Ship Design Rules

By the Junction Crew

Ships in the game exist in two circumstances; on the strategy board, they move around to facilitate logistics and secure territory for their faction. They also engage in tactical combat, in which they maneuver to achieve their objectives and prevent enemy ships from doing the same. To achieve their roles for both of these levels, ships need to be properly constructed and equipped.

Step 1: Adding Components

All systems of a ship except armor and basic sensors/comms are defined as Components. All Components provide a benefit or functionality to the ship, and may have requirements in order to function. Performance of a Component is defined by its Volume; the Component's durability, price, mass, and requirements to function *also* scale with the Component's volume.

Armor isn't considered a Component, and doesn't have its own volume rating. The **Protection Rating** it provides is equal to $120*(\mathbf{m/v^{2/3}})$; m is the total mass of armor on the ship, and v is the total volume the ship's armor is protecting. The ship's **Armor Value** (different from the Protection Rating) meanwhile is simply 20 times the mass of armor on the ship.

When an attack hits an armored ship, the armor's Protection Rating is subtracted from the attack power of the attack. All absorbed attack power is subtracted from the ship's Armor Value. If the ship's Armor Value isn't at 100%, there's a chance of the attack hitting a compromised section of armor and going directly to the ship's Integrity Score with no reduction. This chance is equal to the percentage of the ship's designed Armor Value which has already been removed.

Due to structural considerations, there is a hard limit to how much armor a ship can be fitted with. To be more specific, for every two points of **volume** a ship has, it can mount one **Mass** worth of Armor, rounding down.

All Components have a Durability Rating. The Durability Rating of all Components is added together to get the ship's **Integrity Score**; incoming attacks that get through the ship's armor have their remaining attack power subtracted from the ship's Integrity Score. A ship that reaches zero or lower Integrity Score is Destroyed.

Unless specifically noted, all stats for components are listed on a per-volume basis.

Class 1 Components: Core Systems

Drives

Drives produce *thrust*, which is used to accelerate ships through space. The acceleration rating of a ship is equal to thrust divided by mass, and exists in increments of 4 m/s^2. In tactical combat this determines how much a ship can change its vector by during a turn. On the strategic level, a ship with an atmosphere-capable drive needs an acceleration rating greater than a planet's gravity rating to take off or land there. For reference, Earth has a gravity rating of 3. The acceleration rating is always rounded down to the nearest whole number, while the gravity rating is always rounded *up*.

Drive Type	Density	DUR	Price /vol	Thrust per Volume	Propellant Used per Volume per Turn	Crew to Maintain	Works in Atmosphere?
Chemical Rocket	1	3	0.5	550	20 Rocket Fuel	1/vol	Yes
Thermal Rocket	1	15	1	500	10 Inert Fluid	2 base, +1/vol	Yes
Electric Rocket	1	6	1	40	0.025 Inert Fluid	5 base, +1/10 vol	No
Thermo-Electric Rocket	1	12	2	250	2.5 Inert Fluid	6 base, +2/vol	Yes
Orion Drive	8	24	6	350	0.5 Nuclear Bombs	6 base, +3/vol	Unfortunately
Mini-Mag Orion	5	12	8	275	0.25 Fissile Pellets	6 base, +2/vol	No
Fissile Salt Water	6	18	9	550	0.75 Dissolved Fissiles	8 base, +3/vol	Unfortunately
Fusion Drive	1	11	7	300	0.001 D3He & 1 Inert Fluid	7 base, +2/vol	No
Fusion Torch	1	3	12	225	0.05 D3He	8 base, +2/vol	No

Thermal and Thermo-Electric rockets both need a nuclear power plant to operate. The Thermal Rocket needs a Fission or Fusion reactor matching its volume to operate, while the Thermo-Electric rocket needs a Fission or Fusion reactor of *half* its volume. Provided you accelerate during a turn, this lets you ignore the “Radiators Damaged” crit.

An Electric or Thermo-Electric Rocket needs 1 Energy per 30 **total** engine Volume to operate for one turn, rounding up. In the latter case, this is in addition to the reactor requirement.

In addition to producing thrust, a Fusion Torch (**NOT** Fusion Drives) produces one Energy per 18 Volume, while a Mini-Mag Orion produces one Energy per 24 Volume; both engines round down in this case. A Fusion Torch can do this while idling, while a Mini-Mag Orion must be used for acceleration to produce Energy. Both these engine types have their thrust and energy output reduced by 50% by the Radiators Damaged critical hit.

Aside from their performance, each drive uses a specific propellant. These propellants have different considerations for their storage. All propellant tanks contain 10 points of their propellant and 3 Durability Rating per unit volume. Density and price are listed per unit volume.

Uniquely, the Fusion Drive uses two different propellants in a specific ratio; if either of these propellants is depleted, the drive cannot function.

Tanks

Propellant	Used By	Tank Price	Total Density	Propellant Price	Risks
Rocket Fuel	Chemical Drive, Fuel Cell	2	4	2	Hazardous to Crew
Inert Fluid	Thermal Rocket, Electric Rocket, Thermo-Electric Rocket, Fusion Drive	0.2	5	0.01	None
Nuclear Bombs	Orion Drive	3	10	12	Theft by Terrorists
Fissile Pellets	Mini-Mag Orion	3	10	8	None
Dissolved Fissiles	Fissile Salt Water Drive	3	12	9	Hazardous to Crew Criticality
D-3He Fuel	Fusion Drive, Fusion Torch	1	3	3	None

Chemical Rocket Fuel and Dissolved Fissiles are Hazardous Propellants. If your ship uses either of these propellants and you fall victim to the Propellant Leak critical hit, there are additional nasty effects.

For both propellants, an additional critical hit is rolled on a random table. This represents where the ship's propellant is leaking *to*. Instead of the normal effects, both sorts of propellant leak cause other issues.

Both sorts of Hazardous Propellant Leak will severely worsen another Critical Hit that impacts their affected area. If another critical hit impacts the area, the following occurs:
-Any and all Repair Point costs are doubled
-Magazine hits cause 35% of loaded Guided Weapons to be lost instead of 25%
-Command Hits paralyze the ship's ability to fire and maneuver for a turn
-Any and all Personnel Table crits have their casualties increased by 20%, stacking additively.

Fixing the Propellant Leak via Damage Control removes these risks.

Dissolved Fissiles are even more dangerous, carrying an additional risk. Regardless of whether their leak location receives another critical hit, it now has a Criticality Countdown. This gives you two turns to clean up all the leaked nuclear material before it goes critical. While the propellant leak is ongoing, the amount of Repair Points needed to clean up the mess goes up by one each turn per two Volume of Dissolved Fissiles tank, rounding up.

Cleaning up all of the leaked propellant resets the countdown, even if the propellant leak is ongoing.

A leakt going critical immediately triggers the associated critical hit effect, with the following modifications:
-No amount of Repair Points will remove a negative effect inflicted by Criticality.
-A Magazine or VLS subjected to Criticality loses all its munitions.
-Command modules going critical paralyzes the ship's ability to fire and maneuver for a turn
-Casualties from a crew section going critical are 90%.
-If Criticality inflicts a *propellant leak*, the entire ship is immediately destroyed in a nuclear explosion.

