

The Void Drive - a new drive system for Star Frontiers

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Introduction

The Void Drive and its associated components are the result of advances in both material technologies and various fields within science, computing and mathematics. Although the Void is utilised by older ion and atomic drives, this new drive simplifies most aspects of FTL and sub-FTL space travel. It also reduces the various inherent costs and dangers that dogged the older drive systems. Lastly, and most importantly, Void drives allow for greater distances to be covered per 20 hour day and to make the calculations for journey plotting at much reduced times. As an aspect of space travel the Void is still somewhat of a mystery, but enough has been ascertained to make this new drive system reliable and safe.

Unless stated otherwise below, all other aspects of ship design and construction remain the same as those given in Knight Hawks (KH).

The Void Drive System

The system is made up of four parts:

- *A magnetoplasmadynamic engine (MPD)*. The MPD is used in all non-Void flight and manoeuvre regimes - i.e. docking, combat, interface travel to and from a planet's surface, and system travel. It draws its power from a mega or hyperbattery.
- *A megabattery (MB) or hyperbattery (HB)*. MBs and HBs are very advanced developments of the common parabattery, but are larger and provide significantly more power. They can also be recharged. They are the heart of the system.
- *A Void Drive*. This is required by any ship that needs to travel distances in light years by utilising the Void.
- *Computer Programs*. These control and manage all of the drive, manoeuvre, navigation and other requirements of the drive system.

A ship design may use an MB or HB in conjunction with an MPD without any need for a Void Drive. Examples of such designs are shuttles (see **Shuttles**), system ships, system freighters, probes, and weapons such as missiles and torpedoes. All (apart from probes, missiles and torpedoes) require specific programs.

Each part of the drive is usually situated within the engineering deck of a ship, or must be connected to that deck in some way (e.g. access tunnels, corridors, etc). This allows the easiest access for the purposes of maintenance, etc. The computer is usually installed on the bridge or in the cockpit of a ship, although other access points can be placed around a ship (i.e. in the engineering section).

Ships designs of the previous chemical/ion/atomic generation can be fitted with the various parts of the new drive system. This process involves a certain amount of expense, usually a flat fee of 25% of the total cost of any new system parts being fitted.

MPDs

Any ship (ranging from shuttles to Hull Size 20 starships) can be fitted with one or more MPD drives. They derive their power from the HB or MB carried by the ship.

MPDs are usually placed at the rear of the hull, and there is no requirement for them to be mounted on struts. Some ship designs feature arm or wing-like extrusions from their hulls and mount one or more MPD on these. In some cases this is based on simple utility, or on others it is an aid to manoeuvring smaller ships (e.g. Assault Scouts). Older ships converted to the new drives may still retain some of the features of their older drives (struts etc). Various thrusters for manoeuvring, landing and take-off (if allowed by the ship's HS) are included with the MPD(s) fitted. Any shuttle and any ship with a HS of 5 or less can use its MPD(s) to enter and leave atmospheres.

Like the older ion drive, MPDs carry large reserves of hydrogen fuel. Each engine is fitted with an integral space for 10,000 units of fuel storage, and more fuel can be carried in any available cargo space. A unit of fuel is stored safely in metal hydride form within hexagonal containers called hydrogons. Hydrogons are easily stacked, are very strong, and are linked together when in use by the MPD. Like the hydrogen fuel required for an ion drive, hydrogons cost 10 Cr per unit (1 hydrogen = 1 unit) and are used up at the same rate (as described in KH).

If a ship has a Void drive and makes a jump, the MPD is automatically deactivated. It is automatically reactivated when the ship leaves the Void, although this can be overridden by the pilot.

MPDs required per Hull Size

Similar to the system in KH, the Hull Size (HS) of any given ship dictates the number of MPDs that must be installed:

<i>HS</i>	<i>Number of MPDs</i>	<i>Cr Price per MPD</i>
1-2	1	25,000
3-7	2	50,000
8-12	3	65,000
13-16	4	80,000
17-19	5	125,000
20	6	200,000

MPDs can be purchased and fitted at any Class I, II, and III centre. However, at Class II centres 2,500 Cr must be added to the above price for each MPD, and at Class III centres 5,000 Cr must be added to the above price for each MPD.

