DEUTEROS

THE · NEXT · MILLENNIUM

ACTIVISION

DEUTEROS
THE NEXT MILLENNIUM

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THE INTERIM

In 2200 AD a gigantic asteroid smashed into the Pacific Ocean with devastating results. All human life ceased to exist in the cataclysm which followed, except for a small colony of researchers living on the Moon. Their destiny was to recolonise the Earth and transform her devastated lands and seas into the gentle blue planet they had once known.

Massive resources were required; materials not available from the meagre deposits on the Moon. The commander of Moon Base drew up his plans and colonised planets and moons throughout the Solar system. The technology of the day had filed the entire human genome and allowed the scientists of Moon Base to create specific human mutations which could live and multiply on other planets.

Eventually, with the Mother planet now restored and habitable, the commander ordered a mass exodus to Earth. Every man, woman and child would be needed to rebuild the civilisation destroyed by the impact. All thoughts turned to this objective. Moon Base, so crucial to their survival, was abandoned. The outer colonies, with varying races of mutations, were forgotten.

For the first two centuries very little occured on the outer colonies. The separate races expanded and traded, each developing their unique cultures. Then a minor argument flared up between the two most advanced and powerful races, the Hydroids and the Methanoids. The Hydroids were a rather unpleasant lifeform who seemed to have retained most of man's more hostile traits. On the other hand the Methanoids were a calm, intelligent and resourceful culture, whose most consuming passion was for music. As long as the Hydroids kept to their planet the Methanoids were happy.

For some years the Hydroids had been surveying a small moon in Saturn's orbit and were now ready to colonise. The Methanoids were having none of it, worried at the speed at which the Hydroids were expanding. The situation was compounded by an incident following a concert given by the spectacularly popular Ulta ben-Cthug, a Methanoid composer. A Hydroid envoy had been invited to the concert, but had left after a few minutes, complaining that ben-Cthug's opening piece had caused them physical distress. The Methanoids were furious, and war followed swiftly, a bitter and prolonged war which was to last for over a century.

The Methanoids' intellect was to give them the ultimate advantage. Their tactics and weaponry improved with every battle while the Hydroids were losing more and more of their colonies, and with them the resources to build new battle fleets.Finally the Hydroids were pinned down to their last stronghold, the yellowed disk of Jupiter, and the Methanoids moved in for the kill. Their awesome fleet approached the beleaguered colony, the vast ships flanked by hundreds of battle drones. The Methanoid battle anthem boomed across the radio waves as the last battle began.

Meanwhile, on Earth, the passing centuries had seen the rise of a new human civilisation. Life on New Earth was desperately severe and humans had been softened by generations of reliance on technology and science. Thoughts of spaceflight were long since forgotten and contact with the outer colonies was unheard of. No one knew of the frantic conflict between the Hydroids and Methanoids; no one would have been interested anyway. Their lives were a constant struggle with one objective: recolonisation of this harsh new world. Even Moon Base failed to stir any emotions; there were no records of such a place, no proof that it ever existed, and the one time home of the human race became a legend.

All this was to change with the works of a certain Dr. Darrill Trout. Born in the 29th Century he became the head of research at the New World university, revolutionising the world's thinking with works on spaceflight, politics and history.

Dr. Trout believed that Moon Base existed. He had evidence of this and other colonies beyond the asteroid belt. After many years of hard work he published "Principles", a twenty six volume thesis on spacecraft design and construction. The latter two volumes dealt with a plan to build a second "Moon Base" on Earth for the control of an orbital stepping stone to the Moon and beyond.

The effect of "Principles" was spectacular. Work on the new Earth City began forthwith. Depite the feelings of some of the populace that space travel was both unnatural and undesirable, the project provided a much needed goal now that the prime objective had been achieved. By the year 3100 AD the City was complete. Recruits were ready for training and eagerly awaited the arrival newly appointed commander...

Operation "Deuteros" was underway.

GETTING STARTED

AMIGA: Remove all peripheral devices such as printers from your computer before loading. Switch your monitor then your computer on. At the workbench prompt insert the Deuteros boot disk in drive DF0 (A1000 owners should first boot with the Kickstart disk).

ATARI ST: Remove all peripheral devices such as printers from your computer before loading. Place the Deuteros boot disk in drive 1 and switch your monitor then your computer on.

The game will load automatically, displaying the title screen. Press the right mouse button to see the opening sequence. If you wish to skip directly to the game press the left mouse button.

If you have a second disk drive you may use it to save or load the game without changing discs. You should have a blank disk ready before you start, but there is no need to format the disk.

HOW TO USE THIS MANUAL

If you are an experienced player, you may like to start playing the game by exploring the departments of Earth City for yourself. All essential information is available within the game, and maximum satisfaction is to be gained by working out for yourself how to use the equipment under your control.

Explanations of the control icons and descriptions of each of the departments of Earth City are given on the following pages. There is also an alphabetically arranged reference section, describing most of the various pieces of equipment found in Deuteros, and providing instructions on how they are used (see the index on page 3). As a new item is researched you are advised to access the description in the STORES on Earth City (see page 19) .

A complete step-by-step guide to building your first Orbital Factory is also provided, starting on (page 37).

CONTROLS

Deuteros is controlled using the mouse to point the cursor at the various CONTROL ICONS, then pressing the left mouse button to activate the icon. As the cursor moves over an icon its use is identified in text in the top left corner of the screen. Occasionally the right mouse button is used to exit a menu. The keyboard is used only when naming craft or saved games.

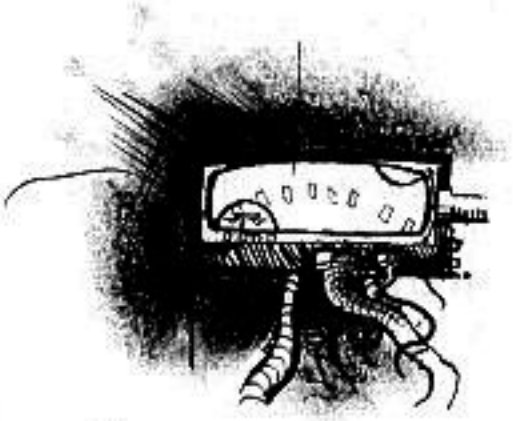
EARTH CITY

THE MASTER COMPUTER

At the heart of Earth City lies a vast network of control and scanning systems. These are designed to give a centralised command base for all activities. The entire network is linked to one main Master Computer.