Orion Drive propellant makes terrorism more likely and destructive in campaign play.

Power Plants

Power plants are another crucial system of ships, in that they produce the electrical power needed for all sorts of other Components to operate.

Power Plant	Density	DUR	Price	Volume per Energy	Crew/vol	Notes
Fuel Cell	3	12	1	3	1 per 2 vol	Needs 10 Rocket Fuel per Energy generated
Photovoltaic Panels	0.2	4	1	10-150	1 per 10 vol	Breaks at Acceleration 5+, cannot be repaired during battle, needs external light
Fission Reactor	5	24	10 base, +3/vol	9	10 base, +2 per volume	
Fusion Reactor	3	9	30 base +2/vol	7	15 base, +1 per volume	

Energy doesn't persist between turns, so best make sure to spend it all.

Special Rule: Smallcraft

If a ship's total un-rounded energy generation is one or lower, while being greater than or equal to the total un-rounded energy needs of the ship, the ship doesn't need to track energy during combat. A 1 volume fuel cell will consume 3 Rocket Fuel per turn of operation, while a 2 volume Fuel Cell will consume 7 Rocket Fuel per turn of operation.

Crew Types

Ships need a crew; making command decisions, complex maintenance, damage control, and similar are all best handled by sophont agents in the high-stakes environment of a warship. This crew needs parts of the ship dedicated to their needs, and in return they can confer *significant* benefits to a ship during combat.

There are five types of crew available to chose between: Biological, Construct, Infomorph, Automaton, and Brainwashed. Each crew type has its own quirks and specialties.

Biological crew is excellent at coming up with creative ideas and quick-fixes on the fly. This makes them great at damage control and tending to injured crewmembers under intense pressure.

Construct crew is strong, perceptive, durable, and has superhuman sensors a lot of the time. This makes them excellent choices for all manner of heavy-duty physical activity, along with navigating hazardous environments.

Infomorph crew exists inside computer systems, and is excellent at everything to do with electronics and data-processing. This makes them naturals at cyberwar, and invaluable assistants in quite a few other endeavors.

Automaton crew represents non-sentient robots. It performs its duties competently, but without adaptability or creativity. It doesn't need pay and has its Morale score permanently locked at +2, costing 1 per hundred Automaton Crew manufactured.

Brainwashed crew is just that, Brainwashed. Be it through extreme ideological indoctrination or more *direct* means, these individuals have had their free will stripped away. Brainwashed crew don't need pay, are "free" to recruit, and have their Morale permanently locked at +0. However, free-willed crew serving on the same ship takes a -4 Morale penalty. Free-willed crew serving in the same *fleet* takes a -2 Morale penalty instead.

That said, all these crew need someplace to live, something to eat, and stuff to do in their downtime. That is the purpose of Crew Quarters, Stores, and Recreational Facilities respectively. All of these have major effects on Morale.

Living Quarters

Type	Density	DUR	Price /vol	Crew per volume	Morale Modifier	Description
Sardine Can	1	3	1	235	-2	The absolute bare minimum of space and facilities to theoretically meet all of a crew's needs. All beds and crew spaces are shared
Cramped	1	6	1	195	-1	There is now some safety margin to account for the vagaries and inconvenience of real life, but everything is still shared
Spartan	1	6	1	155	0	Crew members now have a small personal effects locker and their own bunk
Decent	1	9	2	115	+1	Crew space now includes dedicated recreational spaces for personnel who are currently off-duty
Good	1	9	2	75	+2	Crew quarters are now divided into compartments for 4-6 personnel, affording crew at least *some* privacy

As a side note, Airliner-style seating counts as "Sardine Can" conditions.

Stores

Type	Density	DUR	Price /vol	Crew sustained for 1 turn/vol	Morale Modifier	Description
Survival Rations	1	3	0.5	250	-2	Ration Bars, machine-processed air, bare minimum of maintenance supplies for synthetics
Basic Rations	1	3	1	200	0	MREs, common spare parts, machine-processed air
Good Rations	1	3	1.5	180	+2	Cooked meals from pre-packed ingredients, comprehensive spare parts, machine-processed air.
Algae Reactor	3	12	2	70 (Doesn't deplete)	0	All the spirulina and tilapia you could want ever want to eat, bio-processed air, basic fabricator for synth parts. Needs 2 crew per volume to operate.
Aquaponics Bay	2	6	3	50 (Doesn't deplete)	+2	Lots of fresh veggies and seafood, bio-processed air, comprehensive fabricator shop for synth parts. Needs 4 crew per volume to operate.

While Crew Quarters and Stores are obviously necessary, recreational facilities are considerably less so. Still, they do a lot to improve the crew's morale. The +1 modifiers from different *types* of recreational facilities stack, but not from multiple instances of the same recreational facility.

Recreational Facilities

Type	Density	DUR	Price	Crew Served	Morale Effects	Description
VR Chamber	1	3	5	300	+1 Biological Morale +1 Infomorph Morale	A space where biological and digital crew can socialize in a reasonably physical manner.
Recreational Server	2	9	3	300	+1 Construct Morale +1 Infomorph Morale	A server containing a simulated world for synthetic crewmembers to enjoy.
Tabletop Game Room	1	9	1	300	+1 Biological Morale +1 Construct Morale	A room for playing board games, card games, and tabletop RPGs. Several are provided.

It's worth noting that there *is* a loophole in terms of crew accommodation morale modifiers. If a ship's crew spends most of their time living on a *different ship* (for example, a few small assault craft attached to a tender vessel), then they use the morale modifiers from that ship's crew accommodations.

Command Modules

You need to have *somewhere* to command the ship from, and that's the purpose of Command Modules. A ship with no Command Modules is dead in the void, as is one with no crew to *man* said Command Modules. Command Modules *don't* scale with volume, but you get the full benefits of redundancy for having more than one of them.

Type	DUR	Mass	Price	Crew	Notes
Civilian Bridge	6	1	1	6	Cannot operate weaponry or ECM
Warship CIC	12	2	3	20	
Shipmind Brainframe	12	3	6	1	A Shipmind counts as Infomorph Crew for the purposes of Morale. +2 ECM and Sensors Adds +1 to Acceleration if the ship already has Acceleration 1 or better. Reduces Jump Engine energy cost by 10%. In circumstances where this ship is being attacked and a hit isn't guaranteed, the odds of the attack missing are increased by 10%, then by an additional 5% for every +1 Morale above zero. Doubles the penalties from negative Morale on Resolve and Mistreatment checks.

The single crewmember required for the Shipmind Brainframe is a maintenance technician, and can therefore be diverted to damage control during combat.

The modifiers provided by the Shipmind Brainframe do not stack.

In addition, Command Modules and Crew Quarters can be fitted with radiation shielding. This both significantly increases the room's Durability rating, and also protects the crew within from Neutron Bomb attacks. Radiation Shielding comes in two levels. The protection provided by Radiation Shielding is *in addition* to that provided by armor.

