CON and END would be reduced starting the first day of the disease onset, and remain reduced throughout the course of the fungus infection. Once this disease has run its course, however, damage is recovered at the normal rates.

12.5.1.1.4 Squash-Pear Bush

The squash-pear bush, like newgrass, is a xanthophyll based photosynthetic organism. It is extremely common throughout the central

plains areas of North Continent. The squash-pear fruit has an extremely high sugar content, and is an excellent source of liquid refreshment for campers.

The squash-pear flowers bloom in mid-summer, and the fruit forms before the first of the autumn frosts. The pollen does not noticeably affect the colonists, but does produce mild allergy symptoms in 1-2% of humans from offworld.

The squash-pear fruit can be used to produce an excellent brandy, for which the colonists have found many markets throughout the Commonality.

12.5.1.1.5 Tinkle Bush

Found throughout the temperate zones of Novaya Amerika, this plant accumulates silicates in its long bladelike leaves. These leaves are retained by the plant indefinitely. And as the bush constantly adds to the silicate structure within each leaf as it grows, the leaves of the older plants can take on the appearance of smokey glass daggers; though brittle and easily broken, they are also quite sharp (anyone attempting to charge through a bush must make a luck roll – LUC x 5 on 1D100 – or be struck by 1D6 of the daggerlike leaves for 1D6 damage each). In a light breeze, the leaves of a tinkle bush brushing against each other produce a distinctive wind-chime like sound, easily identifiable to anyone who has heard them before.

12.5.1.2 SMALL HERBIVORES

12.5.1.2.1 Split Tail Squirrel

The split tail squirrel is a large flying rodent with bright red fur. It eats nuts, grains, and berries. Regarded as a pest by many of the colonists, it is locally referred to as a 'tree rat'. This rodent actually glides from tree to tree rather than truly flying (a wing surface is provided by skin stretched from the forelegs to the hind legs). When the two ends of the squirrel's bifurcate tail are separated, the skin membrane connecting the two 'tails' provides an additional control surface during gliding. This species hibernates during the winter.

Characteristics: STR = 1D6, INT = 0, WIL = 3D6, CON = 3D6, END = 4D8, DEX = 3D6, CHA = 3D6, LEN = 2D4+20, BLD = 2D4, Expected SIZ = 4 (expected mass = 0.64 kilograms), TSC = 0, TPR = 1. Expected hit points = 4. Use the tailed quadraped Hit Point allocation table.

Attack: Bite – 1D3–1D4 (40%).

Armor: none.

Other Skills: Climb 75%, Hide in Cover 75%, Glide 70%, Move Quietly 50%, Sense Ambush 50%.

12.5.1.2.2 Bush Squirrel

The Novaya Amerikan bush squirrel, like the split tail squirrel, eats nuts, grains and berries. And, like its gliding relative, it is also considered a serious pest by the colonists. It is an arboreal animal, and can be found throughout forests of Novaya Amerika. The name of this species comes from its habit of hiding among the sharp leaves of the tinkle bush in order to avoid predators. This species has a high breeding rate, being prey for many of the smaller carnivores of Novaya Amerika. Like the split tail squirrel, the bush squirrel hibernates during the winter months.

Characteristics: STR = 2D6, INT = 0, WIL = 3D6, CON = 2D6+6, END = 4D8, DEX = 3D6, CHA = 3D6, LEN = 2D4+18, BLD = 3D4, Expected SIZ = 4 (expected mass = 0.64 kilograms), TSC = 0, TPR = 1. Expected hit points = 5. Use the tailed quadraped Hit Point allocation table.

Attack: Bite – 1D3–1D4 (40%).

Armor: none.

Other Skills: Climb 85%, Hide in Cover 75%, Move Quietly 50%, Sense Ambush 50%.

12.5.1.2.3 Bailey's Jumping Mouse

Bailey's mouse is roughly the size of a terrestrial mouse, and looks like a cross between a beaver and a kangaroo. It will eat virtually any seed or berry, any grain, and any of the edible fungi of Novaya Amerika. It will eat any vegetable material that humans might wish to eat – making Bailey's mouse an intolerable nuisance.

Bailey's mouse has outsized incisor teeth, giving its head the appearance of a miniature beaver. These teeth grow constantly throughout the life of the animal, and are self sharpening. And they enable Bailey's mouse to gnaw through virtually any container material currently being used by humans, other than sheet metal.

Bailey's mouse has an extremely high breeding rate. And being the major food source for many of the small predators, Bailey's mouse needs it.

Bailey's mouse is a biped, using the hopping motion of a kangaroo for high speed locomotion. This leaves the small 'hands' free for carrying small seeds or performing other feats of manipulation. Specimens have been known to open simple locks on their cages using these primitive hands. Fortunately, Bailey's mouse is not particularly intelligent (though it is every bit as intelligent as R. norvegicus – and hence quite a bit more intelligent than the terrestrial mouse).

Characteristics: STR = 1D2, INT = 3, WIL = 3D6, CON = 2D6, END = 4D6, DEX = 2D6+8, CHA = 3D6, LEN = 6, BLD = 6, SIZ = 2 (mass = 0.08 kilograms), TSC = 0, TPR = 1. Expected hit points = 1. Use tailed biped hit point allocation table.

Attack: Bite – 1D4+2–1D4 (30%).

Armor: none.

Other Skills: Move Quietly 75%, Hide in Cover 70%, Spot Traps 65%, Disarm Traps 45%, Jumping 45%.

12.5.1.2.4 Funnybunny

The funnybunny resembles a cross between a rabbit and a wallaby. It is a placental mammal, but it carries the young about in a pouch after birth. A typical fast breeder, it is on the menu of nearly all of the smaller carnivores. It is just a small step up the ladder from the various rodents of Novaya Amerika. It will eat vegetables or roots, but will not typically eat cereal grains. The funnybunny is found throughout the plains of North Continent, in the forests and meadows of South Continent and on the larger islands of Novaya Amerika.

Characteristics: STR = 2D8+1, INT = 0, WIL = 3D6, CON = 2D8+3, END = 6D6, DEX = 2D8+4, CHA = 3D6, LEN 3D4+30, BLD = 3D4, Expected SIZ = 6 (expected mass = 2.16 kilograms), TSC = 0, TPR = 1. Expected hit points = 6. Use tailed biped Hit Point allocation table.

Attack: Kick – 1D4 (45%).

Armor: none.

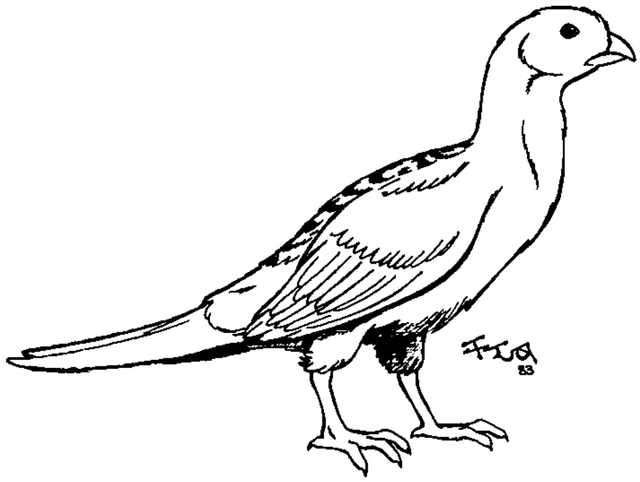
Other Skills: Hide in Cover 65%, Move Quietly 55%, Jumping 50%, Sense Ambush 35%.

12.5.1.2.5 Galliby

The galliby is an avian herbivore. A poor flyer, terrestrial in habit, it flys but little, and then only for short distances (though while airborne it will, typically, fly quite fast). The galliby is a small, compactly built bird, and the male galliby is quite colorful (with every color of the rainbow present on his feathers).

The galliby nests on the ground, typically in stands of high grass. Though most common on the plains, there is a known sub-species that has taken to the forests of Novaya Amerika (though it still nests on the ground).

The galliby is regarded as a delicacy by Novaya Amerikan colonists, as well as by many of the local hawks and small predators. The typical mated pair will lay upwards of ten eggs in a season. And in order to insure a steady supply of their favorite game bird, strict hunting regulations have been imposed by the colonists. In addition, there are large 'galliby farms' raising large numbers of both a domesticated form of the bird (for mass consumption) and of the original wild form (for export to areas where the local wild supply has been exhausted due to overhunting or natural disaster).



Characteristics: STR = 2D4, INT = 0, WIL = 3D6, CON = 3D6, END = 4D6, DEX = 2D6+6, CHA = 3D6, LEN = 40+3D6, BLD = 4, Expected SIZ = 6 (expected mass = 2.16 kilograms), TSC = 0, TPR = 1. Expected hit points = 4. Use the AVIAN CARNIVORE Hit Point allocation table (later in this section).

Attacks: No effective natural weaponry.

Armor: none.

Other Skills: Spot Hidden Object 75%, Flying 25%.

12.5.1.2.6 Reddove

The Novaya Amerikan Reddove is an herbivorous bird. It will eat any grain or fruit it can find, and the reddove has a well developed crop for food storage. Apart from their bright red plumage (which blends well with the local xanthophyll heavy foliage) the reddove are quite similar to terrestrial pigeons in appearance.

The Novaya Amerikan Reddove is, however, one of the most sophisticated living sensor systems yet discovered. Not only does it possess the sonar and motion detection senses possessed by many other Novaya Amerikan animals, but its eyes see well into the infra-red (allowing it to see approaching predators by their body heat, if by no other means) and also into the ultra-violet. In addition, the Novaya Amerikan Reddove appears to have a built in magnetic compass of sorts. And last, but not least, the Novaya Amerikan Reddove has a functional telepathic capability.

It is an extremely good flyer, and a gregarious bird. Flocks of Reddoves have been seen consisting of over two billion birds. It is a migratory bird, as the typical flock will quickly exhaust the ability of any one locale to support it. And it is considered a serious pest.

It will typically nest on the ground, though there are reliable reports of tree nesting flocks.

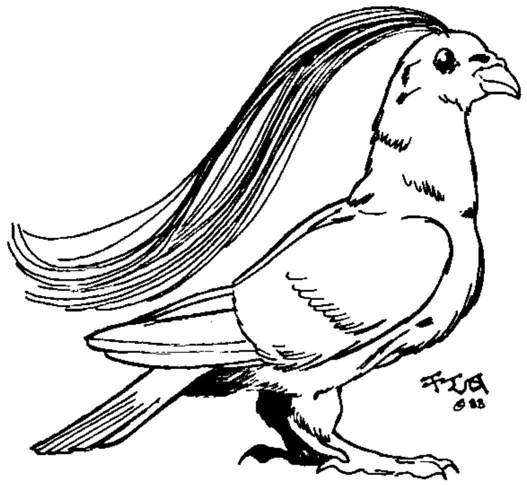
This bird is also prey for virtually all of the land based carnivores of Novaya Amerika (due to the Reddoves' extensive range). This species' breeding rate is high.

Characteristics: STR = 1D4, INT = 1, WIL = 4D6+2, CON = 3D6+2, END = 4D12, DEX = 2D6+6, CHA = 3D6, LEN = 2D4 + 30, BLD = 8, Expected SIZ = 6 (expected mass = 2.16 kilograms), TSC = 1D3, TPR = 1D6+2. Expected hit points = 9. Use the AVIAN CARNIVORE Hit allocation table (later in this chapter).

Attack: None, other than psionic attack.

Armor: none.

Other Skills: Flying 80%, Spot Hidden Object 80%, Motion Sensing (range 10 meters per point of WIL) 75%, Detect Sonar pulse (passive detection capability only) 70%, Sonar (range 15 meters per point of



WIL) 65%, Move Quietly 50%, Hide in Cover 45%, Telepathic detection of active mind (range 5 meters per point of TSC) 35%.

12.5.1.2.7 Sitachai

The sitachai is a tree-dwelling fruit and nut eating bird. Its characteristics are the familiar ones of such a bird – a powerful hooked beak (able to cope with shells and husks as well as other vegetable material), a large head, compact body, and short legs. Like the pikipiki, the feet of the sitichai are well adapted to their arboreal habitat – four toes arranged in two opposable pairs which provide a firm grip for climbing.

They are strong flyers, though they are not migratory birds.

The sitachai is extremely intelligent (for a bird, that is) and it can be taught to perform tricks as well as imitate human voices.

The plumage of the male sitachai is extremely colorful, and to preserve this beautiful animal for their descendants, the people of Novaya Amerika have declared this to be a protected species, barred from export or hunting.

The breeding rate of this tree nesting species is again high, as it is a target for many of the airborne carnivores of Novaya Amerika (in particular, Landry's Starhawk).

Characteristics: STR = 3D6–1, INT = 1, WIL = 3D6, CON = 3D6, END = 4D10, DEX = 3D6+6, CHA = 3D6, LEN = 3D6 + 40, BLD = 2D8+2, Expected SIZ = 8 (expected mass = 5.12 kilograms), TSC = 0, TPR = 1. Expected hit points = 5. Use the AVIAN CARNIVORE Hit allocation table (later in this chapter).

Attack: Beak – 2D4 (50%).

Armor: none.

Other Skills: Climbing 95%, Flying 85%, Spot Hidden Object 75%, Hide in Cover 50%.

12.5.1.3 LARGE HERBIVORES

12.5.1.3.1 Moropes

When H. sapiens came to Novaya Amerika, the horse, for some unknown reason, did not come with him. When technology failed on many worlds (including Novaya Amerika) after the fall of the Terran Empire, a locally available substitute transportation device had to be found. Fortunately for humanity, there was a native species resembling one of the horse's extinct relatives.

The native species, which some terran biologist had named Moropes in the hope of confusing his students, is even less intelligent than the terrestrial horse. (There was a species called Moropus, one of a group of odd-toed undulates, the chalicotheres, present in the early Miocene now extinct, that was a relative of the modern horse). Further, the moropes have tempers typical of the terrestrial camel (an ill mannered beast if there ever was one). Unlike the camel, the moropes do not spit – they bite instead though, unlike the camel, they cannot bite their riders.

The moropes is a herd animal, relying upon speed of flight to avoid most predators. Slightly smaller on the average than the typical wild terrestrial horse, the moropes is still capable of doing considerable damage to any small predator foolish enough to come within striking distance of its sharp front claws.

The moropes is a diurnal plains dwelling ungulate and the only real predators capable of threatening it are the grass leopards and the night-hound packs.