The Master Computer has been designed to give Control access to orbital factories, surface stations, spacecraft and communications, by generating visual displays through the activation of various graphic icons . It also supplies information on stocks, planetary deposit analysis and personnel.

MASTER CONTROL PANEL



The Master Control Panel is the main interface with the Master Computer. It consists of a series of icons although only the first four will be on line initially. The active control icon will animate to provide a reference to Control.

ADVANCE TIME

At the bottom of the display is a digital date and clock readout which indicates the current time. Operations such as production and mining may take several hours or days to complete, so the option to Advance Time is given via this icon.

Activating the icon will advance time at a fixed rate. To stop the advance press the left mouse button again until the cursor reappears.

For fine control time may also be advanced by moving the cursor over the time display itself and pressing the left button. The advance will stop as soon as the button is released.

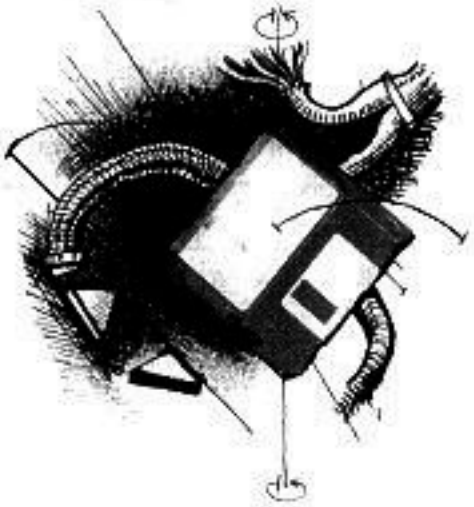
DISK ACCESS

This gives access to saving and loading your position. A separate disk is required which must be formatted using the format function on this display. Up to five positions may be saved on one disk. Each may be given a name of up to ten characters.

The timer keeps track of how long you have been operating in days, hours and minutes. This time is saved along with your game and is shown in the index box. If you change save discs remember to update the index by clicking on the disk Directory icon.

To save or load a position simply click on the icon next to the required index label. If the request is valid you will be asked to confirm the operation. Any incorrect response will cancel the request.

IF YOU HAVE A SYSTEM WITH 2 FLOPPY DISK DRIVES, the system will always use the second drive for saved positions (DF1: for Amiga, drive B for ST). This reduces the need to swap discs (ST owners note that this option is only available if you have 1Mb or more of memory available).

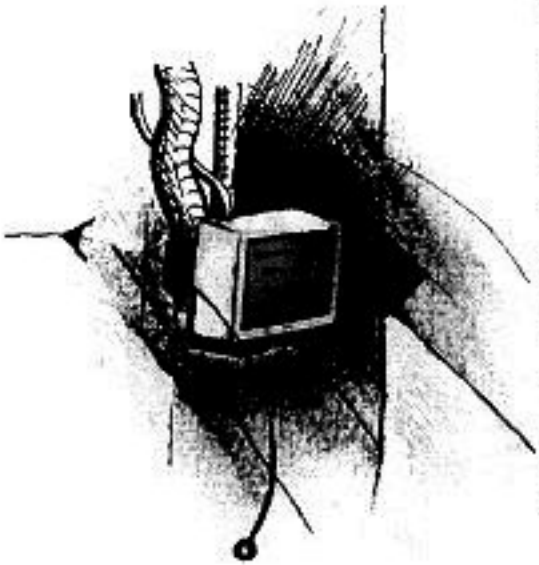


When the ACC becomes available you may set the refuel thresholds for shuttles and IOS from here. This gives the tonnage of fuel for each ship at which the ACC will continue to function. Below this level the ship will be held in dock until fuel is available. These settings are saved with your position.

Amiga owners have the can toggle the sound filter for improved sound quality by clicking the "LED" (Power) icon. Adjust to your taste. Connection to an external stereo hi-fi system or headphones is recommended!

To exit the disk access display press the right mouse button.

NEWS BULLETINS



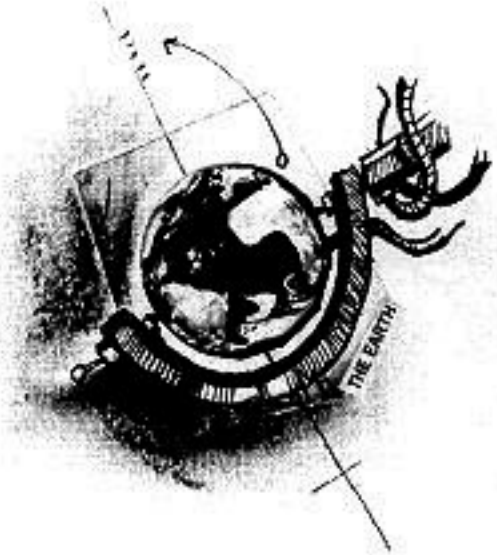
A simple display of the most recent important events. The latest reports are highlighted. Each message is preceded by the date upon which the event occured. During early stages of play the bulletin board may seem superfluous, but its importance will grow as you expand your systems. It can also serve as a reminder when a previously saved position is loaded from disk.

Emergency reports will cause the News Bulletin icon to flash accompanied by a warning buzz; time advance will be halted automatically. You are strongly advised to access the news bulletins in this instance!

Below the reports window is a single icon which can be used to repeat the most recent Special Bulletin (if any).

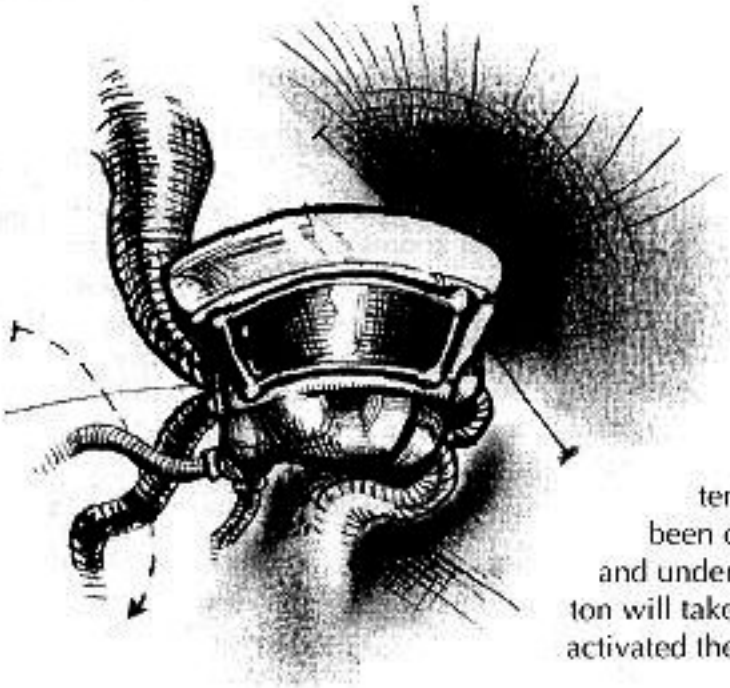
EARTH CITY

Activating this icon takes you directly to Earth City, displaying all relevant icons for accessing its departments in the DEPARTMENTAL CONTROL PANEL (see below). This allows you to return to the surface of Earth from anywhere at any time.