ADR and MR

Installation of these new drives on any given ship does not change the ADR and MR as listed in KH. ADF is reduced as per the KH rules for atomic engines if a ship does not carry the required number of MPDs for its HS.

Mega- and Hyperbatteries

MBs and HBs have been designed to cater to the needs of ships with a variety of hull sizes. MBs are cheaper and better suited to smaller ships, although they can be used by larger ships also. HBs are more expensive but are more capable and efficient. The main differences between the two batteries is the power that they can provide to Void drives, as this in turn affects the possible range of Void travel. Both types include equipment fitted to the ships exterior with which power can be received (and also beamed, see ***Ship-to-ship power transfer***, page 5).

Battery Types and Hull Size

Both batteries range from Type 1 through to Type 4, and each type is different enough from another in design that smaller types cannot be 'daisy-chained' to make a larger type (i.e. if it were possible to link four Type 1 drives together they would still not have the same power capability as a single Type 4 drive). The different types also vary in both their physical size and the HS of any given ship that they can support via MPDs and a Void drive:

<i>MB/HB Type</i>	<i>HS</i>	<i>Size (m³)</i>	<i>Cr Price (MB/HB)</i>
1	1-5	10	10,000/30,000
2	6-10	20	20,000/50,000
3	11-15	30	40,000/80,000
4	16-20	50	60,000/120,000

MBs and HBs can be purchased and fitted at all Class I and Class II centres. However, at Class II centres players must add 5,000 Cr to the above price for Type 1 and 2 batteries, and 10,000 Cr to the above price for Type 3 and 4 batteries.

Battery Cells and Recharging

When used to power Void drives, both battery types have a number of cells. A single cell produces enough power for 1 LY of Void travel. When a cell is drained, it must be recharged at some later point. Recharging a cell requires a certain amount of time, and power must be beamed to it from another source.

The ship requires the *Beam Power* program (see page 8) in order to take on power in such a way.

<i>MB/HB Type</i>	<i>Max cells (MB/HB)</i>	<i>Hours Reqd to Recharge per Cell (MB/HB)</i>
1	8/12	2/1
2	10/16	4/2
3	12/20	6/3
4	14/24	8/4

Cost of Recharging

Batteries can be recharged at several different types of facilities: space stations, spaceports, beamships and orbital power docks (OPDs). Power is beamed to the recharging ship from whatever facility that ship is using to get its power from. Each facility has its own price for each hour of required recharge time:

Space Station: 1000 Cr per hour

Space Port: 750 Cr per hour

Beamship: 400 to 600 Cr per hour

OPD: 500 Cr per hour

The varying costs reflect the level of amenities and convenience that accompany any given facility. Space stations and spaceports allow the crew to live under gravity, take on supplies, have R&R time, or do whatever it is they need to do to spend their time.

A beamship is a spaceship that functions in much the same way as an OPD, but can move through space. They can be seen as a sort of freighter, whose cargo is energy. (see the **Beamships** section below for more details).

An OPD is a recharging station in a geosynchronous orbit and maintained and operated by a small crew (see the **OPDs** section below for more details). The crew of a ship recharging from an OPD can do little but wait on-board in zero-g.

Prices at any one facility may vary depending on local demand, regulations, taxes etc but on average they do not vary by more than +/- 25% of the rate given above. Some beamship and OPD crews will try and sell various goods or services to a recharging ship, but usually at some exorbitant cost. This requires that members of the crew either visit the beamship/OPD or permit one or more of the beamship/OPD crew to come aboard. Depending on the system, this may not always be a good idea.

The referee may also want to include a variety of loyalty and other plans to adjust the recharge cost at any particular system. As various Megacorps are involved in the power market, it may also be possible that facilities owned by them will be given recharges at a much reduced rate, or possibly for free if a crew is in the employ of that megacorp.

