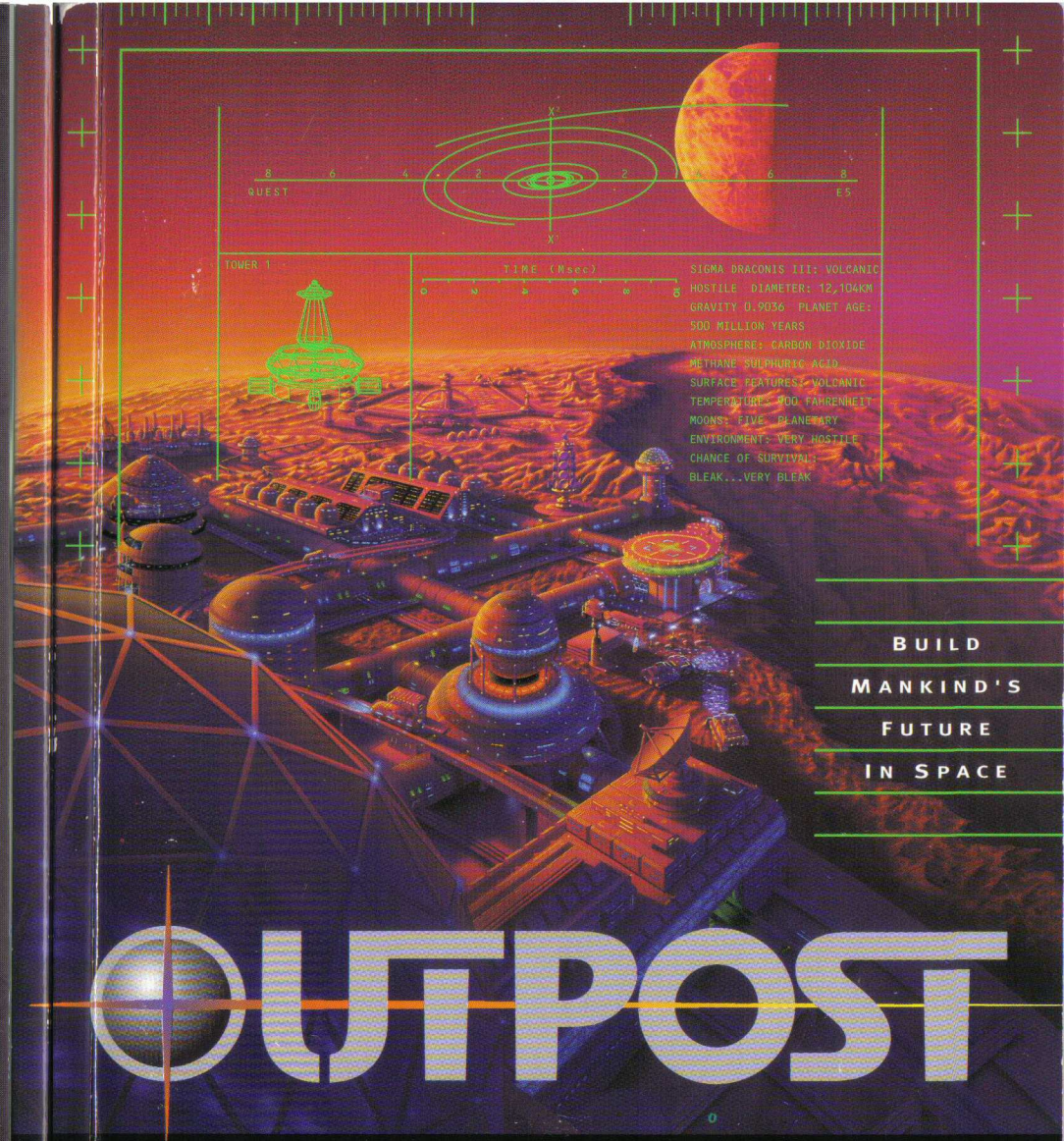




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BUILD
MANKIND'S
FUTURE
IN SPACE





 **OUTPOST**™

 **SIERRA**

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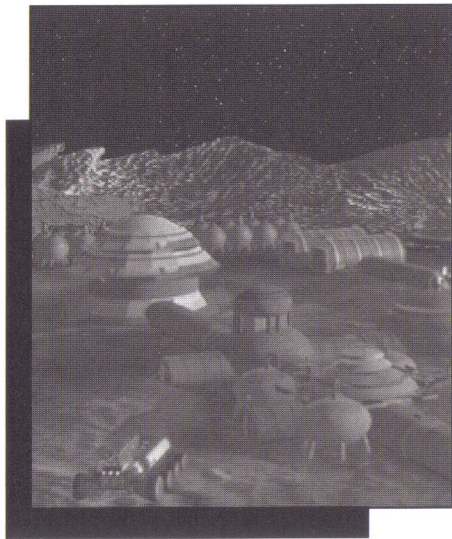
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Chapter 1 INTRODUCTION

What is Outpost?

Outpost is a realistic simulation of what it will take to build a self-contained colony on a hostile planetary surface. This strategy game is based on current NASA research, and is designed by former NASA-Ames Research Center Systems Manager Bruce Balfour. Balfour also designed the award-winning *Neuromancer*, and Sierra On-Line's *The Dagger of Amon Ra*.



You must rescue humanity from certain doom, choose a new planet from a galaxy of possibilities, and establish a colony on the planet's surface. This colony will be the final outpost of humanity, and your competence as the leader of this outpost will determine whether or not our species will survive.

The colony must be managed as though it were any other city on Earth: short-term goals include continuing the building program, keeping the rabble employed and happy, exploiting planetary resources, recycling waste, and dealing with random events such as meteorite strikes. Eventually you may want to pursue long-term goals such as advancing the civilization, researching new technologies, establishing terraforming operations, and establishing trade between colonies. How you proceed in pursuit of your self-established objectives is up to you; you're in command.

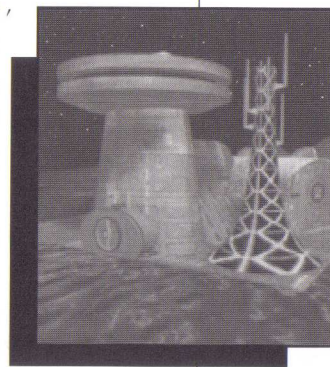
Outpost is based on fact, but it's also a game, which means that there are bits of humor and the occasional dramatized event for

your amusement. A reasonable amount of scientific progress over the next 50 years is also assumed. However, the underlying model, the technologies, and the science have been extensively researched. Planet types are all based on planets in our very own solar system; they're not exactly the same, but they're similar.

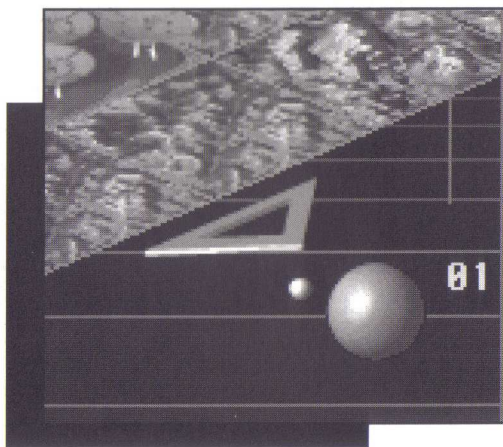
The model used in *Outpost* is one of a complex system in the real

world, so poking the model in one spot will have an effect on everything else. Events will invariably occur that you can't anticipate, and no two games will be exactly the same. Keep in mind that *Outpost* is a

strategy game, and is not played in real time. You can take a half a moment or a week and a half to make your move, so feel free to think about it.



When you arrive at your planet of choice, you'll find an icon on the bottom right of the screen. You will left click on this icon, a planet with an orbiting moon, when you want *Outpost* time to advance one unit. Time advancement will allow mines to be excavated, food to be harvested, roads to be built, factories to be constructed, and other types of progress to be made. Time advancement also furthers plagues, natural disasters, and the decay of your manmade resources; what's more, morale will drop if your population feels that progress isn't being made quickly enough. Advance a turn only when you've done all you can during the current move.



The Plot

It is the early part of the 21st century. Government funding of NASA has continued to shrink since the 1990s, leaving the space program in the hands of a few multinational conglomerates. Now it appears there's a slight problem, and it's hurtling toward Earth.

An enormous asteroid, which the media dubs Vulcan's Hammer after an old science fiction novel, is headed right for us, with an excellent chance of striking the planet with a billion megatons worth of destruction. Only one company responds to the threat by building a colonization starship. The starship is assembled in Earth orbit, and is then fueled from the atmosphere of Jupiter. By the time fueling has begun, pandemonium reigns on our home planet, but by then it's too late to build another starship. Utter destruction of Earth means two things: that yours is the last bastion of humanity, and that you can't turn to other survivors for assistance if your colony falters. There aren't any other survivors.

Your colonist population is limited to 200 people, most of whom have the skills required

to rebuild civilization. You'll be asleep for most of the 50-year trip to your destination of choice; while you nap, any probes you may have sent ahead of the starship will start sending back data when they arrive at your target star system. You'll evaluate the data to select the appropriate planet for your colony.

When you land, a certain element of the population feels that your leadership is lacking, and they abscond with up to half of your colonists and resources to start a rebel colony. You'd like to deal with it, but you're too busy trying to survive. Hostile planets have dust storms, meteorite strikes, and numerous other hazards which can nail you when you aren't looking, not to mention the day-to-day business of just trying to eat and breathe. In the meantime, the rank and file are watching your every move to see what kind of leader you are. When you screw up, morale goes down. When morale goes down enough, colonists begin leaving for the rebel colony. So don't screw up.

That's the situation you find yourself in at the beginning of the game. You'll find more interesting facts and fascinating details in the chapter entitled "How to Play."

Installation and Saving Games

Everything you ever wanted to know about installing *Outpost* and saving games is explained on the installation card enclosed in this box.