MASTER CONTROL

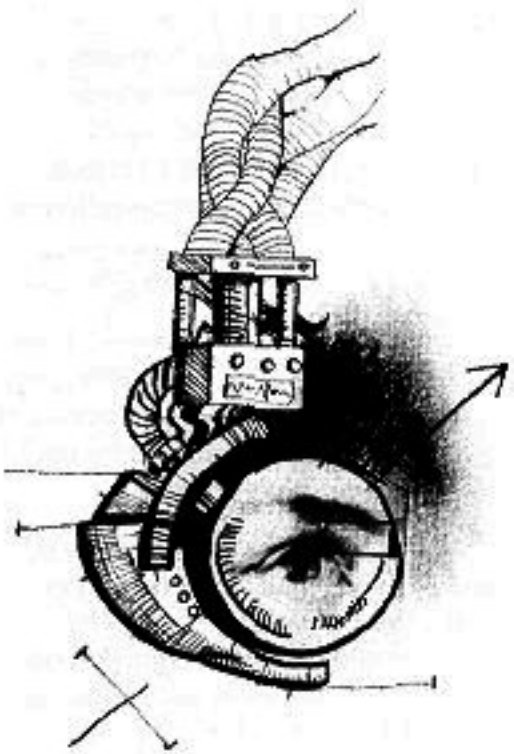
This icon will appear when your first orbital factory is constructed above the Earth. It provides a display of all factories and their current status. Factories are named according to their host planet or moon. Clicking on any factory displayed will give you access to the departments at that location, via the DEPARTMENTAL CONTROL PANEL. Surface stations may be accessed only via the respective orbital factory. Note that Earth is a special case. Earth City is not controlled by its orbitting factory, so may be accessed only via the Earth City icon.



This screen will also provide a display of all your IOS and their current status. Access to the cockpit of each craft may be gained by clicking on the ship's icon.

As this display gives access to so many of your facilities it is used extensively. The right mouse button has been connected to the Master Control icon, and under most circumstances pressing this button will take you to this display, just as if you had activated the Master Control icon.

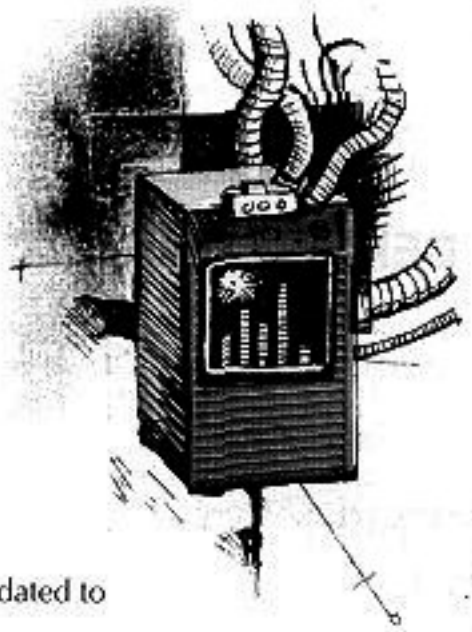
DEPOSIT ANALYSIS



This icon will become available at the appropriate time and is for information only. When activated it gives a graphic display of satellite and system charts, identical to the navigation systems for IOS spacecraft. Below the chart is a deposit analysis of the most abundant minerals available for mining, along with an indicator of any resident orbital factory.

To view the analysis on any planet or moon simply move the cursor over the required loaction and press the left mouse button. While in a satellite chart clicking on the planet zooms out to the system chart, showing all planets in the system. Selecting a planet from the system chart zooms into the appropriate satellite chart showing all moons of that planet. The analysis for the last location selected will be displayed.

STOCKTAKER



This is the main data base provided by the Master Computer. It supplies information on stocks of raw materials and equipment at all the orbital factories in the system. A further function gives a list of all teams of personnel along with their current location and status.

The **SWITCH STOREROOM** icon toggles the display between material stocks and equipment stocks.

MATERIAL STOCKS displays a list of all mineable minerals along with the locations where active factories are currently in orbit. The figures before each location indicate the tonnage in the OF stores of the material highlighted in red. Simply move the cursor over the material names and press the left button to select a material. The figures will be updated to show the stocks.

EQUIPMENT STOCKS displays a selection panel on the right of the screen along with the loactions where active factories are currently in orbit. To make a selection move the cursor over the panel and click the button for the required item.

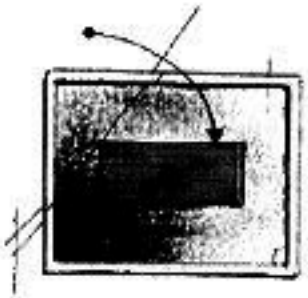
TEAM ROSTER is available only from the Material Stocks display. Click on the ROSTER ON/OFF icon to display the team list. The roster is colour coded: White team names are Mariners, blue refers to production teams while research engineers are grey. Each line shows the rank and name of the team leader along with the number of staff remaining in the team. The small sym-

bols indicate their condition: a small head-and-shoulders indicates that this is the active crew on a ship. The 'sleeping man' shows that the team is on a cryogenic pod aboard a ship. Planet and moon names indicate that the team is probably in the OF cryo stores at that location. Ship names are also colour coded: green for a shuttle and red for an IOS. Use the SCROLL UP (S121) and SCROLL DOWN (S122) icons to view other teams if you have more than twelve active.

DEPARTMENTAL CONTROL PANEL

Below the Master Control Panel is an array of icons which give access to the various departments of Earth City and Orbital Factories. The Master Computer will generate the appropriate icons for each location. If you are not in any particular location no icons will be displayed. If in doubt as to your current location it will be identified in the bottom right of the screen.