Over The Limit

If an MB or HB is forced to travel over the maximum LY distance for its type without being recharged, it will shut down and travel in the Void will no longer be possible until the ship recharges cells. However, the ship can still operate on emergency power, for 10 hours x the MB/HB type number. All ships in this situation can use their MPD but have their ADF and MR reduced to 1 until the battery has recharged one cell per MB/HB number (e.g. a Type 1 MB/HB needs 1 cell to be recharged; a Type 4 MB/HB needs 4 cells to be recharged).

Solar Harvesting

All MBs and HBs have the capability to extend a solar array to collect energy, should the need arise. This array is included with the battery when it is installed. Recharging can only be done when the ship is not travelling in

the Void and is not within a dust cloud. Compared to recharging from space stations etc, this is a slower process. All recharge times as shown in the table above are tripled (e.g. a Type 1 MB requires 6 hours of charging per cell, a Type 1 HB requires 3 hours of charging per cell).

Ship-to-ship power transfer

Although dedicated power transfer from one ship to another can only normally be performed by a beamship, any ship can be fitted with the necessary equipment to beam power to another ship. However, it can only beam power to one other ship at a time, and for every cell that it recharges in the receiving ship, it depletes one cell from its own MB/HB. Power can beamed at the rate of one cell per hour from an HB, and one cell every two hours from an MB. Both ships must be within 500m of each other when this transfer occurs. The equipment costs 5,000 Cr, requires 5m³ and 2 Function Points to operate. Transfer cannot be carried out while travelling through the Void. Both ships require the *Beam Power* program (see page 8) in order to send and receive power in such a way. In practice, some non-Void ships (i.e. tugs) carry this equipment, usually for use in an emergency, although other ships also sometimes install it as a precautionary measure.

Void Drives

Void drives are the means by which a ship can travel from system to system using the Void to 'jump' the intervening light year (LY) distance. The Void drive does not require long acceleration periods in order to access the Void, nor does it require similarly long deceleration periods, or for the ship to turn around mid-journey. A ship simply has to have its route plotted by the navigator and the Void Plotter program and, as long as this process is followed correctly and the MB or HB is on-line, the ship enters the Void instantaneously. The Void Plotter program brings the ship out of the Void instantaneously when the destination is reached, at which point the MPD initiates and takes over the role of moving the ship. All Void travel is at zero-G. Combat during a jump is impossible, and the only form of communication is via sub-space radio.

Although ships are effectively jumping from one star system to another, they must decide in advance which particular planet, moon or point inside the system that they wish to arrive at. This choice forms part of the data that the Void Plotter program requires to make a jump. As well as information on any of the routes between the various systems, that program also holds data on the structure of each system.

Given time and planning, a ship may choose to enter the Void during combat (perhaps in order to escape from a battle). If so, can enter and leave the Void at any movement rate permitted by its design.

Like MBs and HBs, Void Drives are rated from Type 1 to Type 4, and only one drive is required by any given ship. Each type can only be fitted to ships of a particular range of HS:

<i>Drive Type</i>	<i>HS</i>	<i>Size (m³)</i>	<i>Cr Price</i>
1	1-5	3	60,000
2	6-10	10	80,000
3	11-15	20	150,000
4	16-20	40	250,000

As with MBs and HBs, drives cannot be 'daisy-chained' together (e.g. four Type 1 drives do not have the same capability as a single Type 4 drive). Void drives can be purchased and fitted at all Class I and Class II centres. However, at Class II centres players must add 10,000 Cr to the above price for Type 1 and 2 drives, and 50,000 Cr to the above price for Type 3 and 4 drives.

Daily light-year travel times per drive type

The combination of the drive type and the MB or HB also dictate the amount of LY a ship can travel per 20 hour day:

<i>Drive Type</i>	<i>LY per day (MB/HB)</i>
1	1/2
2	2/4

3	4/6
4	6/8

Example Journey

Brax's Revenge, a HS 3 ship, has a Type 1 HB and a Type 1 Void drive. This enables the ship to travel at 2 LY per day, and it can travel up to a maximum of 12 LY before all of its MB cells are depleted.

The crew are making a journey from White Light to New Streel via Theseus, a 15 LY journey. They plan to arrive at Minotaur within the Theseus system, and then at Corpco within the New Streel system.