How to Use this Manual

Since it is modeled on a complex system, *Outpost* must be experienced to be understood. Nevertheless, you'll need fundamental information in order to know what's expected of you, and this manual is our attempt to provide you with this information in orderly fashion.

The "How to Play" chapter is separated into basic needs and higher-order needs, organized in alphabetical order where appropriate. The "Strategies" chapter addresses the different ways to define victory. (As with most things in *Outpost*, what constitutes a victory is determined by the player.) In the Appendix you will find a Glossary and a Bibliography; helpful charts and tables are interspersed throughout the manual.

So, Commander, now you have everything you need to determine the fate of humanity. Sit back, relax, take the helm, and pray that fate is kind.

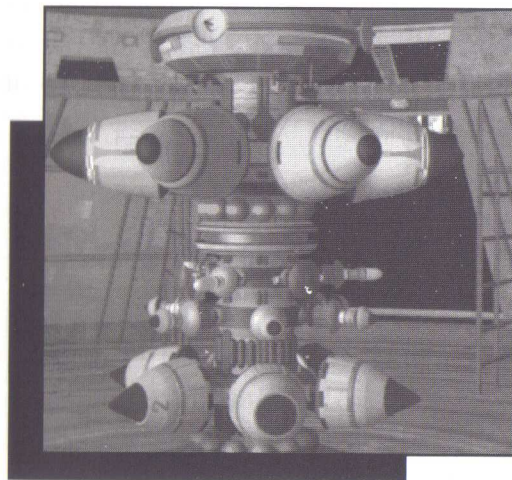
Chapter 2 HOW TO PLAY

Getting Started

Welcome to *Outpost*, a realistic strategy simulation of space colonization. Your mission is to colonize a hostile planet in a distant star system. You'll begin by selecting which star systems you'll consider calling home. You will send out VLBI satellites to four star systems to determine which is the most promising. This information will arrive at Jupiter while you are fueling up for your trip; from it you will decide which of the four systems you will colonize. At this time, if you've packed them, you can send out ULBI satellites for information on planets in your star system of choice.

Difficulty Level

When you start a game, you'll choose a difficulty level. Many of *Outpost's* internal conditions are affected by your choice. Planetary Hostility, the amount of help you get from the AI adviser, the damage level your colony suffers during disasters, and a variety of other issues are affected by the difficulty level you select. The difficulty level you choose also



affects frequency of disasters, how many rebels flee, and how critical your population is when you make a bad decision. During your first game, you may want to select a low difficulty level, and increase the level of difficulty on a future game as your experience increases.

Packing

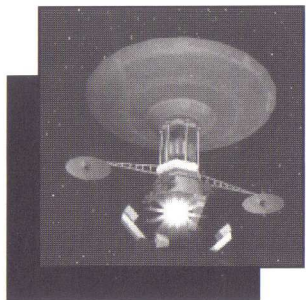
So, Commander, you've got the money, the weight restrictions, and the colonization plan. It's time to choose what cargo you need to take with you to your new home. Unfortunately, you can't take everything. The starship's propulsion system can only push so much cargo up to a reasonable speed to arrive at the destination within a reasonable amount of time. Will you take an extra 50 colonists, or pack an additional unit of food? Should you favor one satellite over another? What will the weather be like? You can't phone ahead, and you have only one chance. You'd better make the right choices.

Certain items will automatically be included. You must, for example, take 100 colonists. At the point when you begin packing additional materiel and personnel, you will have 172 remaining funds, and a remaining weight maximum of 78 units. The following chart will list certain facts about packing which you should take into consideration:

CARGO	WT	COST	ADVANTAGES OF CARGO
Colonists (50)	1	1	Colonists will man factories, etc. upon arrival
Food	1	1	One unit will feed 10 colonists while the agricultural dome is being built
Life Support	1	3	Used in emergencies. Will keep colonists alive if the unexpected occurs
Colonist Lander	9	16	One lander will transport 50 colonists, one way, to the new planet
Cargo Lander	10	17	One lander will transport a cargo-weight value of 20, one way, to the new planet
Seed Factory	10	18	Provides basic power, robots, resource processing facilities, and temporary residence

CARGO	WT	COST	ADVANTAGES OF CARGO
Tokamak Reactor	10	20	Provides most power needs on most planets.
Solar Power Satellite	8	15	On certain planets, will provide clean, safe, reliable energy
Solar Receiver Array	5	10	Two are required to make a solar satellite function
Geological Probe	4	14	Collects data to determine best landing site
Weather Satellite	4	12	Collects data on local weather, including warnings of major meteorological events
Interstellar Probe	0	15	Sends back detailed data on possible new planets
Communications Satellite	4	11	Enables your robots, especially explorers, to find their way around the planet
Orbital Observer	6	13	Provides visual study of planet from orbit
ULBI Probe	0	14	Provides high-quality data about your target star system

Probes and Satellites



In choosing which probes and satellites to pack, you should give careful consideration to the types of data you'll need to make intelligent decisions on your new planet. The starship itself can provide enough basic survey data about topography, chemistry, and geology for your AI to determine the best possible landing site. Satellites and probes provide more information than the starship can, however, and will enable you to make an even more informed decision as to landing site. Additionally, satellites and probes remain in use and perform an ongoing function. Keep this in mind while considering the tradeoffs of various types of cargo.

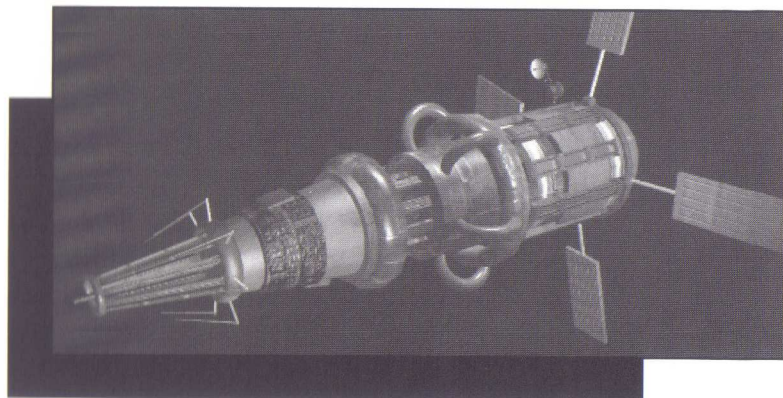
If you have packed ULBI probes, data will begin arriving while you are between Jupiter and your star system of choice. These data will provide information about specific planets within the star system. Since you can't change your mind if you drop down to a planet and

decide it looked more hospitable from orbit, you'll need to make the right decision the first time about which planet to colonize. ULBI data can be very helpful.

Once you've chosen which planet looks the most promising, you can send out an interstellar flyby probe if you've packed one. An interstellar flyby probe will provide detailed information about the planet you've selected. A planet with a low hostility level can have up to 25 possible landing sites; hostile

planets can have as few as one.

When you arrive in orbit at your destination, you'll launch the satellites and probes you brought with you. If you drop everyone down to the planet without deploying your probes and satellites, they won't launch themselves. Don't forget to launch them before you leave the starship forever, or you'll have wasted your resources and your colonists will think you're an idiot.



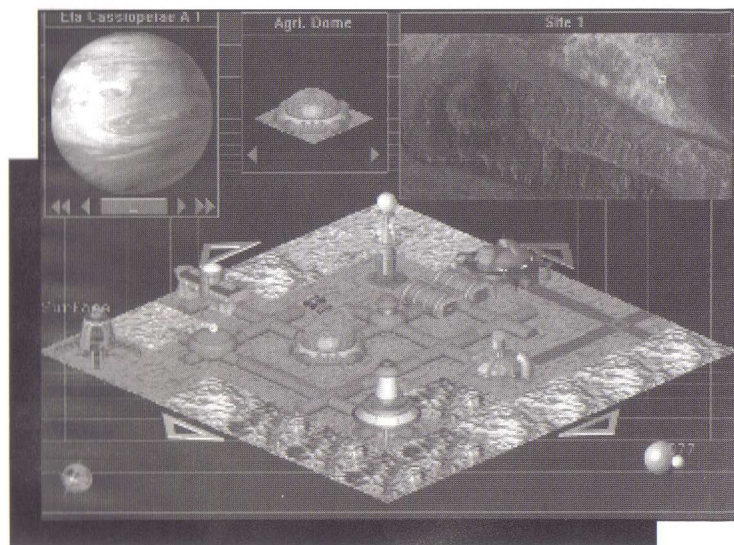
The Windows of Your World

Now that you've finally made your decision as to which planet to colonize, the top left corner of your screen shows the planet you'll call home. The controls will rotate your planet; when you click on the center button, possible landing sites will be shown on the planet as tiny rectangles. These have the best geography, potential mining locations, and environment for colony placement. When you click on one of these rectangles, you have chosen a site for your first colony. If you right click within the window, you will be able to replace the default planet name with one of your own choosing.

After you've made an informed or not-so-informed decision about a landing site, two more windows will appear on the screen. The middle window, or "Tile Picker," shows a Seed Factory tile. The top right window shows your chosen landing area from an orbital perspective. The red dots you see are potential mining locations. This window is called the "Site Map." You can right click here and rename your site.

When you find a good location for your new colony on the Site Map, between a group of mine locations or beside a single mine, left click on that spot. The small square box that formerly appeared in the top left corner of the landing Site Map will now move to that location. The diamond-shaped Tile Map that takes up most of your screen shows the specific area highlighted on the Site Map by the small square.

The four arrows around the Tile Map will move you in any direction within the confines of your landing site. This will allow you to make small steps to put tiles down on the perfect terrain. Larger moves should be made on the Site Map, but the Tile Map is where you'll spend most of your time, since it shows the structures you've built or are currently building.



MOUSE CLICKING

Clicking on windows will become second nature as you play *Outpost*, but here's a crash course on what your mouse can do.

Right clicking anywhere in the parent window will display a default dialogue box.