Characteristics: STR = 3D6+15, INT = 1, WIL = 3D6, CON = 2D6+6, END = 4D12, DEX = 2D6+3, CHA = 3D6, LEN = 4D6+160, BLD = 4D6+16, Expected SIZ = 27 (expected mass = 197 kilograms), TSC = 0, TPR = 1D4. Expected hit points = 22. For hit point allocation, use the following table:

HIT POINT ALLOCATION TABLE FOR TAILLESS QUADRAPEDS

1D20 Roll	Specific Area	Hit points and END points/Total
01-03	Head	0.25 (round fractions up)
04-06	Right Fore Leg	0.35 (round fractions up)
07-09	Left Fore Leg	0.35 (round fractions up)
10-12	Forequarters	0.45 (round fractions up)
13-14	Hindquarters	0.45 (round fractions up)
15-17	Right Hind Leg	0.35 (round fractions up)
18-20	Left Hind Leg	0.35 (round fractions up)

Attacks: Bite – 1D10+1D8 (60%), Kick – 1D12+1D8 (60%), Trample – 3D8 to a downed foe. Armor: 1 point skin vs impact, 0 points vs energy.

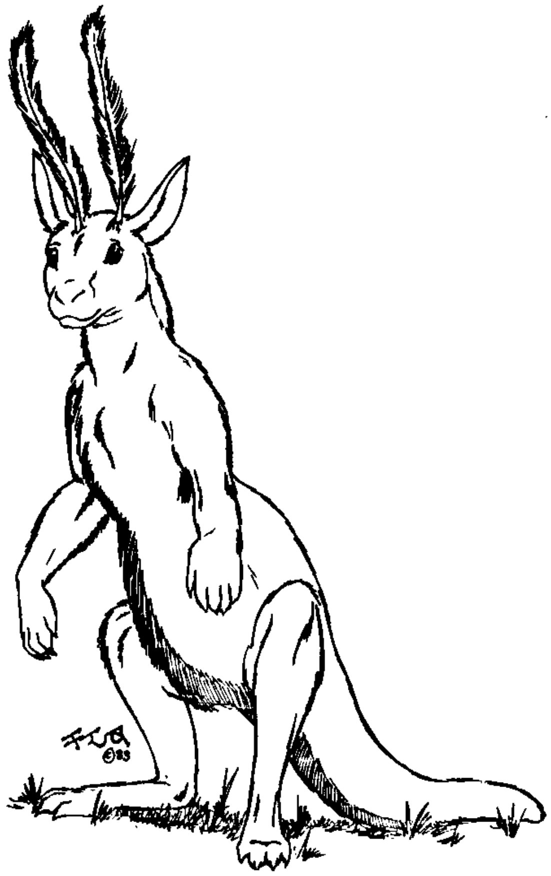
Other Skills: Move Quietly 75%, Sense Ambush 60%, Listen 60%, Spot Hidden Object 45%.

12.5.1.3.2 Larabay

The larabay is a bipedal plains dwelling grass eater. It resembles a kangaroo with feathery antennae at first glance. A more careful examination of a larabay will show that, despite its outward resemblance to a terrestrial marsupial, it is in fact a placental mammal. The antennae are the organ used for the motion sensing ability of the larabay (range = 5 meters per point of WIL).

The larabay will eat virtually any grass or cereal grain (including terrestrial imports) and its considerable hopping ability make it a difficult pest to fence out; the average adult can jump a 5 meter fence with ease, given room for a running start. The larabay moves by hopping, and can reach and maintain speeds of 50 kilometers per hour.

Characteristics: STR = 4D6+6, INT = 1, WIL = 4D6+2, CON =



2D6+6, END = 4D10, DEX = 2D6+6, CHA = 3D6, LEN = 6D20 + 160, BLD = 4D8, Expected SIZ = 34 (expected mass = 394 kilograms), TSC = 1D6+1, TPR = 2D4. Expected hit points = 27. Use Tailed Biped table for hit point allocation.

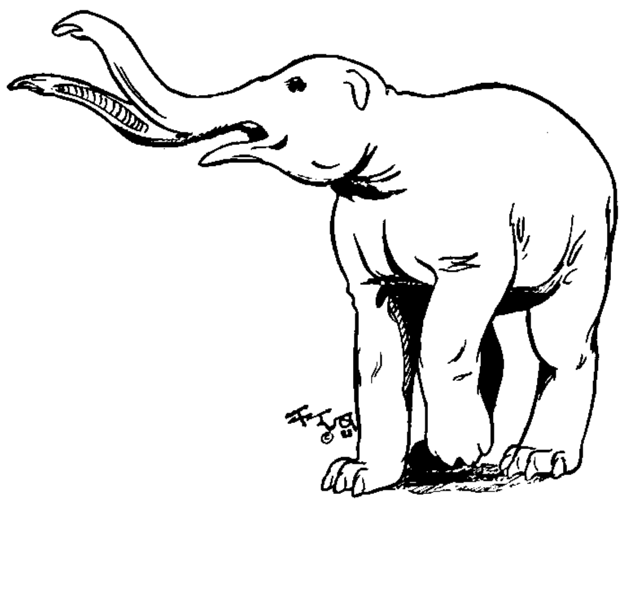
Attacks: Kick (with forepaws) – 1D3+1D8 (75%), Kick (with legs – only rearward kick possible) – 1D8+2+1D8 (90%), Tail (bash) – 2D4+1D8 (60%). Armor: Skin provides 2 points of impact protection, 0 points of energy protection.

Other Skills: Jumping 99%, Motion sensing of moving objects even in absolute darkness (to a range of 5 meters per point of WIL) 75%, Listen 75%, Move Quietly 75%, Sense Ambush 60%, Spot Hidden Object 45%.

12.5.1.3.3 Elebara

The elebara is a diurnal forest dwelling quadrapedal herbivore. It has a bifurcate trunk which enables it to grasp branches and pull them (along with attendant foliage) off trees.

The elebara is a herd animal that will fight rather than flee attacking predators. And an elebara bull is no mean enemy. Elebara have been known to hurl small stones a good distance with considerable accuracy using their trunks, and they possess electrogenerative tissue which they use to deliver shocks of up to 650 volts (at 20-30 amperes) on contact



(the electrogenerative tissue lines the inner grasping surface of the bifurcate trunk).

The elebara also possess a motion detection sense with an effective range of 5 meters per point of WIL.

The elebara is one of the largest land mammals of Novaya Amerika and only the largest and most dangerous of Novaya Amerikan predators will attack an adult elebara.

Characteristics: STR = 2D8+50, INT = 2, WIL = 3D6, CON = 1D6+13, END = 12D6, DEX = 3D6, CHA = 3D6, LEN = 4D6+386, BLD = 4D6+46, Expected SIZ = 59 (expected mass = 2054 kilograms), TSC = 1D4+1, TPR = 2D4. Expected hit points = 49. Use the tailless quadraped hit location and hit point allocation table.

Attacks: Trunk – 2D6+9D6 + electrical shock – 90% (the shock attack requires that physical contact be made and that the elebara expend 1 point of END on a temporary basis – the electrical shock does 6D6 END + a 2D4 attack vs CON). Trample – 2D10 to a downed foe – 90%. Armor: 8 point skin, effective against both impact and energy.

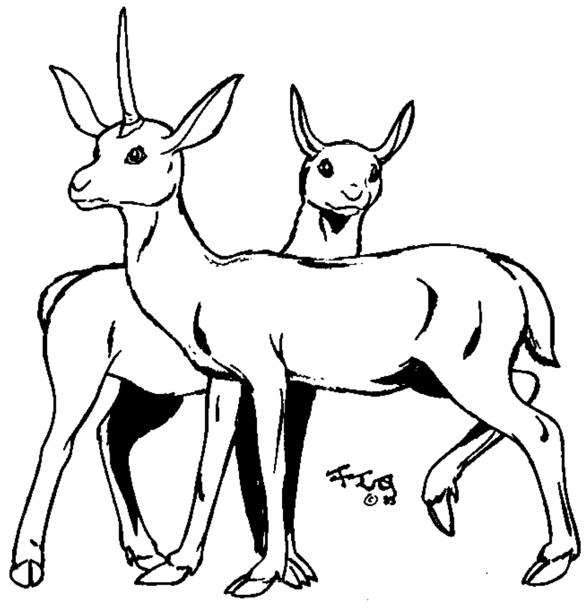
Other Skills: Motion sensing 90% (range equal to 5 meters per point of WIL), Sense Ambush 75%, Listen 60%, Spot Hidden 60%.

12.5.1.3.4 Blaine's Nightdeer

The Nightdeer is a nocturnal herbivore found throughout the plains and forests of North Continent. Like the Nighthound, which was its principal predator on Novaya Amerika prior to the arrival of H. Sapiens, the Nightdeer possesses a sophisticated sonar system.

The Nightdeer is a herd animal, relying upon safety in numbers. A typical Nightdeer herd will graze with the horned adult males at the periphery protecting the females and calves from direct attack. They rely primarily upon their speed to escape the nighthound. The nightdeer are extremely cautious animals, very easily spooked into running. They will attempt to use their sonar to 'jam' the sonar ranging of the nighthounds when attacked, forcing the nighthounds to rely on their motion sensing capability as they close and while the adult males are doing this, the females and calves will run for a few seconds and then freeze motionless – dropping out of sight of the motion-sense of the nighthounds.

The Nightdeer male does not grow a new horn each season – it grows but a single horn and that one horn grows throughout the adult life of the male.



Characteristics: STR = 4D6+12, INT = 2, WIL = 3D6, CON = 2D6+6, END = 4D10, DEX = 3D6+6, CHA = 3D6, LEN = 4D8+214, BLD = 4D8, Expected SIZ = 29 (expected mass = 244 kilograms), TSC = RdD6, TPR = 1D4+1 (as per Humans). Expected hit points = 23. Use tailless quadraped table for hit point allocation.

Attacks: Horn – 1D8+1+1D8 (thrusting weapon) 75%. Armor: Skin provides 2 points of impact protection, 0 points of energy protection.

Other Skills: Sonar echolocation 75% (range of 10 meters per point of WIL), Sonar jamming 75%, Move Quietly 75%, Hide in Cover 75%, Sense Ambush 75%, Spot Hidden Object 75%, Listen 60%.

12.5.1.4 INSECTS

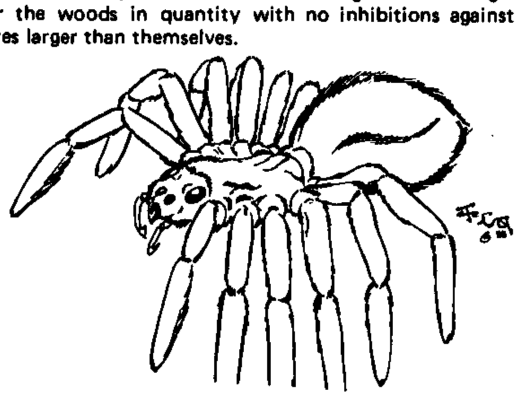
12.5.1.4.1 Dekks

Properly speaking, the genus Dodekapodis does not really belong with the insects, being instead a genus of pseudoarachnida. Species of this genus range in diameter from 2 to 30 cm but are otherwise almost identical in appearance. As the name implies, they have 12 legs; otherwise they resemble the terrestrial tarantula in form. The genus ranges from the tropics to the temperate zones, the larger species being tropical.

The life cycle of the temperate zone species may be typified by that of the deciduous forest dwelling D. sylvestris. Eggs are laid on tree trunks or in leaf mold and lie dormant until spring. After a week of development they then hatch into voracious grubs about 5mm long. These are carnivorous and prey on any other grubs which are present including those of their own species (it is believed that a related species, D. allenii smell and taste bad to their own kind, leading to selective predation on other species). The grub takes about one month to reach 1.5 cm in length, at which point it digs a hole in the nearest reasonably firm non-living surface (usually a rotten log) and moves in to undergo metamorphosis. Another week, and the creature emerges in the form of an adult of approximately 1 cm. This form promptly begins to prey on anything small enough to capture and continues to grow during successive moults, reaching 2 – 2.5 cm by autumn. Now, the hitherto solitary hunters congregate for mating in large numbers. Once the eggs are laid, the adults dig burrows and go into hibernation for the winter. Most do not survive, but captive specimens have been known to live up to three years.

Tropical zone species, having no notable seasons to contend with have a somewhat less regular schedule, some breeding up to three times a year if food is sufficiently plentiful. The time period between the hatching of one batch to maturity is approximately the same as for the temperate zone species. The tropical species include the largest known species, D. gigans, which may reach 20 – 30 cm in diameter. Contrary to folk myth, no species of Dodekapodis is poisonous; from the largest to the smallest all use strong jaws and slightly barbed legs to subdue their prey.

A subspecies of gigans, D. gigans kameskii is quite similar in flavor to terrestrial crabs, and is raised commercially. To improve production, some strains have been genetically engineered for rapid growth, mostly by removing what few behavioral instincts make it more than an eating machine. This includes the mating instinct so that reproduction is handled by cloning or fertilization of the eggs by hand, which may be just as well; nobody cares to think of having these strains get loose and wander the woods in quantity with no inhibitions against attacking creatures larger than themselves.



Characteristics: STR = 2D3, INT = 0, WIL = 3D6, CON = 3D6, END = 4D6, DEX = 3D6+6, CHA = 3D6, LEN = 1D10+20, BLD = 2D8+3, Expected SIZ = 6 (expected mass = 2.16 kilograms), TSC = 0, TPR = 1. Expected hit points = 4. Use the following hit point allocation table:

1D20 Roll	Specific Area	Hit Points and END points/Total
01-02	Head	0.30 (round fractions up)
03-16	Body	0.50 (round fractions up)
17-20	Leg	0.25 (round fractions up)

In the event of a leg hit, roll 1D12 to determine which leg was struck.

Attacks: Bite – 1D4+1–1D4 (35%).

Armor: none.

Other Skills: Move Quietly 100%, Hide in Cover 99%.

12.5.1.5 OMNIVORES

12.5.1.5.1 Blood Bear

This ursinoid omnivore is roughly the size of a North American Brown Bear. Its coat is a bright red color (the color of blood) as a result of an algae that lives in a symbiotic relationship with the pseudo-bear. This relationship is similar to one that exists between the green tree sloth and its algal symbiont on Earth.

The blood bear will feed on anything – fish, berries, smaller carnivores (lone nighthounds separated from their pack, for example) or any of the large herbivores present in the blood bear's range. And, when particularly hungry, the Blood Bear will also eat carrion.

The bite of the blood bear is septic (partly a result of the inclusion of carrion in the diet, partly a result of digestive enzymes in the saliva of the blood bear). As a result, any wounds inflicted by the teeth of a blood bear are liable to infection. The infection will develop in 30% of all bite cases, and is treated as a poison of strength (CON of Bear)/2 (rounding fractions up) with damage being taken within 1D4+2 hours of the mauling.

Like his terrestrial namesake, the Blood Bear hibernates through the worst of the winter months (typically October or November through February or March of the local year).

Characteristics: STR = 2D4+20, INT = 2, WIL = 3D6, CON = 2D6+6, END = 8D6, DEX = 3D6, CHA = 3D6, LEN = 4D20+200, BLD = 6D6, Expected SIZ = 29 (expected mass = 244 kilograms), TSC = RdD6, TPR = 1D4+1 (as per Humans). Expected hit points = 24. Use tailless quadraped hit point allocation table.