The first leg of the journey (White Light to Theseus) is 10 LY, and this takes 5 days. By the time the ship arrives at Minotaur it has depleted 10 cells.

The second leg of the journey (Theseus to New Streel) is 5 LY. As the ship only has 2 cells remaining, it does not have sufficient charged cells to make the trip. The crew decide to recharge 3 empty cells to bring their total available cells to 5.

Minotaur is a popular tourist destination and the local facilities (an FSS, various space ports and OPDs) are milking this fact, so therefore the hourly recharge price is higher than average. The crew want to save money and so decide to recharge at an OPD. This takes 3 hours. The crew must pay 625 Cr per cell recharged and so the final cost is 1875 Cr.

When the ship arrives 2.5 days later at Corpco, all of the HB cells are empty. The crew decide to fully replenish the 12 cells from an OPD at Corpco. This process takes 12 hours and the OPD charges 500 Cr per hour. The total cost of the recharge is 6000 Cr.

Effects of the Void

When a Void drive is activated, it creates a field in the immediate space surrounding a ship, although it cannot be seen by the naked eye. The field places the ship within the Void and then transports it to its destination. However, unlike older drives, the crew will find themselves having to deal with the effects of the Void on their senses for the duration of the journey. Although there is no feeling of acceleration nor deceleration when going in and out of the Void, when travelling within the Void players will feel disorientated and cannot perform anything but simple actions (moving, basic hand-eye co-ordination).

Initial research suggested that this was a major bar to living creatures using Void drives, but further tests showed that the effects could be controlled by three methods:

The first method relies upon the fact that some individuals simply suffer no further adverse effects after their first Void trip of more than 1 LY. This is broadly similar to individuals who do not suffer from various normal forms of travel sickness. In order to determine if any player adjusts this way, they must travel 1 LY, then divide their current STA by 20 (rounded up) and roll beneath that number on a d100. A successful roll indicates that they will not suffer from any adverse Void effects during their entire lifetime. A failed roll cannot be re-rolled at any future point.

The second method relies on accumulating time spent in the Void - in short, the more time spent in the Void, the less its effects are felt. If travelling through the Void for the first time, after 5 days (100 hours) of accumulated Void time a player can try to roll under their STA, and a successful roll indicates that they no longer suffer any adverse Void effects during their entire lifetime. If a roll is failed, it can be re-rolled whenever the player next passes the 5 day/100 hour mark, but +5% is added to their STA score and they must roll below this new number. This percentage is also cumulative.

Example: Khorasai Banashak has a STA of 60 and after his first 5 days of accumulated Void travel he rolls to see if he no longer suffers from its effects. He rolls a 62, and so fails and has to accumulate more time in the Void. 5 days of accumulated travel later, he rolls again and add 5 to his STA score - he now needs to roll below 65. He rolls a 78 and fails for a second time. Hoping for third time lucky, he builds up a further 5 days of accumulated Void time and rolls again, this time with +10. He rolls a 38, and as this number is below 70 (his STA score +10) he no longer suffers from the effects of the Void.

The third method relies on the use of a specialised drug called 'A-Void' to counter the effects of the Void. After this is taken, the player will be able to act normally for 100 hours of Void time without any ill effect. Once this period has passed, the player becomes incapacitated and will sleep for 20 hours. The drug can then be taken again if required once this sleep period is over. A-Void costs 50 Cr per dose. Players can only continue to use A-Void for a limited number of doses (their STA divided by 10, rounded down) before they must spend 3 days (60 hours) without taking another dose. Anyone ignoring this limitation will find that A-Void no longer has any effect until they spend the required 3 days without a dose of the drug.

Any players that do not use the above options usually have to spend their time in the Void doing very little, as all physical exertions become very strenuous and fatiguing. All players stats are at -20 until they leave the Void.

The Void Bubble

The UPF has experimented with various aspects of the Void drive in order to allow smaller ships to travel with one larger ship. As this demands a greater energy input from the larger ship, it does have some impact on the distance it can travel per day, but various experiments have shown both the limits and possibilities of what has been called 'The Void Bubble'.

