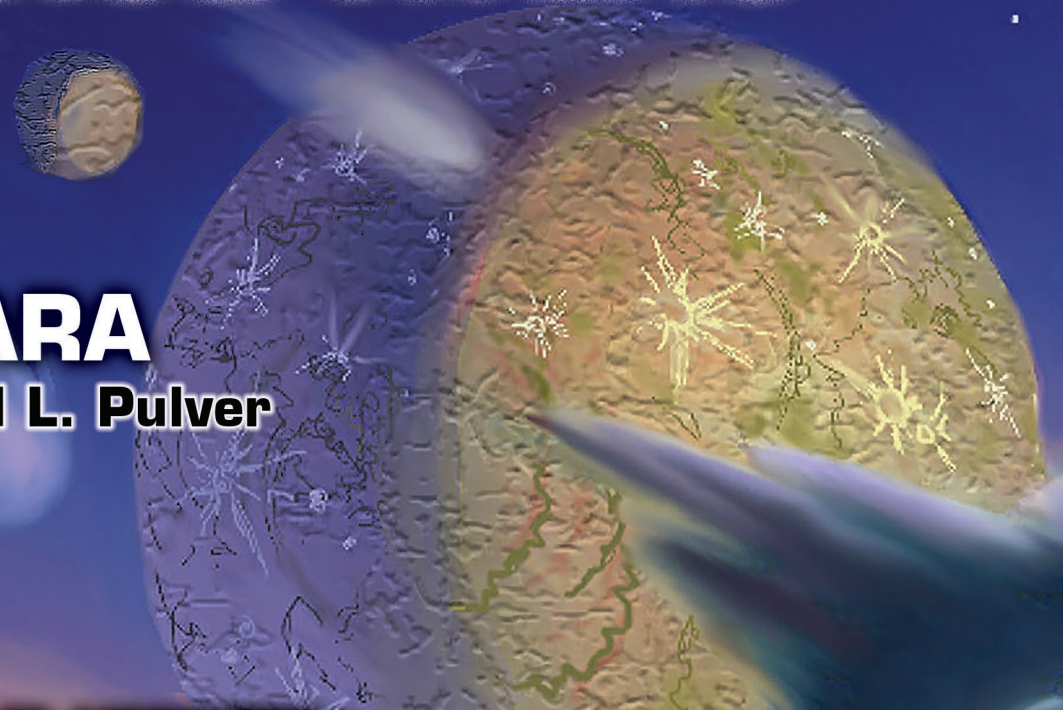
PYRAMID

Issue 3/79 May '15

SPACE ATLAS



OSTARA
by David L. Pulver

HALFWAY TO ANYWHERE
by Timothy Ponce

THE VANISHING SUN
by Christopher R. Rice

THE SKIPTIME HUB OF THE OCEANWE
by J. Edward Tremlett

HOMEWARD UNBOUND
by Steven Marsh

STEVE JACKSON GAMES

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Contents

Man belongs wherever he wants to go – and he'll do plenty well when he gets there.

– Werner von Braun

Article Colors

Each article is color-coded to help you find your favorite sections.

Pale Blue: In This Issue
Brown: In Every Issue (humor, editorial, etc.)
Green: Columnist
Dark Blue: ***GURPS*** Features
Purple: Systemless Features

Cover Art
Alan Gutierrez

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Nikola Vrtis

In This Issue

The heart of space gaming is exploration and travel. This month's *Pyramid* looks at both, taking you to strange new worlds like never before!

Ostara seemed like the perfect place for a colony of outcasts from Earth. But internal division and a mysterious, psionic-inducing plague have created trouble. David L. Pulver – co-author of ***GURPS Bio-Tech*** – guides you through the planet's history, current situation, and planetary details, including ***GURPS*** stats for its sometimes dangerous native life. Find out why scientists and smugglers are so interested in this formerly lost frontier world.

Space is dangerous enough without wandering *solar systems* snagging ships. Long-time *Pyramid* contributor Christopher R. Rice ponders *The Vanishing Sun,* revealing its origins, its purpose, its unusual inhabitants, and its possible campaign uses. You'll get details on a variant of the Empathy advantage, a new racial template, and suggestions for crossovers with ***GURPS Banestorm, GURPS Monster Hunters,*** and more.

What would you pay to know exactly the right thing to do? For just a bit of culture, you can find the answers at *The SkipTime Hub of the OceanWe.* This systemless campaign frame explores the history of the Hub and its creators and some of their mysteries. It also offers two adventure outlines that give would-be explorers a chance to interact with these uncanny prognosticators.

In any universe that follows the laws of physics as we know them, one hard-science question that will be on the forefront of many explorers' minds is, "How much delta-V do we need to get *Halfway to Anywhere*?" These questions can now be answered here, with a distillation of the concepts and mathematics you need to navigate around any solar system. Learn the maneuvers and options that are necessary to make most efficient use of your energy, including Hohmann transfers, gravity slingshots, and more. And everything is fully compatible with ***GURPS Space*** and ***GURPS Spaceships!***

What would happen to space exploration if people could step through a doorway on one side of the galaxy and instantly return to where it all began? They might be *Homeward Unbound.* The mysteries, details, and possibilities of this unique transportation mode are all detailed herein.

This month's Random Thought Table wraps up the issue with tips for infusing awe into any exploratory campaign, while Odds and Ends has more awesome details from the articles herein. Whether you're looking for realistic science fiction or "impossible" cinematic space gaming, this issue of *Pyramid* is your atlas to adventure!

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From the Editor

All the Worlds: A Stage

I talk elsewhere about the significance of other worlds in space gaming (see pp. 36-37). However, there's another way that the idea of "other worlds" ties in well with *Pyramid*. Really, each article in an issue is another opportunity to visit a new vista, to behold an amazing discovery, to boldly roll what no gamer has rolled before.

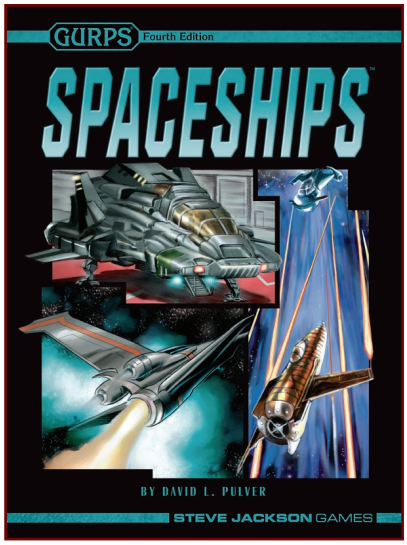
Think about off-world exploration for a moment. We get to a new world. What's one of the first things we're likely to say? "What are we going to *do* with this?" Some worlds might be suitable to start living on as-is; others might require some tweaks or even terraforming to make truly habitable. Some worlds are best seen as resources for other explorations or goals. Living on Plutonium World probably doesn't fit in with our plans, but it might be useful for our goal to have a limitless source of portable energy (or, if you're playing willy-nilly with the cosmos, the foundation of the most explosive Mentos and Diet Coke reaction *ever* . . .). Some worlds may not have any application that we can think of, but it's good to know that it's there in case we ever come up with a need. (Mercury isn't our first pick for colonization needs, but if we invent broadcast energy and want a world that's as close to the sun as we can get, it's a great choice.)

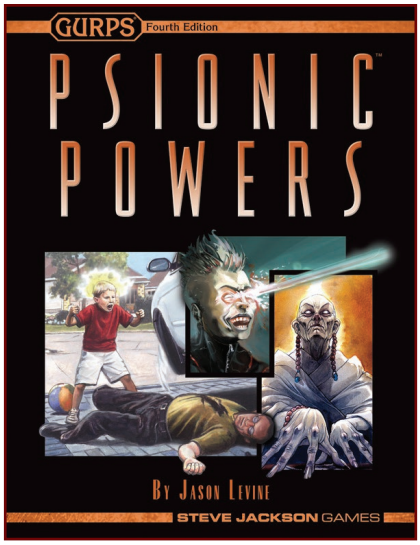
Pyramid is the same way. Some features are perfect straight from the issue, for your heroes to "live in" or benefit from immediately. Some articles are best suited for "mining," taking the cool bits and applying them to your own purposes. Other pieces might not have an immediate utility, but you know they're there and can revisit them if you ever think of the perfect need. (I know I've rediscovered gaming articles in decades-old magazines that I didn't have a use for at the time, but have provided amazing insight in this millennium.)

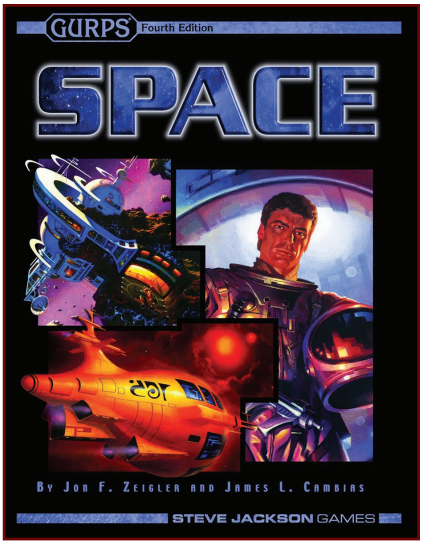
Regardless, thank you for being part of this journey with us, as we explore new realms of gaming goodness together.

Write Here, Write Now

How were the new worlds we explored this month? Are there any you'd like us to visit more or less often? Let us know via private communication at **pyramid@sjgames.com**, or join the public broadcast online at **forums.sjgames.com**.







Special Thanks: Roger Burton West

Ostara

by David L. Pulver

Ostara is a frontier "lost colony" recently rediscovered by an interstellar society. Due to the psionic "pattern-plague" and ongoing conflict on the planet, Ostara has been placed under quarantine. Despite this restriction, it continues to be visited by off-world scientists and diplomats . . . and smugglers.

The setting assumes a TL10+ interstellar state with a navy, a survey service, and traders. Other details are left generic.

History

Some 160 years ago, the Covenant of the Egg was a religion whose followers used radical genetic engineering to promote harmony and fertility. This violated then-prevalent laws against human genetic manipulation, so Covenant believers and their parahuman progeny fled to avoid persecution. Escaping aboard the colony ship *Jackalope,* 17,000 refugees journeyed beyond the frontier, discovering the Yod-307 star system, which contained a habitable terrestrial planet. It had abundant native life, but a dense oxygen-rich atmosphere was only comfortable for humans at high altitudes. The colonists named it Ostara (after the Germanic goddess whose namesake was the Easter festival) and colonized it.

The pioneers settled Port Joy on the southern continent's Easter Plateau. Thanks to their genetic modifications, they reproduced like rabbits, quickly expanding their population. They established multiple towns and villages (the Easter Parishes) and cleared land for Terran crops and animals. Ostaran farming was based around imported Terran plants and livestock such as rice, beans, chickens, and goats, bio-engineered like the colonists for greater fecundity.

Unfortunately, 16 years after First Landing, a powerful earthquake struck, wrecking Port Joy and killing 1,300 people. It destroyed the main reactor, factory complex, and bioresearch lab. The quake precipitated a technological decline; within 50 years, as parts wore out, the colony dropped from TL9-10 until it stabilized at a sustainable TL6.

The technological decline was mitigated by increased use of indigenous resources. Although many native plants and animals were only marginally edible due to biochemical differences, some proved valuable. Most notable were a species of "feathergrove" trees, the longfeather, whose sap produced delicious mildly addictive syrup with anti-agathic and aphrodisiac properties. It could be mixed with local eggs into a potent beverage (feather eggnog) that became a colonial staple.

The longfeathers were prevalent in midland and lowland regions on the fringes of the plateau. Unfortunately, they were also a favorite food for the most advanced native lifeforms – the pattern-hive, a mutually symbiotic cluster of native animals, some of dinosaur size! Some hive-beasts were good eating, particularly the giant behemoths and the fierce shimmerock's eggs, but the hive-beasts also shared similar tastes for humans. There were many different pattern-hives, distinguished by the maze-like skin patterns each member bore. Rival pattern-hives – those with different patterns – fought for control of food supplies, with the fiercest battles over longfeather groves. Human loggers and farmers were often caught in the middle of pattern-hive conflicts.

The pattern-hive's level of organization and coordination came as an unpleasant shock to the Ostaran colonists. After several logging parties and outlying homeholds were destroyed (despite having rifles), the Easter Parishes formed the Covenant Rangers – the colony's first organized fighting force – to protect them. As the Ostaran colonial populations grew, the pattern-hives were pushed back. However, the colonists had little desire for expeditions into the lowlands, where conditions were hostile for humans and the pattern-hives existed in greater numbers. In this sanctuary, pattern-hive numbers periodically swelled until "monster migrations" took place. When Rangers could not be called up in time, unwary farmsteads were often overrun and their inhabitants devoured.

The colonial rangers and militia's TL6 weapons were effective against animals, and had the colonists stayed united, they would likely have prevailed. However, a lingering power struggle between centralist and more rural factions within the Covenant church turned violent. The catalyst seemed trivial: a viral infestation killed most of the colony's chickens; then a dispute occurred over whether native egg-laying species could be used in Covenant temple rituals. The high cost of chickens for rural churches sparked bitter disputes over taxes, tithing, and doctrine. The disputes resulted in the Substitutionist Schism. Disagreements turned to riots, people were killed, and the Covenant Rangers were called up to act against fellow colonials instead of pattern-hives.

To avoid all-out war, a Substitutionist leader, Poppy 3Born, led a faction of the dissidents out of Easter Plateau. Denied aircraft, they made a perilous trek hundreds of miles across the pattern-hive-haunted oxygen-rich lowlands to the arid high-desert oases of the Sundown Plateau. They formed the loose Sundowner confederation, with greater personal and religious freedom then the centralized Easter Parishes.

The Sundowners initially had little conflict with the pattern-hives. However, in the harsher conditions of the Sundown oasis region, many outback farmsteads took to supplementing their diet with behemoth steaks and shimmerock eggs.

Thanks to aggressive hunting, several Sundowner desert hives were exterminated outright; others remained on the fringes of human territory, with occasional incursions.

In the 75th Jubilee year of the colony, the so-called desert rash first appeared. Initially it was just a few teenagers in the Sundown outback. First symptoms were a skin rash and fever, often accompanied by phantom voices and a desire to sleepwalk into the desert. Some claimed they were touched by God – or possessed.

The Sundowners' medicine was insufficient to deal with it, but it was believed to be an allergic reaction or skin parasite. Desert Rash Syndrome was progressive, with the skin blemishes spreading in complex lines that covered more and more of the body. Then the afflicted began to exhibit psychic abilities, especially when brought together, and some could seemingly contact each other's minds! Patients brought together in quarantine reacted bizarrely. Sometimes they developed sudden feelings of love for each other; at other times, patients became maddened and attacked. The latter reaction was common when those who had caught the rash in different regions were brought into the same hospital. It soon became clear this depended on whether the lines on their body were similar or different. . . and these lines matched those of the pattern-hive beasts!

Desert rash was renamed pattern-plague, and fear of contamination reached fever pitch. When word of reached the Easter Parishes, some rejoiced at the divine vengeance that smote the heretics. This was short lived, as outbreaks also began in the towns, perhaps spread by airmail couriers. The pattern-plagued were shunned or imprisoned. As fear of contagion grew, they were killed or driven into the wilderness. Most such exiles died – but not all. Some were torn apart by hostile pattern-hives. Others encountered pattern-hives whose patterns *matched* their own, and discovered they were welcomed into the hive, being able to telepathically transmit emotions and feelings. Humans who joined a pattern-hive experienced a rapturous sense of communion.

Some "hive-bound" went mad, becoming virtual animals themselves; others retained their identity, simultaneously self and multi-minded. Because humans were sapient, many eventually learned to channel the telepathic abilities the pattern-plague had awakened and, with practice, develop telepathic abilities that extended beyond the hive!

Pattern-hives with humans – anthro-hives – were a far more dangerous threat to the rest of society, for they became *smart*. Ordinary pattern-hives were organized, but non-sapient. Now pattern-hives could benefit from human reasoning: serve as mounts, laborers, farmers, and siege engineers. Humans were the brains of the pattern-hives. Shunned by their fellow humans, they embraced their new allegiance with a vengeance.

They had little feeling for the towns that had cast them out, except as a source of stockpiled food and resources. Loyal to their new families, hive-bound humans led raids with their animal companions on croplands and groves. Some hive-bound joined their bestial companions in killing and eating humans, but others retained enough humanity to take defeated humans as captive, seeing their value to the hive as hostages or for ransom. However, it was discovered that by feeding the bodies of dead hive-members to adolescent humans, they could be infected with the hive's own pattern-plague and compelled to join the pattern-hive. Those pattern-hives who followed this strategy began to rapidly swell their numbers. Children of pattern-hive members always developed the pattern-plague.

The threat of forceful assimilation into alien intelligence terrified the rest of the Ostaran colony but neither the Sundowners nor the Easter Parishers could manage to put aside political and religious differences. The Easter Parishes expanded the Covenant Rangers, while the Suntowns formed their own Sundown Volunteer militias. Uncertain as to the cause of the plague, strategists were divided on whether to fight a war of extermination against the hives, or strengthen defenses, build weapons and industry, and quarantine or kill those infected. A few Sundown leaders even felt that the human-hives could be negotiated with, a policy the Easter Parishes vehemently rejected.

If the conflicted humans had faced a united opposition from the pattern-hives, they might have been doomed. However, the hives were equally divided! Humans infected with patterns from *different* hives found that they were unable to overcome the primal instinct to drive rival patterns from their territory. As a result, the hives could not work together either, and instead of raiding humans, hive often fought hive – whether original "nonhuman" hives or new anthro-hives.

Thus began the Pattern-Plague War – a multilateral conflict between Easter Parishes, Sundowners, and rival human and non-human pattern-hives. No side could achieve an advantage. The war turned into a serious of seasonal skirmishes – often during harvest times – punctuated by raids, sieges, relief actions, and fighting evacuations.

During times of group experience the individual continues to perform his ordinary routine of work and recreation, save when some particular activity is demanded of him by the group-mind itself. But all that he does as a private individual is carried out in a profound absent-mindedness.
– Olaf Stapledon, ***Last and First Men***

The Military Balance

Human forces were divided by geography with numerous small towns to defend, and the colonist's limited technology and manufacturing capacity. Although the colony could make small arms and some heavy weapons, Ostara lacked the population and industry to create a modern regular combined arms force; humans fought the hives with light infantry backed up by a few aircraft and armored vehicles.

In contrast, the human-hives had powerful battalions of fierce beasts and nascent psionic abilities, but despite some forced conversions and conquests, they controlled few human towns and had little manufacturing. The colonists preferred to burn or dynamite a community rather than let it fall to the pattern-hives. Moreover, the hives spent their strength fighting each other. It was impossible to "convert" someone, human or animal, who *already* had a pattern, so conflicts between rival pattern-hives were equally violent.

Adventures

Navy, Black Ops, and Marines: Sent to maintain the quarantine or rescue diplomats or biomedical personnel captured by a hive or local factions – perhaps before they can be infected.

Survey Teams, Doctors, and Scientists: Attempting to find a cure for pattern-plague or study the planet's biology.

Smugglers and Criminals: Attempting to smuggle goods (or animals or people) onto or off the planet.

Safari: Seeking to kill, capture, or photograph the exotic wildlife.

Mercenaries: One of the factions may wish to covertly hire a small mercenary team to train its soldiers or militia or fight its enemies, or provide contracted technical support.

Diplomats: Attempting to broker a peace deal while risking being captured or killed by any of the warring factions or wild pattern-hives.

Psionic Institutes: Psis may wish to take the hives under their wing, recruit, or study them.

Protection: Hired as bodyguards for any of the above teams.

Recontact

A dozen years into the Pattern-Plague War, a new player emerged: The tramp freighter *Morning Glory* appeared in the Ostaran system. The human frontier had finally caught up with the lost colony. Landing at the old Port Joy complex, they made first contact with Easter Parish, provided a small shipment of high-tech goods, and left with a cargo of local delicacies such as lumber, artworks, perfumes, and featherwood liquor. The colonial exotica found a ready market among the jaded interstellar elites, and a second larger trade mission soon returned.

By then, the Easter Parish government had gone over their own historical records, and presented the traders with a wish list: ultra-tech firearms, body armor, psi shields, medical supplies, communication gear, and aircraft. The traders were willing to deal, but before they could deliver more than a few examples of the promised arms and equipment, the plan fell apart. The interstellar government's intelligence agencies had identified a flow of new biological products from an unknown border world. As the first reports of the nature of Ostaran pattern-hives reached politicians, a minor panic ensued! The interstellar navy was ordered to interdict the planet: Ostara would be quarantined until they could be sure pattern-plague would not spread off world.