Attacks: Bite – 1D8+1D8 (60%), Claw – 1D6+1+1D8 (60%), Hug – 2D8+1D8 (45%). Armor: Skin provides 2 points of impact protection, 0 points of energy protection.

Other Skills: Climbing 66%, Track by Scent 60%, Spot Hidden Object 60%.

12.5.1.5.2 Anser's Bird

Anser's Bird, also known as Anser's Screamer, or the screamerbird, is an omnivorous swimming bird. It is found primarily in inland freshwater lakes. It is a common sight throughout North Continent. The legs are short and there are three webbed toes. The bill is flat and broad. It is a migratory bird, and is a strong flyer. It will also eat virtually any vegetable matter, as well as fish, insects, and anything else (with the possible exception of carrion) that it can get down its gullet.

The wail of the screamerbird is believed to be involved in the courtship ritual, and it sounds like the scream of a small child in agony.

Characteristics: STR = 2D4+1, INT = 1, WIL = 3D6, CON = 3D6, END = 4D8, CHA = 3D6, LEN = 4D4+80, BLD = 2D6, Expected SIZ = 11 (expected mass = 14 kilograms), TSC = 0, TPR = 1. Expected hit points = 9. Use Avian Carnivore hit allocation table (later in this chapter).

Attacks: Beak – 1D4+1 (75%). Armor: The skin and feathers of Anser's bird provide it with 1 point of impact protection and 0 points of energy protection.

Other Skills: Fly 90%, Swim 90%, Spot Hidden Object 75%, Sense Ambush 50%.

12.5.1.5.3 Rattus norvegicus

Sadly, this terrestrial rodent followed mankind to the stars. And where humanity settled, so did the rat. There are still many local species of small rodents, but r. norvegicus is doing its level best to replace them.

R. norvegicus is an omnivore, like man, and will eat anything that a man will eat. Needless to say, this makes him a big nuisance.

The local small predators have taken to a rat diet with a vengeance, and are doing a reasonably good job of keeping R. norvegicus in check (save where man has eliminated or seriously cut back on the local predator population).

Characteristics: STR = 1D3, INT = 3, WIL = 3D6, CON = 3D6, END = 4D6, DEX = 4D6, CHA = 3D6, LEN = 2D4+20, BLD = 6, SIZ = 4 (expected mass = 0.64 kilograms), TSC = RdD6, TPR = 1D4+1 (as per Humans). Expected hit points = 4. Use tailed quadraped hit point allocation table.

Attack: Bite – 1D3–1D4 (40%).

Armor: none.

Other Skills: Sense Ambush 90%, Track by scent 90%, Spot Trap 75%, Move Quietly 75%, Hide in Cover 60%, Spot Hidden Object 60%.

12.5.1.6 LAND MAMMALIAN CARNIVORES

12.5.1.6.1 Grass Leopard

The grass leopard is a solitary diurnal felinoid carnivore whose primary prey was the local horse equivalent species, moropes until the arrival of H. sapiens and the introduction of all of his domestic animals.

The grass leopard is an expert at stalking the fast moving moropes (described earlier, under Large Herbivores). Its deep red pelt blends in with the high standing newgrass of the plains, granting it virtual invisibility. Once the grass leopard closes on the moropes herd, it will select a target, leap out from cover onto the target, then while holding on with its forepaws, dissect the victim with its powerful hind claws.

The grass leopard is a very fastidious carnivore, and will seldom (if ever) stoop to eating carrion. In addition, the saliva of the grass leopard serves primarily as a grooming and washing agent (as is the case with felis domesticus, the common terrestrial house cat) rather than as an element of the digestive process (as in humans). As a result, the bite of the grass leopard is seldom septic.

Characteristics: STR = 4D6, INT = 4, WIL = 3D6, CON = 2D6+6, END = 3D10+10, DEX = 2D6+6, CHA = 3D6, LEN = 4D6+140, BLD = 3D6, Expected SIZ = 18 (expected mass = 59 kilograms), TSC = 0, TPR = 1D4. Expected hit points = 16. Use tailed quadraped hit location and hit point allocation table.

Attacks: Bite – 1D8+1D4 (60%), Claws – 1D6+1+1D4 (75%), Rip – 2D6+2+2D4 (75%) (rip allowed with hind claws only if the foreclaws have both succeeded in grasping the target). Armor: the skin of the grass leopard provides 1 point of impact protection, 0 points of energy protection.

Other Skills: Hide in Cover 96%, Listening 96%, Move Quietly 90%, Set Ambush 75%, Track by sight 75%, Track by scent 60%.

12.5.1.6.2 Nighthound

The nighthound of Novaya Amerika is a canid pack predator similar to a North American timber wolf in appearance but for the addition of long feathered spines that run from the back of the forelegs up to the shoulders and then continue down the center of the nighthound's back. They are nocturnal hunters, relying primarily upon their motion sensing ability and their keen sense of smell to track down prey. Their eyesight is poor and they rely primarily upon their batlike sonar to detect stationary objects.

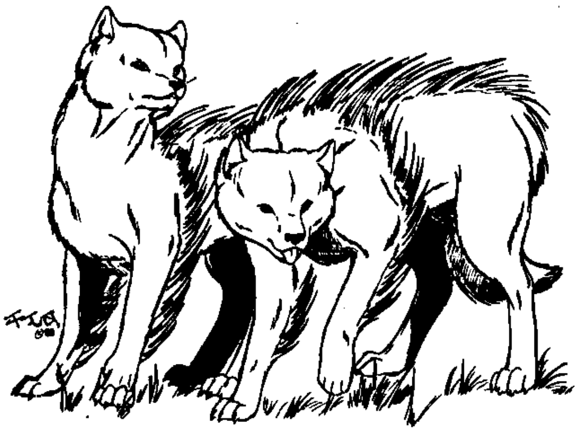
The nighthound has proven to be a severe nuisance throughout his range to the meat animal industry on Novaya Amerika. Being extremely intelligent animals, the nighthounds have learned to deal with the simple traps and snares of the cattlemen. And they (the nighthounds) are not above taking a few precious domesticated grass eaters for their meals as the opportunity presents itself. Nighthounds are considered to be a pre-sapient species that, unfortunately for them, did not develop full intelligence before the arrival of H. sapiens on Novaya Amerika.

The electrogenerative tissue (which is also involved in the motion sensing ability of the nighthound) is capable of delivering severe electric shocks to any target in contact with either the nighthound's fore-paws or the feathered spines that run the length of its body.

Nighthounds mate for the life of the pair (new matings are typical on the death of a mate). The pack typically consists of 8 to 12 adults and 3 to 6 cubs. All adults aid in the effort of raising the young, even though only the dominant male and female typically produce the young.

The nighthound life span (barring accident or disease) is 25 to 35 years.

Nighthounds prey on small rodents, funnybunnies, and those of the local ungulates that they can catch.



Characteristics: STR = 2D6+6, INT = 1D6+1, WIL = 3D6, CON = 3D6+6, END = 4D10, DEX = 2D6+6, CHA = 3D6, LEN = 3D6+130, BLD = 3D6, Expected SIZ = 17 (expected mass = 50 kilograms), TSC = RdD6, TPR = 1D4+1 (as per Humans). Expected hit points = 15. Use tailed quadraped hit point allocation table.

Attacks: Bite – 1D8 (60%), Electrical Shock – 6D6 END damage (60%) (requires contact either by paws or by the feathered spines that run the length of the nighthound s body, and the nighthound expends 1 END point – temporarily – in order to generate the shock).

Armor: none.

Other Skills: Track by scent 95%, Motion Sensing 90% (range of 5 meters per point of WIL), Listening 100%, Sonar sense (locate stationary object by sonic echo) 100% (range of 5 meters per point of WIL), Move Quietly 75%, Spot Trap 75%, Spot Hidden 75%, Sense Ambush 60%, Disarm Trap 60%.

12.5.1.7 AVIAN CARNIVORES

AVIAN CARNIVORE HIT POINT ALLOCATION TABLE

1D20 Roll	Specific Area	Hit Points and END points/Total
01-03	Head	0.25 (round fractions up)
04-07	Right Wing	0.20 (round fractions up)
08-11	Left Wing	0.20 (round fractions up)
12-14	Body	0.50 (round fractions up)
15-17	Right Claw	0.40 (round fractions up)
18-20	Left Claw	0.40 (round fractions up)

12.5.1.7.1 Starhawk

The Starhawk, or Landry's Starhawk, is a diurnal Novaya Amerikan bird of prey. The starhawk mates for life, and each mated pair raises one or two offspring each season (both parents contributing equally in the effort to raise the young). Starhawks live up to 30 years in the wild.

The starhawk is a robust bird, with powerful wings, a short stout hooked bill with sharp edges, and short stout legs with sharp curved claws.

The starhawk lives on snakes, small rodents, funnybunnies, and small birds, and can be found throughout the forested regions and desert fringes of Novaya Amerika.

Characteristics: STR = 2D6, INT = 2, WIL = 3D6, CON = 3D6, END = 4D10, DEX = 4D6, CHA = 3D6, LEN = 2D4+90, BLD = 2D6, Expected SIZ = 11 (expected mass = 14 kilograms), TSC = RdD6, TPR = 1D4+1 (as per Humans). Expected hit points = 10. Use Avian Carnivore hit point allocation table.

Attacks: Beak – 1D6 (60%), Talons (2) – 1D8 (thrusting weapons) (60%).

Armor: none.

Other Skills: Flying 90%, Spot Hidden Item 75%.

12.5.1.7.2 Spheniski

The spheniski are piscivorous (fish eating) birds. Though flightless, they have retained well developed wings – which they use as flippers in swimming. They use sonar and echolocation in order to detect and track their prey (underwater, the range of their sonar is 10 meters per point of WIL). The spheniski are capable of diving to depths of 100 meters and staying submerged for up to 15 minutes.

They are found mainly in the temperate zones, and they come on shore only to mate, to nest, and to rear young. Once the young are old enough to swim, the family returns to the sea for the remainder of the year. They typically nest in burrows on rocky shores, and there are several large nesting sites near the cities of HellsGate and StormGate.

Characteristics: STR = 3D6, INT = 3, WIL = 3D6, CON = 2D8, END = 4D8, DEX = 2D6+6, CHA = 3D6, LEN = 4D10+122, BLD = 3D6, Expected SIZ = 17 (expected mass = 50 kilograms), TSC = 0, TPR = 1. Expected hit points = 13. Use Avian Carnivore hit point allocation table.

Attacks: Beak – 1D6+1 (thrusting weapon) (60%).

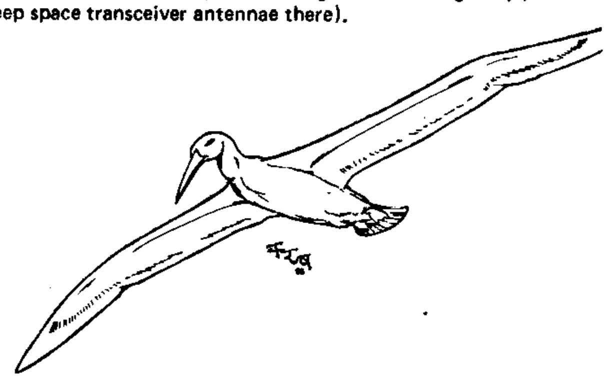
Armor: none.

Other Skills: Swimming 96%, Echolocation (sonar) 60% (range underwater of 10 meters per point of WIL).

12.5.1.7.3 Diverbird

The diverbird, like the spheniski, is a piscivorous aquatic fowl. It is a soaring bird that acquires its meals by diving into the water and spearing fish with its long needle sharp bill. It is among the largest of flying birds of Novaya Amerika, with a wingspread of between 3.5 and 4 meters.

Except for breeding, the diverbird is almost never found ashore – for good reason. On the ground, the airborne grace of the diverbird is lost, and it becomes a clumsy and blundering creature. The diverbird typically nests on the ground on isolated oceanic islands, though there are several long established nesting flocks near Tinbinbilla Station (much to the disgust of the military personnel stationed there – it seems that the birds take a positive delight in removing stray parts from the deep space transceiver antennae there).



Characteristics: STR = 3D6–1, INT = 2, WIL = 3D6, CON = 2D6+6, END = 4D12+4, DEX = 3D6+6, CHA = 3D6, LEN = 3D6+90, BLD = 3D6–1, Expected SIZ = 13 (expected mass = 22 kilograms), TSC = 0, TPR = 1. Expected hit points = 14. Use Avian Carnivore hit point allocation table.

Attacks: Beak – 1D8+1 (thrusting weapon) (75%), Wing Buffet – 1D4 (blunt instrument) (40%).

Armor: none.

Other Skills: Flying 100%, Spot Hidden Item 75%.

12.5.1.7.4 Cicony

The cicony are carnivorous birds. They live on fish and, as available, other animal food. Adapted to wading, rather than a swimming mode of life (with long necks, legs, and bills), they spend most of their lives wading in the surf, eating the local invertebrates and fish (as available).

The cicony are seldom far from the shore, nesting either on beach sands or in rocky cliffs at the edge of the beach. However, at least one subspecies has moved in to the marshes of North Continent (this subspecies is smaller, on the average, than the typical cicony, with a shorter neck and a more compact build overall).

Characteristics: STR = 2D6, INT = 2, WIL = 3D6, CON = 3D6, END = 4D8, DEX = 2D6+6, CHA = 3D6, LEN = 3D6+100, BLD = 1D4, Expected SIZ = 11 (expected mass = 14 kilograms), TSC = 0, TPR = 1. Expected hit points = 8. Use Avian Carnivore hit point allocation table.

Attacks: Beak – 1D4+1 (thrusting weapon) (90%).

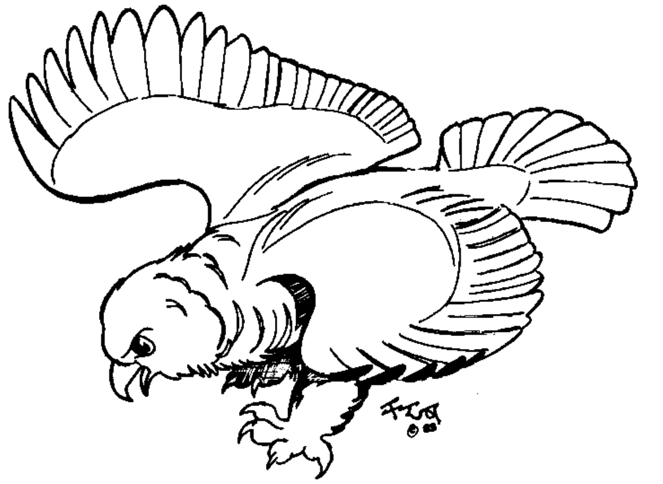
Armor: none.

Other Skills: Fly 75%, Spot Hidden Item 75%.

