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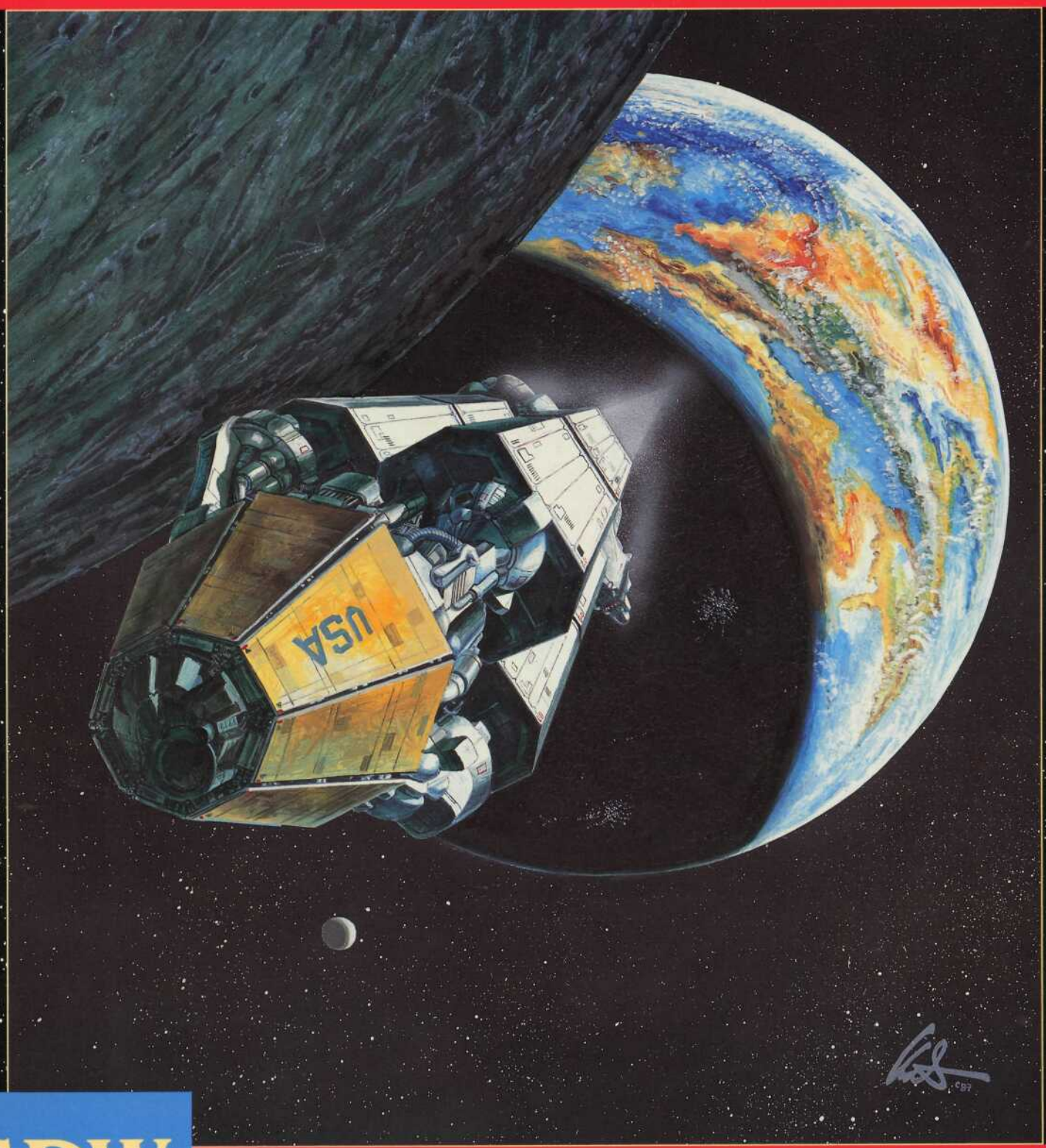
2300AD™

Rob Caswell

Colonial Atlas



GDW

The new worlds of mankind's stellar civilization

2300AD

Colonial Atlas

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Introduction

Humans and their outposts can be found in more than 100 different star systems, but only 29 worlds have become host to our colonies. Most often, every world which is capable of supporting humanoid life, regardless of overall comfort, has been settled by eager colonists from equally eager nations, dividing up resources and territory on alien worlds which have been patiently awaiting our arrival.

Colonial Atlas is a summary of information concerning each of Earth's colony worlds. Each planet with a colony is studied in detail, with information on everything from the star system to which it belongs to the nature of life which may have evolved there. The colonies are also examined, from their history to their current governments and facilities.

FORMAT

Every colony world is presented in an essay format. Each essay has several similar parts.

Stellar data includes ail information necessary concerning the star system to which the colony world belongs. Any stellar objects and important bodies within the system are described in varying degrees of detail.

Planetary data concentrates on the planet itself, generally in its original form (i.e., pre-colonization). Special attention is given to those details which make life there different or difficult for the colonists. Native life forms are also discussed under planetary data.

The remainder of the essay is more free-form, discussing such diverse elements as colonial history, resources, current governments, or special topics unique to that particular colony world. Emphasis is placed on those items which have been most influential in the formation of the colony or those which will be of most interest to characters visiting there.

The Atlas is divided into four major areas of human colonization: the three Arms plus the Core. The only colony world in the Core is Tirane. Each of the Arms—the American, the French, and the Chinese—contain multiple worlds, most of which interact heavily with one another. Be careful not to confuse star names with planetary names, however. In most cases they are not identical (Neubayern is the star name, Nibelungen is the name of the colony world). However, that is not always the case (Beta Canum Venaticorum is the name of both the star and planet).

A map of each Arm of explored space has been provided with the appropriate chapter. The distance of each route on the Arm has been indicated. Also, each colony world is listed with both its star system and its planetary name.

USING THE ATLAS

The *Colonial Atlas* is a Sourcebook for **2300** designed to let the referee take his characters anywhere in explored space. Every colony world is given enough information so that the referee will be able to confidently allow player characters to visit them. Latitude is left for the referee to design his own adventures within the framework of the material presented. To travel to all of the worlds described here would take characters nearly a lifetime, so the Atlas' information will be useful for literally hundreds of gaming sessions.

The Core

TIRANE

Alpha Centauri A

The first world out from Sol, Tirane is by far the single most important colony world. The oldest of the colonies, Tirane is a hub of commerce for virtually all other colonies and outposts.

SYSTEM DATA

The Alpha Centauri system has three stars: Alpha Centauri A, Alpha Centauri B (which orbits Alpha Centauri A with a period of about 79 years), and Proxima Centauri (which orbits the Alpha Centauri A/B binary system at about 10,000 AU). This complicated series of stars has an equally complicated family of planets.

Alpha Centauri A has three worlds in orbit about it, one of which is Tirane, the first world reached by humanity in its journey starward. The star itself is a G2V with mass, radius, and luminosity almost identical to Sol. Tirane occupies the first orbit, within the life zone of the star. It has two satellites: the small ice ball Esa and the more distant rocky moonlet Europos. The second orbit holds the tiny desert world Oikemenos, roughly 5000 kilometers in diameter. The final orbit around Alpha Centauri A is occupied by the 6000-kilometer-diameter failed core world Neuerde.

Alpha Centauri B orbits Alpha Centauri A at a distance which varies from 11 to 35 AU. This second star in the system is a KO V star, similar in size and mass to Sol but less than half as luminous. Alpha Centauri B is orbited by six worlds, the innermost being Sheol, a large hothouse world tidally locked to its parent star. The second orbit holds Hades, a smaller rocky world too hot to be useful. Limbes, the planet in the third orbit, was habitable about 800 million years ago, but has since become a victim of a runaway greenhouse effect. The next two worlds are Enfer and Vorholle, both failed core worlds approximately 10,000 kilometers in diameter. The final orbit is occupied by Purgatoire, a frozen ice ball world on the very edge of Alpha Centauri B's family of planets.

The two stars together are orbited by nine other worlds, making a total of 18 worlds (plus assorted satellites and other planetoids) in the Alpha Centauri A/B system. The first, Gallia, orbits at 106 AU and is a large gas giant. At 115 AU orbits Britannia, a relatively small ice ball world which nonetheless has three satellites: Caledonia, Ordovicia, and Siluria. Further out are Italia, a large failed core world, and Germania, a smaller ice ball. Finally, at 411 and 710 AU respectively are Hispania and Lusitania, two similar failed core worlds almost too far away from the system's stars to enjoy any of their radiation.

Proxima Centauri is a small M5 V star which orbits the A/B system at 10,000 AU. Proxima is orbited by a single gas giant, Moiroi, and its associated satellites, Clotho, Lachesis, and Atropos.

The orbital mechanics of the system have swept large regions of it clear of planetesimals, and have greatly disturbed the orbits of most of those which remain. All worlds of the A/B system show evidence of heavy meteor strikes (although erosion has largely obliterated traces of these strikes on Tirane and Limbes). Some of the more important planets are described below.

Limbes: Limbes is a former garden world sterilized by a runaway greenhouse effect, and it is of interest only to scientists and a few crackpots.

A joint ESA research station is maintained in orbit around the world, although its staff has been drastically reduced as the years have passed, and other, more interesting worlds have been discovered. Despite almost a century of study, no surviving life forms have been detected, but fossil evidence indicates a rich biosphere just under a billion years ago. Over 1800 separate genera have been described, although their exact relationships remain tentative since most of the remains are fragmentary (over 800 million years have passed since the last of them was alive, after all).

A small Terran religious cult holds that Limbes (which they name Ramtha) once had an interstellar civilization which seeded Earth with life. The cult is gathering funds for a massive archaeological expedition to the world in order to prove their contentions. Conventional xenological organizations dismiss such claims (16 exploratory parties have been sent to Limbes and have failed to discover any evidence that the world ever had intelligent life, let alone an interstellar capability). Ramtha devotees claim that volcanic activity has concealed the evidence of civilization and believe the last survivors of the planetary disaster which overtook Limbes now lie in suspended animation deep beneath the surface of the world, awaiting the proper moment to reveal themselves to their descendants and initiate a golden age of enlightenment and universal peace. Detractors claim that Ramtha devotees have been watching too many low-budget science fiction movies.

Sheol: Sheol is a hothouse with fairly large mineral deposits, but the atmosphere and climate are particularly harsh, and there are more economically exploitable deposits of the same minerals elsewhere in the system. A combined Mexican/Argentinian research station is maintained in orbit around the world.

Proxima Centauri: The Proxima Centauri system is uninhabited except for a few scientific installations (engaged in the

study of the first flare star humanity could observe at close range), and a Korean mining operation on Lachesis.

The largest remaining installation is the former French observatory on Clotho, which was sold to Brazil in 2254 and now houses one-fifth of its original complement of 1800. Australia and Indonesia maintain small scientific stations on Clotho and Atropos respectively (the former American station on Atropos was given to the Indonesians in 2242).

PLANETARY DATA

Like Earth, Tirane is mostly water. There are seven continental land-masses and a myriad of smaller islands, almost all of which are inhabited by the colonists. Every landform found on Earth has its analogue on Tirane as well, and the two worlds are very similar since they have undergone similar planetological development.

The biosphere on Tirane is a mixture of native and off-world types. The primary introductions are from Earth, but a few other worlds have contributed lifeforms as well. The biochemistry of Tirane was similar enough to Earth's that little had to be done to adapt Terran life to the world. This was a blessing and a curse to the early colonists: they and their livestock could eat the local plant and animal life with minimal problems, but the reverse was also true. Careful survey work (the identification of potential disease-causing organisms and the preparation of appropriate countermeasures) kept problems with disease to a minimum. All colonists and their livestock were inoculated before they arrived and strict quarantine procedures were in effect from the start. The larger forms of life on Tirane were not difficult to deal with—fences and various environmental barriers kept the local equivalent of wolves from the colonists' meat animals and kept the local herbivores out of the grain fields.

There were a few problems, but by-and-large, the various colonization efforts have integrated themselves well into the local ecology.

In addition to the normal seasons caused by orbital conditions and axial tilt, there are "grand seasons" caused by the proximity of Alpha Centauri B. The radiation from Alpha Centauri B is not significant by itself (even at its closest approach, the companion star only comes within 11 AU), the few degrees added are enough to change the climatic zones of the world. The "grand seasons" each last 19.75 years and can be summarized as follows:

Grandspring and Grandautumn: These are both periods of median temperatures during which temperatures moderate themselves around a habitable mean. During these grand seasons, the ecology of Tirane gradually adapts itself to the coming extreme season.

Grandsummer: The tropical regions become hot, and sensitive organisms migrate to cooler regions. Temperatures peak at about 45 degrees C (the oceans moderate the increased heat fairly effectively and most plant life can survive quite well). The balance of plant and animal life alters, and tropical creatures increase their range.

Grandwinter: The polar regions become very cold (averaging — 40 degrees C), and most animal forms migrate towards the equator or enter a long term hibernation. The tropics cool off, and temperate life forms expand their ranges at the expense of tropical ones.

Because of the constantly shifting weather patterns, farming has taken on a unique pattern. Instead of individual family farms, a system of farming corporations has arisen. A corporation will own large tracts of land in several locations, and a given tract of land will be used for various purposes depending on the season and grand season. Farm families will often undertake to farm a section of land for long-term periods (20 local years is an example of a standard contract).

As a colony's climate shifts, the employment demands of agriculture also shift, and the population transfers from agricultural jobs to other jobs on a cyclical basis. Farm workers could be said to be migratory in one sense, but since they often spend two or more generations in one place, their life is relatively stable compared to other migratory agricultural workers.

COLONIAL HISTORY

Tirane is a garden world in the Alpha Centauri system and the site of the oldest human colonies in space (there are older outposts, but Tirane was the site of the first attempts at full-scale colonization). It was a tremendous coincidence that Alpha Centauri had a world similar to Earth, but this coincidence spurred the search for other such worlds. Had the system contained no world suitable for human habitation, the course of future interstellar exploration might have been considerably different.

The first interstellar probe (an unmanned vehicle, launched under the auspices of the ESA) arrived in system in 2137 and made a detailed survey of the constituent worlds. The probe dropped an instrument package on Tirane, which included the flags of the member nations of the ESA. On the basis of this, when the data about Tirane arrived back on Earth, the member nations of the European Space Agency (at the time, the active members were France, Bavaria, Azania, and the United Kingdom) announced their discovery and claimed the system for colonization. Several nations immediately filed diplomatic protests and began speeding up their interstellar programs. Argentina (in company with Mexico) sent a probe to the system in 2138 to establish their claim to it. American and Japanese probes soon followed, but no human had yet set foot on the world. Manchuria was the only major power to support the ESA, although many remained neutral (especially those without hope of an interstellar exploration program). In 2129 a joint ESA survey party went into orbit around Tirane and spent the next four years studying the first world outside the solar system found suitable for human life. The party landed and planted flags, reasserting their claim to sole colonization.

The ESA began construction of *a* large fleet of interstellar transports with a view to colonization (many of these were converted interplanetary freighters). Other nations followed suit, but Argentina built warships instead, and the Alpha Centauri War was the result.

Most of the war was conducted in the Alpha Centauri system: the Argentinian warships battling the converted merchant ships of the ESA. Both sides were unsure how to go about conducting an interplanetary (indeed, an interstellar) conflict, and the war was characterized by great delays while both sides awaited instructions from Earth. Neither side could gain a clear advantage, but both sides were unwilling to expand the conflict to Earth in more than a limited way.

When Australia offered to mediate, the two sides concluded a cease-fire which turned into an armistice. Both sides later claimed victory, and the war is still a touchy subject in some circles.

The Melbourne Accords which ended the war also opened Tirane to settlement by all spacefaring nations and established the precedent of open settlement which continues to this day (albeit somewhat modified). The nations of the ESA had a head start, however, and Tirane's present demographic situation reflects this. A majority of the planet's 1.05 billion inhabitants are descendants of the ESA colonists. Several colonies failed for one reason or another and were absorbed into one of another of those listed below.

The two moons of Tirane were named after the European space agency (Esa, pronounced AY-sa) and the continent of Europe (Europos, pronounced yoo-RO-pos), and they currently contain nothing but a few small observatories, research facilities, and navigational beacons. There are several orbital colonies and factory complexes around Tirane, as well as four solar power satellite arrays and numerous communications and land-use satellites.

In the last few decades, demographic pressures on Tirane are such that a large surplus population has left to settle in the outer fringe colonies. As the frontier areas of Tirane became more civilized and opportunities for land began to dry up, increasing numbers of colonists have emigrated from Tirane to other worlds where a person can make a fresh start, get in on the ground floor, and generally escape from the pressures of civilized life (such as bill collectors and door-to-door salesmen). In many ways, Tirane has become a second Earth.

COLONIES

There are numerous individual colonies on Tirane. However, though Tirane boasts the largest population of any colony world, its billion inhabitants are sprinkled rather thinly across the continents—Tirane's overall population density is fairly sparse.

Each colony here is listed with its name and a parenthetical statement of its current population and allegiance (if not independent).

Provence Nouveau (French, 238,832,000): Now a department of metropolitan France, Provenve Nouveau is the location of France's largest starship construction facilities, the Universite d'Tirane, the IEX's extensive zoological collection, and the famed Musee Xenologic. Without rival, Provence Nouveau is the cultural capital of Tirane.

Freihaven (194,576,000): The former Bavarian colony was unwilling to become a part of a reunited Germany and is now an independent nation. Relations with the rest of the colonies are better for it, since a strain between two large colonies on Tirane would have possibly created a global conflict or economic hardship. Freihaven is heavily industrialized, noted for the manufacture of heavy vehicles and machine tools for internal use and export.

Tundukubwa (68,405,000): The Azanians made only a small effort on Tirane initially. Along with Provence Nouveau, Freihaven, Tundukubwa shares the largest of Tirane's seven continents. The colony itself is mostly concentrated in an original city complex built against a geologically recent crater *(tundukubwa* means great hole). Mines which used to be operated in the pit of the crater have long since gone out of business, but the colony's roots and center are still there.

New Albion (212,000,000): British settlement was intense in the early days of colonization but soon tapered off as other avenues opened up. Still, to many British, the colony at New Albion marked the rekindling of the long dead empire and the pride associated with it. Now the English have colony worlds along the entire French Arm, but New Albion is arguably the "national favorite." Originally an agricultural and light industrial colony, New Albion is now also a retreat for the nobility, and fiefs granted here are known for their lavish upkeep and luxurious appointments.

Tirania (17,945,000): American settlement on Tirane was never intensive and was carried out largely by private corporations. As an interesting side note, no American colony has ever been named New America, as this phrase has a bad connotation to them (it refers to an extremist movement of the late 20th and early 21st centuries). Tirania is on the brink of being a so called "failed colony" as the local population has been in decline for over a decade.

New Canberra (98,023,000): The Australians received colonial guarantees on Tirane as a result of the Melbourne Accords and claimed them immediately. The Australian colony's main claim to fame was that it was the site of the so-called "First-and-a-Half Interstellar War" between Australian and Japanese survey teams over a major Tantalum strike.

Amaterasu (119,437,000): For reasons which were never completely clear, Japanese survey teams began staking out claims which overlapped those of Australia. The situation was complicated by the fact that tantalum was discovered in the disputed area (called "Duffer's Strip" by the Australians), and several small scale skirmishes resulted between Australian and Japanese survey teams before a mutually satisfactory settlement could be negotiated. The strip went to the Australians, but the tantalum would be mined by a joint Australian/Japanese corporation.

Provincia de Brasil (102,000,000): Brazil became a spacefaring power on the basis of its native tantalum deposits and purchased American and French technology in order to construct ships. Their colony on Tirane is still their proudest achievement.

Tunghu (2,200,000): Manchuria was never overly interested in settlement on Tirane, having decided to exploit the other possibilities in interstellar colonization. Nevertheless, Manchuria purchased a small area in one of the Bavarian claims (approximately 300 square kilometers), in order to maintain trade contacts. The small trade center is now a bustling metropolis and duty-free market for goods from all over human space.

The French Arm

NIBELUNGEN

Neubayern

Neubayern is the first star out along the French Arm from Earth which had the potential for supporting a colony. Today the colony is a very important bastion of both the German and Azanian presences in space.

SYSTEM DATA

The Neubayern system consists of eleven worlds and seven satellites orbiting an orange K7 primary. The star is rather cool, and the life zone is within less than one-third of an AU. Considering the relatively small size of the star, Neubayern possesses an impressive collection of worlds.

The first orbit is occupied by the planet Nibelungen, the only planet which lies within the narrow life zone. Nibelungen has a planetary ring composed of ice and rock particles. Darmstadt, the second planet, is a very small rocky world with no satellites. The third planet in the Neubayern system is Munchen, a larger world than Darmstadt, but made up mostly of ice. Wiesbaden is a failed core planet, but rich in water ice, occupying the fourth orbital position. Neuschwanstein is the fifth planet, an ice ball with a smaller ice ball, Montez, for its only moon. The ice bail in the sixth orbital position was dubbed Essen, and it has two satellites, Dusseldorf and Oberhausen Duisburg is a small rocky world in the seventh orbit, and Dortmund is an ice ball in the eighth. Frankfurt is a substantial ice ball in the ninth orbital position and has three satellites: Nurnberg, Koln, and Lubeck. Augsburg is a small ice ball in the tenth orbit, and, finally, Wurzburg is a failed core world in the eleventh.

PLANETARY DATA

Nibelungen is a smaller planet than Earth, only 8000 kilometers in diameter and exerting only 0.629 G. Water oceans cover 30 percent of the planet's surface area, which helps to moderate the world's moderate temperatures. The planet is tidally locked into position with respect to its primary, so different areas have different characteristics.

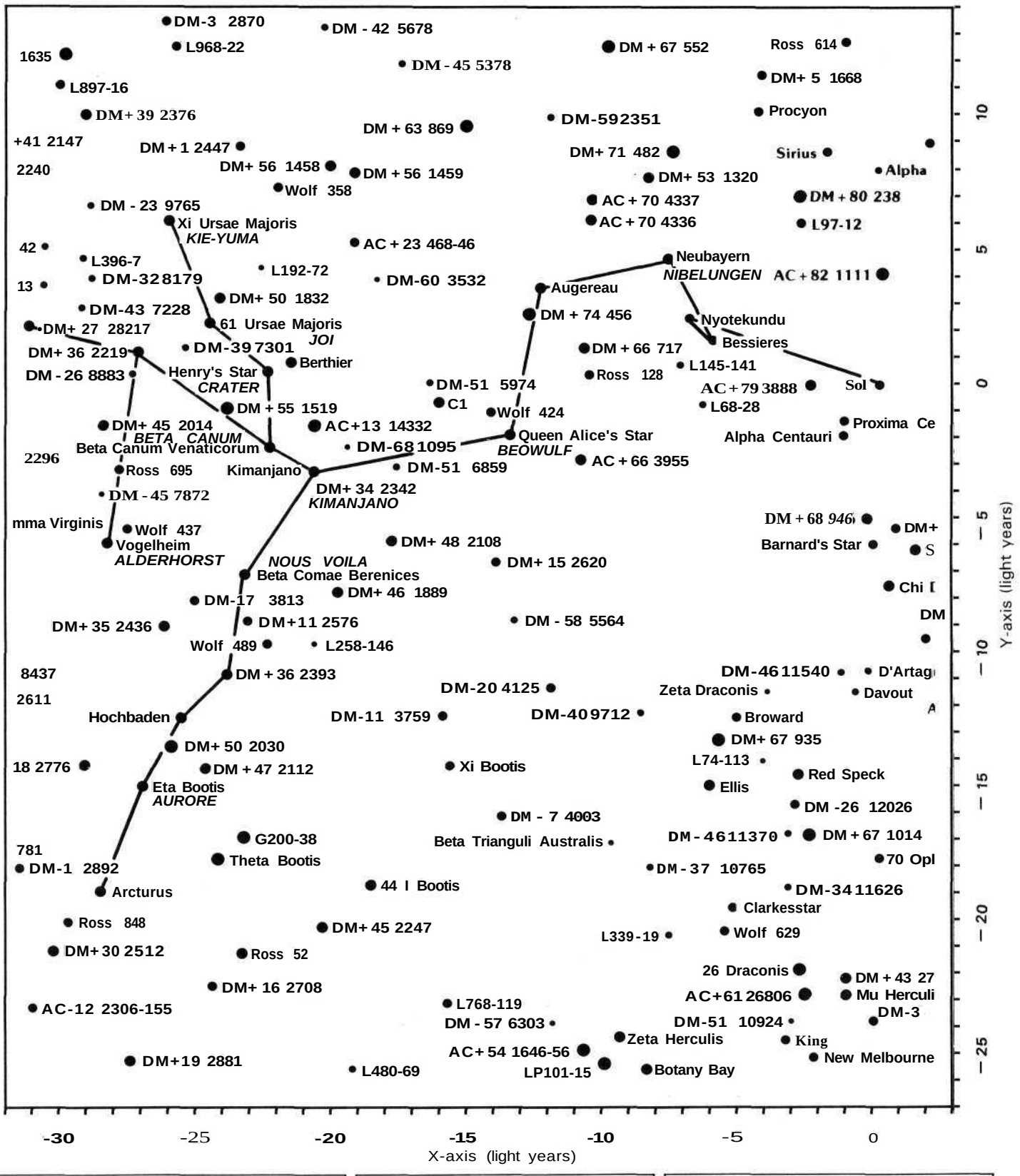
Coldside: The coldside contains most of the land area of Nibelungen, and the largest part of this region is covered by a permanent icepack about a kilometer in thickness. The orbital mechanics of the Neubayern system are such that the Nibelungen atmosphere never freezes, and convection continually circulates moisture-laden air from the oceans into the cold side, where it falls as snow. The icepack builds up, and glaciers slowly flow out of the coldside into the edges of the two twilight zones, where they melt and flow into the oceans. Over the millennia, the land at the edge of the icecap has gradually worn away to huge wet plains resembling tundra in the regions closest to the ice. Further away, the land becomes a giant freshwater marsh that gradually deepens into the Ostmeer (Eastern Ocean). The situation is slightly more complex on the western side of the coldside, where the Eiskopf mountain range has risen. The icecap climbs the eastern edge of this range, warms, and melts, flowing over the edge into the Westmeer (Western Ocean). The flow of water has carved deep channels in the mountains and would have worn them away millions of years ago had the mountains not been rising at a very high rate.

The coldside contains most of the land area of Nibelungen, and the largest part of this region is covered by a permanent icepack about a kilometer in thickness. Since Nibelungen's axial tilt is less than 10 degrees, there is little climatic variation. The temperature at the center of the cold side (the area of perpetual night) is relatively constant at -40 degrees C. Very little snow falls here, since the air has been largely stripped of its moisture thousands of kilometers before it arrives here. The eastern and western glaciations meet here, flowing into each other, and locking into an eternal deep freeze...cold, dark, but (surprisingly) not lifeless. The atmosphere itself would have frozen millions of years ago if it were not for the world's volcanic activity, which warms the center of the coldside enough to keep the atmosphere gaseous. Small pools form around the active volcanoes, which support life in the form of the same mineral-fixing single-celled bacteria which exist in the harshest extremes of the hotside.

Hotside: The Nibelingen hotside contains a large desert in the southern hemisphere. Temperatures in the equatorial regions are moderated somewhat by the presence of the eastern reaches of the Ostmeer but are still very warm by human standards. The Ostmeer is divided through the middle by the Grosshalbinsel, or Great Peninsula, which completely crosses the hotside and extends well into the twilight reaches of the Ostmeer (the westernmost tip of the Grosshalbinsel is inhabited, and linked to the other twilight zone by the trans-hotside railroad).

The Nibelungen hotside includes the eastern edges of the Ostmeer, and this has the effect of moderating the temperature extremes, making it more habitable than it would have been otherwise. Notwithstanding this, the center of the hotside can reach temperatures as high as 70 degrees C.

The French Arm



The X and Y axes on this page are approximate. For precise stellar coordinates, see the near star list in the basic game. The positive Z-axis extends straight up out of the map, the negative, below the map.

All names in upper-case italics are either colony worlds or alien homeworlds.

Z-axis distance is the value above or below the map plane. Symbols represent perspective distance, not stellar size.

- ● 30 to 50 ly
- ● 10 to 30 ly
- • 10 to -10 ly
- •– 10 to - 30 ly
- •– 30 to - 50 ly

Once coordinates are obtained from the near star list, the distance between any two stars can be found by the formula:

$$D = \sqrt{(X_1 - X_2)^2 + (Y_1 - Y_2)^2 + (Z_1 - Z_2)^2}$$

Scale: one light year =5 mm

Twilight: The twilight zone contains portions of both the Ostmeer and Westmeer, several mountain ranges, plains, forests, tundra, and numerous bogs (described in detail elsewhere).

The climate in the twilight regions is quite temperate at the equator, fading to near arctic conditions at the poles. The "perpetual spring" of the twilight zone due to the world's tidally-locked orbit allows crops to be planted and harvested nearly all year.

Nibelungen boasts a well developed local biosphere with significant influxes of Terran species in the settled areas. Many varieties of the local plants proved to be largely edible by Terran livestock, and a wide variety of local species have been adapted to livestock feeds in conjunction with imported Terran varieties, and some have been genetically adapted to the local conditions.

Most of the local animal life has been driven out of the areas of heaviest settlement, but a number of varieties manage to co-exist with the alien imports. A number of small flying species have changed their feeding grounds from coastal areas to the garbage dumps and waste disposal systems of the cities.

There are three separate local ecosystems: the coldside, the hot-side, and the temperate (twilight) zones.

Oceans: The constant flow of minerals into the Ostmeer from the glacial melt supports a large body of single-celled life forms which serve as the base for a large food chain. Microscopic filter feeders eat the bacteria and, in turn, are prey to larger free-swimming fish and amphibian analogues. Larger carnivorous creatures range in size from the meter-long Austerhaifisch (oyster-shark, so-called because its head has a wide mouth which bears a fancied resemblance to that of shellfish) to the 15 meter Schreckenschwimmer (terror swimmer).

Marshes: In several regions of moderate temperatures where water has been trapped in shallow coastal areas (such as the edge of the Ostmeer), large bogs have formed, sometimes several hundred kilometers across. In these regions, the waters teem with marshweed, a sessile plant-like organism resembling a Terran seaweed. Each plant has hundreds of flotation bladders (each about the size of a pea) which keep it near enough to the surface for its form of photosynthesis to take place. Each plant sends rootlike tendrils, which anchor he thick mats of plant life together, down to the bottom. Each plant intertwines with its neighbors, and it is often difficult to tell where one individual begins and another ends. Over the centuries, dead marshweed sinks to the bottom and decays, but the thick mat of root-like tendrils keeps most of the decaying material in place, forming a dense, dark goo interlaced with root systems. These bogs ("too thick to drink and too thin to plow") are the habitat of a huge creature called a Sumpfkuh (mire cow) by the locals. Mire cows resemble Terran manatees externally, but differ radically in internal makeup. There are several genera, but they are enough alike to be simply described. Mire cows are between four and six meters long, smooth skinned, and generally a blue-grey or grey-green in color. They breath air, but can supplement this by absorbing small quantities of oxygen through their skin in order to extend their stay underwater (because of this and an extremely low metabolism, a full grown mire cow can stay under for nearly four hours). Mire cows are large, stupid, and slow, and their low metabolism would ordinarily make them very vulnerable to predators, but their chosen environment (the dank morass of the marshweed) provides them with excellent protection. They are usually not dangerous but can overturn marshboats when enraged or defending their young. Marshboats moving at high speed sometimes collide with sleeping mire cows, usually severely damaging both parties. (Hovercraft often run down mire cows, but seldom do damage; hydrofoils and other larger ships never enter the bogs because of the danger of entangling their props in marshweed).

There are thousands of other life forms making the marshweed their home, but most of these are less than a few grams in size, and live within a few meters of the surface where light can penetrate. Most of these are of interest only to specialists in xenobiology, but a few of the more interesting types are:

Sumpfdotterblume (literally, flower/daughter of the bog): A floating plant of economic significance to the Nibelungen colony. When dried and soaked in a solvent, a Sumpfdotterblume plant yields a small quantity of grey-green liquid. Most cloth dyed with this liquid comes out a grey-green color—pleasant, but not particularly outstanding. When used on cloth made from the fibers of a local plant called Wollgrasse (cotton-grass) the resulting fabric has an iridescent green translucence reminiscent of fine jade, but with the flexibility of cloth. Properly done, the cloth will also partially reflect faint hints of colors around it. The overall effect is quite attractive, and the cloth is in considerable demand, as it cannot be grown commercially anywhere else.

Sumpfdotterblumen which have flowered are useless for the production of dye, and it is only the immature flower buds which have value. These buds usually remain submerged (and thus difficult to find) until they are ready to open. Seeking out the buds is a job requiring an intimate knowledge of the bog and its inhabitants. The buds are harvested by fleets of shallow draft boats of various types piloted by experts in bud hunting.

Burrowers: Small fish-like creatures that live in the upper meter or two of the bog (which is more open and easier for small animals to burrow through than the dark lower levels). During their breeding season, burrowers seek out Sumpfdotterblumen to lay their eggs on the buds (which flower and provide food for the developing larvae), and the creatures can be used as a guide to locating the valuable buds of this plant.

Skimmers: Skimmers are reptile-like creatures which run along the surface of the bog using wide, spatulate feet or burrow just beneath the surface in search of their prey . When at rest, skimmers inflate a flotation bladder to remain on the surface (they are air breathers). They are carnivorous, feeding on other small surface-dwelling creatures in the Nibelungen bogs, primarily burrowers.

Upland Plains: The plains of the temperate zones are covered with a variety of plants similar to Terrestrial grasses, bushes and trees, but differing in the details of their shape, internal workings, biochemistry, and life cycles. The most important to the colony is Wollgrasse, or cotton grass. In combination with a dye from the marshes, the cloth woven from the fibers of the cotton grass, called Nibelungen Green, is in great demand elsewhere in human space. Cotton grass grows wild in the twilight regions of the north shores of the Ostmeer and is cultivated in the settled regions. There are a number of genera of plains grazers and several species (in two main genera) of carnivores native to the upland plains.

Mountains: Like their Terrestrial counterparts, the mountains and rough areas of Nibelungen contain smaller versions of the lowland forms of life, which are adapted to their precarious, cold existence. Two genera of mountain-dwelling grazers (which feed on the moss-like growths of the higher altitudes) have been described. Only a single species of small carnivore, the Bergkatze (mountain cat) is known to live in the mountain regions on the south shore of the Westmeer.

COLONIAL HISTORY

Bavarian advances in material science (with French advances in physics) had made possible the construction of the first interstellar probes, and the unique technological exchange between France and Bavaria ensured that Bavaria was in the forefront of scientific advances. Because of a lack of tantalum, however, all Bavarian-built probes used somebody else's tantalum (either French or Azanian) until well into the 22nd century. Bavarian-built probes carried out the lion's share of the interstellar explorations since French probes had a disturbing tendency to get lost (of 16 French-built probes launched before 2151, only seven reported back). None of the missing probes were ever found, and no plausible reason for their disappearance was ever proven. Bavarian probes had a much better success rate, even though the designs were identical. For reasons equally inexplicable, after 2151 the failure rate of French-built probes dropped to a more normal figure. French-manned surveys never experienced excessive casualty rates, even though the stutterwarp propulsion designs were identical.

The Neubayern system was discovered in 21 42 by a Bavarian-built probe working for the Bavarian government in cooperation with the Astronomishes Rechen Istitut (using Azanian tantalum supplied to the University of Heidelberg for the ARI), but it was not surveyed for nearly a decade. The discovery of a tantalum deposit on Neubayern IV by an ARI team radically accelerated settlement of the system.