The quarantine was "until further studies could be completed" with an embargo on travel and imports or exports save some humanitarian aid. Weapons and devices with military potential (e.g., tactical sensors, explosives, combat vehicles) were completely forbidden; the interstellar polity was leery of allowing technology to be smuggled into a planetary war zone that could trigger genocide if one or the other side gained the advantage. They also feared being drawn into a costly "boots on the ground" humanitarian peacekeeping mission.

As Ostara lacked a space force, a blockade would be cheap: a couple of patrol ships on station. A minimum level of intervention was permitted: a few survey and science teams to research ways to cure the pattern-plague, and a few diplomats (and their bodyguards) to help the warring Ostaran factions came up with a peaceful solution.

Smugglers

Due to the embargo, the prices and reputations of Ostaran biological delicacies – such as featherwood sap liquor, behemoth steaks, shimmerock eggs, and exotic Ostaran woods and flower perfumes – are artificially inflated. Connoisseurs in the core worlds were willing to pay the moon to acquire the forbidden samples of them! This made it worthwhile to run the navy blockade. However, traders had no wish to trigger interstellar-navy intervention, so most restricted themselves to smuggling "slightly more advanced" TL7-9 goods limited to civilian items and small arms. The Ostaran infrastructure was in any case unable to maintain gear like jet fighters or battlesuits!

Another market for smugglers was unscrupulous bioresearch corporations. Several megacorps will pay well for samples of exotic Ostaran lifeforms, up to and including pattern-plague-infected humans and animals. Live samples are most valuable.

The mechanism for smuggling depends on the nature and technology of the setting. It could include slipping past, decoying, or fighting a patrol ship. More subtle methods include bribing or blackmailing patrol-ship officers to look the other way, or corrupting scientists or survey team members into helping smuggle contraband disguised as medical aid or scientific gear. For more ideas, check out *Smugglers Blues* in *Pyramid #3/71: Spaceships II*.

Although the Easter Parish controls the main spaceport and has engaged in most of the diplomatic dealings with the interstellar society, other factions are just as interested (if not as well off). Plenty of opportunities exist for under-the-table deals with the Sundowners or even human-controlled hives. Of course, each side will attempt to sabotage any engagement with rivals. The Parishes and Sundowners have spies, and the hives may infiltrate telepathic agents into human society (provided their marks stay hidden).

Planetary Details

Ostara is a garden planet with an oxygen-rich atmosphere and two large continents. Humans have been living on the world for well over a century.

Planetary Statistics

Ostara's primary is an orange K2V star with a mass of 0.71 solar masses and a luminosity of 0.3. It orbits the star at an average distance of 0.63 AU.

Year: 320 local days.
Day: 30 hours.
Diameter: 1.22 Earths.
Density: 1.03 Earths.
Surface Gravity: 1.2G.
Dominant Terrain: Jungle, swamp, desert.
Atmosphere: Dense oxygen-nitrogen in lowlands (4× times as dense). On mountains and high plateaus settled by humans, the pressure drops to standard (1.2× as dense).
Average Temperature: Temperate to tropical except in small arctic and subarctic zones.
Climate: Heavy rainfall in lowlands except in the shadow of mountain regions. Powerful lightning storms. Plateau regions are often above the clouds and more arid, but human settlements center on lakes and regions fed by snow runoff from mountain peaks.
Hydrographic Percentage: 76% water.
Axial Tilt: 12°.
Moons: One (Nana, bigger than Earth's moon; solar tides are less, so it balances out).

Geography

Ostara has three large continents (Southern, Northern, and Arctic) and numerous smaller island chains. Most humans live in the southern continent at latitudes well below the equator but above the Antarctic Circle.

The Southern Continent is bisected by the Cream Mountains and the Crescent Range, two substantial mountain ranges. It is the site of most human settlement. Many humans live in Easter Plateau located near the Cream Mountains, fed by Sky Frog River, mountain runoff, and the sargasso-choked Purple Lake. Sky Frog River's periodic flooding supports colonial agriculture. The Easter Parish communities (capital: New Covenant) are scattered along the riverbank and the shores of Purple Lake. The edge of the plateau falls off into a mountain pass called the Valley of Giants. This is heavily infested by hives (human and wild). The valley leads down into the lowland regions where the air is too thick for any humans to comfortably survive. The region experiences occasional earthquakes.

The Sundown Plateau, about 700 miles away, is a more arid highland region, most of it desert with scattered oases and human towns (capital: Usagi). The only land route to it passes through the Valley of Giants and then over the highest peaks of the Cream Mountains. The Sundown Lower Valley – in the rain shadow of the mountains – is home to many hives.

The North Continent is largely uninhabited. The climate is too low and flat to recommend itself; most is impenetrable jungle. There are some mountains where the air is thin enough to be comfortable, but not enough for a large population. Some smuggler bases may be here, though! There are numerous pattern-hives present.

The Arctic is too chilly for humans at the altitudes where the air is breathable.

Civilization

There are 140,500 variant humans (Ostaran parahumans), plus 200-300 other humans and aliens (off-world diplomats, scientists, smugglers, etc.) living on the planet.

Easter Parishes are a representative democracy/theocracy, with a population of 91,000. They have CR 2 for most aspects of their lives, and CR 4 on religion. The Sundown Confederation is an Athenian democracy with a population of 44,500 and CR 2. The pattern-hives are essentially Athenian democracies/communist states, each with 0-25 humans and about 50-200 animals. The total population of all patterns hives is estimated to be at least 5,000 humans and 100,000 animals.

Ostarans can switch gender. For general use, they prefer gender-neutral pronouns (Spivak-system: "E" instead of he or she, "Em" instead of him or her, Eir instead of his or her), typically reserving specific gender pronouns for special circumstances or cis-gendered. They use the term "mother" and "father" as appropriate.

Church of the Covenant of the Egg

Believers (90% of the populace) have a first name followed by a name based on their birth order and mother's first name: Poppy, the child of Usagi, is Poppy Usagi 6Born. Their first commandment is "be fruitful and multiply through the cosmos." In services, the priests wear jackalope (horned rabbit) masks. Rites are fertility rituals – often involving eggs, liquor, and orgies– to bless human and animal reproduction; many take place in the fields. The church symbol, also used as the flag of the Easter Parishes, is three hares in a circle with conjoined ears.

Colonists

The Ostaran colonists brought many plants and several species of Earth animals with them, including chickens, rabbits, silkworms, goats, cats, dogs, horses, and cows. All animals were gengineered for improved fecundity. Food crops were modified to produce extra vitamins (e.g., golden rice) the local ecosystem could not. The most radical genetic engineering was the colonists themselves.

Ostaran Hermaphromorph (TL10)

14 points

The majority of the colonists of Ostara were gengineered parahuman species created under the guidance of Covenant of the Egg genetic engineer Dr. Nana 7Born.

Equipment

The Ostaran colony has a variety of early to mid-TL6 equipment (about equal to the early 1920s). Due to the limited population and industrial base, gear that requires metal, plastics, or electronics (including ammo) is 4× cost, so simple equipment is preferred.

A small quantity of ultra-tech equipment has been smuggled in. Weaponry is mostly at the TL6 level: 7.62mm bolt-action rifles and .45 auto pistols are common for civilians, while militia soldiers use 7.62mm semi-automatic rifles, .45 machine guns, and hand grenades, plus a few flamethrowers, 7.62mm auto rifles, and .50 machine guns. Shortswords (as machetes) and bayonets are also used.

Communications are mostly phone or telegraph but radio is in limited use. Most roads are dirt or gravel. A single-track railway line connects the largest towns with iron and coal mines in the mountains of Easter Plateau. Airports are dirt strips except for the old starport. Mechanization is about at the level of the 1910-1920 period. Some powered machinery and vehicles (tractors, bulldozers, trucks, light aircraft, boats) are used but animals still do lots of work. Engines use coal or alcohol fuels rather than gasoline or diesel (multiply the Range by 0.9). Vehicles are light trucks plus a few motorbikes used by couriers. (Use the TL6 Jeep and 2.5-ton truck stats, p. B464). A dozen or so TL6 light tanks serve with the Rangers (use Renault FT 17 statistics, ***GURPS High-Tech,*** p. 234).

Aircraft are simple: the TL6 "Barnstormer" (p. B465) is typical. A few have rear machine guns. Due to the sargasso weeds that snarl conventional propellers, high-speed powerboats are "airboats" with rear-facing aircraft-style propellers; use the TL7 speedboat statistics (p. B464) but with Move 3/18 and +3 to Hearing rolls to notice them.

TL6 gliders are common. TL7 hang-gliders (***High-Tech,*** p. 232) are a recent import (considered legal). Many youths learn to fly. The Parishes and Sundowners have a few elite volunteer units using gliders for aerial assaults.

Attribute Modifiers: HT+1 [10].

Advantages: Hermaphromorph (Accessibility, Not while pregnant, -20%) [4].

Features: Easy Childbirth; Increased Fecundity; No Appendix; Shorter Gestation; Taboo Trait (Genetic Defects, Unattractiveness).

Availability: $64,000. LC3.

The reproductive modifications (see ***GURPS Bio-Tech,*** pp. 59-60) cut human gestation period by about a third (to an average of 180 days), reduce the pain of childbirth, and give +2 to HT rolls to determine success of pregnancy. Additional eggs are also released during ovulation, resulting in twins in about one in six pregnancies. The most extreme modification, however, is the ability to voluntarily alter sex between male and female forms, a process deemed necessary for social harmony. Ostaran families typically have multiple children, and it's customary for family members to take turns being the mother. (The Covenant were working on ways to make oviparous humans when their biolab was shut down by the authorities . . .)

Native Life

Ostaran biochemistry and physiologies are analogous to terrestrial life, but with some differences in amino acids and DNA-equivalents. Vegetation is mostly red, mauve, lavender, or purple hues (using retinal rather than chlorophyll). There are many flowers; pollination is dominated by tiny bird-like creatures rather than flying insectoids. Higher animals exist and grow very large, equivalent in size to dinosaurs on ancient Earth.

Humans can eat some of the native plants and animals (and vice versa), although no native forms are completely nutritious and some are toxic. (Anthro-hives must periodically raid human settlements or clear land to grow human crops.) Few local bacteria are threats but some parasites (such as pattern-plague) and native viruses are.

The oceans and inland lakes are choked with crimson and purple sargasso-like weeds, which support many types of sea creature. The land is home to a huge variety of animals of mostly dog size to insect size, and numerous winged flyers. Few big land animals exist outside of those who are part of the pattern-hives. It's theorized that the hives exterminated most larger creatures that did not assimilate.

Plants

Ostara has countless plant species, but a few are especially notable.

Sponge: Ostara has no grasses as such. The majority of ground cover is a mauve spongy turf with a consistency similar to thick moss. Many native Ostaran animals graze on it. It is mildly toxic to humans, although some Terran animals can chew on it safely.

Feather Groves: The visible parts of these plants are similar to Earthly trees, but with luxuriant feathery frond-like leaves in purple, mauve, and crimson, similar to the plumage of exotic birds. The tree-like upper organism is part of a larger underground "root mass" that serves as a communal root structure for every four to six "trees." The wood itself is light but very strong. Featherwood is used as lumber and firewood.

Pattern-Hives

The pattern-hives are creatures of different species (but all fairly large size) living in mutual symbiosis and exhibiting a level of organization similar to that of an ant or termite hive.

Pattern-bound range from man-sized creatures to giant forms equivalent in size to old Earth's dinosaurs. The only constant is the intricate tattoo-like markings of raised bumpy tissue, similar to a complex maze, that develops on their hides, skin, or scales. The hive-pattern covers their entire bodies.

Few local animals have fur or feathers, so it's unknown how this would manifest in such cases.

Most hives are essentially nomadic. Pattern-hives have a dozen to a few hundred members. Hives stop reproducing when they get much larger than 500 members; this might be a limitation on the "psychic bandwidth" that can be sustained on a single "mental channel."

Hives encompass a variety of creatures, including sizable herds of man-sized to cow-sized grazers who provide mundane food. The GM can simply use statistics of cows or goats for them. The anthro-hives have also absorbed some human livestock animals.

All members of a pattern-hive work together in the common interest. However, they are implacably hostile to rival hives, fighting wars over food stocks and grazing territories.

Some individuals, especially in large hives, are born with minor deviations to the pattern. These tend to be forced out of the hive or killed. It's possible that these sorts of mutations were the origin of the divergence of different pattern-hives in the distant past.

In the early years of the colony, the origin of the pattern-hives was mysterious; various theories such as airborne hormones were advanced. The pattern-plague infections revealed that each pattern-hive was a shared telepathic mass-mind.

Pattern-Plague

Vector: Digestive.
Resistance Roll: HT-2.
Delay: 8d+2 days.
Damage: 1 point toxic.
Cycles: 12 × 12 hours.
Symptoms: Moderate Pain, Phantom Voices (Annoying), and Sleepwalker after 1/3 HP. Pattern-Bound (below) *permanently* after 2/3 HP; at this point, earlier symptoms fade.
Contagiousness: Highly contagious (even a small exposure requires a roll).

This syndrome is believed to be triggered by a form of contagious prion disease, microscopic skin parasite, or viral organism. The prevalent theory is that humans were exposed to "pattern-plague" after hunters ate improperly cooked hive-bound animal meat. (A minority theory is that it came from raw Shimmerock eggs used in eggnog in rituals). In fact, children in puberty can get the plague from eating certain poorly cooked meat and raw eggs from pattern-hive creatures, but this is only a risk for adults if brain tissue gets into the meat or is consumed. The pattern is also passed via intimate contact (provided those involved aren't already infected with a different pattern) and to fetuses in the womb.

The patterns are an outward manifestation of brain and metabolic transformations that alter behavior and stimulates telepathic powers. Each pattern might be considered a single superorganism, although members do maintain a degree of "self." It is a mystery as to why only some animals, all human-size or larger, can host the patterns, but one theory is that both a minimum brain size *and* skin surface area is required to host a colony large enough for telepathic powers to manifest to join the mass mind.

Ways to treat the pattern-plague are currently unknown, but scientists are working to test various ultra-tech medical drugs and cures against it and develop vaccines.

Pattern-Bound

34 points

Someone infected with the pattern-plague may acquire this template. The hive is assumed to be a Patron rather than Ally, as the character's interests are submerged to it. The basic Telesend ability is sufficient to project the feelings of togetherness and friendship to other hive-bound. The Racial limitation on Telesend is assumed to apply not to your race but rather only to members of your own pattern-hive (regardless of race).

Humans who live in a pattern-hive will often further develop their telepathic abilities beyond the minimum given here. Ostaran hive-bound who have lived within the stimulus of a pattern-hive have been shown to develop the full range of Telepathy abilities, skills, and Talent detailed in ***GURPS Psionic Powers*** – in essence, the hive itself serves as a form of catalyst creature for stimulating telepathic powers! Of course, many don't live that long.

Hive-members always want to remain within contact, but as mind-link allows telepathy to work over long distances, individuals may be sent away from the hive on special missions.

Advantages: Mindlink (100-999 people; Telepathic, -10%) [27]; Patron (Pattern-Hive; 15 or less) [30]; Telesend (Telepathic, -10%, Racial, -20%, Vague, -50%) [6].
Disadvantages: Intolerance (Other pattern-hives) [-5]; Phobia (Being cut off from the hive) (12) [-5]; Selfless (12) [-5]; Sense of Duty (Pattern-Hive) [-10]; Unnatural Features 4 (Skin patterns) [-4].
Features: Can infect others.

Customization Notes

Someone who has lost themselves in the animalistic impulses of the hive will have Bestial [-10 or -15].

As they are considered outcasts by a religious society, hive-bound humans on Ostara have Social Stigma (Excommunicated) [-5] when dealing with non-hivebound communities.

Shimmerock

This is one of several creatures found in a typical pattern-hive. It is a flying pseudo-reptile with a lavender-skinned body (often covered in pattern-hive markings), two pairs of shimmering silver-gray wings with 25' span and two clawed legs. It can easily fly in the dense atmosphere of Ostara. It has a long stabbing beak that has a distinct silvery color, hence the name. When not driven by the hive's cooperative impulses, it feeds on lake, ocean, or river fish, but is also an opportunistic scavenger. The Hive uses it as a scout. A Shimmerock is just powerful enough to carry a lightweight young human rider and saddle – or snatch a person into the air and drop him to his death.

ST: 13	**HP:** 9	**Speed:** 6.00
DX: 13	**Will:** 11	**Move:** 1 (Ground)/18 (Air)
IQ: 4	**Per:** 11	**Weight:** 90 lbs.
HT: 11	**FP:** 11	**SM:** +2
Dodge: 9	**Parry:** N/A	**DR:** 1

Bite (13): 1d-3 large piercing. Reach C.
Claw (13): 1d-1 cutting. Reach C, 1.

Traits: Acute Vision 2; Flight (Winged); Lifting ST 6 (BL 72); No Fine Manipulators; Pattern-Bound; Weak Bite; Wild Animal.
Skills: Brawling-13; Flight-17.

Indigo Leaper ("Blue Death")

A fierce blue-skinned (and hive-patterned) 33'-tall bipedal carnivore, it has a wide frog-like head, a great jaw full of 7" fangs, four blunt gripping claws, and two powerful legs capable of leaping several feet. It has a terrible warbling howl. Its patterned gauzy-blue skin is semi-translucent, so people can see what it ate . . . which might require a Fright Check! Pattern-hives usually have only a few of these horrors due to the logistic requirements. It can be fitted with a saddle and ridden by one to two human-sized riders.

ST: 35	**HP:** 35	**Speed:** 6.50
DX: 13	**Will:** 12	**Move:** 15
IQ: 4	**Per:** 13	**Weight:** 2.7 tons
HT: 13	**FP:** 13	**SM:** +5
Dodge: 9	**Parry:** N/A	**DR:** 4*

Bite (13): 4d-1 impaling. Reach C.
Claw (13): 1d+1 crushing. Reach C.
Tail Swipe (13): 4d+3 crushing. Reach C-6, limited to rear arc.

Traits: Pattern-Bound; Short, Weak Arms (1/2 ST); Super Jump 1; Wild Animal.
Skills: Brawling-14; Running-14; Tracking-14.

* Only DR 1 vs. visible-light lasers. Skull has DR 6 vs. all attacks.

Behemoths

The powerhouse of the pattern-hives is a large lavender-skinned herbivorous hexapod, about 43' long. Its giant body is protected by several large spikes that extend vertically. It has a powerful spiked tail that it can wield as a mace. It also has two slashing tusks. They have less "self" than many creatures in the hive, and they will sacrifice themselves to feed other hive-members if necessary!

Eight or so people or shimmerock can cling to it between the spikes. It's also common to attach colorful silk banners or tethered kites in the hive's colors. Sometimes a howdah is mounted between the spikes, with a platform for a pintle-mounted .50 machine gun (with a DR 24 gun shield providing heavy cover).

ST: 83	**HP:** 83	**Speed:** 5.25
DX: 10	**Will:** 10	**Move:** 4
IQ: 4	**Per:** 10	**Weight:** 48 tons
HT: 11	**FP:** 11	**SM:** +5
Dodge: 8	**Parry:** N/A	**DR:** 5

Bite (10): 4d crushing. Reach C.
Long Spines (6): 1d impaling. Reach C, top and rear only.
Tail Swipe (10): 9d+9 crushing. Reach C-6, limited to rear arc.
Trample (10): 9d crushing.

Traits: Hexapod (like Quadruped but with Six Legs); Pattern-Bound; Weak Bite; Wild Animal.
Skills: Running-11.

About the Author

David L. Pulver is a Canadian freelance author. An avid science-fiction fan, he began roleplaying in junior high with the newly released ***Basic Dungeons & Dragons.*** Upon graduating from university, he decided to become a game designer. Since then, David has written over 70 roleplaying game books, and he has worked as a staff writer, editor, and line developer for Steve Jackson Games and Guardians of Order. He is best known for creating ***Transhuman Space,*** co-authoring the ***Big Eyes, Small Mouth*** anime RPG, and writing countless ***GURPS*** books, including the ***GURPS Basic Set,*** *Fourth Edition,* ***GURPS Ultra-Tech,*** and the ***GURPS Spaceships*** series.