12.5.1.7.5 Striga

The striga, a nocturnal bird of prey, lives on the small mammals that abound in the forests and open plains of Novaya Amerika. It resembles the starhawk in such adaptive features as the powerful beak and claws. The striga's large eyes are turned directly forward, so that the same object may be seen clearly with both eyes. This eye placement imposes a certain lack of lateral vision in the normal pose, but as the head can be swiveled slightly more than a full half-turn, this does not impose any great hardship on the striga (also colloquially known as the rubberneck bird).

The striga has an excellent sense of hearing, and its wings are so fashioned that the striga is virtually soundless in flight. The striga's feathers are non-reflective black, and though the striga does not employ sonar directly, its otherwise atrophied sonar organ does enable it to detect and accurately locate the source of sonar pulses. As many of the small nocturnal mammals of Novaya Amerika employ sonar in place of, or in addition to, the sense of sight, this passive detection system enables the striga to locate its favored prey with relative ease.



Characteristics: STR = 2D6+1, INT = 2, WIL = 3D6, CON = 3D6, END = 4D8, DEX = 3D6+6, CHA = 3D6, LEN = 3D6+90, BLD = 1D3+2, Expected SIZ = 11 (expected mass = 14 kilograms), TSC = 0, TPR = 1. Expected hit points = 8. Use Avian Carnivore hit point allocation table.

Attacks: Talons (2) – 1D6+1 (thrusting weapon) (75%), Beak – 1D6 (slashing weapon) (60%).

Armor: none.

Other Skills: Fly Silently 99%, Detect and locate Sonar user (limit to range is 10 meters per point of WIL) 96%, Spot Hidden Item 75%.

12.5.1.8 AQUATIC MAMMALIAN CARNIVORES

12.5.1.8.1 Chidov

Largest member of the family Pelegatherea (sea going mammals) on Novaya Amerika, and the only one to adopt a purely aquatic existence, the chidov (scientific name: Leviathin nessi) can be found in all of the major oceans of Novaya Amerika. It ranges in length between 60 and 80 feet, slightly over a third of which is neck, ending in a large head with well developed teeth and jaws, eyes, ears, and a dorsally located blow-hole. The body is rather like that of a terrestrial sea lion, with four flippers (used by the creature as steering vanes) and a slight dorsal ridge. The remaining fourth of the creature is a horizontally flattened tail of considerable musculature which is used to propel it. The entire creature is covered with sleek brown fur. To the surprise of no one, the chidov is a carnivore, using sonar, its motion detection sense, and excellent eyesight to locate its prey (generally large, schooling fish). Fortunately for the fisherman of Novaya Amerika, it is not exceptionally intelligent, being roughly as intelligent as a terrestrial seal.

Smaller members of the family range from 3' to 20' in length and spend only part of the year at sea, returning to the land to breed and raise cubs, much in the manner of terrestrial seals and sea lions.

Characteristics: (for L. nessie): STR = 8D8+4, INT = 2, WIL = 3D6, CON = 2D6+6, END = 4D10+500, DEX = 4D6, CHA = 3D6, LEN = (7 x 1D100)+1800, BLD = 9D10+220, Expected SIZ = 231 (expected mass of approximately 123 metric tons, 123,000 kilograms, or 271,000 pounds), TSC = 0, TPR = 1D4. Expected hit points = 282. (for smaller members of the family): STR = 8D10, INT = 2, WIL = 3D6, CON = 2D6+6, END = 8D10, DEX = 3D6+6, CHA = 3D6, LEN = 5D100+100, BLD = 8D10, Expected SIZ = 49 (expected mass = 1177 kilograms, approximately 2590 pounds), TSC = 0, TPR = 1D4. Expected hit points = 41. For hit point and END point allocation to locations, use the following Hit point allocation table:

1D20 Roll	Specific Area	Hit Points and END points/Total
01-04	Head	0.30 (round fractions up)
05-16	Body	0.60 (round fractions up)
17-20	Tail	0.35 (round fractions up)

Attacks: (for L. nessie) Bite – 30D6 (99%), Tail Bash – 30D6 (99%). Armor: skin provides 24 points of protection against both impact and energy damage. (for the smaller members of the family) Bite – 2D8+5D6 (90%), Tail Bash – 4D8+2+5D6 (85%). Armor: skin provides 15 points of protection against both impact and energy damage.

Other Skills: Swimming 100%, Sonar location 96% (range of 10 meters per point of WIL), Motion sensing 75% (range of 25 meters per point of WIL), Spot Hidden Item 75%.

12.5.1.8.2 Chidovichki

The chidovichki is a small relative of the chidov, averaging roughly 7' in length. The species is far more intelligent than its larger relative. It is also less committed to a totally aquatic life style, returning to the land to breed and raise cubs in the manner of terrestrial sea lions (and with the same territoriality and polygamous behavior of that terrestrial species). And, apart from its blue-green coloration, the chidovichki resembles a sea lion quite closely. It does, however, have electrogenerative tissue capable of producing a serious shock (6D6 vs END, 2D4 electrical burn). The chidovichki, like its larger relative, possesses a sophisticated sonar sense, as well as a motion detection sense (range = 10 meters per point of WIL underwater, 1 meter per point of WIL out of water).

Characteristics: STR = 4D8+3, INT = 3, WIL = 3D6, CON = 2D6+6, END = 4D12, DEX = 4D6+3, CHA = 3D6, LEN = 4D4+200, BLD = 4D8+3, Expected SIZ = 27 (expected mass = 197 kilograms), TSC = 0, TPR = 1D4. Expected hit points = 22. Hit Locations and hit point and END point distributions as per Chidov.

Attacks: Bite – 1D10+1D6 (60%), Electrical shock (requires temporary expenditure of 1 pt of END, and requires that physical contact be made) 2D4 vs location plus 6D6 END (75%).

Armor: skin provides 4 points of protection versus both energy and impact damage.

Other Skills: Swimming 95%, Sonar (90%) (range 10 meters per point of WIL), Motion sense (90%) (range 10 meters per point of WIL underwater, 1 meter per point of WIL out of water).

12.5.1.9 INSECTIVORES

12.5.1.9.1 Yastrebichki

The yastrebichki are small birds with long pointed wings. They are insectivores, but they will supplement their diet with nectar taken from flowers. They are excellent flyers, capable of hovering or flying backwards as well as being able to fly at high speeds in level flight. The yastrebichki is the smallest of Novaya Amerika's avian life forms, and also the most maneuverable.

Characteristics: STR = 2D4, INT = 1, WIL = 3D6, CON = 3D6, END = 5D10, DEX = 2D8+21, CHA = 3D6, LEN = 12, BLD = 6, SIZ = 3 (mass = 27 grams, approximately 1 ounce), TSC = 0, TPR = 1. Expected hit points = 5. Use Avian Carnivore hit point allocation table.

Attacks: Beak – 1D6+1–1D4 (thrusting weapon) (75%).

Armor: none.

Other Skills: Flying 100%, Spot Hidden Item 100%, Sense Ambush 99%, Evade 96%.

12.5.1.9.2 Pikipiki Bird

The pikipiki is a tree dwelling bird that lives on grubs and adult insects. The four toes of the pikipiki are arranged in two opposed pairs, facilitating climbing. The beak of the pikipiki is a powerful drilling organ, capable of boring deep into trees for the insect food the pikipiki needs to survive. The pikipiki also possesses a very long protrusible tongue with sticky barbs.

Characteristics: STR = 2D6, INT = 2, WIL = 3D6, CON = 3D6, END = 4D8, DEX = 2D6+9, CHA = 3D6, LEN = 2D4+25, BLD = 3D4, Expected SIZ = 5 (expected mass = 1.25 kilograms), TSC = 0, TPR = 1. Expected hit points = 5. Use Avian Carnivore hit point allocation table.

Attacks: Beak – 1D6+1–1D4 (thrusting weapon) (60%).

Armor: none.

Other Skills: Flying 75%, Spot Hidden Item 75%, Sense Ambush 45%.

12.5.1.9.3 Buzzbird

The buzzbird, or Jason's Buzzbird, is a small insectivorous bird common over much of the southern part of North Continent (there being a large insect population in this marshy territory).

The buzzbird is a highly adept flier, remaining in the air for months at a time. The buzzbird even mates on the wing (though of course, it must leave the air to nest).

Like many of the Novaya Amerikan animals, the buzzbird possesses a sophisticated sonar system. And the buzzbird gets its name from the high-frequency sounds it emits to locate small insects – the echolocation sonar burst it uses having components in the human hearing range.

Characteristics: STR = 2D8+1, INT = 2, WIL = 3D6, CON = 3D6, END = 6D12+6, DEX = 3D6+6, CHA = 3D6, LEN = 2D4+40, BLD = 2D4, Expected SIZ = 6 (expected mass = 2.16 kilograms), TSC = 0, TPR = 1. Expected hit points = 12. Use Avian Carnivore hit point allocation table.

Attacks: Beak – 1D4 (thrusting weapon) (45%).

Armor: none.

Other Skills: Flying 100%, Echolocation (in air) 75% (range is 10 meters per point of WIL), Spot Hidden Item 60%, Sense Ambush 45%.

12.5.1.10 REPTILIAN CARNIVORES

12.5.1.10.1 Red Boa

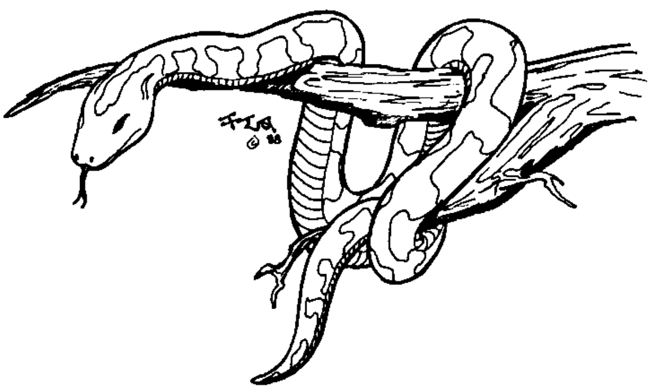
The red boa is a forest dwelling snake that kills its prey by constriction. It lives on small rodents, funnybunnies, and anything small enough for it to swallow. The dark red patterned skin of the red boa blends in well with the xanthophyll derived red coloration of most of the photosynthetic organisms or Novaya Amerika. For the most part, this animal is no danger to humans, though larger specimens could be dangerous if allowed to coil about the neck or torso.

The red boa is cold blooded, and is only active during the warm parts of the day.

The red boa will typically lie in wait for prey on a tree branch, dropping, striking and coiling about its prey as it passes underneath the branch.

If a bite attack is successful, the snake will succeed in folding around the indicated hit location if it makes a roll of DEX x 5 or less on 1D100 (and the bite need not penetrate armor – it is only necessary that the location hit provide purchase for the snake to begin coiling about its target).

If the snake is equal to or larger in SIZ than its victim, the snake is assumed to be wrapped around critical body locations (the neck and/or torso) and it will do damage of 2D6 END per melee round to that location during each melee round in which its STR overcomes the STR of the victim. If the snake is smaller than its victim, the snake may only do this crushing damage if the hit location rolled for the bite is the Head, Chest, or Abdomen. The victim may attempt to break free from the coils only if the roll of STR vs STR for the crush is a fumbled roll (in which case the victim must overcome the STR of the snake with his own STR and make a roll of DEX x 5 or less on 1D100).



Characteristics: STR = 4D8, INT = 2, WIL = 3D6, CON = 2D6+6, END = 4D12, DEX = 2D6+12, CHA = 3D6, LEN = 3D100, BLD = 3D4, Expected SIZ = 17 (expected mass = 50 kilograms), TSC = 0, TPR = 1. Expected hit points = 16. Use Chidov hit location table.

Attacks: Bite – 1D3+1D4 (90%). Crush (described above).

Armor: the skin of the red boa provides 2 points of protection against both impact and energy damage.

Other Skills: Move Quietly 90%, Hide in Cover 90%, Set Ambush 90%, Sense Warm Blooded animal 87% (1 meter range per point of WIL).

12.5.1.10.2 Newcobra

The newcobra of Novaya Amerika is the most dangerous venomous animal on the planet. The venom of the newcobra behaves exactly like Halo-L (and is so similar chemically that Halo-D is commonly used as an antivenom treatment). (See Chapter 11, Hegemonic Technology for details on the action of Halo-L).

The newcobra can be found throughout South Continent. Like its namesake, it has a large hood which it extends when irritated, frightened, or in any way threatened. The newcobra lives on small rodents and funnybunnies, or any other small animal (no more than half the size of the snake).

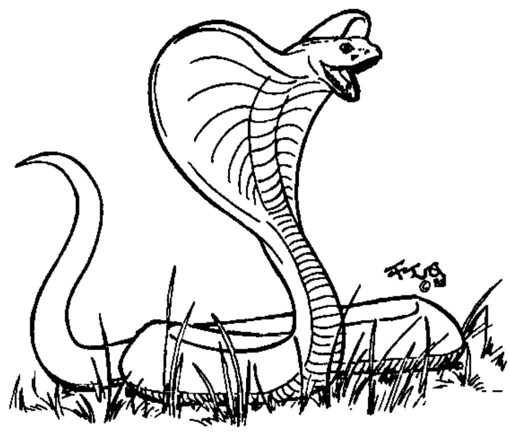
The snake does not rely upon injection to administer its venom – it sprays the poison instead in a fine mist (which reaches 10 meters). The newcobra is immune to the effects of its own poison.

Characteristics: STR = 2D4, INT = 2, WIL = 3D6, CON = 2D6+6, END = 4D12, DEX = 2D6+6, CHA = 3D6, LEN = 4D10+100, BLD = 3D4, Expected SIZ = 14 (expected mass 28 kilograms), TSC = 0, TPR = 1. Expected hit points = 14. Use Chidov hit location table.

Attacks: Spray venom – effects of poison as per Halo-L, (5 x DEX to hit, range of attack is 10 meters). Bite – 1D4+1 (thrusting weapon) (45%).

Armor: none.

Other Skills: Move Quietly 90%, Hide in Cover 75%, Set Ambush 75%, Sense Warm Blooded Animal 70% (range is 1 meter per point of WIL).



12.5.1.11 A FEW CLOSING COMMENTS

The preceeding species list does not include all possible species of the example world. There are, on Earth, after all, several million species of insects alone. So even the most dedicated of Referees can only describe a small fraction of the potential life forms of a world. And the Referee who wishes to keep his sanity intact will do well to restrict himself to creating only a few dozen species anew for each world (and should only do so then if he intends to use the world as the setting for several adventures).

Novaya Amerika is the base of operations for all of the players in the author's current **OTHER SUNS** campaign. As such, the massive effort involved in species design is justified – these creatures can be used again and again for different encounters in the wilds (of which there are many remaining) on Novaya Amerika.

13. Playing the Game

13.1 GETTING STARTED

OTHER SUNS differs in feel and motivation from most other role playing games. It is a game of exploration, puzzle solving, and what might be best described as improvisational theatre, rather than a rerun of the gunfight at the O.K. corral.