Nibelungen, the only habitable world in the system, was the site of an intense colonization effort despite the hardships involved. In spite of the fact that the world was tidally locked, limiting occupation to the twilight bands, the demands for cheap food for the tantalum miners spurred a colonization effort. There was another factor operating as well: national pride. Neubayern was the only system (at that time) discovered solely by Bavarians. It was likely to be the only place open to their people for the foreseeable future (not the case, as it turned out, but it was, for almost a century, the principal Bavarian settlement in interstellar space). The name "Neubayern" applied to the star indicates the level of emotion involved in its discovery, exploration, and colonization. Even though Bavaria obtained other colonies in later years (Hochbaden, Rho Eridani, and DM+ 36 2393), none could replace Neubayern in the hearts of the citizenry. It was to symbolize their brightest and best hopes for the future.

The Neubayern tantalum provided a basis for a Bavarian space fleet, and brought considerable income from sales of excess production. The initial strikes were mined out in the late '30s of the last century, but several smaller strikes on other bodies in the system (most notably Neubayern VIc) have kept prospecting for tantalum a major occupation in the outer reaches of the system. The influx of population and the wealth accumulated by the sale of tantalum gave the Nibelungen colony a remarkable economic boom, and manufacturing centers rapidly blossomed on the world's surface and in near orbit. Bavaria's largest shipyard (now taken over by Germany) is in the Neubayern system. Although it has been largely eclipsed in the last few decades by other, more efficient operations in other systems, the Nibelungen yards remain the main German starship building facility aside from Earth.

With the expansion of the Bavarian space effort further out into the French Arm, the colony continued to grow, supplying the ships and tantalum needed to fuel that settlement. With the participation of Bavaria in the Central Asian War the terrestrial factories of Bavaria shifted over to war production, leaving those of Nibelungen to take up the slack of supplying the outlying colonies with needed manufactures. The demand for labor and capital spurred a boom cycle in the Nibelungen economy. With the conclusion of the Central Asian War and the subsequent War of German Reunification, Nibelungen's economy had become overextended. Though worlds closer to the frontier acquired maturing economies, and became producers instead of consumers of manufactured goods, older colonies such as Nibelungen are now experiencing the first stages of recession.

As it was in most former Bavarian colonies, the War of German Reunification was felt in the Neubayern system, but the repercussions have largely settled themselves out. When the war ended, the Nibelungen Prime Minister was retained and, in a recent interview, remarked jokingly that the greatest change had been Der Postamtfahne (the flag on the post office). The local government remained largely unchanged, the army simply changed flags, and the colonists now consider themselves to have absorbed Germany instead of the other way around. Antiunificationist sentiment is now almost entirely eliminated.

There is a small movement for local independence (which has elected two delegates to the 384-member Bundestag (parliament) in the most recent election. The movement calls itself Die Nibelungen Organisation (The Nibelungen Organization) and was founded in 2261. The decades of economic prosperity prevented the growth of significant dissatisfaction with the government and kept the NO a small, comic, opera group. It even acquired a nickname during this time, Die Nei Gelungen Organisation (the Non-Successful Organization). In the last two years, growing unemployment has swollen the ranks of the NO to the point that it can no longer be ignored. The government has tried a number of stop-gap measures which have proven temporarily successful, and if there is a major war (such as that which may be developing with the Kafers), there may be an increased demand for manufactured goods as war economies become necessary on the frontier. However, if the economy does not improve soon, there is considerable potential for trouble in the Neubayern system.

Other countries never engaged in significant colonization of the Neubayern system because of the size of the Bavarian effort, the limitation of settlement to the twilight zone, and the easy availability of uncontested worlds elsewhere. A small number of Azanian settlers arrived in the colony's early years and now represent about 11 percent of the population. A smattering of other nationalities are present, but these are a minor portion of the total population (which is now over 85,000,000).

Brazil, Indonesia, Great Britain and Canton maintain small mining concessions on Neubayern VIc, but only the British and the

Brazilians are actively mining ore.

A number of plants and animals have been brought to Nibelungen by the colonists for economic reasons and to provide a familiar environment. Several varieties of cereal grains, fruits, and vegetables have been genetically modified to suit the local growing season, and a wide variety of livestock has also been imported. For reasons unknown, however, sheep and goats do not thrive on Nibelungen, and several attempts at introducing them have failed. The animals do well for a year or so, then begin gradual weight loss and eventually die.

A variety of animals have been introduced as pets. Hundreds of species of flowers, trees, and ornamental plants now thrive within the settled regions. Most of these are limited to the area of settlement but some are slowly spreading through the unsettled twilight regions.

Interactions: When two different biospheres meet, there are bound to be unforeseen interactions. The inability of sheep to survive on the planet has already been mentioned. The Terran house cat has established several feral niches along the edges of the hotside desert of the Grosshalbinsel, as well as inside the settled regions. Terran dogs have been slower to establish themselves against the competition of local predators, but are now making small inroads into the ecosystem of the world.

As with all worlds, the simpler life forms were the quickest to adapt, and many varieties of Terran single-celled life have spread throughout the world. Conversely, the local bacteria and the local equivalents of molds, fungi, mosses, and the like have taken to the Terran introductions quite readily.

Only one substantial Nibelungen life form is present in the settled regions in any great numbers: the Spinnemaus (spider-mouse), a small, six-legged omnivore with a predilection for wall interiors, ventilating ducts, crawlspaces, and the back of kitchen cabinets. The creature has spread to practically every city on Nibelungen and is a major pest. Strict quarantine measures have kept the spider-mouse from reaching the orbital installations (so far).

Hotside: The hotside contains a wide variety of small amphibious and land-based lifeforms in the eastern reaches of the Ostmeer and its coastal regions. Water is plentiful in these areas, and the tropical heat serves to spur plant growth at the land/water interface and in the shallows offshore. Closer to the center of the hotside, however, the heat increases beyond tolerable levels. The fish-like creatures are driven deeper in search of cooler temperatures, and nothing goes to the surface if it can be avoided.

At the center of hotside in the two branches of the Ostmeer even underwater creatures cannot survive, and the only known life exists in the mud at the bottom of the sea. Single-celled creatures in the mud draw their existence from the minerals in the water (in a manner similar to certain sulphur-fixing bacteria on Earth) and are preyed upon by sessile filter-feeders. The largest animal yet discovered at the center of the hotside is a small bottom-dwelling crab-like creature, which preys upon the filter-feeders.

In the center of the hotside, where it succeeds in dividing the Ostmeer into northern and southern limbs, is the Grosshalbinsel (great peninsula). The Grosshalbinsel completely crosses the hotside (and its western end continues to extend well into the twilight zone).

BEOWULF Queen Alice's Star

After a circuitous route along the outposts and colony systems of the inner French Arm, all travellers find themselves at the halfway point of Queen Alice's Star. The system's inhabitants accept and profit from their convenient location, welcoming visitors from the core to the truly distant worlds of the frontier.

SYSTEM DATA

The name Queen Alice's Star was applied to DM+ 46 1797, an orange K-class dwarf star, by the captain of the ESAS *Vancouver* during his survey of the nearer parts of the French Arm in the year 2164 A.D. At that time, Queen Alice had been on the British throne for 23 years, but no one expected her reign to compare with that of Queen Victoria in length, prosperity, and colonial development alike. The star lies just under 20 light years away from Earth and is orbited by one of the most important colony worlds in today's British colonial empire.

The star is classified K4V, with a diameter of approximately 879,542 kilometers. Its mass is .62 times that of Sol, with an average luminosity of .148 Sol and a Stellar Effective Temperature of 4260 degrees K. The star has an absolute magnitude of 8.2. Like most dwarf stars in the F-K range, Queen Alice's Star has a planetary system. One world, christened Beowulf, lies within the star's habitable zone.

There are eight planets in all, named by *Vancouver's* captain from among figures in the English national epic *Beowulf.* The innermost world, Wiglaf, is a hothouse planet of significant size with a dense atmosphere. Beowulf, the second planet, is a garden world in the system's life zone. Planet III, designated Grendel, is a pregarden world with an extremely eccentric orbit; it passes inside the orbit of Beowulf at its closest approach to the star. The fourth and fifth planets (Hrothgar and Unferth respectively) are both gas giants; between them is an asteroid belt occupying an otherwise empty orbit. The outer worlds are named Edgetho, Brecca, and Higlac, and are ice balls of not great significance. All are older Population II worlds, although Grendel exhibits several peculiarities that are the subject of considerable controversy among scientists. Current theory maintains that Grendel was captured after the development of the system and is considerably younger; however, several notable theoreticians reject this in favor of various other explanations for the planet's oddities.

The planet Beowulf has two natural satellites, each one of interest in its own way. The *nearer* of the two to Beowulf is Hrunting, which has an orbital radius of 342,400 kilometers (25 radii) and an orbital period of 1 5.76 days. Hrunting's diameter is 5580 kilometers, with a density of .6 Earths and a mass of .061. This gives the satellite a gravity of .365 G. It has a thin, highly corrosive atmosphere composed primarily of various sulfur compounds, with a surface pressure of .356 atmospheres. The atmosphere is largely the result of outgassing from vulcanism; tidal stresses from Beowulf and from the other moon have made the seismic conditions here notably unstable. In addition to the interesting planetological features of Hrunting, the moon is of interest to scientists because of the presence of what seems to be the remains of a crewed surface installation of unknown origins. Archaeologists are hampered in their research of the site by the dangerous conditions that prevail on Hrunting, and as yet, the site has yielded hardly more than a suggestion that there was some sort of ancient outpost on the moon at all.

The second moon of Beowulf, orbiting at 479,360 kilometers (35 radii) with a period of 44.14 days, is named Nagling. With a diameter of 4275 kilometers it is much smaller than Hrunting, but it has a density of 1.2 Earths, a mass of .036, and a gravity (.345 G) nearly equal to its larger neighbor. It, too, retains a thin atmosphere mostly composed of inert gases; Nagling is subject to fewer tidal stresses than Hrunting and thus demonstrates considerably less seismic activity. The high density is an anomaly still being investigated, but it is also a valuable asset to the British colony on Beowulf. Three separate mining installations have been opened on Nagling, with more in the planning stage.

PLANETARY DATA

Beowulf is the only garden world orbiting Queen Alice's Star. Although the overall environment has been classified as Earthlike, there are many characteristics found on Beowulf that differ from Earth norms. The climate is somewhat harsher and the terrain much more rugged (as a rule) than comparable Terran regions would be expected to support. Visitors with little experience of interstellar travel are sometimes surprised at the variety of world types which fall under the same "garden" label, though at that, Beowulf is considerably more Earthlike than some (Crater, orbiting Henry's Star, for instance) counted as capable of supporting life as we know it.

Beowulf orbits Queen Alice's Star at a distance of about .42 AU, with a period of 43.65 standard days. Eccentricity is fairly low, although there has been a measurable perturbation in the orbit caused by the interference of Grendel. A comparatively low degree of axial inclination helps to ensure that this short "year" does not suffer greatly from seasonal variations. Although it lies beyond the "optimum" life zone distance, the climate on Beowulf is generally tolerable over much of the planetary surface.

Beowulf has a diameter of 13,969 kilometers, hence a circumference of 43,885 kilometers. Density is .9 that of Earth (6.435 g/cc), while its overall mass is 1.17 times standard Terrestrial mass. These factors combine to give the planet a surface gravity of 1.045 G, and a surface escape velocity of 11.7 kps. Axial tilt is 6°43'8.6". Beowulf has two satellites, both fairly large and at an average distance, their names, in keeping with the general system nomenclature, are Hrunting and Nagling, after two swords wielded by the Saxon hero Beowulf in his battles.

The planetary atmosphere is close to a standard nitrogen-oxygen mix. Pressure at sea level is 1.021 atmospheres; Beowulf's air contains 22 percent oxygen at a partial pressure of .225 atmospheres. It retains elements with molecular weights of 6 or more, and is thus classed as having a "dense" atmospheric envelope. The oxygen content is similar to that of Earth.

Beowulf's twin moons exert a significant tidal effect on the planet, especially in the case of the *nearer one,* Hrunting. In addition, the proximity of the star causes further tidal disturbances. As a result, the planet's rotation is a slow one; Beowulf turns on its axis once every 21.8 standard days. It completes just over two revolutions in a planetary "year" of 43.65 days. Colonists are forced to make major adaptations in habits to cope with this unusually long rotational cycle, and Earth crops cannot be grown under such conditions—the diurnal period is simply too long to allow most ordinary Terran produce to flourish. A few hardy plant types from far northern climates could be grown under these conditions, but since local plant life can be consumed by humans, there has been no need to introduce off-world forms of marginal utility.

Beowulf has a hydrosphere made up of standard liquid water covering 78 percent of its surface area. The mineral salts in the planetary oceans are somewhat different from those found in Terrestrial salt water, and they have been known to cause allergic reactions in some colonists who have ventured into the water without

protection. About 30 percent of all humans seem to have such allergies; others can bathe or swim in Beowulf's oceans unharmed. As with Terran sea water, Beowulf's oceans can only be used for drinking after desalinization. Roughly 10 percent of the ocean area is locked up in polar ice caps.

Beowulf, being more geologically active than Earth, has an interesting and varied blend of terrain. Roughly a third of the land area is made up of mountains of varying degrees of ruggedness; another third consists of rolling, hilly areas. Steppes and plains round out the picture, but there are far fewer true flatland areas than is common on Terra. Seismic activity is notably more common on Beowulf, with volcanoes a fairly typical part of any mountain chain and quake activity along fault lines somewhat more frequent than the Terran norm.

The planet has only two major continents, separated by a wide sea dotted with island archipelagos. The larger of the two land masses was dubbed Alicia and taken over by the British colony which first settled Beowulf. The French colony is located on the smaller, poorer, more rugged continent, which they have dubbed Europe Neuve. The islands between the two continents, rich in local food resources, have frequently been the subject of diplomatic negotiations and outright disputes; currently about 70 percent fall under British administration.

Beowulf is rather poor in mineral resources, although a few worthwhile mines have been opened in mountainous regions where large deposits of iron and other useful ores have been uncovered. Radioactives are uncommon, and no local sources of tantalum have yet been discovered. The primary wealth of Beowulf is in agriculture, for although Earth crops do not grow well, the planet's native produce is edible without even the need for vitamin supplements. Even more important than croplands are the pelagricultural industries; the harvesting of Beowulf's sea life has become a central facet of the economy of both colonies on the world.

The British colony on Alicia is rapidly developing industrial complexes to make Beowulf fully self-sufficient. Mineral ores brought down from the mining facilities on Nagling are already making these industries an important part of the colonial economy. Lacking the same in-system resources—the British are the only ones, so far, to mount a successful exploitation of the outer moon—the French colony on Europa Nueve has been forced to stick to agricultural resources and rely more heavily on imports to fill the need for manufactured goods.

Beowulf has a rich, robust ecosphere teeming with life. As with most Earthlike worlds, the planet has given rise to life forms that fall into two broad categories—the local analogs of plant and animal life. Beowulfian flora uses a cycle similar (but not identical) to photosynthesis, with complete adaptation to the extremely long days of the slowly rotating world. It is interesting to note that seasons are far less important to Beowulf's life forms than the diurnal cycle; many species of plants grow to maturity and release their seeds or spores between sunrise and sunset, while certain of the animals enter a state more closely akin to three weeks of hibernation than to sleep during the long planetary night.

Most plant forms are nonmotile, and most animal forms are mobile, just as on Earth. As on humankind's homeworld, though, it is not safe to make sweeping statements; the Angel's Web, which floats on a bag of hydrogen gas produced by electrolysis in ponds and streams and traps insects in its flight, bears far more similarity to Beowulf's plants than to its animals despite mobility and a carnivore's diet. On the other hand, various sea animals anchor themselves permanently to one spot on a reef and live by filtering smaller swimmers through their powerful pump-like mouths. The basic form taken by higher animals on both continents is loosely analogous to the Terran mammalian structure, with fur to regulate body heat, warm blood, and the bearing of live young typical. However, most of these animals also share characteristics of Earthly marsupials, and in almost every instance young Beowulfian carnivores live off blood or flesh from birth, while herbivorous types ingest a predigested pablum prepared by the parents. Most of these higher animals have six limbs.

There are several carnivores on both continents large and nasty enough to threaten humans. The Beowulfian Dragon-Bat is perhaps the most feared. Resembling neither a dragon nor a bat in any but the loosest sense, this animal is a large, furry, winged carnivore which lives in mountainous regions but will often extend its hunting flights over a hundred square kilometers or more. Though much larger than a man, it has hollow bones and a low body weight. Though capable of flight, it prefers to glide or ride updrafts and has little stamina for prolonged efforts. The Dragon-Bat has powerful teeth and sharp tearing claws plus a long, barbed tail which it uses with great effect in battle. Feared more because of their depredations to herds and fields than because of any direct threat to man, these beasts are occasionally known to attack humans, particularly when wounded. Other animals of interest include the Tusker, an omnivore about the size of a small elephant which is raised as a beast of burden and is sometimes used for food, and the Rangerunner, once described as a six-legged antelope. It is raised in small herds as a food source.

There is no sign of animals at the level of intelligence of Terran primates or dolphins, although persistent folklore claims that the Dragon-Bats are as smart *as* any dolphin that ever lived. Periodically, rumors surface from the French colony of sightings of a six-limbed beast walking on two rear legs and using well-developed hands to gather food from higher tree limbs. There are colonists who believe that these sightings are of an as-yet undiscovered life form that some say is sentient, or at least pre-sentient. Legends of the "Rousseau," as it has become known (after the French philosopher of that name, who extolled the virtues of life as a primitive savage) rival the 20th-century legends of Bigfoot in North America.

Life forms from Beowulf and Terra are mutually compatible; each find food from the other planet nourishing. Vitamin supplements, so important on many colony worlds, are not necessary on Beowulf.

THE BRITISH COLONY

British colonists were first to settle on Beowulf, and they quite naturally chose to develop the best of the two continents when they arrived. They named the continent Alicia, in honor of the Queen; the first large city (and capital until 2279 A.D.) was Aliceport. Later a new capital, named Heorot after the grand hall where Beowulf battled Grendel, was built to house the colonial government. The focal point of the colony is along the southeastern shore of the continent, where a narrow strip of coastal plains backed by mountains produces a lush sub-tropical environment. A few very small settlements have been set up elsewhere on the continent, but the majority of the colonists live in this area. The settlers are almost all of English stock, with a scattering of Irish, Scots, Canadian, and Australian. It is rare for non-British colonists to be admitted; Alicia is considered to be Britain's showcase colony world, and there is little room for outsiders in this outpost of the New British Empire. Settlement is encouraged by offers of large landholds and other incentives, and there is no shortage of volunteers for emigration to Beowulf even today.

The population (as of Britain's 2295 census of the colonies) is 25,859,600, and covers roughly 10,000 square kilometers of the planetary surface in a narrow line down the coast, plus the settlements—most of them of a temporary nature—in the islands between the two continents. The largest cities are Aliceport (pop. 3,879,000), Heorot (pop. 1,919,500), New Greemwich (pop. 1,450,250), and Spenceton (pop. 737,750). Most transportation on the surface of Beowulf is performed by sea or by air; large hydrofoil merchant ships ply the sealanes and jet passenger and cargo service is provided between most cities, even in the French colony. Land travel is usually difficult, limited to the slow-going all-terrain vehicles available. All four cities support a burgeoning industrial base, although most of the major factory production is carried out in orbit, where there is no chance of repeating past mistakes in environmental waste. Over 60 percent of the population lives in rural areas—scattered farms and ranches, or large floating "sea ranches"—that follow the migrations of Beowulfian sea life through the islands.

Although Government House and other administrative facilities are located at Heorot, Aliceport continues to be the primary port of entry for visitors from off-planet. An orbital catapult complex was completed there in 2267 A.D., but even though it is capable of handling most traffic, a small fleet of scram aircraft are still maintained for orbital interface as well. New Greenwich is the site of the University of Alicia, endowed there by the Duke of Alicia in 2288. The University also houses a branch of the Royal Society, which supports various exploratory and scientific endeavors on the planet and in nearby systems. Another site of considerable local interest is the museum that now stands where Sir George Spence, one of Britain's foremost explorers and discoverer of Crater (Henry's Star), built himself a frontier home after retiring from the Service. It stands in the heart of the city known as Spenceton.

Beowulf's two natural satellites are supplemented by numerous artificial ones. The British maintain a solar power station, a large orbital factory complex, and a defense installation (the latter connected to the orbital terminal). The terminal occupies a geostationary orbit over Aliceport. In addition to these manned stations, the British colony also controls a network of weather and communications satellites that provide coverage for most of the planet, even those areas that are not yet inhabited. A hydrogen road net connects the various towns, cities, and small communities of the mainland, while Aliceport serves duty as principle seaport as well as main spaceport by operating a large fleet of ocean-going vessels that maintain contact with the islands.

Alicia has been granted status as an Associate Member of the British Commonwealth. This means that it has more voice in internal affairs than the Crown Colonies (such as Crater) but is still dependent on Great Britain in most matters concerning foreign relations, external trade, and defense. An elected Governor is selected by the colonial population once every five years, subject to the approval of the Colonial Office on Earth. The Governor is supported by a Privy Council of 1 2 men and women plus other locally administered bureaucratic organizations. However, the British naval base and other elements of the planetary defense forces take their orders from the Flag Officer Commanding the Queen Alice's Star station, and there are restrictions in the types of interplanetary or intercolonial agreements the local government can validly negotiate. A planetary army and constabulary are answerable to the Governor, though, giving him some independence in a crisis.

Great Britain has sanctioned the creation of a Beowulfian *peerage.* Like the Irish peers of the 18th and 1 9th centuries, the noble titles and estates granted on Beowulf are largely honorary; they do not, for instance, confer a seat in the House of Lords. Such titles are used to honor British citizens (not necessarily limited to colonists on Beowulf) who have distinguished themselves in any of several fields of endeavor. One noble with a Beowulfian title, the Duke of Alicia, has been granted the same title in the peerage of Great Britain, and does have a seat in the Lords. Nobles generally have titular control over an estate comprising several landholds, but only those who actually choose to live on Beowulf have any real holdings of their own.

The British colony, lying along the coast of Alicia at roughly 25 degrees to 35 degrees south of the planetary equator, goes through fairly extreme changes in temperature over the long course of the planet's "days." The daytime high at Herot is generally close to 38 degrees C, although the effects of the ocean nearby do moderate this to a certain extent. Over the nearly 22 standard days of daylight there will be eight days of gradually increasing temperatures, then seven days when the temperatures are peaking at a level which is dangerous to humans working outside, followed by another eight days of declining temperatures until the planetary sunset. The middle week is a period in which little if any work outdoors is performed. Night sees a definite drop in temperature over a similar period; at its lowest, the temperature can dip below 10 degrees C. There is little in the way of seasonal variation, but terrain and exact latitude can adjust these figures.

Tides are a major factor on Beowulf. However, the slow rotational period of the planet makes tidal changes a very gradual process. The presence of three major tide-causing bodies—the star and two moons—makes for a complex interplay of forces that vary the high and low tide marks and times considerably. At high tide, many low-lying coastal and island areas are completely covered by water. The British colony is built on higher ground overlooking the coasts; port towns are protected by high sea walls, dikes, and locks that permit sea traffic to come and go in the protected harbor no matter what the outside water level may be. Many structures on the islands are either temporary in nature or watertight to allow them to be submerged safely. As a rule, tides do not "rush in"; the water rises in a slow and stately manner under the pull of various outside forces and ebbs out just as slowly. The normal occurrence of high tide comes once every eight days (tied to

Hrunting's 15.76-day period), but the positions of the sun and of Nagling can significantly effect the height of the tides for good or ill.

THE FRENCH COLONY

The French arrived on Beowulf 18 years after the British in 2196 A.D. Their colonization effort was far less intensive than that of the British on Alicia, moreso because of the region they were forced to settle in, the smaller continent they named Europe Neuve, was of far less exploitable value. After just over a century, their population (from the French Empire's 2299 census) stood at 14,886,450. This much smaller population is actually spread over a somewhat larger area, due to the relative infertility of the region in which the settlers found themselves. The capital and sole large city of the French colony is Devereaux, named for the leader of the first colonial expedition. It has a population of over four million, making it larger than Aliceport. The remaining population is scattered in smaller towns and farming communities over an area of roughly 13000 square kilometers. Like the British, the French are mostly found along the coast of the continent; the interior is untamed and largely unexplored. A large scientific facility has been established in the rugged hinterlands to investigate a number of interesting life forms and natural phenomena.

The French maintain several small orbital facilities, including a solar power satellite, a space terminal, and a small defense installation. Interface with orbit is accomplished by scram aircraft; proposals to build a catapult system have so far been shelved due to lack of funds. Unlike the British, the French have no commitments on either moon, and surface-to-orbit traffic is strictly limited to contact with interstellar vessels.

Europe Neuve, like most other French colonies, is governed by representatives of the French Colonial Administration. Locals hold the various offices which govern the colony but are answerable to Paris on all major matters. A colonial advisory board made up of the Commandant of the Orbital Defense Installation, the Director of the Science Council, and several experts on governmental and colonial affairs appointed by the Imperial Government back up the locals. Though theoretically answerable to the colonial government, these advisors often control the administration, rather than the other way around.

The administration maintains a militia force, the Gendarmes d'Europe Neuve, a body with both police and paramilitary training used for dealing with a broad rage of emergencies. The number of Gendarmes has risen to all-time highs recently, as disputes with the British colonists have become more and more common.

If anything, temperatures in the French region are harsher than in Alicia. The main French colonies lie closer to the equator and so suffer from greater heat during the day. Another problem they must contend with is monsoon-type rains; storms brew over the open ocean and hit the exposed French colony with long periods of wet, muggy weather. Tidal effects, of course, are much the same on the French coast, but once again the British have an easier time of it—much of the Europe Neuve coastline lies lower than the comparable British lands, requiring a greater investment to create sea walls that can protect the settlements. Recently, *France* has been looking into the possibility of introducing rice crops to take advantage of the local conditions; rice is one of the few crops that might adapt fairly readily to Beowulf's unusual climate and conditions.

Of some concern in recent times is the escalation of tension between the two colonies on Beowulf. Most of this hinges on the issue of claims to the island regions and fishing rights therein. With pelagriculture a major part of the economy in each colony, rights to exploit the shallow archipelago grazing grounds in which the largest amount of undersea can be found are of vital importance. The French have been excluded from many of the choicest areas by prior British claims, even though some of these areas are not actively exploited by Alicia. With their long history of being forced to accept second best, the French colonists have been growing increasingly restive. Three separate commissions sent out by the ESA have failed to resolve matters, and a number of incidents have flared up in which French vessels have intruded into British-claimed waters to harvest sea life illegally. On at least five occasions, British and French groups have exchanged small arms fire, and the French colony has been actively mobilizing militia to defend disputed claims from similar British incursions. Though the matter is unlikely to threaten relations between the principles on either side, local disturbances can be expected to grow even more violent.

ADVENTURE POSSIBILITIES

Beowulf offers a number of interesting adventure opportunities. Most significant is the growing friction between the two colonies; adventurers might easily find themselves drawn into a conflict on one side or the other, or even caught in the middle as a result of local suspicions and hatreds. The French militia is almost certain to be interested in recruiting mercenaries to train their troops, while the British are apt to look for troubleshooters to help them settle individual crises in a more subtle fashion.

The planet, despite its old and fairly large colonies, is still largely unexplored. Scientific expeditions are mounted from both colonies to study the flora, fauna, and planetology of the planet. The French would be particularly interested in finding proof of the "Rousseau" sightings; such a find on the French continent would definitely lead to a greater investment in their colony by scientific bodies at home. The archaeological find on Hrunting is another point of great interest to scientific experts from Earth.

KIMANJANO DM+ 34 2342

Kimanjano I lies at a major nexus of the French Arm. Cargoes entering or leaving Beta Canum Venaticorum pass through the Kimanjano system. For this reason alone the planet would have become a center of mercantile activity. However, it has gained notoriety for its extremely cheap polycarbon products as well. From key constituents of many drugs to raw materials for plastics and resins, Kimanjano offers a wide variety of cheap, abundant supplies. The combination of readily available resources and a key position within the Arm has given rise to a large and thriving trade economy.

SYSTEM DATA

The central sun of the system has been the recipient of more scrutiny than any other star in the French Arm. Evidence found on Dedre, Kimanjano's moon, and Tanburg, the second planet, as well as on the other moons, suggests that, some half a billion years ago, the sun flared, temporarily doubling its normal output. Much of the surfaces of these worlds literally melted. Indications are that the flare only lasted a few hours, and there are no other records of abnormalities in the intervening period. Solar observations have been positioned in near orbit in hopes of learning the cause of this irregularity, which would spell certain doom for the colony if it recurred, but the star appears to be perfectly normal.

The primary is .932 the radius of Sol, but being an older main sequence star, it is cooler. It has about .82 the mass of Sol, but outputs only .42 the luminosity. This all fits well within the standard range for a K4 star. It shows no unusual or aberrant flare or prominence activity. Its 38 year sunspot cycle is typical for stars of its age and composition. No factor can be found to explain its sudden flare. Some theories postulate the close approach of a rogue brown dwarf which caused the flare, but the orbits of the planets would have been disturbed by such an event. One popular theory suggests the impact of a quantum black hole. However, this is not substantiated by any observable wobble in orbit or loss of angular momentum.

The rest of the solar system exhibits the normality manifested by its sun. The planets all lie within .5 degrees of the ecliptic plane. There are a number of short period comets, as well as extremely long period ones. The lack of median period cometary material has been attributed to the flare. The outer Oort cloud, a spherical cloud of material left over from the formation of the solar system, is unusually sparse. This has led to some speculation of recurrent solar flare depleting it by boil-off, but this has not been confirmed.

Of the eight planets in-system, only two are terrestrials—that is to say, composed predominantly of rock and metals. These are Kimanjano and the second planet, Tamburg. Tamburg is 5280 miles in diameter and has a rocky core. Its thin atmosphere is largely carbon dioxide, though traces of neon and argon are also present. It orbits at a distance of 181 million kilometers, just beyond the life zone. There are indications that liquid water may have once been present though it has long since evaporated. Its two polar caps consist of carbon dioxide ice. The surface is primarily basaltic. Resource scans have indicated useful amounts of iron, manganese, and other industrial metals, but the cost of acquiring them has been deemed too excessive. Tamburg has no moons.

The other planets of the system are gas giants. The collection is typical, all having rings of collected material and hosting at least two major moons and a number of asteroidal bodies. They are, in order outward, Setanne, Nivith, Roubaix, and Lyth. The largest, Setanne, is 98,000 kilometers in diameter, slightly smaller than Jupiter. The smallest, Lyth, is a little more than 44,000 kilometers in diameter. All sport massive radiation belts, although Lyth's is only about one-tenth as strong as currently accepted theory allows. Research is ongoing as to the reason behind the anomaly; an automated station has been set up on the inner moon for this purpose. It is visited periodically by researchers to calibrate instruments and collect readings. So far, studies indicate Lyth's core is unusually lacking in metallic content. This condition, combined with a slow rotation (about 28.5 hours), seems to be the principle cause for its modest radiation belts. Setanne and Nivith radiate in the infrared, indicating internal heat production that is common in this size range. Their heat production is probably due to the "helium raindrop" effect which powers so many radiating gas giants. No direct internal observations have been made of any of these planets, as they seem to fit well within our basic understanding of such worlds. Some surprises may still await further observation, however.

PLANETARY DATA

Kimanjano is the innermost of six planets circling a K4 main sequence star. Its orbit has an eccentricity of 0.031, making it the most circular of the system's orbits, and is inclined 0.26 degrees to the ecliptic. Its orbital radius is 100.062 million kilometers, well within its star's life zone, though slightly farther out than optimum. The planet itself has a axial tilt of 21 degrees, making seasonal variation generally less severe than on Earth. Its day is 35 hours, 17 minutes long. With a diameter of 12,043 kilometers, the core is molten, leading to a tectonically active world with 18 known tectonic plates, numerous active volcanoes and several unstable fault lines, some discovered only after initial colony site selection had been completed. The atmosphere is largely inert gases with a breathable percentage of oxygen and an abundance of methane, especially at lower altitudes. The hydrosphere covers about 87 percent of the globe, much of it in shallow, soupy seas containing high percentages of organic compounds. These compounds are responsible for the breathable oxygen in residence. Kimanjano is accompanied by a single large moon, roughly 1263 kilometers in diameter and having a mean orbital period of 23 days. The molten core provides a significant Van Allen radiation belt which surrounds the world. Although modern starships can easily endure passage through such fields, they are of sufficient intensity that certain convenient orbits, especially geocentric ones, are prohibited for permanently manned facilities. As a result, meteorological and communications satellites are automated, like the two Colonial Solar Power Grids. These facilities are visited periodically for maintenance purposes.

HISTORY

The Kimanjano system was initially surveyed by the French Exploration Cruiser *Regulas.* As was customary for such surveys, the *Regulas* first stopped in the Oort cloud to gather samples of the original solar nebula which formed this system. It was at this time that the first evidence was discovered of Kimanjano's superflare. Many of the larger masses visited displayed definite signs of surface melting and refreezing. Such surface faults and stratifications are normally observed in periodic comets but not on masses stably orbiting six billion kilometers from their primary. These observations gave rise to speculation about a long-term companion star, but gravitational analysis of the system negated such a possibility.

The cometary material also showed definite signs of carbon compounds and plentiful hydrogen. Both were good signs for the possibility of life in the inner solar system. *Regulas* proceeded inward, its telescopic arrays scanning each world on its flight path.

At periastron survey probes were dispatched into parabolic

transfer orbits to Tamburg and Setanne. The telescopes and spectrometers were then trained on Kimanjano in order to determine any irregularities. An unstable star would have immediately disqualified the system from colonization.

The *Regulas* used the gravity of Kimanjano to set course for Kimanjano I and shortly established polar orbit around that world. The planet was brown and blue beneath its veneer of white water-vapor clouds. Absorption spectra taken during the first orbit indicated the presence of ozone in the upper atmosphere. Radio occultation experiments proved the presence of molecular oxygen in the atmosphere. All signs pointed toward some form of life on Kimanjano I. As soon as the obligatory mapping orbits were complete, the captain ordered surface and atmospheric probes to be launched.

The initial probes were dispatched to the shallow seas and lowlands. Atmospheric probes floated above the highlands, sniffing the upper atmosphere. All probes reported that no life of any kind existed on Kimanjano I, much to the surprise of the survey crew. The presence of molecular oxygen had been, up to this time, a certain sign of metabolic activity. A landing boat was dropped to investigate the seemingly contradictory information.

The enigma of Kimanjano I's free oxygen was resolved rather quickly. The planet's oceans were teeming with complex amino acids. Chain molecules resembling RNA and other sophisticated organic compounds were in abundance. Some of the most prevalent of these compounds broke down ocean water, liberating oxygen in the process of various reactions. Still others utilized the oxygen and hydrogen from these reactions in yet other reactions. Some oxygen remained in the atmosphere, however, having bubbled into the open air.

The oceans were fatally poisonous to humans. The air of the lowlands reeked of methane, but the uplands were livable, if a bit cool. The survey team's report was favorable for further investigation. Kimanjano I held unique opportunities to observe complex organic chemistry in action. The planet was a prebiotic treasure house—a unique discovery. So despite the poisons, less than two years later a scientific outpost was grounded in the lowlands of one of the equatorial continents, funded and staffed by the Institut des Etudes Exobiologiques.