What this means in essence is that the drive of the parent ship extends its field outside the immediate area around it, and any ships within this 'bubble' can travel at the same rate as the parent. All ships must have a Void drive in order for this to work, and their drives must be active during the journey. The secondary ships cannot rejoin the bubble if (for whatever reasons) they leave the Void - they must then travel onwards at their usual rate.

In order for ships to use the bubble, their combined HS cannot be greater or equal to the HS of the parent ship. For example, a fighter cannot provide a bubble for another fighter, but an Assault Scout can carry two fighters in its bubble. A HS17 Assault Carrier could potentially have 16 fighters within its bubble - but it could not provide the means to support those fighters in the same way it could for those it is already carrying as it's standard complement. In this way, a bubble allows a ship to bring one or more ships of varying sizes and capabilities with it through the Void to its destination.

The LY per day travel time for the parent ship is halved, and every LY travelled depletes two cells from its MB/HB. The other ships within the bubble travel at the same rate as the parent ship but deplete their MB/HB cells at their usual rate.

This is, of course, an emergency measure used only for military ships operated by the UPF and the software that allows a bubble to function is a matter of utmost secrecy. Ordinarily, players will never have access to this software - it may also be possible that the Void bubble is regarded as a tall tale or rumour.

Computer Programs

Those programs that deal with Life Support, Weapons, Defensive Systems, Exploration, Mining and Agri are the same as stated in KH in terms of their cost, the Function Points (FP) they require, and the space they require. Similarly, the programs for Alarm and Computer Lockout remain the same as stated in KH. As with ships of the previous generation, the various parts of the new drive system require computer programs in order for them to function.

MPD Drive Program

This programme manages all aspects of the MPD(s) carried by the ship. The cost of the program is 1,000 Cr per FP.

<i>Number of MPDs</i>	<i>Level</i>	<i>FP</i>
1	1	1
2	2	2
3	3	4
4	4	8
5	5	12
6	6	16

Void Drive Program

This programme manages all aspects of the Void drive. The cost of the program is 1,000 Cr per FP.

<i>Drive Type</i>	<i>Level</i>	<i>FP</i>
1	2	8
2	3	12
3	5	16
4	6	24

Damage Control

This program coordinates the crew's and computer's efforts to repair damage that has been inflicted upon a ship. It also allows the ship to use its full DCR; ships without this program can use only half of their DCR.

<i>Number of MPDs</i>	<i>Level</i>	<i>FP</i>	<i>Cost</i>
1	1	1	1,000 Cr
2	2	2	2,000 Cr
3	3	4	4,000 Cr
4	4	8	8,000 Cr
5	5	16	16,000 Cr
6	6	24	24,000 Cr

Non-Void Plotter

This is an astrogation program that assists with the plotting of all non-Void travel, and includes the equipment necessary to assist in that task. The cost of the program is 1,000 Cr per FP.

<i>Number of MPDs</i>	<i>Level</i>	<i>FP</i>
1	1	1
2	2	2
3	3	4
4	4	8
5	5	16
6	6	24

Void Plotter

This is an astrogation program that assists with the plotting of all Void travel. The cost includes the equipment necessary to assist in that task. It also acts as a Non-Void plotter as a secondary feature. The cost of the program is 1,000 Cr per FP.

<i>Drive Type</i>	<i>Level</i>	<i>FP</i>
1	2	4
2	3	8
3	5	12
4	6	16

Beam Power

This programme is required for ship-to-ship power transfer (as described on page 4) and for recharging from beamships and OPDs. It is a Level 1 programme that costs 3,000 Cr and uses 2 FP.

Beamship Operations

This program manages and maintains all aspects of power management and directing for beamships. It is a Level 2 programme that costs and uses 4 FP per module installed (see **Beamships**, page 10).

Plotting times for Void travel

The main advantage of the Void Plotter program is the speed at which it can aid astrogators when they are planning jumps. Plotting time is now much reduced and can be ascertained thus:

10 minutes + 2 x Drive Type + 1 minute per LY of jump distance. Even if a jump is made up of several legs, only one calculation needs to be made by the Void Plotter program.