The referee in **OTHER SUNS** is advised to start with simpler exploratory scenarios first, using only human Adventurers, avoiding the more exotic capabilities presented in these rules until the referee and the players have developed a sound understanding of the basic mechanics.

Before spending too much time working on his first scenario, the prospective referee should sit down and roll up several Adventurers, preparing them completely for play (see Chapter 2, How to Create a Character, Chapter 5, Specialties and Skills, Chapter 7, Making a Living, and Chapter 8, Previous Experience, in that order, for further details).

13.1.1 Simplifying The Scientific Skills

If the referee wishes to reduce the number of scientific skills for simplicity's sake in his beginning scenarios, the following simplifications should be made:

13.1.1.1 MODIFYING INITIAL SKILL POINTS

The area of specialization should begin at a skill level of 35% + INT + Knowledge bonus, and skill points available in Previous Experience should be reduced to (INT x 2D4)/2 (round fractions up), with no skill point adders.

13.1.1.2 SKILL SUBSTITUTIONS

In place of the existing skills, certain new skills must be substituted.

13.1.1.2.1 Biological Sciences Knowledge
This skill replaces the skills of Biochemistry, Biology, Biophysics, Botany, Ecology, Genetics, Immunology, Molecular Biology, Paleontology, Pharmacology, Toxicology, and Xenobiology. It is a 0% base knowledge skill with training costs as follows: 225/450/900/1800/3600.

13.1.1.2.2 Chemical Sciences Knowledge
This skill replaces the skills of Biochemistry, Chemistry, Geochemistry and Pharmacology. It is a 0% base knowledge skill with training costs as follows: 175/375/750/1500/3000.

13.1.1.2.3 Computer Sciences Knowledge
This skill replaces all skills of the Computer Science Specialty (Applications, Artificial Intelligence, Data Base, General Programming, Operating Systems, Real Time Systems, and Security Systems). It is a 3% base knowledge skill with training costs as follows: 250/500/1000/2000/4000.

13.1.1.2.4 Engineering Applications Knowledge
This skill replaces all of the existing engineering skills. It is a 0% base knowledge skill with training costs as follows: 225/450/900/1800/3600.

13.1.1.2.5 Legal Knowledge
This skill replaces all of the legal skills, including Legal Semantics. It is a 0% base knowledge skill with training costs as follows: 250/500/1000/2000/4000.

13.1.1.2.6 Mathematical Sciences Knowledge
This skill replaces all the existing mathematical skills. It is a 0% base knowledge skill with training costs as follows: 275/550/1100/2200/4400.

13.1.1.2.7 Medical Sciences Knowledge
This skill replaces all the individual species medical skills, as well as Immunology, Pathology, Pharmacology, Toxicology, and Xenobiology. It is a 0% base knowledge skill with training costs as follows: 400/800/1600/3200/6400.

13.1.1.2.8 Physical Sciences Knowledge
This skill replaces all the skills of the Physics specialization (Astrophysics, Cosmology, General Relativity, Nuclear Physics, and Generalist Physics). It is a 0% base knowledge skill with training costs as follows: 250/500/1000/2000/4000.

13.1.1.2.9 Planetological Sciences Knowledge
This skill replaces Cartography, Geochemistry, Geology, Meteorology, Oceanography, and General Planetology. It is a 0% base knowledge skill with training costs as follows: 200/400/800/1600/3200.

13.1.1.2.10 Social Sciences Knowledge
This skill replaces Archeology, Contact Xenology, Cultural and Physical Anthropology, History, Linguistics and Xenolinguistics, Sociodynamics and Economics, and Sociology. It is a 0% base knowledge skill with training costs as follows: 225/450/900/1800/3600.

The above simplification will still allow for a reasonable degree of specialization of character's skill fields without swamping the players with the full complexities of **OTHER SUNS** detailed scientific specializations. Multiple skills may be used for the same problem in the above approach (e.g. the Biological Science and Medical Science skills can both be used to solve a problem in Immunology); this is intentional, for there are many ways to attack any given problem in the real world.

13.2 PLANNING THE SCENARIO
The heart of a typical **OTHER SUNS** scenario is the puzzle. For the first few scenarios, until the players are all familiar with the mechanics of the game, the puzzle should be kept as simple as possible while still maintaining interest.

In order to improve the flow of the game, and to minimize delays, the referee should perform all calculations possible well in advance. All the planetary characteristics of the star system to be explored should be determined before the players sit down to begin the game. Since the entry point in normal space is determined randomly (with a 1D10 Astronomical Unit scatter in a random direction), determining this location and calculating flight times from the entry point to any point of interest will speed play. And pre-calculating the travel time from each world in the system to every other world in the system at 1 g accelerations will speed play even more. When the ship has made entry into normal space, the referee then need only refer to his precalculated tables to inform the players of all necessary flight times (rather than delay play while calculating these values). The simplifying assumption is made that the planets will not move appreciably in their orbits during the course of play in the interest of the referee's sanity.

The puzzle itself should be planned as a series of smaller problems, each solvable, but relying upon the solution of the previous layer of the puzzle for their resolution.

13.2.1 Crewing The Ship
To insure that all of the necessary skills be present to solve the problems presented, some care should be taken in the selection of the crew composition for the starship sent to deal with whatever problem or puzzle has been developed

The two ships most commonly used for preliminary exploratory missions are the Scattership (with a crew of one to eight) and the Armored Scout (with a crew of twelve to twenty). Typical useful crew complements for each of these two ships are listed below:

13.2.1.1 SCATTERSHIP
(1) Captain: Pilot or Weapons Officer
(2) [Executive Officer: Weapons or Alien Contact Officer]
(3) [Engineer]
(4) [Scientist: Planetologist]
(5) [Scientist: Other specialty]
(6) [Scientist: Other specialty]
(7) [Medical Officer]
(8) [Survival Expert]

(positions in brackets are optional, though it is advised that planetary EVA not be planned if there is no survival expert or medical officer).

13.2.1.2 ARMORED SCOUT
(1) Captain — Line Officer (Primary field either Piloting, Tactics, Alien Contact or Weapons).

COMMAND STAFF (in chain or command order)
(2) Executive Officer — Line Officer (Primary field as per Captain, with possible addition of Administration).
(3) Alien Contact Officer
(4) Weapons Officer
(5) Communications Officer

SCIENTIFIC AND ENGINEERING STAFF (not generally in chain of command)
(6) [Senior Medical Officer]
(7) Medical Officer
(8) [Senior Science Officer]
(9) Biologist
(10) Computer Scientist
(11) Planetologist
(12) Sapientologist
(13) [Senior Engineer]
(14) [Computer Systems Engineer]
(15) [Contragravity Systems Engineer]
(16) [Life Support Systems Engineer]
(17) Jump Drive Engineer
(18) Power Systems Engineer

GROUND TEAM
(19) [Ground Team Leader — Survival Expert]
(20) [Survival Expert] or [Soldier]

Crew functions set in brackets are optional. If a minimum size crew is used, all indicated skills should still be present in the crew (at least up to the 50% level). If there is no survival expert to serve as Ground Team Leader the Executive Officer should be prepared to so serve.

Each player should run two or more Adventurers — one 'ship type' character (an engineer, a medical officer, a pilot, or the like) and one 'ground type' character (a biologist, a survival expert, or the like). This will help reduce to a minimum the times during which any one player is 'locked out' of the game for the lack of some specialized skill. It is also strongly suggested that the same player not run both the Captain and the Executive Officer. Where possible, different players should handle the Captain, Executive Officer, Alien Contact Officer, and Weapons Officer. As **OTHER SUNS** is primarily a game of role playing rather than blood and thunder combats, the wise referee will limit the number of players present to five or six (at least until he is very experienced in refereeing the game) as this will also help to minimize the chances of any one being left out of the play.

The ship crew list (included in the play aids) should also be filled out at the beginning of each expedition in order to assist both the referee and the players in recalling what personnel are available for which functions, and when they are available.

13.3 PLAYING OUT THE SCENARIO

13.3.1 Random Encounters During The Scenario

While in unexplored space (i.e. virtually anywhere in jump space or in any previously unexplored starsystem) it is possible for Adventurers to encounter strange and wonderful things. Within even a few hours flight time of the home base of the characters it is possible to run into previously uncontacted (and possibly hostile) aliens. For though the Hegemony has tens of thousands of member races (only the most important few being described in Chapter 9, Intelligent Species) and there are several million member worlds, it is spread out over a vast area in which only a small percentage of the star system have even been briefly visited, let alone thoroughly explored.

Roll 1D300 to determine interval in hours between encounters in space. At each encounter, roll on the appropriate table for type of encounter.

13.3.1.1 JUMP SPACE ENCOUNTER TABLE

1D100	Event
01-60	Freighter encountered (crewed by a known Hegemonic species)
61-80	Friendly warship/survey craft encountered.
81-88	Small (armored scout class) L'Dreyan trading ship encountered
89-90	Large L'Dreyan Homeship encountered (500,000 plus crew, 50 million metric ton plus mass)
91	Freighter encountered (crewed by an unknown or previously uncontacted species)
92-95	Experimental Starship encountered (Hegemonic in origin)
96	Warship/Survey craft of unknown origin encountered
97	Space dolphins encountered
98	Space sharks/killer whales encountered
99	Space whales encountered
00	Referee's Choice – the stranger the better

13.3.1.2 NORMAL SPACE ENCOUNTER TABLE

1D100	Event
01-80	Meteoroid, comet, or asteroid detected at limit of sensor range on collision course
81-90	Another powered craft detected – reroll using the jump space encounter table above
91-93	Space dolphins encountered
94-96	Space sharks/killer whales encountered
97-99	Space whales encountered
00	Referee's choice – the stranger the better

Description of Space Dwelling Creatures in above listed tables:

SPACE DOLPHINS:

These vacuum and jump space dwelling creatures are small living starships. Their name was given by the Human astronauts who first spotted them and named them for their habit of riding the 'bow shock' of the FTL drive field of starships in jump space. They are harmless to spacecraft, and generally mass in the 10,000 to 15,000 metric ton range. Their usual cruising speed in jump space is 60 ly/hr, their usual acceleration in normal space is 10 gs. They have the capability of generating a defensive screen of value 5, and firing an offensive beam (range factor 0.5) of strength 3. They have passive sensors of grade 5 and ECM grade 1.

SPACE SHARKS/KILLER WHALES:

These somewhat larger versions of the space dolphins can definitely be dangerous to small or lightly armed and armored spacecraft. They generally mass in the 10,000 to 50,000 metric ton range, can generate defensive screens of strength up to 25 (divide mass by 2000 to determine strength) and fire offensive blasts of strength up to 15 (multiply defensive screens by 0.6 to determine offensive strength). Their cruising speed in jump space is 60 ly/hr, and they can maneuver in normal space at 25 gs. They have passive sensors of grade 5 and ECM grade 1.

SPACEWHALES:

These are larger versions of the space dolphins and are regarded as harmless to spacecraft. They generally mass in the 1 million metric ton plus range, cruise at 20 ly/hr in jump space, maneuver at 5 gs in normal space, can generate defensive screens of value 25, and offensive blasts (range 0.5) of strength 5. They have passive sensors of grade 5 and ECM of grade 1.

13.3.2 Wheels Within Wheels – The Puzzle

As stated earlier, the problem presented in the scenario should be a multi-layered puzzle. A simple scenario might begin as a Search-And-Rescue mission of a prior exploratory craft that has failed to return from its mission.

The first stage of the problem would be to get to the last reported position of the earlier craft. What with various and sundry possible encounters along the way, this might take an afternoon gaming session in itself.

Having reached the last star system visited by the other ship, the ship itself or evidence of its last touchdown point must be located. This is a simple tactical problem, complicated only slightly by the lack of information as to the reason for the earlier ship's failure to return to base.

Did the ship crash on a terrestrial world, a gas giant, or is it just adrift in space? Locating the lost craft in either of the last two situations might prove difficult. But even if it crashed (or somehow was stranded) on a terrestrial world, it still must be located. And a world is a big place to hide even a large ship. So the precise location determination will require a certain amount of dogged persistence, and perhaps just a bit of luck on the part of the players.

Assuming that the ship can be found, landed on a terrestrial world, the problems are far from over – they are in fact just beginning. Is the world inhabited? If so, are the locals friendly? And what (if any) is their technological level, and have they found the stranded crew? Will it be necessary to perform a 'guns blazing' rescue? (If so, the Captain had better be prepared to justify the decision before a Board of Inquiry, or possibly a Court Martial Board). Can the stranded crew be removed without violence? If so, how? Perhaps the local life forms (non-intelligent) have dispatched the stranded crew, or said crew is simply stranded as a result of the failure of some critical component with their engineering personnel rendered non-functional for one reason or another. The detailed problems of the on-site rescue can provide the Adventurers further opportunities for heroism (or lack thereof) pending their own return to base.

Finally, there will come a time for the triumphant return of the heroic rescuers to return (or, alternatively, for the whipped remnants of the rescue party to flee with their tails between their legs). And their return through the wilds, again, of unexplored space will provide ample opportunity for yet more trials and tribulations before the scenario is laid to rest.

13.4 SAMPLE SCENARIO

13.4.1 Common Knowledge

All aircraft are required to carry an ELT (emergency locator transmitter) which will emit a special signal automatically under the stress of an accident, upon immersion in water, or upon manual activation. The ELT is battery powered and broadcasts on 486 Megahertz continuously after activation for 72 hours. This frequency is reserved for distress calls.

There are a large number of low orbit satellites whose sole function is to monitor this frequency. When one of these satellites passes over an activated ELT, it will receive a signal whose frequency is Doppler shifted (first to a higher frequency as the satellite approaches the ELT, then to a lower frequency as it moves away from the ELT). Given the shape and slope of the curve of observed frequency versus time together with the location of the satellite at the time of each observation along that curve it is possible to locate the position of the ELT to within a few miles.

A low orbit satellite in a polar mapping orbit will cover the entire planet in one half a planetary rotation period. Novaya Amerika, like Earth, rotates once approximately every 24 hours, so a low orbit satellite will scan all of Novaya Amerika in 12 hours. The Novaya Amerikan government has orbited and maintains six such ELT search satellites, staggering their orbits so that a distress signal anywhere on the planet can be detected in no more than two hours.

13.4.2 Players' Information

ELS–4 and ELS–6 (Emergency Locator Satellites 4 and 6) have malfunctioned. A shuttle has been dispatched from Starport to repair these satellites on site. But while the two satellites were inoperative, a gap of nearly six hours was created in the planetary emergency locator satellite system. During this six hour window, an gravcar carrying the son of the Propaganda Ministry's Director crashed somewhere in the Anvil of God.

ELS–2 passed over the region just in time to detect the fading signal of the gravcar's ELT, six hours after ELS–5 passed over the same region. The ELT has apparently failed prematurely (or been sabotaged) before ELS–2 could pinpoint its location. The gravcar has been located to within a circle 20 kilometers across. It is 2000 hours at the crash site, two hours after sunset. It is summer in the Northern Hemisphere, and the temperature in the Anvil is expected to reach 150 degrees F. by midday. A sandstorm is predicted for the crash site by 1400 hours on the following day. The sandstorm is expected to last for roughly six hours.