The I.E.E., which at the time was enjoying considerable political and economic favor, had established a large research base staffed with experts on organic chemistry and evolutionary biology. Their hope was to chronicle the basic developments that led to life. This hope was quickly submerged among a variety of perplexing and contradictory discoveries.

The most disturbing of these revelations was the Phreds. These were masses of gelatinous material which oozed onto the surface from the shallow seas and travelled at random along the coastal rocks. These blobs, some of which measured as much as two meters in diameter, gained minerals needed to sustain themselves among the rocks of the coast. They were not, in the strictest sense, alive, though definitions were beginning to cloud. The Phreds (named by a junior research assistant) did not exhibit differentiation within their structure or many other aspects of "life," though they did replicate through division. They were only the first of many such borderline cases.

The self-replicating blobs were not the only surprises. Early on, several new compounds had been discovered, some unreproducible in the laboratory. A few of these held promise as key ingredients in medicinal products. Combinations and processes that had been only theorized before were showing up in mass quantities beneath the researchers' microscopes. There seemed an endless list of basic discoveries to be made upon this world.

Part of the job of the research team was to thoroughly map the planet for resources. This was not normally part of the I.E.E's duties, but as the agency in charge of the world, it fell to them nonetheless. Detailed orbital surveys were conducted in the winter of 2227 which would effect the planet's development for years to come.

These scans clearly showed the presence of tantalum deposits in the uplands of the equatorial continent occupied by the I.E.E. outpost, but these reports to the public were suppressed to protect the world from commercialization.

Under the watchful gaze of the new Colonial Governess, mining operations began in 2231. The original colony site at Fromme was selected for accessibility to the tantalum deposits, little thought given to the I.E.E. outpost almost 2000 kilometers away. Several politicians had made their reputations on their quick establishment of this mining colony. Other considerations were secondary to its ability to quickly produce the tantalum France so desperately needed to maintain its interstellar fleets.

The I.E.E. base had to eventually relocate closer to the colony. The move necessitated an 18-week cessation in the I.E.E. programs. In the interim, which also saw the installation of a new project director, plans were laid for the second phase of research-one which would emphasize the practical benefits of Kimanjano's unique chemical properties. The new director was very much not in political favor in France, and he was determined to save the reputation of the I.E.E. single-handedly if need be. What he actually did saved much more than that.

The first five years of tantalum extraction went more-or-less uneventfully. Periodic reports indicating the vein was not as significant as previously believed were viewed with extreme disfavor by the Governess, who held them to be a minority opinion. When the quotas began to fall below expected levels, she ordered her staff to investigate.

Efforts were made to discover other tantalum deposits on-world, but to no avail. Other far less valuable minerals were targeted for mining, but estimates indicated that these operations would not be financially viable.

By this time, the I.E.E. had determined that certain properties

of the polycarbon soup that was a majority of the shallow seas of the planet was ideal for the manufacture of plastics and resins. Combined with the medical applications of certain compounds, this process was determined to be sufficiently profitable to maintain the colony work force at a somewhat reduced level of expansion.

With the tantalum mine slowly weakening in production, the colony began adapting equipment to the task of collecting and refining the organic soup. Initially, the only materials available were from the sections of the mine works that were shut down. These components were adapted into platforms which could be constructed on the seabeds, and eventually became the mainstay of the extraction effort.

The first successful drugs distilled from Kimanjano I's organics began appearing two years later. By this time it was becoming obvious that Beta Canum would one day be the Arm's breadbasket, and Kimanjano would be on the route in and out. Commercial concerns began to invest in Kimanjano hoping to take advantage of the burgeoning trade situation. Still others, intent on exploitation of the biochemical bonanza the planet offered, soon followed suit.

Sixty years after the initial French colonization, long after the planet was established as a production and trade center, Azania decided to establish a colony there. It seemed a perfect opportunity to settle on a world guaranteed to show profit. Their effort has been eased greatly by the presence of the prosperous French colony, allowing them to gradually build their facilities while purchasing needed supplies from outside. They have imitated the French economic markets without French protest. There is, after all, enough for everyone.

Today, the French government on Kimanjano is close to total autonomy. It still regards itself as French but is acutely aware of the mistakes possible when governing from light-years away. The government is pragmatic in its obedience to Earth's sometimes unrealistic demands. Fortunately, the prosperity of the colony is sufficient for France to allow a certain degree of freedom. Politics are underplayed—no one wishing to be accused of making similar mistakes as those who initially founded the colony. The I.E.E., now know as the I.E.X., still has large research facilities on world, now much more conveniently located. Research on complex organic chemistry continues in many untouched sections of the planet.

The two colonies on Kimanjano I reflect the eras in which they were founded. The French colony, established in 2231, was typical of designs of the period. The principal colony facilities, such as the medical center, logistical support, water purification and electrical power production, were located in a semi-submerged dome. Livestock pens, colonist dwellings, and equipment storage were ringed around the dome. The entire complex was then surrounded by defenses, which have since been dismantled. Today the French site looks quite different. Manufacturing and administrative complexes have circled the original site to the west, while new residential districts, research and service-based industries have grown up to the east and into the hills in the southeast. The spaceport occupies the northern quadrant. There is still an overall feeling of the original order and logic of design present, however. In contrast, the Azanian site is a study in inspired anarchy. Very much the latecomers, the Azanians only settled in 2280. Their colony consists of standardized, commercially purchased modular units. These have been set down with apparently no order, scattered over a 20-square-mile region roughly surrounding a small bay. Central power is provided by a rectenna to the north of the colony and beamed in at low frequency. There is a landing strip just beside the bay.

Azanian presence is mainly felt in the oceans, where their floating processors are busy collecting and refining the rich organic soup that comprises much of the planet's water. In contrast to the randomness of their colony, these facilities are compact and efficient, utilizing fission plants that allow them to stay out on their missions for a year or more before servicing. They are supplied by large Heliostats which call periodically, transferring their processed distillates to the main spaceport. In this way the Azanians have avoided many of the problems encountered by the reliance on fixed platforms and undersea pipelines used by the French.

Transportation between the colonies is handled mainly by air, though hovercraft have started running recently, and a maglev train track is currently under construction. Within the colonies, a diversity of transport modes are used. The French have installed a sophisticated computer controlled mass transit system. Small vehicles travel on superconducting guideways, stopping at stations depending upon passenger destination. This network serves the main colony as well as the industrial park, spaceport, and the French Foreign Legion outpost. The Azanians seem to prefer small V/TOL aircraft and hover vehicles for getting around. Large cargo operations are handled by Mega-Lifter Blimps. There is also a much greater reliance on foot power in the Azanian colony.

Crop production is one area in which the two colonies are identical. Both use processes developed on the space colonies orbiting Earth for extreme high-yield, low maintenance agriculture. The strains of wheat and rice have been tailored to Kimanjano's mild environment, *as* have the fruits and vegetables. They are tended largely by agribots which are supervised by specialists. Animal husbandry is handled similarly. The French have been totally independent of the need to import food for some time, while the Azanians are still buying some items from the French. They estimate another five years before they attain total independence, though some observers say they simply are not interested enough in agriculture to *ever* be totally self-sustaining.

Of prime importance to both colonies is orbital starship facility. The primary structure is once again an artifact of early French colonial policy which dictated the presence of orbital support stations for any colony. The original core is a flattened sphere which spins on its short axis, providing a .5 G centripetal force at its rim. Shuttle and starship handling bays are attached to the rotation axis. The station is oriented with the axis always pointing toward the center of Kimanjano. Planetward docking bays service shuttles, while spaceward facilities service the starships. Each of these long, faceted cylinders have been extended several times to keep up with the increased demands for access to Kimanjano and its resources. An independent yard for overhauling starships has been constructed a few kilometers away from the main station, and satellite terminals, linked by orbital ferries, are being considered for the near future. The Foreign Legion maintains a small defense cadre for the purposes of customs inspection and maintenance of biological quarantine procedures. They also operate remote fighter installations at undisclosed locations elsewhere in the system. The crews for those duty stations rotate through the orbital port on a regular basis.

The Orbital Station is a prosperous free port, offering goods from the entire French Arm at duty-free rates. This incentive serves to lure most starship crews in, even if they had only intended to use Kimanjano as a convenient stutterwarp discharge point. Numerous freight companies have located their main colonial offices at the port or on the the world beneath.

Kimanjano I has a population of over 6,417,000 French citizens, located either at the main colony site or at the new city of LaTrove, 60 kilometers to the east. The Azanian population measures about 628,000 people. In addition to these there is a transient population

of 40,000 to 60,000 at the various research and mercantile facilities. Thirty percent of the French colony's troops are natives. This percentage is fixed, it but can vary a total of plus or minus 5 percent.

Kimanjano I's unique organic chemicals account for 27 percent of the total plastic and polycarbon product sales in the French Arm. The biomedical applications of these materials have been firmly ensconced in modern medicinal manufacture and account for some 12 percent of the total raw materials used to produce Pharmaceuticals in this area of the Arm.

Kimanjano I is a successful, thriving environment, full of opportunity for commercial gain. Its political and corporate scene is complex and ever changing. It provides an abundance of opportunity for businessmen and free traders alike.

BETA CANUM VENATICORUM

Beta Canum Venaticorum

There is a lot to be said about Beta Canum Venaticorum-4. At nearly 100 years of age, its colonies are older than 75 percent of Earth's other colonies and outposts, and the years have given the colonies of Beta Canum (as the world is usually called) much time to grow and to develop diverse cultures and economies.

SYSTEM DATA

The star Beta Canum Venaticorum lies 29.9 light years from Sol on a straight line, but actual distance travelled by human ships is 41.8 light years, as they voyage from star to star along the French Arm. The star is very similar to Earth's, being just slightly larger, hotter, and brighter.

There are eight planets in the system. The common usage when discussing the system is to simply refer to them as Beta Canum-1 through -8. Planets 1 to 3 all lie short of their star's life zone; planet 4 lies at exactly optimum distance within the life zone; and planets 5 to 8 all lie considerably outside of it.

Both Beta Canum-1 and -2 are actually twin world systems. That is, Beta Canum-1 is officially listed as a 5000-kilometer diameter rocky core world with a ring and a 4000-kilometer diameter satellite—in actuality, the world and its satellite are so close to the same size and mass that they both orbit a point fixed between them. Beta Canum-2 is a little larger at 6000 kilometers, but it also has a 4000 kilometer satellite. Beta Canum-1 and its twin orbit their star at 0.2 AU, while Beta Canum-2 and its twin orbit at 0.3 AU.

Beta Canum-3 is 19,000 kilometers in diameter. It is a hothouse world with a dense atmosphere and no free-standing water. Surface gravity is 1.3 g. The world has no satellites.

Beta Canum-4, the stellar system's garden world, is described in detail below.

Beta Canum-5, -6, and -7 are icy core worlds with very little gravity or atmosphere. Beta Canum-5 is 4000 kilometers in diameter and orbits its star at 2.27 AU; Beta Canum-6 has a diameter of 7000 kilometers and an orbital distance of 8.16 AU; and Beta Canum-7 orbits at 12.25 AU and has a diameter of 4000 kilometers. None of these worlds have satellites.

Beta Canum-8, the last world in the system, orbits its star at 15.92 AU and has a diameter of 16,000 kilometers, making it the second largest planet in the system. This small giant (or gas midget) holds four satellites captive as well as a ring. In order, progressing from the planet's surface, they are: a 4000-kilometer diameter water and ice ball at 1 6,000-kilometer orbit (gravitational stress keeps much of the planet's water in liquid form), a 100-kilometer diameter rock at 32,000 kilometers, a ring at 90,000 kilometers, a 5000-kilometer diameter rock at 112,000-kilometer orbit, and a 2000-kilometer ice ball at 1,760,000-kilometer orbit.

PLANETARY DATA

Beta Canum Venaticorum-4 is, as the name indicates, the fourth satellite of the star Beta Canum Venaticorum. It is usually called simply Beta Canum by outsiders, since there is little chance of confusing it with any other planet as it is the only garden world and, indeed, the only planet of any real interest in the system. Natives of the world usually call it "BC" among themselves, a decades-old, ironic reference to the primitive conditions that many of its rural inhabitants have to deal with.

Beta Canum has an orbital distance of 1.13 AU from its star and therefore falls at exactly the optimum distance for that star's life zone. It has a diameter of 12,000 kilometers, a density of 1, and a mass of 0.82. The planet has a rotational period of 20.4 hours and orbits its star once every 407.9 days, which translates into 346.8 Terran days, or just under one Terran year.

Beta Canum's gravity is 0.94 G, just enough lighter than standard that visitors feel a pleasurable weight loss without any problems of imbalance, exaggerated motion, or the like. Its atmosphere is classified as dense, having a surface pressure of 0.92 atm., and it includes a mix of 77 percent nitrogen, 1 9 percent oxygen, 2 percent argon, and 1 percent trace gases. Thus, although the atmospheric pressure is slightly less than Earth's, atmospheric oxygen is also slightly higher, yielding an atmosphere almost ideally suited for humankind. On a related note, Beta Canum's sky is a very clear, royal blue.

Sixty percent of the world's surface is covered by saltwater oceans. The remaining 40 percent is divided into four major continents, a handful of very large islands, and a multitude of smaller ones. Of the four continents, one covers the planet's southern pole. The other three lie largely within the temperate and torrid zones. Native life abounds on these latter three and within the oceans.

Beta Canum's axial tilt is just under 19 degrees, causing the planet to have much larger polar regions than Earth, but making seasonal temperature variations less on the planet as a whole. Weather patterns on Beta Canum are much milder than on Earth as well. Average temperature is a very comfortable 25 degrees K.

The southernmost continent lies nearly entirely within the southern polar region, and as a consequence, experiences continual cold. Near the coasts, snowfall is a frequent occurrence.

The easternmost continent spans an area from the borders of the northern polar region to the borders of the southern. Vast mountain ranges stretch along both of these borders, however, and the bulk of the continent is a tableland stretching between these two major ranges. On the polar faces of both groups of mountains, snowfall is almost constant. The tableland between them is consequently somewhat drier than other areas of the planet, and the fact that it is higher in altitude means that temperatures are somewhat cooler as well.

Nearly half of the westernmost continent is a mountainous tract lying within Beta Canum's northern polar zone. The combination of latitude and altitude make this some of the planet's coldest terrain. This continent's southern half is much more hospitable, being somewhat warmer than the easternmost continent and receiving a more regular rainfall as well, particularly on the central eastern coastline.

Between these eastern and western continents lies another, somewhat smaller sibling. It rests entirely within Beta Canum's temperate and torrid zones. Also, it is much lower in altitude than its companions, and its mountains are older and more worn. Rainfall over the majority of this land mass is very heavy, averaging 1500 to 2000 millimeters of rain per year. Temperatures here average 30 degrees K.

Life forms are abundant on Beta Canum, but as on Earth, they vary greatly from continent to continent. The oceans also teem with life, both plant and animal, although only a very small percentage of types has been catalogued to date. Two general statements can be made about Beta Canum life forms: (1) Plant life on the planet is very similar in function to Terran plant life, although form is usually very different, and (2) The dominant pattern for animal life, although warm-blooded and viviparous, is much closer to Terran reptiles than to Terran mammals (the closest Terran parallel would actually be some of the later dinosaurs).

One of the most important differences between Terran life forms and those indigenous to Beta Canum lies in the natural selection

of amino acids. All of Beta Canum's life developed utilizing dextro amino acids (right-handed) versus the terrestrial choice of levo amino acids (left-handed). What this means is that terrestrial life (including humans) can derive no nutrition from the ingestion of any of Beta Canum's forms, and vice-versa. If either form does ingest some of the other, the body's enzymes get tied up in the attempt to break down the food, but are unable to. If this continues, the body cannot get the amino acids required and the result is malnutrition (leading to death, if the diet continues). The most insidious aspect of this scenario is that one can die of starvation on a full stomach! It is not uncommon for terrestrial pets which escape and run wild to die in this manner.

Though there is no nutrition to be derived from Beta Canum's life, some forms are quite tasty to humans and are safe (even if useless, once beyond the taste buds) if consumed on an infrequent or moderate basis. One of Beta Canum's more popular exports is its spices. These can be used simply to enhance the flavor of a food, while passing through the body reasonably harmlessly. Some have even tried dieting by balancing their intake with a portion of levo-based food, though this method is not free of ill-effects.

The one exception to this rule involves Beta Canum's "insects," which have demonstrated some ability to adapt themselves to Terran ecosystems, given sufficient time (usually a few decades). If handled carefully, they could be a useful tool in adapting Beta Canum to human needs. On the other hand, they could also become a rampant plague upon human agriculture on the planet, as has already happened once during the grain blights of 2268 to 2271.

Other generalizations that can be made about native life on Beta Canum involve a categorization of life by continent. It has already been stated that Beta Canum's oceans teem with life. What few lifeforms exist on the southern continent are all oriented to this aquatic environment as well. The southern continent serves primarily as a breeding ground for these creatures, but they spend the majority of their lives in the seas. The eastern continent sports a profusion of herbivorous and omnivorous creatures that live within its vast grasslands and numerous small forests, but there are very few true carnivores here, and most creatures on this continent are smaller than a Terran iguana. The western continent is, again, the home to numerous types of herbivores, including a shaggy creature something like a woolly Terran ornithomimus. Carnivores are scarce here as well, the most recognized being a fanged monstrosity the size of a Terran pony, which patrols the northern coasts and mountains hunting amphibian game that comes here to breed. Miners in this region have named this creature "banshee" after its chilling cries and its ferocity. The central continent has the greatest number of different plant and animal types, and the most exotic as well. Much of the continent is covered by jungle, and most of its creatures are benign herbivores, although there are scores of types of carnivores as well.

Beta Canum offers several valuable resources to humanity. Its rugged mountain ranges, particularly on the northern half of the eastern continent, hold rich deposits of metal mineral ores. There has even been some tantalum discovered in the eastern continent's mountains, although deposits have been very small to this point.

With its comfortable weather and gravity, together with its scenic beauty, Beta Canum is also a famous vacation spot. Besides the appeal of many of the cities on the mainlands, tourist resorts have been developed on a few of the major islands as well. Greenford, a center of tourism on the large island just off the western arm of the central continent, has enjoyed particular success.

But perhaps most importantly, as the vast tracts of sunny land on the eastern and western continents are being adapted to Terran agriculture, Beta Canum is becoming increasingly more important as an exporter of food along the French Arm. It is estimated that by the year 2350, 70 percent of the foodstuffs shipped on the French Arm will originate from Beta Canum. This figure may be somewhat misleading, *as* many of the other colony worlds in this region of space are agriculturally self-supporting, so nowhere near 70 percent of the food *consumed* along the French Arm will originate from Beta Canum, but the statistic demonstrates nonetheless that agriculture will be a very important resource for Beta Canum in the foreseeable future.

COLONIAL HISTORY

The Beta Canum Venaticorum system was first visited by human starships in 2181. These were French starships exploring under the auspices of the European Space Agency. From 2182 until 2202, detailed surveys of the system were performed by a research team from Das Astronomischen Rechen-Institut. The other seven planets in the system were found to hold too little in the way of needed resources to make further study worth the effort; most effort was spent on the study of Beta Canum Venaticorum-4, which looked to be a real treasure. They established their base of operations on the northernmost tip of Beta Canum's southern continent.

To these early explorers, Beta Canum-4 must have appeared to be a paradise much as the Hawaiian Islands of Earth appeared to Captain Cook in 1 778. Only the fact that, due to incompatible biochemistries, Beta Canumite organisms could not serve as food for Terrans cast any blemish upon the appearance of paradise. And even that had a beneficial side, as it meant that Beta Canumite microorganisms were unable to live in the human body—humans need not fear native diseases.

Three years later, in 2205, the French began a major colonization effort on the eastern continent, followed two years later by a Bavarian colony on the western continent and a more modest British settlement on the middle continent. The French intended to adapt their land to agriculture; the Bavarians, once they had a viable colony going, intended to process ores; and the British simply wanted to establish themselves as a link in the world's developing economic chain—they concentrated on service

industries such as transportation, and on the export of rare and beautiful plants and animals from the middle continent's jungles.

In 2240, the Bavarians, who had been actively mining since 2211, discovered small, scattered tantalum deposits. Immigration ballooned in what was subsequently called "the Tantalum Boom." In the space of just a couple of decades, immigration more than doubled the existing population on Beta Canum.

In 2261, the Pentapods, first contacted by humans in 2251 at DM+ 27 28217, requested to build an enclave on Beta Canum's western continent's western shore. That request was quickly approved by all ESA governments, in the desire to establish stronger ties with this strange race of bio-engineers. Constructed as a warren of rooms and corridors that extends for kilometers in every direction, some of its rooms lie underwater; others are in towers which rise above the waves; still others are awash with the ocean flowing through them. Pentapods, being amphibians, are equally at home in all three environments. Humans gain greater respect from the Pentapods by braving the wet rooms when dealing with the aliens.

In 2268, the Beta Grain Blight began. It raged across all three colonized continents in the next few years until it was halted in 2270 by a pentapod-produced lichen later called "Terraban." But with the crisis behind them, colonists began taking sides along national lines making all sorts of accusations about the cause of the blight. One rumor has been that one nation or another had the Pentapods create the blight in the first place, only to be called upon to end it later.

The French began work on a beanstalk on their colony in 2272. It was interrupted 10 years later by France's involvement in the Central Asian War on Earth, and full efforts to finish it were not begun again until 2289. The beanstalk was finally completed in 2291.

In 2293, due to the War of German Reunification on Earth, Beta Canum's Bavarian colonists found themselves no longer members of the ESA. Tensions between French and Bavarian—now German—colonists escalated, especially when German employees of the Bavarian firm that designed the beanstalk were laid off. Later, when a number of beanstalk capsules came loose and fell to their destruction, the French claimed it was the work of German saboteurs; the Germans claimed it was French incompetence.

Over the last six years from 2294 until 2300, tensions have continued to escalate. Beta Canum's French colonists have grown more ethnocentric and its German colonists have grown more belligerent. The fact that the Kafer War has been raging further out along the French Arm has done nothing to soothe Beta Canum's troubled waters.

COLONIAL LIFE

Initial ESA personnel assigned to oversee development of Beta Canum Venaticorum-4 had a very business-like turn of mind. No imaginative names were invented for the planets of the system, and the fourth planet's three major continents were simply divided among the three main members of ESA: France, Britain, and Bavaria. In ESA files, the three colonies were called simply the French, British, and Bavarian colonies, and the continents the French, British, and Bavarian continents. Over the course of the years, these names stuck—with the one change from Bavarian Continent to German Continent in 2293. Names of local cities and regions are, of course, much more imaginative, as they were devised by the colonists themselves.

Antipathy between the French and German colonists has already been mentioned. Caught between these two, the British colonists continue to work at making themselves an essential link in the world economy as a whole. With feuding neighbors to either side, this is often a very difficult task to perform.

As all three colonies began from a common effort, some generalities can still be made about Beta Canumite society as a whole. First, it was determined early on that the local year should be divided into weeks of eight local days. This gives a year of almost exactly 51 weeks, close to Earth's 52. The usual workday is 10 hours long, with the remaining 10.4 hours for rest and recreation, and most office and agricultural workers spend five of a week's eight days on the job. Among blue collar workers in many industries a practice of having two work crews per job is becoming increasingly more common—one crew works the first four days of the week and takes the next four off; the second crew rests the days the first crew works and works while it rests.

All three colonies depend upon tourism for a major portion of their yearly income, and all maintain facilities for taking their visitors to and from space. The French colony's beanstalk takes most other commodities to and from orbit, and it has been gaining popularity as an interface method for tourists as well, yielding a progressively larger share of the tourism pie to the French colony. In the face of this, the German colony has maintained extensive catapult facilities for non-fragile commodities, and it is revamping its spaceplane facilities as well. The British colony, with its extensive airfilm train lines, profits best when trade between the other colonies is frequent, and as a consequence, it has been investing much of its energy into diplomatic efforts in an effort to reduce intercolonial tensions.

There is one other generalization to be made about all three colonies: There is a marked difference between urban and rural populations. In general, urban members live much like their counterparts on Earth. Advanced technology surrounds them on all sides, Earth's art and culture are very important, and politics is a common topic of discussion. Among rural dwellers, however, life is slower, the colonies' parent governments are more removed, and political feuds are less important. In these people's minds, they are less a colonial citizen of whatever parent nation and more a Beta Canumite. They form their own local governments as needed and often make their own justice.

MAJOR POINTS OF INTEREST

Major spots to see when visiting Beta Canum Venaticorum-4 are the beanstalk (especially its space facility), the pentapod enclave, the French Continent's capital city of Premiere, the British colony's tourist city of Greenford (on the northern island between the French and British continents), the German Continent's capital city of Uethen and its Handschuheim University, and the ESA city of Adrian on the southern continent—a tribute to mankind's finest achievements in art and science.

For more information about Beta Canum, consult the module *Beanstalk.*

CRATER

Henry's Star

Not all colony worlds are approximately Earthlike in their makeup and conditions, as Crater is a marvelous example. Some worlds are only habitable by a stroke of luck after one of nature's more spectacular accidents.

STAR SYSTEM DATA

Henry's Star was the name applied to DM+ 38 2285 by the captain of the ESAS *Endeavor* during the first survey of the region in the year 2182 A.D. It is the larger component of a close binary system; the companion is designated Catherine's Star. The two stars lie roughly 28.8 light years from Sol, near the very heart of the French Arm. Five major bodies and a number of smaller chunks make up the star system.

Henry's Starr: The star is classified G8VI, with a diameter of just over 635,900 kilometers and a mass .47 times that of Earth's sun. Its average luminosity is .145 of Sol, with a Stellar Effective Temperature of roughly 4520 degrees K. The star's absolute magnitude is +6.71. A subdwarf, it is unusual that Henry's Star possesses any planets at all, and even odder in that its single planet is actually a garden world known as Crater. It has a companion star as well, the M-class dwarf known as Catherine's Star.

Catherine's Star: Classified as an M0V, Catherine's Star has a diameter of 746,496 kilometers. It has a mass of Sol and an average luminosity of .04 Sol. The Stellar Effective Temperature is roughly 3500 degrees K, and it has an absolute magnitude of 12. Although Henry's Star is the brighter of the two suns and is generally designated as the primary body of the system, Catherine's Star *is* actually slightly larger. They share a mutual orbit around a common point at an average separation of 2 AU. Crater, the only planet in the dual system, orbits Henry's Star alone.

The planetary system of Henry's Star and its companion is fairly young and is classified as Population I. There is only one true planet in the system: Crater, which orbits Henry's Star within the proper life zone distance to produce near-habitable conditions, is only a "Garden World" by comparison with such hell-holes as Inferno in the Nyotekundu system. Numerous planetoidal chunks in a highly elliptical orbit testify to the breakup of a planet-sized intruder into the system eons ago. Some of these chunks have proven quite valuable and support a fair-sized asteroid mining operation. However, the main focus of attention in the system is Crater, the site of a thriving British colony.

PLANETARY DATA

But for an accident of history, Crater would probably have developed as another of the worthless rocks so common in explored space. Supporting a rather thin atmosphere and scant free water, Crater's classification as a "garden world" is due to exceptional conditions in a single region of the planet. These special conditions have shaped the planet's role in colonial exploitation.

Crater orbits Henry's Star at a distance of roughly .36 AU, with minimal eccentricity. This gives it a period of 36.26 days; due to the regularity of the orbit and a minimal axial tilt, however, seasonal changes within this month-long "year" are almost unnoticeable. The planet's orbit places it squarely in the stellar Life Zone.

Crater has a mass of .31 Earths and a planetary diameter of 11,041 kilometers, giving it a circumference of 34,683.3 kilometers. Owing to the low density and mass, gravity is only .612 G, which gives the world a surface escape velocity of 9.46 kps. The axial inclination is 3°18'12.5". Crater has no natural satellites.

Given the low density and surface gravity, Crater has a low atmospheric pressure of roughly .597 atmospheres. The planet retains elements with molecular weights of 1 7 and up and supports an atmospheric mix comprised of nitrogen, oxygen, carbon dioxide, and various trace elements. Though similar in some respects to Earth, this atmospheric envelope is somewhat different in its percentages of these different components; with an oxygen content of over 10 percent, the partial pressure of oxygen (0.059 atmospheres) is barely enough to support unprotected humans.

Although Crater's low mass and close orbit cause it to experience a tidal lock to its primary, the complex interplay of the twin stars in their mutual orbits cause considerable libration effects, giving a significant band of the so-called "twilight zone"—something of a day/night cycle with an average period of 22 hours of daylight followed by a nine-hour night. However, this varies considerably according to the observer's location in relation to the terminator line and the exact positions of the two suns in their orbits around one another. Moreover, Catherine's Star does give the "darkside" of Crater a faint reddish illumination during those periods when the planet and the star are in conjunction. The thin atmosphere does very little to diffuse the stellar radiation. Temperatures tend to be high on the dayside and in the twilight zone during daylight hours, dropping radically on the darkside or at night. Extremes of temperature produce violent wind storms moving across the twilight zone from the cold night side into the warmer day side; as the warm air rises it moves back across the terminator producing some limited precipitation across the habitable band.

Crater lacks a significant radiation belt, which leaves the surface exposed to the unpleasantly high levels of lethal radiation poured out by the two stars. A further risk is posed by periodic flares emitted by Catherine's Star, which, like most M-class dwarfs, is somewhat unstable in output. Luckily these flares are rather irregular (occurring on the order of once every 25 to 30 years), but when they do occur, they cause a significant increase in radiation and in stellar magnitude. During flare periods, the Henry's Star colony is subject to several weeks of quarantine due to the inability of most interstellar ships to find a safe haven from the radiation threat. The orbital facility around Crater is also shut down and evacuated during this quarantine period. During flares, the temperature on Crater can climb by as much as 60 degrees C over normal limits, causing hazardous conditions for anyone not able to take shelter in underground or shielded facilities. The radiation problem also limits communications to line-of-sight under the two suns, and during flares, it causes an almost complete breakdown in all but the most high-powered signalling systems.

Crater's hydrosphere covers just under 10 percent of the planet's total surface area. A significant portion of this hydrosphere is locked up in the form of ice sheets on the night side. The hydrosphere is composed of water, but it has an unusually high salt content that renders it largely useless to human colonists without extensive desalinization.

The planet possesses a fairly usual mix of terrain types, the most common variety being extensive desert uplands. The most prominent terrain feature on the planet, and the one responsible for its name, is a gigantic crater located in the twilight zone region not far from the planetary equator. Planetographers have postulated that a rogue world plunged through the system several hundred thousand years ago, but was broken up as a result of tidal stresses generated from too close a passage between the twin stars. The planetary detritus remained as a highly elliptical asteroid belt, which remains a prominent part of the system to this day. The belt lies at a sharp angle from the solar ecliptic, but twice each "year" (once every 18.13 standard days) Crater moves through this zone. At

some point in the planet's history, it was subjected to a strike by a particularly large planetoidal fragment, a "dinosaur killer" of epic proportions.

Research indicates that planetary conditions before the asteroid impact were considerably more pleasant than those prevailing today. The evidence suggests that the planet had a much thicker atmosphere which gave rise to a significant "greenhouse effect" and made darkside conditions somewhat more favorable to life—a higher percentage of the surface area was covered by water, and more of the water was liquid. Pre-strike Crater supported a varied ecosystem with native life well-adapted to the unusual surface conditions of the world. The impact, however, produced massive changes, ripping away much of the atmosphere and raising massive dust clouds which had a major effect on the climate. Mass extinctions occurred in virtually every niche of the ecology, leaving life forms sparse but extremely hardy and adaptable. The other major effect of the strike was the creation of the giant impact crater itself, which is a perfectly circular depression that drops almost a mile below the planet's surface level and is sheltered by high rim walls. The crater is nearly 100 miles in diameter. The irregular floor includes several fairly deep lakes fed by condensation from above but drained off through deep underground rivers. Evidently caused by a fragment that included a number of high-density minerals and radioactives, the crater belies the planet's low density by being the source of some incredibly rich mineralogical deposits.

For the most part, the world lacks any worthwhile concentrations of usable resources. Only within and near the crater proper are there worthwhile mineral deposits, including sizable quantities of gold, silver, iridium, platinum, uranium and plutonium. Very small amounts of tantalum have also been uncovered, and the British government remains interested in surveying and exploiting additional tantalum finds as they are uncovered. One politician has referred to Crater as "the new South Africa" because of the extreme value of the mining operations found there.

In the area of non-mineral resources, Crater was largely useless until the widespread introduction of Terrestrial products onto the planet by the expanding colony. Because of the shattered ecological structure of the world, Terran plant and animal forms can compete quite efficiently in some regions. However, it takes a particularly hardy life form to cope with the harsh conditions prevalent over most of the planet, and the process of transplanting a full Terrestrial ecosystem has been a slow and sometimes frustrating one. Nonetheless the desert uplands around the crater proper have become home to a particularly tough mutated scrub grass originally developed in the ranching stations of the Andes Mountains on Earth, and sheep have proven capable of adapting to some protected areas of these new grasslands. Industry remains poor at best; importation of manufactured goods is still the rule, and the colony has all the aspects of a frontier facility where the mother country is more concerned with extracting raw materials and selling finished goods than it is with upgrading local capabilities for production or colonial diversification.

Presumably, preimpact Crater was very much like Earth in many respects. Life existed in a multiplicity of forms adapted to a broad range of ecological niches. The higher incidence of radiation seems to have led to a higher mutation rate, which helped life develop at a faster pace than was true on Earth. This gave Crater a leg up on other worlds, despite the fact that the planet is somewhat younger, geologically speaking, than most Earthlike worlds. The disruption caused by the planetoid impact long ago resulted in massive changes in the planetary environments and ecology, with mass extinctions in all but the hardiest of species. Those which survived quickly adapted to the new conditions, aided again by the naturally high mutation rate. However, by Terrestrial standards, life on Crater is still neither particularly abundant nor as highly varied as humans are accustomed to.

Vegetation on Crater has evolved in three distinctly separate directions according to local conditions. On the darkside of the planet, where no photo-synthetic analog is possible, a nonmotile chemosynthetic form is typical. This type of vegetation clusters around concentrations of chemicals and/or minerals and directly converts these into food. Most are rather similar in appearance to Terran funguses, but they tend to be tough-skinned and durable. In the regions where a day/night cycle does prevail, plants use a process much like Terrestrial photosynthesis, using sunlight to fuel the extraction of carbon dioxide and necessary minerals from the soil. In the regions of eternal daylight normal photosynthesis is impossible, but in these areas the evolution of plant life has made use of the much higher quantities of energy received to produce motile vegetable forms which take advantage of the shadows cast by natural features as a substitute for a normal diurnal cycle. These plants can actually move from place to place, exposing themselves to light and then retreating to shaded areas. Some plant forms on the dayside gain a portion of their chemical and mineral needs by feeding off other plants, or off animal life. Although these motile plants occasionally range into the habitable zones, in general the three types of vegetation are largely limited to their own distinct spheres of influence.

Animals on Crater are similarly adapted to different environmental conditions. Very few large types exist today, though fossil evidence shows that there were once very large animals on the planet. Nightside species tend to be slow, sluggish, and rather simple in nature, living by grazing on the chemosynthetic mosses of the region. Those on the dayside are more active but also tend to be small and simple due to the harsh conditions they must face. A few larger and more familiar types are found in the habitable zone, but even here the largest carnivore is little larger than a Terran domestic cat. Carnivores of all types tend to be solitary; rarely can a region support a high population of beasts high on the simple planetary food chain. Even herbivores are found in groups only infrequently.