PRODUCTION



Selecting this icon will give a display of the production department for this location. It comprises of an item selection panel to the far right, a book of blueprints, a production progress indicator and a team status box.

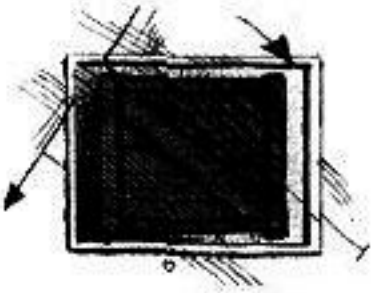
Moving the cursor over the selection panel reveals the blueprint and name of each item. Clicking on this panel will cause that item to be produced. As play commences only the Derrick, or Resource Mining Rig, is available for production. Other items must first be researched before they appear on the selection panel.

To produce anything you must first have a team of artisans for production control. These may be supplied direct from the Training Department on Earth or from the ship Service Bays in orbital factories. Most items have a Tech Level. The controlling team leader must have the corresponding minimum rank for each Tech Level. Team leaders will be promoted as they gain experience by producing items. The higher the rank of artisans the faster they will produce selected items. Speed is also affected by the number of staff in the team. Each artisan team leader may supervise up to 200 staff. Finally, production teams may be moved to the ship Service Bays for transportation to another location. Simply click on the icon to the left of the team status box. If there is space available the team will be tranferred to the Service Bay and production will be suspended.

All production requires raw materials. When a request is made for an item to be produced the stores are checked for any shortages. If deficiencies exist they are shown on the display. Otherwise the stocks will be removed from the stores and production will begin. When complete the item will be transferred directly into the Equipment Stores ready for use. Note that some items, such as the AOC, are built in situ and not passed to stores.

STORES

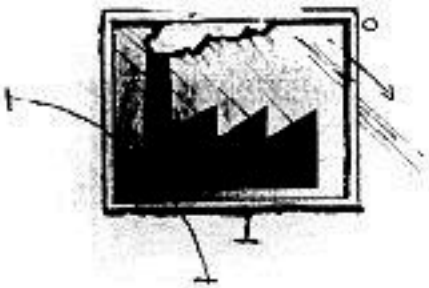
Earth City, orbital factories and surface stations all have storage capabilities for raw materials and equipment. The Stores display may be toggled between the two types of storeroom using the icon at the bottom of the display.



MATERIAL STORES gives a list of all possible raw materials. To the left of each is the amount currently in stock up to a maximum of 50000t. The blue arrows indicate deposits available on the local moon or planet. The item selector panel allows you to find out how many of a particular item may be produced from the current stocks. When any item is selected the stock figures are colour coded to show which materials are required; green indicates sufficient for at least one of that item, while red indicates a shortage. Grey figures are not required for this item.

EQUIPMENT STORES gives a list of researched items along with the current stocks. Stores may hold a maximum of 15 of each item. Moving the cursor over the name of any item will access the design library, providing a short description and function of the selected item. Press the left button to close the description.

N.B. Amiga users with an unexpanded machine will note that this function will cause the item to be loaded from the DATA disk. Library access will allow production to display the seperate stages of manufacture of that item, while production of any other item will display a general purpose graphic.



RESOURCE

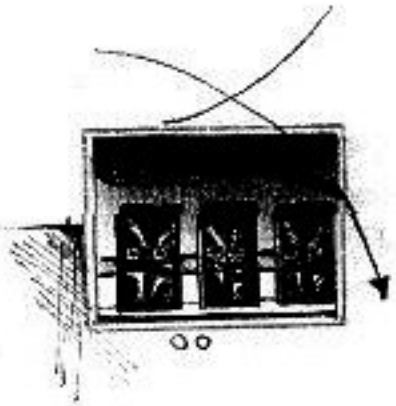
Resource centres are available on Earth City and surface stations. They control any mining rigs (derricks) and the surveying of fresh mineral seams. The rigs are responsible for the extraction of minerals.

The display shows a list of the deposits which may be mined at the current location. To the left are figures giving an estimate of the size of the current seam - NOT the current stock of that mineral. Once the seam has been exhausted the figure will change to show that a SURVEY is underway for a new seam. During this period no mining of that material will be achieved. Surveys will take varying times to complete depending on the rarity of the mineral.

When derricks have been manufactured they may be assigned to Resource from Stores by clicking on the ADD MINING RIG icon at the bottom right of the display. Control systems allow for a maximum of 8 derricks for each resource station. The more rigs assigned the faster minerals will be recovered.

TRAINING

Training is available only in Earth City and is responsible for supplying skilled personnel for the three professions: Research, Production and Mariners.



Earth City has a vast population. However, only a small percentage is available and suitable for recruitment. Recruits form a pool of available people which may not be replenished. The training department display gives the current size of the recruit pool to the left. There are three training areas to which recruits may be assigned, each door showing the area of training available. To train a team point the cursor to the RECRUIT icon inside each door and press the button,

keeping it held down for a fast transfer. A maximum of 100 personnel may be trained in each area at any one time. Training will commence once the ADVANCE TIME function is activated.

When training is complete the new team will be transferred to the respective department with the most promising student as team leader. The training area doors will be opened for further recruits. If a team is already present in the department then all newly trained recruits will be added to the staff of the existing team. Teams may be brought to full strength in this way. Training for Production and Research will not allow more recruits than necessary for the existing teams. When Mariners are trained they will first be split to maximise the teams in the Shuttle Bay. Any remaining recruits will form a new team. The shuttle bay cryogenics may hold up to four teams.

When first released from training the leader has the lowest rating for his profession. Higher ranks may only be achieved through experience in the field.

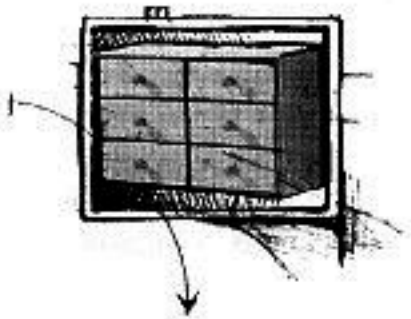
Maximum staff		Ratings		
Research	250 + leader	Technician	Doctor	Professor
Production	200 + leader	Apprentice	Engineer	Expert
Mariners	40 + leader	Pilot	Captain	Admiral

While teams are active natural losses of staff will occur, due to ageing, disease or accidents. These losses will not occur while the team is stored inside a ship's cryo pod!