Crew in a Command Module automatically benefit from Radiation Shielding applied to a Command Module. Crew assigned to Medbay and the Nerve Center automatically benefit from Radiation Shielding applied to crew quarters. Crew assigned to Damage Control, Medevac, or Engineering need to evacuate from their normal posts for a turn to benefit from Radiation Shielded quarters; you can declare you're doing this as part of the Neutron Bomb attack, depriving yourself of the relevant effects during the following Maneuver and Crew phases.

Type	+Density	+DUR	Price	Protection
Light	4	10	2	This Command Module is immune to Light Neutron Bomb attacks. It counts as having 200 more Protection Rating than normal against Heavy Neutron Bombs.
Heavy	8	20	6	This Command Module is immune to both Light and Heavy Neutron Bomb attacks.

As a reminder, this is a modifier to a Component rather than a Component in its own right.

Jump Drives

Getting between stars in a timely manner means circumventing the speed of light, and the Jump Engine is the tool allowing ships to do exactly that. By punching a short-lived hybrid of a wormhole and a warp bubble through a parallel space, a Jump-equipped ship can cross the distance between stars in an instant… from their perspective. Jump Space runs at a *much* slower time rate than normal spacetime, meaning that a ship jumping to the extent of their jump range vanishes from the wider universe for approximately a *month* before arriving. Ships with a jump range longer than they're actually *using* show up considerably sooner, but no-one's ever been able to lose less than forty seconds when jumping, no matter how short the range.

Jump range is determined by the percentage of the ship's **mass** that is Jump Engine, coupled with the type of Jump Engine the ship is fitted with. You cannot effectively use multiple types of Jump Engine *for the same Jump*. Attempting to do that degrades performance to be equivalent to an Interdictor Jump Engine.

In order to get any use out of a Jump Engine at all, it must be capable of providing at least one point of Jump Range. Engines meeting this criterion can synchronize together for longer jumps so long as the type matches, counting as a single Jump Engine of the appropriate size.

Jump Drives can also be used to disrupt Jump Space, preventing nearby ships from performing Tactical Jumps. Spend Energy up to the maximum your Jump Engine can use, gaining one Interdiction Strength per unit of Energy spent. Interdiction Strength lasts for one turn.

Each point of Interdiction Strength makes all ships treat their Jump Rating as one rank lower. Interdiction Strength decreases by one for every squaring of distance (1, 4, 9, 16, 25...) between the interdicting ship and the jumping ship. A ship needs an effective jump rating of one or higher to perform a tactical jump.

Interdiction of any strength resets all progress on performing a non-combat jump.

Type	DUR	Density	Price /vol	Volume per Energy Needed	Crew to Maintain	Turns lost during tactical jump	Jump Range Formula
Interdictor	3	6	1	6	5/vol	5	10% of ship mass for Jump 1, x2 per jump range
Rudimentary	6	8	1	11	10 base, +4/vol	3	8% of ship mass for Jump 1, +8% per jump range
Standard	12	8	4	13	5 base, +2/vol	2	4% of ship mass for Jump 1, +4% per jump range
Tactical	24	10	10	8	5 base, +3/vol	1	4% of ship mass for Jump 1, +4% per jump range
Long-Range	9	8	15	10	6 base, +4/vol	4	2% of ship mass for Jump 1, +2% per jump range
Industrial	21	12	3	15	2 base, +1/vol	3	1% of ship mass for Jump 1, x4.5 per jump range

Outside combat, all Jump Engines save Interdictor models only need a tenth of their listed power; the listed entries are for when a ship absolutely needs to jump RIGHT NOW. Charging a tactical jump in a single turn always needs at least one Energy, regardless of the size of the jump engine. Outside combat a ship can afford to take their time preparing to jump, instead of frantically shoving energy into the engine as quickly as possible. Interdictor Engines don't get that benefit.

As a clarification, "Turns lost during tactical jump" isn't how long it takes to charge up for a Jump. That's instant, assuming the ship has the energy available. Instead it means that after the jump happens, it takes that many turns for the ship to pop back into reality. For a tactical drive jumping on Turn 1, it misses Turn 1's crew phase and Turn 2's firing phase, reappearing **at the end of** Turn 2's maneuver phase.

Due to the extreme time dilation inherent to Jump travel, stores do not noticeably deplete for a ship which has used the entirety of its jump range on a given turn. Ships in this situation also do not need to make a mistreatment check for this turn.

Class 2 Components: Utility Payloads

There's any number of jobs you might want a spaceship to do aside from fighting stuff. The equipment needed to do those jobs is what this section is dedicated to.

Component	Density	DUR	Cost	Crew	Function
Cargo Pod Rack	1 - 9	6	1	None	Transports cargo
Shuttle Hangar	1 - 3	3	2	4/vol	Stores one Shuttle per volume. Shuttles can be used to land Ground Forces.
Docking Gantry	0.1	6	1	None	Used to stick two ships together.
Mining Equipment	6	30	3	1/vol	Used to collect Ore.
Materials Refinery	4	18	20	1/vol	Converts Ore to Refined Materials.
Basic ISRU Module	3	12	6	0.5/vol	Produces Rocket Fuel or Inert Fluid from Ore.
Advanced ISRU Module	5	6	18	3/vol	Produces Fissile Pellets, Dissolved Fissiles, or D3He from Ore.
Industrial Fabricator	3	9	15	2/vol	Uses Refined Materials to make Manufactured Goods, Supplies, Automatons, or people. Requires Fissile Pellets and D3He for produced Supplies to be elligible for conversion to Guided Weapons requiring nuclear material. Can be used to make Orion Drive propellant.
Construction Equipment	5	24	5	4/vol	Used to construct Infrastructure using Refined Materials and Manufactured Goods. Can also be used as an improvised shipyard, especially in conjunction with a Docking Gantry.

Cargo Pod Rack

One of the simplest things you might want to do with a spaceship is move cargo pods full of freight from one place to another. The cargo pod rack facilitates this function, being capable of moving food, ore, refined materials, or manufactured goods without much trouble. By default cargo pod racks have Density 1, 6 DUR per volume, and price per volume of 1. Biological cargo (such as food) has a Density of 2. Ore and refined materials both have a density of eight. Manufactured goods have a density of five. Supplies count as Manufactured Goods for the purpose of shipping.

Shuttle Hangar

Sometimes you just need an auxiliary craft to move some important personnel around. In these circumstances the Shuttle Hangar is quite excellent at that job. Density 3 with a shuttle in it, Density 1 without. The hangar itself has a price of 2, the shuttles cost 4 each. Shuttles have an acceleration rate of 8 and 60 delta v, using engines that work in atmosphere. They are not realistically useful as guided weapons.

Shuttles can be used as landers, with each one capable of carrying 2% of a single unit of Ground Forces.

The hangar has DUR 3, and the shuttle has DUR 9. Maintaining a shuttle requires 4 crew.