However, Terran and Crateran life forms are mutually edible, at least as far as the habitable zone types are concerned. As a result, the introduction of Terran livestock into the desert uplands has attracted larger concentrations of local carnivores. This is posing a definite problem for colonial farmers who are faced with the choice between losing their herds to Crateran carnivores or tampering—potentially fatally— with the environment. The usual laws of ecology, which provide for an expansion of predators for any form which itself goes through a major population increase, thus guaranteeing an eventual balance, does not seem to apply on Crater. Carnivores in Crater's food chain are largely non-specialized in their diet, so there does not seem to be any specific delineation between predators and prey at the top of the ecological pyramid. As a result, most carnivores on Crater are likely to prefer a Terrestrial sheep to a local predator that can fight back. The problem has been under study, unsuccessfully, for several years.

Although local forms find *Terran* life edible (and vice versa), there are major differences in crucial vitamin complexes between the two animal kingdoms. Thus local life alone cannot be used to support human colonists for any length of time without the use of major vitamin supplements, nor can local animals prey exclusively on Terran food sources.

COLONIAL HISTORY

Britain's colony on Crater was founded in 221 7 A.D. and has flourished for 83 years. The population (as of the census conducted in 2295) stands at 1,557,300 people. So far, the colony covers only about 3000 square kilometers of the planetary surface, centered on the crater proper. Mining is the mainstay of the economy, but the ranches and farms of the uplands comprise the majority of the colony's inhabited regions.

Crater was discovered by the survey ship ESAS *Endeavor* in 2182 A.D. The star names were bestowed by Captain Sir George Spence in honor of Henry, Prince Consort to Queen Alice of Great Britain, and the Queen's sister, Princess Catherine. Crater itself was named by the expedition's chief scientist, in defiance of the age-old tradition that reserved the right of naming to the ship captain. Spence had originally intended to name the planet Tycho, also in reference to the *crater,* but Dr. Pembroke's *preferred* name was the one that was ultimately used.

Power is provided by a large-scale fusion plant located at the bottom of the crater along the shores of the largest of the salt lakes of the area. The plant serves double duty in furnishing power to the colony and providing the brute energy necessary to operate extensive desalinization and produce water usable both for colonist needs and as a source of irrigation for the Terrestrial plants in the uplands. The colony is linked together by a hydrogen road grid; within the road surfaces are a network of pipes and power lines used to distribute essentials to and from all points within the colony. Expansion is carefully planned and regulated, with construction of the road grid always considered first in all new land claims.

The majority of the colonists are concentrated in the small city of Rimview on the upper edge of the crater. Many alternatives were initially considered before this site was chosen; it represents a compromise between a number of different possible sources of discomfort. The city proper has a permanent population of perhaps 950,000 people, most of whom are employed in various light industries or service-oriented jobs. The non-urban population of Crater is divided between the ranchers of the uplands and the various small mining towns that are found at various points around and within the crater itself. Notable features of the town of Rimview include the large orbital catapult on the east edge of the city, the large elevator complex that allows a descent to the crater floor and the fusion plant located there, and a network of underground shelters built into the crater wall below the city where the population can take refuge in case of high radiation activity or a failure in the town's shielding systems.

Rimview and other inhabited areas are not protected from the full force of the local radiation output of the star. Buildings, ground vehicles, and personal clothing are always heavily shielded, especially from above, against what could be a harmful dose of radiation during a flare period.

The colony does possess a small orbital station. This is used as the primary port of call for visiting ships. Permanently manned, it is evacuated whenever Catherine's Star enters a flare phase. The station staff is small, and the facilities there are limited. Interface transport of cargo is handled by an orbital catapult complex, with the return journey made by gliders that land at an adjacent runway. Passenger and delicate cargo service is provided by a small number of space planes privately owned and operated.

Great Britain's colony on Crater is fairly typical of the sort of neocolonialism now in vogue in the new British Empire. A Governor General appointed by the British government Earthside is responsible for the administration of the colony. Although the settlers have come voluntarily in search of land and wealth, conditions within the colony are rarely up to their expectations. The government is forced to regulate many activities closely. The conflict between the imperatives imposed by the Foreign Office (the export of raw materials being uppermost) and the lack of local industry or self-sufficiency make the colony a hotbed of sedition and unrest. Restrictions on trade outside of that sanctioned by the British government have served to fan the fire. The Governor General is titular head of a large force of Colonial Militia drawn from the local population but tending on the whole to be composed of the bullies and the bad bargains who couldn't find a way to make a more honest living. These people compose a Colonial Constabulary to enforce the Governor General's laws, as well as to provide for local defense and emergency services. They are a corrupt and undisciplined body much disliked by the average colonists.

The colony on Crater is not an easy one to live in. Colonists living and working in the desert uplands must contend with a thin atmosphere, desert temperature extremes, a lack of potable water, and other unpleasantries. Prolonged exertion is almost impossible in the uplands because of the low partial pressure of oxygen and the already thin atmosphere. Rimview and other population centers feature sealed buildings where internal pressure can be raised to Earth standards, and most people forced to work or travel outdoors carry oxygen masks. Still, fatigue is a major problem. As for temperature, the daytime temperature in the uplands can climb as high as 30 degrees C, and drop to near 0 degrees C in darkness. These extremes are the result of the thin atmosphere, which has poor heat-retentive qualities.

The miners who work within the crater have a different set of problems to contend with. The atmospheric pressure within the crater climbs as one approaches the floor of the rim; at the lowest levels, it approaches Earth-normal pressure. However, decreased altitude also brings a significant increase in temperature. The floor of the crater consistently runs 8 to 10 degrees C higher than the upland temperatures. In full daylight, this is above the level of human tolerance. Protective gear must be worn.

The need for protection from the elements is at the heart of miners' grievances with the government. Light local industries are slowly beginning to furnish some essentials, but all too often the equipment essential to miners trying to make a living on Crater is imported, subject to high initial prices and even higher

government tariffs. Imported goods on Crater can cost two or in some cases three times as much as they might cost on Earth or any of the more self-sufficient colony worlds. In many cases, these inflated prices stem as much from local corruption as from actual economic necessities.

In light of these facts, the opportunities for adventure on Crater are extensive. First and foremost, there is the ongoing search for wealth, which pits the colonists in constant battle with the elements and, to a lesser extent, even with each other. This latter is especially prevalent in the small mining settlements inside the crater and in the semi-circle of Rimview that overlooks the crater directly—the Rimwall District, as notorious for violence and vice as any water-front area of a pre-spaceflight Terran seaport. Small prospectors must worry about claim jumpers, and also about members of the Colonial Constabularly who may use their positions to lose valid claims in favor of relatives or friends, or who require sizable bribes to do their duty in upholding the law in a given area.

The uplands are more directly concerned in the ongoing battle against Crater. The encroachment of native predators in the ranching districts could demand the attention of scientists and/or troubleshooters, particularly if locals should ever make the mistake of taking matters into their own hands and introducing some factor—such as Terrestrial animals intended to prey on the native carnivores—which could throw the ecology even further out of balance. Examples of this sort of thing are common in Earth history, and the results, if some Terran species—such as wildcats or wolves—were to run wild, could, in fact, be very dangerous to the colonists.

Scientific research into the secrets of Crater's intriguing planetology, biology, and natural history is an ongoing process. So far, no permanent research establishments are present, but periodic expeditions are mounted into the dangerous dayside and darkside regions to study various aspects of the planet and its life forms. Adventurers will find these expeditions a worthwhile source of employment; there is a need for skilled scientific and technical experts as well as for troubleshooters to protect the research personnel.

Finally, there is the matter of colonial unrest on Crater. Sooner or later the struggle between colonists and government will reach the boiling point. Will it lead to another "shot heard round the world," or will the outcome here more closely resemble the failed risings in Australia during the British colonial era of the 19th century? At present, the future life of the colony is fairly secure, but its political direction is very uncertain.

JOI

61 Ursae Majoris

A true melting pot of human proliferation, Joi is home to no less than six different national colonies. A remarkably hospitable world on the outer edge of the French Arm, Joi attracted settlers almost from the date of its discovery.

SYSTEM DATA

Located 29.65 light years from Earth in the fertile Ursae Majoris Corridor of the French Arm, 61 Ursae Majoris is a yellow dwarf star whose third planet supports the second largest number of colony worlds in the human sphere. The system was first surveyed by the ESAS *Argonaute* in the year 2226 A.D. Fourteen planets were discovered, although few of these were of anything more than abstract scientific interest.

Classified as a G8V dwarf, 61 Ursae Majoris has a diameter of 1,257,750 kilometers and a mass .868 times that of Sol. Average luminosity is .52 Sol, and the stellar effective temperature is approximately 5140 degrees K. It has an absolute magnitude of +5.55. The star, like most of its kind, has an extensive planetary system. One of these worlds, Joi, is located inside the habitable zone.

The planetary system includes 14 worlds, although most of these are small, relatively unimportant ice balls offering nothing in the way of worthwhile features. All of them were named by Captaine DeSalles of the Argonaute in his native French. Planet I, a hothouse world designated Chaud, is a large-diameter planet with a dense atmosphere; Gris, planet II, is smaller but similar in nature. Both resemble Sol's Venus, shrouded in impenetrable clouds which cause a run-away greenhouse effect and temperatures hundreds of degrees beyond what humans find tolerable. The third planet was named Joi, and it is the colonized planet of the system.

The outer worlds are mostly of little importance. Planets IV and V (Frais and Froid) are both failed core planets, would-be gas giants which lacked sufficient mass to *realize* their potential. The next seven planets in the system are all either ice balls or even smaller failed core worlds. Planet XIII, Hiver, circles the star at an orbital radius of over 73 AU; it is a Mars-type desert world with a thin atmosphere but with some potential for resource extraction. The outermost world, 61 Ursae Majoris XIV, is a spectacular gas giant named Grandpere which has an orbital radius of over 154 AU, completing one circuit of the star every four and a quarter *million* years. The entire planetary system is considered to be made up of worlds classed as Population II.

The Moons: Three small, largely insignificant natural satellites orbit Joi. Named after their apparent colors in the night sky, they are (in order, starting with the inner moon) Blanche, Argent, and Or. Blanche has an average orbital radius of 254,875 kilometers (15 radii), giving it an orbital period of 5.8 standard days. Its diameter is 3896 kilometers, with a density of .5 Earth and a mass of .015. Its gravity of .222 G is not sufficient to retain any significant amount of atmosphere, and it is classed as an airless rock no different from thousands of others in explored space. The white disk of Blanche is a popular subject for paintings and photographs from Joi; an unusual mixture of sands gives it its distinctive coloring. Argent's orbit *is* 20 radii out, at 339,850 kilometers with a diameter of 2030 kilometers and a density of gravity of .121 G. If anything, Argent is even less interesting than Blanche, retaining no atmosphere and possessing absolutely no exploitable raw materials. Its only significant contribution to the colony is its convenient 13.6-day orbit; the inhabitants regard it as a celestial timekeeper in much the same manner as Terrans regard Luna; it even works out that one of Argent's "months" is just about half of a Lunar month, corresponding to the six-month "year" of Joi. Beyond such purely conversational value, Argent is worthless. The outer moon, Or, reflects light with an intense golden hue. It has several interesting points, from its extreme distance (60 radii, or 1,019,525 kilometers, which gives it a period of 365.57 days) to its composition (a density of only .4 but holding several valuable mineral deposits) to its actual orbit (both tilted from the stellar ecliptic by over 45 degrees and moving in a retrograde motion). Or is classed as a desert world, very much like a smaller version of Mars. It has a diameter of 61 1 2 kilometers, a mass of .041, and a thin atmosphere composed largely of xenon at an atmospheric pressure of .291 atmospheres. There have been several proposals regarding exploitation of the mineral resources on Or, including one plan to turn it into a penal work colony, but the various colonial governments on the planet have not yet reached agreement regarding rights to make use of the satellite's resources.

PLANETARY DATA

Joi, 61 Ursae Majoris III, is the single human-habitable planet in the star system. It is one of the most Earthlike of the colony planets settled to date, although as with all worlds it also displays notable divergences from the Terrestrial "norm." A garden world, Joi is a veritable paradise that has attracted settlers from six different nations.

Joi's orbital radius averages at .765 AU, displaying a mild eccentricity (deviation of .0136). Its period is 1 88.39 days (just over half of a Terran year). The planet's eccentricity and low-to-moderate axial tilt ensure a seasonal cycle considerably less varied than that of Earth. Although it lies beyond the "optimum" life zone distance for an Earthtype planet, factors of atmosphere and albedo help to maintain climatic conditions comparable to Earth's over most of the globe.

Joi has a diameter of 16,992 kilometers and a circumference of 53,382 kilometers. Its density is only .7 that of Earth (3.85 g/cc), giving it a total mass of 1.36 Earths. The planetary gravity is 1.054 G, with a surface escape velocity of 11.8 kps. Axial tilt is 14°29'53.8". Three small satellites-Blanche, Argent, and Or—circle Joi at moderate distances.

A standard nitrogen-oxygen atmospheric envelope surrounds the planet. Pressure at sea level averages 1.029 atmospheres. The atmospheric composition is 19 percent oxygen, 78 percent nitrogen, plus 3 percent various trace elements in more or less Terrestrial proportions. The partial pressure of oxygen at sea level thus runs at .196 atmospheres. This is thin but acceptable by human standards. Molecular weights of 5 and up are retained in Joi's atmosphere.

Despite being considerably closer to 61 Ursae Majoris than Earth is to the Sun, and despite the presence of three moons, tidal effects on Joi are within normal limits. This is because none of the bodies exerting a tidal influence are as massive as their Terran counterparts: of the three moons, only Blanche is close enough to be a significant factor, and it is quite small next to Luna. The rotational period is close to that of Earth at 28 hours, 48 minutes.

Joi's hydrosphere covers only 58 percent of the planet's surface area. It is fairly typical in composition despite the presence of alien salt compounds in the sea water. The planet's cool climate has resulted in a glaciation rate of nearly 25 percent, locking extensive amounts of the hydrosphere into oversized polar ice caps.

Joi is a much less geologically active world than Earth, a fact reflected in its lack of heavy metals and relative freedom from seismic activity. Lacking much impetus to mountain-building, the planet's land surface area contains no more than 7 percent

mountains, and even fewer hill or foothill regions. Most of the surface consists of slowly rising lowlands and large steppes inland.

There are three major continents; two are connected by a narrow isthmus and are sometimes regarded as a single land mass. There are also a number of large islands, more reminiscent of Mediterranean isles than the archipelagoes of Earth's Caribbean or Pacific areas. Colonists from five different space-faring nations have settled in various enclaves on the land masses. For the most part they get along peacefully, although relations are in some cases still strained since the recent War of Elysia Independence, fought from 2285-2291 A.D.

Joi is poor in the heavier metals important to an industrial society. It is almost entirely a planet of farmers and herders, with very little manufacturing base. Certainly the rare finds of useful metals are insufficient to feed local demand, much less support an export market.

Native crops are considered suitable for human consumption, but the colonists have found that the relatively less advanced ecosphere of Joi simply cannot compete with plants introduced from off-world. Although ecologists have issued dire warnings, there are two colonies—Azania's and Japan's—which have mounted large-scale importation of such crop seeds. Plans to do the same in Elysia were largely responsible for their break with the French government nearly two decades ago.

The very term "Garden World" presupposes the existence of native life forms on the planet. Joi is no exception to this rule; life is present in abundance. Although the basic biochemistries are compatible and the lay community insists on using terms like "mammalian" or "reptilian" to describe these creatures, any resemblance they have to Terrestrial forms is strictly a matter of common responses to the same evolutionary imperatives. A species of "reptiles" under study by the Japanese are anything but the cold-blooded, sluggish specimens some would expect; they are warm-blooded animals with high metabolic rates, large brains, rudimentary hands, and a definite potential for future evolution to sentience. One controversial Japanese scientist maintains that they are sentient, having taught over 1800 words of Japanese sign language to a captive beast. Efforts by fringe groups to classify the region where these animals are thickest as a protected reservation are being strongly resisted by all the colonial governments—not just the Japanese, who stand to lose the most. Predictably the former French colony has been vocal in suggesting the total withdrawal of all humans from the continent in question; they can do this since none of the animals have ever been encountered in or around Elysia.

COLONIAL DATA

Five different nations have planted colonies on Joi. Each one has its own unique characteristics, and each a distinct local identity that has led, on more than one occasion, to serious disputes among them. Even now, with nationalism supposedly dying out and the time-worn excuses of Earthbound competition long since rendered obsolete by the limitless resources of the stars, humankind has managed to learn very little. On this planet named for joy, the mistakes of the past could easily return to haunt the future once more.

The German Colony: Although the French were the first to survey Joi, other commitments to colonial expansion prevented them from exploiting their find. Instead it was a German colony ship which first came to Joi, establishing themselves on a long peninsular projection into the oceans of the northern hemisphere. Their settlement is generally called Halbinsel (or Peninsula) rather than the official name, Landeplatz-Frederich Der Grosse.

Founded in 2241 A.D., Halbinsel covers an area of roughly 4000 square kilometers, much of it being the city of Raumhafen. Altogether the population (as of 2295) numbers roughly 2,907,000. Extensive farming lands surround the city. There is also a fusion power complex along the north coast of the peninsula. Communication with the German colony's orbital facilities is via Scramjet; these service the orbital terminal and a fairly large orbital defense station placed in position over Joi during the Franco-Bavarian crisis a decade ago. Although it is not presently staffed with anything like a full complement, the defense station is a potent factor in the politics of Joi.

The colonial government operates with a typically German efficiency. There is very little input from the colonists themselves; they answer to an Earth-appointed governor who has some very large—indeed sometimes totally impractical—quotas and schedules to meet. It is particularly ironic that the German colony served as a hotbed of subversion and support for the French rebels in Elysia.

In addition to the colony proper, the Germans maintain a separate research outpost on the distant world of Hiver. Their colonial policy in this system at least is one of aggressive expansion and exploitation of all their opportunities. The failure of German colonialism in the 19th century is still remembered over 300 years later, and the newly unified German nation doesn't plan to allow history to repeat itself.

The ex-French Colony: France arrived on Joi less than a decade after the Germans, settling on the large island (or small continent) of Elysia. At that time Franco-Bavarian cooperation was at its height, and the French and German colonial administrations cooperated in many key areas. From 2258-2261, while the French orbital terminal was being rebuilt after the devastation of a Japanese ship's stutterwarp malfunction and collision with the structure, France and Germany shared the German terminal. But this cooperation fell apart over the last quarter-century; by 2291 the German policy of "hostile neutrality" on Joi helped turn the tide in favor of the Elysian rebels.

Elysia proper covers an area of roughly 5000 square kilometers of some of the lushest land on Joi. It has a population of something under 3,650,000; exact figures are hard to obtain due to the chaos

that still prevails in this newly independent nation. Like most of Joi's colonists, the people have a largely agrarian society which is trying hard to adapt to the concept of independence.

The Elysians have taken over the old French orbital terminal, servicing it via rocket plane interface vessels. Spare parts are difficult to come by, but black market trade and underworld connections have kept them coming to date. They also make use of the magnificent fusion power complex completed by French engineers near the town of Bonne Chance just two years before the outbreak of the Elysian Uprising. A shortage of trained technicians and damage sustained from the war have left the center incapable of operations at full capacity.

The rebellion grew out of a number of factors and was helped along by short-sightedness, corruption, greed, and opportunism. It first flared up when a young lieutenant of the Gendarmes d'Elysia, the Colonial Administration's local peacekeeping force, lost his head and ordered troops to open fire on a crowd protesting the French government's rumored plans to tamper with the planetary ecology in the interests of keeping up with the aggressive efforts of the Japanese at Samurai Bay. The "Esperance Massacre" was blown out of proportion on both sides and steadily escalated into all-out conflict. The bitter guerrilla fighting that eventually developed was kept up largely because the exhausted French were still recovering from the Central Asian War, and because (as other colonial powers have found out across the centuries) supply routes made massive intervention by French forces prohibitive. The guerrillas were also strongly supported by certain German *agent provacateurs* who saw the unrest on Joi as a means of sapping French money and morale; before the guerrilla conflict at 61 Ursae Majoris was fully resolved, German forces were striking at France in the War for German Unification.

The rebels eventually won but found that six years of fighting had badly drained the colony's resources and manpower. The Provisional Government that took the official surrender of the last French garrison troops in 2291 remains in control. Promises to draw up a constitution and elect a popular government have so far been postponed indefinitely. The government is by no means a tyranny; if anything, its great weakness is that it is made up of honest, sincere, patriotic men who are having trouble coming to grips with the realities of power. Elysia today is brimming with intrigue; rumors are continually surfacing that suggest that one or another of the Joi colonies is planning on moving in troops to restore order and stabilize the fledgling nation. Like most rumors, these are wildly exaggerated, but there are certainly unscrupulous elements who would prefer that Elysia remain helpless for the foreseeable future.

The British Colony: Britain came to Joi in 2254, six years after the French, yet they maintain today one of the smallest of the colonial presences on the planet. The British have been mounting the settlement of their colony, known as New Cornwall, in an extremely slow and deliberate manner. In 2295 the population stood at 287,000 people, but this tiny colony is the most technically advanced and progressive of all the groups present on Joi. Rapid expansion is expected in the years to come, now that a sound and well-planned colonizing effort has been put in place.

Although the total colony covers less than 1000 square kilometers, it features some very sophisticated facilities. The British have built a catapult complex for orbital interface with their terminal and lease the use of both to the Azanian colony of Lubumbashi just up the Fal River from the main British town, New Falmouth. They have also put up an efficient solar power satellite which provides far more power than they presently need; it is expected to meet the energy requirements of the colony for the next century (at least) even under projected heavy colonization quotas.

New Cornwall is the brainchild of Sir Henry Penvenen, who served as Minister of Colonial Affairs in the period just preceding the settlement of the planet. It was Penvenen's belief that the British colonial effort was becoming too sporadic and haphazard to continue working effectively; poor planning was leading to situations where the government could not provide adequate supervision of colonial matters, corruption was rife, and the colonists were often being thrown into situations where they had to fight so hard just to survive that they could furnish little useful economic support to the Mother Country except under forceful methods that might lead, as they had at Alpha Centauri, to independence movements that benefited no one.

Penvenen attempted to mount what he considered a proper colony on Joi, having won government permission to put his scheme into effect as a pilot project for future colonization efforts. The plan called for a decade of light colonization by highly trained specialists who would develop the colony carefully according to a long range plan, after which the world would be thrown open to general settlement. Unfortunately Penvenen badly underestimated the cost and manpower needs, and it will be closer to five decades rather than one before the next great wave of colonization can begin. Meanwhile New Cornwall has been a serious drain on the Crown budget, one which has been supported only out of a sense of national pride and commitment. Needless to say, Sir Henry, who retired to New Cornwall, was not considered a great success in the Colonial Office.

The British colony remains a home to specialists and their families; colonization is open only to those who have useful services to offer. However, in the next few years this policy is expected to change, and in preparation for the event, the Colonial Office has been quietly building up a force of troubleshooters, law enforcement experts, and others who will be necessary to smooth over the transition from quiet backwater to a booming colony world.

The Japanese Colony: Japan settled Joi in 2257, shortly after the British arrived, and in contrast to the former colony, chose to commit a massive effort to build up their colony as quickly as possible. Located on the isolated, smaller continent (known from the French survey as the Pays d'Esperance), the Japanese colony is known to the majority of the planet as Samurai Bay. The official name for the colony, however, is Tosashimizu. In 43 years the population has risen to over 2,507,000 people, covering an area over 40,000 square kilometers in size. The Japanese have constructed their own separate orbital terminal serviced by Scram aircraft; the terminal is accompanied in orbit by a defense complex. On the surface, a fusion power reactor has been constructed on the shores of the Uwa-Wan bay, and government-supported military and scientific bases have also been set up in the colony. The Toyoda Foundation, which sponsors planetographic research on a number of worlds, has also erected a facility there.

The Japanese on Joi are aggressive in their colonial expansion. They were the first to introduce Terrestrial crops and livestock on a large scale, much to the horror of environmentalist fringe groups who predicted the doom of the entire, unique Joian ecosystem. Japanese policy has been largely isolationist, but with distinctly hostile overtones where the Germans are concerned. Among other things, the Germans and the Japanese on Joi are currently disputing the ownership of a large and unusually mineral-rich island which lies squarely between their two colonies. The Japanese are also extremely distrustful of the German support for the Elysian rebellion and have built up their military strength in the aftermath of the guerrilla victory. They are rumored to have offered to intervene militarily in favor of the French, who failed to respond in

time for the offer to do any good. The Elysians are still convinced that France intends to mount a re-conquest using Tosashimizu as a base of operations.

The government of the Japanese colony is rigidly authoritarian, following traditional Japanese lines. The colonists continue to follow the old Japanese ethics of total commitment and obedience, which came back into full force in Japan following the turmoil of the Third World War era and the obvious failure of the Western value system (in Japanese eyes, at least) which had been corrupting the older ways since the mid-20th century.

The Azanian Colony: Lubumbashi, the youngest of the Joi colonies, is an Azanian settlement founded in 2280. Still more of a pioneer venture than a full-fledged colony, it has a population of just over 4,000,000 people spread over an area of 3000 square kilometers. It is the only colony which is not built in a coastal area, depending on traffic down the broad, easily navigable Fal River through British territory for contact with the *sea* and other colonies on the planet. British/Azanian relations are particularly good; the Azanians lease the use of the British solar power satellite, their orbital catapult, and, until recently, their space terminal as well. Recently an Azanian terminal facility entered independent service, but it is still used on a comparatively limited basis.

The Azanians have been anxious to catch up with the older, more established colonies on Joi. Because of this they, like the Japanese, were eager to import Terrestrial life forms to supplant the local sources of food. Their farm production has already climbed to nearly half that of the German colony, despite the fact that the Germans have six times Lubumbashi's population to work with. Food exports from the Azanian colony now top those of all the other settlements, and during the Elysian famine of 2292-2293, it was food from Lubumbashi that kept their colonists from dying in droves.

Joi is one of only three worlds to contain an Azanian colony. In typical Azanian fashion, the administration of the colony is largely independent of any central control; a Colonial Coordinator has been appointed to advise locally selected government officials on matters pertaining to Azania's interests, but his position carries no actual administrative power or authority. The Azanians try to get along with everyone, although there has been evidence of sabotage to their agricultural plantations south of the Fal River in recent months. Whether this is the work of militant environmentalists or some hostile national or colonial interest is not as yet known.

CONDITIONS

Joi is a paradise world in terms of terrain, climate, and other purely environmental conditions. Few dangers exist for Man (outside of the occasional predator) that arise from purely natural origins. But with five nations competing on Joi, political differences pose a significant threat to the unwary.

The German colony has become a center of subversive elements, and in consequence, few of the other colonies—even the Elysians who benefited from their intervention—trust them. Halbinsel is something of an enigma to outsiders, who can't be sure of the motivations of its leaders or the future actions they may choose to take. Japan's colony actively distrusts and fears the German presence, while the British and Azanians are warily neutral. Elysia owes the Germans a debt of gratitude (and a large bill for arms shipments and other aid), and for the moment, it is more or less the unwilling satellite of Halbinsel proper.

Elysia is in serious difficulties. With facilities in disrepair, farms still fallow even several years after the war, an immense debt, and a government seemingly incapable of taking positive action, the colony is ripe for further conflict, either from internal disunion or opportunistic outsiders. Although the typical adventurer will find plenty of opportunity for employment here, the conditions are so volatile that almost anything could happen.

In New Cornwall, the decision to open large-scale colonization is likely to spark a land-rush of epic proportions. Although the British Colonial Office is taking steps to *prepare* for the expected chaos, the sudden arrival of unprecedented numbers of settlers is sure to destabilize the area considerably. Here, too, adventurers can expect to find dangerous work in a land apt to become as lawless as the American West in the 19th century, thanks to too many people and too few centers of administrative authority.

The Japanese, insular and suspicious, are apt to question the motives of any outsiders. Their ambition is to become the dominant colony on Joi. They are attempting to pursue this goal through economic means at the moment, but they fear the chance that the Germans and the Elysians are going to export revolution wholesale and have armed extensively against the worst. Ail too often, wars have started over small misunderstandings in such an atmosphere of fear and mistrust.

As to the Azanians, their colony is small but vigorous. Largely tied to the fortunes of the British, they are under fire from conservationists and apparently the target of sabotage that may or may not be connected with their controversial ecological position. No matter what, the Azanians are a factor to be considered; their progressive attitudes and rapid expansion make it likely that they will soon assume a prominent position in the political and economic arenas on Joi.

KIE-YUMA

Xi Ursae Majoris

Kie-Yuma is the only human colony world claimed exclusively by a corporate entity. As such, it is a unique world where corporate bureaucracy and governmental operation have often become one and the same.

SYSTEM DATA

Xi Ursae Majoris A-I is a pre-garden world located on the frontier of the French Arm of explored human space. Xi Ursae Majoris A-I is situated in an unusual, quadruple star system. Comprised of two MO dwarf stars and two GO main sequence stars, the system contains a total of nine planets. This system can be thought of as two binary systems, each with a GO star as the primary (Xi Ursae Majoris A and B) and an MO dwarf as the secondary (Xi Ursae Majoris A' and B'), which then orbit around their common center of mass. The A-A' system has a total of five planets of which the innermost has been colonized by Trilon Industries. Separated from A-A' by 12.188 AU, the B-B' system has four planets, all of which are located farther out than the life zone.

The Trilon world, Xi Ursae Majoris A-I, is one of three planets in the A-A' system life zone. As the only "hospitable" world in the entire Xi Ursae Majoris system, the Trilon world is generally referred to as Xi Ursae Majoris (Xi U.Ma. for short, or "Kie-Yuma" as the colonists tend to say and spell the name of their world). Of the other two life zone planets, one is a rock ball of about 2000 kilometers diameter with no real atmosphere, and the other is a desert world of approximately 8000 kilometers in diameter possessing a thoroughly unbreathable atmosphere. Kie Yuma, while not perfectly hospitable, does possess a breathable atmosphere (with a small percentage of unhealthy elements present), and the Trilon corporation found it sufficiently attractive resource-wise to establish a colony on it.

PLANETARY DATA

Located 0.697 AU out from the center-of-mass of A and A', Kie-Yuma has a diameter of 22,000 kilometers and a mass of 2.156×10^2 grams (3.6046 times the mass of the Earth), making it a significantly larger world than Earth. With an overall mean density of only about 0.7 times than that of the Earth, Kie-Yuma ends up with a surface gravity of 1.208 G, not as great an increase as one might think for a world of its size, but still heavier than most humans are accustomed to. The atmosphere of Kie-Yuma is denser than that of Earth (1.416 atmosphere versus 1 atmosphere) and often appears "hazy" or "murky" to the colonists on the surface. With an oxygen content well within human tolerances (20.3 percent free oxygen in the atmosphere), Kie-Yuma's air is quite breathable (although a bit "thick" and "heavy" to breath for those used to an Earth-normal pressure) except for a relatively small fraction of unsavory gases present.

As a pre-garden planet, Kie-Yuma is still undergoing the change from an early-type reducing atmosphere to an oxidizing atmosphere that the Earth underwent eons ago. Significant traces of such gases as methane, carbon monoxide, and ammonia still remain in the atmosphere along with other unhealthy components. While these elements are not immediately fatal when inhaled, they can prove detrimental if inhaled frequently over a long period of time. Huge atmospheric processors, therefore, have been constructed by Trilon and are hard at work on Kie-Yuma removing the unhealthy elements of the atmosphere and slowly creating an atmosphere that will be breathable by humans on a long-term basis. While creating a healthy atmosphere for humans is the main reason for the atmospheric processors, Trilon has been concerned that the trace levels of methane could prove hazardous in some industrial operations (enhancing the risk of potential fires or explosions, for example). Removing those atmospheric substances that could be occupationally dangerous is, therefore, another key purpose of the processors.

The orbital period of Kie-Yuma *is* 208.68 Terran days (0.57 Terran years). With a rotational period of 26.501 Terran hours, the Kie-Yuma "year" is almost exactly 189 Kie-Yuman "days." The rotational period of Kie-Yuma is close enough to that of Earth to allow humans to adapt their cycles to it, but it is just enough longer than a Terran day that humans feel "dragged out" and "out-of-synch" for awhile after arriving in Kie-Yuma. Adaptation periods for new arrivals can vary from only a few weeks to many months, depending on the individual. Women, in particular, tend to take a longer amount of time to adapt to the lengthened day than men, a tendency probably due, in part, to the cyclic nature of female internal biochemistry.

Two natural satellites orbit Kie-Yuma. The innermost one is a small rock ball of approximately 1 600 kilometers in diameter with an orbital radius of 132,000 kilometers (about 1 2 planetary radii out from Kie-Yuma's center). The outermost satellite is also a rock ball, though it is significantly larger than the inner one. This outer moon has a diameter of about 5000 kilometers and is approximately 80 planetary radii out from Kie-Yuma's center. Both satellites are tidally locked to the planet, allowing viewers on Kie-Yuma to see only one face of each moon (much like on Earth with Luna). Due to the presence of not just one but two satellites, tides on Kie-Yuma, to the colonists living there, seem to occur at irregular intervals. In reality, however, predictions can be made as to when they will occur.

The smaller moon appears as a small silvery disc while the larger one shines with a distinctive red hue. Like Mars, this reddish color is due to large amounts of iron oxides in the surface soils (the moon has a very thin carbon dioxide atmosphere). Several sizable iron deposits have been located on this moon, prompting Trilon Industries to set up some extensive mining and ore processing operations there. A catapult has been built on the satellite to ship cargo into orbit where it can be picked up by waiting Trilon freighters to be taken either to market or to a Trilon manufacturing plant. The smaller moon has not yet been explored extensively, but so far little of interest has been found there.

Native Life: Oceans cover 68 percent of Kie-Yuma's surface, a percentage close to that of Earth (70.8 percent). Most of the animal life on Kie-Yuma lives in these oceans, with almost all of the land life being plant-type organisms. As a pre-garden world, life on Kie-Yuma is in a stage similar to that of the Earth's Silurian era approximately 400 million years ago. The animal species living in Kie-Yuma's oceans most closely resemble Terrestrial invertebrates such as molluscs and crustaceans, although none really have any close Terrestrial counterparts. Several animal species seem to be possible precursors of future vertebrate-type forms, having some semi-rigid internal support structures but no true car» tilage or bone in their bodies. The size of the animals on Kie-Yuma tends to be small, from the near-microscopic to a maximum size of about three to four meters in length. A number of the animal species have been caught and studied with the thought of using them as food for humans (mostly to be marketed as "rare delicacies"), but those few which were found to be safe for human consumption were also found to be thoroughly unpalatable to anyone with a functioning sense of smell or taste.

The most striking aspect of Kie-Yuman life is the relative paucity

of life forms on the land. Except for a few small creatures which scuttle up on the shores for short periods of time, the land masses on Kie-Yuma are devoid of any native animal life. Plant forms do exist on land, but most of these are small, scrubby types. The tallest plants yet discovered on Kie-Yuma grow to only about one meter in height, and these are found only in coastal regions. Deep inland, fewer plants are seen, with some of the land farthest from the water appearing completely devoid of life. The lack of tall plants (and in some areas, the absence of any plants) has tended to aggravate agrophorbic tendencies in some of the colonists on Kie-Yuma.