The Adventurers' mission is to locate the gravcar, recover the Propaganda Minister's son, and do so before he suffers injury from exposure, wind or storm. Thus, there is a time limit – the gravcar must be found and the passengers withdrawn to safety before the sandstorm hits the crash site in 18 hours. The Adventurers are currently at South Pole Base 11000 Kilometers from the crash site when they are informed that they have been 'loaned' to Planetary Search and Rescue (the local name for the Air Arm) to carry out the rescue. They will carry out their search using a standard grav car. There is no reason initially to expect foul play.

The list of people officially on board the gravcar is as follows:

(1) Jimmy Chung, Human male, Age 59, Pilot and Navigator.

(2) Svetlana Kutuzov, Human female, Age 35, Co-Pilot and Flight Engineer.

(3) Lisa Howard, Human female, Age 36, Survival Expert – employed by the Minister of Propaganda as Yakob's Bodyguard.

(4) Yakob Mueller, Human male, Age 14, son of the Propaganda Minister.

13.4.3 Referee's Information

13.4.3.1 WHAT REALLY HAPPENED

The gravcar crashed due to sabotage. A small explosive charge was placed in the control panel, and the detonation killed Chung and seriously injured Kutuzov. The controls were virtually destroyed, and Kutuzov barely managed to avoid a serious crash. She was 'killed' in the crash (her heart stopped) but her medikit injected a dose of slowtime 12 seconds after impact. The gravcar's primary radio was destroyed by the explosive charge, the backup was damaged in the crash (and neither Lisa nor Yakob know enough about engineering to repair the damage).

The battery for the ELT was also sabotaged, and the ELT failed three hours after the crash.

13.4.3.2 TO FIND THE CRASH

The crash site is visible from the air, but will require a successful cartography roll (photo-interpretation) or a LUC x 2 roll by one of the Adventurers (try cartography first – if unsuccessful, try the LUC rolls of all characters). Repeat at one hour game-time intervals until successful or the sandstorm hits. This is not a situation in which the Adventurers' lives are threatened, so a success in this LUC roll does not provide an opportunity for increase in WIL.

13.4.3.3 DRAMATIS PERSONNAE

13.4.3.3.1 Jimmy Chung

Jimmy Chung is irrecoverably dead, his head having been destroyed. He was 180 centimeters tall and masses 80 kilograms.

13.4.3.3.2 Svetlanta Kutuzov

Svetlana's characteristics are as follows: STR 13, INT 15, WIL 12, CON 14, END 27, DEX 15, CHA 13, LEN 165, BLD 7, SIZ 18, TSC 0, TPR 2. She has 16 hit points normally, and masses 59 kilograms. In the explosion and crash she suffered 31 hit points damage and is 'dead' as a result. Slowtime was automatically injected by her medikit and she can be saved if she receives medical attention within ten hours.

13.4.3.3.3 Lisa Howard

Lisa Howard was unharmed by the explosion and crash. She is a type BD cyborg with 3 points subdermal armor and her characteristics are as follows: STR 42, INT 14, WIL 14, CON 21, END 66, DEX 32, CHA 16, LEN 175, BLD 9, SIZ 20, TSC 0, TPR 5. She has 30 hit points. She has a damage bonus of +1D8, masses 80 kilograms and is able to carry 132 kilograms in equipment without encumbrance penalties.

Lisa habitually wears Styrane body armor (good for 7 points of energy and impact protection), leaving only her face unprotected (hit location 1 only). The mass of this armor is 7.6 kilograms. She carries a hand blaster and a 44 magnum automatic, and is an expert in the use of both weapons (97% and 90% respectively). She is also a Martial Arts master (Evade at 120%, Hand-to-Hand at 120%, and Disarm at 150%). Lisa's professional skills are as follows: Climbing 140%, Hide in Cover 98%, Move Quietly 122%, Scout Suit Operation 136%, Sense Ambush 73%, Set Ambush 75%, Skiing 153%, Spot Hidden Object 81%, Spot Traps 79%, Swimming 182%, Vac-Suit Operation 109%, Vehicular Operation 82%.

She is a loyal Party member and will defend her charge, Yakob, with her life. She is also slightly paranoid, and must be calmed by the Adventurer's or she will assume them to be threats to Yakob's life.

Lisa Howard's Hit Location Table

Hit Number	Location	End Points	Hit Points	Armor
01-02	Head	17	8	3/10*
03-05	Right Arm	20	9	10
06-08	Left Arm	20	9	10
09	Chest	30	14	10
10-12	Abdomen	27	12	10
13-16	Right Leg	24	11	10
17-20	Left Leg	24	11	10

* = her face (location 01) is the only portion of her body not covered by styrane armor – and thus she must rely upon only her natural 3 point armor for protection there.

13.4.3.3.4 Yakob Mueller

Yakob is currently on vacation fr..n Somerset Boy's Academy (a military boarding school in Landing). He hopes to earn one of the few openings to Han's T'Chin Yan Military Academy and become a Star Arm officer. To prepare himself, he has been following a rigorous exercise program. He is somewhat heavy for his age – but it is not fat, and he will 'get even' with anyone who calls him fat.

Yakob is also a spoiled brat, and will make a considerable pain of himself at virtually every opportunity. And as he is the only son of an extremely important local political figure, he is for all intents and purposes immune from reprisals (so long as he does nothing truly stupid or illegal).

Yakob's characteristics are as follows: STR 15, INT 13, WIL 15, CON 16, END 28, DEX 12, LEN 157, BLD 12, SIZ 19, TSC 0, TPR 2. He has 18 hit points and masses 69 kilograms. He is able to carry 50 kilograms of equipment without encumbrance penalties.

Yakob Mueller's Hit Location Table

Hit Number	Location	End Points	Hit Points	Armor
01-02	Head	7	5	0
03-05	Right Arm	9	6	1
06-08	Left Arm	9	6	1
09	Chest	14	9	1
10-12	Abdomen	12	8	1
13-16	Right Leg	10	7	1
17-20	Left Leg	10	7	1

13.4.3.3.5 Local Life Forms

A wandering nighthound pack, several small rodent forms (use Bailey's Jumping mouse and R. norvegicus) Newcobras, and Landry's Starhawk.

The Nighthounds will not attack unless provoked, the small rodents will flee if possible, Landry's Starhawks will attack if the nesting area is approached, and the Newcobras will attack just for the joy of attacking.

13.4.3.4 TIME LIMITS

The environmental controls of the gravcar are ruined. If medical assistance is not provided to Svetlana within 10 hours (by 0300 hours), she will die. If the rescue is not carried out by 1800 hours, the downed craft will be buried by the sandstorm, and the survival chances of the crash victims will rapidly drop to zero.

13.4.3.5 COMPLICATIONS – THE ASSASSINS

If the players radio base to indicate that they have found the lost vehicle, the radio transmission will be intercepted (by the parties responsible for the sabotage). Unless they indicate that their transmission is being sent scrambled or in code, the saboteurs will be made aware of the pickup. In this event, the saboteurs will send assassins to deal with the party while it is still on the ground (allow 20 minutes for the assassins to arrive at the scene). If the players leave before the assassins arrive, they will attempt to intercept them and force their vehicle to the ground (they have only a standard grav car themselves) via ramming, if necessary. The skill of assassin pilot is 95% (vehicular operations skill).

To determine if Assassin pilot forces the Search and Rescue vehicle to land, Referee should roll 5+1D100, SAR pilot's player should roll (100–Vehicular Operations skill)+1D100, and the lower roll 'wins'. If the player wins, the SAR craft is not forced down, if he loses, he is forced to land. Only one attempt will be made to force the SAR craft to land.

Once they have forced the SAR craft to land, the Assassins will then attempt to kill all members of the group (use six copies of the 'ready-made' assassin provided – reduce the number of assassins by one for each Adventurer less than five in the party). If captured, the assassins will suicide (they each have poison capsules containing small doses of Halo-L) and the pilot (who remains with their gravcar at all times) will abandon the others if reinforcements arrive, or if the adventurers neutralize the assassins. The assassins will attempt to fight their way through the party and kill Yakob – if they succeed, they will then attempt to break off combat and flee (suiciding if captured).

Assassin characteristics are as follows: STR 17, INT 11, WIL 15, CON 15, END 30, DEX 15, CHA 10, LEN 170, BLD 12, SIZ 20, TSC 0, TPR 2. Each assassin has 18 hit points and wears Styrane armor (for 7 points of protection) in all locations (covering the face as well).

Their skills are as follows: Needler 75%, Type 1 Blaster Rifle 80%, Martial Arts, Evade 50%, Martial Arts, Hand-to-Hand 60%, Martial Arts, Disarm 50%, Set Ambush 75%, Hide in Cover 75%, Listen 90%, Spot Hidden 90%, First Aid 50%, Vehicular Operations 95% (only one assassin at this skill level – the others have this skill at 50%).

Assassin's Hit Location Table

Hit Number	Location	End Points	Hit Points	Armor
01-02	Head	8	5	7
03-05	Right Arm	9	6	7
06-08	Left Arm	9	6	7
09	Chest	14	9	7
10-12	Abdomen	12	8	7
13-16	Right Leg	11	7	7
17-20	Left Leg	11	7	7

14. Appendix

14.1 SIZE AND MASS

The mass given for each different size is in kilograms. The corresponding weight is in pounds, and assumes that the character is in a 1 g gravitational field.

SIZ	Mass	Weight
1	0.01	0.02
2	0.01	0.02
3	0.03	0.59
4	0.64	1.41
5	1.25	2.75
6	2.16	4.75
7	3.43	7.55
8	5.12	11.26
9	7.29	16.04
10	10.00	22.00
11	13.31	29.28
12	17.28	38.02
13	21.97	48,33
14	27.44	60.37
15	33.75	74.25
16	40.96	90.11
17	49.13	108.09
18	58.32	128.30
19	68.59	150.90
20	80.00	176.00
21	92.61	203.74
22	106.48	234.26
23	121.67	267.67
24	138.24	304.13
25	156.25	343.75
26	175.76	386.67
27	196.83	433.02
28	219.52	482.94
29	243.89	536.56
30	270.00	594.00
31	297.91	655.40
32	327.68	720.90
33	359.37	790.61
34	393.04	864.69
35	428.75	943.25
36	466.56	1026.43
37	506.53	1114.37
38	548.72	1207.18
39	593.19	1305.02
40	640.00	1408.00
41	689.21	1516.26
42	740.88	1629.94
43	795.07	1749.16
44	851.84	1874.05
45	911.25	2004.75
46	973.36	2141.39
47	1038.23	2284.11
48	1105.92	2433.03
49	1176.49	2588.28
50	1250.00	2750.00
51	1326.51	2918.32
52	1406.08	3093.38
53	1488.77	3275.29
54	1574.64	3464.21
55	1663.75	3660.25
56	1756.16	3863.55
57	1851.93	4074.25
58	1951.12	4292.47
59	2053.79	4518.34
60	2160.00	4752.00

14.2 SPECIAL RULES

14.2.1 Drowning

A character can always hold his breath for one turn. The character must roll at or under his (CON + WILL) x 2 on 1D100 each melee round thereafter to continue holding his breath.

Once a breath holding roll is failed, the character begins to drown. He takes 2D6 END damage to his chest and 2D4 END damage to his head each melee round until he is able to breathe again.

Any character not taken by surprise by the immersion has opportunity to take and hold a breath. If he is taken by surprise, a character has an opportunity to take and hold a breath if he can roll at or under LUC x 5 on 1D100. If he does not have an opportunity to take a breath, he begins to drown immediately.

14.2.2 Falling

1D6 damage is done for each 3 meters (or fraction thereof) fallen in a 1 g gravitational field. Armor does not protect against falling damage. The maximum damage in a 1 g field with a normal density oxygen-nitrogen atmosphere from falling is 100D6. If a jumping roll is made, reduce the distance fallen by 9 meters (in Earth normal gravity) for purposes of damage calculation and allow the player to select the location(s) landed on. If a roll of LUC x 1 on 1D100 is made, halve the damage – and the luck roll may be repeated until a roll is failed (the damage being halved for each successful roll). In a gravity field of strength N a successful jumping roll will reduce the equivalent height fallen by 9/N meters.

Falling damage is done to the location struck until that location is down to zero END points, then hit point damage is done to that location until it has been reduced to zero hit points, and this procedure is repeated with the next logical hit location until all locations have been reduced to zero hit points and zero END points. The initial location struck then takes hit point damage until it is at –8 hit points and remaining damage points are allocated to the next logical hit location, (moving on to a new location each time the current location has been reduced to –8 hit points).

The effects of falls in gravitational fields other than 1 g are as follows:

Gravity (1=Earth)	Damage	
0.1	1D6	per 30 meters
0.2	1D4	per 30 meters
0.3	1D6	per 10 meters
0.4	1D4	per 5 meters
0.5	1D4	per 4 meters
0.6	1D6	per 5 meters
0.7	1D8	per 5 meters
0.8	1D6	per 4 meters
0.9	1D8	per 4 meters
1.0	1D6	per 3 meters
1.1	2D3	per 3 meters
1.2	1D4	per 2 meters
1.3	1D8	per 3 meters
1.4	1D12	per 3 meters
1.5	1D6	per 2 meters
1.6	1D10	per 3 meters
1.7	2D3	per 2 meters
1.8	1D12	per 3 meters
1.9	1D8	per 2 meters
2.0	2D4	per 2 meters

14.2.2.1 DROPPED OBJECTS

Dropped objects in a 1 g field do 1D6 blunt instrument damage per 3 meters of fall, up to a maximum of 2D6 per kilogram mass of the object. In a gravity field differing from 1 g, the amount of damage done varies as per the chart for falling damage, with the constraint that no more than 12 x N points of END damage (round fractions up) may be done by a falling object per kilogram mass of the object where N is the relative strength of the gravitational field.

14.2.3 Fighting Blind

If a character is caught in darkness by foes who can maneuver in it (i.e. anyone wearing infra-red or image intensifier goggles), or he is blinded, or is attacking an effectively invisible target, then subtract 50% from his attack and parry chances.

14.3 NEW SPECIES DESCRIPTIONS

14.3.1 The Descriptions And How To Build Your Own Species

The species of **OTHER SUNS** are described in a fixed format. Game mechanics data is given first. This allows players to roll up characters of that species, though not to role play them. Then a brief background giving basic biology and a description of the home world and the species is given. Next, a brief description of the language and racial character of the species is provided to aid in role playing members of the species. Individuals may deviate (sometimes dramatically) from these species 'norms' of behavior, but players should endeavor to play their characters 'in character' for the species (this is, after all, one of the principal reasons for playing this game). Finally, a description is provided of the physical characteristics of the species in question (more about the form of this section in a moment).