File	Open Save Save as Exit Alt-X
Control	Run a turn Ctrl-T Tile Grid Preferences Animated Sequences On Off Once Only Tile Animations Title Bar Music Sound Effects
Level	Surface Alt-0 Underground 1 Alt-1 Underground 2 Alt-2 Underground 3 Alt-3 Underground 4 Alt-4
Help	F1 Document About

Under "Control," a left click on "Tile Grid" will turn the grid shown on the tile map on or off. The preferences box will enable you to turn on or off the animated sequences, music, title bar, and sound effects. You can view the surface or underground levels by selecting "Level."

The Planet Display Window and the AI are generated immediately upon arrival at your new planet, and you can click on them before any other windows appear. A right click on the Planet Display Window will enable you to move the window, give the planet a new name with up to 16 characters, or get access to context-sensitive help.

System	Restore Move Size Minimize Close
Tools	Name New Name: _____
Help	F1 - Planet Display Help

When you right click on the Tile Picker window, you will see:

System	Minimize Close
Help	F1 - Tile Picker Help

A right click on the Site Map will cause the following to be displayed:

System		
Tools	Name	New Name: _____
Help		

Your First Move: The Seed Factory

When you've located a spot you think is suitable for building, click on the Seed Factory in the Tile Picker window. The arrow cursor will change into a diamond-shaped cursor. Now you can position the cursor on the Tile Map, and left click the mouse. The Seed Factory will appear on your Tile Map. Nothing else will appear on the Tile Picker screen.

A Seed Factory is an automated, unmanned manufacturing facility capable of making more factories. When the Seed lands, four robots — a robominer, a robodigger, a robodozer, and an explorer — roll off and begin working without your intervention. After two turns, diggers, miners and dozers become available to you. You can set these robots down to do your bidding at a site of your choice.

Turns

When tiles are available for placement on the Tile Map, they appear in the Tile Picker window. When you have made all the moves allowable in one "turn," an unspecified unit of time, no tiles will appear in the window, and a message reading "None Available" will appear. When this happens, you must advance time by clicking on the icon at the bottom right of the screen. This will advance the number of turns, and hence the units of time, by one.



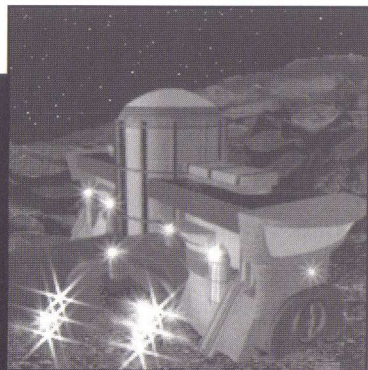
Help

At the bottom left of the screen is another icon, which looks like a rotating silver ball. This is your Artificial Intelligence. Left click on this icon and you will be presented with a list of options, one of which is Help. A right click on any part of the main game screen, when the Tile Map is displayed, will give you a dialogue box with a context-sensitive Help option. Context-sensitive Help will send you directly into the portion of the Help system that relates to the part of the screen you clicked on.

Playing to Survive

Your first goal is quite simple. It is to make it without being killed by famine, lack of oxygen, sandstorm, exposure — you get the idea. In order to survive, you must have the following: mined resources to build and operate your structures; CHAP facilities to provide air to your buildings; Agricultural Domes for food; energy; protected underground residential areas; and a DIRT (Disaster Instant Response Team) to minimize the damage caused by catastrophic events.

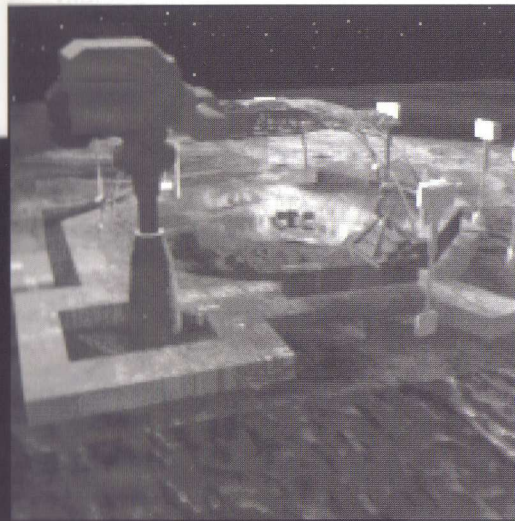
You must also connect all of these structures with tubes so that air, water, people, and recyclables can pass between them. Later in the game, you'll play to thrive, but for right now, if you live through the next turn you're doing great.



Construction

Build facilities for your colonists at the first opportunity. They'll really think you're the greatest if, early on, you provide them with a place to live and food to eat. You should build your first structures in this order: Agricultural Dome, CHAP, power facility, Storage Tanks, and Residential units. Later, as their lower-order needs are met, your colonists will demand Medical Facilities, Research Labs, and Parks.

There are a lot of buildings to choose from in *Outpost*. What does each one do?



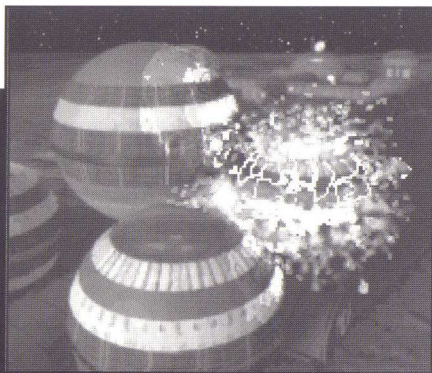
When it's time to construct some buildings, use this handy guide elucidating your building options. For additional information about each facility, use the Help feature.

Title	Description	# Ppl to Operate	# Turns to Build	Morale Effect	Production Result	Chance of Breakdown
Surface Structures:						
Agricultural Dome	Food Source	1	5	+1	Food	20
CHAP Facility	Produces life-support gases and water	4	6	0	LSA, LSB, LSC	10
Command Center	Core building, needed to start a colony	1	3	0		50
Communications Tower	Extends communications	1	2	0		5
DIRT Facility	Helps minimize damage from catastrophes	2	5	+1		0
Factory	Produce robots, road material, etc.	1	6	0	Robots, Parts, Roads, Fuel Cells	10
Hot Laboratory	Houses potentially dangerous experiments	2	5	-1	Research	20
Mass Driver	Rail gun for launching payloads into orbit	4	9 per segment	0		20
Mine	Provides ore for building	1	7	0	Mined ore	30

Tile	Description	# Ppl to Operate	# Turns to Build	Morale Effect	Production Result	Chance of Breakdown
Nanotechnology Facility	Eliminates reliance on resources	2	5	+1	No resources requirements	20
Police	Reduces crime level, improves morale	2	4 surface	+1 or -1		20
Robot Command	Communicates with robots, orders repairs	1	3	0		30
Seed Factory	Produces robots and processes ore	0	2	0	Robots	0
Smelter/Ore Processor	Changes ore into processed resources	3	7	0	Processed resources	10
Solar Powersat Receiver	Produces power from orbiting powersats	1	4	0	Power	20
Spaceport	Launches cargo and satellites into orbit	4	7	0		30
SPEW Facility	Recycles wastes	2	8	+1	MPG (Multi-Purpose Goo)	40
Storage Tanks	Delivery point for processed resources	0	2	0		0
Terraforming Facility	Creates breathable atmosphere for planet	4	9	+5	Breathable air	20
Tokamak Fusion	Creates safe, reliable fusion energy	1	2 if brought, 9 if built	0	Power	5 if brought, 30 if built
Tube	Supply line between buildings	0	1	0		0
Warehouse	Stores medicine, fuel cells, robots, etc.	1	2	0		5

Tile	Description	# Ppl to Operate	# Turns to Build	Morale Effect	Production Result	Chance of Breakdown
Underground Structures:						
Administration	Allows creation of research/industrial parks	1	2	0	Increase in productivity	10
Commercial	Store where colonists can buy luxury items	2	3	+1		10
Geothermal Power Plant	Clean source of energy	1	9	0	Power	20
Laboratory	"Safe" experiments	2	4	0	Research	20
Light Industry	Luxury, clothing, or medicine production	2	4	0	Luxury, Clothing, Medicine	20
Medical Facility	Reduces population attrition from disasters	2	4	0	Life extension	20
Mine Shaft	Built by robominer	0	varies by terrain	0	Mined ore	0
Park/Reservoir	Provides safe environment to play in	0	3	+1 per turn	Entertainment	10
Police	Reduces crime level, improves morale	2	3 underground	+1 or -1		20
Recreational Facility	Provides colonists with entertainment	1	4	+1 per turn	Entertainment	20
Red Light District	Provides colonists with entertainment	2	4, or spontaneous	+2 per turn	Entertainment	0
Residential	Houses colonists	1	3	+1 or -1		10
Spaceport Warehouse	Generated undergrd when Spaceport is built	1	2	0		5
Tokamak Containment	Generated undergrd when Reactor is built	0	varies by terrain	-1 to 0		0
University	Educates the rabble	2	4	+1 per turn	Education	20

Emergencies



Crises are a foregone conclusion on your new planet. The variable is your competence in handling such emergencies. If you had the foresight to launch satellites, they will give you advance warning about catastrophe from natural disasters. Other events, however, won't be so predictable, and a major blunder on your part could destroy your colony. Plus, your colonists will be watching to

see how you handle yourself, and morale will increase or decrease based on your leadership ability.

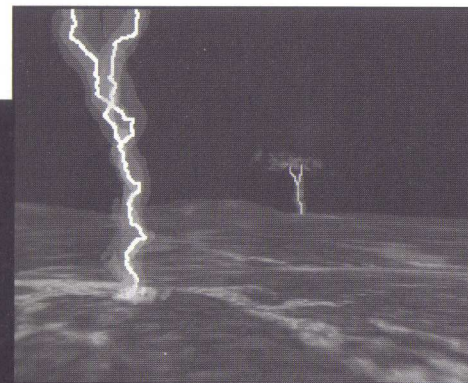
One course of action during certain emergencies is to evacuate underground. If you choose to evacuate, surface factory production will cease during an evacuation period of two turns. At that time, workers can return to the surface. If such a situation presents itself, be sure to tell your colonists to

evacuate. Otherwise, the few who survive will be demoralized in a big way.