The Vanishing Sun

by Christopher R. Rice

It is whispered in legend along the space lanes, sometimes in fear, other times in wonder or greed. Part Brigadoon, part Treasure Island, the system of Saturi Talis holds amazing technology, strange peoples, and fabulous treasures – or so the tales say. But Saturi Talis appears and disappears – almost never in the same place and seemingly at whim. Those who've been there and escaped speak in hushed tones of something horrific going on behind the scenes. Something too mad to actually happen . . . right? Use this exciting new location in your ***GURPS Space*** campaign, or if you are *adventurous,* in any campaign.

It was easy to believe that Quofum did not exist because most of the time it didn't.

– Alan Dean Foster, ***Quofum***

The Legend of the Disappearing System

The original people of Saturi Talis got to their new home via generation ship, the *Great Michael*. Faster-than-light travel had yet to be invented, and the colonists had originally aimed for Proxima Centauri. The mix of Korean, Scots, Irish, and South African immigrants had left Earth after a terrible sickness began to spread across the globe and into the solar system.

What happened after they left Earth's solar system was baffling. They found themselves in a solar system that was on no chart, thousands of light years off course from their destination. The captain was relieved when three of the seven major planets turned out to be inhabitable. One of the habitable planets (later named Talis Tertius) was rich in minerals – and mystery, with prospectors reporting "creatures" watching them, which the humans named "Shellycoats," after the Scottish bogeyman. One geologist, Si Yun Rang, said she "heard the earth speak." Her story got around quickly, and the stranded crew decided to name this system *Saturi Talis,* a portmanteau of Korean slang for "spoken dialect" and an English mythological creature composed of stone.

When the *Great Michael*'s passengers and crew found Talis Primus (see p. 12), they discovered the climate so Earth-like that it was as if the planet was made for them. Even the flora and fauna were similar enough to be digested without genetic tinkering. Adding to the surrealism, some colonists seemed to be aging more slowly than normal, while others sickened or died quickly and unexplainably. This led to the slower-aging colonists being nicknamed "Methuselahs." The first generation of children grew rapidly, reaching adulthood at nine years old, and then seemingly stopped aging afterward. Strangely, their hair was silver-white, which led to their moniker, the "Quicksilver-Born." The ruling council of Saturi Talis has slowly but surely been becoming more and more 'Silver as the years go by, making "normal" humans nervous.

During their survey of the system the colonists discovered the Paragon (see pp. 13-14), but they initially left it alone. They set up mining operations in the Kuiper belt, but only the most tenacious stayed on when mining ships disappeared, never to be seen again. When long-range scout ships vanished without a trace, the explorers stopped looking for anything outside the orbit of the Furthest Sister, the most distant planet.

It wasn't until 30 years after arrival the settlers of Saturi Talis had their first visitor. The *Walrus,* a trade ship, wandered into the system much the way the *Great Michael* had. Captain Jane Flintwood made contact with the castaways, who were shocked to learn that over 100 years had passed "outside." What most bewildered them was that FTL travel had been discovered. The *Walrus*, a newer ship, had been moving at FTL speeds when it veered off course. Flintwood's crew reported knocking sounds, headaches, and other problems (as it turned out, these were things that the survivors of the *Great Michael* also had experienced when they entered the system). When the *Walrus* tried to leave, Flintwood found their FTL engine would not work – despite it being undamaged. Eventually, they found Talis Primus and mingled with the original settlers.

Despite only 100 years passing in the Saturi Talis system, nearly 500 years have passed outside it, with more and more people getting drawn in, seemingly without rhyme or reason. From space liners to cargo ships to military vessels, some 50 of ships found their way to the system. A "cultural ark," the *Santa Margarita* (which had been hauling art, precious jewelry, and other valuable rarities from Earth's blasted landscape) made its way in-system. Likewise, the *Emerich* and *Roland,* a military frigate and its consort ship, were pulled in. All ships' crews experienced the same thing the *Walrus* and the *Great Michael* had: Once they were in, they couldn't get out. Many settled on Primus (but see p. 13 for information about the Rovers). Furthermore, brushes with the elusive Shellycoats have been reported a handful of times since.

Saturi Talis System

The Saturi Talis system is *remarkably* similar to Earth's. Closest to the sun is Nessuno, a small rockball with a chlorine atmosphere. The next planet in the system is Saturi Talis Tertius (p. 13), a *big* rockball with a surprisingly breathable atmosphere, followed by Secundus (below), a water-world with a large number of island-like landmasses. Fourth from the star, Primus (below) is an Earth-like clone in gravity, mineral content, and climate. The fifth planet, the Rover's Eye, is another rockball (p. 13), but it lacks an atmosphere. Next is the Asteroid Belt and the Paragon (pp. 13-14), followed by the Kings' Crown Comet and then the Further and Furthest Sisters.

The Numbered Scions

Less than 10 years after his abrupt arrival in the system on the *Great Michael*, Jonas MacDonough discovered the "sun signals." He grew obsessed with them and spoke to others about his findings, but he was dismissed by most as a madman. Some listened, though. They noticed the greatly lengthened lifespans some colonists exhibited and the equally hard-to-miss silver-haired offspring. Over the last hundred years, MacDonough's small collection of numbers-obsessed cohorts has grown into a politically powerful and diverse group of adherents calling themselves the Numbered Scions. They are suspicious of the Rovers (see p. 13), but only a few are crazy enough to try to discover the secrets of the Paragon. Many view the Quicksilver-Born Talisians as abominations and are deeply wary of them, especially since they are beginning to replace the "normal" humans. Most Scions mutter about aliens and the Shellycoat watcher and how it has plans – *dark* plans – for them.

The mysterious radio signals could be anything the GM likes, but see p. 16 for one possibility.

Saturi Talis Sun

The sun is a G2V star and is only a few solar masses heavier Earth's Sol, but emits strange radio signals. These radio waves pulse from the star at very specific timed rates (like the old number stations from Earth's 20th century). This odd phenomenon has even inspired a religion of sorts that's part ideology and part conspiracy theory (see *The Numbered Scions,* above).

Curious scientists have tried to study the signals over the years, but none of them have discovered anything other than irregularly regular radio waves put out by the sun.

Inhabited Planetary Bodies

Most Talisians live on Primus, but both rockball Tertius and water-world Secundus are populated. Various outposts are also in the system, notably the Tent-City dome on the Rover's Eye and the small mining outposts that spring up in the asteroid belt (p. 13). A skeleton crew maintains (and inhabits) the *Great Michael* as a communications hub for the system.

Talis Primus

Even with 100 years of almost explosive expansion, the settlers have yet to cover even 5% of their planet. Primus itself is a verdant paradise with easily accessible natural resources, few predators, and abundant life. This Earth-like environment made it extremely easy to adapt to. Heavy industry is almost unknown on Primus; most factories are built on Tertius (p. 13). The capital of Primus is the grand city of Skye, which boasts a population of over a million in the urban centers and twice that in the surrounding farms and suburban neighborhoods. There are several key space docks; one serves double-duty as a sea port.

The Landing Field has long since been overgrown with the Talisian equivalent of grass. The decaying hulks of the landing craft (which have been stripped of all useful parts) serve as a reminder of their arrival on Primus to later generations. Very few of the original settlers remain alive, though Birdie May, born shortly before the colonists arrived in-system, still survives. She often talks about the otherness of the Quicksilver-Born (p. 15) and is more than happy to share her fears with any who will listen.

The majority of the Quicksilver-Born live on Primus. Thanks to their enhanced cerebral capabilities, they are often in positions of authority. It's not uncommon to meet a 'Silver who has yet to reach adulthood in a job supervising those many times his age.

Because of the occasional Rover raids (or all out war!), a strong military contingent exists. It doubles as a peacekeeping force and disaster relief – powerful hurricanes and storms are common on Secundus and Primus.

Talis Secundus

Despite being the largest planet, it has the least surface area and is over 90% water. There is plant and animal life, and the oceans are rich with the Talisians' chief fuel source: deuterium oxide, or "heavy water."

The central city of Nautilus is a large "bubble" anchored to the sea floor by a gigantic nanocarbon chain. Nautilus floats on the surface most of the time, but descends beneath the waves in storms. It's known for its pharmaceutical trade due to the myriad forms of aquatic life there. It has the second highest population in the system. 'Silvers don't seem to like the depths of the sea, so those who fear or distrust them have begun to flock to Nautilus.

Talis Tertius

The least of the inhabited worlds is also absolutely vital to the others. All settled spaces on the planet are mining towns of some variety, with food and supplies being brought in. Many factories (often robotic assembly lines) dot the surface, creating manufactured goods that are needed by the rest of the solar system. The byproduct greenhouse gases are transforming the atmosphere of Tertius; it will become breathable without respirators in another 500 years or so. The miners of Tertius see themselves as heroic "frontiersmen," eking out a living in a place as rough and tumble as they are.

Other Notable System Features

Nessuno, the King's Crown Comet, and the Further and Furthest Sisters are left for the GM to flesh out.

The Rover's Eye

A ball of rock with no atmosphere, the Rover's Eye is the home of the only semi-permanent settlement of the Rovers – the Tent-City. Its name comes from the lack of lasting structures within its enormous dome-like enclosure. More spaceport than settlement, it's one of the populated areas where lawlessness is rampant and justice is regularly meted out by a "voidkiss mob" (the equivalent of a lynch mob but with airlocks and vacuum). There is enough murder that "getting tented" has become slang for being killed. Despite the dangers, people come from all around to trade with the Rovers. Illicit deals often go down in Tent-City.

Asteroid Belt

The *huge* asteroid belt beyond the Eye is heavily mined by Rovers. Families can live on a single asteroid for years, siphoning off its resources, until moving to another. Rover families keep meticulous charts of their portion of the belt and hide their knowledge jealously from everyone else. Despite the riches, some won't stay in the belt for long as they are afraid of the *dokebi* – a vacuum-dwelling, invisible creature that breaches the hulls of ships to feast on the occupants. Of course, no one has ever *seen* a *dokebi* – but belter ships do seem to have above-average numbers of hull breaches resulting in disappearance of all onboard personnel . . .

The Paragon

This odd artificial structure is a massive cube easily the size of Primus with several openings along its surface. Getting to it is fairly easy as the docking stations alongside the Paragon have some sort of smart program that can guide ships and restructure the station's surface to accommodate any ship.

What's more, ships without any active personnel left "docked" in the system will inevitably get drawn inside of the Paragon as it shifts its form to accommodate the vessel. This is what happened to both the *Santa Margarita,* the *Walrus,* and the hundreds of other ships down through the years. This is why there is no ship graveyard and one of the reasons the *Great Michael* is manned constantly. The Paragon seems to emit some sort of omnidirectional signal that overrides any autopilot or artificial intelligence steering a vessel and brings it to dock on its surface. It has no effect on ships guided by sentient living hands.

Once inside of the Paragon, the first room is always a plain white cube, 20' by 20', with airlocks on each wall, the floor, and the ceiling. There are handholds to assist the climb, but the pull of gravity changes depending on the surface the person is on, so visitors are always feel like they know which way is "down." The next room is usually of the same construction, but something is inside – often just inanimate objects like a chair or desk, but grassy lawns, rooms decorated in all eras from Earth, and other oddities have been reported by those who have returned. The deeper someone goes in, the more anomalous each room becomes.

A psychological effect goes along with how "far" the visitor has gone, but it ends if the person solves a given route's riddle (see p. 14). The further away from your starting point, the greater the strain on the mind. The GM should feel free to give curious adventurers any number of temporary mental disadvantages, which go away as soon as they spend time outside the Paragon.

Wherever They May Roam

The Rovers started off as a small group who deeply mistrusted the situation they had found themselves in. Several inhabitable planets with readily available resources right at their fingertips? Too good to be true. When Primus was settled, the Rovers only stayed long enough to buy ships and supplies and then headed as far away as they could. This seed of mistrust grew until a thoroughly intolerant attitude sprang up between them and the other Talisians, leading to occasional armed conflicts. Over the generations, many battles have sprung up between the Rovers and the other Talisians, which have left deep and lasting scars in both peoples.

This has not stopped the Rovers from trading with the "grounders," and a culture reminiscent of other traveling peoples of Earth has developed. They're excellent miners and prospectors (often called "wildcatters" by those of Tertius) who always seem to find what they are looking for.

Their reputation as traders, travelers, and "the enemy" masks the goal that truly drives the Rovers. They have long sought to discover the purpose of the Paragon and believe it to be a way to leave the system. In fact, they are among the few people to have set foot inside of the Paragon and lived to tell about it.

No "end" has ever been discovered, and some Rovers angrily whisper of the Sisyphean nature of their task, even as they continue performing it. From what they've learned, the doors lead to millions of similar rooms, which shift in an ever-changing manner. There is a very specific pattern as some routes have been retraced by explorers, but such maps are guarded more jealously than belter charts. Each route's riddle is solvable but difficult.

Perhaps the strangest effect of the Paragon is that some explorers get "rewarded" in what appears to be a totally nonsensical manner (the GM should make a reaction roll to determine what is given; see below). Rewards often take the form of a badly needed item (like medicines for an incurable disease) or coordinates to a rich load of valuable resources. Such help comes in the form of technology beyond what the receiver can comprehend and seems like magic (treat as TL12^ *or* one TL higher than the campaign default). Indeed, some Rovers have come to worship the Paragon as a godlike being whom they can petition for "help" – *if* they can solve a route's riddle.

Instead of designing a maze, or to simulate a short route, the GM can require an IQ-5 roll using the highest IQ of a given group. Failure indicates that time was lost wandering around. Success means a reaction roll, with a bonus equal to the solver's margin of success. The better the reaction, the better the help (see above), with negative reactions resulting in being ignored, trapped in the maze, or thrown into a deathtrap.

The other Talisians have grown curious about the Paragon and have been mounting expeditions to it, much to the chagrin of the Rovers. In fact, at least one non-Rover has solved a maze riddle and received some form of fantastic technology, though no one knows what it was.

What's in the Box?!

What is the Paragon really? It could just be a big dumb object with glitchy programming, or it could have sinister intent. The GM is left to decide exactly how it works for his campaign. A few possibilities about what the Paragon might be:

- An artificial intelligence so vast and so advanced its mainframe requires a planet-size computer. Its capabilities are such that it seems like an omniscient deity. It's come across human transmissions and wants to see what "live" specimens might do.
- A part of a "collection" mission by an alien species – humans are just next on its list.
- An ancient device designed to preserve entire species from destruction up to and including the death of the universe – but has it already done so? Are the Talisians living inside it even now?
- A massive artificial planet made and abandoned by an advanced species.
- An object that comes from the far future to ensure the survival of particular peoples, places, or species, to make sure *its* future is the one that occurs.
- A test by pandimensional beings to see if humans can prove they are intelligent enough to join them (eventually) or if they should be wiped out now.

New Character Traits

The following traits are germane to this setting.

Advantage Variant

As introduced in ***GURPS Transhuman Space: Changing Times*** (p. 52), the GM may allow characters to purchase a form of Empathy affecting AIs, robots, and other artificial machine minds. The following advantage is similar to, but different than, the one proposed there.

Empathy

see p. B51

Many Rovers have developed this odd ability and are treated by their people with reverence. After all, they can *attempt* to plumb the depths of the Paragon's mind, however limited their capabilities.

Machine Empathy: Use the rules for Empathy, but you also gain a bonus to Computer Programing (AI) or Psychology (AI) rolls. You can ignore Indomitable in such a subject (a common trait for artificial minds). Optionally, the GM may allow you a roll against Computer Programming instead of IQ (if better) to see if an AI is lying to you or if its programming is malfunctioning. If the GM is using ***GURPS Psionic Powers,*** then this becomes a Cyberpsi ability (see ***Psionic Powers,*** pp. 30-32) making cost 5 and 13 points instead.

New Racial Templates

As far as doctors can tell, there are currently four genetically similar human species in the system: "normal" humans, Methuselahs, Rovers, and Quicksilver-Born.

Methuselahs are standard humans with an added meta-trait that gives Fit [5], Longevity [2], Rapid Healing [5], and Resistance to Metabolic Hazards (+3) [10], for 22 points.

Rovers are standard humans with No Degeneration in Zero-G, for 1 point. Many Rovers also have 3D Spatial Sense, Improved G-Tolerance, G-Experience, and/or Machine Empathy (above). The GM may allow the Spacer upgrade (***GURPS Bio-Tech,*** p. 71), since at least some of the Rover population would enhance themselves and their offspring if the campaign tech level and local resources allow.

For the 'Silvers, use the following template.

Quicksilver-Born

226 points

The Quicksilver-Born – or 'Silvers – are in equal measures hated and loved. They are superior to normal humans in nearly all ways. Faster, smarter, stronger, tougher – they are simply *better*. Their appearance can vary, but they are always pale-haired, pale-skinned, and beautiful. The one thing they lack is an understanding of human emotions; they are coldly logical to the point of utter dispassion. This makes them susceptible to manipulation, though they are completely fearless and attempts to intimidate or coerce them with physical violence always fail. They are often found in roles of power or privilege because of their enhanced abilities – something many "normal" humans highly resent. See *Children of the Shellycoat* (below) for one possible explanation of who and what the Quicksilver-Born are.

Attribute Modifiers: ST+2 [20]; DX+2 [40]; IQ+2 [40]; HT+2 [20].

Secondary Characteristic Modifiers: HP+2 [4]; Will+2 [10]; Per+2 [10]; FP+2 [6]; Basic Speed+1.00 [20]; Basic Move+2 [10].

Advantages: Appearance (Beautiful/Handsome) [12]; Combat Reflexes [15]; Eidetic Memory [5]; Extended Lifespan 2 [4]; Fit [5]; High Pain Threshold [10]; Less Sleep 4 [8]; Longevity [2]; Regeneration (Slow) (Heals Radiation, +40%) [14]; Resistant to Metabolic Hazards (+3) [10]; Unfazeable [15]; Voice [10].

Perks: Honest Face [1]; No Degeneration in Zero-G [1].

Disadvantages: Curious (12) [-5]; Increased Consumption 1 (Large Meals*, -20%) [-8]; Low Empathy [-20]; Odious Racial Habit (Coldly Logical) [-5]; Oblivious [-5]; Overconfidence (12) [-5]; Truthfulness (12) [-5]; Unnatural Features 4 (Silver hair, silver eyes, pale-white skin, etc.) [-4]; Unusual Biochemistry [-5].

Features: Interfertile with humans; Taboo Traits (Genetic Defects, Mental Instability, Unattractiveness).

* Instead of eating more often, 'Silvers may either eat more often, *or* eat twice as much per meal, much as normal humans may get their calories from the usual two to three meals a day, or many smaller snacks.

Customization Notes

Common traits not included in the racial template are 3D Spatial Sense, Ambidexterity, Common Sense (often with Inspired, from ***GURPS Powers,*** p. 56), Extra Attack 1, Extreme Sexual Dimorphism (***GURPS Bio-Tech,*** p. 170); Intuition, Language Talent, Intuitive Mathematician, Mathematical Ability, Photographic Memory, Single-Minded, Very Fit, and Very Rapid Healing. Some 'Silvers exhibit a full understanding of human emotions . . . but don't actually care. For such characters, exchange Low Empathy for Callous and remove Taboo Trait (Mental Instability), increasing the template cost by 15 points. The GM may give them a racial Reputation, depending on their role in the campaign.

Children of the Shellycoat

The Quicksilver-Born are the results of nanotechnological genetic experimentation by the Avaxi (see *The Truth,* below) on human beings to achieve some mysterious purpose. The Avaxi manipulated the genetic code of certain females and males onboard the *Great Michael* and then induced pairings via subliminal messages in dreams. In order to get optimal amounts of genetic material from each pairing, they extended the selected humans' lifespans and reduced the time it took for their offspring to mature. The experiment is still ongoing, and the watchers are confused by the hostility the 'Silvers have received from the "wild-bred" humans. After all, what need do humans have for emotions? The Avaxi don't have them, and look how far *they've* come.

Still, the Quicksilver-Born *are* human . . . just *more*. Some of the Avaxi's careful planning is already starting to unravel as a few 'Silvers seem to be experiencing human emotions – even at a diminished capacity. What's more there is rumor of a female 'Silver, named Ishtar, raised by the Numbered Scions from birth, who seems able to experience the full range of human emotions with no reduction in her other capabilities. If such a thing is possible, it might destroy the Avaxi's carefully laid plans.