RESEARCH

As with Training, Research facilities are only available in Earth City. Research requires a trained team and is responsible for the design and blueprints for the Production department. Nothing can be produced until it is first researched in this department.

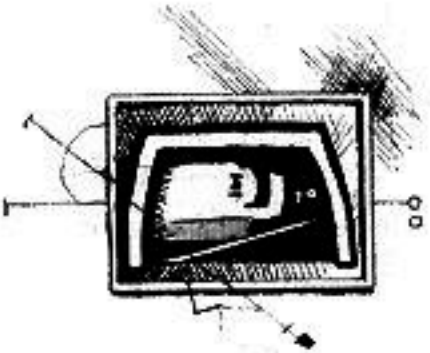
At the bottom of the display is a team status box which gives information on the resident team. The speed at which items are designed is relative to the number of staff assigned to the team. Note also that each item has its own Tech Level which demands a minimum rating from the team leader.



To select an item for research move the cursor over the selection panel to the right of the display. When the item name appears press the left button. Each drawer in the selection panel has a coloured light, indicating the progress of research on that item. Red indicates that the item is completely unresearched. Yellow indicates that some progress has been made. Green shows that the item is fully designed and passed to the Production department. Selection of a green item will give a rundown of the requirements for manufacture, i.e. Tech level, raw materials and type of production facilities. Selection of red or yellow items will start the reseach work.

Research is also responsible for investigating objects you may find, and designing tools for problem solving. The team leader will inform you of any developments via the News Bulletin. Work on any new items must be requested by Control, so keep an eye on what the Research team is doing!

SERVICE BAYS



These are responsible for the servicing of all your spacecraft. Refuelling, loading and unloading, engine fitting, crewing and general refits are all carried out here. Each Service Bay is directly linked to the Stores via a series of hydraulic elevators. Chassis and equipment may be moved to and from the Stores as required. Each Service Bays also has the capacity to house up to four teams of Mariners for transfer to and from spacecraft. Note that there are two types of Service Bay. One is specifically designed for Shuttles (bays) while the other is for larger spacecraft (docks). The space dock is only available at orbital factories; larger ships cannot be landed on Earth or surface stations.

An empty Service Bay may be used to build new vessels. Simply click on the **NEW SHIP** icon at the top of the display and a new chassis will be lifted from the Stores. Note that new ships require an engine and fuel before they are operational. While a ship is docked in any bay a computer generated image of the ship appears over the top of the gantry. Clicking on the sections of the image will move the gantry over the selected part of the ship, thus allowing access to each section.

CREW SECTION displays the nose of the ship, the name and rank of the crew, if any, and the four team rooms where Mariners or Artisans may reside. Mariners are colour coded red, Artisans blue. To assign a crew move the cursor over one of the resident teams and press the left button. Remove crews by clicking on a vacant team room. Note that clicking on a resident team of Artisans will transfer them to the Production department.

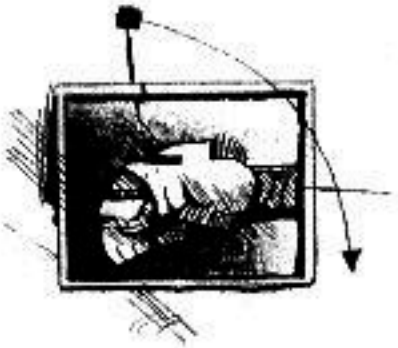
POD MOUNTS allows the fitting and removal of the three different types of pods (see page 33. Three different icons at the bottom left of the display decide which type of pod is fitted to the ship. If the pod is already fitted it will be removed and replaced in Stores. To load or empty the pod move the cursor over the graphic of the pod on the ship's chassis until INSPECT POD appears in the text description area and press the left button. A window will appear for the appropriate pod. Materials, equipment and teams may now be transferred to and from the pod. Press the right button to close the window.

ENGINE MOUNTING allows a newly commisioned craft to be fitted with an engine by clicking on the INSTALL icon. Damaged engines may also be replaced in the same way. Of course, the old engine is scrapped and not replaced in the Stores. The refuel bar beneath the gantry shows how much fuel is in the ship's tanks. The white figure shows how much is in stock. Click on the + or - to adjust the fuel level. While in the service bay access to the ship's cockpit is gained by clicking on any part of the chassis.

DISMANTLE will initiate the dismantling of the entire ship, placing all components into storage. However, the procedure will be halted if there is no vacant team room for the crew. Items held in grapples must be removed manually before selecting this function.

SHUTTLE

Only one shuttle may be active on each planet or moon. This icon gives access to the cockpit of the shuttle, showing all necessary information on the status of the craft and any cargo it is carrying. The ETA reading shows the time at which its current manoeuvre is expected to be completed.



SHIP CONTROL

Most functions of ship control are performed from the cockpit. Not all ships have the same controls. The shuttle is restricted to its mother planet and so no course setting is required. Each function is explained below (refer to the diagram for the location of the icons).

SERVICE SHIP

If the ship is docked this will take you from the cockpit into the service bay.

DOCK, LAND and LAUNCH

These are the manual override buttons for ship manoeuvres.

POD CONTROLS

This panel shows all pods fitted to the ship. Select the appropriate pod mount to access the contents or controls for that pod. While the ship is docked selecting a pod will take you to the service bay, with the gantry positioned over that pod mount.

SWITCH VIEW

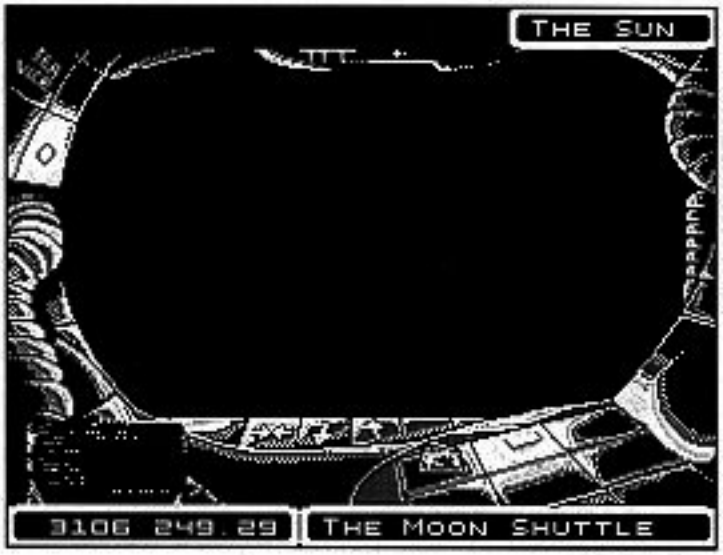
The cockpit display has two modes, and by selecting the Switch View icon it is possible to toggle between a status display and a visual display of the exterior view (expanded computers only).