Docking Gantry

While any two ships can run a propellant hose between them and set up a pressurized gangway for crew, it takes rather more than that to stay properly docked during combat maneuvers or a Jump. When docked, the sub-vessels count against their mothership's mass as far as jump range is concerned. Sub-vessels may not contribute to jumps while docked. Docking gantries have a density of 0.1, 6 DUR per volume, and a price of 1 per volume.

To properly dock a ship, the gantry must have at least 20% of the volume of the ship to be docked. Already docked ships may be undocked during the maneuver phase in combat, but docking may not take place until after the battle is over.

Mining Equipment

Used for violently disassembling asteroids in order to get their delicious mineral contents, Mining Equipment has Density 6, 30 DUR per volume, and a price per volume of 3. When in active use asteroid mining, each volume point of mining equipment can extract 360 Mass of Ore per monthly strategic turn.

Mining equipment of Volume 10 or greater contains a mining laser which could be used as a base stats laser weapon in an emergency; this is the only "weapon" which a Civilian Bridge can use in combat.

Mining equipment requires 1 crew per volume to operate.

Materials Refinery

The Materials Refinery is used for converting raw ore into the advanced materials used by fabricators to manufacture high-tech parts. Refineries have Density 4, 18 DUR per volume, and a price per volume of 20. Refineries need 1 crew per volume. Refinery output is non-linear, greatly favoring larger refineries.

The refinery equation for Ore input per monthly strategic turn is 120*v^1.3. While a Volume 1 refinery can only handle a third of the Ore output of one volume of Mining Equipment, it hits parity at Volume 43. By Volume 300, a Refinery can accept the Ore output from nearly twice its volume in mining equipment. The ratio only gets better from there. Ore is converted into Refined Materials at a 1:1 rate.

Basic ISRU Module

The device used to turn Ore into Rocket Fuel and Inert Fluid, a Basic ISRU Module has Density 3, 12 DUR per volume, and a price per volume of 6. A Basic ISRU Module requires 1 crew per 2 volume to maintain.

In use, one Volume of Basic ISRU Module can produce 480 points of either Rocket Fuel or Inert Fluid from 480 mass of Ore per monthly strategic turn. The 240 leftover Ore mass is no good for producing propellants, but can still be fed to a Materials Refinery for Refined Materials production.

Advanced ISRU Module

The device used to turn Ore into Fissile Pellets, Dissolved Fissiles, and D-3He fuel, the Advanced ISRU Module is a frighteningly effective isotope separation and nuclear transmutation machine. An Advanced ISRU Module has Density 5, 6 DUR per volume, and a price per volume of 18. An Advanced ISRU Module requires 3 crew per volume to maintain.

When used to produce D-3He fuel, an Advanced ISRU Module can produce 400 points of D-3He fuel

from 480 mass of Ore per monthly Strategic Turn in a process involving heavy neutron bombardment and D-D fusion. The remaining 360 mass of Ore can be put through a Materials Refinery as normal.

When producing Fissile Pellets or Dissolved Fissiles, only 12 and 20 points of those propellants can be produced from 480 mass of Ore per Strategic Turn respectively. The remaining 475 Mass of Ore can be used for anything except fissile pellet/dissolved fissiles production.

Industrial Fabricator

Miniaturized general purpose automated factories, Industrial Fabricators are the solution to the problem of turning Refined Materials into Manufactured Goods. Industrial Fabricators have Density 3, 9 DUR per volume, and a price per volume of 15. An Industrial Fabricator requires 2 crew per volume to maintain.

One volume of Industrial Fabricator can turn 240 mass of Refined Materials into 240 mass of Manufactured Goods (or Supplies) per strategic turn. 1000 Automatons or 1000 untrained personnel counts as a single Mass worth of Manufactured Goods for this purpose.

By default, the Supplies produced by an Industrial Fabricator contain no nuclear material, and therefore cannot be converted to Guided Weapons containing the following parts: Nuclear Bomb, Neutron Bomb, Casaba Howitzer, NEFP, Excalibur, Nuclear Thermal Thruster, Nuclear Thermo-Electric Thruster, Fissile Salt Water Thruster, Fusion Thruster. Such Supplies are to be flagged as Non-Nuclear.

To change this, twenty points each of Fissile Pellets and D3He must be included with each 240 Mass of Supplies produced.

Industrial Fabricators are needed to make Orion Drive bombs; one Mass of Refined Materials plus one point of Fissile Pellets and one point of D3He makes three points of Orion Drive bombs. One volume of Industrial Fabricator can make 300 points of Orion Drive bombs per month in this manner.

Construction Equipment

Construction Equipment is how you build bases, shipyards, *cities*. It can *technically* be used to build ships too, but it’s not great at that. Construction Equipment has Density 5, 24 DUR per volume, and a price per volume of 5. It requires four Crew per volume to operate.

Construction Equipment can be used to produce Infrastructure; for every 30 Volume of Construction Equipment on a ship, it can produce one point of Military Infrastructure per strategic turn. This consumes 1,000 Mass of Refined Materials and 250 Mass of Manufactured Goods. If building Infrastructure on a rocky planet, the ship must be capable of landing and takeoff for that planet. The requirements for a single point of Civilian Infrastructure are 1,000 times higher than the requirements for Military Infrastructure.

Construction Equipment can also build or repair ships. If there is no docking gantry capable of accommodating the ship being worked on, every 70 volume of Construction Equipment counts as one Infrastructure point of shipyard. If there *is* an appropriate docking gantry available, then every *40* volume of Construction Equipment counts as an Infrastructure point of Shipyard.

Class 3 Components: Weaponry

Weapons can be divided into two broad categories: direct fire and guided. Both of these categories have multiple options and plenty of room for customization. Direct fire weapons are unguided, going in a straight line after being shot out of some kind of gun. They generally don't have to worry about ammunition within the space of a single engagement. Guided weapons are basically disposable miniature ships; they're highly versatile and have plenty of uses aside from direct attack, but they're also in limited supply on the ships that use them.

Direct Fire Weaponry

The targeting rule for Direct Fire is dead simple; pick a target, shoot them, they take damage. Direct fire weaponry has three range brackets: Precision Targeting, Guaranteed Hit, and Probable Hit. Within Precision Targeting range, chances of a critical hit are tripled and the attacker can choose which critical hit table to roll on. Within Guaranteed Hit range, direct-fire weaponry rolls its critical hits at normal odds against random crit tables. Within Probable Hit range, there is a 50% chance of shots missing completely. These range brackets are abbreviated as PT/GH/PH respectively.

All direct-fire weaponry has a specific set of base stats at Volume 1; as points of volume are added, their stats can be upgraded. All direct-fire weapons can have their range and attack power upgraded, along with a special stat that's unique to that weapon type. Upgrades from volume don't improve *every* stat; each additional volume provides only one upgrade point, and you must *choose* which stat it applies to.