The Truth

The Avaxi are an ancient race, once dwelling on a planet near the galactic core. They left their homeworld when it was destroyed by a unknown enemy. They traveled throughout the Milky Way and have been meddling with other races every step of the way. They couldn't find a "worthy successor" to their ancient legacy – until they stumbled across Earth. In humans, they found greatness, but despaired at their sometimes illogical and emotional ways. So they devised a plan to seed Earth with potent nanotech that, in a few generations would increase the human brain's intellectual capacity while reducing impulsiveness and emotion. This worked . . . sort of.

The broad-spectrum nano only increased the number of outliers in human emotion; everything in the psychology books already existed, but the Avaxi's meddling enhanced what was already there, as well as causing new mutations along similar lines. The Avaxi postulated this was due to human-made chemical interactions, and attempted to create specialized bloodlines (where their gengineering could take environment and individual biology into account). These experiments, in out-of-the-way locations to minimize human medical intervention (or discovery), tended to fail messily. Without a critical mass of "odd" children, the humans tended to reject their unusual young. Even those who achieved adulthood were unlikely to pass down their genetic superiority. Earth was too big a testing ground and too interconnected.

So the Avaxi waited until humans began to send out ships to the stars and snatched up the *Great Michael* as a perfect testing ground for their experiments. They intercepted the ship with several of their own, launched it into hyperspace, and began introducing their nanotech into the ship's environment. Once they'd finished gengineering the groundwork for the Quicksilver-Born (p. 15), they focused on using subliminal hypnogogic tech to make the humans compliant and accepting of the situation they found themselves in.

The Avaxi had prepared the planetary system centuries before, using their advanced technology to terraform the planets, seed them with life, and make them habitable to humans. They also placed a globe of powerful "transphase engines" around the solar system to hide it from discovery and bar entry from the outside. But those engines attracted something else into the system, something the Avaxi had not foreseen: the Paragon.

> *I'm the world's Ultimate Lifeform.*
>
> *– Shadow the Hedgehog, in* ***Sonic Adventure 2***

The Paragon seems to be the one "shifting" the solar system around, phasing it in and out of space by some unknown means (which the Avaxi would *love* to discover!). It's also slowing the passage of time for some unfathomed reason. Despite their best efforts, they've been unable to remove it and soon left it alone. After all, it distracts the humans from the Avaxi's own work, namely the radio bursts from the sun which control the nanotech the system is suffused with. Regardless of the interference from the Paragon, the Avaxi watchers continue their work while trying to evaluate and compensate for the unwanted variable in their equations.

The ultimate goals of the Avaxi are unknown, Perhaps the Avaxi are naturally psionic and wish to breed the same trait into humans. Maybe they just want someone to share their technology with, or are experiencing loneliness and don't understand it. They might seek to thwart their race's social stagnation by interaction with a similar species. Or the GM may have an even *better* idea.

Adventure Seeds and Crossovers

Banestorm: The Ministry of Serendipity does its best to keep high technology secret from the masses, but what if an Avaxi ship was hurled backward in time and crashed in another timeline? Not deterred by finding themselves planet-bound in an alternate universe, the Avaxi's experiments must continue. Saturi Talis becomes a large landmass to the west of the Hesperian Sea. Primus becomes a huge city, the Quicksilver-Born are treated as yet another nonhuman race, and the Paragon becomes an enigmatic fortress high in the mountains above Primus.

Built to Last: Investigating the Paragon has become one of the top priorities of the Talisians, despite Rover interference. Their latest acquisition from the maze – artificial gravitic technology – has convinced the ruling council it's worth investigating. The PCs are the team sent in. Can they beat back the madness they feel as they go deeper into the labyrinthine structure? Will they kill one another before the maze's riddle can be solved?

Child of Man: The Numbered Scions have indeed managed to raise a 'Silver (see *Children of the Shellycoat,* p. 15), but the rumors are false. They stole *several* children and have taught them to be human, using therapy and hormone treatments to eliminate the emotional block the Avaxi engineered. The Scions intend to use these children in their unending quest to find the meaning of the numbers and unravel the mysterious of the Quicksilver's very being. The PCs might be the 'Silvers raised by these fanatics, applying their shining intellects to the mystery as they plumb the depths of who they are and where they came from.

Dungeon Fantasy: Probably the easiest switch – especially if using *Dungeons of Mars* (see *Pyramid #3/72: Alternate Dungeons,* p. 14). Ignore most of the material presented here and focus on the Paragon: the ultimate megadungeon where smart delvers who solve its riddles are rewarded with greater and greater power.

Infinite Worlds: An ISWAT team got lost on its last mission: to investigate an echo of the Roswell Crash of 1947. The PCs are sent in to find the team and finish the investigation. It becomes increasingly apparent this might not be an echo after all. Drawn into the Avaxi's web, can they stop the rogue Avaxi from unleashing a deadly virus designed to convert all humans into Quicksilver-Born – or kill them?

Monster Hunters: Now champions have to deal with little green men too? What happened to dealing with just vampires and zombies and werewolves (oh my!)? The Avaxi have been kidnapping people from Earth for centuries, trying to breed the ultimate psychic, and the PC's team are the latest abductees. Ending up on Saturi Talis Primus, they have to find a way to get home and stop the Avaxi's plans for humanity.

About the Author

Christopher R. Rice was born the usual way without any alien interference . . . or *was* he? From Portsmouth, Virginia, he dreams of being able to write full time, or at least eke out a living doing it. He wishes to thank L.A., his own personal muse, as well as the rest of his gaming group; Antoni Ten Monrós; and Beth "Archangel" McCoy, the "Sith Editrix," for being most excellent sounding boards.

The SkipTime Hub of the OceanWe

by J. Edward Tremlett

Some time ago a number of galactic alliances, interplanetary federations, and small but strong coalitions of planets – along with worlds powerful enough to hold off an empire – received a puzzling subspace message containing an intriguing offer.

In it, they were invited to meet with a hitherto-unknown race: the OceanWe, from HomeOcean. These mysterious humanoids offered prognosticative abilities – what they called "SeeSaying." They were willing to barter these unique services for cultural exchanges, historical records, and small trinkets: "ThingNot to You EndangerEver," they promised in their singsong way.

What the OceanWe want in return for a glimpse of the future may not be damaging, but what they've offered has brought both promise and peril. SeeSaying answers only one question at a time, but breeds many more, as well as a creeping uncertainty. It also creates envy, distrust, and low-scale belligerence that may soon erupt into a galactic war.

What the OceanWe are offering could add an interesting and mysterious angle to any space-based campaign with a lot of disparate factions. To help the GM insert the Hub into his setting, this systemless campaign frame presents what's happened so far – both known and unknown – and what's waiting down on the planet. It gives the truth about HomeOcean and SeeSaying, and why we should be worried. Two setting add-ons are also given, along with story seeds for each. A final coda will answer one question, but doubtless spawn even more.

In the Future, There Is No Past

However long ago the Hub appeared, the empires involved, their exact number, and a detailed accounting of what's been going on are up to the GM, so as to have maximum freedom in utilizing the Hub. So long as there's a number of discrete civilizations jockeying for position and alliances, and either seeking to preserve what they have, or take even more, HomeOcean will fit right in.

One other note: when things are described as polyhedral – such as the buildings on HomeOcean – the number of sides *exactly* matches the number of areas provided by the Hub. Is it coincidence or foresight? That's up to the GM.

PastTime

After the invitation to HomeOcean, only a few of the recipients immediately followed through. Others thought it a trap, or a prank, given that Colelex-10 had been long been deemed unworthy of serious exploitation. It may have been perfectly situated within a buffer zone, but it was little more than a small, gray, and lifeless rock orbiting a red dwarf star.

However, when the emissaries of empires arrived, they discovered that what had once been Colelex-10-D was now quite extraordinary. It was surrounded by a thick, shimmering temporal field, and encircled by a long, thin equatorial docking ring, sitting right at the edge of the distortion. By some coincidence, the ring had a number of docking areas equal to the number of beings the OceanWe had contacted.

The emissaries were instructed to dock at the areas reserved for them, and not attempt to enter the field. Aboard, they discovered large areas tailor-made for their species, with gravity, atmosphere, lighting, and architecture all perfectly adjusted.

Awaiting each delegation was a small group of OceanWe, wrapped in thick canvas and glass environment suits, all smelling of sulfur. After first contact protocol, the beings offered to take their guests to "PlaceYours." They led them to a large, shimmering portal on the far side of the hub, which seemed part of the temporal distortion itself.

Entering, the emissaries felt a strange, stomach-flipping sensation. When they regained their bearings, they found themselves in an area much like the one they'd left. They soon realized the windows were showing the surface of another world – one that was yellow and very wet.

WorldNew

Outside the windows, a weak, distant sun – definitely *not* red – twinkled through thick clouds swirling with rain. Below those clouds was a rock-strewn plain, ending at a wide, placid ocean, its horizon obscured by precipitation. A vast city squatted along the shoreline – its buildings single-story and polyhedral, their surfaces dyed a poisonous yellow from near-constant downpours.

Specially tailored environmental suits were given to the emissaries. They were warned that the planet had low gravity and a dense, wet atmosphere. Once outside, they were led to a wide, covered area where other emissaries awaited, also wearing suits (unless they didn't need to).

As expected, there were some initial misgivings; some of the races and alliances were rivals, if not outright enemies. However, they were told that they should not fight here, as doing so would deny them the use of the OceanWe's SeeSaying ability. It was a hard sell for some, but once the SeeSaying was aptly demonstrated, even the most hotheaded were willing to be on their best behavior – for now.

DaysStrange

That was some time ago. Since then, all those invited have come to Colelex-10-D – now called HomeOcean – to partake in the SeeSaying. Subsequent galactic commerce has been mostly excellent, with some worlds clearly prospering thanks to more interplanetary traffic and increases in technology. Conversely, some don't know what to do with what they've learned. A creeping paralysis has taken hold of others, as less-decisive leaders dare not make a move without a SeeSaying – or three.

But there are still those who struggle, leading to instability and anarchy in some areas. Those who were not invited clamor and fight to be allowed in. Meanwhile, age-old rivals, momentarily assured of success, engage in major intrigues and minor proxy skirmishes to gain a new advantage over one another, however temporary.

As if that wasn't nerve-wracking enough, there's a new and deadly player in the area. Reports are coming in of small, swift, saucer-like spacecraft that appear from nowhere, attacking vessels on their way to or from the Hub. They destroy their targets with some as-yet-unknown weapon and then vanish before anyone can retaliate.

No one knows who they are, and no one has discerned the reason for their attacks. The fact that their appearance neatly corresponds with HomeOcean's appearance has led some to believe there is a connection. But the OceanWe either cannot or will not SeeSay who these mysterious adversaries are.

SeeSaying We

SeeSaying is the uncanny ability to, when presented with two choices, unerringly pick the one that will bring about the best results for the party invoked, at least in the short term. OceanWe can predict the best courses of action in anything from alliances to economics, war to peace, or just whether to turn left or right while navigating a new town.

All OceanWe can SeeSay. However, only certain ones are given the privilege of officially interacting in this fashion with visitors. Each different group has a specific SeeSayer assigned to them for life. When SeeSayers leave the city to die, off in the empty rocks upstream, one of their children picks up their mantle.

Such is their power that SeeSayers don't even need to be told the details. If sat down before two differently colored objects – each one symbolizing a different choice unknown to the OceanWe – he will pick the object that corresponds to the correct choice. In fact, this is how many clients prefer to have it done, as it minimizes the chance that their rivals, enemies, and trading partners will know what they asked.

In return for each Saying, the OceanWe ask for certain things – determined well before the delegation arrives. Often times, they desire auditory recordings of historical records or literature, or possibly music, animal sounds, background noise, or jokes. They also love small trinkets that can't be made on HomeOcean because they lack the needed materials, or are things they can't conceive of.

Asking why the OceanWe require these things is met with silence, usually followed by a polite change of topic. The general consensus is that they're looking for something they can't begin to describe. What happens when they finally find it is anyone's guess.

NowFuture

The equatorial docking ring, known as the Hub, is always very busy. Each invited alliance and empire is entitled to have as many ships docked as its own part of the hub will allow, and most of them take full advantage of this. Other guests only arrive every once in a while and don't allow the use of their portion while they're away. In such cases, their environmental controls are still maintained, which sometimes attracts refugees, criminals, and other cosmic squatters.

The different areas of the Hub are not designed to be traveled between. Trade and negotiations are permitted on HomeOcean or via private telecommunications. Maintenance passageways run the length of the Hub, but these are filled with viscous, raw materials the automatic repair facilities use to fix and replace broken machinery, or organic matter to manufacture food and drink. Traveling from area to area through the passageways requires a pressure suit and unerring timing – failure means certain death.

Each separate section of the Hub has much more room than is needed for official delegations. As the OceanWe have allowed the alliances full authority over their own areas, some have opened it up to trade, travel, and the like. Some are no-man's-lands and Casablancas where traders, entrepreneurs, and less-upstanding "businesspeople" have set up shop. Others are run much more efficiently, only allowing authorized people to journey to and from the surface.

Any ship docking at the wrong hub is mechanically rebuffed. Ships that force the issue, attempt to drill in, or start shooting at other spacecraft are attacked by the temporal distortion itself. Long, shimmering tendrils extend out from the field and literally rip the offending ship apart – sending pieces of it through time and space, to wherever HomeOcean actually is.

The Hub is controlled by the same piezoelectric systems the OceanWe use when high technology is required. Each area has control over certain functions, of course, but overall control resides in a central, unusually high-tech building on HomeOcean. The OceanWe there very rarely intervene, unless there's a severe emergency. They also insist the time-space tendrils that strike errant ships are beyond their control: "NeedWhen Kills HomeOcean," they say.

The OceanWe

The OceanWe are hairless, genderless, endoskeletal humanoids – tall and thin, almost willowy, with light pink skins dyed yellow from near-constant immersion in sulfur. They have webbed hands and feet ending in blunted claws, scaly pads on their knees and elbows, and small, almost vestigial tails just above their dorsal excretory organ.

Their eyes are big and black, with thick lids and nictitating membranes to protect them from especially grainy rainfalls. They have a flat, thin mouth with no teeth and a short, prodigious tongue, capable of mimicking many different forms of spoken language, and tasting the air. A filter at the back of the throat allows them to strain the water for the microbes they eat. Their ear-holes are small but quite powerful.

OceanWe tend to wear very little in the way of clothing, mostly a long, woven scarf that they throw over their faces if the air gets too heavy with particulate matter. Some of them wear long-brimmed, flat hats to keep off the rain.

VisitMusts

The OceanWe have two rules for visitors. The first is that, while properly authorized persons may stay on HomeOcean indefinitely – so long as they respect their hosts – there will only be one SeeSaying delegation from each hub allowed on HomeOcean at any given time. It may contain as many people as required, but they must come and leave as one.

The second is that there will be no conflict upon HomeOcean. Whatever enmities or angers one has, they must be left behind at the Hub. HomeOcean is for trade, knowledge, and the SeeSaying, not war, destruction, and an end to potential.

FactSurface

HomeOcean is just over 4,000 miles in diameter, with gravity a little over 35% of Earth. Its day is 24.5 hours long, and it takes a little under two Earth years for it to travel around its sun. Temperatures range from 90° to 110° F during the day to 60° to 80° F at night. The humidity ranges from 80% to 99% at all times.

According to the OceanWe, HomeOcean is the fourth planet in a fairly young, otherwise-uninhabited system containing eight. It once had moons, but the OceanWe used them to create the Hub. It also has a strong magnetic field, one so robust that they once used it to power spaceships, and still use it to power the Hub's SkipTime field.

Its thick atmosphere is mostly carbon dioxide, with a high sulfuric content. The many active volcanoes, along with fairly frequent meteor strikes, send a lot of particulate matter into the clouds. The everyday rain is yellow and grainy, and the massive, northern ocean is grimy with sulfur, as are the many lakes and rivers that channel through that half of the planet.

The local solar system has a great number of asteroids swirling about, causing the skies of HomeOcean to constantly light up with meteor strikes. Most of them burn up in the thick atmosphere, but when they *do* strike, the OceanWe seem unconcerned – treating the resulting shockwave, wind, and weather disruption as humans might treat a sudden squall of rain.

There are no animals of any kind; the OceanWe are the only non-microscopic species on the world. HomeOcean's vegetation is all aquatic, with wide beds of various kinds of yellowy wrack being harvested almost constantly to dry and make fabric for hats, scarves, art, and other items.

BuildingRock

The one city on the whole of HomeOcean has no name. It was carved out of the solid rock of the shoreline, long ago. It stretches along the edge of the ocean for 100 miles, between two mighty rivers, and extends a half mile inland.

All the buildings are the same polygonal shape, with each side having at least one small, thick, polygonal window at eye-level. No building is taller than a single story, but some of them have more than 1,000 rooms within them, radiating out like stone fractals.

Many covered markets are within the city. Most of the trade consists of clothes, tools, and artwork. Words and ideas (written down on polygonal, stone tablets) are also popular. Oddly enough, the mercantilism seems to be a recent development. None of the markets look anywhere as old as the buildings surrounding them.

Every alliance has their own separate house, which contains the portal leading from their area of the Hub. All the visitors' houses border a special, large covered market, which they're expected to use for their own commerce. There are some small, climate-controlled rooms where compatible species can meet and do private business together. Some of the visitors call them Confessionals, as a sort of a joke. Some suspect they're bugged.

TravelNot

If visitors want to leave the city, and take in the bracing, quiet scenery of HomeOcean, they must have at least one OceanWe as a guide. Four main trails go out of the metropolis – one on each side of the two rivers that mark the boundaries of the city. All travel is done on foot.

As wanderers go further inland – past a graveyard of long-abandoned, polygonal spaceships – and the rivers are joined by streams and other, smaller rivers, the trails multiply. The occasional stone dam acts to both bridge the waterway and provide a deeper body of water for the OceanWe to feed in.

The OceanWe won't go any further than half a day's travel from the nearest body of water, so that they can feed frequently. This limits how far visitors can go, but the OceanWe assure them there's nothing worth seeing past that.

However, some travelers have sworn that, as they moved close to some mountains, a few days down the trail, they got the distinct feeling they were being watched. Their guides insisted they were wrong and deftly changed the subject.

SayingNot

The truth is that there *is* someone out there, beyond the city: iconoclastic OceanWe who believe that SeeSaying is slavery. These brave beings – the OceanFree – have turned their back on their own civilization to get away from what they see as a growth-stunting dependence on the ability. In doing so, they have declared war on the strange, powerful, and unseen being that provides it, hoping to forge a new and different destiny for all their kind.

But as they look to alien skies, they can't help but wonder if their rebellion has already come too late.

Magnetogenesis

When the OceanWe suggest that HomeOcean is alive, they aren't being flowery in their speech. About a half million of their years ago, when the planet was just under three-quarters of a billion years old, a bizarre cosmic intelligence – best described as a timeless, free-floating magnetic field, perhaps older than this universe – infected the young world with its consciousness. It had traveled far to find the perfect planet for its purposes, and, for some reason, this wet, sulfuric planet was exactly what it needed.

The sentient field interspersed itself within the developing world, and then began to work on the life it found there, seething within its oceans. It gave these microscopic lifeforms the gift of SeeSaying, and with it a rudimentary degree of consciousness. Knowing which decisions would bring the best short-term outcome allowed those tiny but hardy OceanWe to be fruitful and multiply.

This encouraged rapid-fire developmental changes, so it only took them around a half million years for them to create language, form a civilization, and then leave the ocean for the land. Within a generation, they'd conquered it, too, and achieved paradise on the shores of their ocean.

PostPerfection

Once that state of physical and societal perfection was reached, the drive to further evolve their minds, bodies, and world mostly went away. They couldn't have SeeSaid "what now?" because that was too open-ended a question, and they didn't dare ask for more than they deserved.

So they SeeSaid less and less, using it only for minor, mostly interpersonal decisions. In doing, so they felt curiously bereft of spiritual guidance, and languished in the stale ennui their perfect world now provided. They knew, somehow, that they were missing something – some quality of life that no amount of SeeSaying could provide, as they weren't even sure of the question itself.

Thus began the quest to find others to help them find those questions. With it came both the bold resurgence – and eventual sad division – of their race.

Forwarding

Through SeeSaying, they cast their questions into the universe, searching for sentience. Once they'd found it, they sought a time and place when many such beings existed side by side – giving them as wide a sample to ask their questions. Meanwhile, others began to SeeSay what they needed to do to get there, using the strange understanding of time and space that HomeOcean provided to reach such a far-flung era.

They created new vehicles to take them into near orbit, there to dismantle both their moons and incoming asteroids. The OceanWe used them to erect a docking platform around their world. Once the Hub was completed, they used HomeOcean's power to generate a mighty temporal field – a SkipTime – inside of it. Then they cast the Hub forward into the eons, making a stable link between their world and a certain perfectly placed planetoid.