ENGAGE/DISENGAGE DRIVE

On interplanetary flights the main drive must be engaged to travel to the preset destination. Minor manoeuvres such as docking will engage the drive automatically.

SET COURSE

By selecting this icon it is possible to set the ship's destination. A series of charts will be displayed showing the local planets and moons. Anywhere in the system may be targetted. The display also gives an ETA (estimated time of arrival) for the selected destination. There are two types of chart: the satellite chart and the system chart. While in the satellite chart clicking on any moon will select it as the destination, and the ETA will be calculated and displayed. Clicking on the subject planet will set the destination as that planet, but also switch display to the sys-



tem chart. In the system chart all the planets in the system are shown and may be selected as destinations. Clicking on a planet will also take you to the satellite chart for that locale. Pressing the right mouse button will close the display and log the last selected planet or moon as the ship's destination.

If you wish to change course while the ship is already in flight, disengage the drive first! Changing course may force the ship to come to a halt before turning to its new heading, extending the time it will take to reach the new destination. It may even be quicker to let the ship reach its present target before changing destinations.

EQUIPMENT AND DATA REFERENCE

This guide should be used as new items are made available to provide more information on the operation of items.

ACC

The ACC is designed to carry raw materials in a pre-programmed cycle, controlling mundane tasks such as docking, launching and loading of stores. You'll wonder how you ever managed without it! Both shuttles and IOS may be fitted with the ACC.

The computer is fitted from the crew section in any ship service bay, or automatically when a new chassis is removed from the stores and an ACC is available. Access to the computer is gained by clicking on the pulsing red icon at the top left of the cockpit display.

The computer provides a list of all available materials with columns of LEDs on both sides of the list. To program the ACC simply toggle the required LED on or off. For example, to take Iron FROM the surface TO the orbital factory stores toggle the green LED to the left of "Iron" so that it is lit. The column to the right of "Iron" should be off. Now engage the ACC by activating the ENGAGE icon. With this setting the shuttle will fly from surface to the orbital factory and back, carrying Iron on the upward trip each time and depositing it in the orbital stores. The two pointers on the display show which material will be taken next. If multiple settings are made the pointer will cycle through the selected materials, taking one pod full at a time.

Note that the computer will not take any action while the ship is in orbit. Dock or land the craft manually to begin the cycle. The computer may be disengaged at any time, or set to complete

its current cycle, which will be when the ship has docked or landed and unloaded its current cargo. If no supply pod is fitted a warning will be given, but the computer will still follow the flight plan. Obviously no supplies will be transferred.

The ACC also controls all refuelling of the ship when it docks. If sufficient fuel is not available the ACC will hold the ship in dock until the refuel threshold is reached. This refuel threshold may be set manually from the DISK ACCESS display. The settings will be stored with any saved games.

Once you are accustomed to the use of the ACC you might like a few tips on using it to its full. The computer may be used to balance the material stocks of two different stores. Simply turn on the LEDs on each side of a material and the ACC will assess the levels of stock at each end of its flight plan. A complete balance may take a little time to achieve.

Although a crew is not required aboard a ship which is under ACC control, they will gain flight experience during their travels. The ACC may be used in conjunction with an AMA (Asteroid Mining Attachment). Treat the asteroids as you would any orbital stores and the AMA will mine the requested materials automatically.

AOC

Construction of any item requires the presence of highly trained production staff. These Artisans take time to learn their skills, making them rare and greatly valued. However, the drawback of using humans is that they need a separate request for each item they make. The AOC replaces artisans, freeing them for use in new locations. All production can now be made automatic.

To program the AOC select items to be made as usual. Each light on the item selection panel has three states indicated by different colours. Red means that the selection is OFF, and no items will be produced. Yellow means that the AOC will attempt to make one of these items, while green programs the AOC to produce this item until the storage area is full (the AOC will switch to red automatically at this point).

The AOC will cycle through the list, producing the items requested. If there are insufficient raw materials in stock, the item will be skipped and the next selected. Only one AOC may be built in any factory. As soon as the AOC is installed the resident artisans will be transferred to the ship service bays.

IOS CHASSIS AND DRIVE

The Interplanetary Operations Spacecraft is the most versatile vessel ever designed and compounds the theories of Dr. Trout. It permits interplanetary travel on a scale never seen. Similar in basic design to the shuttle, the IOS allows human control by a crew and the mounting of three pods. Each pod may be of any type and controlled separately. This gives a maximum payload of 750 t.

In addition, the IOS has in-built navigation computers allowing flight paths anywhere within the solar system. Its massive engine, the I Drive, is capable of long burst high thrust performance. This means that the IOS may escape any gravitational field at extreme speeds. Maximum velocity is yet to be ascertained, but is estimated to be 0.3c (one third light speed).

Due to the linear design and rear directed thrust the IOS is incapable of landing on the surface

of large planets or moons. Orbital factories provide the only means of service. It is feasible, however, that they could rendezvous with large asteroids, although this has not been tested.

ORBITAL FACTORY SECTION (OF FRAME)

CREW REQUIRED: Pilot

ACTIVATION CONDITIONS:

- Host ship must be in orbit.
- Operational factory must not be present already.

Don't be fooled by its simple name: the OF Frame is a very sophisticated piece of equipment. Orbital Factories are too large to be carried into orbit from the planet surface. They must be transported in kit form and constructed section by section. Eight OF Frames are required to construct one Orbital Factory.

Each Frame is designed to fit inside a Tool Pod and may be activated from the carrying shuttle cockpit. A small computer controls expansion and location of the section to any already in orbit. This is an automatic process but skilled humans are required to oversee the deployment. The computer has an automatic fail safe to prevent further release of sections where an Orbital Factory is already in operation. Furthermore, the Master Computer can control only sixteen factories at one time.

The Orbital Factory becomes operational as soon as the last section is locked into position. Docking bays and store rooms may be used immediately, though production facilities will require artisans and raw materials, both of which may be supplied via the shuttle. Power for the

factory is obtained from solar panels cladding the exterior surfaces, giving maximum exposure to sunlight at all times.