Example: The astrogator aboard the Brax's Revenge is plotting a jump from White Light to New Strel via Theseus. The ship has a Type 1 Void drive and the journey is 15 LY. He feeds this information to the Void Plotter program and 27 (10+2x1+15) minutes later the ship is ready to begin the journey.

However, the above assumes that the ship is jumping along a known route between one or more star systems, and in such cases there is pre-defined plot data available to the astrogator. If instead a jump is being plotted along a new route, more time is required and calculation time is quadrupled:

10 minutes + 2 x Drive Type + 1 minute per LY of jump distance x 4. An astrogator must have the skill *Chart New Routes* for such jumps to be possible.

Jump Interruptions

Ships with Void drives can move instantaneously out of the Void at any point along their jump if needed (i.e. to deal with some emergency, answer a distress call, etc). However, the Void Plotter program then has to take bearings and make recalculations before resuming the jump. This process requires some time, which may be problematic in certain situations (i.e. escaping attack). Calculation time in minutes can be ascertained thus:

5 minutes + 2 x Drive Type + 1 minute per LY of jump distance remaining to the destination.

Example: the Brax's Revenge has been lured into a pirate ambush by a bogus sub-space distress call. Seeking to escape their pursuers, the ship's navigator and computer need time to process the data required to re-enter the Void. The ship has a Type 1 drive, and they have yet to travel another 3 LY to the planned destination previously given by the Void Plotter program to the computer at the start of their jump. This means that 10 (5+2x1+3) minutes are required before they can jump - the pilot and gunner will have some work to do in the meantime...

Risk Jumping

Risk jumping is still a possibility, despite reduced calculation times. In such cases, the **Risk Jumping** skill can still be used, but minutes must be substituted for hours when determining the roll required for a successful jump.

Misjumps via this process are ascertained in the same way as stated in KH.

Drive tweaking

Although the Void drive is intended to work at a certain optimum efficiency, it is possible to tweak its various functions and programming. This in turn can squeeze extra range from the drive in terms of the LY distance it can potentially travel per day. However, increasing the range of a ship in this manner also incrementally uses up more of the available power cells that it has in its MB/HB. At the same time, successfully modifying the drive in this manner allows the crew to choose when they use the extra range they have acquired; a drive may be tweaked to give, say, a range of an extra 0.3 LY per day but the crew may choose to use 0.1 or 0.2 LY per day, or decide not to use the extra range on any given trip if there is no particular need or if it may go too far in depleting their available power cell supply.

To successfully make such adjustments to a Void drive requires a new skill from both a navigator and an engineer, and the range can only be improved by a certain fractional amount:

IMPROVE VOID DRIVE EFFICIENCY

Success Rate: 30% + 10% per averaged skill level - LY fraction target as %

Both engineer and astrogator need to have this skill in order for this procedure to be carried out. Before work begins, a target LY fraction must be agreed upon - anything from 0.1 to 0.5 LY. Both crew must then devote 100 hours of work and preparation between them, although this time can be spread out as much as required (i.e. it can be an on-going project). Any drive improvement will only be added after a successful roll has been made and the ship makes a new jump - a roll *cannot* be made whilst the ship is in the Void.

After that time has passed and a successful roll is made, the ship's jump range is improved by the target LY fraction per day. Should the roll be failed, no additional LY fraction will be added to the ship's usual daily jump range. In order to try again, the two crew must spend a further 100 hours and then make another roll.

Should the crew have previously made a successful drive improvement and want to increase the target fraction, they must spend another 100 hours and make new roll. If they fail, the ship remains on the previous drive fraction. If successful, the ship's jump range is improved by the target LY fraction per day.

Catastrophic failure after any rolls means that the Void drive has become permanently inoperable and will have to be replaced.

Example: The crew of the Brax's Revenge want to improve the range of their Type 1 Void drive. The astrogator has the Improve Drive Efficiency skill at 20% and the engineer has the skill at 30%. Both decide to aim for 0.3 LY improvement to the drive, and after 100 hours of work they attempt to make a successful roll.