Terrain and Natural Resources: Like Earth, Kie-Yuma has a wide variety of terrain types, ranging from broad, flat plains to steeply peaked mountains. There are numerous volcanically active regions, both on land and in Kie-Yuma's seas. Most of the area occupied by humans on Kie-Yuma is located in a large coastal plain region on the eastern shore of one of the two major continents on the planet. A small chain of active volcanoes is visible from the westernmost mining operations (located on the extreme fringes of the main colonial settlement on Kie-Yuma).

Mineral ores are the major resource on Kie-Yuma of interest to Trilon. Iron, copper, and nickel ores have been located in sizable deposits and are currently being exploited. A very small deposit of tantalum located in the heart of the inhabited continent has raised hopes that there might be some worthwhile quantities of tantalum on Kie-Yuma, but, as of yet, tantalum has not been found anywhere else on the planet. Many geologists doubt that further tantalum will be found and believe that any quantities found will be so small that exploitation will not be profitable.

COLONIAL HISTORY

The Xi Ursae Majoris system was initially surveyed in 2250 by a Trilon ISV-4 survey vessel on an expedition designed primarily to test out a new, stutterwarp prototype. Previously ignored by most explorations as a system unlikely to possess habitable planets, Xi Ursae Majoris proved to be an interesting system after all. After the discovery of the only garden world in this previously unexplored system, Trilon quickly laid claim to the planet that would within the decade become its first and only colony. After officially announcing its claim, Trilon swiftly dispatched an SSV-21 intensive survey vessel to the new promising world. The crew of this vessel found a relatively hospitable world with two main continents, large areas of ocean, potentially profitable resources, and numerous locations that could prove suitable for settlement.

In 2254, plans were drawn up for three initial facilities (mostly sealed habitats for construction crews) and mining operations were begun. Construction was begun on larger living quarters (large groups of workers and their families were being transported to Kie-Yuma by Trilon) and on food and power production facilities to support the fledgling colony. After these facilities were completed and mining operations were proving more profitable than expected, Trilon found it necessary to transfer large numbers of employees (both newly hired and already employed by Trilon) to Kie-Yuma in order to staff both mining and support operations. A *York-class* colonization vessel was leased by Trilon from the British supplier of those craft for the purposes of transporting the new colonists to Kie-Yuma.

By early 2260 (the year Trilon has set as the date of its colony's establishment), the initial facilities were completed at all three sites and inhabited by colonists. From this start, Trilon operations on Kie-Yuma continued to expand, new employees were recruited off-world and imported to Kie-Yuma, and more extensive facilities were constructed.

The year 2261 saw the first of the atmospheric processors installed and construction started on the other three stations. Within five years, all four were completed and brought on-line. Shortly after the fourth processor started up in late 2266, a sabotage attempt was made simultaneously on all four processors by a radical faction of the North American Research League (NARL) who felt that altering the natural atmosphere on Kie-Yuma would drastically affect the course of evolution on the world. This NARL faction had voiced its complaints to Trilon back when plans for the first processor were announced, but Trilon had dismissed their concerns as "scientifically unsubstantiated" and stated the Trilon's environmental scientists had determined that such changes as were going to be made in the atmosphere would have little effect on native life forms. This response from Trilon prompted the NARL faction to more drastic action—a sabotage attempt on all four processors shortly after they came on-line. Trilon security managed to stop most of the NARL saboteurs (who were masquerading as Trilon maintenance workers), but one NARL team did get through to disable one processor. Damage to this station was relatively minor (the saboteurs were caught before they could complete their task), although repairs caused it to remain off-line for several months. The saboteurs, denounced as radical extremists by NARL itself (which denied any official sanction to the saboteurs' activities), were shipped back to Earth for trial on charges of trespassing and destruction of private property. After this event, security around the processing stations was beefed up significantly. NARL, while disapproving of the processing stations, refused to engage in anything but nonviolent protests against Trilon, at least officially.

Trilon opened up its world to other companies in 2274. Various businesses were encouraged to start up branches on Kie-Yuma. Transport facilities as well as office and manufacturing space could be leased from Trilon. A number of companies, eager for a chance to gain a foothold in the French Arm markets, established their own operations in Kie-Yuma. Growth has continued up to the present day, and expansion of the Trilon facilities on Kie-Yuma has occurred at a steady pace.

Government: Government on Kie-Yuma is essentially dictated by Trilon Industries. With most of the colonists on Kie-Yuma being

Trilon employees, and with most of the space used by non-Trilon companies being leased from Trilon (including all the spaceport facilities which are owned and operated by Trilon), Trilon is the highest authority on its world. Being an American-based corporation, Trilon technically follows the laws of America. As the sole controlling body of the colony world of Kie-Yuma, however, Trilon can effectively make its own laws. While adhering to American laws, Trilon has also formulated a number of new, more restrictive "laws." By euphemistically referring to these "laws" as "corporate policies and regulations" and "security precautions," Trilon has managed to institute laws which many people would loudly object to if they were proposed by a national government. As corporate policy, however, on a world populated mostly by Trilon employees, these laws have been accepted by most if not all colonists, with the few objectors content just to gripe about the "dumb company rules." So long as no one accuses Trilon of breaking established laws, the American government has little interest in keeping an eye on how Trilon runs its colony; the unofficial attitude is that since they are nationals in the employ of an American company with facilities located in a foreign country, they are subject to the laws of the soil they're living on. American citizens living on Kie-Yuma, however, are expected to file an American tax return annually with the Internal Revenue Service as do all American citizens living and working in foreign lands.

The "government" of Kie-Yuma is the Board of Directors of the Xi Ursae Majoris Branch of Trilon Industries, Inc. Headed by the chief Executive Officer of the Branch, the Board sets all company policies and oversees the operation of all activities on Kie-Yuma that are under Trilon jurisdiction. Representatives of other companies with operations on Kie-Yuma are frequently invited to attend open board meetings, although they are only able to make suggestions and are not able to vote on policy decisions being considered by the Board. Colonists can petition the Board of Directors for changes and/or improvements in the colony, but they are not allowed to attend Board meetings, and their ideas are regarded as just suggestions by the Directors (who are under no obligation to act on these suggestions).

The legal system in Kie-Yuma is under the control of two bodies: the Trilon Corporation legal department (which serves as lawyers and judges in minor legal matters) and the Trilon Security Service (which serves as the police force). The legal code used is that of America, but only minor legal disputes are handled on Kie-Yuma. For major criminal acts, the defendants are deported to Earth for trial (under guard by Trilon Security, of course), where the guilty are sentenced and taken care of by American courts. In cases where a plaintiff finds the Trilon legal decision unfavorable, an appeal can be made to the American courts on Earth. This, however, can be a lengthy and expensive route to take; thus such appeals are relatively uncommon. Other companies with operations on Kie-Yuma often have their own security services in charge of their facilities. These other security forces are, however, answerable to the Trilon Security Service in cases of emergency or other potentially dangerous situations. Trilon Security maintains several quasi-military installations, both on Kie-Yuma and in orbit around the planet, in order to keep alert for and defend against, if necessary, Kafer attacks. Although Kafers have yet to be spotted in the vicinity of Xi Ursae Majoris, the possibility of such an appearance cannot be ignored (since this is on the frontier of the French Arm).

As a "government," Trilon generally takes reasonably good care of its "citizens." Local taxes do not exist, per se. Instead, Trilon employees are subjected to an "administrative deduction" on their paychecks, which serves to help finance the "government." Non-Trilon companies/citizens pay an "administrative support fee," a "facilities rental fee," and a "security services fee" to Trilon for as long as they are in Trilon territory and utilizing Trilon facilities, land, or personnel. Trilon, in exchange for these fees, offers living and recreational facilities, insurance, transport services, and utilities to the colonists at a nominal cost. Life, health, and property insurance are administered by Trilon under a group plan available to Trilon employees on a paycheck-deductible basis and to non-Trilon personnel on a low fee basis. Health care is furnished by Trilon-operated medical centers and hospitals on Kie-Yuma. All utilities are also run by Trilon, although several small companies have been contracted to operate these utilities. Everyone using the utilities pays for them on a fee-for-usage basis, although the rates are subsidized by Trilon funding.

Trilon keeps a close watch over imports and exports to the colony. Free trade is encouraged, although minor protective tariffs have been instituted on some products that Trilon produces itself (they don't want their "captive" market threatened). Exports in particular are observed, especially to make sure no one is illicitly selling Trilon products, property, or information ("company secrets") to off-world buyers. To this end, Trilon controls all shipping and cargo handling to Kie-Yuma, and all shippers must file a "Statement of Cargo" (in triplicate hardcopy: a computer-readable form) with Trilon's shipping department (for Trilon's "inventory records").

Facilities: Due to the unsavory elements in the planet's atmosphere, all of Kie-Yuma's colonists live and work in sealed habitats of some form. Air and water are pumped in from the planet's surface, although both must pass through extensive filtering before being utilized by humans. The sealed habitats also serve to protect the colony's facilities from the severe thunderstorms that often develop on Kie-Yuma's surface.

The city of Arnor, located below the plateau where the colony's main spaceport was built, is the showpiece of the colony. Possessing all the comforts (and more) of the most modern Earth cities, Arnor is completely enclosed under a huge transparent dome. Many colonists live in Arnor or its outlying suburbs (connected to Arnor by enclosed tubeways). While the suburbs are also protected by transparent domes, they are not nearly near as large as Arnor, nor is the standard of living in them as luxurious as in Arnor.

ADLERHORST

Vogelheim

The Vogelheim system has a remarkable two worlds with independently developed biologies. The first is Adlerhorst, home of a human colony. The second is Oiseau, which has evolved a bizarre Halogenaceous biosphere which is under investigation by curious scientists.

SYSTEM DATA

Adlerhorst is the colony world which orbits the star Vogelheim, a K3 V star on the extreme fringes of the French Arm of explored space. The star's radius is 0.696 that of Sol, and its mass is 0.70. The luminosity is rated at 0.216, and the star has an effective temperature of 4420 degrees. The star's heat and radiation output support a narrow life zone band extending from 0.3 to 0.6 astronomical units around it.

Vogelheim supports an extensive family of planets, including a planetoid belt in the outer fringes of the system. The last planet in the system is a gas giant which itself has a family of seven planets. A detailed listing of planets and their information follows:

Vogelheim I, Adlerhorst: *Orbital Radius:* .5 AU *Diameter:* 14,000 kilometers *Density:* 1.1 Earth Mass: 1.43 Earth *Grav:* 1.156 G *MMW:* 5 *ATM:* 1048 *World Type:* Garden *Water:* Oceans 80% *Temperature:* Temperate *Atmosphere: 22%* Oxygen partial pressure 230.56.

Vogelheim II, Ptak: *Orbital Radius:* .85 AU *Diameter:* 26000 kilometers *Density: .* 1 Earth Mass: .83 Earth *Grav:* .647 G *MMW:* 16 *ATM:* 632 *World Type:* Failed Core *Water:* None *Temperature:* Cold.

Vogelheim III, Pasare: *Orbital Radius:* 1.28 AU *Diameter:* 2000 kilometers *Density: .6* Earth Mass: .002 Earth *Grav:* .121 G *MMW: 299 ATM:* 118 *World Type:* Ice Ball *Water:* 60% ice *Temperature:* Cold.

Vogelheim IV, Oiseau (Halogenic Biosphere Fluorine/Oxygen - 50C): Orbital Radius: 1.91 AU Diameter: 11,000 kilometers Density: A Earth Mass: 0.25 Earth Grav: .547 G MMW: 23 ATM: 534 World Type: Failed Core Water: Ice Sheets 20% Atmosphere: Florine 21%, Oxygen 8% Temperature: Cold.

Vogelheim IVa, Aigle: Orbital Radius: 330,000 kilometers Diameter: 6000 kilometers Density: .2 Earth Mass: .02 Earth Grav: .211 G MMW: 158 ATM: 205 World Type: Ice Ball Water: 30% surface ice Temperature: Cold.

Vogelheim V, Pouli': Orbital Radius: 3.5 AU Diameter: 4000 kilometers Density: A Earth Mass: .012 Earth Grav: .199 G MMW: 178 ATM: 194 World Type: Ice Ball Water: 10% surface ice Temperature: Cold.

Vogelheim VI, Tori: Orbital Radius: 4.6 AU Diameter: 18,000 kilometers Density: .6 Earth Mass: 1.66 Earth Grav: 1.097 G MMW: 5 ATM: 1072 World Type: Failed Core Water: 80% ice sheets Temperature: Very Cold.

Vogelheim VIa, Washi: Orbital Radius: 18,000 kilometers Diameter: 300 kilometers Density: .1 Earth Mass: .0001 Earth Grav: .001 G MMW: 299 ATM: 8 World Type: Ice Ball Water: 50% surface ice Temperature: Very Cold.

Vogelheim VIb, Ahiru: Orbital Radius: 720,000 kilometers Diameter: 600 kilometers Density: .8 Earth Mass: 0.0002 Earth Grav: .070 G MMW: 299 ATM: 68 World Type: Rock Water: 1 % ice Temperature: Very Cold.

Vogelheim VIc, Kijuuki: Orbital Radius: 1,260,000 kilometers Diameter: 300 kilometers Density: .2 Earth Mass: .002 Earth Grav: .105 G MMW: 299 ATM: 102 World Type: Ice Ball Water: 20% surface ice Temperature: Very Cold.

Vogelheim VII, Ndege: Orbital Radius: 8.2 AU Diameter: 14,000 kilometers Density: .7 Earth Mass: 0.91 Earth Grav: .92 G MMW: 8 ATM: 900 World Type: Failed Core Water: 30% ice sheets Temperature: Very Cold.

Vogelheim VIIa, Winchi: Orbital Radius: 980,000 kilometers Diameter: 1000 kilometers Density: A Earth Mass: 0.0001 Earth Grav: .049 G MMW: 299 ATM: 47 World Type: Ice Ball Water: 40% surface ice Temperature: Very Cold.

Vogelheim VIIb, Bata: Orbital Radius: 1,540,000 kilometers Diameter: 2000 kilometers Density: 1.3 Earth Mass: .004 Earth Grav: .179 GMMW: 299 ATM: 87 World Type: Rock Water: 1 % ice Temperature: Very Cold.

Vogelheim VIII Aves: Orbital Radius: 1 5.6 AU Diameter: 11,000 kilometers Density: .2 Earth Mass: 0.1 2 Earth Grav: .387 G MMW: 47 ATM: 377 World Type: Failed Core Water: 50% ice sheets Temperature: Very Cold.

Vogelheim IX, Planetoids: Orbital Radius: 20.2 to 22.1 AU

Vogelheim X, Tsipor: Orbital Radius: 36.4 AU Diameter: 19,000 kilometers Density: .7 Earth Mass: 2.28 Earth Grav: 1.251 G MMW: 4 ATM: 1 222 World Type: Gas Giant Water: 1 % atmospheric ice crystals Temperature: Very Cold.

Vogelheim Xa, Manof: Orbital Radius: 57,000 kilometers Diameter: 4000 kilometers Density: A Earth Mass: .012 Earth Grav: .199 G MMW: 178 ATM: 194 World Type: Ice Ball Water: 20% ice Temperature: Very Cold.

Vogelheim Xb, Nescher: Orbital Radius: 76,000 kilometers Diameter: 1000 kilometers Density: 1.1 Earth Mass: .0004 Earth Grav: .04 G MMW: 299 ATM: 47 World Type: Rock Water: 1 % ice Temperature: Very Cold.

Vogelheim Xc, Beytsah: Orbital Radius: 855,000 kilometers Diameter: 1000 kilometers Density: .5 Earth Mass: .0002 Earth Grav: .055 G MMW: 299 ATM: 54 World Type: Rock Water: 1 % ice Temperature: Very Cold.

Vogelheim Xd, Avazah: *Orbital Radius:* 1,140,000 kilometers *Diameter:* 100 kilometers *Density: .6* Earth Mass: .0001 Earth *Grav:* .001 G *MMW: 299 ATM: 8 World Type:* Rock *Water:* 1 % ice *Temperature:* Very Cold.

Vogelheim Xe, Yonah: *Orbital Radius:* 2,470,000 kilometers *Diameter:* 900 kilometers *Density:* 1.2 Earth Mass: .0004 Earth *Grav:* .086 G *MMW: 299 ATM:* 83 *World Type:* Rock *Water:* 1 % ice *Temperature:* Very Cold.

Vogelheim Xf, Tarnegol: *Orbital Radius:* 2,660,000 kilometers *Diameter:* 3000 kilometers *Density:* .3 Earth Mass: .003 Earth *Grav:* .129 G *MMW: 299 ATM:* 125 *World Type:* Ice Ball *Water:* 10% ice *Temperature:* Very Cold.

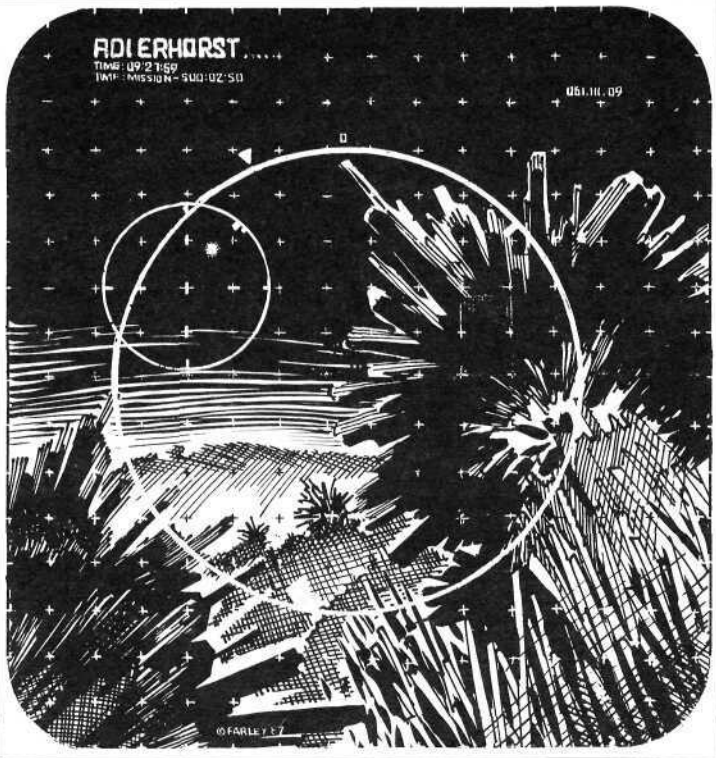
Vogelheim Xg, Barvaz: *Orbital Radius:* 2,850,000 kilometers *Diameter:* 1000 kilometers *Density:* 1.0 Earth Mass: .0004 Earth *Grav:* .078 G *MMW: 299 ATM: 76 World Type:* Ice Ball *Water:* 60% ice *Temperature:* Very Cold.

PLANETARY DATA

There are two main continents on Adlerhorst (Brunnquell and Turmfalken) and a smaller south polar landmass. A chain of islands stretches east from Brunnquell for over 1 2,000 kilometers along the world's main tectonic fault line.

Climatic variation on Adlerhorst ranges from the arctic and near-arctic conditions of the south polar landmass to the temperate and tropical climes of the two largest continents.

When tectonic activity created two major landmasses on Adlerhorst about 180 million years ago, life on the world split into two similar but distinct lines of evolutionary development. Although descended from the same basic types of creatures, the



main life forms on each continent have been isolated for eons and now form two different classes: *Xenoavia* (strange birds) and *Tomavia* (almost birds). Superficially, both classes resemble Terran birds, which caused the initial survey crew to name the system Vogelheim (Bird Home) and inspired the basic nomenclature for the remainder of the system (various avian-related names from a variety of Earth languages). Unlike birds, however, the avians of Adlerhorst have largely kept their teeth, and many have manipulatory appendages at the carpal joints of their wing-like forelimbs.

Naturally, there are other forms of life on Adlerhorst (just as there are more than reptiles and mammals on earth), but these two classes are the dominant life forms on the world and thus of the most interest. Adlerhorst boasts more than thirty other classes of life inhabiting all environments, ranging from single-celled life forms through invertebrate and vertebrate animals, to the largest creature on the planet, the thirty-meter-long Meeresungeheuer *(Cetasquamatus singhensis),* which is neither Xenoavian nor Tomavian.

The inhabitants of Brunnguell (the various orders and genera of the class *Xenoavia) are* feathered, four-limbed vertebrates with a homeothermic metabolism. They are oviparous and retain vestigial clasping appendages on their wings. Some forms have lost the ability to fly. Among those of interest are:

Pferdvogel *(Hippoavia var*.): The Pferdvogel (or horsebird) is a large, flightless herbivore of the plains of Brunnguell. One species *(H. bicolor)* has been domesticated and serves as a food animal, but it still thrives in the wild as well. The largest Hippoavians weigh nearly two tons *(H. optimus),* the smallest *(H. cervicelli)* less than 80 kilograms.

Hummers *(Pterodeimos var.):* A bipedal carnivore native to the uplands of Brunnquell similar to the now extinct Diatrema of the Ogliocene epoch on Earth. Their distress call is a loud, low-pitched hum, hence the name commonly applied to them by the early colonists. Hummers have all but lost their wings, but they retain highly developed claws on their legs with which they bring down their prey. Hummers attack in family groups, usually of six or more individuals, chasing their prey to exhaustion and then moving in for the kill with great slashing leaps. Hummers are now largely restricted to the sparsely settled northwestern plains of Brunnquell. Hummers range from 100 to 400 kilograms in weight, and from 1 to 2 meters in height.

Papageitaucher *(Gymnopteros var.):* The Papageitaucher is a small (. 1 kilogram) bird/rodent of the Brunnquellan woodlands, living a semi-burrowing existence in the undergrowth. Its small size and photophobic (light-shunning) lifestyle make it similar to Terran rats in some ways. As a result of their lifestyle, "Tauchers" (as they are called) have lost most of their feathers, retaining only a thin, downy coat (like a chick's). Their wings have lost all capacity for flight, and they now possess two claw-structures for burrowing or stripping seeds from plants. *G. laticlava* is a pest to human farmers, and it accounts for significant crop losses each year despite active campaigns against them. A smaller form, *C. kohli* dwells in the Gelbwuste (yellow desert) south of the Baumberg mountain range.

Overall, the Xenoavians are quite successful, even though their development is somewhat primitive compared to Terran mammals. Escaped Terran imports have been largely unable to establish themselves in the face of the local competition except in certain limited areas.

The Tomavians of Turmfalken are likewise feathered, four-limbed vertebrates with a homeothermic metabolism. They have developed along divergent evolutionary pathways, and in some ways, they are more sophisticated than their Xenoavian cousins. Although both classes usually have teeth, Tomavian teeth are usually more differentiated and more likely to be adapted to a specialized use. Tomavians have more developed manipulative appendages, often very highly developed. The main difference between the two classes, however, is in reproduction: Tomavians have developed a semi-viviparan reproductive cycle similar to that of Terran marsupials. Tomavians give birth with the embryo in a relatively early stage and carry the developing young in a pouch. Since Tomavians are not mammals, they cannot nurse and must feed the developing embryo with fluid (predigested food from a special digestive sac) fed mouth-to-mouth.

The most interesting animal of the Turmfalken forests is the Schlingel (scalawag), a monkey-like animal with highly developed manipulative appendages and forelimbs adapted to climbing and brachiating. The Schlingel leads an arboreal life in the lowland rain forests of Turmfalken and has been domesticated as a pet by the local colonists. Its name is a result of its playful nature and its comical curiosity.

Ocean Dwellers: Semi-aquatic Xenoavians have filled a limited number of niches on the shores of Turmfalken. They range from small diving forms resembling otters or beavers to a large carnivore similar to the Terran sea lion. They must return to shore or at least shallow water in order to hatch their eggs and are thus limited to certain ranges. A wide variety of long range flyers (including Tomavian, Xenoavian, and other types) populate the various islands of different parts of the world. Of these last, the most famous is the Adlerhorst Albatross *(Mareviator sempervolans),* a Xenoavian flyer which has been known to remain aloft at sea for for more than 14 months, landing on remote islands only to nest and mate.

Located at the extreme end of its finger of the French arm, Vogelheim is at the frontier of human space. Unfortunately, it is also at a dead end, and explorations have largely abandoned this sector of space for more profitable areas. The recent Kafer troubles have caused some concern on Adlerhorst, but the world is far enough from the front (16 light years) that the war amounts to little more than an occasional unpleasant episode on the evening news.

COLONIAL HISTORY

The Vogelheim system was initially surveyed in 2204, and an ESA scientific station/outpost was established four years later. Adlerhorst proved to be an excellent prospect for settlement, but the conditions in the arm at the time prohibited extensive settlement by any nation. The Bavarian government, displaying the traditional Germanic fear of being elbowed out of a good colony made the greatest colonization push, and a Bavarian colony on Adlerhorst was established in 2231. Thirteen years later, in 2244, the first French settlers landed on the world, and a French colony was established near the Bavarian one. Both colonies thrived until the last decade of this century, when politics on Earth shattered the peaceful life on the frontier.

At the beginning of the War of German Reunification, the Bavarian colony was deeply divided over the reunification question. Tension built as the French on Adlerhorst watched reunificationist sentiment build, and a flashpoint was reached when anti-French militia groups took control of the world's lone starport (which was in Bavarian territory but had been operated by a binational starport commission for the last 30 years) and closed it to French traffic. The Bavarian colonial government, facing a rising reunificationist sentiment among its populace, was unable rectify matters. The French, having activated several colonial military units in anticipation of such a problem, moved to reopen the starport. The Bavarian colonial government lost control of the situation, and most of the colony rose in open rebellion. A number of guerilla actions followed, which were primarily fought between local French forces and the Bavarian Constabulary with one side against Bavarian pro-unification militias and guerilla forces on the other.

The anti-French coalition never had much of a chance, and the main result of the war locally was to completely destroy the spirit of cooperation and friendship that had existed between the two colonies. The war ended when the French government on Earth sued for peace in 2293, but the war on Adlerhorst cannot be forgotten. Seven years later, tempers can still run high, and occasional incidents still trouble local authorities. The treaty agreement pertaining to Adlerhorst provided for strict limits on military presence by both countries and declared the spaceport to be extraterritorial. German and French main force military units were moved in, but the spaceport is garrisoned by a multinational force composed of neutral military units (mostly British, American, and Australian).

The destruction caused by the recent war has largely been repaired. The rift between the two colonies is not as easily put aside.

OISEAU

Oxygen is present in significant quantities in the atmosphere of Oiseau, but it has only a minor role in the local biochemistry. Its main effect as far as humans are concerned is to render the atmosphere even more reactive to most metals. Unless protected, metals exposed to the "air" of Oiseau disintegrate into metallic oxides and fluorides very rapidly, some so rapidly they could be said to burn.

Life Forms: The recent discovery of a halogenaceous biosphere on Oiseau has caused considerable excitement in the scientific world. Oiseau was of some scientific interest because of the rarity of fluorine atmosphere worlds (fluorine is not a common chemical in the universe, and its presence in such quantities on Oiseau is an incredible statistical anomaly). Since the corrosive atmosphere and low temperatures left no possibility of human occupation, and since there was no particular need for any minerals which might have been present, detailed investigation of the world's surface was low-key. A few old-fashioned remote probes were dropped, but standard life detection sensors will not register Oiseauan lifeforms as alive, and therefore they did not pick them up. The world's highly corrosive atmosphere caused the metal in the early probes to deteriorate rapidly, and few remained in operation long enough to do much other than provide a few details of the world's surface. Interest waned, and studies slowed as research money was pushed into more interesting locales.

Part of good scientific technique, however, is to occasionally re-examine old data for new insights. Because of certain anomalies detected in the data from Oiseau, a researcher with the Adlerhorst branch of the ARI reached a startling conclusion late in 2287. A number of odd-looking formations on the world's surface, along with the local equivalent of trees, seemed to be alive (instead of the inorganic crystalline structures they were thought to have been initially). Other (supposedly inorganic) structures seemed to be able to move of their own volition! In 2279, a new series of probes (built using more advanced synthetic materials and less effected by the atmosphere) were sent to the surface of Oiseau. They soon confirmed the presence of a wide variety of halogenic life forms.

The discoveries electrified the scientific community, and surveys from the ARI, the IEX, and other organizations are underway. A cooperative orbital study facility has been established, and regular probes are sent to the surface. Because of conditions, it is rare for a manned survey party to land on Oiseau, and they never stay long. Specimens are difficult to study at close range, and the precise taxonomic relationships and ecological dynamics of the Oiseauan biosphere are still hotly debated. Although the recent War interfered with the study of the planet, the return of peace has caused a renewed effort, and new data become available on an almost daily basis. The body of knowledge about this odd world continues to grow and pose many more questions than it solves.

The nature of basic biochemistries has been fairly well established. The local "plants" photosynthesize carbon tetrafluoride, hydrogen fluoride and other chemicals into food, releasing gaseous fluorine. The local animals convert food into energy by eating the plants, using the inhaled fluorine gas and hydrogen fluoride, and exhaling carbon tetrafluoride. Details of body structure vary, but most plants use chain polymers in their supportive structures, causing one xenobiologist to remark that they are made of PVC plastic.

Speculation about the possibility of intelligent life on Oiseau has grown in the last few years, but no evidence of this has been discovered so far. The extremely low activity level of the most lively local lifeforms makes any conclusions in this area difficult (Oiseauan life moves only when it has to, and then relatively slowly). Even the chief proponents of intelligent life on Oiseau will admit they don't know what form intelligent life might take or how to find it.

NOUS VOILA

Beta Comae Berenices

Beta Comae Berenices is the first system out from Beta Canum along the finger stretching out toward Kafer space. As such, it is likely to become a seat of military power to ward off Kafer advances.

SYSTEM DATA

According to an ancient myth, when Ptolemy Evergetes, the king of Egypt, went off to fight in the wars, his wife, Berenice, was worried over his safety. In order to assure his eventual return, the pretty, young queen swore an oath to Venus that she would sacrifice her hair to the goddess. Nor was her hair ordinary by any means, but was widely known for its loveliness.

As fate would have it, Ptolemy Evergetes did come home, and Berenice, being a faithful woman, proceeded to carry out her vow. Over her husband's protestations, Berenice went to the temple and had her beautiful hair shaved from her head.

The next day, horrible news reached the royal palace: Berenice's beautiful hair had disappeared from the temple treasury! Ptolemy Evergetes was understandably upset, and he immediately sent his troops to arrest the temple's priests who were responsible for his wife's precious locks. Once the clerics were in tow, the king proceeded to arrange for their forthwith execution, to be carried out in as slow and painful a manner as possible.

At that time, the Greek astronomer, Conon, arrived on the scene and saved the temple guardians' necks. The priests were innocent of any wrongdoing, Conon explained, for it was the goddess Venus herself who had taken Berenice's tresses from the temple. In proof of this, he pointed to a fuzzy cloud of light near Arcturus, the brightest star in the constellation Bootes, and claimed that the goddess had placed the queen's hair in the heavens, where it would be seen by all every spring and summer.

The hapless king was out of his league: he knew little of astronomy, and fell for Conon's explanation. Venus's priests were released, and immediately returned to the temple, where they presumably paid off Conon for his able and timely assistance.

At any rate, since ancient times, the constellation lying in the triangle formed by Arcturus, Alpha Canum Venaticorum, and Beta Leonis, has been known as Coma Berenices, or "Berenice's Hair." The second brightest star in the constellation is known, of course, as Beta Comae Berenices.

Nous Voila is one of six planets which circle Beta Comae Berenices, a brilliant GO star similar to Sol. The inner two worlds are a hot house and desert, Senere and Delecroix, respectively. Senere has a dense water and ammonia atmosphere which has trapped the surface in tremendous pressure and heat from the greenhouse effect. A probe to the surface of the planet has indicated that the solid planetary chunk is quite small, only about 5000 kilometers in diameter, but possibly rich in heavy metal deposits. Delecroix is slightly larger than Earth, but much less dense, and as a result has insufficient gravity to attract and hold a significant atmosphere. A manned expedition to Delecroix in 2213 failed to find significant mineral deposits or native life of any kind, dooming the planet to be virtually ignored, at least for the present. The outer three worlds are all gas giants, known arithmetically as Un, Deux, and Trois. The gas giants also have a collection of small worldlets, but none are worth noting. To date there have been no attempts to occupy or even seriously study any planet in the Beta Comae Berenices system outside the orbit of Nous Voila.

PLANETARY DATA

Nous Voila is the third planet circling Beta Comae Berenices, the home of a French colony founded 80 years ago in 2220. The world itself is less dense than Earth, but has a diameter of 1 5,000 kilometers, so its gravity is almost identical to that of Earth. Nous Voila has only about half the water percentage of Earth. The world supports its own military and naval bases.

Nous Voila's climate was not always as temperate as it is today. When explorers first discovered it, it had an adequate atmosphere, but was cold, with ice caps covering most of the planet's surface and holding most of the available water. Native life was adapted to this temperature, with hardy plants and a few small sea creatures, but no land animals.

Scientists used a microbial organism, developed through genetic research, in an effort to make the planet inhabitable by man. The microorganism was let loose on the planet's surface, where over a period of 12 years it spread over the ice caps. The dark color of the tiny creatures changed Nous Voila's albedo, warming the planet and melting most of the ice caps and glaciers except at the poles. Once the change was in effect, a second biological agent was released to kill the microorganism. The world was quarantined for another six years to prevent the undesired contamination of other worlds before the microorganisms were totally destroyed.

Man's ingenuity had changed a frozen, barren world into a garden ready for planting, and later French colonists worked zealously at making their new home a true paradise. The technique of using the microorganisms to warm a world's surface temperature has since been used at two or three other worlds, principally to free up the available water, although the warming of the atmosphere is usually a beneficial side effect.

Interestingly enough, once the ice was melted from the surface of Nous Voila, fossil evidence was discovered that showed that the world had had much more abundant life *before* its latest ice age. French archaeologists found bones of extinct species, some twice as large as the Earth elephant.

Native Life: One species in particular attracted considerable interest, and debate still rages today over its true import. Was there intelligent life on Nous Voila before humans arrived? Some archaeologists believe so. Much of the evidence was destroyed by ice and snow, so artifacts are hard to come by, but some sites seem to yield signs that a mammalian quadruped gathered into communities on the largest continent in the northern hemisphere and settled down to civilized life on a small scale.

It is difficult enough to judge whether a species is intelligent when the species is present before the researcher studying it, but when the species has been extinct for thousands of years, the question may never be answered conclusively. Geneticists have collected vast samples from the life present on Nous Voila, and have attempted to extract as much genetic material as possible from the fossil evidence, but have had no luck in cloning any of the extinct creatures.

Not all of the native life on Nous Voila was harmless to mankind. A virus now known as BCB-IX was responsible for a plague which broke out in 2241. More than half of the colonists on the world at the time were infected, and over a third of these died, resulting in the loss of 70,000 lives. Victims suffered a debilitating decay of muscular strength in their lower extremities, which gradually moved up through the body until it paralyzed the diaphragm, resulting in suffocation and death.

The epidemic was carried to other colonies, including Dunkelheim in the DM +36 2393 system, and as far as Neubayern, but outbreaks there were less severe. For two years, ships past Kimanjano were prohibited from travelling to Earth, and many starship captains refused to pilot their vessels into the French Arm for fear of being caught up in the general quarantine and thus

prevented from returning home.

Working with a skeleton staff, Dr. Louis Damon dedicated his every waking moment to conquering the affliction that had felled so many of his countrymen, including his wife and two of his four children. Necessity is the mother of invention, so it is said, and Damon in his hour of need developed some brilliant techniques to study the virus and possible counter-agents.