Weapon type	Density	DUR	Price /vol	Vol/ Energy Need (Min 1)	Crew /vol	Base Range PT/GH/PH + Range per upgrade PT/GH/PH	Base Attack Power +Attack per upgrade	Special Stat (details below table)
Macron Gun	2	6	3	35	6 base, +2/vol	1/2/4 +1/+2/+4	14 +14	Area Denial (Base: 1) +1 per upgrade
Laser	3	9	3	30	5 base, +3/vol	6/8/10 +3/+4/+5	12 +12	Redundant Emitters (Base: 0) +1 per upgrade
Particle Beam	2	6	3	30	8 base, +2/vol	2/4/6 +2/+4/+6	4 +4/8/12/16 +16 after	Target Armor Effectiveness (Base: 75%) x0.85 per upgrade (Minimum 20%)

Macron Guns have Area Denial as a secondary attack mode. During the firing phase, they can mark hexes within twice their PH range equal to their Area Denial stat. Any ship or guided weapon that enters or passes through marked hexes during the following maneuver phase takes a guaranteed hit, dividing the weapon's normal attack power by the number of marked hexes. All marked hexes from a single gun must be connected. After the following maneuver phase, those hexes are no longer hazardous.

A ship or guided weapon can skip over Area Denial hexes that were placed closer to their current position than half their total speed without taking damage. An object that ends its maneuver on an Area Denial hex takes damage regardless of how it was moving.

Lasers can have Redundant Emitters, allowing them to take hits without going offline. A "weapon disabled" critical hit to a laser with Redundant Emitters only disables one emitter, allowing the rest of the weapon to keep shooting. In addition, a laser can divide its attack power between multiple targets, up to the number of currently active emitters.

That said, this *does* have some limitations. There's only so big you can make a laser emitter while still having them be redundant, doubling the volume cost of laser range upgrades for a laser with redundant emitters. In addition, a particle beam able to penetrate ship's armor **completely ignores** this sort of redundancy.

As was alluded to, particle beams have the ability to penetrate armor. At base, only 75% of armor's protection rating is subtracted from a particle beam's Attack Power. Subtracted attack power (rounded up) counts against the armor for the purpose of compromising armor coverage. Any leftover attack power (rounded down) hits whatever component that armor was protecting.

Upgrading armor penetration *decreases* the percentage of the armor's protection rating that is subtracted from the particle beam in question. One upgrade reduces it to 64%, then to 54%, 46%, 39%, 33%, 28%, 24%, then finally 20% at eight upgrade points into Target Armor Effectiveness. Yes, this means particle beams with better penetration are *worse* at trashing an enemy's armor.

Guided Weapons

Guided weapons come in two sizes (Light and Heavy); each size has a variety of available payloads, propulsion options, and guidance packages available. But first, we need to cover the launchers; aka the parts that *stay* on the ship. There are two basic types; VLS and EM Catapults.

VLS combine the magazine and launcher into a single unit; they can fire off potentially their entire load in one go and are lighter for a given payload, however they don't impart any sort of starting kick to the guided weapon in question. EM Catapults have a separate magazine from the launcher and a limited rate of fire, but can provide their guided weapons with a *large* initial boost.

Beyond that, each guided weapon is composed of three segments: propulsion, payload, and guidance. Propulsion defines how a guided weapon can maneuver, defining acceleration and delta v. Payload defines what the guided weapon can *do*, be it attacking things or performing some sort of defensive or utility function. Guidance defines what the weapon *hits*, since it's able to correct its course en route to the enemy. By default, Light guided weapons have 1 Durability, while Heavy guided weapons have 8 Durability. Guided Weapons are immediately destroyed by any attack that overcomes their Durability Rating, but their Integrity isn't otherwise tracked.

Payloads come in two types: Warheads and Modules. Warheads destroy the guided weapon when used, modules don't. Guided weapons with warheads are called missiles, ones with modules are called drones. Guided weapons can only have one payload. One of each segment in general, really.
Guided weapons accelerate *after* ships during the Maneuver phase, allowing them to set up impact trajectories despite the normal simultaneous resolution of maneuver.

Guided weapons resolve their hits during the firing phase, at this point the target ship may attempt to defend itself via Point Defense. This represents having anticipated the incoming guided weapon and shot it down *retroactively*. Any direct-fire weapons that weren't used for anything other than Point Defense last turn may shoot at the incoming guided weapons; Macron Guns can shoot targets equal to their Area Denial stat, while lasers may shoot targets equal to their Redundant Emitters stat (minimum 1). Particle Beams may only shoot a single target. The weapon's normal attack power is divided by the number of targets engaged when used for point defense, rounding down.

Due to the small size of Guided Weapons, Light Guided Weapons can only be targeted from a maximum of fifteen hexes away; Heavy Guided Weapons can only be targeted from a maximum of *twenty* hexes away.

Guidance	Price	Performance Notes
Heat Seeking	0.1/1	Always rolls its crits on the Power table, with three times crit chance. If jammed, rolls crits on random tables, with normal crit odds and a 50% chance of missing completely.
Home On Jam	0.1/1	If the target ship has ECM active, always causes the “ECM Damaged” critical hit regardless of ECM rating or crit rolls. Otherwise it always misses.
Imaging Radar	0.1/1	Always rolls its crits on the Systems table, with three times crit chance. If jammed, rolls crits on random tables, with normal crit odds and a 50% chance of missing completely.
Center of Mass	0.1/1	Rolls its crits on random tables. If jammed, 75% chance of hitting normally anyway, 25% chance of missing completely.
Remote Guidance	0.1/1	Rolls its crits on whatever table you want it to. If jammed, has a 25% chance of hitting randomly, with a 75% chance of missing completely.

Payloads	Type	Price	Usage
Kinetic	Warhead	Free	**Light:** Passively increases missile DUR to 3. Can attack ships in the same hex, with Attack Power equal to the relative velocity squared. **Heavy:** Passively increases missile DUR to 24. Can attack ships in the same hex, with Attack Power equal to eight times the relative velocity squared. Kinetic missiles killed by Area Denial don’t count as destroyed until the end of the next firing phase. If such missiles weren’t jammed (or *were* jammed and had Home on Jam) they have 80% odds of hitting normally. If they *were* jammed, they miss.
Inertial Mine	Warhead	0.1/1	An Inertial Mine is a variant of kinetic payload; it lacks the increased durability and cannot delay destruction from area denial. In exchange, it has a second attack mode. In this attack mode, the Inertial Mine hits *every* ship or Guided Weapon in the same hex as it with Attack Power a tenth of its normal value at current velocities. This targets random hit locations when attacking ships. This counts as Area Denial as far as Kinetic Missiles are concerned. Multiple Inertial Mines used in the same hex during the same phase stack their Attack Power, instead of interfering with each other. Missiles fitted with Inertial Mines can be fired as point defense, even if not launched before the firing phase on which it is needed. Inertial Mines used for point defense in this manner can only affect Guided Weapons that started their turn in the same hex as each other. This *still* counts as Area Denial, as far as Kinetic Missiles are concerned.