A DIRT (Disaster Instant Response Team) Facility will minimize damage from unpredicted events that occur to your structures, such as meteorite strikes, explosions, etc. The DIRT response area is limited; on average, the DIRT can protect structures within a five-tile radius. The closer a structure is to a DIRT team, the likelier it is to survive catastrophes with minimal damage.

WEATHER PHENOMENA

If you have a weather satellite in orbit, you'll be forewarned of impending solar flares, dust storms, electrical storms or other large-scale weather phenomena. Without the satellite, you still might get lucky and avoid suffering major damage to your colony. Certain other events such as earthquakes can strike without warning, satellite or no satellite. Below are listed the likelihood of each event for each type of planet, on a scale of one to ten.



PLANET CLASS:

MERCURY

VENUS

MARS

Event:

Solar Flare	10	6	2
Meteorite Strike	7	1	4
Earthquake	7	6	5
Volcanic Eruption	2	7	0
Sand Storm	0	0	4
Electrical Storm	0	3	3

EARTH'S MOON

PHOBOS

CERES ASTEROID

PLUTO

4	3	5	0
7	7	7	5
3	3	2	3
0	2	0	0
0	0	0	0
0	0	0	0

Factories

Since you couldn't bring everything with you from Earth, you had the foresight to bring those materials which you would need to create factories. In these factories you can manufacture those items you require to survive, and later, to thrive.

There are two major categories of factories: light industry factories, which are clean and non-polluting and which can operate under the planet's surface; and surface factories, which require much more in terms of raw resources and energy, and which are placed on the surface so that they won't contaminate the underground environment.

Light Industry consists of three categories of production:

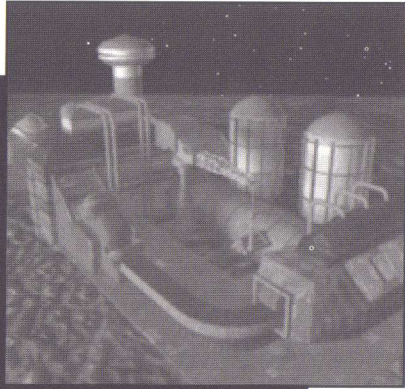
Medicine is produced at the rate of one unit per turn. When a medical emergency strikes the colony, stored medicine is automatically used. If there is no medicine in storage, colonists will die. 100 units of medicine can be stored in a warehouse.

Clothing is produced at one unit per turn, and is distributed in

Commercial structures. 33 units of clothing can be stored in a warehouse.

Luxury items are produced at the rate of one unit per turn per factory, and are distributed in Commercial structures. Distribution of luxury items is the primary means of manipulating the morale of your colonists, and Commercial structures draw luxuries at a rate of one per turn as long as there are luxury units available. You must

choose which luxury items you wish to produce, from a list that includes fuzzy dice, chia figurines, and wax lips.



Surface Factories engage in building two basic products:

Fuel Cells, used to power robots, are produced at the rate of one every ten turns. Fuel cells die after 200 turns of use. Each fuel cell takes two mass units of storage, so you can store 50 of them in a warehouse.

Robots are manufactured in the Seed Factory when you arrive at your new home, but a regular surface factory can build the full range of robots, including the new types you're able to develop through scientific research. A factory can produce only one robot type at a time, which you select, and can build them at the rate of one every five turns. Robot storage at a surface factory is limited to ten, after which production stops until the robots are deployed or stored in a warehouse.

Warehouses can store 20 robots with fuel cells, or 33 robots without fuel cells.

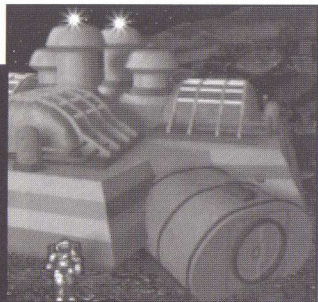
In addition to these Surface Factories, there are five **"Special" Factory** types. Each produces one type of product. Note that the terraforming facility is only available after suitable research has been performed.

The Agricultural Dome produces units of Food. Food production is directly affected by the hostility of the planet and its distance from the local star. Each dome produces ten units of Food per turn, assuming the dome receives enough resources per turn, and any research resulting in a new Food source increases the amount of Food produced. The storage available at a dome is 1000 mass units, after which dome Food production is shut down until the stored Food is consumed. No other storage for Food is

available. One unit of Food feeds ten humans per turn.

The smelter processes ores into pure, useful resources. In the smelter, ores produce half their weight in processed metals, and minerals lose nothing. Fusion elements are also processed at a one-to-one ratio. One entire transported load of ore is processed in one turn, after which the processed resources must be shipped to colony storage tanks to become available for use. Smelter storage is limited, so processing will cease if maximum storage capacity has been reached.

The CHAP (Closed Habitat Atmospheric Production) facility produces a breathable environment for most of the colony structures. This differs from the terraforming facility, which allows an atmosphere to be generated for the entire planet. One CHAP is sufficient to generate the breathable gases for a large colony, but having multiple CHAPs reduces the chance of losing your atmosphere production capacity in the event of a catastrophe.



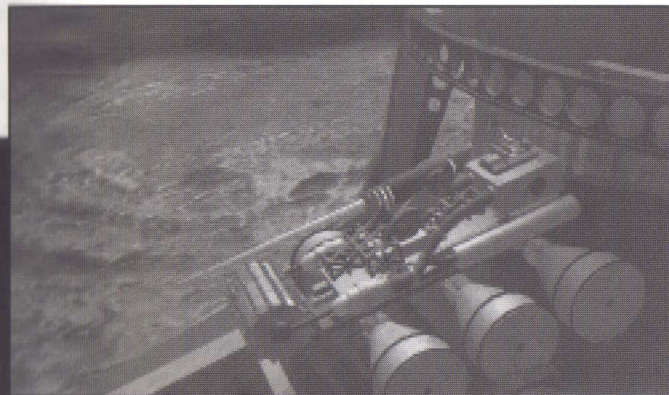
The SPEW (Sewage Processing and Environmental Waste) facility recycles basic wastes and building materials from structures you've chosen to destroy. Recycling improves morale and enables you to reuse resources. Recycled buildings produce units of MPG (Multi-Purpose Goo), a special synthetic that can be used to replace any other resource required to maintain the functional status of an existing structure.

Terraforming facilities are generated through extensive scientific research. They allow you to create a breathable atmosphere on certain planets. Success with terraforming has a significant positive effect on the morale of your colonists.

Mining

In *Outpost*, the mining of local resources is necessary to the survival of your colony. Each planet type has a different composition of ores, reflected in the value called Planetary Hostility. If you select a planet with a high Hostility rating, the offsetting characteristic of the planet will be a greater abundance of mined resources.

On average, any mine will have a mixture of ores, with life support, metals, and minerals being most common, followed by fusion elements. (See the chart.) In general, Metal Ores A and Minerals A are more common than B-grade ores, which are more common than C-grade ores, etc.



GATHERING RESOURCE INFORMATION

There are several different ways to gather information about resources on your planet.

From orbit, your starship will provide pertinent but basic information about the hostility level of your new planet, surface mineral deposits indicating reasonable mine locations, and basic planetary data. The AI will then generate landing site maps with the red dots that indicate potential mine locations.

You can launch a geological surface penetrator from orbit. The AI will then provide you with the maximum digging depth for your

miners and diggers, an estimated total number of mining locations, and a general indication of the planet's primary resources.



MINING AND PROCESSING ORE

Explorer robots investigate potential mining sites identified from the starship. Their exploration reveals the exact concentrations of resources in potential mining locations. Explorer robots will also mark any potential mining locations with a red dot.

Mines will produce ore for a period between 100 and 400 turns, depending on the digging depth of the planet. If the storage maximum of 500 units is reached, the mine will shut down temporarily, but otherwise production from an active mine will be continuous. See the section on transportation for more information about moving mined resources.

When mined ore reaches the smelter, production of processed ore begins. Metal ores will generate processed metals at a ratio of two to one; minerals and fusion elements are processed into purified minerals at a rate of one to one.

MINED AND PROCESSED RESOURCES

There are four categories of resources which must be mined for survival. For simplicity's sake, *Outpost* resources are grouped. They are:

GROUP	PROVIDES	CONSISTS OF
Life Support	Water, Oxygen, other basics	Life Support A, B, and C (LSA, LSB, LSC)
Metal	Building materials	Metal Ores A, B, C, and D (MOA, MOB, MOC, MOD)
Fusion	Reactor fuel, other fuel	Fusion Elements A, B, and C (FEA, FEB, FEC)
Mineral, Precious Metal	Raw materials such as gold	Minerals A, B, and C (MA, MB, MC) and Precious Metals A and B (PRMA, PRMB)
Processed Metals*	Building materials	Processed Metals A, B, C, and D (PMA, PMB, PMC, PMD)

*produced at the smelter from processed ores

OTHER RESOURCES

Besides mined materials, other resources are generated by your colonists. These are:

Food is produced in Agricultural Domes, and production is enhanced through scientific research.

Luxury Items are manufactured in your light manufacturing facility, and distributed in commercial facilities.

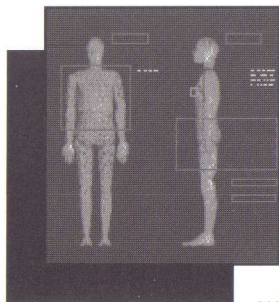
Population is increased by — well, the population. Morale level affects the rate of reproduction.

Power is created by the Seed Factory and the other power facilities.

Breathable Atmosphere is created by the CHAP for your buildings.

People

One of your goals should be an ever-increasing population. Another is to keep this population contented so that they will be productive and not creep off in the night to the rebel colony. A good rule of thumb is to keep them reproducing, especially in the beginning.