*In order to be successful they must roll **25 or less** on a d100: the 30% base chance for the skill, plus 25% (by adding the astrogators 20% skill level and the engineer's 30% skill level and dividing the sum by two), minus 30% for the target 0.3 LY fraction (at -10% per LY fraction). Or, simply: $30\% + 25\% (30+20/2) - 30\% = 25\%$*

A roll of 12 is made: from the next jump onwards, their ship can now travel up to 2.3 LY per day.

Beamships

A beamship is a travelling energy supply from which other ships can draw power. It is fitted with specialised equipment with which it can collect and store solar energy and beam power to other ships that are within 5000 metres. Beamships are usually either old freighters converted and refurbished for their new role or new ships built expressly for beaming power. The costs of acquiring such a ship means that many are owned by megacorps. That said, there are still enough ships being run by companies or by individual crews although these tend to be ships with a smaller HS. Most beamships range in HS from 5 to 10, although larger and smaller types do exist.

All beamship operators require a license from the UPF to trade, which includes an encrypted electronic handshake that certifies the operator as a legitimate registered vendor. This is beamed to the buying ship prior to any transfer of power. Any operator must pay a yearly fee to maintain their license, as their handshake is updated at that time. This is 1000 Cr multiplied by the ship's Hulls Size. If an operator owns more than one beamship that is actively trading, an extra 10,000 Cr per ship (after the first) is added to the yearly fee. Megacorps and larger companies may also find their trade subject to tax and other costs in certain systems, but at the same time they may also dominate the power trade in that system.

A typical beamship is festooned with solar panels and spends most of its time travelling within a chosen system. Those with Void drives jump from system to system, selling power where local facilities may be restricted or trade freer. Those owned by megacorps usually supply megacorp shipping while those owned by larger private companies have contracts to supply parts of a system (i.e. where asteroids are being mined) or via some other variety of agreement.

The smallest operators tend to have a more nomadic lifestyle and bring their supply to wherever they think it may be needed. They may reside or roam within systems advertising their services via radio and other forms of data link. They may also offer a variety of other goods and services for sale, depending on the crew, facilities and available cargo space (i.e. some act as traders, others as passenger transport, etc). Star Law has, on occasion, made surprise inspections and found that contraband and illegal activities have been taking place on some beamships. Some systems turn a blind eye to such activities. The crew and the ship will have their license permanently revoked if found guilty.

The beamship equipment is carried within a ship's cargo space and is modular. This is to allow the ship to decide how much and power supply capability it needs. Each module is fitted with a set of large solar panels and contains the beaming equipment and a power storage block. The module occupies two cargo spaces and can simultaneously beam power to two ships. It cannot be daisy-chained nor can it supply power to the ship in which it is fitted. The storage block has 60 cells and recharges one of these cells every two hours. It cannot be recharged during Void flight or if within a dust cloud. As previously described (page 4), the ship being recharged takes on power at a rate determined by its battery type. Any ship recharging from the beamship must travel at the same rate as the beamship and be within 5000 metres of it, although it can make other manoeuvres as long as it stays within that distance. The beamship must have the *Beamship Operations* program in order to function, and the receiving ship must have the *Beam Power* program.

Each module costs 40,000 Cr, and can be installed at any class of Construction Centre. Installation requires 2 days and costs 5000 Cr per module. Removing a module also requires the same amount of time and cost.

OPDs (Orbital Power Docks)

OPDs are a very basic form of space vehicle, consisting of one or more modules and one or more solar arrays. They are held in a geosynchronous orbit and have no manoeuvring capability other than that required to keep it in orbit. Large OPDs are usually found in use by megacorps or the military, and access to them is extremely limited or impossible without the necessary permissions. An OPD must be constructed in space, either in its allotted orbit or on-board a ship and then placed within that orbit. This process takes 10 hours.

Any ship recharging from the OPD must be within 1000 metres of it, although it can make other manoeuvres as long as it stays within that distance.