The "technique damone" was soon successful, and an antiviral vaccine quelled the progress of the disease. Damon was called to Earth by the French Parliament and awarded the Medal of Honor for his efforts.

COLONIAL DATA

Immediately following the lifting of quarantine by French officials in 2220, the newly adapted planet of Nous Voila was opened for independent colonization. Since the government was already supervising colonization efforts on a number of other worlds, it was agreed that Nous Voila would best be settled slowly by independent contractors and families. The planet's new citizens would enjoy French citizenship and protection, of course, but would be basically on their own to make the colony a success.

The first settlers were mainly families from areas in French Africa like Camaroon and Senegal, which were already a pleasant mixture of races and cultures. They occupied a river valley region which they named Nouveau Amman, where a municipal government was established to provide for steady supplies of food and regulation of a simple structure of laws. By the 2220s France had become one of the most over-bureaucratized societies ever seen, and an unfettered colonization program on Nous Voila naturally drew individuals anxious to leave that legacy behind.

The first generation of colonists were characterized by cooperative families and hard work, putting large areas of land to the plow and establishing an effective hydroelectric network for a colony which at the time stretched over about two hundred square kilometers. Because of the government's hands-off policy, there were no "free rides" to Nous Voila, and this fact did much to filter out all but the highest quality colonists for Nouveau Amman. For a colony world, the climate and conditions on Nous Voila have always been extremely good, and in its early days the colony at Nouveau Amman prided itself on the theory that anyone who visited them would probably relocate to live among them.

But by the second generation, the pressures of an increasing population began to take their toll on the "utopian" society at Nouveau Amman. A greater diversity of laws became necessary, as did wider regulation of many activities, most importantly interface transportation. Also, more distant areas on the planet were being colonized, and the government had to expand its revenue base substantially to provide transportation routes between them.

In 2264, Claude LeVarse of the Paris Conservatory published his *Trait Philologique,* in which he claimed that physical laws were not constant, but depended instead on an evolutionary growth. In some respects, his ideas resembled those of Hegel some 350 years before him, but they were also affected by Willems of Mannheim University in the 2120s and Nakabuki of the Tokyo Center for the Study of Humanity in the 2180s. But while Hegel, Willems, and Nakabuki all considered themselves philosophers, LeVarse professed to be "l'homme utile,"a practical scientist whose ideas could (and should) be applied to the conduct of everyday life.

LeVarse's ideas were hotly debated among philosophers of his day, and opposed principally by Miguel Simon y Vargas of the Universidad de La Paz in Peru. While scholars on Earth confined LeVarse's teachings to the ivory towers of universities and the learned jargon of philosophical journals, on Nous Voila his ideas took root and flourished. Louise Vachon, a student of LeVarse's in Paris, established the LeVarse Laboratory of Utilitarian Philosophy in Nouveau Nice, which had the advantage of being remote from most inhabitants of Nous Voila. There she and her coterie of students developed a new language, which, according to LeVarse's books, would enable them to reshape reality.

In 2281, tragedy struck. Two hundred and sixty-five students, along with Vachon, perished when the life support system for the laboratory was shut off, evidently at Vachon's direction. Documents left behind, written entirely in the installation's new language, described a "deathless state" achievable only by renouncing the "material state" within which humanity was confined.

The government of Nous Voila tried to cover up the incident, which only exacerbated the reaction from opponents of LeVarse. Simon y Vargas published a scathing critique in *Acta Philosophica,* stating that LeVarse's teachings had for the first time been followed to their logical conclusion, and that the results had been anything but useful. LeVarse for his part retired from his Conservatory post that same year after refusing comment on the incident, and died shortly thereafter without publishing any other works.

Today, Nous Voila is an extremely pleasant colony world, still largely independent of direct control by the French Empire. Its 12 million inhabitants lead comfortable lives on this garden world, engaged mostly in agricultural pursuits.

Nous Voila's economy is based on these pursuits, with agricultural goods making up more than 80 percent of the colony's exports. The colony exchanges these goods for manufactured products, as Nous Voila has very little local manufacturing capability. Nous Voila uses an orbital catapult or slingshot as its primary system for boosting goods into orbit. Scramjets are used as supplemental transportation for passenger service and shipment of particularly fragile goods.

The settlements on Nous Voila are not typical of those on other agricultural worlds. Local government operate maglev and airfilm lines connecting hundreds of tiny communities, called villages locally, where specialized activity has become the economic reality. One village might be known for its exotic cheese manufacture, and another for its fine breads or wines. The readily available transportation makes this specialization possible and gives every village a sense of pride in itself and its inclusion in the world community. Competitions for greatest achievements in agricultural produce are held on a village level, winners gaining notoriety on a planetary scale. Certain villages are renowned through all of explored space. (For example, the beers of Shezbourg are highly prized on Earth.)

A typical village is home to between 500 and 5000 people, many of whom live in the nearby countryside. Central power distribution is usually controlled from the village itself, either from a ground station (wind or solar facility), or possibly from a single nuclear power plant. The equipment for the village's specialized operations is usually owned by a village cooperative used and owned by everyone involved. In some cases, where operations are similar, multiple villages are known to jointly own and operate equipment that they might not individually be able to afford.

Agricultural surplus which cannot be consumed locally is exported as cash crops. Commodities not locally produced are then purchased on the open market for consumption. However, since most off-world interests have neither the time nor the desire to deal with villages individually, export cooperatives have been established to present a united front of several communities and their products. These cooperatives deal only with the exporting and importing of produce under the direction of their individual village backers, and are as close as Nous Voila has come to sectioning off into nations.

DUNKELHEIM DM+ 36 2393

Not every colony world has necessarily developed a society which mirrors that left behind on Earth. Dunkelheim is a terrific example of deviated social progress.

SYSTEM DATA

DM+ 36 2393 is a dim, red M2 star in the outer reaches of the French Arm. Its low mass and diminished radiation output make it an unlikely parent of a habitable world, but random elements have conspired to beat the odds. Three tiny worlds circle the star—the first within the narrow life zone and the other two well beyond it. The outer two bodies are both rocky desert worlds without exploitable resources. Only the innermost, Dunkelheim, was fortunate enough to have both some substantial water and sufficient radiation from its star.

PLANETARY DATA

Circling DM + 36 2393 in its first orbit is Dunkelheim, a world colonized by the Germans in 2224. Dunkelheim is a dry, barren world, about half the size of Earth in diameter, with a gravity of about 60 percent of Earth's. Dunkelheim's greater density is an indication of its mineral wealth; Dunkelheim exports many ores, and most of its economy revolves around mining. But it is forced to import agricultural products since the planet is basically incapable of supporting widespread agriculture due to the honeycombing effect of much of its surface.

Dunkelheim has extremely little free-standing water. Typically described as a desert world, there are areas where water is stored, but it is nearly impossible to get at and use for the purposes of the colonists. Large areas of the planet's surface are characterized by its dominant life form, a tiny creature known locally as the Kamelinsekt, or camel fly.

Kamelinsekts live in enormous colonies consisting of billions of individuals. Their social groups can occupy an area up to a mile in diameter, where they consume the sandy soil and excrete a form of cement with which they fabricate a honeycombed habitat up to ten meters deep. Here they breed a new generation before moving on to a new location. Abandoned habitats tend to collect water, and it is very difficult to get it out of the billions of tiny fissures encased in the extremely hard resin.

Unfortunately, Kamelinsekts are the most successful survivor species after a disastrous meteor impact within the last thousand years. Most of their predators have been wiped out, so their population has increased tremendously. They have grown in number to the limit of the local vegetation's ability to support them, and their occupied or abandoned habitats dot the surface of the world, locking up a huge percentage of the world's available water. Local animals have no means of retrieving it, and since evaporation out of the habitat is extremely slow, this water has basically been taken out of the system until a wide-scale plan is implemented to reverse the problem. Currently it is estimated that half of the world's water is locked up in abandoned Kamelinsekt habitats. Approaching a Kamelinsekt habitat can be dangerous—though the creatures are relatively inoffensive, they can easily overwhelm and suffocate people or clog up vehicle components by sheer weight of numbers.

COLONIAL HISTORY

While the world itself is dismal, it boasts a sizable population, the result of an experiment by the Bavarian government in social planning. During the time of colonization, the Bavarian government had a serious problem with so-called "victimless" criminals: prostitutes, drug users or dealers, vagrants, pornographers, and so on. The costly burden of keeping these criminals away from the rest of society was growing to a point of excess, helping to exhaust the Bavarian treasury; meanwhile, the Bavarian government was eager to establish a colony on the mineral-rich first planet circling DM +36 2393, but the living conditions there were not such as to attract colonists.

The Bavarian government killed two birds with one stone by offering remission of sentences to those victimless criminals willing to move to Dunkelheim. The offer was not made, of course, to all of the criminals in Bavaria, but only to those who had some useful skill that the colony could make use of. It was soon populated with sufficient doctors, engineers, lawyers, businessmen, and other professionals. The choice between "live behind bars for a number of years (or pay a hefty fine and suffer the ignominy of a criminal record here on Earth)" versus "move to the stars" was an easy one to make.

As the program progressed, the colonization efforts were so successful that the Bavarian government expanded the program to include criminals with less education or work experience. Violent criminals, of course, were never sent as colonists, but many of the descendants of the original colonists pretend in a facetious way that this was the case.

In fact, every year the colonists commemorate the founding of Dunkelheim by holding "Diebwoche,"or the "Week of Thieves." During the festivities, revelers "steal" small items from restaurants and shops; careful shopkeepers leave out special items just for this purpose, just so more valuable items are not taken. Parties are held, and invited guests must crawl through windows or descend through skylights to gain entrance.

Naturally, the present government of Dunkelheim is not composed of lawbreakers, and except for the Diebwoche, the judicial order on Dunkelheim proceeds apace much as it does on other colonies. The only noticeable difference in the legal structure of the world is a strong libertarian tint. Most of the "crimes" for which the original colonists were charged are not illegal on Dunkelheim. The government knows well enough not to try to poke its nose into the daily lives of its citizens.

Another difference between the basic laws of Dunkelheim and those of most other places is its total absence of professional license laws. Anyone who wants to practice medicine on Dunkelheim may, without restriction. Anyone who wants to practice dentistry also has this privilege. The same goes for plumbers, electricians, lawyers, cab drivers, accountants, and all other occupations.

Surprisingly enough to skeptics on Earth, this lack of regulation has not reduced the quality of services offered on Dunkelheim. To be sure, there are occasional quacks and snake-oil peddlers in the medical field, and shysters in the legal profession, and a few accountants who find it difficult to add up a column of figures, but the market weeds these incompetents out with amazing alacrity. People depend on the recommendations of friends and professional organizations to make their decisions as to whom to patronize, rather than on any official standards set up by the government.

A few brilliant individuals have distinguished themselves under this system. Helmut Rothfarb, a self-taught dentist, cannot legally practice his art off-world, despite having been awarded the De Carvalho Prize for Medicine on Earth six years ago for his research into reconstructive techniques.

Different worlds are colonized at different rates, depending upon the conditions of the world and the inducements offered by governments and private corporations for individuals to set up homes on the colonies. Dunkelheim's population growth has been spurred

by the discovery of several precious minerals there.

While Dunkelheim has yet to produce any tantalum, large deposits of gold were discovered there in 2249. A new batch of "Forty-niners" hurried to participate in this gold rush, and Dunkelheim responded by setting up strict immigration laws. The main thrust of these laws was to prohibit entry into Dunkelheim by French and Azanian nationals. Both governments protested the laws to their Bavarian embassies, and tensions were high enough to result in the expulsion of the Bavarian ambassador to Azania in *2258.* This was a time of considerable strain between Bavaria and France for other reasons as well.

In this case, public complaints resulted in the lifting of the Dunkelheim immigration laws. Azania went so far as to attempt to establish its own colony on Dunkelheim, as was its right (the Melbourne Accords held that newly discovered worlds are open to colonization by all, subject to some reasonable restrictions by the discoverer; Bavaria was a signatory in the 2160s), but the Azanian government failed to follow through on the mission and the colony was disbanded in *2280.* Many of the Azanian colonists returned to Earth, but about *8500 were* absorbed into the Bavarian colony.

As a colony, the planet exports a number of valuable minerals, including zinc, platinum, and uranium. Recently, magnesium and chromium ores have been discovered in the colony's southern hemisphere, and mining crews are moving to exploit these.

In *2286,* a political scandal rocked Goldberg, the capital city of Dunkelheim. It was then that it was discovered that some of the pens used by the government were transmitting information, both sound and position, to unknown spies. Because of the electronics in the pens, not only were the discussions broadcast to waiting ears, but the subtle movements of the pens could be picked up and decoded, so any writing of notes was also captured. As it turned out later, the spies were employees of Hofstadter, an interstellar trading company which was hoping to take advantage of the conditions on Dunkelheim. By bugging government offices, the corporation was aware of all national statistics at the instant they were collected, as well as knowing any possible discussions of government policy which could affect trade.

In the wake of the scandal, the company was forced to shut its doors. The president and chief executive officer of the firm, Gerard Hofstadter, fled, but was captured on Chengdu in the Chinese Arm. Since Hofstadter also traded with many other colony worlds, investigations were made in other places, including Heidelscheimat, Tirane, and even Earth, but no further incidents of electronic surveillance by the company were discovered. (Some historians believe that bugging was discovered, but covered up by authorities afraid of public embarrassment.) Since that time, "writing with a Dunkelheim pen" has entered the common vernacular to mean "telling a secret to an untrustworthy source."

Another interesting episode in Dunkelheim's history is its Mounted Exploration Brigade. Cost analyses by the German government determined that the transport and care for good horses would be cheaper than the transport and upkeep costs for ground vehicles. After considerable study, Arabian horses were chosen for the mission, based upon their superior endurance, strength, and temperament. Four stallions and twenty mares were chosen from Bavarian breeders, as well as from the well-known Polish and Idaho (North America) lines, as the initial Dunkelheim breeding stock. Thirty-six horses of lesser quality were also chosen so that operations on the planet could begin immediately. The starship Rose der Freundschaft was outfitted to carry these special passengers, and the group was carried to Dunkelheim to start breeding operations. Use of the horses on the barren world was an immediate success, greatly facilitating exploration and planning at the ground level. Ten colts and eight fillies were born on Dunkelheim a year later, and the herd was well on its way.

The Dunkelheim Arabians were the first horses taken into space, and over the last 40 years the herd has merited great respect from breeders of Arabians on Earth; many of the horses have returned to their ancestral homes to garner prizes and awards in interstellar competition. Dunkelheim itself continues as a valuable breeding ground for the animals: careful quarantine conditions have prevented the incursion of most horse diseases, so the creatures can be raised and bred in this safer environment.

While technology anywhere makes life easier, living conditions on Earth's colony worlds are not on a par with those of Earth itself. Unscrupulous colony governments can exploit conditions in such a way as to improve the quality of life for their inhabitants at the expense of those left behind.

The government of Dunkelheim exercised the now-proverbial "Dunkelheim slyness" in just such a fashion. In 2291, after six years of bitter guerilla warfare, the French colony of Elysia Joi in 61 Ursae Majoris rebelled against the French government. Shortly after the War of German Reunification, the Bavarian colony of Freihaven, one of the original national colonies on Tirane (Alpha Centauri 4), declared its independence. It has survived because it enjoys close relations with the French Empire, and thus derives military support from it.

Shortly after these related events, the Dunkelheim cabinet, meeting in a secret session, formed its own plans for rebellion. Several ministers were not convinced at first, but others demonstrated at the meeting that current intolerable conditions were sufficient grounds for a dissolution of political ties with Earth.

The entire episode was choreographed well in advance. It was known that Klaus Binger, the Minister of Transportation, regularly reported the discussions of cabinet meetings to friends in the German government on Earth. Different ministers planned out their parts, and objections were raised in such a way that the German government had a way out.

Thus, when Binger tattled to his masters on Earth, he explained that some of the ministers would work to stop the rebellion if certain

conditions were met. It was not long afterward, then, that the German government "suddenly" announced that it had been planning a concerted colonization aid program, and that the program was about to be put into effect. Dunkelheim was to be the first to receive these benefits.

The largesse of the German taxpayer brought better technology and improved conditions to the Dunkelheim colonists. These improvements included a new starport, complete with an orbital catapult for surface-to-orbit transportation, as well as a maglev line connecting the two cities of Neue Berlin and Goldberg and a university in Goldberg.

The threatened rebellion of Dunkelheim hangs like a sword of Damocles over the German government on Earth; while it is now known that the original plans were a ruse, the fact that such a ruse would be resorted to has worried the home government enough that it closely monitors complaints voiced by the citizens of Dunkelheim.

In the early 2290s, Hanover was finally successful in its call to the other German states to unite with it into one unified Germany. At the time, France did not see this as within its political interests, so it acted to prevent this reunification from taking place. The War of German Reunification, waged between France and Bavaria, Hanover, Westphalia, Saxony, and Brandenburg, lasted from 2292 to 2293, and during that time relations in the French Arm were less than cordial.

Formal hostilities between colonies were never declared, but populations lived in fear that a space war might break out. The environmental living conditions of many colonies are not conducive to ongoing strife—a slight disturbance could mean the death of millions of people who are dependent for their support on the continued working of delicate technological devices. Most colonies can survive even if cut off from outside contact; few can survive if their life support systems are destroyed by marauders.

In the case of the French Arm, the French colony at Eta Bootis was entirely cut off, as the Germans in the Hochbaden system refused to refuel ships travelling in that direction. The colonists at Hochbaden also sent ships to their neighbors at DM + 36 2393, to protect the Dunkelheim colony there from any possible incursion from the French at Beta Comae Berenices. (Ironically enough, this same naval squadron was dispatched to Eta Bootis only five years later to defend the again-friendly French colonists there from the Kafer threat.)

Eta Bootis survived comfortably despite its isolation; the colonies at Hochbaden and DM +36 2393 did not fare so well. Most of the food supply for the two German colonies had come from the French at Beta Comae Berenices; with the hostilities at home, both colonies were forced to fend for themselves. Starvation was never a real danger, but food supplies were depleted during the course of the two-year war, and many colonists grumbled at the diminishing choices of foodstuffs. Real imagination was a necessity to prepare the same old staples in an appealing and satisfying way. Thus skilled cooks received any salary demanded during the war.

While Dunkelheim is not well supplied with water, much of the water that it does have is naturally heated by geothermal activity. This, combined with the high mineral content of the water, has created a small health spa industry on the world. Health-seekers travel from as far away as Earth to bathe in the hot springs of Dunkelheim; authorities there do not prohibit any claims of medical benefit for the springs, so the industry flourishes. Efforts have been made to ship the mineral water off-world, but high prices make this commodity a slow seller.

Dunkelheim has very poor interface transportation. A catapult was built for bulk cargo launch, but passenger service is restricted to ships capable of making an atmospheric landing. No government-regulated interface craft are on call, though there are some private agencies available. Their prices are generally high and service is unreliable, but most of the time they are the only game in town.

HOCHBADEN DM+ 2296

The desert world of Hochbaden has become home to a human colony troubled by outside politics. However, with assistance, it has become one of mankind's most remote colonies.

SYSTEM DATA

On the very edge of the French Arm lies Hochbaden, a K6 star with a family of four worlds. Explorers will tell us that such a system has a fair chance of containing a garden world, but in the case of Hochbaden this is not the case—none of the four worlds have spawned life of their own nor are they capable of supporting life transplanted there. Hochbaden is a naturally barren system.

There are apparently one or two empty orbits in the system, since the first world, Hochbaden (the name of both the star and the planet in this system) orbits just outside the life zone of its parent star. The second orbit is held by a rogue, Stein, obviously a captured body, orbiting 30 degrees out of the plane of the ecliptic. Stein has been visited, and has been noted as having substantial iron deposits, but these have yet to be tapped. The third planet in the system is the gas giant Sturmwelt, an enormous world racked by powerful winds and terrific lightning displays. The final world is a frozen ice ball called Hoffman, after its discoverer. Though never visited, Hoffman is almost certainly without value.

PLANETARY DATA

Hochbaden is defined as a desert world. It has a very thin atmosphere which can cause erosion and occasional dust storms, but which cannot support human life. Aside from some microorganisms found around the fringes of poles, Hochbaden is a world without life. Even these microbes are presumed to have been transplanted here by a meteor strike, since they probably could not have evolved under these conditions. Hochbaden has been likened to Mars in many scientific circles.

Around the equator, sufficient radiation strikes the world to keep the average temperature around 10 degrees C. The artificial colony there expends very little energy to maintain a suitable temperature. The day is roughly 15 standard hours in length.

COLONIAL **HISTORY**

The Astronomischen Rechen-Institut is a German foundation active in pure research into the nature of stars and their planetary systems. Founded in 2144, the Institut received much of its early financing from Azanian tantalum supplies. Significant progress was made in the Institut's initial years into extending the range of stutterwarp drives. The Institut has also participated in space exploration and observation, including the first contacts of Beta Canum Venaticorum and Vogelheim nearby in the French Arm.

In the late 2100s, French industrial interests made an attempt to economically take over the Institut, but Bavarian backers did everything they could to avoid this. The solution hit upon was to provide the Institut with entirely independent funding, so that the Institut need never accept money from any outside source. The Institut received extensive endowments, mostly consisting of land and industrial facilities on many worlds.

To commemorate the seventy-fifth anniversary of the founding of the Astronomischen Rechen-Institut, in 2219 Bavarian government officials announced that a "model star city" would be built in the Hochbaden system, which had no garden worlds to colonize. This daring effort was recognized on Earth as an attempt to prove that Bavarian technology was superior to that of the French.

A 12-year period of planning began, and with the cooperation of the Astronomischen Rechen-Institut, construction of Kolonie Zwei was started by the Germans in 2231. Moving a sufficient quantity of goods to the new colony was a costly and difficult undertaking, but the Institut's scientists solved it by planning "Kleinfabriken," or small factories, built in their entirety on Beta Canum Venaticorum and carried to Hochbaden via starship. The Kleinfabriken were designed to immediately produce actual parts of the Kolonie Zwei facility, using ores imported from Dunkelheim, the German colony next door at DM+ 36 2393.

The construction of the colony was not without incident. While the plan was a good one, oversights in the conception of the colony's initial needs caused embarrassing shortages of materials, events which the Earth-based French media were quick to exploit. News accounts of food shortages and uncomfortable living conditions were rampant in the early days of the colony. A satiric pseudo-documentary produced by the French journalist Pierre de Morrage, titled "La Vie Douce" ("The Sweet Life"), was a big hit in the cinemas of the French territories. The film's narrator, a "Bavarian colonist" named Hans Blasekopf (that is, "bubblehead"), escorted audiences through a "typical day on Kolonie Zwei," supposedly showing where he lived, where he worked, and how he relaxed. Blasekopf's constant refrain was "superior Bavarian technology gives me and my family the sweet life."

At the start of the movie, Blasekopf showed the many inconveniences of daily life on Earth with his wife and two children in the town of Essen. Happening upon an advertisement seeking "unhappy souls desiring the sweet life," he inquired into the position and found himself enlisting as a colonist to the Hochbaden system. The rest of the film was high-class farce.

Blasekopf and his family were outfitted in space suits painted to look like German lederhosen; the family's living quarters on one of Hochbaden's asteroids was little more than a cave; a burrowvarg had tunneled through the complex, appearing at inopportune moments for further comic relief; and Blasekopf spent his days supervising a Kleinfabrik where nothing ever worked right, while his housebound wife fought off bouts of boredom by dreaming up new ways to serve "space rations" for her doting husband.

One scene in particular aroused severe Bavarian condemnation. In his off hours, Blasekopf belonged to a league of "Manchurian keglers." Taking advantage of the low gravity in the asteroid, five team members would hurl a Manchurian high into the air in a large dome-shaped room, aiming him at a series of wires stretched across the ceiling. Points were awarded for various combinations of "hits" on the wires.

The Bavarian press accused de Morrage of racism in a series of scathing editorials, but the charges backfired: the publicity given the film only heightened its popularity, and dubbed foreign-language versions were soon being enjoyed by Americans, Russians, Arabs, and, surprisingly, Manchurians.

In fact, although proud Bavarians on Earth felt stung by the barbs in the film, the colonists themselves enjoyed the attention brought about by it. They knew firsthand that the new technology provided by the Institut was in its own way superior to that of Earth and other colonies, and while life was not always "sweet," it was certainly more than adequate. Today, Kolonie Zwei's principal newsweekly is titled "Das S'leben" ("The Sweet Life"), and inhabitants of the colony refer to themselves as "Blasekopfe."

Kolonie Zwei is a small colony occupying the first orbit of Hochbaden. Half of the four million colonists live in orbital complexes circling Kolonie Zwei, constructed from large asteroids sharing the planet's orbit. The remainder of the colonists inhabit small-to-medium-sized complexes on the world's surface.

With the technical assistance of the Astronomischen Rechen-Institut, Kolonie Zwei is known for its high tech manufacturing facilities, many of which are orbital. The colony exports computers, electronic components, space satellites, and energy-weapon systems. Since these goods are manufactured in space, there is no cost in getting them to orbit. Each year, Kolonie Zwei imports a large quantity of ore and a moderate amount of agricultural goods.

Kolonie Zwei is effectively "at war" with the mysterious Kafers, who have destroyed a research station and invaded another world nearby. First contacted in 2295 by an exploratory party to the Arcturus system, very little is known about this race.

The next major incident in human-Kafer relations came with the destruction of the French research outpost in the Arcturus system in 2297 and the subsequent attacks on merchant and military vessels entering that system. So far as is known, all 1 73 men and women on duty at the French outpost were killed in the initial attack.

In 2298, a large Kafer invasion squadron entered the Eta Bootis system. Although Ukrainian and Imperial French naval reinforcements had been dispatched to the system as a precaution, the early battles went in favor of the Kafers due to their superior numbers. All satellites in orbit around Eta Bootis were destroyed, including the three operational solar power arrays. Close orbit was captured and infested with Kafer surveillance and defensive craft, and ground troops were landed.

Although relations between Germany and France remain stormy even to this day, the obvious crisis at Eta Bootis prompted the dispatch of a German naval squadron which, along with French and Ukrainian reinforcements, managed to drive the Kafer star fleet from the Eta Bootis system. Although the human defenders on the surface of the planet were relieved, surviving Kafer ground troops continue to strike from wilderness bases at outlying settlements in sudden, savage assaults. Understanding an alien race is difficult enough when all of the data is immediately available—the Kafers present a special and on-going puzzle because there is no formal contact with the race, and no Kafer has ever been captured for study and analysis. Virtually nothing is known about their society and government, and very little is understood about their physiology.

Will the Kafers attack again, and if so, where? These two questions are foremost in the mind of every colonist on Kolonie Zwei, which is only five days travel from the world of Aurore in the Eta Bootis system. Particularly disturbing to the colonists is the high military value of Kolonie Zwei to the Kafers, who would no doubt benefit from its highly industrialized facilities, especially its heavy weaponry manufacturing plants. Originally, the orbital city of Kolonie Zwei was not really defended (as is the case with most colony worlds) simply because it would be too much trouble for an Earth-based power to attack a colony, compared with the benefits from successfully capturing one.

In the case of the Kafers, a sudden attack is much more probable. The Kafers need not worry about their compatriots on Earth, because they have none. They need not worry about the public opinion of humans, because they evidently don't care, and besides, their merciless attacks against Arcturus and Aurore have already besmirched their reputations sufficiently. They need not worry about interference with the supply lines to their other colonies in retaliation, because presumably their supply lines lead backward, farther out in the French Arm, where humans have not yet explored.

Meanwhile, the residents of Kolonie Zwei are kept in a constant state of readiness against attack. The side effects of this policy have not been entirely pleasant. The population is of course disturbed; the normal anxieties of space-bound life are exacerbated by the threat of an invasion, and the resulting tensions have pulled apart some of the interpersonal ties that keep a society running smoothly. The crime rate in Kolonie Zwei is up, as is the rate of divorce and family member abuse. Interstellar trade has dropped off slightly, as many vessels do not want to chance being trapped in the system whenever the inevitable Kafer attack finally takes place. Prices on imported commodities have skyrocketed in the last two years; wholesalers and retailers claim this is an effect of the normal workings of the law of supply and demand, while many citizens (and more than one government commission) argue forcibly that consumers are being bled dry by unscrupulous businessmen taking advantage of a state of emergency.

When the War of German Reunification broke out, the population and government of Hochbaden fell directly behind the German cause. In its aftermath the entire colony considers itself to be a German organization, welcoming all Germans and their allies as friends.

In January of 2299, the "Kafer Riots" broke out. The failure of a warning satellite at the outer edge of the system provoked a panic in the citizenry, further inflamed by irresponsible news reporting. The populace was a dry tinder-box waiting for just such a spark. First broadcasts implied that the loss of the satellite was the harbinger of imminent invasion, and an escalation of the panic convinced many citizens (who heard the ever-growing rumors) that a fleet of 60 Kafer vessels had been spotted heading toward the colony.

The colonists erupted into a free-for-all of looting and pillage, with every man for himself. Insurance companies reported claims of over Lv30 million from shopkeepers and warehouse owners who lost entire inventories to mobs determined to grab hold of anything of possible use. Within a matter of hours, 16 starships were hijacked by rioters attempting to flee the system and escape to DM+ 36 2393. Four of these starships were lost entirely, presumably destroyed in space accidents fomented by untrained crew members acting in panic. The final casualty count was 89 deaths and several hundred injuries.

It took another 48 hours before the situation was back under control, and another eight months to repair the damage. Much chagrined, the populace settled back into its day-to-day existence. Over the protests of the news media, the government declared it a crime to falsely or incorrectly report a Kafer attack, such crime to be punishable by deportation from the colony and seizure of the offending broadcaster's assets.

Another intriguing discovery made on Hochbaden, one which attracted much attention for several years, was the so-called "singing stones," similar in certain respects to the "singing sands" of Tibet and the Sahara on Earth. The singing stones of Hochbaden were a natural crystalline mineral, which was found to vibrate slightly whenever the air around it was sufficiently charged with static electricity. While to most humans this vibration was too high-pitched to actually be audible, some could hear the soft whine of the rocks by putting their ears a few millimeters from the stone's surface.

Further investigation by mineralogists led to a more interesting accidental discovery: the sound of the stones was soothing to humans, having a physiological effect as a natural tranquillizer. Scientists studying the stones discovered this quite by accident, experiencing the soothing effect themselves in the course of their research. Extensive double-blind tests proved that the resonance generated by the stones did indeed calm the human nervous system, and further studies were made to discover why this was so.

Meanwhile, the entrepreneurs who owned the Hochbaden

Steinmarkt were becoming wealthy, supplying overstressed executives, housewives, students, and others with the miracle of the singing stones. High-quality digital recordings were sold in the millions, and many of the stones themselves were loaded into starship holds and transported off-world. Actually, the recordings worked better than the stones themselves, because the apparatus necessary to keep the stones sufficiently charged was unwieldy and expensive. Besides this, the "sound" from the stones was at an almost subliminal level, and many purchasers felt less than satisfied when they weren't able to hear the stones at as loud a level as the recordings made possible.

After about a year and a half of brisk sales throughout the French Arm and on Earth, customers suddenly found themselves unable to purchase either the stones or the recordings. Moneys sent for products yielded nothing, and when the Hochbaden police investigated, they found that the Steinmarkt had closed its doors and disappeared. Shortly thereafter, the incredible power of suggestion in humans came to light: in fact, the singing stones never sang at all, and certainly had no external, objective psychological effect whatsoever. The "scientific studies" printed in prestigious journals had been part of a gigantic hoax, and those individuals who found it difficult to make it through the day were relying entirely on their own mental processes to produce the supposed calming effect of the stones.

Police searched for the owners of the Steinmarkt for eight years before closing the file on the case. Embarrassed "stoners" sued the Festschritt der Psychologischen Forschung, but without success. One new church tried to capitalize on the scandal, preaching that peace of mind was possible for every man and woman if certain focusing and autosuggestion techniques were used, but little came of this movement and it disbanded a few years later.

Today, Hochbaden is an extensive colony complex both on planet and off. Fully enclosed cities on the surface house every aspect of colonial life, from limited agriculture to residential areas to medium and heavy industrial plants. The citizenry enjoys a fair amount of recreational return from their tax livre. The government provides plenty of parks and sporting activities—Hochbaden has often been prominent at the Olympic games. The government also actively seeks out entertainers willing to make the trip to Hochbaden, offering money for multiple performances. As a colony which has been completely manmade without benefit of a garden world, Hochbaden is a marvel of the new age.

AURORE

Eta Bootis

The moon of a gas giant, Aurore is a colony world ravaged by war. The Kafer invasion has left the planet reeling, trying desperately to recover the progress it has lost.

SYSTEM DATA

The Eta Bootis System consists of five gas giants all orbiting the system's double primary in its outer zone. Eta Bootis A and B orbit one another with an average separation of 1.425 AU with an orbital period of 495 days. The stars are too close together to allow Earthlike worlds to orbit one star or the other and too far apart for an Earthlike world to exist in a habitable zone circling both.

The Eta Bootean planets have been named Hesperus, Tithonus, Laodemon, Theia, and Astraeus. In terms of the mass of Jupiter, these gas giants are 0.8, 5.3, 1.6, 0.5, and 0.28 respectively.

The largest of the Eta Bootean planets is a small member of that class of objects known as "brown dwarfs." Over five times more massive than Jupiter (Sol V), Tithonus radiates far more heat than it receives from its suns due to gravitational contraction. It is not quite massive enough to trigger the thermonuclear reaction which would allow it to "turn on" and shine as a true star; thus it is doomed instead to exist as a sullen, dull-glowing body lying halfway on the hierarchy of cosmic objects between the largest true planets and the smallest true stars.

The heat Tithonus gives off is sufficient to *create a* narrow habitable zone at a distance of 3.6 planetary diameters. Tithonus' third major satellite lies within the habitable zone and is massive enough to have retained an atmosphere during its early history.

PLANETARY DATA

Eta Bootis IIc is Aurore. It has an equatorial diameter of 9450 kilometers, but the overall shape of the planet is elongated, its longest axis always pointing toward Tithonus. The surface gravity is 0.734 G.

Aurore is young, as planets go. Eta Bootis A, a young sub-giant rather than a main-sequence star, and its attendant planetary system are probably no more than two billion years old.

Evolution has proceeded rapidly on Aurore, however. The slightly higher-than-normal background radiation stimulates mutagenic processes and has resulted in the rapid evolution of plant-analogues, animal-analogues, and a third intermediate kingdom or regnum which has not been assigned a formal name. All subsequent regional references are to these groupings.

Auroran animals are either actively poisonous to humans, or they do absolutely nothing for them, passing through their systems undigested. This is because Auroran life is based on right-handed, or dextro-amino acids, mirror image (and indigestible) forms of the levo-amino acids necessary for human life. For the same reason, humans eaten by Auroran life forms either do nothing for the predators or make them very, very sick.

Auroran plants use a blue-green chlorophyll analogue as a catalyst in a typical photosynthetic cycle. A majority of Auroran plant forms, however, supplement their nutrient intake directly by feeding on other life forms, either as saprophytes or as carnivores. Auroran vegetation tends to be massive, leathery, and blue to charcoal in color. The equivalents of trees tend to be low with thick, spreading caps or foliage masses. The type known as broadtops resemble Terran mushrooms, grow up to ten meters tall, and are noted for their light, strong wood. Area-producing plants have the appearance of terrestrial liverworts or coral, are blue to blue-green in color, grow in low-lying clumps, and are rubbery or spongy to the touch.