When constructing a new species for use in the game the brief species background should be prepared first. Build the homeworld (see Chapter 12, World Building for details), and decide on the basic biology of its species. Then decide on the basic biology of the species. Are they carnivores, omnivores, or herbivores? Next, decide upon the basic social structure of the pre-intelligent form from which the species evolved (as Man from a tribe living primate or, in the game, the H'Reli from a solitary felinoid predator, or the Altani from a pack predator). This will give some insight into the basic outlook of the species. Then construct the basic cultural attitudes that developed out of the biology of the creature – and as a guide to the possible, examine some of the human societies that have developed on Earth. There are few approaches to living together that have not been so strange that someone, somewhere, has not tried to live by them.

From the homeworld description one can gather the basic environmental tolerances of the species. If there are no obvious limits imposed by the world environment, compare the species' homeworld to that of one of the other species already described for the game and derive the tolerances by analogy.

Next, based upon the homeworld's characteristics, decide upon the characteristics rolls. Assume that smaller creatures will tend to be faster, and that larger creatures will tend to be stronger. And creatures from high gravity worlds will tend to be smaller and faster than those from low gravity ones. And so on.

All sections of the species description should be filled in by the referee for his new species. Care should be taken to produce no species which 'solves' all the physical problems of the game (overwhelming all other species in every category), as this approach quickly reduces the enjoyment potential of playing all the different possible species (why play any of the other species, after all, if one species has all the others beat physically and mentally?)

The existing species are roughly equal in intelligence (by far the most important characteristic in the game) and as to the physical characteristics well . . . taking a hint from the old west, 'all men are equal, Samuel Colt made 'em that way'.

14.3.2 The Species' Physical Description

One of the biggest problems in describing any new creature for game purposes (especially in science fiction gaming) is being sure that nothing important to the description has been omitted. Note that the following comments are meant to aid in the description of the creature. Specific die rolls, etc., must be determined based on the overall capabilities of the creature in comparison with the other existing beings in the game environment (humans, in particular).

The form used to describe each of the species in **OTHER SUNS** requires a bit of explanation. First, there is what might be called basic data – i.e. what you need to know first if there's one outside. This includes gravitational, atmospheric, temperature and general electromagnetic tolerances, plus size. This last is more important than you might think – your extraterrestrial might be used to 1 g acceleration, an oxygen-nitrogen atmosphere at 14 pounds/square inch pressure with 21% oxygen content, prefer 22 degrees centigrade, and like the sort of electromagnetic radiation you receive from a G2 star at a distance of 1 Astronomical Unit with a nice ozone layer in the way (i.e. an Earth normal environment) but if he is six meters tall and proportioned to match, the chances are he's not going to fit through the personnel lock on a spaceship designed for use only by human beings.

Next comes the general chemical data. What element is the species based on? Anything living in liquid water temperature range is probably based on carbon, simply because at such temperatures it is the best at forming all the chains, rings, and other complex combinations (with just the right degree of instability) that life goes in for. Note also, that water will probably be used as a medium for most of the chemical reactions, it being a truly handy solvent which is unlikely to destroy the compounds dissolved in it. In this temperature range (that of liquid water), silicon is a rather poor second as a base for a life form, but it might come into its own at temperatures considerably below the freezing point of water – especially in the superconducting temperature ranges. Above the superconducting stage, it is probable that such creatures would be rather slow compared with humans, since many chemical reactions are slower with less ambient energy about. By the same token, one might find high temperature creatures that are considerably faster than humans, but whose organic chemistry is based on a fluorocarbon (something like teflon) which, though far too stable at liquid water temperatures, might have the requisite instability at far higher temperatures.

The Hegemony is a multi-species federation in which virtually all the member species are carbon based life forms living in liquid water temperature environments. Other species, based on widely differing chemistries, and with star flight capability of their own co-exist in the same region of space with the various Hegemonic species. These other species do not wish to occupy the same planets (for obvious reasons) and so the relations between these exotics and the races of the Hegemony have remained peaceful. There is little to trade between such species with widely differing biochemistries save information (and little enough of that), so contact has remained minimal between the carbon based life forms of the Hegemony and the 'exotic' chemistry life forms that roam the common space.

As long as life consists of quasi-stable complex molecules in complex reactions, the introduction of unwanted extra energy in the wrong place by a high speed neutron or a gamma ray is likely to cause damage. Shielding and multiple redundancy of genetic coding and the like may help, but most life forms are still not likely to enjoy sitting atop unshielded atomic piles. And the higher the particle radiation level a being experiences in its home environment, the more unstable radioactive particles it will likely contain at any given time. This might well make one creature's presence lethal to another.

Now for the means by which the creature perceives the universe:

(1) Sight is a reasonably pure sense, using the effect of incoming electromagnetic radiation on certain chemical compounds to detect the photons of incoming light (plus, in some cases, their wavelength).

(2) Hearing uses the slight differences in pressure caused by vibrations of a medium connected in some physical fashion to the organism.

(3) Smell detects and analyzes small (and often trace) amounts of chemicals in a connected medium.

(4) Taste also analyzes chemicals in coarser detail, generally, and also detects some chemical reactions. The taste of some foods (pineapple, for example) is due, at least in part, to a mild corrosive attack on the taste buds.

(5) Touch is actually several senses. First, there is a pressure differential sensing ability similar in nature to hearing, but less sensitive to fine detail. There is also a sensing of texture. Next comes the sensing of chemical reactions on a relatively coarse scale, as in the detection of corrosion of the surface of the organism. This comes under the heading of pain sensing, along with sensing of general damage to the creature and miscellaneous major and minor disfunctions (such as strained or cramped muscles).

(6) ESP may be considered either as yet another electromagnetic wavelength range detection system, some other input source altogether, or some combination of the two, depending upon the species.

(7) Other senses will include any other remote sensing capability not easily fit into one of the other categories.

The additional categories describing the physical characteristics of each species in **OTHER SUNS** are self explanatory.

14.4 A BRIEF HISTORY OF THE L'DORAN HEGEMONY

14.4.1 Dating Systems Used

Humans in the Hegemony date their calendars from the first year of the atomic era (1945 C.E. is the year 0 Anno Atomica, and 1944 C.E. is the year 1 Pre Atomic – Anno Atomica and Pre Atomic are abbreviated henceforth as A.A. and P.A. respectively). The timeline presented is given using the human dating system, rather than the system used throughout the Hegemony in the interest of simplicity.

14.4.2 The Beginnings

The early history of the L'Doran Hegemony is, to a great extent, a history of the Altani. The Altani are a product of genetic engineering and their history as a species is not all that long. So we must begin our discussion with the Old Race Altani from whom the modern breed were developed.

The Old Race Altani were carnivores. As a result, the land area needed to support a single individual was considerably greater than for omnivorous life forms of comparable mass. And Han, the homeworld of the race, was entering an ice age as the Old Race technologists split the atom and began to reach for the stars. The Old Race had not seen fit to limit their numbers to what the land would support. The consequences: Overpopulation, starvation, and war . . .

14.4.3 Timeline

5483 P.A. On Han, the Old Race Altani detonated their first atomic bomb.

5481 P.A. On Han, extensive use of atomic, biological and chemical weapons has destroyed some 62% of the world population and rendered approximately 54% of the planetary surface uninhabitable.

5456 P.A. The world population of Han stabilizes at 350 million – and the world can support little more than this. Birth control measures are formulated, and are rigidly enforced. The world is united at last—under the lash of the K'Taian Assembly, a totalitarian dictatorship.

5434 P.A. First controlled fusion power plant operational on Han.

5430 P.A. First manned orbital flight by an Altani.

5406 P.A. First manned expedition to Han's outer moon. The landing craft is damaged on landing and the mother ship abandons landing crew of 14 and returns to Han.

5399 P.A. Second manned expedition to Lyen-Tyai, Han's outer moon. The expedition returns to Han 140 days later with only four casualties.

5369 P.A. First operational Altani constant boost ion propulsion spacecraft flown.

5366 P.A. First extraplanetary colony begun on Lyen-Tyai. Two thirds of the surface of Han is uninhabitable as a result of biological, chemical, or radioactive contamination.

5364 P.A. First manned expedition launched to Y'Sirau (planet 3 in the L'Dorai System).

5345 P.A. Planetary engineering project begun on Y'Sirau, and colonization effort stepped up (both on Lyen-Tyai and Y'Sirau). Numerous space habitats constructed. 75% of the surface of Han is uninhabitable. K'Taian Assembly, controlling three worlds and numerous space habitats, rules what it now refers to as the Suzrainty of Han.

5339 P.A. Developments in genetic engineering and a primitive science of psionics begin to mesh. Telepathy is proven to exist, and is shown to disregard the speed of light limit of normal electromagnetic radiation.

5323 P.A. The Altani launch their first interstellar probe – a Bussard Ramjet. Beginning of the First Expansion.

5177 P.A. First successful New Race Altani born of genetically altered Old Race stock.

5161 P.A. First generation of New Race Altani number 1000.

5121 P.A. Second generation telepaths number six thousand, third generation telepaths begin to appear. First colony ships launched towards recently discovered inhabitable extrasolar planets – manned, for the most part, by second generation New Race Altani.

5096 P.A. Civil War in L'Dorai system, fomented by third generation New Race Altani against the military dictatorship of the K'Taian Assembly.

5085 P.A. End of Civil War in L'Dorai system. Han totally uninhabited and uninhabitable. The population of Lyen-Tyai is one million, that of Y'Sirau is thirty-nine million. There are 40 thousand New Race Altani, and it is evident that they are incapable of interbreeding with the Old Race. Their natural life spans are also longer – 400 vs 50 Han years (720 vs 90 terrestrial years).

5084 P.A. The part the New Race had in starting the War becomes widely known. Pogroms on Lyen-Tyai and Y'Sirau. Exodus of the L'Drey telepaths begins. End of the First Expansion.

4844 P.A. First slowboat returns from the Inner ring colony of L'Dyen III to Han, manned solely by New Race Altani. Population of the L'Dorai system is 400 million, that of the extrasolar colonists, 1.5 million (virtually all are New Race Stock). Beginning of the Final War.

4623 P.A. Discovery by the New Race Altani of a method of propelling their spacecraft faster than light.

4402 P.A. The Final War ends – the Old Race Altani are virtually exterminated. Some survivors are believed to have escaped the final battles in sub-light speed starships. Planetary engineering project begun on Han to render the homeworld fit for habitation.

4347 P.A. Han fit for habitation. Au Ira Ching proclaims herself empress of the new empire. Beginning of the Second Expansion.

4275 P.A. First Contact, between the H'Reli and the Altani. The H'Reli have FTL starships also.

4183 P.A. First Suzrainty-Combine War (Altani-H'Reli). Beginning of the Expansion Wars.

4171 P.A. First Contact between the H'Reli and the Uquoi and between the Altani and the Uquoi.

4169 P.A. End of First Suzrainty-Combine War.

4167 P.A. First Contact between the Altani and the Korli.

4166 P.A. First Contact between the Korli and the Uquoi.

4165 P.A. First Contact between the Korli and the H'Reli.

4129 P.A. Beginning of the Four Way War between the Korli, the H'Reli, the Altani, and the Uquoi. At no time for the next two hundred sixty years will all four parties be at peace with each other. The alliances change on an almost daily basis.

3869 P.A. End of the Four Way War. Those Korli worlds not under Altani control have been occupied by the Uquoi.

3407 P.A. Successful overthrow of the Military Government on the Inner Ring Altani colony of Ileewoe by Tuu Pack rebels. Rebels appeal to the Syind Combine for aid against the Suzrainty of Han. Beginning of the Civil Wars, and end of the Second Expansion.

3389 P.A. Final Defeat of the Suzrainty High Space Fleet at the Battle of Tak Ruu by the combined Rebel and Syind Combine Fleets. Fall of the Suzrainty of Han.

3374 P.A. Formation of the L'Doran Hegemony out of the ruins of the old Suzrainty of Han. First OverGovernment Councils of the L'Doran Hegemony meet on the Rebel capital world of Ileewoe. Han and its colonies surrender sovereignty to the OverGovernment, together with the colonies of the Korli and the Uquoi. Beginning of the Third Expansion.

3358 P.A. First contact between starships of the Bjoran Allthing and the L'Doran Hegemony.

3245 P.A. Syind Combine surrenders sovereignty to the OverGovernment of the Hegemony.

3046 P.A. Bjoran Allthing joins the L'Doran Hegemony.

2694 P.A. Beginning of the Kor Rebellion against the OverGovernment.

2669 P.A. End of the Kor Rebellion with the destruction of the Rebel main fleet at the Battle of Tak Rin Cluster.

911 P.A. First Contact between the L'Doran Hegemony and the Kryll Web.

906 P.A. Beginning of the Hegemony-Web War. End of the Third Expansion.

6 P.A. End of the Hegemony-Web War with the detonation of the Kryll Home sun. End of the Kryll. On Earth, the beginning of World War II. Beginning of the Fourth Expansion.

24 A.A. Neil Armstrong walks on the Moon.

65 A.A. World War III begins between a U.S.-Soviet alliance and the Chinese Communists. Two thirds of humanity dies in the first three days of the war. The combined space forces of the United States and the Soviet Union eliminate the Chinese forces in orbit and the war ends after seven days.

66 A.A. Soviet and American Spaceforces impose 'peace' upon the world. Beginning of the Terran Empire.

78 A.A. FTL stardrive developed by the Terran Empire.

100 A.A. Beginning of forced 'relocation' of political dissidents to the stars (the Gulag colonies).

381 A.A. First Contact between the L'Doran Hegemony and the Terran Empire. End of the fourth expansion.

396 A.A. First Contact between the L'Doran Hegemony and the Terran Empire. End of the Fourth Expansion.
First Hegemony-Empire War. The Hegemony, though still pire, loses the war on the battlefield then proceeds to win it at the peace table. Humanity retires to its own sector and plots final revenge.

411 A.A. Second Hegemony-Empire War begins.

436 A.A. Second Hegemony-Empire War ends with the total annihilation of the Imperial fleet and the destruction of Earth. Earth's last line of defense in Sol System, Infield Station (located in the asteroid belt) holds out against the Hegemonic forces for three months before it is overwhelmed.

440 A.A. Beginning of The Collapse. Economic strains from the Hegemony-Web Wars and the two Hegemony-Empire Wars result in collapse of Hegemonic Civilization. End of Starflight capability for most major races of the Hegemony. The Dark Times begin.

1160 A.A. First starships refitted by major races of the Old Hegemony.

1198 A.A. Representatives of the Altani, Ata'a, Bjoran, H'Reli, and Uquoi meet in deep space to organize the new Hegemony.

1230 A.A. Beginning of the Fifth Expansion of the L'Doran Hegemony.

1782 A.A. Current date.

14.5 THE COMMONALITY OF MAN

The Commonality is the Human subgovernment within the Hegemony. It directs the activities of the race as a whole and does not concern itself with the details of day to day life on the many worlds of the Commonality. Individual worlds of the Commonality have considerable local autonomy.