It should be noticed that the low gravity environment and larger size of the production facilities allow the Orbital Factory to produce items not possible on Earth.

PODS

There are three types of pod which may be mounted upon spacecraft. The type of pod fitted determines the function for which the craft will be used.

SUPPLY POD

Supply pods are used for general haulage of raw materials between surface stations and Orbital Factories. Each pod has a single cavity and so may only hold one type of material at a time. A single pod may hold up to 250 tonnes.

TOOL AND EQUIPMENT POD

The tool pod is simply a mounting for equipment and provides control circuits from the cockpit of the craft to any tool fitted to the pod. Some items have no function but may be carried from one place to another via a tool pod. Tools which may perform functions while mounted may be activated by accessing the pod from the cockpit. A logic box in the pod decides if the conditions are correct for the operation of the mounted tool. If not, the pod locks out and replies with a report on the contents of the pod.

CRYOGENIC HOLDING POD

Cryo pods are the easiest to use but the most advanced in technology. They are designed specifically for the transport of live humans. While the occupants are inside all life systems are frozen, giving complete protection from viruses and degeneration from age.

RESOURCE MINING RIG (DERRICK)

Derricks are the hub of all operations. They provide raw materials for the manufacture of ships, fuel and equipment. Although simple in design they can perform very complex functions.

Each derrick is controlled remotely by a computer in the resource centre. Once a sizeable mineral seam has been located by the survey function of the rig, the computer will direct the derrick to move into the optimum location for mineral extraction. Mining is then automatic until the seam is exhausted and the rig is relocated. The resource computer may handle up to eight derricks.

As the raw materials enter the derrick they are passed through a series of processes, refining them into usable packages which are ferried to the local material stores. Some processes are extended to maximise efficiency. Iron, for example, is mixed with carbon and other trace elements to produce a range of graded steels.

The versatility of derricks is evident. They are capable of extracting solids, liquids or gases in most environments with the minimum of maintenance. Designs date back hundreds of years to the days of the legendary Moon Base. Although current designs are greatly improved, the original principles are still used.

RESOURCE STATION SECTION (R FRAME)

CREW REQUIRED: Pilot

ACTIVATION CONDITIONS: Host ship must be on the surface of an unoccupied planet or moon.

To complement any Orbital factory, surface stations may be constructed on the planet below. The construction of these stations is based on the same principles as that of Orbital factories.

Surface stations require two R frames to be deployed. Each frame is designed to fit inside a tool pod and may be activated from the carrying shuttle cockpit. A small computer controls expansion and location of the section. This is an automatic process but skilled humans are required to oversee the deployment. Once construction is complete the working shuttle is placed inside the newly operational service bay.

Surface stations have no production facilities or cryogenic storage areas for crews. They are purpose built resource recovery and storage units. Little maintenance is required although Derricks must be supplied, via shuttle, before any mining may commence.

Surface stations rely on the orbitting factory for power and control. In the absence of the factory, all processes will cease and the station will fall into disrepair.

SHUTTLE CHASSIS AND DRIVE UNIT

The Shuttle is the planetary workhorse, the only link between surface and orbit. Master Control allows for only one shuttle per installation.

Present day designs for spacecraft are based on the "Principles" outlined by Dr. Darrill Trout of the New World University, circa 2900. He stressed the point that building specific craft for specific purposes was "restrictive and ridiculous".

We shall not go into details of his 26 volume thesis on craft design. Suffice to say that ships are built for maximum flexibility. Using a basic chassis and a standard mounting platform, the function of the ship depends upon the tools and equipment fitted. It is then simple to turn a cargo ship into a personnel carrier, into a construction vehicle, etc.

Basically, the shuttle consists of three sections. The nose houses the crew, if assigned, and all command and control systems for the craft. Each shuttle has one pod mounting. Extensive circuitry from pod to nose section allows total control over the pod and its contents from within the cockpit (see "Pods" on page 33).

The engine mounting to the rear of the shuttle allows for the fitting of a short burst, high thrust drive unit. Prototype designs incorporated the engine with the chassis but this proved to be costly. If the engine failed or became damaged the entire shuttle would be scrapped. Current designs allow for the replacement of drive units on old chassis.

Shuttles provide the perfect crew training vehicle.

HOW TO BUILD AN ORBITAL FACTORY

A STEP-BY-STEP GUIDE

Setting up your departments

1. Your first priority as Earth City controller will be to enlist and train personnel for each department. Go to the Training department and transfer recruits to each area, pointing to the right hand arrow in each of the doors and holding the left mouse button. You will be unable to run any departments until the recruits are trained, so click on the Advance Time icon until the doors re-open. The first batch of trained staff will be assigned automatically to their departments, but before you leave the Training department transfer more recruits to each area.
2. The next step is to build the Resource Department up to its maximum output, and to research the other projects which will be needed to construct a shuttle and the sections of the Orbital Factory. Go to the Research department and select the Shuttle Chassis. This is achieved by clicking on the button in the item selection panel on the right of the screen. The green button for the resource mining rig shows that it has already been researched; the red buttons denote projects awaiting research. Enter the Production department and click on the green button to select a Derrick.
3. Advance Time and you will see the derrick being built. When it is complete and the derrick graphic disappears ,go to the Resource department and add the rig, using the icon at the bottom right of the screen.

4. Repeat this procedure until your Resource department has a complement of 4 rigs.

5. Go to the Research department and select the Shuttle Drive. Now enter the Stores and click on the Shuttle Chassis (point the cursor at the text in the centre of the screen). The item will be shown, along with a description of its use. Return to production and build a Shuttle Chassis. Advance Time. Build another 2 rigs. Advance Time. You will notice that the Production team will be promoted to Engineer. The team's performance and capabilities have improved due to their experience in their field.

6. Go to the Stores and select the Shuttle Drive to view a description. You will be told that the drive requires fuel: return to Research and select MeH fuel. Once this has been researched it will be produced automatically from your stocks of Methane and Hydrogen.

7. Return to Production and build a Shuttle Drive. Advance Time. Build another two rigs to bring Resources up to the maximum of eight.

Building a Shuttle

8. You are almost ready to send your first shuttle into orbit. Go to the Shuttle bay and you will see the trained marines available as crew. Above them is the New Shuttle icon which will bring the newly constructed chassis into the bay. Click on this icon. The shuttle be lifted into view, while above the bay the New Shuttle icon will disappear, replaced by the Dismantle icon and a small representation of the three sections of the shuttle. Clicking on any part of this will allow you access to the Crew section, Pod mount, and Engine section. Assign a crew by pointing to any available team and clicking the mouse button. The team will be transferred to the Crew section of the shuttle.