OPDs are usually run as a private business, either by small companies, co-operatives or megacorps. OPDs are monitored and regulated by the planet around which they orbit. All must rent an allotted orbit from the planet around which they operate. OPDs based around moons must pay rent to the planet around which that moon orbits. In order to prevent clutter and overcrowding, OPDs are legally only permitted to occupy an orbit within a band or distance around any given planet or moon, and this will be stipulated by the planet renting the orbit. Orbits around certain planets are hotly contested, although UPF law prevents monopolisation of all available orbits by megacorps (an issue which megacorps continually challenge by legal or other means). Rents vary from system to system, and competition is fierce at those systems that are particularly favoured by travellers, traders, etc. Rent is usually charged per year, at an average fee of 5000 Cr - although this price can vary upwards by to 50-70%.

In its simplest form, an OPD is essentially similar to the module carried by a beamship insomuch that is made up of a solar array, beaming equipment and a power storage block. However, an OPD also requires positioning thrusters and the necessary fuel (contained in one package), as well as a support pod in which the 2-person crew reside. This pod has one airlock hatch and one or more methods of seeing the outside world (windows, half-size camera system). It also contains a basic proximity radar, a videocom and all of the supplies necessary to support the crew in relative comfort for 5 days, after which time it is usually resupplied via shuttle or some other means. Larger OPDs feature extra storage pods and crew quarters to extend the 5 day limit. The crew have spacesuits and various other space-related equipment to hand in order to carry out their work.

A single OPD, including one solar array, beaming equipment, power storage block, thrusters, communications equipment and a single support pod with life-support costs 30,000 Cr. It can beam power to two ships simultaneously. The storage block has 40 cells and recharges one of these cells every two hours.

Adding a second array and the necessary power block and beaming equipment costs 15,000 Cr. For every 6 arrays in an OPD, another set of thrusters is required at a cost of 5,000 Cr. Each extra array can beam power to another two ships simultaneously.

An extra pod with life support for two crew costs 5,000 Cr. A storage pod with no life-support is 1,750 Cr per unit of cargo space (a standard pod is equivalent to one unit of cargo) - it cannot be adapted to have life support. A larger pod with life support (but no internal fixtures and fittings) costs 5,000 Cr per 10 person capacity. Any new additions can be joined together with airlock hatches and access tubes at a cost of 100 Cr per 10 metres - 200 Cr per 10 metres if a life-support function is required. 'Luxury' versions of each of these parts can be acquired for at least three times the base cost or more, depending on need.

Adding an array or pod requires 2 hours and two persons to install. Adding access tubes requires 2 hours and two persons per 50 metres installed. A *Technician* skill of 2 is required by anyone constructing, maintaining and making additions to an OPD.

There is a secondary industry centred around those OPDs that aren't owned by large companies or megacorps that can construct and create additions to an OPD for a fee - usually 1,000-3,000 Cr. Others also handle resupply duties (providing food, life-support recharge, etc), usually for around 500 Cr per trip. As with beamships, OPDs can offer a variety of other goods and services for sale, depending on the operator, facilities and available cargo space. Some sell basic supplies and hydrogons, while larger OPDs are more akin to orbital hotels or bars. Some OPDs have been shut down by Star Law for their involvement in various illegalities and their operators have been permanently banned from trading.

Shuttles

Shuttles are fitted with an MB and an MPD, both of Type 1. Their main advantage over the previous generation of shuttles is that they do not need a chemical drive to travel from the surface of a planet into space. In terms of crew comfort during such journeys, the flight is little different than that for a ship with an atomic drive unless the shuttle accelerates rapidly. In such cases, the same rules for chemical drive shuttles apply. Shuttles use hydrogons as a fuel source, and usually carry 2 to 5 of them on-board. A single hydrogon is enough power for 20 'full-burn' trips (i.e. similar to that of rapidly accelerating chemical engine) from surface to space.

When landing, another advantage of these new shuttles is that they can set down on any surface that will support their weight. The thrusters on their MPD drive allow for vertical landings, as well as take-offs. They have landing legs that have a wheel and pad foot - the wheels allow for taxiing around starports with paved runways and other surfaces. In all other respects they are the same in terms of use and required piloting skills as shuttles with chemical drives.