Land animals are relatively simple, and most are members of a single class, the xenocancerforms. Approximate terrestrial homologues would be horseshoe crabs or similar crustaceans.

The intermediates share characteristics of plants and animals, distinctions which are somewhat blurred on Aurore to begin with. They appear to be either sessile animal forms or nonmotile plants which have evolved motile forms as one stage in a complex and, as yet, unknown life cycle. One notable example, *Stragulum ambulatio,* is motile or sessile depending on the presence or absence of water.

The human colonies on Aurore have been steadily replacing the native life in selected areas with imported Earth crops. Where terrestrial strains have grown wild in places, they have generally failed in competition with native Auroran forms, and colony farms must be carefully and patiently worked to maintain the balance of their miniature and artificial terrestrial ecosystems.

Acids: Numerous Auroran life forms use powerful organic acid, either as a digestive juice or, in the case of the creep, to create a shelter from the incoming tide in soft rock. The referee is reminded that these acids do not perform the miracles attributed to various acids on TV or in the movies. They do not eat through steel, nor can the creatures use them to tunnel through solid rock.

Acid-secreting life forms are immune to the corrosive effects of the acids they produce. Many are armored with carbon-based compounds best described as organic plastics.

The effects of acid on unprotected human flesh are severe but not immediate; the stuff will burn the skin and break it down in time but is more dangerous as a systemic poison than as a corrosive. The exception is the creep, which can cause terrible acid burns with just a few moments of exposure.

Humans have occupied several small parts of Aurore for only a little over 50 years. Vast areas of the Auroran wilderness are virtually unknown or have never been visited at all. The life forms listed above are those dangerous or notable creatures which have been frequently encountered by the colonists.

Others exist, however, which are as yet undiscovered, or which are known only as tales and stories told by frightened or otherwise preoccupied men. Several of these are presented below. Some are dangerous, some merely threatening, some simply unusual. They are unnamed since naming is the prerogative of the characters who discover them.

COLONIAL HISTORY

First Survey: The first long-term human visitors to the Eta Bootis system were scientists of the French Imperial survey vessel, *Le Chercheur,* on a French-directed, ESA-sponsored mission to chart the systems of the finger of the French Arm beyond Beta Comae.

Earlier explorational visits had noted that Eta Bootis' inner system was barren of planets due to the perturbational effects of the GO IV star's red dwarf companion, and that the system's second planet was a sub-brown dwarf of possible interest for future missions. Data drawn from long-range photographic and spectroscopic surveys had alerted the scientists aboard *Le Chercheur* to the possibility that one of the brown dwarf's satellites might lie within a narrow habitable zone created by the superjovian's own radiated heat. A ship's boat commanded by Capitaine de Corvette Georges Loubet made the perilous approach through the superjovian's radiation belts by executing a transpolar orbital insertion, landing on Eta Bootis IIc near the present site of Lumiere d'Aube on August 24, 2238.

Loubet's expedition remained on the planet for 18 days, visiting

four different sites and transmitting the survey reports to *Le Chercheur* by laser. While attempting to land at a fifth site, the landing boat was destroyed by the arrival of an unexpectedly high tidal surge, and Loubet and his entire command were lost.

First Colony: In 2240, on the return of *Le Chercheur* to Earth, data from the survey were disseminated among ESA member states. The Ukraine, though not a member nation, had close political and scientific treaty ties with the European Space Agency and was intensely interested in establishing an out-world colony. In 2241, in exchange for promised development royalties, the Ukraine received an ESA charter to exploit the commercial potential of Eta Bootis IIc. Three years later a Ukrainian colonial expedition headed by Vasily Martos and Polkovnik Yuri Leonivich Kamarov arrived in the Eta Bootis system aboard a leased colony transport converted from the aging French bulk freighter Sans *Facon.*

The site chosen for the new colony was a mountainous island continent astride the equator in the eastern hemisphere which offered some shelter from the world's fierce storms. World, continent, and colony all were named "Novoa Kiyev."

Second Colony: Promises of rapid commercial exploitation of Novoa Kiyev's mineral resources proved too optimistic. The Terran Ukrainian government was unable to expand funding of the colony to meet unanticipated losses of equipment and development costs. In 2245 the French decided to establish a colony of their own in the planet's western hemisphere. The settlement of Port Loubet was established late in 2246.

Though the French colony, too, encountered unexpected difficulties in the economic development of its interests on the planet, French off-world industrial interests and a public spirit of national pride at home combined to funnel money through the Colonial Authority to secure and expand the French base. The settlement of Port Loubet grew to become Aurore, a name which, inevitably, was extended to embrace the entire planet. Since French media and trading corporations had far more visibility on Earth than did the Ukrainian government, the name "Novoa Kiyev" soon was understood to refer to the Ukrainian colony alone.

The name "Aurore" provided the mythological basis for naming the other planets of the system. In particular, Aurore's gas giant primary became "Tithonus." In myth, Aurora, the Greek Eos, goddess of the dawn, pleaded with the gods to grant her mortal husband eternal life, forgetting to include in her request a plea for eternal youth as well. The planet, Tithonus, seemed aptly named, sullenly glowing for billions of years, doomed never to achieve the celestial splendor and vigor of a true star. The twin suns of Eta Bootis became, simply, "Notre Soleil" (Our Sun) and "Rubis" (Ruby).

Third Colony: In 2257, a third colony was established south of the tidal fissure called "La Gouffre." Its backers were a multinational cartel of North American and European corporations interested by survey reports which suggested that large deposits of rhenium and other metals might be present in the area in commercial quantities. The American, Texan, and German colonists had already heard of the difficulties encountered by the French and the Ukrainians in establishing profitable mining operations, however, and with wry humor elected to name their colony "Tanstaafl"—a very old, popular acronym for "There Ain't No Such Thing As A Free Lunch."

When the cartel broke up the following year due to the bankruptcy of two of its members, and corporate assets were frozen by the American courts, Tanstaafl declared its independence and applied to the colonial authorities both of Aurore and of Hochbaden in the neighboring system for favored trade status. Presented with a *fait accompli* and the possibility of broken relations with Bavaria, the United States of America became the first Terran government to formally recognize the independent colony of Tanstaafl on February 12, 2258.

Further Growth: In 2280, French expansion of mining outposts and farming settlements south of Aurore/Port Loubet led to the incorporation of a satellite colony called "Lumiere d'Aube" (Light of Dawn). Though still administered through the Auroran Colonial Authority and dependent upon the port facilities at Port Loubet, Lumiere d'Aube was locally considered to be an entity apart from Aurore proper, a community of farming settlements or collectives clustered around the site of a former mining outpost.

Nearly half of the initial investment capital for Novoa Kiyev, Aurore, and Tanstaafl had been plowed into the construction of a trio of sophisticated power satellites in Eos-synchronous orbits and the microwave rectenna farms and power transmission grids on the surface. Though this investment slowed early economic growth, by 2285 nearly 70 percent of Aurore's industry was powered from the satellite grid, and it was predicted that future growth, with this inexhaustible source of cheap power already in place, would boom.

Primarily because of the power grid, all three Auroran colonies were showing signs of modest economic success by the 2290s. Already rhenium mines opened by Tanstaafl speculators were judged to be marginally profitable, and all promised higher returns as detailed surveys indicated signs of platinum, iridium, uranium, and vanadium in commercially exploitable quantities and placement among the volcanic Hotback Mountains at the base of the High Desert Plateau. Despite the hardships of life on the Auroran frontier, an influx of immigrants seeking a path to quick riches swelled the world's population to almost three million by 2297.

More immediately vital for the colonists than the heavy metals mines was Auroran agriculture. Native Auroran and Terran life are radically different biochemically; humans cannot survive eating native Auroran food, and Terran crops do not grow in Auroran soil. A limited form of terraforming was employed to make food crops possible. Shiploads of soil from the Ukraine, South France, and the Great Plains were shipped at prodigious expense to Aurore, where it was divided into tiny parcels to be carefully worked into larger quantities of sterilized native soil. An entire ecological chain of certain carefully selected Terran organisms, from nitrogen-fixing bacteria to earthworms, were imported, bred, and introduced to the carefully maintained terrestrial plots.

The process represented a large fraction of the initial cost and effort of establishing a human presence on Aurore, but the colonial farms were self-sufficient by 2264, and viable dirt and Terran organisms were no longer needed. The Tanstaafl settlement actually reported a food surplus in 2291, though ground-to-orbit transport costs prohibit the export of agricultural products.

The Kafer War: Contact with the alien race known as the Kafers was first made in 2295 by French scientists aboard a deep space research outpost at Arcturus, though attempts at establishing communication with them evidently failed. All contact with the outpost was lost in *2297,* and merchant and military vessels entering the Arcturus system were attacked. Imperial French and Ukrainian naval squadrons were dispatched to the Eta Bootis system as a precaution.

The precaution was tragically well-founded. On April 4, 2298, a large alien invasion squadron entered Eta Bootis's space from the general direction of Arcturus and attacked the human fleet under the joint command of Contre-Admiral Paul Armand DuBoise and Kontr-Admiral Sergei Sergeivich Borodin. In three days of savage fighting, the human fleet was broken by superior enemy

numbers. Eight Terran ships were destroyed, including the Imperial French flagship, *Ste. Jeanne d'Arc.*

The survivors were reorganized under Borodin's command at Hochbaden, some four light-years farther up-arm. Reinforcements, including Imperial French, Ukrainian, and German squadrons, arrived at Hochbaden to bolster the human fleet, and plans were drawn for a return to Eta Bootis.

Meanwhile, enemy ships invested every off-world outpost and station remaining in the Eta Bootis system. Heedless of the dangers presented by the Tithonian Van Allen belts, alien vessels approached Aurore and destroyed the planet's three eos-stationary power satellites and all other orbital facilities. Close orbit was infested with alien warcraft, and surface installations were attacked from space on April 8. The landings began two days later.

Fighting was severe at first and bitter, brutal, and desperate at the last. All three human colonies clung to their central facilities, mines, and farmland, but most outlying settlements were overrun and destroyed.

For almost three months, the Combined Fleet at Hochbaden did nothing but draw fire from Earth's news media for its inaction. At last, however, a powerful German naval squadron arrived from Earth. Franco-German relations were still difficult in the aftermath of the War of German Reunification which had ended five years before, but it was recognized that this alien threat—the "Arcturian Menace" as the media had it—was a far greater danger than mere international rivalries. The squadron's commander, Kommodore Wilhelm Lutke, was directed to rendezvous with the Combined Fleet at Hochbaden and cooperate with Imperial French forces "in the face of the present crisis."

In fact, he took *de facto* command, chivvying French and Ukrainian officers and officials until the Combined Fleet was under way towards Eta Bootean space. The Kafer armada, already bloodied by the first Battle of Eta Bootis and now scattered throughout the system, seemed unable to organize a coherent defense. Fears that alien reinforcements had arrived during the intervening three months proved groundless, and the isolated and individual Kafer squadrons were systematically hunted down and destroyed. Human ships returned to close orbit, ground forces were landing to relieve the colonial defenders by July 3, and the remnants of the Kafer fleet had abandoned the system within five days after that. That was not the end of the fighting, however. In many ways, it was only the beginning.

The Kafers, unable to overrun the principal human strongholds, had established numerous bases in the Auroran wilderness. From these bases they continued to strike at human settlements, outposts, and convoys with (if possible) increased viciousness and savagery.

As human relief forces pressed the Kafers back, it was discovered that the populations of areas overrun by the invaders had been brutalized to a degree unthinkable even to a species with so bloody a past as humanity. Whole communities had been annihilated; homes, hospitals, entire villages had been *razed;* whole families had been slaughtered. It was estimated that over 300,000 people, most of them civilians, had died in three months. On a world with a relatively small population to begin with, nearly everyone had lost loved ones and friends.

Less personal, perhaps, but even more threatening to the survival of the colonies than human casualties has been the disruption of Auroran industry and agriculture. The Kafers destroyed everything they could in the areas which they controlled before they were driven out. Everything from factories and mine workings to roads and private vehicles was blown up, burned, or damaged. The three orbital power satellites, together with their ground-based rectenna arrays and transmission grids, had been destroyed. This was a particularly severe blow to all three colonies, who had invested heavily in the satellite power system rather than in less expensive but less promising technologies and had been counting on it for present industrial power and for future development. Finally, wildly virulent fungal agents were deliberately introduced to human croplands, apparently in an effort to wipe out the human population by starvation. The outcome of this particular attack is still in the balance; fungal blights in crops and particularly nasty skin and lung diseases in humans and animals have been spreading slowly, and all efforts to combat them have so far been unsuccessful. The effects of the war on the Auroran economy have been catastrophic.

As a result of this intensely bitter assault, Auroran colonists set out to prove that the Kafers were not alone in the single-minded blood-thirstiness with which they waged war. Early orders to capture Kafers for study and interrogation were ignored, and officers finally stopped even trying to enforce them. Kafers never surrendered—never—and the human troops, the colonial militias especially, rarely attempted to capture them. A few Kafers incapacitated in combat and taken by human units were later found to have been "shot while trying to escape." Dried Kafer heads became popular trophies which were mounted on vehicles or fence posts, and many communities paid bounties of Lv20 or more for Kafer shells, the horny carapaces covering their backs.

The Chinese Arm

COLD MOUNTAIN Delta Pavonis

The only world to evolve life in the Delta Pavonis system has truly outdone itself. Cold Mountain boasts some of the most exotic alien life forms in all of explored space.

SYSTEM DATA

Lying comfortably along the main sequence of stellar evolution, Delta Pavonis is a G8 star some 1 8.7 light years linear distance from Earth. With an effective temperature of 5500 degrees K, this star radiates more strongly than Sol towards the red end of the visible spectrum, its actual color being an orange-yellow. It is orbited by a total of four significant bodies, two of them being asteroid belts crouching within the inner zone. One particularly large body of 1574 kilometers in diameter, residing in the innermost belt, is regarded as a minor planet. The third orbit is placed rather optimally in the star's ecosphere. This is the habitable world of Cold Mountain which is host to Manchuria's first colony. The fourth and last orbit contains a small (40,000 kilometers in diameter), green gas giant called Jade Emperor, accompanied by a swarm of moons and a thin, aging ring system.

PLANETARY DATA

Measuring 10.246 kilometers in equatorial diameter, Cold Mountain is a slightly smaller world than Earth. Though its density is somewhat higher than standard, the small radius yields a smaller mass than that of Earth. The resulting surface gravity is of a mild .825 G. The atmospheric pressure is .806 atmospheres at sea level, but the atmospheric composition at this elevation has restricted colonization efforts to higher altitudes. Technically, Cold Mountain is a garden world, but its human inhabitants would hardly agree.

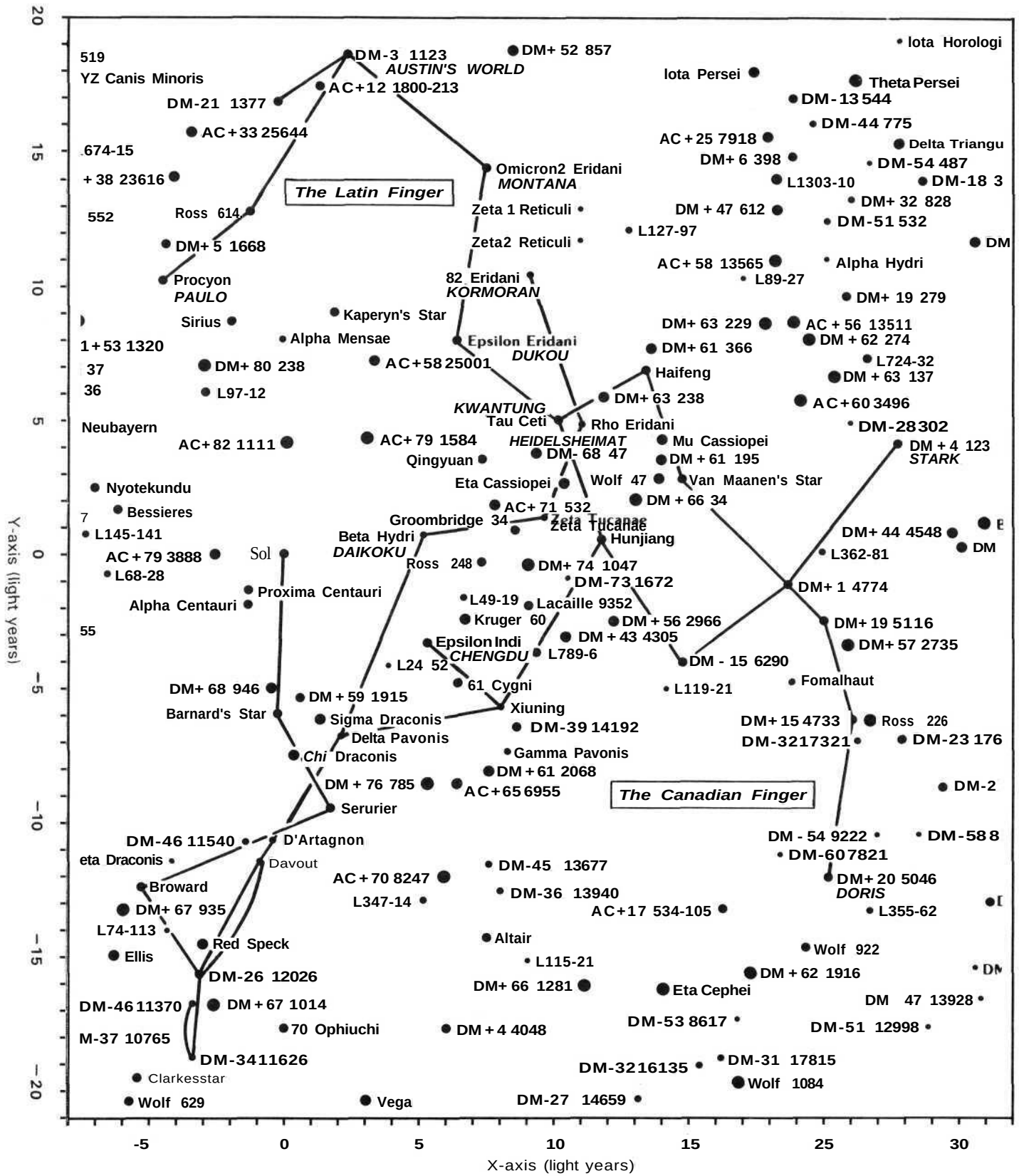
Due to an excess of oxygen in the atmosphere (39 percent), settlements are impossible below eight thousand feet elevation. This excess poses a direct health risk, and it puts strict limits on the type of equipment that will function below this altitude. Any spark or backfire starts a conflagration which will spread wildly. Excess oxygen has, over time, led to an acidification of the atmosphere, the water table, the seas, and the soil. Metals corrode and oxidize rapidly at sea level, often within hours. The oxygen problem leads to another, perhaps more dangerous problem. A fire on Cold Mountain is never a trivial event. Lightning, volcanic activity, and other natural forms of ignition create firestorms which spread rapidly over the surface of the planet. Some of these firestorms are large enough to be visible from the orbit. At any given time, some part of the planet will be burning out of control. At higher altitudes, these storms lose force and become as fierce as the worst of terrestrial forest fires. Cold Mountain has a heavy ozone layer, which filters out much of the ultraviolet light from Delta Pavonis and muffles short wave transmission. The ionosphere is correspondingly active, and its wild fluctuations effectively prohibit radio broadcasts. Auroras are frequent in the upper latitudes, and sunsets on Cold Mountain are spectacular.

The day is 25 hours long. Delta Pavonis rises in the east, and weather travels from west to east, as on Earth. The climate varies with latitude much as on Earth, except that the axis of rotation is tilted less than Earth's, resulting in milder seasonal changes. There are two icecaps, both larger than their Earth counterparts. Rains are, of course, acidic, but snow is relatively free of acids. Large firestorms fill the air with smoke and ash for thousands of feet up, blocking out sunlight and chilling large areas of the planet. Naturally, this has affected the rhythms of the life on the planet since the seasons are more or less at random. This cooling also affects local weather patterns, making the planetary climate much more locally variable than would be expected from its slight axial tilt.

Not much is known about the seas on Cold Mountain. The environment at sea level is so hostile that no exploratory missions have been undertaken. The water looks perfectly normal but is highly acidic. Anyone exposed to it will not be poisoned, but excessive skin irritation will result. It is unknown whether there is life under the surface. The mountains of Cold Mountain are remarkably like those of Earth. There is, however, a notable lack of fossils. Mining here is profitable, and in fact, is the basis for most of the colony's exports. The core is molten and active. Volcanoes are common, as are regional earthquakes.

Native Life: Indigenous life on Cold Mountain is exceptionally hardy. The pH of every organism reflects the acidity of the planet's water supply. Nothing on the planet is edible by humans or by Earth-derived organisms. In root plants and tubers, this acidity graduates downward to intensely poisonous levels. Alkaloids, naturally, are injurious to these organisms. In response to the frequent firestorms and the resulting climactic fluctuations, the life on Cold Mountain is highly adaptable to changes in circadian rhythm. As well, natural fire-proofing of one sort or another is common. Defense mechanisms against the highly acidic rains have also developed. Only the plants show any complexity of structure. The plants are green, mostly large-leafed, and tough. Most of them

The Chinese Arm



The X and Y axes on this page are approximate. For precise stellar coordinates, see the near star list in the basic game. The positive Z-axis extends straight up out of the map, the negative, below the map.

All names in upper-case italics are either colony worlds or alien homeworlds.

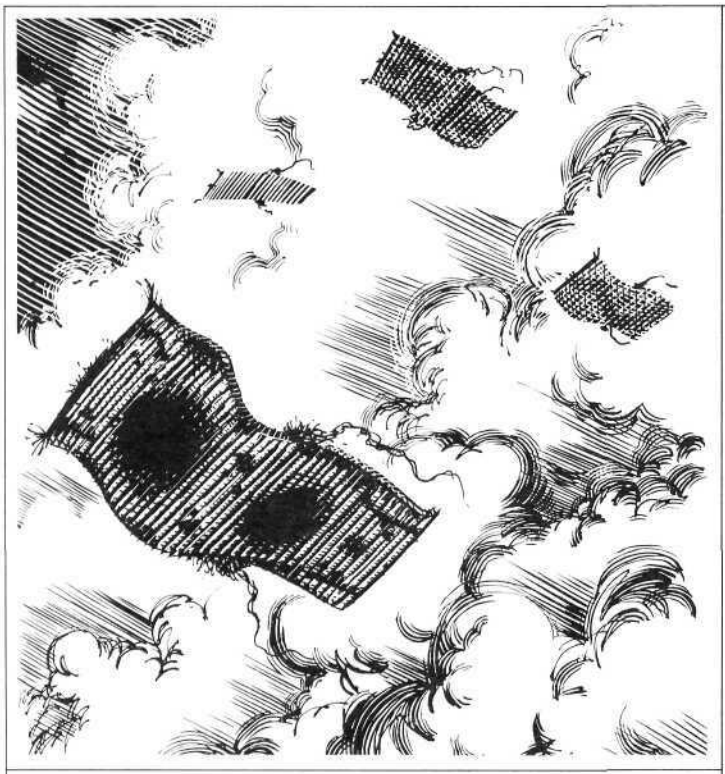
Z-axis distance is the value above or below the map plane. Symbols represent perspective distance, not stellar size.

- ● 30 to 50 ly
- ● 10 to 30 ly
- • 10 to -10 ly
- • -10 to -30 ly
- • -30 to -50 ly

Once coordinates are obtained from the near star list, the distance between any two stars can be found by the formula:

$$D = \sqrt{(X_1 - X_2)^2 + (Y_1 - Y_2)^2 + (Z_1 - Z_2)^2}$$

Scale: one light year = 5 mm



are low, bushlike or shrublike, and wide. There are some vines and some treelike stalk plants. They are categorized by their defense strategies, as follows:

Top Cover-Type: Leaves and structures are covered on the tops with an acid protection enzyme (rain defense). These plants include those with long, tough stalks (flood defense).

Full Cover-Type: The entire plant secretes an acid protection of some sort (flood/rain defense).

Closure-Type: These snap shut at the first evidence of fire or rain and are very sensitive to air pressure (fire/flood/rain defense). This type includes as a subtype those plants which use reflective leaves to focus sunlight, thereby reducing the necessity for large, vulnerable leaf surfaces.

Withdrawal-Type: These close and retreat completely underground to avoid fire and rain (fire/flood/rain defense). This includes mostly smaller plants.

Explosive Seed Spreader: Probably closure-type, but with a different fire defense; exposure to heat causes increased seed production and tight closure; pressure builds up inside, resulting in a seed-spreading explosion (fire defense).

The animal life on Cold Mountain never evolved into complex organisms. Circulatory systems and centralized nervous systems never developed. Despite this, some of the animal forms grow to be quite large, depending on the supply of food. Essentially, these animals are enormous collections of cells. In order to oxygenate without a circulatory system, the animals are very thin, generally less than 50 cells thick. This structure also allows direct access to nutrients without a complex digestive system. Every animal form on the planet uses selected cellular waste products to build sharp edge areas, which are as strong as some contemporary composite materials. These edges aid the creature in accessing the nutrients stored in plants and other animals. The remaining surface of the creature consists entirely of ingestion surface, which is coated with powerful digestive enzymes. Some of the animal forms also use these waste products to build protective coverings. These creatures reproduce by splitting when exposed to fire, serious injury, or starvation. They are somewhat sensitive to changes in air pressure and vibration, and, if exposed to food by touch, will turn in its direction. Animals on Cold Mountain react to fire with blind flight (exceptions noted below), and not at all to rain. Due to their high rate of oxygenation, they are always hungry. Food input accelerates their highly efficient metabolisms. This "acceleration" lasts until the food is metabolized. The animals move faster and faster in an effort to maximize the nutrient input. The growth rate of these animals during and immediately after these periods is nothing short of astonishing. Obviously, they are very hard to kill. So far, only five major forms have been identified. Each comes in many variations and sizes and is found everywhere on the planet (note exception). The only areas which are clear of animal life are the polar caps and the mountains above a certain altitude. The discovered forms are as follows:

Flying Blinds: Flat, airborne creatures which resemble Venetian blinds, or maybe Chinese kites; each "blind" edge is razor sharp, and they attack by swooping into prey edge-on; "blinds" are held together by a tether of edge material which snaps when the creature splits.

P (pseudo)-sharks: Tubular creatures with a hard outer coating, filled with oscillating, blade-like projections which shred prey, splashing inner surfaces with nutrients; some are equipped with hard spines on the outside, which allow movement (spines oscillating much like the inner blades), and some have outer vanes, the uses of which are unknown (theories include heat dissipation and aerodynamic stability); ingestion of prey by the spined type always results in accelerated spine motion, and thus forward motion.

Razor Flies: Tiny, swarming animals which are flat and roughly the size of a glass sliver (some bigger, of course); these are hard to spot and nearly impossible to remove, and they ride *breezes* since they have no mobile capacity.

Screwworms: Rotini-shaped burrowers, found mostly in plants and upper layers of topsoil; they move like screws, eating as they move, and will enter anything that is in contact with the soil.

Sand Screws: Brother of the screwworm, but more prone to ingestion of minerals than of flesh; these creatures are found in the sand and water on and near the shore, and they do attack other organisms.

Screwworms and sand screws burrow straight down to escape from fire, rather than simply accelerating. During a rain or a flood, they simply take advantage of the defensive mechanism of whatever plant they happen to be in at the time.

COLONIALHISTORY

Cold Mountain was colonized by Manchuria in 2201 during a period of intense nationalism. Due to the statistical similarities between Sol and Delta Pavonis, Cold Mountain was considered prime real estate. The remains of Japan's failed colony (2190) can be found on the big continent.

Ancestors of today's colonists were drawn by the almost irresistible prospect of homesteading their own land. The current colonists are aware of the support Manchuria has supplied them in the past and are fiercely loyal to her.

None of the surviving settlements are below eight thousand feet elevation. Most settlements consist of a protective barrier (usually a stone wall, architecturally similar to the Great Wall of China-Manchurians have not forgotten their united past): terraced farmland, consisting of mostly rice paddies; residential and urban areas, set low on the slopes; and the residences and work places of the upper and ruling classes, set high on the slopes.

Early in the colony's history, the presence of the settlers seemingly set off a sort of planetary immune response. Animals in the vicinity of a settlement grew larger and their appearances (and

subsequent attacks) became more frequent. Animal populations near the settlements grew rapidly, and many settlers were killed. Livestock imported from Earth also suffered, as did Terran crops and other imported plant life. Planetary biologists later discovered that the local animal activity was simply a response to an increased food supply that was not as hardy as the native life. Increases in population and activity were due to their efficient metabolisms and subsequent reproduction.

To protect themselves and their valuable terrestrial imports, the settlers mined local stone, then erected walls separating the lower elevations from the higher. These walls effectively segregated the indigenous life forms from the more vulnerable Earth-based forms. Tailings from the mines were mixed with terrestrial bacteria and used to created topsoil or the paddies in the larger valleys. The paddies serve two functions in the settlements: first, they are a valuable native food source; second, the paddies themselves are a deterrent to most of the local plant life. The wet areas, combined with the alkaloid nature of the water (from the snowcaps) prevent them from getting a foothold within the walls. The settlers strung wire nets at an angle from the walls to keep out the flying blinds. Still necessary, colonists perform "watch duty" on the walls with pride.

Nonetheless, the colonization of Cold Mountain was costly. Over one half of the original settlers were lost to local dangers. But this was Manchuria's first colony world, and every effort was made to make certain it survived, at severe cost to the Manchurian homeland. New colonists were sent to replace those killed and to broaden the population base. To this day, Manchuria supports a strong emigration policy to Cold Mountain. The prospects are tempting enough for would-be colonists to ignore the inherent dangers. This strategy has prevented the development of local dialects, while strengthening planetwide gratitude toward and honoring of Manchuria.

After 50 years of instability, the survival of the colony was finally assured. A loose dynastic government was set up to manage local affairs and trade. The constant influx of newcomers insured cultural integrity. The social structure of the colony tends toward the rigidity of status, but as in all frontiers, there is room for some upward mobility. Furthermore, there is great potential for lateral mobility within one's station.

For example, in any particular valley, the farmers will live nearest the bottom and closest to the walls. Artisans will live further up the slopes, and bureaucrats and nobles live higher still. Total world population is now roughly 9.6 million persons. To prevent fragmentation of the mountain settlements, Manchuria provided a communication network for Cold Mountain. Information is passed between settlements by tight-beam microwave relay transmissions, which are unaffected by local atmospheric conditions. Transportation is by lighter-than-air craft, glider, or (rarely) helicopter. Ships from off-planet must load their cargoes into space planes from groundfall. Due to atmospheric conditions, inexperienced pilots are advised against attempting groundfall themselves. There is a small orbital facility for this purpose (less than 700 permanent residents), as well as for refueling and maintenance. The space planes must land at the local spaceport, located at 8500 feet, within a valley nestled in a tectonically stable mountain range near the equator. This port contains but one runway capable of landing a space plane. Note that due to the increased atmospheric oxygen, even at this altitude, flammables are very strictly controlled. Cavernous hangers exist to house space planes not on the runway. They are provided to travellers of Manchurian registry free of charge.

For raw cargo (especially ores), a launch catapult loads on a nearby ridge. Termination of the launch vector is near the orbital facility.

Trade is mostly with nearby Manchurian colonies and outposts and with Manchuria herself. Japan and France are considered political antagonists, and relations with them are strained at best. Of course, there is no direct contact between colonies of these nations. Socially, there is considerable antagonism toward the French and Japanese, and travellers of these nationalities should be advised.

An influx of colonists occurred at the end of the Central Asian War of 2282. These colonists have not forgotten those events and will not hesitate to effect personal "revenge" if given the opportunity.

Colony-wide attitude toward local life has been directly affected by the local flora and fauna. This attitude is generally interpreted as paranoia by offworlders. In fact, on Cold Mountain, the words *animal* and *demon are* interchangeable.

To colonists, the mountain and its environment represent "Heaven Above," an attainable goal of beauty, safety and happiness. Fire, of course, portends disaster. As mentioned previously, local life forms, especially the animals, are understandably seen by settlers as devils and demons, intent on destroying the lives and happiness of the colonists. The colonists see the local life forms as the enemy, to be defeated at all costs. The animals and plants are killed preemptively, without remorse. Settlers are also rather callous toward injury or death as a result of the actions of local fauna. For them, it has become a way of life. Otherwise, death by illness, or accident, or (rarely) old age is mourned as in any culture. Visitors are often shocked by this dichotomy.

Colonists usually undergo some sort of rigid martial training involving primitive and modern weapons adapted to better defeat local animals. Their padded cold weather clothing is also armored against sudden attacks.

Due to the attitudes the colonists have fostered, there is no ecological consciousness to the colony. They are not concerned with preserving the local wildlife in any way. If they could, the colonists would wipe out all indigenous life tomorrow, and in fact, two such plans involving nuclear weapons have been proposed. Neither has been acted on.

Because of their environment, colonists of Cold Mountain feel superior to the average human. They feel that only the finest Manchurians could successfully tame their home. Historically speaking, they are correct.

Colonists view and treat tourists with disdain. However, new colonists are quickly accepted by the more experienced ones and "shown the ropes."

For reasons outlined previously, visitors are encouraged to adopt the local style of dress. No one is immune to the danger of attack. Consider: Their planetary paranoia is probably a survival trait, and past visitors claim it is justified. New visitors, however, invariably view the colonists' habits and attitudes as harsh and over-zealous. They generally learn quickly.

Translations: Of course, most of the terms in this essay are in English and are translations of the original Chinese. In Chinese, Cold Mountain is *Han Shan;* Jade Emperor is *Yu Huangdi;* Flying Blind is *Fei Lianmu;* Pseudo Shark is *Jia* Shayu; Razor Fly is *Dao Chong;* Screwworm is *Niu Chong;* Sand Screw is *Sha Niu.*

DAIKOKU

Beta Hydri

Daikoku is an important transportation hub along the Chinese Arm. The ruins discovered there have made quite a ripple in the scientific community, and their exploration has only been begun.

SYSTEM DATA

The system of Beta Hydri, located between Delta Pavonis and Zeta Tucanae in the Chinese Arm, consists of a single, G1 subgiant star with 10 planets. Of these, only one falls within the life zone of the star. The outer planets, of which there are eight, range in size from a tiny ice ball of a world with a diameter of only 2000 kilometers to a fairly large world (for being in the inner system) of approximately 22,000 kilometers in diameter. Most of these planets seem to be potentially good sources of heavy metals, although the surface conditions on some planets are nasty enough to preclude mining operations at the present time. Unfortunately, the world that appears to offer the least in terms of mineral wealth is also the only world in the system that is hospitable without resorting to sealed habitats. This planet, however, does offer other resources and has therefore been colonized. Currently, only two nations, Japan and Arabia, have full-fledged colonies on this world, named "Daikoku" by the original Japanese explorers. In addition to these two colonies, the Astronomischen Rechen-Institut (AR-I) and the Accademia Dei Lincei foundations have outpost-level installations on Daikoku. Presently, the Japanese are the only ones engaging in mining operations on planets other than Daikoku in the Beta Hydri system (although Arabia intends to initiate such operations within the next decade).