All they had to do, then, was send out invitations to those many races, and look through what these aliens could offer in exchange for their SeeSaying.

The OceanWe have dissected histories and cultures. They have read philosophies, jokes, and nonsense. They have listened to the sounds of their laughter, music, and bodily noises. They have puzzled over their baubles and treasures, and pried apart all things they have been given in search of that something they think that they do not have.

But still, the questions they should be asking eludes them, to say nothing of an answer to the original quandary.

SolvingProblem

Unfortunately for the OceanWe, some among them found both a question *and* an answer – just not to an issue the others cared to consider.

Looking through the histories of the other species, these beings found something interesting. As they studied others' attempts to balance authority with freedom, religion with science, and destiny with free will, they asked if *they*, too, needed to do what was expected of them. Fueled by their new friends' own experiences, their answer was "no."

This led to other questions. Why had HomeOcean created them in the first place? Why had HomeOcean stopped guiding their evolution? What did HomeOcean want anyway?

No amount of SeeSaying could solve those questions, but they knew they couldn't ask them within the city. They also knew that, should they actually find the answers, their fellow OceanWe would never listen, and might even go to unheard-of lengths to silence them.

FutureImperfects

So these dissenters quietly left the city, going upriver and into the mountains, to build a new life that did not rely on divine revelation.

In their secret city in the hills, these OceanFree slowly learned to deny themselves the "cheat" of SeeSaying, thereby removing the miraculous shackles placed upon them at birth. That would have been enough, but, in time, they came to understand that their people would never find the *true* answers until their dependence on SeeSaying was overcome. But that, sadly, would never happen until the false god of HomeOcean was gone.

Knowing that, their philosophies quickly turned from a desire for freedom into outright antagonism and preparations for war. As of now, these OceanFree will do whatever it takes to defeat, banish, or destroy HomeOcean, even if means the end of their own world. Thanks to clandestine contact with arms merchants, less scrupulous worlds, and certain amoral galactic concerns, they believe they can finally put some weight behind their words.

Still, as they absorb the others' histories – sadly noting what *isn't* there – and keep track of the saucer attacks, the OceanFree wonder if they have already failed or, worse, succeeded too well. Since they refuse to SeeSay to find the answers to that question, they know they'll just have to learn it as all other species do: one triumph or mistake at a time.

UpFallDown

Apart from the benefits of SeeSaying, HomeOcean and its Hub could play a central part in a campaign.

Travel to and from the Hub could be major events, as numerous worlds send delegations to ask one, carefully phrased yes or no question at a time. The mighty powers could wage wars to restrict others' access, so that only the victors reap benefits. It could be the destination of a thousand galactic pilgrimages, with the wretched and impoverished lining up for years at a time to try to barter their way down to HomeOcean's surface. Less-scrupulous members of a delegation might gladly take their life savings to ask a question on their behalf.

Conversely, if most of those in authority consider SeeSaying a parlor trick, HomeOcean could be little more than an unfairly maligned curiosity. Maybe only one of the major powers lends it credulity and has been carefully using the OceanWe's gift to quietly prepare for economic or military conquest. Maybe the Hub is mostly deserted, with only the truly desperate coming to trade, given the strange reputation of the OceanWe, or the unpredictable danger of the mysterious, swift-striking saucers.

The PCs could be diplomats, or part of a delegation's retinue of guards and spies. They could be anthropologists or exobiologists, or at least *pretending* to be them as they gather intelligence on the OceanWe and those who use their gift. They could be workers in their alliance's area of the Hub, doing grunt work, police duties, section administration, or defense of the realm. They could be con artists or entrepreneurs, using space traffic to line their pockets, make deals, or get information on where the real action is going down.

Two timeframe options are given below, along with story seeds that would work best within that particular timeframe. The first could work in just about any space-opera campaign with few modifications. The second would require that things be at a boiling point, with galactic war being a terribly real possibility.

For more on the OceanWe's history, see p. 38.

DaysEarly

The OceanWe made contact not that long ago. The Hub is extraordinarily busy, but it's the early days still – mostly diplomats traveling for a SeeSaying, and administrators setting up shop in their areas. Occasionally, scientific teams investigate the temporal field, cultural experts visit HomeOcean, and all kinds of businesses set up above and below. It's a time for people to find brand-new opportunities and make the rules before someone else does. It's also a time for the less honest to find an angle and exploit it at all costs.

OutDown

The PCs are just passing through when their ship comes under attack by some rogues, and they have to put in at the Hub for repairs. While there, they get caught up in a case of mistaken identity that has one of them snatched and taken down to HomeOcean. Saving their fellow requires skill and skulduggery, but at the end of this adventure the PCs will each have a new friend, a favor or two, and a personal SeeSaying to apologize for their predicament – one that *will* be important later.

KeepPeace

The PCs police their section of the hub, which can be pretty dangerous. They're always keeping other alliances and powers at bay, rousting spies and saboteurs, and preventing suspicious types from using their portal and safe house on HomeOcean. They also monitor traffic to and from the hub, and back and forth from the planet.

They soon become aware of one OceanWe who is not known to the others. He wears an environment suit of off-world manufacture and works in secret in their section, consorting with less reputable types.

He claims to be a self-exile ("Atheism," he explains) and desires their silence and a free hand to run his "business." In return, he'll use his questionable contacts to provide information they'll need to safeguard their area from "TomorrowFire" – whatever that is.

HuntSaucer

The PCs are fighter pilots, protecting their ships from trouble on the way to and from the Hub. Then a convoy they're working gets attacked by one of those "saucers" they've heard whispers about, and not only do they survive, but they get a good look at it. The swift, shimmering craft was surrounded by a distortion field that blocked all their weapons and ripped ships apart when they got too close – exactly like the Hub's tendrils do.

Needless to say, the PCs report is triple-classified, and they're told to button it. Not long thereafter, a scary black-ops officer assigns them to her new task force. Their job is now to find out what these things are, why they strike certain ships, and how to stop them. Their very first assignment is to help her take one of them down.

NowDanger

It's been a generation or two since HomeOcean appeared, and the Hub is an amazingly busy nightmare of ships, commerce, crime, and intrigue. A great economic boom has risen, but wiser heads fear that a horrible bust will soon follow. Increased optimism in each alliance's strength of arms has led to increased diplomatic tensions, and all events seem laced with the threat of a serious, full-blown war. Indeed, many delegations leave their SeeSayings white-faced and terrified – quite unnerved at what the answer could mean.

ChangeFace

The PCs are in a private security firm, keeping a number of businesspeople safe at a massive economic summit, hosted at the Hub. It includes dignitaries from numerous alliances, and it will conclude with a SeeSaying of how this new venture will fare. Just before it's about to start, the bodyguards find out that one of the industrialists was found dead at home, which means they've been protecting a facially camouflaged impostor this entire time.

Now the assassin is gone – skulking about the large conference incognito. He could be anyone, anywhere. He could be trying to influence the summit, hold it hostage, or even destroy it. Or does he have some other business, somewhere else – like on HomeOcean?

Whatever's going on, it's too late to call the party off, and the last thing they want to do is cause a panic. They'll just have to catch this creep on their own and hope word doesn't get out of how badly they messed up.

TomorrowFire

Something is brewing, down on HomeOcean. Members of certain, more warlike galactic groups are traveling away from the city, quite a bit, and coming back lighter yet richer. As it's the PCs job to tail these individuals (while pretending to be scientists), they soon discover they're meeting with OceanWe up in the mountains, in a city no one's told them about.

Entering the city of the OceanFree is cause for imprisonment, and maybe even death. If they lurk about they can find out what those individuals were involved in. It turns out they're dealers of exotic weaponry – highly altered terraforming devices that burrow deep into a planet and rip away its magnetic field. If captured, the weaponeers might admit to selling such things to their "clients," but have no idea why they wanted it.

"They said 'GodKill'," one of them shrugs, "but I never know what they mean. Do you?"

EnemyDenied

The PCs are part of an elite extraction team, well-known for slipping behind enemy lines, infiltrating secure facilities, and smuggling people, goods, and information either out or in. So when an incredibly old, battle-scarred, and darned scary black-ops officer tells them they need to go into the belly of their enemy's war machine to smuggle out a downed pilot, they think it's business as usual.

But the moment they get into the facility, a new message decodes, informing them that the pilot was from one of those mysterious flying saucers. The officer's task force managed to shoot it down, but it escaped into enemy space, and it was picked up by their military rivals. Now the opposition has both the alien and its spacecraft, and they are interrogating one and dissecting the other – or maybe vice versa.

The officer wants the facility and saucer vaporized, and the alien either brought to her alive, or else left to burn with its spacecraft. Thankfully, the pilot's willing to cooperate, but the PCs will doubtlessly notice how closely it resembles the OceanWe, only with light gray skin instead of pink, and no webbed extremities. They might also be shocked when its speech patterns sound a lot like that of those aliens, though asking why it's been shooting down their ships gets answers like "HappenNow" and "OceanWeHelp."

If the alien is mortally wounded, or else taken away by the officer's goons at the end, the last thing it says to the PCs is: "SeeSay, OceanWeTell. SkipTime Continue? SkipTime Abandon? SoonSeeSay. QuicklyComes TomorrowFire."

This means nothing to military intelligence. But if they ask a SeeSayer on HomeOcean, the results may be quite interesting.

This article is lovingly dedicated to
Chris "CJ" Tremlett (1969-2015)
"To strive, to seek, to find, and not to yield."

About the Author

By day an unassuming bookstore clerk, J. Edward Tremlett takes his ancient keyboard from its hiding place and unfurls his words upon the world. His bizarre lifestyle has taken him to such exotic locales as South Korea and Dubai, UAE. He is a frequent contributor to *Pyramid,* has been the editor of *The Wraith Project,* and has seen print in *The End Is Nigh* and *Worlds of Cthulhu.* He's the author of the fictional blog *SPYGOD's Tales* (**spygod-tales.blogspot.com**) and writes for Op-Ed News. He currently lives in Lansing, Michigan with two cats and a mountain of Lego bricks.

Halfway to Anywhere

by Timothy Ponce

Rocket science. The subject conjures images of socially awkward men in thick-rimmed glasses scribbling ferociously on dry erase boards while stabbing away at the keys on their oversized calculators, but the topic is not nearly as arcane as one may think. These guidelines provide two tables to help anyone wade through the mires of mathematics that stand between them and answering questions like, "How much delta-V does my ship need to reach Venus?" It also starts off with the means to calculate all of these quantities for solar systems generated using ***GURPS Space***.

Orbital Mechanics 101

A few concepts are essential to understand before proceeding much further.

Changes in Velocity: The Greek letter delta (**Δ**) is the mathematical symbol for "change." Consequently, the currency of space travel – delta-V – is the degree by which a spaceship can alter its velocity and its orbital energy.

Orbit: An orbit is the path one object takes around another, such as the path described by Earth as it travels around the Sun.

Elliptical Orbits: The most fuel-efficient orbits are ellipses with the orbited body – or primary – at one focus. Such orbits have a number of characteristics described below.

Changing Orbits: Movement between celestial bodies occurs by altering one's own orbit. This typically involves entering a new orbit that will eventually intersect the desired orbit. Such orbits are called *transfer orbit* (see pp. 26-28).

Thrust and Propulsion: There are two types of thrust – instantaneous thrust and low thrust. The former refers to the instant acceleration of a spacecraft; for the purposes of these guidelines, treat any ships capable of at least 2G acceleration – e.g., modern rockets – as producing instantaneous thrust. As a ship's acceleration decreases, inefficiencies in converting thrust to delta-V mount; this places some instantaneous thrust maneuvers beyond the reach of ships capable only of low thrust – acceleration below 2G.

Direction of Thrust: Thrust comes in two common directions – prograde and retrograde. The former refers to thrust in the direction a spaceship orbits about an object, and the latter is thrust against the direction of the orbit. Prograde thrust increases a ship's orbital speed and raises it to a higher orbit, while retrograde thrust decreases the ship's orbital speed and drops it into a lower orbit.

Thrust and Effect: Changing your speed at any point changes the location of the opposite side of the orbit – a burn at the "top" of an orbit will change where the bottom is, and a burn at the bottom will alter its top.

Orbital Characteristics

Orbits are defined by the length of their semi-major axis – half the distance of the widest part of the orbit – and a number of angles that orient the orbit with respect to its primary. To facilitate number crunching, we will ignore those angles.

As an object orbits another, it falls toward that object, increasing its speed until it reaches *periapsis* – its closest approach. After that point, it steadily slows down until it reaches its furthest distance, *apoapsis*. When the primary is a star, these are called *periastron* and *apastron*, respectively.

These guidelines present simplified equations that treat orbits as circular with a radius equal to its semi-major axis (see *Glossary of Variables*, above).

Glossary of Variables

The following common variables pervade the formulae given here.

a is the semi-major axis of an orbit (in AU).
A is the spaceship's acceleration (in Gs).
$\mathbf{R_f}$ is the radius of the spaceship's final orbit (in AU).
$\mathbf{R_i}$ is the radius of the spaceship's initial orbit (in AU).
S is the object's surface gravity (in Gs).
T is the time requirement (see individual formulae for units).
ΔV is the spaceship's delta-V (in miles per second).
$\mathbf{V_{esc}}$ is the escape velocity of the primary (in miles per second).

Delta-V Calculations

The following formulae help calculate various useful delta-V requirements for spaceships. All units are congruent with those used in ***GURPS Spaceships***. Those who prefer to estimate delta-V and time requirements of space travel should skip to *Reference Tables* (pp. 30-33) for benchmarks based on our own solar system.

Orbit and Beyond

For many spaceships, the first – and most difficult – leg of any journey is leaving the ground. This requires sufficient delta-V to achieve a near-circular orbit about a celestial body; an example is Low Earth Orbit (LEO). Winged spacecraft use lift to fight the pull of gravity instead of engine thrust alone; they require thrust equal to 1/5× the world's atmospheric pressure in Earth atmospheres times the world's gravity in Gs. Those that blast off vertically need thrust exceeding the world's gravity.

Use the following formula to find the required delta-V to reach such an orbit:

$\Delta V = 4.92 \times \textit{square root of} (M / R) \times [1 + S / (A - S)] + P.$

M is the mass of the body in Earth masses.
R is the radius of the body in Earth radii.
P is the atmospheric pressure in Earth atmospheres.

Ships will often launch in the direction of the sunrise to steal a little of the planet's rotational speed and lower the delta-V requirements for liftoff. The following formula gives this amount. Subtract it from the delta-V requirements of any dawnward launches, but add it to launches toward the sunset!

$\Delta V \text{ savings} = \textit{cosine of} (L) \times (0.3 \times R / T).$

R is the radius of the planet in Earth radii.
L is the latitude of the launch site in degrees.
T is the length of the local day in Earth days.

The following formula gives the time required to reach orbit in minutes:

$T = \Delta V / [263 \times (A - S)].$

Escape Velocity

Escape velocity is the minimum velocity required for an object to leave the gravitational grip of its primary. It is of particular importance to coasting maneuvers (see p. 29). Calculate this with the following formula:

$V_{esc} = 6.95 \times \textit{square root of} (M / R).$

M is the mass of the body in Earth masses.
R is the distance to the *center* of the primary.

To find the necessary delta-V required to achieve escape velocity once in orbit, use the following formula:

$\Delta V = 2.03 \times \textit{square root of} (M / R).$

Variables are as above. Time in hours is given by:

$T = 4.39 \times (\Delta V / A).$

Launch Windows

Both Hohmann transfers and bi-elliptic transfers require the calculation of launch windows – times when the angle between the destination through the primary to the point of origin is such that the spaceship catches up to and stops at its intended target. While the calculation of this angle is not particularly difficult, the rules for generating star systems in ***Space*** don't provide the requisite information, thus boiling the entire exercise down to GM arbitration. Consequently, it's simplest for the GM to arbitrarily decide when launch windows occur. For a guide to frequency of launch windows, use the synodic period of the origin orbit (P_i) and the destination orbit (P_f):

Synodic Period = *absolute value of* $[(P_i \times P_f) / (P_i - P_f)]$.

Divide by 86,400 for time in days or by 31,700,000 for years.

Warning: Einstein Ahead

When dealing with high-velocity transfers, such as the brachistochrone transfer (pp. 27-28), special relativity potentially can rear its ugly head. This occurs as velocities approach the speed of light. The formulae presented here are purely classical and do not take into account any relativistic effects. For the most part, reasonable – 1G or less – constant accelerations will not noticeably infringe on special relativity within the confines of a solar system, but exceeding this may. Beware of high constant accelerations that drive maximum velocity above about 15% of the speed of light. Anything more than that will suffer more than a 1% "Lorentz Transformation" correction, which increases the fuel required to achieve a given delta-V by shockingly high amounts as the ship's velocity approaches the speed of light. This is beyond the scope of these guidelines.

Transfer Orbits

Spaceships use transfer orbits to move from one orbit to another. Remember that the initial orbit (R_i) is the origin world's orbital radius – its average distance from its star – and the final orbit (R_f) is the destination's orbital radius. See the *Solar System Travel Table* (***Spaceships,*** p. 34) for figures for our solar system.

Typically, transfer orbits use two or more instantaneous thrust burns to alter course and are more eccentric than either the original or destination orbits. The brachistochrone transfer (pp. 27-28) is the sole example of a low thrust transfer given here.

Hohmann Transfers

Usually the most efficient transfer, Hohmann transfers use the least delta-V of any method whenever the larger orbit's semi-major axis is no more than 12 times that of the smaller orbit's. These involve two prograde burns: one to enter an eccentric orbit tangent to both the initial and final orbit, and a second to push from the transfer orbit into the final orbit. When dropping to a lower orbit, these burns are both retrograde.

To find the necessary delta-V of a given Hohmann transfer, add together the delta-V required for each of the two burns. For the first burn, use the following formula:

$\Delta V_1 = B \times \textit{square root of} (M / R_i) \times \{\textit{square root of} [2 \times R_f / (R_i + R_f)] - 1\}.$

B equals 18.52.
M is the mass of the primary in solar masses.

The second burn requires delta-V given by the following formula:

$\Delta V_2 = B \times \textit{square root of} (M / R_f) \times \{1 - \textit{square root of} [2 \times R_i / (R_i + R_f)]\}.$

B equals 18.52.

M is the mass of the primary in solar masses.

If the result of either equation is negative, it means that the burn is retrograde to the orbit – *not* that the ship gained fuel by executing the maneuver. The delta-V of fuel required equals the absolute value of the calculated results.

The total change in the spaceship's velocity equals $\Delta V_1 + \Delta V_2$, but the total delta-V of fuel needed equals the absolute value of ΔV_1 plus the absolute value of ΔV_2.

Use the following formula to find the total time elapsed during the transfer:

$T = 3.14 \times C \times$ *square root of* $[(R_i + R_f)^3 / (8 \times M)]$.

C equals 58.11 for answers expressed in days or 0.159 if years are preferred.

M is the mass of the primary in solar masses.

While Hohmann transfers are usually the most efficient option, they also suffer three drawbacks. They are generally the longest duration transfer, low thrust ships cannot use them, and most restrictive of all, they have narrow launch windows (p. 26) during which they can be used. The GM is free to decide if such a transfer is even a viable option at any given time.

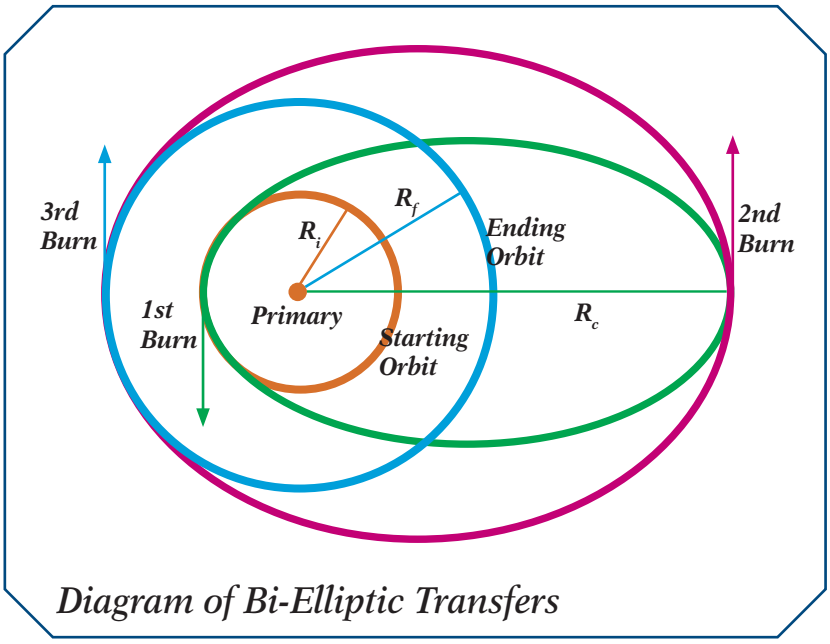


Diagram of Bi-Elliptic Transfers

Bi-Elliptic Orbits

For transfers between orbits whose semi-major axes have a ratio of 12:1 or more, bi-elliptic orbits are more efficient. These entail using a prograde burn to enter an extremely eccentric orbit tangent to the initial orbit that takes the spaceship far beyond the destination orbit. Just as it begins to fall back toward the primary, another prograde burn pushes the craft into a rounder orbit tangent to its destination orbit. The ship continues falling back toward the primary until it reaches its destination orbit where it executes one final retrograde burn to slow it into the destination orbit.