During the first 60 turns on your new planet, the fatality rate will be high. Realistically, however, this hardship will produce a human race which is tougher than it was. Morale will drop when people die, just as it will rise when a birth occurs. Reproduction will take place at a tremendous pace: during the first 60 turns, your colonists average six children per couple, although low morale will cause a lower birth rate and higher mortality rate.

After the first 60 turns, reproduction will drop to four children per couple. When birth and mortality rates have stabilized at a lower level, you can begin making plans for the long-term growth of your colony.

Power

The colony's ability to expand and thrive depends in large part on access to, and exploitation of, available sources of power. You can generate power through several means:

SOURCE	PROS	CONS
Fuel Cells	Simple, immediately available	Limited to robots
Geothermal Energy	Cheap, clean	You may or may not find a fumarole
Seed Factory	Immediately available	Extremely limited
Solar Power Satellite	Generates up to 2000 units per turn	Needs two solar receiver arrays; you must be near a source star
Tokamak Fusion Reactor	1000 units of power per turn, efficient	Requires maintenance

Robots

Robots are important to your colony. They perform tasks that would otherwise have to be performed by the human population. When your colonists must perform menial tasks, morale drops. Additionally, when robots are performing the less glamorous functions, humans are able to perform higher-order jobs such as research, which enables your colony to progress and thrive. Keep in mind, however, that robots cannot think in the abstract, which precludes their use in scientific research.

Factories produce robots at a rate of one every five turns, and fuel cells at a rate of one every ten turns. One fuel cell will operate one robot for 200 turns.

ROBOT COMMAND

Robot Command facilities communicate with field robots. Ten robots can be controlled by each Robot Command. If you find you're losing contact with your robots, you should build remote Robot Command facilities. Sometimes you'll lose contact with field robots because they've been lost in rough terrain. Unfortunately, there is no preventative

measure for this situation; just keep building robots to replace those which will inevitably be lost.

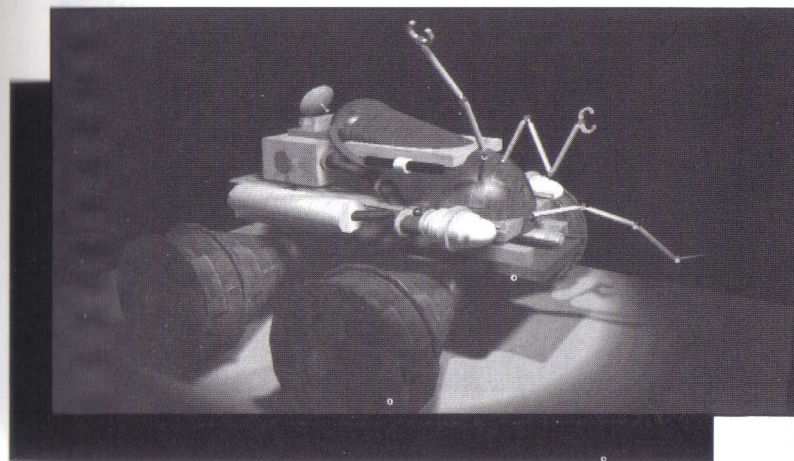
ROBOT TYPES

Here are the types of robots available to you, and a brief description of their uses.

Robodozer: Prepares a foundation for building both on the planet surface and underground. The number of turns required to prepare terrain for building

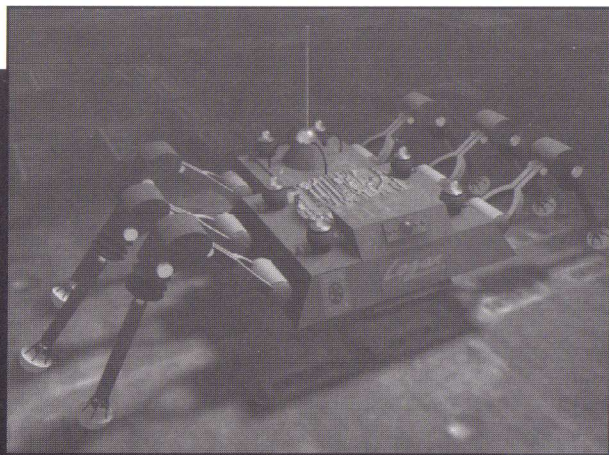
depends on the condition of the terrain. Robodozers can also create dirt roads by bulldozing in a straight line, at which point paved roads can be laid down.

Robominer: Able to dig mine shafts, locate mineral deposits, build ore elevators, and cap the mines with storage facilities. The number of turns required to dig a mine depends on the condition of the terrain. Homes in only on existing mine beacons.



Robodigger: Creates underground residences. It can dig either horizontally or vertically. The area dug out will be visible to the player, while the unexplored surrounding area will remain black.

Roboexplorer: Wanders the surface of the planet seeking new mines. The number of turns required to locate new mines varies by mine prevalence on your chosen planet.



Storage

There are two types of facilities used as storage on your new planet.

Storage tanks are used to store processed resources. If the resource comes from the smelter, it must go to the storage tank rather than a warehouse. Storage tanks can store 1000 units of processed resources.

Warehouses store everything but processed resources. Each of these items requires a specific mass unit of storage, and each warehouse can accommodate 100 mass units of storage. Warehouse storage is provided for:

Clothing	3 mass units
Fuel Cells	2 mass units
Luxury items	3 mass units
Medicine	1 mass unit
Robots	3 mass units
Robots with Fuel Cells	5 mass units
Trucks	6 mass units

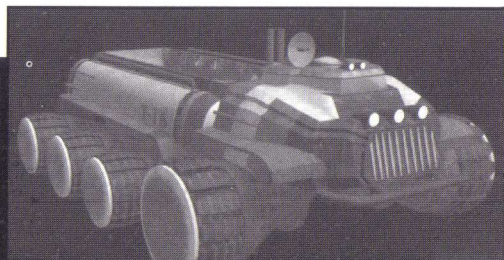
A warehouse close to a spaceport can store a spacecraft or satellite probes.

Transportation

An effective transportation system on your new planet is critical to your survival. What good are ores if you can't get them to a construction site? How can an agricultural dome help you if you can't move the food to your colonists?

TRUCKS AND MINES

An active mine can store up to 500 units of ore. If the mine reaches this limit, however, the mine will shut down until the ore is removed. Trucks can carry 100 units of ore from a mine to a smelter, or from a smelter to a storage tank. Once the pro-cessed ore is placed in a storage facility, it is available for use by the colony.



Playing to Thrive

So now your colony is developing at a healthy rate. You want to move to the big time: to perform scientific research, increase morale, delegate, and spy on rival colonies, just like leaders did back on good old Earth. In a word, you wish to thrive.

Information

You need information to make intelligent decisions, and there are plenty of sources in *Outpost*. Your AI will provide you with a variety of reports at any time. If you would like an overview of your planet, the Executive Summary Report is available either through your AI or through the Command Center. This information includes the total number of active mines, the current pool of available resources, the number of labs performing research, and how many Agricultural Domes are producing food, among other things. There is also a

Detail button under the Population entry, which will provide you with a breakdown of your population categories. Later in the game, when you have multiple AI managers to handle the minutiae for you, you will be provided with a Macromanagement Report, which gives you overall numbers for each colony and which allows you to reallocate your AI managers and their administrative tasks.

A left click on most buildings will give you a report on that facility. These include individual mining reports, factory production summaries, warehouse and resource storage reports, and laboratory research reports. A request for a lab report will also enable you to choose which area of research that lab should pursue.

You can reach the Help file either by clicking on the chrome ball in the bottom left-hand corner of your screen or by clicking on any part of the main game screen when the Tile Map is displayed. This will give you a dialogue box with a context-sensitive Help option. Context-sensitive Help will send you directly into the portion of the Help system that relates to the part of the screen you clicked on.

Information is disseminated among the population through the *Outpost Evening Star*, the newspaper on your planet. Whenever news of note occurs on the planet, it is mentioned in the newspaper. News items are then condensed into briefs by your AI as an Executive Summary of the news. The newspaper is a good way for you to gauge the opinion of the man on the street — or the man in the tube, as they say on your planet.

Morale

In *Outpost*, as in life, the morale of the population is dependent on many factors. Significant rises in morale mean you're doing a good job; they lead to a higher birth rate, a lower death rate, and increased production. Drops in morale mean you're a failure as a leader; they result in a lower birth rate, a higher death rate, decreased production, and colonist defections to the rebel colony. Of course, if your colony's morale soars, rebels will defect to you. It's that kind of capricious behavior on the part of the colonists that makes your political life uncertain, and makes the morale model too complicated to explain.

When trying to determine how your population will react, think how you would feel in a given situation. If, for example, someone forgot to tell you to evacuate the surface during a solar flare, you might get a little grouchy. On the other hand, if your leader provided you with sophisticated luxury items such as whoopie cushions, your morale would rise. Okay, maybe that isn't such a good example. Play with the model. Poke it and see what happens.

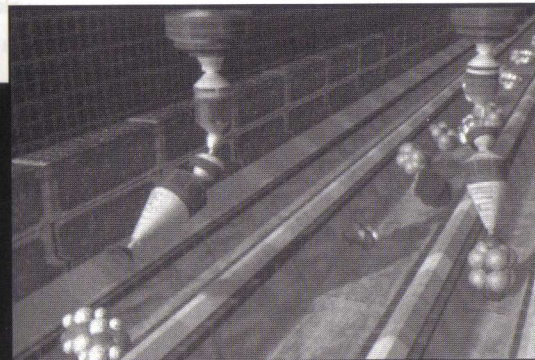
Morale has a direct effect on factory production quantities, so you must try to keep it as high as possible. The best way to directly manipulate morale is through providing colonists with luxury items. The hostility level of the police will have an effect, as will the crime rate. Technological advances will also have a positive effect, so do scientific research, and bulldoze old factories to make way for new, improved factories. And whatever you do, don't make the mistake a certain 1980s presidential candidate made and assume you can get away with anything. They're out there. They're watching you. And they know every move you make.