Nuclear Bomb	Warhead	0.6/5	**Light:** Can attack a ship in the same hex, hitting with 200 Attack Power. If a miss is induced by ECM, it does no damage. **Heavy:** Can attack a ship in the same hex, with 2000 Attack Power. Other units in the same hex are damaged as if hit by a Light Nuclear Bomb. This includes Guided Weapons. Both sizes of nuclear bomb automatically deal ten times their normal Attack Power to a ship's Armor Value, regardless of what the armor's Protection Rating is. Missiles fitted with Heavy Nuclear Bombs can be fired as point defense, even if not launched before the firing phase on which it is needed. Heavy Nuclear Bombs used for point defense in this manner can only affect Guided Weapons that started their turn in the same hex as each other. If the targeted salvo contains Guided Weapons with Chemical Lasers or Light Gas Guns, those units can attempt to shoot down the defensive nukes.
Neutron Bomb	Warhead	0.8/6	Neutron Bombs can attack a ship in the same hex. If that ship is completely unarmored, all crew are killed, and all command modules are destroyed. Armor protection converts these automatic kills to regular Casualties at a rate of 1% per Protection Rating for Light Neutron Bombs, and 1% per 3 Protection Rating for Heavy Neutron Bombs. Once 100% of automatic kills have been converted to regular Casualties, further protection negates Casualties at the same rate. The ship's effective Protection Rating is reduced by the percentage of the ship's Armor Value that has been compromised. Radiation Shielding applied to components is not affected by this reduction. At 50% regular Casualties, Shipminds are only disabled instead of destroyed, needing 2 Repair Points to reactivate. At 50% Casualty Negation, Shipminds are unharmed. Heavy Neutron Bombs affect other ships in the same hex as if they were directly hit with a Light Neutron Bomb. They also destroy all other Guided Weapons in the same hex. Missiles fitted with Heavy Neutron Bombs can be fired as point defense, even if not launched before the firing phase on which it is needed. Heavy Neutron Bombs used for point defense in this manner can only affect Guided Weapons that started their turn in the same hex as each other. If the targeted salvo contains Guided Weapons with Chemical Lasers or Light Gas Guns, those units can attempt to shoot down the defensive nukes.

Casaba Howitzer	Warhead	0.8/6	**Light:** Gives the guided weapon a one-shot direct fire attack with a range of 5/8/10, provoking point defense if within those weapons' Guaranteed Hit range. A Light Casaba Howitzer hit has 850 Attack power. **Heavy:** Gives the guided weapon a one-shot direct fire attack with a range of 8/12/16, provoking point defense if within those weapons' Guaranteed Hit range. A Heavy Casaba Howitzer hit has 8,000 Attack power.
Nuclear Explosively Formed Penetrator (NEFP)	Warhead	1/7	**Light:** Gives the guided weapon a one-shot direct fire attack with a range of 1/3/5, provoking point defense if within those weapons' Guaranteed Hit range. Each 150 volume the target ship has increases range by +0.5/+0.75/+1. A Light NEFP Hit has 4,000 Attack power. **Heavy:** Gives the guided weapon a one-shot direct fire attack with a range of 1/3/5, provoking point defense if within those weapons' Guaranteed Hit range. Each 150 volume the target ship has increases range by +1/+1.5/+2. A Heavy NEFP Hit has 36,000 Attack power.
Bomb-Pumped X-Ray Multiple Laser (Excalibur)	Warhead	1.2/8	**Light:** When used, this warhead has 20 total Attack power, divided between any number of targets within 10 hexes. **Heavy:** When used, this warhead has 180 total Attack power, divided between any number of targets within 16 hexes. A missile fitted with an Excalibur warhead can be used for Point Defense, even if not launched before the firing phase on which it is needed.
Decoy	Module	0.3/4	If this drone is in the same hex as a friendly ship currently being attacked and the attacker is jammed, the attack's target is chosen randomly between the ship and all applicable decoys. This does not work against Home On Jam missiles. Light Decoys only work for ships of 300 signature or less, while Heavy Decoys only work for ships of 800 signature or less. Decoys can also be fired as part of a guided weapon salvo; in this role, enemy point defense will always prioritize the Decoys. For this purpose, Light Decoys have DUR 4 and Heavy Decoys have DUR 32. Indiscriminate attacks (such as Nuclear Bombs, Area Denial, or Inertial Mines) are not distracted by Decoys, nor do they treat the Decoy has having increased Durability compared to regular Guided Weapons.

EM Deflector	Module	0.5/4	EM Deflector drones redirect particle beams; this can be used for defending against enemy particle beams, *and* to curve your own beams around the enemy's deflector drones. To force an enemy particle beam to miss, the EM Deflector Drone must be positioned directly on the straight line between the attacker and the ship being defended. EM Deflectors have a base deflection chance, which improves based on the distance between the drone and the ship it's defending. For Light Deflectors, it's 30% + 5% per hex. For Heavy Deflectors, it's 50% + 10% per hex. In all cases, multiply the deflect chance by the beam's Target Armor Effectiveness rating (75% means multiply by 0.75) to get the total deflection chance. Additional EM deflectors in line with the beam path modify the deflection chance; Light Deflectors adjust the odds by ± 10%, while heavy deflectors adjust the odds by ± 25%. This is subject to the Target Armor Effectiveness rating as normal. Defending EM Deflectors raise the deflection chance, while those belonging to the attacker *lower* the deflection chance. Any enemy EM deflector eliminates the precision targeting crit multiplier and table-selection ability, regardless of if a miss is forced or not.
Light Gas Gun	Module	0.3/3	**Light:** Gives the guided weapon a reusable direct-fire attack with a range of 1/2/3, provoking point defense if within those weapons' guaranteed hit range. This weapon has 2 Attack Power, and can be used for Area Denial targeting a single hex. **Heavy:** Gives the guided weapon a reusable direct-fire attack with a range of 1/2/4, provoking point defense if within those weapons' guaranteed hit range. This weapon has 16 Attack Power, and can be used for Area Denial targeting a single hex.
Chemical Laser	Module	0.3/3	**Light:** Gives the guided weapon a reusable direct-fire attack with a range of 3/5/7, provoking point defense if within those weapons' guaranteed hit range. This weapon has 1 Attack Power. **Heavy:** Gives the guided weapon a reusable direct-fire attack with a range of 4/7/10, provoking point defense if within those weapons' guaranteed hit range. This weapon has 8 Attack Power.

Laser Relay	Module	0.5/4	Laser Relays can be targeted by friendly laser beams. Instead of being destroyed, they may then use the attack power from those lasers to perform their own laser attacks. Laser Relays may combine laser power from up to four sources, and divide it between up to four targets. Shipboard lasers and chemical laser modules are compatible with laser Relays, Excalibur missiles aren't. Laser Relays may target other Laser Relays in a chain. Targeting Laser Relays is subject to the normal range restrictions on targeting guided weapons. Laser relays cannot form closed loops, and cannot store laser power between turns. **Light:** Light Laser Relays have a range of 10/15/25. They can handle a total of 100 Laser Attack Power. **Heavy:** Heavy Laser Relays have a range of 15/25/35. They can handle a total of 650 Laser Attack Power.
Missile Rack	Module	1/3	A Missile Rack acts like a VLS mounted to a Guided Weapon, enabling them to launch additional Guided Weapons. If the drone is retrieved, its missile racks can be reloaded. **Light:** Can hold six mini-missiles. These mini-missiles maneuver like they have a Solid Rocket Motor, and use the Kinetic Missile damage formula with a multiplier of x0.1. The mini-missiles are treated as having Center-of-Mass Guidance. They have one Durability, and no ability to penetrate Area Denial. Mini-missiles don't need to be tracked for resupply purposes. **Heavy:** Can hold four Light Guided Weapons. These are full-fledged Guided Weapons, built according to the normal rules. The carrier must have sufficient Light Guided Weapons in magazines to replenish its drone's stocks.