Calculating delta-V and durations for bi-elliptic transfers is somewhat more complicated than Hohmann transfers. First, you must find the semi-major axes of the two elliptical transfer orbits using the following formulae:

$a_1 = (R_i + R_c) / 2.$
$a_2 = (R_f + R_c) / 2.$

R_c is the distance from the primary to the point of the first burn. This is arbitrarily determined by the navigator; the longer it is, the slower the trip but the greater the delta-V savings.

Knowing this, you can calculate the delta-V requirements of each burn. Use the following three formulae, and remember that negative delta-Vs indicate a retrograde burn, not an increase in fuel!

$\Delta V_1 = B \times$ {*square root of* $[(2 \times M / R_i) - (M / a_1)]$ - *square root of* (M / R_i)}.

$\Delta V_2 = B \times$ {*square root of* $[(2 \times M / R_c) - (M / a_2)]$ - *square root of* $[(2 \times M / R_c) - (M / a_1)]$}.

$\Delta V_3 = B \times$ {*square root of* $[(2 \times M / R_f) - (M / a_2)]$ - *square root of* (M / R_f)}.

a_1 is the semi-major axis of the first ellipse as calculated above.

a_2 is the semi-major axis of the second ellipse as calculated above.

B equals 18.52.

M is the mass of the primary in solar masses.

Remember that while the final burn serves to slow the vehicle, its delta-V counts toward fuel usage.

The time between each burn and the total time of the transfer are given by the following formulae:

$T_1 = 3.14 \times C \times$ *square root of* (a_1^3 / M).
$T_2 = 3.14 \times C \times$ *square root of* (a_2^3 / M).
$T_{Total} = T_1 + T_2$.

a_1 is the semi-major axis of the first ellipse as previously calculated.

a_2 is the semi-major axis of the second ellipse as previously calculated.

C equals 58.11 for answers expressed in days or 0.159 if years are preferred.

M is the mass of the primary in solar masses.

T_1 is the time between the first burn and the second.

T_2 is the time between the second burn and the third.

Like Hohmann transfers, bi-elliptic orbits require instantaneous thrust, but their durations are *significantly* longer. Fortunately, they don't suffer launch window restrictions!

Brachistochrone Transfers

Brachistochrone (literally meaning "shortest time") transfers are those that use constant thrust throughout the duration of the voyage, performing a 180° rotation halfway to decelerate until coming to rest at the target destination. They are not technically orbits so much as a curved trajectory that intercepts the destination in the minimum possible time. Such orbits require constant acceleration – something typically only possible with low thrust motive systems, because of the immense delta-V requirements. Find these requirements with the following formula:

$\Delta V = D \times$ *square root of* $[A \times (R_f - R_i)] + B \times$ *square root of* $[M / (R_f - R_i)]$.

Index of Formulae

Here is a quick-reference guide to key formulae. See *Glossary of Variables* (p. 25) and the relevant section for definitions of variables. For the original formulae upon which these simplified versions are based, see *Formulae by the Numbers* (p. 29).

Achieving Orbit

$\Delta V = 4.92 \times \textit{square root of} (M / R) \times [1 + S / (A - S)] + P$

ΔV savings = *cosine of* $(L) \times (0.3 \times R / T)$

$T = \Delta V / [263 \times (A - S)]$

Escape Velocity

$V_{esc} = 6.95 \times \textit{square root of} (M / R)$

$\Delta V = 2.03 \times \textit{square root of} (M / R)$

$T = 4.39 \times (\Delta V / A)$

Hohmann Transfers

$\Delta V_1 = B \times \textit{square root of} (M / R_i) \times \{\textit{square root of} [2 \times R_f / (R_i + R_f)] - 1\}$

$\Delta V_2 = B \times \textit{square root of} (M / R_f) \times \{1 - \textit{square root of} [2 \times R_i / (R_i + R_f)]\}$

$T = 3.14 \times C \times \textit{square root of} [(R_i + R_f)^3 / (8 \times M)]$

Bi-Elliptic Transfers

$a_1 = (R_i + R_c) / 2$

$a_2 = (R_f + R_c) / 2$

$\Delta V_1 = B \times \{\textit{square root of} [(2 \times M / R_i) - (M / a_1)] - \textit{square root of} (M / R_i)\}$

$\Delta V_2 = B \times \{\textit{square root of} [(2 \times M / R_c) - (M / a_2)] - \textit{square root of} [(2 \times M / R_c) - (M / a_1)]\}$

$\Delta V_3 = B \times \{\textit{square root of} [(2 \times M / R_f) - (M / a_2)] - \textit{square root of} (M / R_f)\}$

$T_1 = 3.14 \times C \times \textit{square root of} (a_1^3 / M)$

$T_2 = 3.14 \times C \times \textit{square root of} (a_2^3 / M)$

Launch Windows

Synodic Period = *absolute value of* $[(P_i \times P_f) / (P_i - P_f)]$

Brachistochrone Transfers

$\Delta V = D \times \textit{square root of} [A \times (R_f - R_i)] + B \times \textit{square root of} [M / (R_f - R_i)]$

$T = J \times \textit{square root of} [(R_f - R_i) / A] + 9.8 \times A \times C \times \textit{square root of} [(R_f - R_i) / M]$

Orbital Plane Changes

$\Delta V = 2 \times B \times \textit{square root of} (M / R) \times \textit{sine of} (\Theta / 2)$

$T = (2 \times R \times \textit{sine of} \Theta) / (K \times \Delta V)$

Oberth Effect

$V_f = \textit{square root of} \{[\Delta V + \textit{square root of} (V_i^2 + V_{esc}^2)^2 - V_{per}^2]^2 - V_{per}^2\}$

$\Delta V = \textit{square root of} (V_f^2 + V_{esc}^2) - \textit{square root of} (V_i^2 + V_{esc}^2)$

$V_{per} = 4.92 \times \textit{square root of} [M \times (1 + e) / [a \times (1 - e)]]$

B equals 18.52.

D equals 1,500.

M is the mass of the primary in solar masses.

Such a transfer has a duration given by the following formula:

$T = J \times \textit{square root of} [(R_f - R_i) / A] + 9.8 \times A \times C \times \textit{square root of} [(R_f - R_i) / M]$.

C equals 58.11 for answers expressed in days or 0.159 if years are preferred.

J equals 2.86 for answers expressed in days or 0.00783 if years are preferred.

M is the mass of the primary in solar masses.

Brachistochrone transfers are always the most time-efficient transfer, and do not require any particular launch window. Additionally, they can produce the semblance of gravity within a spaceship equal to the acceleration of the ship. Unfortunately, they require immense amounts of delta-V, which usually makes them nonviable to all but the most efficient low thrust motive systems. Spaceships with large fuel capacities or reactionless drives likely use this transfer over any others.

Orbital Plane Changes

Every elliptical orbit exists within a flat plane, but not every orbit lies within the *same* plane. That is, some orbits are slanted when compared to other orbits. While this may be beyond the level of detail required by most games, those groups who enjoy the nitty-gritty may be inclined to track the delta-V requirements for orbital plane changes.

This requires that a craft makes a single burn "downward" or "upward" relative to its orbital plane to tilt that plane like a seesaw into its new orientation. This maneuver doesn't affect the craft's orbital characteristics other than the inclination of its orbital plane, which, makes it particularly useful for orbital transfers between planets or moons with differing orbital planes.

It is worth noting that these are among the costliest possible maneuvers when performed close to a primary. This is the main reason polar orbits are extremely expensive. Rockets are rarely launched directly into such orbits to avoid flying over populated areas.

Total delta-V for the maneuver is given by the following formula:

$\Delta V = 2 \times B \times \textit{square root of} (M / R) \times \textit{sine of} (\Theta / 2)$.

B equals 18.52.

M is the mass of the primary in solar masses.

R is the distance from the center of the primary in AU.

Θ is the angle between the two orbital planes.

Planar changes have a duration given by the following formula:

$T = (2 \times R \times \textit{sine of} \Theta) / (K \times \Delta V)$.

K equals 0.000932 for answers expressed in days or 0.33 for answers expressed in years.

R is the distance from the center of the primary in AU.

ΔV is the delta-V requirement of the orbital change maneuver in miles per second.

Θ is the angle traversed by the change in degrees.

Other Maneuvers

There are two maneuvers commonly used in conjunction with transfer orbits to help save delta-V: coasting and gravity slingshots. While they are often combined, both are independently viable.

Coasting

Coasting capitalizes on the Oberth effect, which states that the faster an object is moving, the greater the effect of any thrust. While this may appear to violate the Law of Conservation of Energy, it merely accounts for the effects of speed on the propellant – it does *not* work for reaction-less drives!

The result is that a spaceship using instantaneous thrust at periapsis – that is, when it is moving fastest – requires less delta-V in terms of fuel to effect a change in velocity. This is why the best place to break orbit is at closest approach.

To find the amount of delta-V used in terms of fuel and the actual delta-V, you must first determine the planet's escape velocity; see *Escape Velocity* (p. 26). Once this is known, you can calculate the effect of an application of delta-V on your final velocity:

$\mathbf{V_f}$ = *square root of* $\{[\Delta\mathbf{V}$ + *square root of* $(\mathbf{V_i^2} + \mathbf{V_{esc}^2})]^2 - \mathbf{V_{esc}^2}\}$.

$\mathbf{V_i}$ is the spaceship's initial velocity.

Sometimes it is useful to know how much delta-V you need to expend in terms of fuel to achieve a desired final velocity:

$\Delta\mathbf{V}$ = *square root of* $(\mathbf{V_f^2} + \mathbf{V_{esc}^2})$ - *square root of* $(\mathbf{V_i^2} + \mathbf{V_{esc}^2})$.

A ship breaking orbit can use the equations above by replacing initial and escape velocity with the ship's velocity at periapsis ($\mathbf{V_{per}}$):

$\mathbf{V_{per}}$ = 4.92 × *square root of* $\{\mathbf{M} \times (1 + \mathbf{e}) / [\mathbf{a} \times (1 - \mathbf{e})]\}$.

e is the eccentricity of the orbit.

M is the mass of the primary in solar masses.

Remember that the actual change in the velocity equals the final velocity minus the initial velocity, regardless of delta-V of fuel expenditures.

Gravity Slingshots

Gravity slingshots involve a spacecraft stealing a little momentum from a planet as it passes by to increase its speed without burning fuel. This maneuver can produce a change in velocity as great as *twice* the planet's orbital speed at the time of the flyby, although it usually provides less. For example, Voyager 2 gained about 6.2 mps from its Jupiter flyby, another 3.1 mps from Saturn, and an additional 1.2 mps from each of Uranus and Neptune. None of these encounters involved a particularly large change in direction; Jupiter has an orbital speed of 8.1 mps – enough for a 16.2 mps gravity assist!

Formulae by the Numbers

The formulae presented with these guidelines use a number of conversion factors to make them conform to standard ***GURPS*** units. Below are the original formulae in all of their glory. Remember that **π** is roughly equal to 3.1416 and **G** is the gravitational constant and approximately equal to 6.673×10^{-11}.

Achieving Orbit

$\Delta\mathbf{V}$ = *square root of* $(\mathbf{G} \times \mathbf{M} / \mathbf{R}) \times [1 + \mathbf{S} / (\mathbf{A} - \mathbf{a})]$

$\mathbf{T} = \Delta\mathbf{V} / (\mathbf{A} - \mathbf{S})$

Escape Velocity

$\mathbf{V_{esc}}$ = *square root of* $(2 \times \mathbf{G} \times \mathbf{M} / \mathbf{R})$

$\mathbf{V_{orbital}}$ = *square root of* $(\mathbf{G} \times \mathbf{M} / \mathbf{R})$

$\Delta\mathbf{V_{esc}} = \mathbf{V_{esc}} - \mathbf{V_{orbital}}$

Hohmann Transfers

$\Delta\mathbf{V_1}$ = *square root of* $(\mathbf{G} \times \mathbf{M} / \mathbf{R_1}) \times$ [*square root of* $[2 \times \mathbf{R_2} / (\mathbf{R_1} + \mathbf{R_2})] - 1\}$

$\Delta\mathbf{V_2}$ = *square root of* $(\mathbf{G} \times \mathbf{M} / \mathbf{R_2}) \times \{1$ - *square root of* $[2 \times \mathbf{R_1} / (\mathbf{R_1} + \mathbf{R_2})]\}$

$\Delta\mathbf{V_{total}} = \Delta\mathbf{V_1} + \Delta\mathbf{V_2}$

$\mathbf{T} = \pi \times$ *square root of* $[(\mathbf{R_1} + \mathbf{R_2})^3 / (\mathbf{G} \times \mathbf{M})]$

Bi-Elliptic Transfers

$\mathbf{a_1} = (\mathbf{R_i} + \mathbf{R_c}) / 2$

$\mathbf{a_2} = (\mathbf{R_f} + \mathbf{R_c}) / 2$

$\Delta\mathbf{V_1}$ = *square root of* $[(2 \times \mathbf{G} \times \mathbf{M} / \mathbf{R_i}) - (\mathbf{G} \times \mathbf{M} / \mathbf{a_1})]$ - *square root of* $(\mathbf{G} \times \mathbf{M} / \mathbf{R_i})$

$\Delta\mathbf{V_2}$ = *square root of* $[(2 \times \mathbf{G} \times \mathbf{M} / \mathbf{R_c}) - (\mathbf{G} \times \mathbf{M} / \mathbf{a_2})]$ - *square root of* $[(2 \times \mathbf{G} \times \mathbf{M} / \mathbf{R_c}) - (\mathbf{G} \times \mathbf{M} / \mathbf{a_1})]$

$\Delta\mathbf{V_3}$ = *square root of* $[(2 \times \mathbf{G} \times \mathbf{M} / \mathbf{R_f}) - (\mathbf{G} \times \mathbf{M} / \mathbf{a_2})]$ - *square root of* $(\mathbf{G} \times \mathbf{M} / \mathbf{R_f})$

$\mathbf{T} = \pi \times \{$*square root of* $(\mathbf{a_1}^3 / \mathbf{G} \times \mathbf{M})$ + *square root of* $(\mathbf{a_2}^3 / \mathbf{G} \times \mathbf{M})\}$

Launch Windows

Synodic Period = *absolute value of* $[(\mathbf{P_i} \times \mathbf{P_f}) / (\mathbf{P_i} - \mathbf{P_f})]$

Brachistochrone Transfers

$\Delta\mathbf{V} = 2 \times$ *square root of* $[\mathbf{A} \times (\mathbf{R_f} - \mathbf{R_i})]$ + *square root of* $[(\mathbf{R_f} - \mathbf{R_i}) / (\mathbf{G} \times \mathbf{M})]$

$\mathbf{T} = 2 \times$ *square root of* $[(\mathbf{R_f} - \mathbf{R_i}) / \mathbf{A}] + \mathbf{A} \times$ *square root of* $[(\mathbf{R_f} - \mathbf{R_i}) / (\mathbf{G} \times \mathbf{M})]$

Orbital Plane Changes

$\Delta\mathbf{V} = 2 \times \mathbf{V_{orbital}} \times$ *sine of* $(\Theta / 2)$

$\mathbf{V_{orbital}}$ = *square root of* $(\mathbf{G} \times \mathbf{M} / \mathbf{R})$

$\mathbf{T} = (2 \times \mathbf{R} \times$ *sine of* $\Theta) / \Delta\mathbf{V}$

Oberth Effect

$\mathbf{V_f}$ = *square root of* $\{[\Delta\mathbf{V}$ + *square root of* $(\mathbf{V_i^2} + \mathbf{V_{per}^2})]^2 - \mathbf{V_{per}^2}\}$

$\Delta\mathbf{V}$ = *square root of* $(\mathbf{V_f^2} + \mathbf{V_{per}^2})$ - *square root of* $(\mathbf{V_i^2} + \mathbf{V_{per}^2})$

$\mathbf{V_{per}}$ = *square root of* $\{[\mathbf{G} \times \mathbf{M} \times (1 + \mathbf{e})] / [\mathbf{a} \times (1 - \mathbf{e})]\}$

The GM is the final arbiter on just how much free delta-V – if any – a planet can provide at a given time and should realize that the greater the delta-V provided, the closer to a full U-turn the spaceship makes around the planet.

Coasting is often performed at closest approach to a planet used for a gravity slingshot, because that's when the spaceship's speed is greatest; see *Coasting* (p. 29). This could make low orbits valuable port locations for passing long-range ships slingshotting to new destinations.

Measuring the Vastness of Space

The orbital transfer formulae presented here all use ***GURPS*** standard units: *acceleration* and *surface gravity* are measured in Gs, *distance* is measured in AU, *mass* is measured in solar masses, and *velocity* is measured in miles per second. This is typical of any orbits about a star, but what if the spaceship orbits a planet?

While velocity, acceleration, and surface gravity are measured the same, distances are given in Earth radii and mass is expressed in Earth masses. Use the formulae presented here, but the following variables take on new values:

B equals 4.92.

C equals 0.224 for time expressed in hours and 0.00932 for days.

D equals 9.83.

J equals 0.448 for time expressed in hours and 0.0187 for days.

K equals 1,087 for time expressed in days and 2.977 for years.

Further Reading

Braeunig, Robert A. *Rocket and Space Technology,* **braeunig.us/space/**. An excellent in-depth look at calculating orbital maneuvers among other aspects of space flight.

Chung, Winchell. *Atomic Rocketships of the Space Patrol,* **projectrho.com/public_html/rocket/**. A detailed site on multiple aspects of spaceship design and operation.

Jet Propulsion Laboratory. *The Basics of Space Flight (2013 Edition),* **www2.jpl.nasa.gov/basics/index.php**. A good introduction to basic concepts and mission planning.

Reference Tables

The following tables provide useful information on our solar system. *Planetary Distances and Communication Lag Times* gives the range of distances between various celestial bodies followed parenthetically by the range of lag times in communications due to the speed of light over such vast distances. *Hohmann Transfers* give the delta-V requirements for the first burn, second burn, and total requirements, followed parenthetically by the duration of the transfer.

Use the tables by looking up the point of origin on the left and reading across to the column corresponding with the destination.

Dude, Where's My Table?

While the tables presented here always apply to our solar system, there is no way to create a table to represent every instance of liftoff, bi-elliptic transfers, or brachistochrone transfers, because the navigator, pilot, and hardware capabilities all affect the characteristics of such transfers. Consequently, it is impossible to present concise, adequately, informative tables for any of these maneuvers. To that end, a spreadsheet makes such calculations trivial for the busy GM!