Research

Research is a means to an end, and should be pursued with vigor. One measure of victory is establishment of a space program for your colony, and this cannot be achieved without a lot of research in every field. You may also do research to engage in terraforming, improve the quality of life for your colonists, and increase their morale.

Scientific research is the key to your continued survival and the advancement of your civilization, which is comprised of a lot of scientists who think they're too good to work in the SPEW. You should put them to work doing research in active labs as quickly as possible, to keep their morale high.

Just as their morale is affected by their positions on your colony, the rate of research progress will be affected by your colony's overall morale.



When you click on an active lab, you'll get a lab report. This report will tell you of any operating problems the lab might have, what its current line of research is, and how much progress has been made. The report will also give you the opportunity to assign the lab to a certain research area.

Basic Research will accelerate all current research after about 100 turns. Because Basic Research is modeled after think tanks, AIs assigned to Basic Research labs are unable to think intuitively enough to have an effect on the rate of progress. AIs can, however, make a difference when assigned to Applied Research, specific research in any of nine areas.

When you have completed a given area of Applied Research, the result benefits the colony. Some areas of research were mastered on Earth, but because you brought only the basic necessities of life with you on the starship, technology must be reestablished or subjects rethought from your new planetary perspective. The number of turns required to make progress in Applied Research varies, and can be positively affected by the presence of an AI.

Terraforming

Terraforming is the process of making an Earth-type environment on another world. Obviously, if you could manipulate the climate of your new home in such a way as to make it more like your old home, that would be a good thing. Your colonists would certainly like being able to breathe the air, and morale would go up accordingly. You can't just start terraforming, however. You'll have to do extensive research, and even then some planets just aren't appropriate for transformation into replicas of good old Earth. Mars-type planets are the likeliest candidates, a fact which should influence your choice of a planet destination if you wish to engage in terraforming activity.

Chapter 3 STRATEGIES

You've managed to survive on your new planet, and you're even thriving. Now you'd like to develop some subtlety to your play, perhaps delve a bit deeper into *Outpost's* paradigm and gain insights into this complex and involving strategy simulation. Or maybe you'd just like to know how to cheat. Either way, this chapter offers tiny glimpses into certain aspects of the game. If you don't want to know, read no further.

Game Goals

Outpost is about control. We've set out to create a strategy game that you can customize according to your preferences. You determine when to end the game, and what the goal is. If you'd like to work toward a specific goal, you can build up your space program to the extent that you can build a new colonization starship. You can also work toward the worthwhile goals of development of nanotechnology or terraforming technology. Or, if you're a people person, you can work toward making your colonists so blissfully happy that even the rebels come to stay.

Morale

In an attempt to maintain a realistic feel to *Outpost*, we've made the people as fickle and capricious as possible. As you are the leader of the colony, you bear the brunt when morale is low. The good news is that morale in your new home is like morale here on Earth. If you're an effective politician, you can manipulate it to your benefit.

You must always try to keep the morale of your population as high as possible. Morale has a direct effect on factory production, population production, the death rate, research progress, and the defection rate. The most effective way of manipulating morale is to provide the colonists with luxury items. Perhaps you have several factories cranking out road material so that your transportation system will remain strong and efficient. What are you thinking? Your people want whoopie cushions. Switch those factories over! The more luxury items your colonists have, the happier they are.

Police have an effect on morale. You can define the attitude of the police yourself. Are they hostile toward the population? Then morale will be affected negatively. But hostile police also reduce the crime rate significantly, which affects morale in a positive way. Benevolent police, while impacting morale positively, don't have much of an effect on the crime rate.

A Red Light District has an effect on morale as well. This is an unusual structure, because you can place it on the tile map, or it can generate spontaneously because of a high crime rate. The Red Light District increases morale and the birth rate, but draws two luxury units per turn from the storage area which might otherwise been distributed to the population. If the crime rate remains high, more and more of your residential areas will turn into Red Light Districts. You can reduce the number of Red Light Districts by building more Police Stations near trouble areas, or by bulldozing them.

Planetary Resources

You began mining as soon as the starship touched down, but the digging depth on this hostile planet is limited, and the mines play out quickly. What should you do? Build a SPEW facility as quickly as possible. SPEWs will provide you with the miracle element MPG (Multi-Purpose Goo), which you can use as a substitute for other resources.

Space Program

If you want to develop your own space program, you'll have to do extensive research in the areas of astrophysics, extraterrestrial mining, celestial mechanics, standard propulsion spacecraft, mathematics, wind tunnels, and spacecraft testing and analysis. Then, when your research has been completed, you must build a mass driver and a spaceport. When you're ready to launch, you can do so at that time and thus end the game, or you can hold off launch and continue to play. Launching the starship will be your last official act as commander of the colony.

Technological Advancement

Your factories work fine, but the tile picker has just offered a new factory type. Should you replace your factories with these newer ones? When you have a chance to advance the technological level of a factory, bulldoze the old factory and build a new one to produce the same items. The newer factory will work more efficiently and have fewer breakdowns, and you can use the old materials to make Multi-

Purpose Goo. Your workers will produce more because they appreciate the new facility. When raw resources are low, or if you want to focus your available resources into certain areas for a few turns, you can also shut down production at some of your lower-priority facilities.



Late-Breaking Outpost News

ADDITIONS

The following features have been added to *Outpost*:

- A text menu in the tile picker window to speed up tile selection and colony improvements.
- A color legend to enhance the laboratory research tree.
- The ability to run multiple turns. This option is reached by pressing the F5 key.
- The ability to jump five spaces in any direction by holding down the SHIFT key while you left click on a directional arrow on the tile map border.

USEFUL KNOWLEDGE

Since some people have had questions about the fine points of *Outpost* game play, we now present some information you may find useful:

SAVE GAMES:

Games can only be saved from the main game screen where you see the diamond-shaped map. If you encounter a problem saving a game, try running another turn before you select the Save Game option. This will complete the internal processing steps required so that you can save the game.

SITE MAP COLOR MARKERS:

Colored markers identify locations on the site map. Red diamonds mark potential mines, yellow diamonds mark active mines, white diamonds mark depleted mines, light blue dots mark your colonies, and a dark blue triangle marks the rebel colony location. If you don't have an Orbital Observer satellite, the rebel colony will remain invisible on your site map unless it becomes abandoned, in which case the marker will change into a light blue dot.

ELEVATION MAP COLORS:

The main thing to remember about the false color elevation map is that black areas represent clear terrain. You can reach the

elevation map if you right click on the site map, then select the Tools and Elevation Map options. The best area on which to start building your colony is black with a red diamond (mine) nearby.

DEFECTION LEVELS:

Defections will occur when morale in a colony drops below 200 for an extended period of time. Your colonists will defect to the rebel colony at an increasing rate for every turn in which morale is below 200. If morale hits zero, the colony will empty out quickly.

The reverse of this is also true. If your colony's morale rises above 800 for a prolonged period, rebel colonists will defect to your colony. The rate of immigration will increase as your morale gets closer to 1,000. This increased population load means that the

immigrants will have to be housed and fed, just like your regular colonists; otherwise morale will start dropping.

Defections can also result in a "ghost town" ending for your colony, as well as the ability to assume ownership of the abandoned rebel colony. Both possibilities are described below.

GHOST TOWN ENDING:

If your colony is completely abandoned due to colonist defections, you will find that your colony is suddenly inactive and you are unable to get reports by clicking on your structures. An AI message will inform you that your colony is abandoned. At this point, you still have access to the AI interface News Briefs, which will give you the final news reports from your colony.

ACTIVATING AN ABANDONED REBEL COLONY:

When the rebel colony has been abandoned, the dark blue triangle changes into a light blue dot, just like the one that marks your home colony. You can assume ownership of the rebel colony by left clicking on the site map where the rebel colony is located, then left clicking on the rebel Command Center. You will then be able to see the rebel colony executive report. When there are multiple colonies available, clicking on any Command Center makes that the active colony. Until another colony's Command Center is selected, all reports you see will only relate to the active colony.

When you assume the operation of a rebel colony, you will have the capability of bulldozing their

structures and rebuilding the colony, or starting to build new structures right away using normal building methods. A right click on any friendly Command Center will bring up the "Move Colonists" interface. This friendly little box asks for the number of colonists you'd like to move, which colony you'd like to move them from, and which colony you'd like to move them to. After you fill in your responses, run a turn to move that portion of your population.

DIGGING NEW SHAFTS

If you're having trouble digging deeper mine shafts or air shafts, keep this in mind:

1. To extend a mine shaft to a deeper level on planets where this is possible, place a robominer directly on an existing underground mine shaft.
2. To extend an air shaft to a deeper level on planets where this is possible, place a robodigger directly on an existing underground air shaft.

WHEN ROBODIGGERS DIG

On the surface of the planet, a robodigger can only dig a new level when it starts next to a surface tube connecting it to its home colony. Because the robodigger constructs

the air shaft for the underground levels, the tube connection is required to carry air and power to underground structures.

EXPLODING ROBODIGGERS

If you find that you've built your colony in an area surrounded by impassable terrain, don't give up hope. Place a robodigger on the impassable location of your choice and set it to "Self-Destruct". As if by magic, the robodigger will destroy itself and leave clear terrain in its place two turns later. Underground, the contained explosion of the robodigger will also destroy any structures on the eight tiles immediately surrounding it.

PLAYING THE OUTPOST CD SOUNDTRACK ON YOUR CD PLAYER:

The orchestrated *Outpost* soundtrack is the classic "Mars, the Bringer of War" movement from the Gustav Holst symphony, "The Planets." You can listen to this dramatic soundtrack by inserting the CD into any handy CD player, or by using the Windows Media Player on the CD-AUDIO setting to play it from your CD-ROM drive. Skip to Track 2 and play the theme.

(The score to "The Planets" is copyright G. Schirmer, Inc.)