Propulsion Segment	Acceleration	Delta v	Price	Notes
Solid Rocket Motor	20	20	0.1/1	Can only be used during one turn
Liquid Fueled Rocket	18	30	0.2/2	
Nuclear Thermal	14	56	0.4/4	
Nuclear Thermo-Electric Hybrid	12	84	0.5/5	
Fissile Salt Water	25	150	0.6/6	If destroyed by Magazine Hit, deals 20/200 damage to ship
Fusion Thruster	16	240	1/7	

While a propulsion segment is optional, payload and guidance aren't. Without a payload there's no point, and without guidance there's no way to aim.

Launchers

Type	Density	DUR	Price/ vol	Volume per Energy Need	Crew/vol	Performance details
Light VLS	5	9	3	-	4 base, +2/vol	Holds 8 Light guided weapons per volume
Light Magazine	5	12	2	-	3 base, +1/vol	Holds 8 Light guided weapons per volume
Light EM Catapult	3	9	4	12 (min 1)	5 base, +1/vol	Can launch 4 Light guided weapons from a Light Magazine per turn; imparts velocity up to eight times the square root of catapult volume.
Heavy VLS	5	9	3	-	3 base, +2/vol	Holds 1 Heavy guided weapon per volume.
Heavy Magazine	5	12	2	-	2 base, +1/vol	Holds 1 Heavy guided weapon per volume.
Heavy EM Catapult	4	12	5	12 (min 1)	5 base, +1/vol	Can launch 1 Heavy guided weapon from a Heavy Magazine per turn. Imparts velocity up to four times the square root of catapult volume.

If an Electromagnetic Catapult can make the future position marker for the guided weapon it's launching and the ship it's targeting match, and the guided weapon has a higher acceleration than the target, the EM Catapult can perform a Mass Driver attack. When performing a Mass Driver attack, record how much of the EM Catapult's velocity cap *wasn't* used to put the Guided Weapon on its collision trajectory.

Guided Weapons fired in a Mass Driver attack are committed to targeting the specific ship they were launched at. They cannot divert their course to hit another ship, though they *may* be ordered to miss and simply be removed from play. In exchange they get to apply the un-used velocity from the EM Catapult for the purpose of kinetic damage calculations.

Class 4 Components: Support Systems

There are some pieces of equipment only found on warships that don't really count as *weapons* exactly. That's what this section is for.

Component	Density	DUR	Cost	Crew	Function
Drone Retrieval System	3	15	4	2/vol	Retrieves Guided Weapons, returning them to the magazine/VLS.
ECM	3	9	4	4 base, +2/vol	Makes the ship harder to hit.
Sensors	3	9	4	4 base, +2/vol	Used for penetrating enemy ECM.
Sensor Uplink	3	9	3	2/vol	Used for helping allies penetrate enemy ECM.

Drone Retrieval System

If a friendly guided weapon is in the same hex as a ship with this component and has a velocity difference of no more than 1, a Drone Retrieval System can extend a tether and retrieve the guided weapon. Retrieved guided weapons are sent to the ship's guided weapon magazine, and have their delta v refilled, provided the ship has a supply of the appropriate propellant*. Guided weapons powered by solid rocket motors are ineligible for retrieval.

Each Drone Retrieval System has 1 volume at base, a density of 3, 15 DUR, and has a price of 4. They also need 2 crew per volume.

Individual Drone Retrieval Systems can only retrieve a single Heavy Guided Weapon or four Light Guided Weapons per turn, but *can* be upgraded to handle higher velocity differences by adding volume. Each point of volume added is an additional two points of velocity difference that can be handled.

*Liquid Fueled Rockets need Rocket Fuel
*Nuclear Thermal and Nuclear Thermo-Electric Hybrid need Inert Fluid
*Fissile Salt Water needs Dissolved Fissiles
*Fusion Thruster needs D-3He *and* Inert Fluid
If these are not available, retrieved guided weapons are simply deleted from consideration.

ECM & Sensors

ECM is a method of fouling up an enemy's targeting, while Sensors are what you use to get an accurate targeting lock on an enemy. Both ECM and Sensors have Density 3, 9 Durability Rating per Volume, a Price Per Volume of 4, and need a base of 4 Crew, with an additional two Crew needed per volume. However, their effects are quite different.

Each volume point of Sensors adds one point to the ship's Sensors rating. Meanwhile, the total ECM rating is determined by the following equation: (1500*E)/(v+r). E is the total volume of ECM aboard the ship, v is the ship's total volume, and r is the ship's total volume of fission or fusion reactors.

Ships start with a Sensors rating of one and an ECM rating of zero, without any investment.

When resolving an attack, subtract the attacker's Sensors rating from the target's ECM rating. If the result is positive, the attacker is jammed. For direct fire weapons, being jammed causes both their Precision Targeting and Guaranteed Hit range brackets to behave like their Probable Hit range bracket, while rendering their Probable Hit range bracket un-usable. If the result is ten or higher, it renders the Guaranteed Hit range bracket unusable.

Ships also have a Clear Targeting radius equal to the square root of their Sensors rating. If their target is within this range, the ship's Direct Fire attacks ignore jamming.

Macron Guns firing in area denial mode ignore the effects of jamming.
Light Guided Weapons have a Sensors rating of 4, while Heavy Guided Weapons have a Sensors rating of 20; their guidance packages interact with being jammed as described in their section. Guided Weapons do not have a Clear Targeting radius.

Sensor Uplink

The Sensor Uplink allows ships with extra Sensors capacity to help their allies see through enemy ECM. Sensor Uplinks have Density 3, 9 Durability Rating per volume, a Price per Volume of 3, and require 2 Crew per volume.

When an ally is attacking a target with ECM, a ship with a Sensor Uplink may opt to assist said ally with the attack. Subtract the enemy's ECM from the assisting ship's Sensors rating to get the Assist Factor, then add that value to the ally's sensor rating for the purpose of attack resolution only. This only lasts until the end of the current Firing Phase. Per unit volume of Sensor Uplink, a ship can assist five allied ships or guided weapons per turn in this manner.

Step 2: Compiling

Now that you have all your components, there's a couple other things that are needed to get your ships ready for gameplay.

Summation

Certain things need to be added up, divided, or otherwise have math done to them.

All Component, Propellant and Guided Weapon expenses are to be added up, as is the ship's required crew complement and the total morale modifier for crew aboard.

All energy sources and consumers must be listed, along with total energy generation and their energy usage.