Planetary Distances and Communication Lag Times (Sun, Mercury, Venus, Mars, Ceres, Jupiter)

	Sun	***Mercury***	***Venus***	***Earth***	***Mars***	***Ceres***	***Jupiter***
Sun	–	0.31-0.47 AU (2.6-3.9 min)	0.72-0.73 AU (6-6.1 min)	0.98-1 AU (8.2-8.5 min)	1.4-1.7 AU (11-14 min)	2.6-3 AU (21-25 min)	5-5.5 AU (41-45 min)
Mercury	0.31-0.47 AU (2.6-3.9 min)	–	0.41-1.2 AU (3.4-9.9 min)	0.68-1.5 AU (5.6-12 min)	1.1-2.1 AU (8.9-18 min)	2.2-3.4 AU (19-29 min)	4.6-5.9 AU (39-49 min)
Venus	0.72-0.73 AU (6-6.1 min)	0.41-1.2 AU (3.4-9.9 min)	–	0.26-1.7 AU (2.2-15 min)	0.66-2.4 AU (5.5-20 min)	1.8-3.7 AU (15-31 min)	4.2-6.2 AU (35-51 min)
Earth	0.98-1 AU (8.2-8.5 min)	0.68-1.5 AU (5.6-12 min)	0.26-1.7 AU (2.2-15 min)	–	0.4-2.7 AU (3.3-22 min)	1.6-4 AU (13-33 min)	4-6.5 AU (33-54 min)
Mars	1.4-1.7 AU (11-14 min)	1.1-2.1 AU (8.9-18 min)	0.66-2.4 AU (5.5-20 min)	0.4-2.7 AU (3.3-22 min)	–	1.2-4.6 AU (9.8-39 min)	3.6-7.1 AU (30-59 min)
Ceres	2.6-3 AU (21-25 min)	2.2-3.4 AU (19-29 min)	1.8-3.7 AU (15-31 min)	1.6-4 AU (13-33 min)	1.2-4.6 AU (9.8-39 min)	–	2.4-8.4 AU (20-1.2 hrs)
Jupiter	5-5.5 AU (41-45 min)	4.6-5.9 AU (39-49 min)	4.2-6.2 AU (35-51 min)	4-6.5 AU (33-54 min)	3.6-7.1 AU (30-59 min)	2.4-8.4 AU (20-1.2 hrs)	–

Planetary Distances and Communication Lag Times (Sun through Jupiter) (Continued)

	Sun	*Mercury*	*Venus*	*Earth*	*Mars*	*Ceres*	*Jupiter*
Saturn	9-10 AU (1.3-1.4 hrs)	8.7-11 AU (1.2-1.5 hrs)	8.3-11 AU (1.2-1.5 hrs)	8.1-11 AU (1.1-1.5 hrs)	7.7-12 AU (1.1-1.6 hrs)	6.5-13 AU (54-1.8 hrs)	4.1-16 AU (34-2.2 hrs)
Uranus	18-20 AU (2.5-2.8 hrs)	18-21 AU (2.5-2.8 hrs)	18-21 AU (2.4-2.9 hrs)	17-21 AU (2.4-2.9 hrs)	17-22 AU (2.4-3 hrs)	16-23 AU (2.2-3.2 hrs)	13-26 AU (1.9-3.5 hrs)
Neptune	30-30 AU (4.1-4.2 hrs)	29-31 AU (4.1-4.3 hrs)	29-31 AU (4-4.3 hrs)	29-31 AU (4-4.4 hrs)	28-32 AU (3.9-4.5 hrs)	27-33 AU (3.8-4.6 hrs)	25-36 AU (3.4-5 hrs)
Pluto	30-49 AU (4.1-6.8 hrs)	29-49 AU (4.1-6.8 hrs)	29-50 AU (4-6.9 hrs)	29-50 AU (4-6.9 hrs)	28-51 AU (3.9-7 hrs)	27-52 AU (3.8-7.2 hrs)	25-54 AU (3.4-7.5 hrs)
Haumea	35-52 AU (4.8-7.1 hrs)	34-52 AU (4.8-7.2 hrs)	34-52 AU (4.7-7.2 hrs)	34-53 AU (4.7-7.3 hrs)	33-53 AU (4.6-7.4 hrs)	32-55 AU (4.5-7.6 hrs)	30-57 AU (4.1-7.9 hrs)
Eris	38-98 AU (5.3-14 hrs)	38-98 AU (5.3-14 hrs)	38-98 AU (5.2-14 hrs)	37-99 AU (5.2-14 hrs)	37-99 AU (5.1-14 hrs)	36-100 AU (4.9-14 hrs)	33-100 AU (4.6-14 hrs)
Sedna	76-940 AU (11-130 hrs)	76-940 AU (11-130 hrs)	76-940 AU (10-130 hrs)	75-940 AU (10-130 hrs)	75-940 AU (10-130 hrs)	74-940 AU (10-130 hrs)	71-940 AU (9.9-130 hrs)

Planetary Distances and Communication Lag Times (Saturn, Uranus, Neptune, Pluto, Haumea, Eris, Sedna)

	Saturn	*Uranus*	*Neptune*	*Pluto*	*Haumea*	*Eris*	*Sedna*
Sun	9-10 AU (1.3-1.4 hrs)	18-20 AU (2.5-2.8 hrs)	30-30 AU (4.1-4.2 hrs)	30-49 AU (4.1-6.8 hrs)	35-52 AU (4.8-7.1 hrs)	38-98 AU (5.3-14 hrs)	76-940 AU (11-130 hrs)
Mercury	8.7-11 AU (1.2-1.5 hrs)	18-21 AU (2.5-2.8 hrs)	29-31 AU (4.1-4.3 hrs)	29-49 AU (4.1-6.8 hrs)	34-52 AU (4.8-7.2 hrs)	38-98 AU (5.3-14 hrs)	76-940 AU (11-130 hrs)
Venus	8.3-11 AU (1.2-1.5 hrs)	18-21 AU (2.4-2.9 hrs)	29-31 AU (4-4.3 hrs)	29-50 AU (4-6.9 hrs)	34-52 AU (4.7-7.2 hrs)	38-98 AU (5.2-14 hrs)	76-940 AU (10-130 hrs)
Earth	8.1-11 AU (1.1-1.5 hrs)	17-21 AU (2.4-2.9 hrs)	29-31 AU (4-4.4 hrs)	29-50 AU (4-6.9 hrs)	34-53 AU (4.7-7.3 hrs)	37-99 AU (5.2-14 hrs)	75-940 AU (10-130 hrs)
Mars	7.7-12 AU (1.1-1.6 hrs)	17-22 AU (2.4-3 hrs)	28-32 AU (3.9-4.5 hrs)	28-51 AU (3.9-7 hrs)	33-53 AU (4.6-7.4 hrs)	37-99 AU (5.1-14 hrs)	75-940 AU (10-130 hrs)
Ceres	6.5-13 AU (54-1.8 hrs)	16-23 AU (2.2-3.2 hrs)	27-33 AU (3.8-4.6 hrs)	27-52 AU (3.8-7.2 hrs)	32-55 AU (4.5-7.6 hrs)	36-100 AU (4.9-14 hrs)	74-940 AU (10-130 hrs)
Jupiter	4.1-16 AU (34-2.2 hrs)	13-26 AU (1.9-3.5 hrs)	25-36 AU (3.4-5 hrs)	25-54 AU (3.4-7.5 hrs)	30-57 AU (4.1-7.9 hrs)	33-100 AU (4.6-14 hrs)	71-940 AU (9.9-130 hrs)
Saturn	–	9.3-30 AU (1.3-4.2 hrs)	21-41 AU (2.9-5.6 hrs)	21-59 AU (2.9-8.2 hrs)	26-62 AU (3.6-8.5 hrs)	29-110 AU (4-15 hrs)	67-950 AU (9.3-130 hrs)
Uranus	9.3-30 AU (1.3-4.2 hrs)	–	11-51 AU (1.6-7 hrs)	11-69 AU (1.6-9.6 hrs)	16-72 AU (2.3-9.9 hrs)	20-120 AU (2.8-16 hrs)	58-960 AU (8-130 hrs)
Neptune	21-41 AU (2.9-5.6 hrs)	11-51 AU (1.6-7 hrs)	–	0.11-79 AU (0.89-11 hrs)	5-82 AU (41-11 hrs)	8.5-130 AU (1.2-18 hrs)	47-970 AU (6.5-130 hrs)
Pluto	21-59 AU (2.9-8.2 hrs)	11-69 AU (1.6-9.6 hrs)	0.11-79 AU (0.89-11 hrs)	–	5.1-100 AU (42-14 hrs)	8.6-150 AU (1.2-20 hrs)	47-990 AU (6.5-140 hrs)
Haumea	26-62 AU (3.6-8.5 hrs)	16-72 AU (2.3-9.9 hrs)	5-82 AU (41-11 hrs)	5.1-100 AU (42-14 hrs)	–	3.5-150 AU (29-21 hrs)	42-990 AU (5.8-140 hrs)
Eris	29-110 AU (4-15 hrs)	20-120 AU (2.8-16 hrs)	8.5-130 AU (1.2-18 hrs)	8.6-150 AU (1.2-20 hrs)	3.5-150 AU (29-21 hrs)	–	38-1,000 AU (5.3-140 hrs)
Sedna	67-950 AU (9.3-130 hrs)	58-960 AU (8-130 hrs)	47-970 AU (6.5-130 hrs)	47-990 AU (6.5-140 hrs)	42-990 AU (5.8-140 hrs)	38-1,000 AU (5.3-140 hrs)	–

Hohmann Transfers (Mercury, Venus, Mars, Ceres, Jupiter)

	Mercury	*Venus*	*Earth*	*Mars*	*Ceres*	*Jupiter*
Mercury	–	4.2, 3.6, 7.8 mps (2.5 mos)	6, 4.7, 10.7 mps (3.5 mos)	7.8, 5.5, 13.3 mps (5.6 mos)	9.7, 5.6, 15.3 mps (12 mos)	11, 5.1, 16.1 mps (2.3 yrs)
Venus	-3.6, -4.2, -7.8 mps (2.5 mos)	–	1.7, 1.6, 3.3 mps (4.8 mos)	3.6, 3, 6.6 mps (7.1 mos)	5.6, 4, 9.6 mps (1.2 yrs)	7.1, 4.1, 11.2 mps (2.6 yrs)
Earth	-4.7, -6, -10.7 mps (3.5 mos)	-1.6, -1.7, -3.3 mps (4.8 mos)	–	1.8, 1.6, 3.4 mps (8.5 mos)	3.9, 3, 6.9 mps (1.3 yrs)	5.5, 3.5, 9 mps (2.7 yrs)
Mars	-5.5, -7.8, -13.3 mps (5.6 mos)	-3, -3.6, -6.6 mps (7.1 mos)	-1.6, -1.8, -3.4 mps (8.5 mos)	–	2, 1.7, 3.7 mps (1.6 yrs)	3.7, 2.7, 6.4 mps (3.1 yrs)
Ceres	-5.6, -10, -15.6 mps (12 mos)	-4, -5.6, -9.6 mps (1.2 yrs)	-3, -3.9, -6.9 mps (1.3 yrs)	-1.7, -2, -3.7 mps (1.6 yrs)	–	1.6, 1.4, 3 mps (4 yrs)
Jupiter	-5.1, -11, -16.1 mps (2.3 yrs)	-4.1, -7.1, -11.2 mps (2.6 yrs)	-3.5, -5.5, -9 mps (2.7 yrs)	-2.7, -3.7, -6.4 mps (3.1 yrs)	-1.4, -1.6, -3 mps (4 yrs)	–
Saturn	-4.3, -11, -15.3 mps (5.6 yrs)	-3.7, -7.9, -11.6 mps (5.8 yrs)	-3.4, -6.4, -9.8 mps (6.1 yrs)	-2.8, -4.7, -7.5 mps (6.5 yrs)	-2, -2.7, -4.7 mps (7.7 yrs)	-1, -1.1, -2.1 mps (10 yrs)
Uranus	-3.4, -12, -15.4 mps (15 yrs)	-3.1, -8.5, -11.6 mps (16 yrs)	-2.9, -7, -9.9 mps (16 yrs)	-2.6, -5.4, -8 mps (17 yrs)	-2.1, -3.6, -5.7 mps (18 yrs)	-1.5, -2.1, -3.6 mps (21 yrs)
Neptune	-2.8, -12, -14.8 mps (30 yrs)	-2.6, -8.7, -11.3 mps (30 yrs)	-2.5, -7.2, -9.7 mps (31 yrs)	-2.3, -5.7, -8 mps (31 yrs)	-2, -3.9, -5.9 mps (33 yrs)	-1.5, -2.5, -4 mps (37 yrs)
Pluto	-2.5, -12, -14.5 mps (44 yrs)	-2.4, -8.7, -11.1 mps (45 yrs)	-2.3, -7.3, -9.6 mps (45 yrs)	-2.1, -5.8, -7.9 mps (46 yrs)	-1.9, -4.1, -6 mps (48 yrs)	-1.5, -2.7, -4.2 mps (52 yrs)
Haumea	-2.5, -12, -14.5 mps (48 yrs)	-2.3, -8.7, -11 mps (48 yrs)	-2.3, -7.4, -9.7 mps (49 yrs)	-2.1, -5.8, -7.9 mps (50 yrs)	-1.9, -4.1, -6 mps (52 yrs)	-1.5, -2.7, -4.2 mps (56 yrs)
Eris	-2, -12, -14 mps (100 yrs)	-1.9, -8.9, -10.8 mps (100 yrs)	-1.9, -7.5, -9.4 mps (100 yrs)	-1.8, -6, -7.8 mps (100 yrs)	-1.6, -4.3, -5.9 mps (110 yrs)	-1.4, -2.9, -4.3 mps (110 yrs)
Sedna	-0.8, -12, -12.8 mps (2,100 yrs)	-0.8, -9, -9.8 mps (2,100 yrs)	-0.8, -7.6, -8.4 mps (2,100 yrs)	-0.8, -6.2, -7 mps (2,100 yrs)	-0.7, -4.6, -5.3 mps (2,100 yrs)	-0.7, -3.3, -4 mps (2,100 yrs)

Hohmann Transfers (Saturn, Uranus, Neptune, Pluto, Haumea, Eris, Sedna)

	Saturn	*Uranus*	*Neptune*	*Pluto*	*Haumea*	*Eris*	*Sedna*
Mercury	11, 4.3, 15.3 mps (5.6 yrs)	12, 3.4, 15.4 mps (15 yrs)	12, 2.8, 14.8 mps (30 yrs)	12, 2.5, 14.5 mps (44 yrs)	12, 2.5, 14.5 mps (48 yrs)	12, 2, 14 mps (100 yrs)	12, 0.78, 12.78 mps (2,100 yrs)
Venus	7.9, 3.7, 11.6 mps (5.8 yrs)	8.5, 3.1, 11.6 mps (16 yrs)	8.7, 2.6, 11.3 mps (30 yrs)	8.7, 2.4, 11.1 mps (45 yrs)	8.7, 2.3, 11 mps (48 yrs)	8.9, 1.9, 10.8 mps (100 yrs)	9, 0.77, 9.77 mps (2,100 yrs)
Earth	6.4, 3.4, 9.8 mps (6.1 yrs)	7, 2.9, 9.9 mps (16 yrs)	7.2, 2.5, 9.7 mps (31 yrs)	7.3, 2.3, 9.6 mps (45 yrs)	7.4, 2.3, 9.7 mps (49 yrs)	7.5, 1.9, 9.4 mps (100 yrs)	7.6, 0.76, 8.36 mps (2,100 yrs)
Mars	4.7, 2.8, 7.5 mps (6.5 yrs)	5.4, 2.6, 8 mps (17 yrs)	5.7, 2.3, 8 mps (31 yrs)	5.8, 2.1, 7.9 mps (46 yrs)	5.8, 2.1, 7.9 mps (50 yrs)	6, 1.8, 7.8 mps (100 yrs)	6.2, 0.75, 6.95 mps (2,100 yrs)
Ceres	2.7, 2, 4.7 mps (7.7 yrs)	3.6, 2.1, 5.7 mps (18 yrs)	3.9, 2, 5.9 mps (33 yrs)	4.1, 1.9, 6 mps (48 yrs)	4.1, 1.9, 6 mps (52 yrs)	4.3, 1.6, 5.9 mps (110 yrs)	4.6, 0.73, 5.33 mps (2,100 yrs)
Jupiter	1.1, 0.96, 2.06 mps (10 yrs)	2.1, 1.5, 3.6 mps (21 yrs)	2.5, 1.5, 4 mps (37 yrs)	2.7, 1.5, 4.2 mps (52 yrs)	2.7, 1.5, 4.2 mps (56 yrs)	2.9, 1.4, 4.3 mps (110 yrs)	3.3, 0.7, 4 mps (2,100 yrs)
Saturn	–	0.93, 0.78, 1.71 mps (27 yrs)	1.4, 1, 2.4 mps (44 yrs)	1.6, 1.1, 2.7 mps (60 yrs)	1.6, 1.1, 2.7 mps (64 yrs)	1.9, 1.1, 3 mps (120 yrs)	2.4, 0.66, 3.06 mps (2,100 yrs)

Hohmann Transfers (Saturn through Sedna) (Continued)

	Saturn	*Uranus*	*Neptune*	*Pluto*	*Haumea*	*Eris*	*Sedna*
Uranus	-0.8, -0.9, -1.7 mps (27 yrs)	–	0.44, 0.39, 0.83 mps (61 yrs)	0.67, 0.56, 1.23 mps (79 yrs)	0.71, 0.59, 1.3 mps (83 yrs)	1, 0.75, 1.75 mps (140 yrs)	1.6, 0.6, 2.2 mps (2,200 yrs)
Neptune	-1, -1.4, -2.4 mps (44 yrs)	-0.4, -0.4, -0.8 mps (61 yrs)	–	0.22, 0.2, 0.42 mps (100 yrs)	0.26, 0.24, 0.5 mps (110 yrs)	0.6, 0.49, 1.09 mps (170 yrs)	1.3, 0.54, 1.84 mps (2,300 yrs)
Pluto	-1.1, -1.6, -2.7 mps (60 yrs)	-0.6, -0.7, -1.3 mps (79 yrs)	-0.2, -0.2, -0.4 mps (100 yrs)	–	0.04, 0.04, 0.08 mps (130 yrs)	0.37, 0.32, 0.69 mps (200 yrs)	1.1, 0.51, 1.61 mps (2,300 yrs)
Haumea	-1.1, -1.6, -2.7 mps (64 yrs)	-0.6, -0.7, -1.3 mps (83 yrs)	-0.2, -0.3, -0.5 mps (110 yrs)	0, 0, 0 mps (130 yrs)	–	0.33, 0.29, 0.62 mps (200 yrs)	1, 0.5, 1.5 mps (2,300 yrs)
Eris	-1.1, -1.9, -3 mps (120 yrs)	-0.8, -1, -1.8 mps (140 yrs)	-0.5, -0.6, -1.1 mps (170 yrs)	-0.3, -0.4, -0.7 mps (200 yrs)	-0.3, -0.3, -0.6 mps (200 yrs)	–	0.74, 0.42, 1.16 mps (2,500 yrs)
Sedna	-0.7, -2.4, -3.1 mps (2,100 yrs)	-0.6, -1.6, -2.2 mps (2,200 yrs)	-0.5, -1.3, -1.8 mps (2,300 yrs)	-0.5, -1.1, -1.6 mps (2,300 yrs)	-0.5, -1, -1.5 mps (2,300 yrs)	-0.4, -0.7, -1.1 mps (2,500 yrs)	–

A Mission to Mars

So you want to go to Mars tomorrow? Because there currently aren't any constant acceleration drives that can propel something large enough to carry people, the mission is limited to either a Hohmann (pp. 26-27) or bi-elliptic (p. 27) transfer. Your initial orbit is Earth's at 1 AU, which is more than 1/12 that of the final orbit – Mars' at 1.5 AU. Thus, a Hohmann transfer provides the most fuel efficient route.

The first step is to calculate the delta-V required for the first burn. We know that the first Hohmann equation tells us **B** equals 18.52; both planets orbit the Sun, so **M** equals 1 solar mass; we are leaving Earth, so $\mathbf{R_i}$ equals 1 AU, and we are going to Mars, so $\mathbf{R_f}$ equals 1.5 AU. By plugging this into the equation, we find the delta-V requirement for the first burn is 1.8 mps:

$\Delta\mathbf{V_1}$ = **18.52** × *square root of* (**1** / **1**) × {*square root of* [2 × **1.5**/ (**1** + **1.5**)] - 1} = 1.8.

Second, we must find the delta-V requirement for the second burn. We use the same figures, but plug them into the second Hohmann equation and chug through that to get a delta-V requirement of 1.6 mps:

$\Delta\mathbf{V_2}$ = **18.52** × *square root of* (**1** / **1.5**) × {1 - *square root of* [2 × **1** / (**1** + **1.5**)]} = 1.6.

Next, we add the delta-V of both burns to find the total fuel requirement for the trip: 1.8 + 1.6 = 3.4 mps.

We also need to account for a 1.85° difference in orbital planes:

ΔV = 2 × **18.52** × *square root of* (**1** / **1**) × *sine of* (**1.85** / 2) = 0.60 mps.

Our spacecraft will need at least 15 fuel tank systems (***GURPS Spaceships,*** p. 17) and be powered by a chemical rocket (***Spaceships,*** p. 21).