TO IMPROVE GAME PERFORMANCE

PREFERENCES FOR SPEED:

To improve the performance of *Outpost* on slower machines, choose the "Preferences" button on the control panel that starts the game, or right click on any area outside the tile map diamond when you're playing the game. Select Control, then Preferences. Click on the boxes for each option you wish to de-select. If the box has no "X" in it, the option is turned off. Press the OK button to return to the normal game screen. To be sure the change in options has the desired effect, save your game, exit, and restore the game.

If you're looking for a hardware solution with the CD version of *Outpost*, the animated sequences will run best on CD-ROM drives that are double-

speed or faster. Increasing your amount of system RAM to 8 Megabytes or better will also improve game performance.

We also recommend that you run *Outpost* using a Swap File under Windows. In order to do this, you need to launch Windows in Enhanced mode. For more information about creating a swap file and launching Windows in Enhanced mode, consult your Windows manual. If you continue to run into problems, a good troubleshooting technique is to increase the size of your swap file.

If you're installing the floppy version of *Outpost*, installation time can be reduced by using disk caching with Smartdrive or other disk caching utilities. Refer to your system software manual for instructions on installing disk caching.

SOUND CARD OPTIONS:

During the install process, you are asked if you have certain sound cards installed on your system. If you responded with the "I have no idea" option, and you have since learned that you have a Roland MT-32, CM-32, or LAPC-1 sound card, re-install the game and select that option to improve the quality of the *Outpost* music.

Outpost The Next Generation

You love *Outpost*, and you want more. More variety, more opportunity for interaction with fellow colony commanders, more everything.

We created *Outpost* with expansion modules in mind. In this way we could, once again, provide you with the control you need to customize the game to suit yourself. With expansion modules, we can also continue to use the latest technologies to create the very best in simulation games. Here's what you have to look forward to:

Outpost PlanetPack: The *PlanetPack* will contain a wide variety of game enhancements. This add-on will also increase the number of star systems and planet types available to the *Outpost* player. We'll also offer packaged colonies with existing problems, allowing you to jump right in and manage the situation without the setup and early construction period required in the original game.

Chapter 4 CUSTOMER SERVICE AND TECHNICAL SUPPORT

Customer Service

Sierra On-Line is dedicated to helping our customers with each and every question or problem. Because we will go to any lengths to guarantee complete satisfaction with all Sierra products, our customers know that when they buy our games, they buy the support of the whole company.

Direct any inquiries to the Customer Service department for issues pertaining to returned or defective merchandise, back orders, company policy, and general game information. Call (800)743-7725 or fax to (206) 562-4223.

Technical Support

System configuration or installation problems may cause any one of a number of different error conditions. Refer to the README file in the game directory for information on error messages and possible solutions.

Direct your inquiries to the Technical Support Department if your question is about hardware and software compatibility specific to Sierra games (i.e., sound card configuration and memory management).

Technical assistance is only a phone call away. Dial (206)644-4343 in the US or (44)734-303 171 in the UK for convenient, person-to-person service. If you prefer, you may request assistance by mail or by fax; the US fax number is (206)644-7697, while the UK number is (44)734 303362.

If you choose to write or fax us with your request, please give detailed information on both your computer system and the nature of your problem. Include your address and telephone number in case we need additional information. Send postal inquiries to:

Sierra On-Line
P.O. Box 85006
Bellevue, WA 98015-8506
Attn: Technical Support

Sierra On-Line Limited
Attention: Technical Support
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The Old Brewery,
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Sierra Tech Support is also available through:

Sierra BBS: US (209)683-4463* or UK (44)734-304 227

Sierra BBS Access through

Compuserve: GO SIERRA

Compuserve: GO-GAMAPUB, Section 11 (Technical Support ID-76004,2143)

Prodigy (Technical Support ID - WBWW55A)

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GEnie: Private Email - SIERRA.SUP

* Answers to our most frequently asked questions are available through our Sierra BBS (US only). At the main menu, select option 8 for Technical Help.

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Sierra On-Line, in our commitment to provide the best Technical Support in the industry, offers a 24-hour automated Technical Support Line. Our automated Technical Support Representative has answers to our most frequently-asked technical questions and is available by calling (206)746-8100. If you do not find the answer to your specific technical issue, you can call the Technical Support Department at (206)644-4343 and speak to a Technical Support Representative Monday through Friday, 8:15 to 4:45 Pacific Time.

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PATCH DISKS

If you have spoken to a Sierra Technical Support Representative or have read about an available patch disk in *InterAction* magazine, please send in your request for a patch (repair) disk, along with which game and the disk size you're having problems with, to:

Sierra

Dept. 10

P.O. Box 485

Coarsegold, CA 93614-0485

If you find that you need to send for replacement diskettes, send the original disk #1 to:

US:

Sierra On-Line

P.O. Box 85007

Bellevue, WA 98015-8507

Attn: Returns

Europe:

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RG7 5AJ United Kingdom

Be sure to include a note stating your computer type, and the size diskette you need (5.25" or 3.5"). We will gladly replace your program disks free of charge during the first 90 days of ownership. (Please enclose a copy of your dated sales receipt with your request.) After 90 days there is a \$10.00 (£6.00) charge for replacement diskettes.

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Appendix

GLOSSARY

aerobraking. A technique for slowing the flight of a spacecraft with atmospheric drag by descending into the upper levels of a target planet's atmosphere until the craft has slowed enough to maintain a stable orbit.

AI. The standard abbreviation for artificial intelligence. For a longer definition, see "artificial intelligence."

airbot. Airborne robot.

alpha particles. Nuclear particles with a positive charge that are ejected at high velocity from specific radioactive transformations. These particles consist of two protons and two neutrons.

Amor. Asteroidal objects that cross the orbit of Mars and approach the orbit of Earth. Over short time scales of hundreds or thousands of years, about 10 percent of the Amors have orbits that evolve into Earth-crossing orbits. The first Amor class asteroid was 1221 Amor, discovered in 1932.

Apollo. Asteroidal objects that cross the orbit of Earth. The first Apollo class asteroid was 1221 Amor, discovered in 1932.

arc second. An arc of one second, 1/3600 of a degree of angle, is less than the apparent diameter of a U.S. dime when viewed from a distance of two miles, or the apparent diameter of a golf ball when seen from a distance of five kilometers.

artificial intelligence. The goal of artificial intelligence research is to produce computers that can think and learn in a manner analogous to human behavior. This includes the ability to apply known facts, combined with new information, common sense, and guesses to arrive at an appropriate response to a problem.

artificial intelligence personality. Your assistant in *Outpost* is a computer with artificial intelligence. It has been provided with an artificial personality to allow easier communication with humans.

asteroid. A large interplanetary object that has no characteristic cometary coma or tail. The term includes dormant old comets covered with dust that no longer have comas or tails.

astrometry. A method for detecting planets in other star systems by watching for periodic changes in a primary star's position due to the presence of a nearby Jovian planet.

Aten. Asteroidal objects with orbits that mainly lie inside Earth's orbit. The first Aten class asteroid discovery was 2062 Aten, located in 1976.

AU. Astronomical unit. The average distance from the Earth to the Sun, equal to about 92.9 million miles.

bioengineering. The application of engineering principles to biological or medical science. This includes such things as construction of artificial organs.

biosphere. The portion of a planet's atmosphere, ground, and water where life can flourish. On a typical planet, the biosphere is located far away from fast food restaurants and used car dealerships.

bioterraforming. The use of genetically engineered plant life, such as blue-green algae, to make an Earth-type environment on another world.

black dwarf. Superplanets, such as Jupiter or Saturn, that are too far away from their primary star to shine by reflected light, and too small to generate much light of their own.

brown dwarf. Planetlike objects with masses up to 85 Jupiter equivalents and cool temperatures in the 120 to 2,000 degree Kelvin range. The size of a brown dwarf falls between gas giant worlds and small stars. This term was coined by Jill Tarter, a prominent astronomer in SETI research.

calculus of variations. This mathematical technique is used to find the optimum path between two fixed trajectory endpoints. Typically, this calculation assumes zero initial and final velocities with minimum time trajectories. Propulsion parameters can vary to minimize cruise time and increase fuel costs, or to lengthen cruise time and minimize fuel requirements.

Cambrian. The paleontological/geological 100-million-year period that began about 600 million years ago and was characterized by an explosive growth of marine life, primarily the invertebrates and nuclear submarines.

carbonaceous minerals. Minerals that are rich in carbon compounds. A carbonaceous chondrite is a class of sooty black asteroid known to be loaded with carbon compounds.

CCD. Charge Coupled Device. An electronic detector that is several times more sensitive than photographic equipment in capturing images of weak astronomical light sources, such as asteroid movement against background stars.

CHAP facility. Closed Habitat Atmospheric Production facility, where breathable gases are produced for the colony's contained atmosphere.

chemical fractionation. The selection process that determines the composition of an individual planet during its formation.

comet. A small body consisting of frozen gases and dust in orbit around the Sun. As it nears the Sun, its surface material vaporizes to form a large head, or coma, at the center of which lies a dark nucleus where its mass is concentrated. In its powdered form, a comet is handy for household cleaning.

comsat. Communications and navigation satellite.

constant proper acceleration. A term used to describe the throttling down of a rocket engine so as to maintain a constant speed without further acceleration.

constant proper thrust. A term used to describe rocket acceleration performed at a constant full throttle, maintaining a uniform fuel consumption rate.

cryobiology. The study of the effects low temperatures have on biological processes.

cryoprotective agents. Used to protect cell membranes and organs before freezing. Agents such as glycerol are infused into biological tissues to replace the extracellular water that would expand when frozen.

deorbit. A deorbit maneuver drops a spacecraft out of orbit toward the planet's surface.