There are three types of pods which can be installed in the shuttle. These are:

(i) Supply pod

(ii) Tool and equipment mounting

(iii) Cryogenic holding pod

Research each of these pods and then access their descriptions from the Mining store to view more information on the use of each type of pod.

You will also need to research and construct an Orbital Factory section. To transport an OF section into orbit, build a Tool and Equipment mounting. Install this mounting in your shuttle, then point to the pod - the words Inspect Pod will appear at the top left of the screen. Click the left mouse button to view the Equipment stocks and select OF Frame from the list. Now click the right mouse button to exit from this menu.

Now click on the Engine mounting icon at the top of the screen. You will move along the shuttle bay to the stern of the shuttle. Select the Install Drive Unit icon.

The shuttle is fuelled by pointing to the + sign to the right of the fuel bar below the shuttle bay. Hold the left mouse button to transfer fuel. Hydrogen Methanol fuel is produced automatically at any factory where both resources are available.

Controlling The Shuttle

There is now a new icon available which will take you to the cockpit of the shuttle. From the cockpit you may view a text display giving information on the location, fuel available, crew and

cargo of the shuttle. By clicking at the bottom left corner of the cockpit you will switch to the actual view from the shuttle cockpit. The controls for the shuttle are positioned around the cockpit window.

(i) Service ship - this appears in the top left corner and will allow you access to the shuttle bay when the shuttle is docked.

(ii) Dock - this is in the centre of the screen under the window; use it to dock with an OF when in orbit.

(iii) Land - this is to the right of the Docking icon and is used to land the shuttle from orbit onto a planet or moon base.

(iv) Launch - to the right of the Land icon. Launches a ship from a base into orbit.

(v) Pod mounts - these appear in the bottom right of the cockpit screen.

Select Launch: the text will change to read: Climbing from Earth. Now Advance Time until the shuttle reaches Earth's orbit. Click on the pod mount to activate the OF frame. Note that a further seven frames are required to complete the factory.

When construction of the Orbital Factory is complete the Master Control screen will become available, showing your new factory to the right of the master control icons. You will come to use this screen a great deal as the plot unfolds and your colonies spread throughout the solar system. Good luck!

ADDENDUM A

Extracts from "Principles" Vol. XXI, Dr. D Trout

Chapter 4

"...and I have already theorised on the principles of interplanetary propulsion. You can see that the time taken to travel from one planet to another is well within the life span of a human being.

However, using the same propulsion system over the distances to neighbouring stars would not be practical. For such exploration a craft which could approach the speed of light would be necessary. This in itself would create new problems.

For the sake of my explanation we shall take Proxima Centauri as our example, a star some four light years distant, i.e. it takes light from this star four years to reach us. You would imagine that a ship travelling at the speed of light would take four years to reach the star. Well, this is only true as long as you accept that time passes at varying rates.

To an observer on Earth, the ship travelling to Proxima will take four years to complete its journey. In fact, the physical mass of the ship will take four years. However, as the ship approaches the speed of light , time begins to pass more slowly. Not only do clocks slow down, but everything else is affected; the atomic processes we discussed earlier are slowed, including the mental and metabolic processes of the crew. To the crew everything would seem normal except that they are ageing more slowly than those on Earth.

When the ship arrives at Proxima, four Earth years will have passed, but due to the effects of time dilation it will seem like only weeks to the ship and its crew!

Remote control computers for such craft would require that they remain in the same time frame. For example, if our ship was to return directly to Earth at the speed of light it would arrive eight years into the future of our current time frame! Control would be lost resulting in the probable destruction of the craft.

Of course, 100% light speed is not actually attainable, but something approaching it would have the desired effect. Consider the formulae for..."

Chapter 5

"...but we have already proven that full light velocity is unreachable. Perhaps 99.9% is the maximum ever attainable.

I shall expand upon my theories a little later, but you will see that once light speed is approached it is a simple matter to exceed it, never actually reaching the velocity of light itself! I shall prove that any mass can travel at less than, or faster than but not equal to the speed of light.

For the time being I shall revert to my earlier discussion of time dilation. We have seen that time slows as we approach the speed of light. It would seem natural to assume that time would simply stop at this magical velocity. And beyond it? Backwards?

Hyperlight travel would allow a ship to travel back and forth between any locations in the universe, arriving in any time frame it wished. Remote control computers would no longer have the problem of losing track..."

ADDENDUM B — GLOSSARY

A.C.C.	Auto Cargo Computer
A.M.A.	Asteroid Mining Attachment. Used for Surface Mining on Large Asteroids
A.O.C.	Auto Operations Computer
Bandaid	Surface Station Repair Equipment
Blaser	Electromagnetic Pulse Laser
Blaster	Sonic Pulse Weapon
CommsPod	Special Pod incorporating a Communication Unit
Cryo Pod	Pod for transportation of Personnel held in Stasis
D.F.C.C	Drone Fleet Control Computer.
Derrick	Automated Ore Recovery and Refining Unit
Drone	Computer Controlled Warcraft
E.T.A.	Estimated Time of Arrival
FuzLaser	Thermo-nuclear Fusion Laser
G Chassis	S.C.G Chassis
G Drive	S.C.G. Drive Unit
Grapple	Equipment for retrieving Small Asteroids of up to 250t
HeD Fuel	Helium-Deuterium Fuel

Hyperlight.	Hyperlight Speed Travel
I Chassis	I.O.S. Chassis
I Drive	I.O.S. Drive Unit
I Drone	Drone built from a I.O.S Chassis
I.O.S.	Interplanetary Operations Spacecraft
MeH Fuel	Methanol-Hydrogen Fuel
OF Frame	Orbital Factory Section
OF	Orbital Factory
P.T.L.	'Prejudice' Torpedo Launcher
Prison Pod	Special Cryo Pod modified to prevent escape of Occupants
R Frame	Surface Station Section
S Chassis	Shuttle Chassis
S Drive	Shuttle Drive Unit
S Drone	Drone built from a S.C.G Chassis
S.C.G.	Star Class Galleon
S.D.M.	Self Destruct Mechanism
Shuttle	Surface To Orbit Service Ship
Supply Pod	Pod for haulage of raw materials
Tool Pod	Pod for haulage and Mounting of Tools or Equipment

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