Calculate the number of turns the ship can accelerate for, and multiply that by the ship's Acceleration Rating. This gets your ship's Delta V. During combat, Delta V is the resource you spend instead of tracking every last unit of propellant.

Combat Stations

During combat Crew not manning the Command Modules are freed up from their normal maintenance duties and are instead available to man Combat Stations, providing their benefits to the ship. Combat Stations *are not* Components, instead representing what duties your crew is assigned to during battle, instead of their normal maintenance tasks.

Combat Stations	Crew & Morale needs by Level	Effect:
Damage Control	Lv. 1: 10+ Crew	Lv. 1: +1 Repair Point per 10 crew assigned
	Lv. 2: 25+ Crew, 2+ Morale	Lv. 2: +3 Repair Points per 25 crew assigned
	Lv. 3: 50+ Bio/Const Crew, 4+ Morale	Lv. 3: +7 Repair Points per 50 crew assigned
	Lv. 4: 50+ Bio + 50+ Const Crew, 6+ Morale	Lv. 4: +15 Repair Points per 100 crew assigned
Engineering	Lv. 1: 10+ Crew	Lv. 1: +1 Acceleration[1]
	Lv. 2: 25+ Crew, 2+ Morale	Lv. 2: OR +10% Energy
	Lv. 3: 25+ Bio/Const + 25+ Info Crew, 4+ Morale	Lv. 3: OR +10% Delta V
	Lv. 4: 50+ Bio/Const +50+ Info Crew, 6+ Morale	Lv. 4: All of the above
Nerve Center	Lv. 1: 10 Crew	Lv. 1: +1 ECM or Sensors
	Lv. 2: 25 Crew, 2+ Morale	Lv. 2: +2 ECM or Sensors
	Lv. 3: 50 Info/Const Crew, 4+ Morale	Lv. 3: +3 ECM **and** Sensors
	Lv. 4: 100 Info Crew, 6+ Morale	Lv. 4: +4 ECM **and** Sensors
Medbay	Lv. 1: 10 Crew	Lv. 1: Heal 5 WIA Crew per 10 crew assigned
	Lv. 2: 25 Crew. 2+ Morale	Lv. 2: Heal 14 WIA Crew per 25 crew assigned
	Lv. 3: 25 Bio + 25 Info Crew, 4+ Morale	Lv. 3: Heal 32 WIA Crew per 50 crew assigned
	Lv. 4: 50 Bio + 50 Info Crew, 6+ Morale	Lv. 4: Heal 75 WIA Crew per 100 crew assigned
Medevac Route	Lv. 1: 2% of crew	Improves WIA/KIA Ratio
	Lv. 2: 4% of crew, 2+ Morale	Lv. 1: 60:40
	Lv. 3: 8% of crew, equal Const & Info, 4+ Morale	Lv. 2: 70:30
	Lv. 4: 16% of crew, equal Const & Info, 6+ Morale	Lv. 3: 80:20
		Lv. 4: 90:10

The effects of multiple Damage Control units and Medbays stack, and activate every turn. Repair Points do not persist between turns. The effects of additional crew assigned to Nerve Centers, Engineering Spaces, or Medevac Routes don’t. Having additional Crew assigned there may still be worthwhile for redundancy though.

1 All acceleration buffs require that the ship have at least Acceleration 1 under its own power.

Critical Hit Charts

Any attack that gets through a ship's armor has a chance of becoming a Critical Hit. For each percentage point of a ship's Integrity Rating that the attack had in post-armor Attack Power, there is a 10% chance of getting a Critical Hit. Round up.

If critical hit chances exceed 100%, that converts to a number of guaranteed crits equal to full multiples of 100% crit chance, and an additional possible crit using the last two digits of total crit chance as its crit odds.

Critical hits are rolled on the following three tables, selecting which table randomly using a three-sided die, then selecting randomly from within that table using a twenty sided die. The exact proportions of these critical hits within each table vary based on the design of the ship, **determined by the following method:**

For table one, sum together the **total*** volume of Propellant Tanks, Power Plants, Drives, and Jump Engines aboard the ship. Add radiator volume equal to the total Power Plant volume (this doesn't count as part of the ship's volume). Allot the crit ranges according to these proportions, rounded to fit on a d20. Any system which is *present* receives a minimum of one side on the die.

For table two, sum together the **total*** volume of Sensors, ECM, Weapons, Magazines, and Command Modules aboard the ship. A VLS counts as BOTH Weapon and Magazine for this purpose, while an EM Catapult counts as a Weapon. Allot the crit ranges according to these proportions, rounded to fit on a d20. Any system which is *present* receives a minimum of one side on the die.

*If you have a volume 18 Fusion reactor and a volume 24 Fission reactor, that counts as 42 volume of Power Plant, and 42 volume of Radiators. **DO NOT** separately list each Power Plant on the crit table. Generalize this to ALL critical hit effects and components.

For table three, sum up the ship's total crew complement (minus command crew), then determine the proportion assigned to each Combat Station. Allot the crit ranges according to these proportions, rounded to fit on a d20. Any Combat Station which is *present* receives a minimum of one side on the die.

Table 1: Power	Repair Points to Fix	Effect
Propellant Leak	1 per 3 total volume of Propellant Tank	Lose 5% of your maximum Delta V each turn until repaired. Certain propellants have worse leaks. Orion Drive bombs and Fissile Pellets only have a one-time loss of 5% max propellant, without an ongoing leak.
Radiators Damaged	1 per total volume of power plant	-50% total Energy production until repaired. Multiple crits of this type stack multiplicatively.
Reactor Offline	2 per volume of power plant disabled	One of your largest power plants stops generating Energy until repaired.
Engine Offline	2 per volume of drive disabled	One of your largest drives stops generating Thrust until repaired.
Jump Offline	2 per volume of Jump Drive disabled	One of your largest Jump Drives cannot be used until repaired.

Table 2: Systems	Repair Points to Fix	Effect
Sensors Damaged	1 per total Sensor volume	-50% Sensor rating until repaired. Multiple crits of this type stack multiplicatively.
ECM Damaged	1 per total ECM volume	-50% ECM rating until repaired. Multiple crits of this type stack multiplicatively.
Weapon Disabled	2 per volume of weapon disabled	One of your largest weapons can’t be fired until repaired. If that weapon is a VLS, you also receive the effect of a Magazine Hit.
Magazine Hit	Not Repairable.	Lose 25% of loaded Guided Weapons. If your largest Magazine is a VLS, it is also Disabled as per the Weapon Disabled crit.
Command Hit	Not Repairable.	One of your Command Modules is destroyed. All personnel manning said module become Casualties.

Table 3: Personnel	Effect
Hull Breach: Damcon	30% of Crew assigned to Damage Control become Casualties
Hull Breach: Medevac	50% of Crew assigned to Medevac become Casualties
Hull Breach: Medbay	50% of Crew assigned to the Medbay become Casualties
Hull Breach: Engineering	50% of Crew assigned to Engineering become Casualties
Hull Breach: Nerve Center	50% of Crew assigned to the Nerve Center become Casualties