DIRT. Disaster Instant Response Team. The DIRT facility houses this team, which is intended for rapid response to disasters and emergencies in a colony.

drydock. A traditional term meaning a dock that can be kept dry during the construction or repair of ships. In space, there's no problem keeping a ship dry, but the drydock has to support a construction and repair crew in the weightless vacuum of their work area.

ecosphere. A region in space, near a star, where suitable planets can have surface conditions compatible with the origin, evolution, and continuous existence of land life. Humans can survive the surface conditions on a planet within a stellar ecosystem.

Elevation Map. The Site Map screen in *Outpost* can be toggled to show the false color topographical Elevation Map, indicating the four relative heights of terrain shown on the Site Map.

emergent behavior. A biological and philosophical theory used to describe simple systems of interlocking processes that generate unpredictable results of a higher order.

escape velocity. The speed that an object must acquire to escape from the gravity of a planet.

false color. A method of applying colors to a normal image to make details more apparent.

finishing. Part of a fabrication process that refines a basic shape into its final form, as with a finished machine part.

fuel cell. A battery cell that continuously changes the chemical energy of a fuel and oxidant to electrical energy. Fuel cells power *Outpost* robots and can be manufactured in your factories.

fumarole. A hole in a volcanic region that emits vapors and hot gases, such as steam. This is a very handy sort of hole to find, since you can build a geothermal plant on top of a fumarole to generate power.

gas giant. Large, non-terrestrial planets composed primarily of gaseous and liquid hydrogen. In the Solar System, the gas giants are Jupiter, Saturn, Uranus, and Neptune. This type of planet is also called Jovian.

geosynchronous orbit. A geostationary orbit. This relates to an artificial satellite that orbits above a planet's equator at the same speed as the planet rotates so that the satellite effectively stays in the same place.

greenhouse effect. The trapping of infrared radiation by gases in a planet's atmosphere, raising the surface temperature.

hibernation. A slowed metabolic state that allows animals to sleep without food for days or weeks. This is also the state entered by a computer game development team right after it finishes its current project.

hostility level. As used in *Outpost*, this is the rating of a planet's relative environmental hostility with regard to humans. As used in computer game development, this is the level of animosity that the team feels toward the game designer as a project nears completion.

hypoxia. Oxygen deficiency in the blood, cells, or tissues.

illuminance. As used in *Outpost*, this is the quantity of radiation a planet receives from its primary star. The habitability of a planet depends on this quantity of radiation. It also determines how useful solar powersats will be at a particular planet.

impactors. Celestial bodies, such as comets or asteroids, that strike a planetary surface.

Jovian. See "gas giant."

KAO. The Kuiper Airborne Observatory, a civilian C-141 Starlifter aircraft operated by NASA-Ames Research Center. A popular platform for astronomy since it's able to fly above most of the water vapor in the Earth's atmosphere with its infrared telescope. Among its many successes, the KAO was used to discover the rings of Uranus.

kinematics. A branch of dynamics that deals with aspects of motion apart from considerations of mass and force.

Kuiper Belt. A belt of comets orbiting the Sun just beyond the orbit of Pluto. This comet reservoir was postulated by astronomer Gerard P. Kuiper in 1951 and its existence has been supported by recent discoveries.

lawbot. Police robot.

light year. The distance over which light can travel during one Earth year. Used as a unit to express the distances between stars. One light year equals 0.306 parsec. The velocity of light is about 186,000 miles per second.

luminosity. A measure of the total radiation emitted by an object. The ratio of the amount of light that would reach us from a star to the amount that would reach us from the Sun if both the star and the Sun were at the same distance from us.

macromanagement. Strategic management of the overall operations of a complex system, such as a corporation or a colony, without getting involved in the smaller, tactical management issues.

mass driver. An electromagnetic rail gun. Used to launch buckets of resources off a planetary surface and into space for use in space manufacturing or as reaction mass for starships.

meteor. A flash of light visible as an object passes through a planet's atmosphere and burns up as a result of frictional heating. These objects are no larger than motes of dust.

meteorite. A natural object of extraterrestrial origin that survives passage through a planet's atmosphere to strike the planet.

meteoroid. A natural object in interplanetary space that is smaller than about 30 feet in diameter. Larger objects are called asteroids.

microbot. A very small robot.

mothership. See "starship."

nanotechnology. The thorough, inexpensive control of the structure of matter based on molecule by molecule manipulation; the products and processes of molecular manufacturing.

NEA. A Near Earth Asteroid passes within the orbit of Mars and approaches Earth. Asteroid 433 Eros, discovered in 1898, was the first NEA to be identified. Amor and Apollo asteroids are both NEA categories.

Oort cloud. The region extending more than 100,000 AU from the Sun, where perhaps a trillion cometary nuclei are thought to reside.

optical interferometry. An astronomical technique, used in the search for extrasolar planets, that requires widely separated optical telescopes to make use of the interference pattern of light waves coming from closely spaced points in the sky. The greater their baseline, or separation, the better the resolution.

orbital insertion. A spacecraft maneuver that places it in a stable orbit around a celestial body, such as a planet.

photolysis. The breaking up of a chemical compound by the action of radiant energy, especially light.

photometry. An astronomical technique used to detect variations in a star's luminosity caused by the alignment of a companion between the star and Earth, eclipsing the star.

photosynthesis. The formation of organic chemical compounds from water and the carbon dioxide of the air in the tissues of green plants exposed to light.

planetary ecosynthesis. The process of making an Earth-type environment on another world. Also known as terraforming.

planetfall. The landing of a spacecraft on a planet.

powersat. Solar power satellite placed in geosynchronous orbit. Uses solar photovoltaic cells to collect a star's energy and convert it to centimeter-length microwaves for power beaming to ground based receiver arrays (rectennas).

primary shaping. Part of a fabrication process that involves turning a raw material into the approximate size and shape of an intended machine part. Casting and powder processing are two primary shaping methods that show promise for space manufacturing.

primary star. The massive body (a star) around which another body (a planet) is orbiting.

rad. A measure of exposure to ionizing radiation, equal to 100 ergs of energy per gram of absorbing material.

rectenna. Solar power receiver array. Receives the centimeter-microwave power beam generated from an orbital powersat.

refactory. Denoting an element or compound that vaporizes at high temperatures, such as uranium, calcium, and aluminum. Also refractory.

regolith. The layer of dust and fragmented rocky debris, produced by meteoritic impact, that forms the uppermost surface on planets, satellites, and asteroids.

remote sensing. Any technique for investigating an object from a distance.

robodigger. Robot digger. Creates the underground chambers and tunnels for your colonists so that they can spend most of their time in safety underground.

robodozer. Robot bulldozer. Prepares terrain for building structures.

robominer. Robot miner. Digs vertical shafts, locates ore, establishes and operates mines.

seed factory. An automated, unmanned manufacturing facility. It consists of perhaps 100 tons of the right set of machines, tools, and teleoperated mechanisms to permit both production of useful output and reproduction to make more factories. In *Outpost*, the Seed Factory lands on a new planet to prepare the way for human landings.

self-reproducing automata. Machines that reproduce themselves. This idea originated with John von Neumann.

sim. Simulation, or simulated life form. The digital inhabitants of a mathematical simulation such as *Outpost* are often called sims. A strategy simulation game may also be called a sim.

Site Map. In *Outpost*, this is an orbital view of a landing site on a planetary surface. Some potential mining locations, as well as the locations of your colonies, are indicated on this map.

slow sleep. In *Outpost*, the decreased metabolic state of suspended animation in which the colonists travel during their interstellar voyage.

solar flare. A sudden, violent release of magnetic energy in or near the Sun's photosphere that often sends great amounts of radiation and highly accelerated charged particles into interplanetary space. Flares are unpredictable, last from a few minutes to an hour, and emit high energy protons that constitute one of the most serious hazards of spaceflight.

speckle interferometry. A mathematical image reconstruction technique that improves optical and infrared images by removing atmospheric interference. At infrared wavelengths, scientists have detected dim companion stars using speckle interferometry.

spectroscopy. The study of the light emitted from a body (its spectrum).

SPEW facility. Sewage processing and environmental waste facility. This is where materials in a colony are recycled.

spysat. Spy satellite. The orbital observer satellite performs this function.

starship. A generic term for spacecraft capable of making interstellar voyages.

superconductor. Various metals that exhibit a complete disappearance of electrical resistance, usually at temperatures near absolute zero.

superplanet. A gas giant planet with a history similar to Jupiter or Saturn, both of which might be considered small members of the superplanet family.

suspended animation. The biological state in which metabolic functions are stopped through deep-freezing, with the intent of reviving the person in the future.

teleoperator. A device that allows action or observation at a distant site, by a human operator, through a mechanical or computer interface.

telepresence. The ability of a human to sense and affect a remote environment through mechanical means.

terraforming. The process of making an Earth-type environment on another world. Also known as planetary ecosynthesis.

Tile Map. In *Outpost*, the diamond-shaped terrain map that dominates the main tile screen. This is where the colony structures are built.

tile picker. The top center window in the main *Outpost* tile screen. This is where spacecraft that are available for landing, and structures that are available to build, are displayed.

tokamak. The preferred device for generating power from nuclear fusion. The word, tokamak, is the Russian acronym for "toroidal magnetic chamber." The first success of a tokamak device was announced in Moscow in 1968.

trajectory. The flight path of an object, such as a starship, a rocket, or a thrown beer can, through space.

Trojan asteroids. Asteroids located near the two stable Lagrangian points of Jupiter's orbit.

ULBI probe. Ultra long baseline interferometer.

VLBI probe. Very long baseline interferometer.

volatiles. Elements or compounds with low melting temperatures, such as water, ammonia, potassium, and sodium.

vulcanism. A general term for the geological processes in which crustal movements are accompanied by the generation of heat and gases, often with the violent ejection of cinders and lava.

weathersat. Weather satellite.

white dwarf. A member of a class of small, dense, white-hot stars of low luminosity.

WIMP. Weakly interacting massive particle, a hypothetical subatomic particle able to travel freely through matter.

wireframe. The basic structural frame of a graphic model intended for 3-D rendering.

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