Our final consideration is how long the voyage will take. We can plug in the same initial and final orbits from earlier, plus the mass of our sun into the third Hohmann formula to find that our trip will take 255 days:

T = 3.14 × **58.11** × *square root of* [(**1** + **1.5**)^3 / (8 × **1**)] = 255.

The ship requires at least one habitat system (***Spaceships,*** p. 17) and probably a cargo hold (***Spaceships,*** p. 13) for food, water, and supplies. Including the control system (***Spaceships,*** p. 14), this leaves only one system remaining for the designer to assign – perhaps to more cargo, just in case . . .

About the Author

At an early age, Timothy "Humabout" Ponce's parents introduced him to Arthur C. Clarke, Isaac Asimov, and Robert Heinlein, and he has never since looked at the night sky the same way. Carl Sagan and Stephen Hawking did little to turn his gaze downward, and he still pines for the vastness beyond our atmosphere. He wishes to thank Ross Hrubyak and Douglas Cole for their incredible patience and willingness to answer silly questions, and Julia for her love and support in this arduous adventure. Lastly, he would like to thank Christopher R. Rice's *Pyramid* Write Club, but the first rule of Write Club is that we do not talk about Write Club.

Homeward Unbound

by Steven Marsh

"I want to go home."

"I know, Ensign. It's not easy being on the outreaches of the Consortium."

"No, I mean . . . that's what it says. This archway. 'I want to go home.'"

*"This is **very** curious," said the captain as she stepped through the opening. "How could this **possibly** say 'I want to go hom–'"*

*And that was the last anyone aboard the **Horizon** saw of Captain Lin . . . for eight months, until the vessel arrived back on Earth.*

Since lifting off from the blue-green mudball that gave birth to humanity oh-so-many years ago, the denizens of Earth have expanded their reach among the cosmos. However, on a previously unexplored world on the fringes of our investigative efforts, an enigma threatens to change the universe forever . . . or at least make the next phase of exploration that much more interesting. For on this world there awaits an Archway.

> *My planet is called Lorien, but Earth is my home now. It's as good a place as any in the universe.*
> *– John, in **I Am Number Four***

The Archway Awaits

The Archway looks like a mostly natural rock formation, forming a not-terribly-impressive imperfect curve with a 12' height and a 10'-tall by 5'-wide semi-oval opening. It feels vaguely impossible to nonscientists, although any geologists can come up with a number of mundane theories about how it could have come into being. Analysis reveals that it's mostly igneous, with a strong secondary crystalline component. There is nothing that is inherently "off" about it.

The only visibly unusual element about the Archway is that – near the top of its arch – it has inscribed "I WANT TO GO HOME." The words are about 1' tall, roughly centered in archway. It is written in the visitors' dominant language (English, Common, Interlac, etc.). Since this world has – to the heroes' knowledge – not been explored before, this should be impossible. The text's font is somewhere between "script" and "typeset"; each of the T's and O's are distinctive, but it still has a slightly mechanical feel to it. Investigation of the individual letters reveals that they're irregular but *feel* like they should be the same, similar to how using a typewriter on a craggy moist orange peel would result in letters that all look different (even though they're all supposed to have similar basic features).

Moving through the Archway under any condition except one seems to do nothing. However, if someone steps through the Archway while saying the sentence "I want to go home" in the same language as the inscription (or whatever the dominant spoken language of the Earth empire is, if different from the written one), he will disappear.

He reappears a few minutes later tumbling through a specific archway on Earth, disheveled and disoriented but intact. The specifics of the journey and final destination are left up to the GM's imagination, depending on the campaign world; an adventure should be a possibility (especially if it's the heroes making the first trip), but the destination shouldn't be "in Antarctica" or "in the middle of a volcano." Some ideas include:

- In a museum display in an interesting part of the world (perhaps crashing through glass or security measures).
- In an archaeological ruin.
- In a private art collection, perhaps owned by an eccentric but intriguing person of wealth.

The destination portal has some odd characteristics about it. First, it's ornate and interesting, but seems to be entirely Earthly. (It looks to be made of marble, and analysis reveals that it is.) It is roughly the same dimensions as the off-world Archway, but obviously more ornate and crafted by – presumably – human hands. (In a campaign setting that assumes Earth history, it might appear to be of an architectural style similar to Ancient Greece.) It has some unusual markings at the top of its archway; it would be logical to assume that they have some relationship to "I want to go home" in an alien tongue, but the inscription defies all translation (including efforts by universal translators, should they exist).

The Earth-bound receptive portal does *not* allow transport back to the original Archway. The only way to get back to the origin is the long way . . . using whatever spaceship technology is available to Earth. This almost certainly means that those who are left behind won't know for a long while that the person who went through the Archway is safe.

The Only Way to Travel?

The Archway can transport up to 500 lbs. of a single person, limited to the dimensions of the opening itself (about 10' tall and 5' wide). It generally doesn't permit transporting any objects, non-living material, or living material that doesn't have the same genetic component as the wielder, unless the wielder thinks of the extraneous material as part of him. Thus a person's gut bacteria and hair will almost certainly go along for the ride, as would a transported individual who received a pig's heart as a transplant in the past. Someone who wears (say) glasses or a pacemaker would probably bring them along, depending on how much a part of himself the wearer thinks they are. (This means that someone who doesn't think about it too much can probably bring more objects with him than someone who overanalyzes it.) This can lead to some interesting circumstances of peoples' accouterments being left behind (or not), depending on how they feel about the accessories in relation to themselves . . .

If someone is trying to "trick" themselves and the Archway into carrying things they normally can't ("Of course this Zebulon Blaster is part of me!"), then a successful Autohypnosis or Meditation roll is required, modified based on how much extra weight is brought along. (Use the *Size and Speed/Range Table,* p. B550, reading "yards" as the number of extra pounds and "Speed/Range" as the penalty; trying to bring 2 lbs. of foreign material is no penalty, trying to bring 50 lbs. is -5, etc.) Regardless, no weight above 500 lbs. – including the traveler – is permitted. Within these limitations, the GM should permit and encourage cleverness; scratching the vital 40-digit code number into one's skin before travel should work, for example.

The Archway is a one-at-a-time transport; it takes 1d minutes to reset after each usage. If two people try to use it at the same time, use a Quick Contest of DX to see who is "first."

Travel in the Archway is wild, like a roller coaster. It isn't dangerous, but it takes a successful Acrobatics or Body Sense roll to end up on your feet at the end. Even if the traveler doesn't have a space suit (which is likely), he is still fine.

The Archway can be destroyed. Treat it as an 18"-thick brick wall (DR 96, HP 80; see p. B558). If destroyed, it *regrows* at the rate of 1d HP per day, regaining functionality once it regains its full HP. The destination portal can also be destroyed, but it does *not* grow back . . . although if it is repaired and restored, it will regain its abilities. The Archway cannot send anyone if the Earth-bound portal is destroyed.

The Archway cannot be moved without breaking or destroying it (which negates its abilities). The destination portal *can* be moved (even to another planet), and it retains its receptive abilities from the Archway provided both remain intact.

The rest of the planet that the Archway is on is roughly Earth-like; it'd be suitable – if less-than-ideal – for colonization (GM's imagination). No matter what kind of world the Archway is on, it's no place like home.

Arch Wit

The Archway has the potential to greatly change a campaign. It permits nearly instantaneous communications from the frontier world to wherever the receptor portal is (but *not* the reverse). Suitably meditative individuals can carry significant cargo as well. The drawback is that any crew members sent back that way won't be returning anytime soon. (Of course, if *everyone* goes back that way . . . well, you're probably leaving a spaceship behind.)

In a campaign world that develops around the Archway, it's possible ships will start carrying "homeward crewmen": strong-minded individuals who are designed to return home as needed to deliver news or cargo.

About the Author

Steven Marsh is a freelance writer and editor. He has contributed to roleplaying game releases from Green Ronin, West End Games, White Wolf, Hogshead Publishing, and others. He lives in Indiana with his wife, Nikola Vrtis, and their son.

Archway Assumptions

Here are baseline assumptions for a game world that uses the Archway, and how much flexibility you have with the assumptions.

- *There is a "frontier" of space – an edge that we haven't explored yet.* Ideally, there is a most interesting edge (as opposed to a boring backwater part of the galaxy). If this isn't possible – perhaps the entire cosmos is canonically mapped, or there are hard limits to how far vessels can explore – then the Archway works suitably well on a world that's otherwise uninteresting, in a part of the setting that *is* interesting.
- *FTL communication is tricky, or there are limits.* Part of the appeal of the Archway is that it pushes those boundaries (within the confines of its own limitations).
- *Ultra-space transportation is impossible.* If it's already possible to zip unfathomable distances across the cosmos, then the Archway loses much of its specialness. In that case, perhaps the Archway is somehow at another frontier where instantaneous transportation *is* impossible: the edge of the Negati-realm, or (more fantastically) across the rainbow bridge to the Realm of the Gods.
- *Humans are humans.* Obviously, "Earth" can be replaced with whatever planet assumes a most-important, special, or historical status among the campaign. The device and its manifestations exhibit a slight human-centric nature, but this is relatively flexible, depending on its origins.
- *There is a universal language.* If there isn't – or if the heroes all happen to be solely Esperanto speakers in a cosmos where Mandarin Chinese is the lingua franca – then those first explorers will probably recognize the language as being something that they don't speak, but that is from the homeworld (which should be impossible). This should be a minor complication to revealing the mysteries of the Archway.

Random Thought Table

Awe's Right With the World

by Steven Marsh, *Pyramid* Editor

I don't speak much about gaming at the metaphorical level: "Don't you see? Our need to go dungeon-crawling represents our own descent into the underworld; if we can emerge from those challenges alive, it's like we *conquer death*!" I don't delve into the metaphorical much not because I can't – I got a degree in English; I can analyze stuff *all day* – but because it's not usually too helpful to campaign or character design. However, I'm going to make an exception: *Why are new worlds so important to so many spacefaring campaigns?*

It's not because it's essential, really; ***Transhuman Space*** has steadfastly refused to introduce new planets into its setting, and you probably know the name of its worlds even if you've never looked at a page of that material. (Whoever came up with "Uranus" wasn't thinking it through . . .) Indeed, our own planet offers more than enough material for a lifetime of adventure, if you had the wherewithal and desire. I've lived in a city of less than 100,000 people for nearly 10 years, and there are still elements that I haven't gotten around to seeing yet.

Even if other worlds aren't really *necessary,* per se, there's a very good metaphorical reason that we keep going to them in literature, movies, and gaming. One of the most amazing things about visiting space is that it is . . . well, *amazing.* I've heard several astronauts speak over the years, and they've all seemed to have this giddy awe about them when they reflect upon being beyond the Earth's shell.

However, when it comes time to translate that to a roleplaying game, it's difficult to convey that awe, to turn it into something relatable. It's not enough to have the GM yelling at his players over and over, "Can you believe it?! You're in space! Think about what that means!! You're *on a spaceship . . .* ***IN OUTER SPACE!!!***" Eventually the players are going to grow tired of this and go play video games.

The introduction of other worlds can be a tangible proxy for the sense of wonder that we might feel for leaving our own world. We can wrap our minds more easily around new planets with strange physical laws, or new civilizations that stretch our understanding of what it means to be human. By boiling down the awesomeness of space into something more approachable, we can ironically get closer to how it might feel to actually go there.

Continuing the metaphor, then, this is one reason why other worlds often have mysteries or something unusual about them. Figuring out what's happening on a world – whether it's an odd social custom that must be navigated, a strange phenomenon that needs to be unraveled, or a literal science-fiction mystery in the Asimovian tradition – is a good approximation for lighting up the parts of the brain that might be excited to be ***IN OUTER SPACE!!!!*** And it's easier to come up with new worlds and mysteries than it is to keep tacking on exclamation points to ***OUTER SPACE!!!!!*** Here, then, is an examination of some of the meta-aspects of building a mystery of a new planet, keeping in mind that part of the goal is to trigger that sense of wonder.

> *Now I'm sure you're all aware of the extremely grave potential for cultural shock and social disorientation contained in this present situation, if the facts were prematurely and suddenly made public without adequate preparation and conditioning.*
>
> *– Dr. Heywood Floyd, in* ***2001***

Scope

How big (geographically) is the problem, situation, or opportunity? Is it one puzzling alien in an otherwise unremarkable new civilization? A problem plaguing an entire city? A worldwide phenomenon? A gateway to another dimension?

The enigma's scope will have an effect both logistically and conceptually. Stopping a plague that threatens to destroy an entire planet is more awe-inspiring than helping a small village defeat the same plague, but it's also more impersonal.

In this case, it might be worthwhile to determine if you want to instill a sense of awe ("We saved a whole planet!") or a sense of awww ("We saved those adorable twin children!").

Stakes

How dangerous or impactful is the situation? Is the penalty of failing to adhere to this alien culture's rules death, or a week's imprisonment in a resort-prison? The former is a high-stakes situation, while the latter is potentially amusing (if annoying): "Two months have passed since you set foot on this world; you're starting to get a hang of their customs, but you've spent most of them at the Penitentiary Spa . . ."

Not everything needs to be a life-or-death situation. Take, for example, *Star Trek: Generations;* part of its plot centered on Soran attempt to destroy a star, which had a heavily populated planet in its orbit. In my opinion, the decision to make the planet populated was one of the film's (many) missteps; a very interesting story lurked beneath the surface about the ethics of destroying an otherwise uninteresting star to fulfill your own personal whims. (In fact, most of the *Star Trek* films suffer from having stakes that were much higher than its show-of-the-week origins.)

So, let's go back to our "strange plague is affecting a planet" scenario. Sure, you could make the virus fatal; that's obvious. But what if it's nonfatal but leaves 50% of the populace sterile? Or what if it makes them lethargic and unmotivated? An illness that gave everyone the Hidebound disadvantage wouldn't have life-or-death stakes, and – if it were contagious or applicable off-world – might create interesting moral dilemmas. (Can we leave this world alone for a while and prioritize other problems? Do we try to weaponize this illness?)

Duration

How long is the situation? If it's ongoing, is there any reason for the mystery or problem to resolved sooner than later? For example, imagine a world where anyone who spends a day upon it finds that they're somehow an extra hour into the future (that is, they've lost an hour of their lives). It's curious, and might point to a larger enigma that can be unraveled, but there isn't any particular urgency to solve or resolve the issue. That's fine!

Returning to our global plague that only the heroes can resolve: If it's going to take six months to fully implement their brilliant plan, do they take the time? Do they figure out how to hand it off? Do they try to find shortcuts?

Similarly, if this planet is infested with a rapidly evolving nanobot collective that the heroes estimate will gain sapience in nine years, do they try to do something about it now? Keep tabs on the situation?

Perhaps an even more interesting option is to push the limits on the other end. In most science-fiction stories, the heroes get there with Just Enough Time to resolve the situation. But what if they get there when they know it's too late? The global chain reaction is destroying the intriguing alien ruins *right now.* The heroes have an hour at most to assess the situation as quickly as possible, gather as much Interesting Stuff as they can, and get off the planet before it goes kablooey. Or – as another possibility – run the adventure in real time; this world will phase out of existence sometime in the next 30 minutes, and the heroes must figure out its strange situation before the players' pizza delivery arrives.

Implications

What are the ongoing implications of this world and its mystery? For campaigns that aren't emulating "the universe resets at the end of each episode" tele-cinematics, the long-term implications of each new discovery should be foremost in the heroes' minds – such as the previously mentioned possibility of weaponizing the Hidebound plague.

However, any world might contain some aspect that can become important later. Even something relatively mundane like befriending a new civilization means the scope of the heroes' allies grows larger. And stranger implications can become focal points for new complications and conundrums. For example, say the heroes find a piece of mysterious alien tech that seems to function as a universal translator (the first one known in the campaign). Their initial attempts at replicating the device are failures. Do they keep the unique device to themselves to give themselves a significant edge? Turn it over to the Powers That Be in hopes that off-screen scientists can unlock its mysteries? Attempt to investigate and unravel its abilities more?

Although the long-term implications of any situation should be forefront in the heroes' and the GM's minds, the GM doesn't need to "lowball" his offerings to the adventurers (unless a more realistic take on the universe is desired, of course). What the GM giveth, the GM can taketh away . . .

Layers

Just because the heroes unravel one mystery of a world, that doesn't mean they can't lead to other enigmas. For example, on the world where visitors lose an hour a day, the heroes discover that there is a superscience device that is stealing this time to keep another species alive. (It's taking it from the ambient cosmos; any outsiders who get caught in its effects are collateral damage.) The obvious question is: What do the heroes do about this situation, if anything? But this might be the beginning of a larger mystery: What if the aliens reveal that they think they're only siphoning 30 minutes? Somehow, something seems to be using the aliens' own abilities to claim the extra half-hour as their own. The plot thickens . . .

In fact, a world could have any number of interesting unrelated mysteries. Maybe, once the heroes resolve the alien plague, they discover the Archway (pp. 34-35) elsewhere on the world. Considering how much wonder and strangeness there are on our own planet, it's reasonable to presume that any number of new mysteries could be lurking on an unexplored world. And each mystery the heroes face serves to evoke the awe and wonder of outer space . . .

About the Editor

Steven Marsh is a freelance writer and editor. He has contributed to roleplaying game releases from Green Ronin, West End Games, White Wolf, Hogshead Publishing, and others. He has been editing *Pyramid* for over 10 years; during that time, he has won four Origins awards. He lives in Indiana with his wife, Nikola Vrtis, and their son.

Odds and Ends

In the Past, There Is No Future

by J. Edward Tremlett

The history of the OceanWe may well extend beyond what is revealed on the SkipTime Hub of the OceanWe (pp. 18-23).

It's a matter of some interest that, out of all the sentient lifeforms the OceanWe have dealt with, they've always had something of a soft spot for humanity. They have never revealed why, though some of their more loquacious members – perhaps ones that have cultivated a friendship with the PCs – have hinted they share a unique connection. They would just rather not say what, at this time.

Should the Hub be destroyed, or permanently disconnected from HomeOcean's current location in spacetime for one reason or another, the protagonists will eventually get a time-delayed message from one of the OceanWe that they know. The message may contain advice or suggestions, or possibly even promises or warnings of what's to come. But one thing it *will* contain is a set of galactic coordinates and a grid reference for the planet they'll find there.

Those coordinates take the PCs to the planet Mars. The grid reference leads to a Noachian-era plain in the northern hemisphere. There, buried beneath the rocky soil in an area no human ever cared to exploit, is a small, vacuum-sealed, polygonal chamber that has been there for billions of years. Inside it lie the last treasures of a long dead, truly ancient civilization, the bits and pieces that other civilizations gave them, thinking them useless, that the OceanWe found incredibly meaningful.

What ultimately happened to the primeval Mars the PCs knew as HomeOcean is not made clear, here. There's not a jot of their history or any likeness of their race. Nor is there an explanation of their downfall or any last, somber messages for those who may find this place. But perhaps some small trinket the PCs once gave their old friend lies there, too, among the holiest of relics.

And perhaps that's all that needs to be said.

Never let the future disturb you. You will meet it, if you have to, with the same weapons of reason which today arm you against the present.

– Marcus Aurelius

Arch Deluxe?

As mentioned elsewhere (pp. 36-37), part of the joy of science-fiction gaming is reflecting on the implications of future technology and discoveries. In the case of the Archway (pp. 34-35), part of its appeal is giving enterprising players and GMs a foundation to work with. You have a fixed, regenerative portal on one world, and a movable (but destructible) destination on the other end. What do they do with it? Here are some ideas.

- *Instant portable transport.* The heroes can take the destination portal with them via spaceship anywhere they want . . . including new worlds *beyond* the frontier home of the Archway. Explore stranger, newer vistas, then teleport back to the Archway planet if things get rough. (Of course, it'd really be lousy if the irreplaceable destination archway were on a spaceship that blew up . . .)
- *Weaponize, of course!* Enterprising (or foolhardy) heroes might sneak the destination portal across enemy lines, since it might be easier to smuggle a small solo spaceship with no obvious weapons deep into adversarial territory. Then, when it's in place, the meditative space marines can come through, guns a-blazing . . .
- *Muck with the laws of time and space.* What happens if the receptor archway travels at near-relativistic speeds? Do the "handful of minutes" elongate accordingly, or does time-space get *really* weird? What if some yahoo tries to take the destination portal *through* the Archway? (Maybe that's where black holes come from . . .)

Of course, these only scratch the surface of possibilities. Like scientists, players are a creative and innovative bunch – *especially* when they get a new discovery to check out.

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