14.5.1 Key Worlds

With the exception of Felicity, all the following worlds have the same surface gravity as Earth.

14.5.1.1 CHORA

This world was colonized by 'involuntary relocatees' from the slums of North America during the purges of the second and third centuries. It is now the site of the finest scientific research and teaching institutes in the Commonality (some chauvinistic Humans would say the best in the Hegemony). The scientists and researchers have turned over the business of government to their intelligent computers, which now rule the world. The societal type of this world is S5R17A.

14.5.1.2 DIKTAL

Diktal was colonized by artists and musicians relocated during the so called 'Beatnik Purge' of the early second century in North America.

Diktal was cut off from communication with the Empire shortly after the beginning of the First Hegemony-Empire War (situated as it is on the far side of the Hegemony from the Empire). Rediscovered by Hegemonic survey craft early in the thirteenth century, it was not determined that it was a terro-human world until late in the fifteenth century. The local government resembles a theocracy (insofar as it resembles any terrestrial form of government).

Genetic drift has produced a breed of human on Diktal with silver hair, green eyes, and an average height of eight feet (roll for 3D6+230 for LEN and 2D3 for BLD – other characteristics as per normal Humans). This new variety of human is otherwise like the parent species, though the probability of successful interbreeding is now quite low. The societal type of this world is S16R8A.

14.5.1.3 FELICITY

This world was colonized by survivors of the old North American democracies of Canada and the United States shortly after the development of a cheap and efficient stardrive made escape from Earth possible.

Felicity, so named from orbit, has a surface acceleration of 1.3 gs and orbits an F7 primary. These deviations from Earth normal took only a small toll of colonists compared to the local fauna (which hunt using telepathy). Most of the human telepaths and espers come from this world, and for those wishing to learn of psionics, this is the first human world to visit.

No records exist of the form of government originally attempted on this world; currently there is no real government to all outward appearances, though there is a population estimated at over one billion. When asked about their government, locals have been frequently known to reply with Zen coans. Industrially and technologically, Felicity is an advanced world. The societal type of this world is S4R4B.

14.5.1.4 MAKASARA

One of the last worlds colonized by the Terran Empire before its destruction at the hands of the Hegemony, Anti-OverGovernment feeling is still strong in Makasara, and the locals dream of the glory that was. The local government is a totalitarian dictatorship and the societal type is S17R4A.

14.5.1.5 NEW AUSTRALIA

New Australia was settled largely by involuntary colonists just prior to the Second Hegemony-Empire War. Since then, the population has been kept low intentionally, and thus the world has retained much of its original frontier character. The underground and orbiting automated factories and the self-aware global computer network of New Australia are indications of the high technological level of this world. The societal type of this world is S9R14A.

14.5.1.6 NEW HOME

Another 'Gulag' world, New Home lies on the boundary between the Ata'an Assembly and the Syind Combine. And like Bakunin's Home, it is an anarchist 'state'. It also possesses the best automated defense network of any world in the Commonality, with the possible exception of New Australia. This is a societal type S4R14B world.

14.5.1.7 NEW HOME II

This world was colonized by New Home late in the twelfth century by all of the 'Statists' that New Home didn't want to have around. New Home II is a republican democracy, and now has a population of over 3 billion. The societal type of this world is S11R9A.

14.5.1.8 NEW JERUSALEM

New Jerusalem is the capital world of the Commonality. It is a republican democracy similar in political structure to the United States (ca 1955), and its societal type is S9R14A.

14.5.1.9 NEW JORDAN

Colonized by New Jerusalem in the 15th century of the atomic era, New Jordan formed its own government (along the same lines as the mother world) in the late 16th century. It is now a major exporter of 'recreational pharmaceuticals', and microelectronics. The societal type of this world is S11R11A.

14.5.1.10 NEW LONDON

This is the business capital of the Commonality. It is run by the great corporations for the benefit of all citizens. There are few violent disputes between the Five Families who own the majority of the stock in most of the major corporations (with the notable exception of Instel Corporation — which functions independent of the entire Commonality) and it is a peaceful and enlightened society. This world is a societal type S7R16A.

Lloyds of New London, descendant of Lloyds of London, has its central offices in Landing on North Continent. The lutine bell is still rung when ships insured by Lloyds are lost — it having been salvaged from the ruins of London, Earth, and removed during the First Hegemony-Empire War.

14.5.1.11 NOVAYA AMERIKA

This world is a collectivist dictatorship similar in governmental structure to modern day Soviet Russia. It sits on the Solward frontier of the Hegemony, and is the site of a major OverGovernment Naval Base. The societal type of this world is S17R17A.

14.5.1.12 NOVAYA ROSSIYA

This world is a parliamentary democracy reminiscent of England in the early 1900s. It is a republican monarchy, and the societal type is S12R13A.

14.5.1.13 NOVY MIR

Once used as a 'Gulag' colony by the Terran Empire, Novy Mir is now the most democratic of the Commonality worlds. It is a democracy, with a true one-man-one-vote arrangement using a global telecommunications and computer network (into which all citizens are tied). The societal type of this world is S7R13B.

14.5.1.14 SHAYOL

Shayol was involuntarily colonized by scientists and free-thinkers 'relocated' there by the Terran Empire during the early years of the third century (and then lost during the Collapse). They bootstrapped themselves back up to starflight technology and came looking for Imperials to clobber late in the tenth century. The Empire having long fallen they were somewhat disappointed and have never quite forgiven the Galaxy at large for stealing their chance to 'get even'. Shayol is unique among the fifteen key worlds of the Commonality in that it has no central world government — it is broken up into a collection of city states, each run along Athenian democratic lines. The societal type of this world is S8R17A.

14.5.1.15 WE MADE IT

This world was settled by the remnants of the Imperial Grand Fleet after it failed in its attempt to penetrate to the central worlds of the Hegemony during the first Hegemony-Empire War. Survivors among the crew aboard the various ships of the fleet mutinied, captured the fleet, then fled until fuel and supplies (none to plentiful at the time) ran too low to continue. We Made It was the first terrestrial world they found suitable for human colonization after almost eighteen months of searching and dodging Hegemonic patrols. The current population is high, almost 800 million, and the government is a hereditary monarchy. The societal type of this world is S15R9A.

14.5.2 Instel Corporation

Instel Corporation, though not a world, functions as if it were one. With interests in transportation, manufacturing, telecommunications, salvage, exploration, and banking, Instel dominates the economic life of several of the lesser worlds of the Commonality. It is an independent subgovernment under the Hegemonic OverGovernment allied to the Commonality of Man.

Instel maintains its own Navy and police forces, and Instel Corporation Offices are treated as embassies by the governments of the worlds of the Commonality. It is ruled by a hereditary aristocracy. Periodically the most capable among the workers are elevated to the peerage. The Board of Directors of Instel Corporation is elected from the peerage at 15 year intervals, and has been multispecies in composition since late in the fifteenth century. The societal type of Instel Corporation is S12R11A.

14.5.3 Major Corporations

Though by no means as large as Instel Corporation, there are a number of other businesses of considerable power based within the Commonality. A brief rundown of some of the more important corporations (in order of decreasing size) follows:

14.5.3.1 LLOYDS OF NEW LONDON

Major Interests: Insurance

Lloyds of New London, descendant of Lloyds of London, has its central offices in Newhope on North Continent. The lutine bell is still rung when ships insured by Lloyds are lost — it having been salvaged from the ruins of London, Earth, and removed towards the end of the Second Hegemony-Empire War.

14.5.3.2 SORYHO LINES LIMITED

Major Interests: Transportation and Salvage

This is the largest of the major cargo shipping lines in the Commonality. Approximately one third of all interstellar cargo not carried by Instel within the Commonality is carried by Soryho Lines ships. Soryho Lines is controlled by the Yamada family and the central offices of the Corporation are on Makasara. The current size of the Soryho Lines SuperCargo Fleet is estimated at over five thousand ships, with a total cargo capacity of slightly over five billion metric tons.

14.5.3.3 SEETRAN CORPORATION

Major Interests: Telecommunications

Seetran built and maintains the C+ transceiver network used to tie together the myriad worlds of the Commonality of Man. Seetran is primarily an engineering firm, though it is heavily involved in research in theoretical physics and general relativity.

14.5.3.4 ALDERSON SHIPYARDS

Major Interests: Starship Construction

The Alderson Yards, founded shortly after the beginning of the Fifth Expansion, are among the largest shipyards on New Jerusalem or New Jordan. Noted for their excellence in design and construction techniques (as well as for the shrewdness of their managers and salesmen) the Alderson Yards are extremely important to the continued economic well being of the Commonality capital, New Jerusalem, and to New Jordan as well. The Alderson shipyards are a strictly family owned business—younger sons are called upon to found new shipyards on other worlds of the Commonality upon maturity. Some of the yards have been known to carry out illegal modifications of civilian starcraft, but as there has to date been no evidence of any widespread conspiracy on the part of the Alderson family to support such illegal activities, no action has been taken against the yards as a whole by the Commonality or by the Hegemonic OverGovernment.

14.5.3.5 TERRAZON SALVAGE

Major Interests: Exploration and Salvage

Terrazon Salvage was founded in 1723 by Daniel O'Grady Pierson, a retired Star Arm Survey Branch Commander. Until the Commander's death in 1763, Terrazon Salvage, though small by comparison with such giants as Instel Corporation, managed to maintain the highest return on investment and the greatest annual increase in profits of any salvage or exploration operation on the Solward frontier. In the year of Commander Pierson's death, the firm reported a net profit of thirty-six billion smu. Since the Commander's death, however, Terrazon Salvage has been fighting for its existence (Instel has made no less than five unsuccessful corporate take over attempts in the last 19 years). In addition, certain less than scrupulous managers have involved Terrazon in operations of questionable legality during this time, and both Commonality and Hegemonic police actions have cut heavily into Terrazon profits in the last two decades.

14.5.3.6 CA CYBERSYSTEMS

Major Interests: Artificial Intelligence, Telecommunications, and Manufacturing, and possibly, illicit activities of various sorts.

CA Cybersystems was founded in 1764 by Joachim Cohen, Jr., of New Jerusalem, and Regina Azneipas, of Novaya Amerika. Ms. Azneipas, a noted computer scientist, and Mr. Cohen, a lawyer admitted to practice before the High Courts of the OverGovernment, began CA Cybersystems as an engineering consulting firm, but have since broadened the corporate interests considerably. No evidence of any criminal activity by the firm has come to light in its eighteen year existence, but due to the meteoric rise in corporate income, there is little doubt in the minds of the Commonality governments as to the source of these profits. CA Cybersystems is believed to be the source of the components used to produce the cyborg assassins responsible for the death of Novaya Amerika's premier in 1773.

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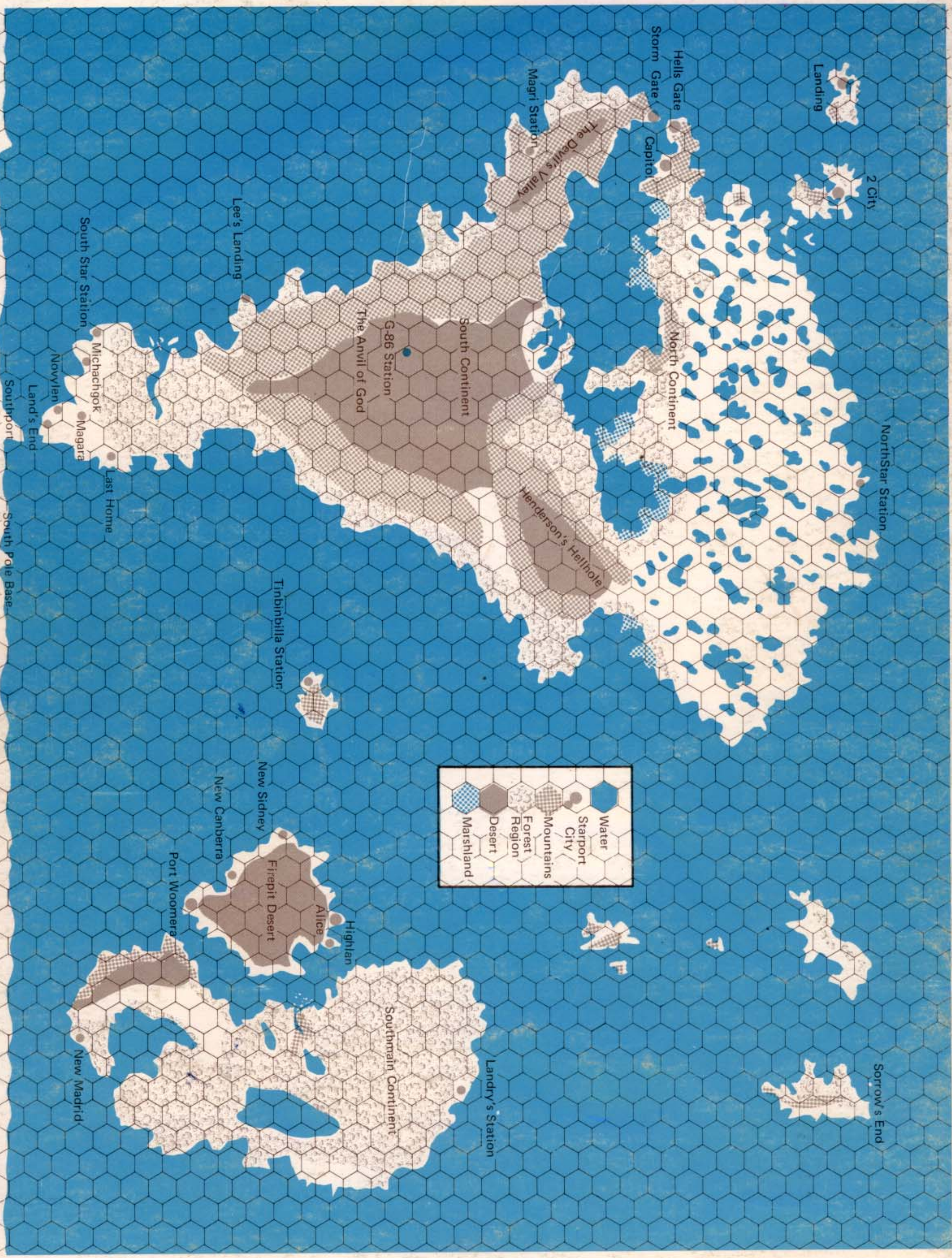
OTHER MATERIAL FOR OTHER SUNS

The Lords of Chaos: This is an Amateur Press Association which includes a section by Niall Shapero called 'Operation: Chaos' which are the notes from his personal **OTHER SUNS** campaign. TLOC also has excellent material by other contributers on **OTHER SUNS** and related subjects. For subscription information, write to Niall Shapero, c/o the Publisher.

Index



Beware: Mercater style projection used on this map results in distortion of polar regions.

Scale: 1 hex is 500 miles or 830 kilometers