PLANETARY DATA

Daikoku, situated 1.601 AU from Beta Hydri, is a large world with a diameter of 20,994 kilometers. Possessing a mean density of only 40 percent that of Earth and a mass of 1.7915 Earths, Daikoku has a surface gravity of only 0.659 G, less than that of Earth, an unusual occurrence for a world so large. The planet has a rotational period of 25.82 hours, an orbital period of 1 99.07 Terran days (185.04 Daikokian days), an orbital eccentricity of 0.020 (slightly greater than Earth's 0.0167), and an axial tilt of 15 degrees 2.5 minutes.

Three rocky moons orbit Daikoku. The innermost, at 210,000 kilometers, is the smallest, with a diameter of almost 2000 kilometers. The middle moon is the largest, having a diameter of about 5000 kilometers, and orbits at 1.68 million kilometers from Daikoku. The outermost moon, with a diameter of 2100 kilometers, orbits at 2.73 million kilometers, giving it an orbital period of 386.94 Terran days, causing it to orbit the planet roughly once every two Daikokan years. The two inner satellites, with densities of 1.1 Earths, are currently being mined by Japan for some heavy metals. The outer moon (density 0.6 Earths), however, is largely untouched and possesses little in the way of attractive mining resources. Designed to study the subgiant Beta Hydri, an unmanned research station of the AR-I is the only permanent facility located on this moon (which, coincidentally, keeps the same face towards Beta Hydri at all times).

Daikoku's atmosphere is quite amenable to human respiration. With a hydrographic percentage of 39 percent, the surface of Daikoku is mostly dry land. The majority of Daikoku's water is held in three large oceans, which tend to run in a north-south direction with spacing being roughly equal between the three. The polar caps are both covered by ice sheets over a layer of ocean.

Seasonal temperature variations are more extreme on Daikoku than on Earth, with winter temperatures averaging -20 to 20 degrees, and summer temperatures averaging 80 to 115 degrees in the temperate zones. Seasons are shorter on Daikoku than on Earth, being roughly half as long as their Terran counterparts.

Native Life: Daikoku is an old garden world (though not yet post-garden), and as such, has a rich variety of life forms existing on it. Like Terran life, all life on Daikoku is of the levo (left-handed) amino acid base, enabling some life forms on Daikoku to eat or be eaten by Terran life forms. In the majority of cases, however, Daikokian life and Terran life find each other relatively unpalatable. Many of the Daikokian life forms, having a long evolutionary history, have become quite exotic and specialized in adapting to their environments. One such example is the "yo-yo tree." This carnivorous plant, when triggered by pressure exerted on its surface roots, uncoils sticky tendrils from pods on its upper branches. These tendrils attach themselves to the unsuspecting prey below, after which they coil back up, bringing the prey back up into the pod-like structure for digestion. Colonists are advised to keep small children and pets well away from these trees.

Terrain and Natural Resources: Due to the planet's age, the land on Daikoku has been greatly affected by weathering. Waves have eroded coastlines, rivers have cut deeply into their hard rockbeds, and winds have scoured rock into dust. With volcanic and tectonic activity at a minimum, no new mountain ranges have appeared on Daikoku for a long time. The mountains that do exist on the planet have been worn down from craggy peaks into gently sloping hills. Sharp cliffs and peaks do occur as a result of severe river erosion or as a result of wind erosion of softer rock surrounding hard rock cores. Caves are prevalent in many hilly areas and spelunkers exploring these have found within them some remarkable stalactite/stalagmite formations as well as some unusual life forms.

Much of Daikoku's natural resources come in the form of agricultural products. The soil is fertile, and a number of native plants have proven useful for cultivation along with imported Terran crops. Although relatively poor in heavy metals, Daikoku does have some mineral deposits worth developing. Natural gas, petroleum, and other fossil fuels are abundant. Significant deposits of aluminum ore and, unusually, lithium have been discovered and are currently being exploited on Daikoku.

COLONIAL HISTORY

The Beta Hydri system was first visited by a Japanese exploration expedition in 2205. Initial surveys of the system revealed potentially profitable mineral resources along with a world which, although probably poor in heavy metals, did appear pleasantly hospitable. Japan swiftly announced its initial claim on the system and on the garden world within it. Plans were then made for several more intensive explorations of the system by the Japanese. In early 2206, a group of three Japanese survey ships arrived at Beta Hydri. Two of these were to explore the garden world in some detail as a prelude to colonization, while the third was to engage in more detailed investigations of some of the other potentially mineral-rich planets in the system.

By consensus of the survey teams, the garden world was named "Daikoku," after the goddess of prosperity in Japanese mythology. As a colony world, Daikoku would require effort to prove profitable, but, in all probability, it would be worthwhile to colonize in the long run.

In the next seven years, Japan mounted an extensive effort to establish its colony on Daikoku. Having been forced to abandon their failing, fledgling colony on Delta Pavonis, the Japanese were determined to make this colony on Daikoku survive and flourish.

An initial site was selected and prepared, and in 2209, the first major group of colonists arrived.

From 2213 to 2235, the Japanese colony on Daikoku flourished and grew. Aquaculture became a major activity of the colony, with a number of the native sea plants proving to be valuable both as food and as sources for pharmaceutical compounds. Several of the tree-like species growing near the colony were found to be producers of very attractive woods. One type in particular is prized for its lightweight, yet very strong heartwood that is a rich blue-black color (much like a bluish ebony in appearance). Fine furniture made from this wood has been pulling in a sizeable profit from off-world markets in which it is sold.

An extensive hydroponic farming project (begun when the very first colonists arrived on Daikoku) was now producing enough of a surplus to enable foodstuffs to be exported, and sold to fledgling colonies in the Chinese Arm (notably the Manchurian colony of Zeta Tucanae and the Bavarian colony recently established at Rho Eridani). Farming operations utilizing native Daikokian plants were also proving fruitful as a number of these plants were found to produce edible parts rich in protein, vitamins, and minerals. Most of these tasted good and enabled the Japanese colonists to live on a nearly meat-free diet (a much more economical alternative to importing Terran livestock for food purposes).

In 2237, as the Japanese were initiating mining operations in Daikoku's innermost moon, the Arabian government asked for permission to start a colony of their own on Daikoku. Since the exhaustion of its oil fields in the early 22nd century, Arabia had been searching for a new source of status and profit. With humankind's expansion to the stars came new, untapped resources, available to those who could get out there to exploit them.

Lacking a strong financial base to support explorations of its own, Arabia had sought a chance to "piggyback" an Arabian colony with some other colony on an already-proven world. After requests for assistance to other colonial powers had been turned down, the Arabians approached the Japanese, who had been part of the occupation force in 2008 protecting the Saudi oil fields. The Japanese agreed to help, extending loans of money and starships to the Arabians, as well as allowing them to start a colony on the opposite side of Daikoku from the Japanese colony. The loans would be repaid with interest from the profits obtained by the Arabian colony once it got on its feet. The only restriction imposed by the Japanese on the Arabian colony was that any resource exploitation must be accomplished without major disruption, destruction, or pollution of Daikoku's ecology (the same restriction applies to the Japanese colony, which has endeavored to exist in harmony with the Daikokian environment). The Arabians agreed, and in 2238, an Arabian precolonization expedition arrived on Daikoku to begin surveying and planning their colony site.

Construction at the Arabian site began late in 2239. Progress was slow but steady, with cash flow being the major factor limiting construction. Colonists arrived at a steady rate (often via Japanese stutterwarp ships) and filled the housing almost as fast as it was built. Food supplies were purchased mostly from the Japanese colony, while other living supplies were shipped by the Arabian government. With the harvest of the first native food crop (using seeds and plant stock purchased from the Japanese colony's farms), Arabia proclaimed a major holiday (to celebrate its official entry into the colonial club) and declared its colony officially established.

In late 2249, aerial photographs of the region due south of the Arabian colony's main settlement area revealed an unusually regular pattern of bumps and ridges beneath a lush cover of plant growth. An Arabian expedition was sent to check this out close up. Beneath the vegetation covering one of the larger "bumps," careful digging revealed a structure of obviously artificial origin.

The excitement generated by the Arabian discovery quickly carried news throughout explored space. Here was evidence of a second extraterrestrial technological civilization (the Sung had just been contacted the previous year), and the Arabians soon found themselves swamped with requests by archaeologists and xenologists for permission to investigate the ruins. Not wanting to see their colony overrun by hordes intent on seeing the ruins, the Arabian colonial government approved only a limited number of those requests, generally those coming from either Arabian scientists or notable foreign scientists of proven ability.

In 2250, formal excavations were begun by a group of archaeologists and sapientologists predominantly from the Arabian universities on Earth, with a small group of foreign scientists (most of whom were members of either the AR-I or the Institut des Etudes Exobiologiques (IEE)). Work progressed slowly and carefully as the scientists sought to find out who had created the ruins and what had happened to them. Comprehensive aerial photography of Daikoku revealed a second, larger area of probable ruins farther south, but turned up no other potential ruins than that. With the discovery in 2253 of another set of ruins on the Heidelsheimat (which seemed to be by the same builders as those on Daikoku), some of the interest in Daikoku's ruins was shifted to those in Heidelsheimat in the Rho Eridani system. When the Ebers were discovered at 82-Eridani in 2256, it was learned that the ruins on Daikoku and Heidelsheimat were those of two Eber colonies which had been destroyed approximately 4000 years ago.

To study the Daikoku ruins, the AR-I set up an outpost in 2262 midway between the two ruin sites. Several months later, the IEE (now known as the Institut des Etudes Xenologiques (IEX)) set up a research station on the fringes of the AR-I settlement. Many artifacts were recovered and catalogued (and a large number were stored at the AR-I outpost), but only a few of these were able to be identified as to purpose and function.

COLONIAL LIFE

Japan's colony is a relatively happy and productive one, serving

as a base of operations for Japanese mining activities in the Beta Hydri system as well as being a major producing colony in its own right. The governmental authority is respected and obeyed by virtually all the Japanese colonists (as is required by traditional Japanese ethics). Ultimately answerable to the Japanese emperor on Earth, Daikoku's Japanese government is essentially organized the same as that on Earth.

Military presence on Daikoku was virtually nonexistent up until the time of the Central Asian War. When Japan was solicited by the French to intervene in the war against the Manchurians, it was deemed a wise move to establish a military presence at Daikoku since the two nearest colony worlds were both Manchurian-settled. A military base was established just outside the main Japanese settlement of Aoki, and a second military installation was placed in orbit. Neither of these military posts proved necessary, although they did make the colonists feel more secure. Today, these bases are still staffed, although at the minimal levels deemed necessary for defense of the colony.

In the 87 years since its establishment, the Japanese colony on Daikoku has grown to a population of approximately 10 million people, occupying an area of a little over 200,000 square kilometers (slightly larger than half the surface area of Japan proper). Most of the colonists live in the cities or their attached suburbs. There are three major cities: Aoki, Enkiro, and Matsumoto. Each has a spaceport and airstrip facilities, although those facilities at Aoki are part of the military installation there. Smaller settlements tend to be located on the fringes of the agricultural operations outside the cities.

The colony is essentially self-sufficient, with most of the population living comfortably (only a very few could be said to be living affluently). Most colonists work for companies, rather than being self-employed. These companies vary greatly in size, from small companies based exclusively in Daikoku to large corporations which may have headquarters off-world. Employees of these companies are hard-working and fiercely loyal to their employers.

Since its founding 55 years ago, the Arabian colony on Daikoku has done well for itself. Also essentially self-sufficient, the Arabian colony engages in trade both off-world and with the Japanese on-world, dealing mostly in textiles, handcrafts, petroleum products (notably synthetics), and perfumes. As with the Japanese colony on Daikoku, the Arabian colonial government is a duplication (on a smaller scale) of its mother government on Earth. The constitutional basis for Arabian colonial law, as in Arabia, is the Shariah, the Islamic religious law set down in the Koran as revealed by Mohammed and his successors. The law is interpreted by the *ulama* (learned religious men) who assist in the governing of the colony. All those in positions of authority in the Arabian colony are required to swear allegiance to the king of Arabia back on Earth.

As a colony of a strongly Islamic country, the Arabian colony is a devoutly religious one. Virtually all the Arabian colonists are Sunni Muslims, adhering to traditional Islamic tenets. With the first Arabian colonists on Daikoku, a religious problem became apparent regarding daily prayers. According to Muslim tradition, prayers were to be made facing the holy city of Mecca in Arabia. As Mecca was now not even on the same planet as the worshippers, the direction of daily prayers became a religious crisis. Fortunately, the ulama on Daikoku came up with a solution quickly. Special permission was obtained from the Arabian king and the ulama on Earth to remove a very tiny fragment of the holy Black Stone at the Kaaba in Mecca and bring it to Daikoku. The fragment was then sealed in a specially-crafted vessel and enshrined in the newly-built mosque on Daikoku. The mosque became known as the "Mosque of the Stone" and the ulama decreed that Allah would see favor in those that made their prayers facing the mosque. Through the years, the Mosque of the Stone has been embellished and expanded. Today it stands as a magnificent example of beauty in Islamic architecture.

Although the prayer crisis was quickly resolved, a second religious problem developed. If at all possible, all good Muslims are expected to go on a pilgrimage to Mecca at least once in their lifetimes. For most of the Arabian colonists on Daikoku, this would be a prohibitively expensive journey. The Arabian government has therefore instituted a policy of subsidizing its colonists on their pilgrimages to Mecca. Passage to Earth on a special pilgrimage ship is paid for in part by the Arabian government. Pilgrims are expected to pay at least a small fraction of their passage, although the fee paid is dependent on a pilgrim's financial resources. Once on Earth, however, pilgrims must make their own way to Mecca. Return passage is subsidized in the same way as passage to Earth, although there is a limit on the time one can remain on Earth, (if one overstays the limit, one forfeits the subsidy, except in special cases of emergency). The special pilgrimage ships leave Daikoku once every Daikokian year, and each colonist is allowed only one subsidized passage in his lifetime.

The Arabian colony is smaller than the Japanese one on Daikoku. There is one main city (Al-Fredoun) and a number of smaller towns and villages spread over a surface area of about 140,000 square kilometers. Total population numbers roughly four million people, with about three-quarters of the people living in the smaller towns. Only one main, public spaceport exists Oust outside of Al-Fredoun), although there are a number of small airstrips scattered throughout the colony. A token military base, located in the large town of Hakim, has limited spaceport facilities, but these are reserved for military craft only.

The outpost-level installation of both the AR-I and the Accademia Dei Lincei are located in fairly close proximity to both the Arabian colony and the Eber ruins. Neither outpost has spaceport facilities, so all space travel must be done through the Arabian Spaceports. A small airfield, used mainly for supply transport flights, is located at the AR-I settlement. Both the AR-I and the Accademia are interested in the Eber ruins, which are essentially the prime reason for both outposts on Daikoku. While the AR-I is interested in the ruins from the point of view of scientific study, the motivations of the Accademia are not entirely understood. From all appearances, the Accademia is convinced that the long-dead Ebers were somehow an extraterrestrial Christian-equivalent sect (this assumption seems based entirely on the discovery of some cruciform Eber artifacts, whose purposes have yet to be ascertained). Dedicated to the pursuit of antiquity and the reincarnation of the Holy Roman Empire, the Accademia group on Daikoku (which is a more radical and officially unsanctioned branch of the Accademia on Earth) has annoyed both the Islamic Arabians and the AR-I (mostly for disrupting the Eber ruin excavations and disturbing the Ebers living with the AR-I scientists).

SYUHLAHM

Zeta Tucanae

Struggles for power between nations have not been completely left behind on Earth, and conflicts on Syuhlahm have been commonplace for some time. The different Chinese nations vying for power here have turned to *warfare* to settle their differences.

SYSTEM DATA

The Zeta Tucanae system was both a disappointment and a pleasure to its first explorers. Its G2 V star promised a garden world, and the first sweep through the system confirmed that promise. But the system delivered little else: merely two gas giants and a failed core. Rarely does a G-type star produce such a small brood.

The Zeta Tucanae system centers on a G2 V star very similar to Sol. The star is affectionately called Amah (Paternal Grandmother); stellar mass, radius, and luminosity are all slightly higher than Sol, but the difference is not enough to matter.

Amah has four planets:

Gaaumouhjeung (Dean of the Faculty) is a gas giant at the inner edge of the life zone; it orbits Amah at 0.8 AU.

Gaaumouhjeung has four satellites: three are inconsequential minor worlds (called Jahtsyun—Grand Nephew, Jahtsyunneui—Grand Niece, and Neuih Syun—Son's Daughter), but Syun (Son's Son) is a temperate desert world. With a 5000km diameter, a rocky core, and a density of 1.2, it has a gravity of 0.43 and a standard atmosphere composed primarily of nitrogen (90 percent), with a scattering of carbon monoxide and molecular oxygen. It is possible to breathe the atmosphere of Syun using a respiratory compressor and CO absorbent. Chyuantii maintains a mining base on Syun exploiting a major heavy metals lode.

Syuhlahm (Grove) is a garden world in the center of the life zone; it orbits at 1.1 AU. The Manchurian colony of Chyuantii was established in 2214. The Cantonese colony of Lihngtou was established in 2259.

Yahnhaak (Guest) is a failed core in the outer zone; it orbits at 4.2 AU.

Hongaangge (Watchman) is a gas giant in the outer zone; it orbits at 18.7 AU. Hongaangge has seven satellites, none more than rudimentarily explored.

PLANETARY DATA

Like all garden worlds, Syuhlahm evolved its own life forms. Unlike most garden worlds, Syuhlahm's biological mechanisms are profoundly different from those of Earth. Evolution on Syuhlahm has made no firm distinction between plant and animal. Instead, all life is based on a few standard building block units such as muscle, nerve, absorber, digester, and specialized forms. Single-celled life forms handle all of these functions within one cell. Higher forms of life, however, are accumulations of each of these specialized cells in the proper proportions. Specialized cells adapt to specific situations and needs by manipulation at the molecular level: they create structural bones or frameworks that higher forms need, they provide direction to the whole organism, and they spark reproduction. Other specialized cells have evolved specific structures that can survive independently, but which can easily graft themselves onto other organisms in a symbiotic relationship.

Biologists differ in their evaluation of Syuhlahm's native life. Some feel that each building block unit is a separate type, and that higher life forms are colonies. Others classify each life form encountered as a distinct type.

Long research into Syuhlahm's biological processes has worked out at least a rudimentary understanding of how it works. Building block cells aggregate into organisms seemingly at random, but successful groupings are capable of reproducing not only their components, but also their arrangement.

Syuhlahm organisms are unusually sensitive to background radiation—random cosmic rays, natural radiation, and even sunlight occasionally reach threshold levels. When a threshold is reached, the specialized cells release, and the organism collapses in a puddle of single cells, ready to start over in their struggle up the evolutionary ladder.

Various levels of Syuhlahm organisms have developed protective measures which inhibit the effects of radiation. Some reproduce rapidly. Others have evolved a radiation-shielded core of cells (their specialized cells processing lead from their environment) that can rebuild after an encounter with radiation. Some basic structures have developed a resistance to radiation, while others have a higher threshold.

Encountered Life Forms: The life forms of Syuhlahm are as diverse as any encountered on Earth, but a number of basic building block structures are continually encountered. These include the leaf, the leg, the sensor, and the torso.

The Syuhlahm leaf is a square about 25 centimeters on a side and 1 millimeter thick; its efficiency at processing sunlight and air has made it a predominant life form and a basic structure of Syuhlahm life. Windblown leafs (the accepted plural of leaf) attach themselves to stationary pedestals that can lift them high into the air; the pedestal and leaf symbiosis provides protection for the leaf and nutrient for the pedestal. The same windblown leafs attach themselves to mobile organisms and exchange nutrients for transportation. Leafs generate a surplus of sun-generated energy, and generally live in attachment to another organism, although they can live alone. The cellular material which processes sunlight is an analog of chlorophyll characterized by a purplish-green color. Leafs vary widely in size; small ones cover the ground much like grass; extremely large ones often look like sails flapping in treetops.

The Syuhlahm leg is a column about 1 meter long, hinged with a ball joint in the center, ending in a foot, and equipped with an attachment point at its top. Alone, the leg is a pedestal that can support a large number of leafs; provided with energy from leafs, it grows longer or taller, carrying its leafs out of reach of predators. The leg reproduces by budding smaller legs from around its knee. Like leafs, legs can attach themselves to other organisms: to torsos, sensors, even to other legs. Large tree-like pedestals which accumulate enough legs can move from place to place. Torsos may have one, two, or many legs.

The Syuhlahm sensor is a specialized branched antenna typically about 2 millimeters thick and 50 centimeters long. It is sensitive to smell, sound, and light. The sensor cannot survive alone, but often grows in conjunction with leafs attached to pedestals or animals. The sensor's major value is an attachment to torsos, which are capable of processing and using the sensory information the antenna provides.

The Syuhlahm torso is an egg-shaped body about 1 meter in diameter. It contains a basic framework skeleton surrounding a digestive system and a brain. Numerous points on the skeleton allow legs and sensors to attach themselves. Immobile torsos lie in wait for their prey and are often aquatic. Once they accumulate legs, they can move about and occupy different niches in the ecology of Syuhlahm. More than one torso can join together; one functions as a head and the other as a body.

Torsos, legs, leafs, and sensors also adapt to their surroundings: they grow taller or shorter, thinner or fatter, in response to the ecological niche they occupy.

The result is an unending variety in what life forms can be like, just based on the basic components. Many resemble Earth organisms, but with surprising differences. A single leg covered with leafs is a bush; many grow larger and become trees; but some take on legs of their own and become the walking trees of Syuhlahm.

Higher forms of life on Syulahm are often considered voluntary associations. In the face of trauma or disease, the healthy components abandon the whole: legs detach and fall away; leafs drop off in a flurry of activity; sensors droop and fall away.

Syuhlahm's life forms are capable of transmitting acquired characteristics. A properly matched set of legs, sensors, and torso will breed true; that is to say, their offspring will breed true. Subjected to a proper stimuli, such a creature will adapt to its environment, and still breed true. Agricultural research stations on Syuhlahm have produced excellent new life forms using Syuhlahm's raw material: riding animals, beasts of burden, fruit trees, even food beasts.

In addition, the special characteristics of Syuhlahm life forms have great potential. Many have an ability to refine lead from the environment; researchers have produced life forms that instead refine copper, aluminum, silver, and even gold. Mine processes on both Syuhlahm and Chyuantii use native life forms to refine ore into metal.

To the newcomer on Syuhlahm, the landscape looks familiar: grass, trees, occasional animals. Only on closer examination do the differences become more apparent. The ground cover is a wide variety of leafs. The trees are legs with clusters of leafs about their crowns. The local animals are groupings of torsos and legs, with a scattering of sensors attached. The outward appearances conceal the vast differences between Earth and Syuhlahm biologies.

During the initial decades after Syuhlahm's establishment, the world was explored by organized survey parties, but also by hardy individuals who simply preferred to trek the wildernesses of their newfound home world. These frontiersmen learned through trial and error the vital techniques necessary for continued survival on Syuhlahm.

Since their explorations were informal rather than government sponsored, there were originally no provisions for formal reports from them. Their discoveries were announced more by rumor and bragging than by documentation and proof. Frontiersmen discovered the pharmaceutical properties of stretchwood sap, both for simple muscle pain, and to prevent native blinking fever. Frontiersmen first reported the three cavern passages through the equatorial mountain ranges (each a unique formation undetectable by satellite survey), and first developed techniques for manipulating and customizing local life forms.

COLONIAL HISTORY

Chyuantii, the Manchurian Colony: When the initial colonization of a system begins, the survey squadron has effectively finished its job. When the Manchurian colony at Delta Pavonis was established in 2201, the Manchurian survey squadron in the Chinese Arm was dispatched to the next prospect on the list: the Zeta Tucanae system. It spent the next decade carefully investigating the worlds of the system and their potential for colonization.

But actually, the decision to colonize Zeta Tucanae 2 had been made on Earth 20 years before. Only if the survey found insurmountable problems would the colony *not* be placed. Three years into the survey, the initial report back to Earth showed no major anticipated difficulties, so final preparations and colonist recruitment began.

Manchuria placed Chyuantii, its third colony and the first colonial establishment to be placed on Zeta Tucanae 2, in 2214. Experience in organizing colonies made the process go smoothly. By 2224, the colony was well established and thriving.

Lihngtou, the Cantonese Colony: Canton selected Syuhlahm as the site for its first colony because of available and fertile land, the existing (although rival) Manchurian colony, which at least shared a written language with them, and the mineral potential of the proposed territory.

Canton negotiated with Manchuria between 2240 and 2255 to arrange placement of a colony during a period when the two nations had relatively friendly relations. Since Manchuria would be unable to prevent the placement of a Cantonese colony on Syuhlahm, it was to their advantage to participate in the planning of a new colony, regardless of who placed it.

Lihngtou was established in 2259 in Syuhlahm's southern hemisphere, and has grown steadily since that time. The colony centers on a mining and heavy industrial complex surrounded by farming operations.

Chyuantii and Lihngtou have a long-standing rivalry which dates from the first establishment of Lihngtou. Although both colonies depend on each other economically, culturally they are great rivals and occasional enemies. Chyuantii calls Lihngtou *Nan Man Chi Yuan,* or "The Farness of the Southern Barbarian."

Colonial Ethnology: Although both Lihngtou and Chyuantii were established by Chinese ethnics, the ethnic mix within both colonies is surprisingly cosmopolitan. Manchuria recruited technological help in the training and original organization of the Chyuantii colony from such diverse sources as Azania, America, Argentina, Britain, France, and Japan. As much as 15 percent of the original colonial population of Chyuantii was non-Manchurian, and because those non-Manchurians were selected for their experience, expertise, and intelligence, they naturally rose to the top of their newfound society.

In addition to the two colonies, three settlements have been placed on Syuhlahm.

In 2214, the FPK funded a research base in conjunction with the Manchurian colony. Originally operated by a contractor, the settlement transformed into an agricultural operation that experimented with Syuhlahm life forms. The settlement, New Liverpool, is primarily British ethnics with a scattering of Azanians and Irish. The settlement thrives by marketing agricultural goods to Manchuria.

In 2254, Japan negotiated with Manchuria the placement of a settlement on an island off the Chyuantii coast. The settlement, still 90 percent ethnic Japanese, evenly divides its economy between farming and mining.

In 2294, Canton placed a distinct Vietnamese settlement adjacent to the Lihngtou; it is primarily a farming establishment.

Colonial Interaction: The economies of the two colonies on Zeta 2 are inextricably intertwined. Chyuantii's burgeoning population is rapidly straining the food production ability of its farm system; at the same time, Chyuantii's industry has excess capacity that needs to be utilized. Lihngtou's farms and mines are an excellent source of supply for Chyuantii, and there is a continuing interdependence between the two colonies that both recognize and accept.

At the same time, the friction between Manchuria and Canton on Earth definitely color how the colonists see and deal with each other.

Tentatively, Chyuantii has staked out the northern hemisphere while Lihngtou has claimed the southern. Each acknowledges that it is impossible to control an entire hemisphere, let alone a world;

instead the colonies' laws and controls apply only to their own settled territories. Beyond their immediate boundaries, there is no law and no civilization. As a result, there are two interfaces between Lihngtou and Chyuantii.

The formal interface is a single point on the equator where trade goods are exchanged, visitors cross the border, and diplomatic notes are presented. A highway leads from the interface to each colony; a rail link is planned for some point in the future. Chyuantii has constructed its orbital catapult just north of the interface. Both governments station officials at the interface to handle the bureaucratic details of imports, exports, and travellers. Lihngtou and Chyuantii, by agreement, share a single orbital terminal.

The informal interface between Lihngtou and Chyuantii is the broad expanse of unpatrolled and unpatrollable equator that forms the border between the two colonies. Apart from the catapult and the original Chyuantii industry complex, there is no settlement within 1000 kilometers of either side of the equator. The strip is a "no man's land" which both sides have agreed should remain unexploited and unsettled. This same unsettled equatorial strip is a resource bonanza: mineral deposits, strange variations of local life, and unexplored territory make it beckon frontiersmen and explorers. At the same time, the "grass is always greener" syndrome makes explorers from each colony look longingly at the potential across the equator. Naturally enough, they find it easy to cross the unpatrolled border and explore in forbidden regions. Equally naturally, locals on that side object and resist.

Explorations along the informal interface are usually undertaken in walkers, and armed walkers are preferred because they provide the greatest protection against the major menace: man.

Syuhlahm Walkers: Combat walkers first made their appearance on Zeta Tucanae by an expensive accident. During the Slaver War (2252 to 2255), a shipment of two-legged walkers was misdirected up the Zeta Tucanae branch of the Chinese Arm, and then mistakenly diverted to Syuhlahm's surface and stored in a warehouse until shipping space back to orbit was available. They were never returned to orbit, and were sold as surplus when the war was over.

The first walkers on Syuhlahm were only a novelty; a bargain-hunting merchant bought them, refurbished them for civilian use, and sold them as a cheap alternative to the local hover-jeeps. Within a year, the entire lot of 1200 walkers was sold out, and demand was nowhere near satisfied. Local industry *geared* up to produce its own models: two and four-passenger vehicles, transports, frontier explorers, solar rechargers, waders, swimmers, rocket-assisted leapers, open-topped and convertible models, construction manipulators, and cold weather models. Self-contained nonair-breathers are used at the mining base on Syun.

By 2275, wheeled vehicles were passe on Syuhlahm, and Syuhlahm's industry was thoroughly committed to the manufacture of walker transport systems. At the same time, "walker" had taken on a new meaning. Walkers were no longer armored, man-sized, man-shaped suits with powered assistance. Instead, they had become pods in which an operator could sit or recline in comfort, insulated from the outside environment.

The walkers resembled sports cars; the technology transfers from Chyuantii to Manchuria were the basis for most of the Manchurian combat walker systems utilized in the Central Asian War (2282 to 2287). Chyuantii remains the best-known producer of walker vehicles, although few are physically exported; instead, the designs are license-produced on a variety of worlds.

Rumors of the Ebers: During the mid-23rd century, explorations of the branch of the Chinese Arm which includes Beta Hydri, Zeta Tucanae, Rho Eridani, and 82 Eridani discovered the 4000-year-old ruins of interstellar colonies on Beta Hydri and Rho Eridani, and the post-holocaust civilization of the Ebers on 82 Eridani.

No sign of an Eber colony has ever been found on Syuhlahm or on S4, although common logic would suggest that an Eber colony was placed somewhere in the Zeta Tucanae system.

Continuing rumors of lost cities in the wilds of Syuhlahm have never been confirmed. Since less than 10 percent of Syuhlahm's total surface has been explored, there remains the chance that the ruins of a 4000-year-old Eber colony could be discovered tomorrow, or in the next century.

HEIDELSHEIMAT

Rho Eridani

Heidelsheimat is a world teeming with its own life forms, basking in the warm climate provided by its orange sun. The nations which have settled here have found an abundance of resources and opportunities for growth.

SYSTEM DATA

Rho Eridani is a K2 orange dwarf star located in the Chinese arm. Part of a binary system, Rho Eridani has a DM-56 328, a K5 dwarf, as a companion star. The two stars are fairly widely separated (59.25 AU), which has enabled a planetary system to form around each star. Rho Eridani, slightly larger and more luminous than its companion, has a total of five planets in orbit around it. Ranging in size from 3000 kilometers to a maximum of 22,000 kilometers, these planets include one inner zone rock ball of a planet (3000 kilometers in diameter), two life zone planets, and two outer zone planets. Of the two life zone planets, one is a garden world with a diameter of 14,000 kilometers, while the other is a rocky-cored "gas midget" (essentially a very small gas giant) of about 22,000 kilometers in diameter. DM-56 328 possesses only two planets, one in its inner zone and one in its life zone. Unfortunately, the life zone world around DM - 56 328 is very close to an asteroid belt which extends from the middle of the life zone out into the outer system. Impacts from the smaller asteroids (and several of the not-so-small asteroids) have rendered the surface of the life zone planet totally lifeless and uninhabitable (unless habitats are used).

The only hospitable planet in the entire system, the garden world around Rho Eridani has had four groups place settlements on it. The first to plant a colony on this world was the Eber race, although their settlement was completely wiped out about 4000 years ago. Human nations have established three colonies so far on this planet, named "Heidelsheimat" by the Bavarians, who were the first humans to reach the system.

PLANETARY DATA

At a distance of 0. 348 AU out from Rho Eridani, Heidelsheimat is located in the inner region of Rho's life zone, giving it a somewhat warmer climate than Earth's. With a diameter of 13,997 kilometers, Heidelsheimat is slightly larger in surface than Earth. Possessing a mean density of only about 0.4 that of Earth, Heidelsheimat has a mass that is only about half that of Earth (0.5308 times Earth's mass, to be exact). This gives it a light surface gravity of only 0.4396 G. Atmospheric pressure is on the low side, with the mean pressure on Heidelsheimat's surface being 0.680 atmospheres. Oxygen pressure, while also slightly low with a value of 0.1387 atmospheres, is well within human tolerances (the fraction of the atmosphere that is oxygen is actually quite similar to that of Earth).

Due to the thinner air, colonists on Heidelsheimat must be careful not to over-exert themselves, lest an altitude-sickness like malady result. Those with respiratory or cardiovascular problems should be particularly cautious when engaging in strenuous activities on Heidelsheimat. Other gasses (such as carbon dioxide and argon) are present in Heidelsheimat's air, but they are of sufficiently low levels as to be negligible in terms of health concerns.

For consistency of dates, local Heidelsheimatian time is referenced to Terran standard time. With an axial tilt of 13.3 degrees, seasonal variation of the hours of daylight on Heidelsheimat is not as great as on Earth. The differences in temperature between winter and summer on Heidelsheimat are also less pronounced than on Earth, giving rise to a more temperate climate in general at the middle latitudes.

Native Life: Life on Heidelsheimat has evolved to levels of complexity comparable to those on Earth. Like Earth, plants and animals abound in a multitude of varieties. Unlike Earth's life, however, life on Heidelsheimat is based exclusively on right-handed amino acids (Earth's are exclusively left-handed). Therefore, in terms of mutual edibility, Terran life forms and Heidelsheimatian life forms are completely incompatible. The soil on Heidelsheimat, however, will support both Terran and native plants, allowing Terran crops to grow easily. The incompatibility of native life and Terran life has a plus in that Terran plants are rarely bothered by Heidelsheimatian pests. One exception to this has been the Heidelsheimatian "bush bunnies" (named more for similarity of temperament and behavior than for physical resemblance to Terran rabbits) found on the Texan continent, which found a number of Earth vegetables irresistibly tasty. Unfortunately, the bush bunnies' digestive systems could not absorb any nutrient value from the Terran crops. Thousands of the creatures actually starved to death (after having gorged themselves for days on Earth vegetables) before a foolproof means could be found to keep them away form Terran plants.

Like many of the animal life forms on Heidelsheimat, the bush bunnies have some gliding abilities. The dense air and low surface gravity of the planet have favored development of flying species. In the case of the bush bunnies, they often travel by hopping three or four meters into the air, then gliding on a wing-like membrane attached to their forelimbs for a distance of up to 100 meters if the wind is in their favor. This enables them to scout out the surrounding territory and see up over the tall underbrush. A number of other animal species have similar gliding abilities, although a large fraction of these glide down from heights they have climbed to rather than leaping like the bush-bunnies do. Animals on Heidelsheimat with true flying ability (rather than just gliding ability) tend to resemble bats and pterasaurs in form.

Heidelsheimatian plants are noted more for their annoying characteristics than for any other quality. Most of the tree-like plants on Heidelsheimat fall into a group known as "umbrella trees" (much of the life on Heidelsheimat is known by the "colorful" names the Texans have christened them with, rather than the names originally thought up by the Bavarians). These umbrella trees are generally tall and spindly, with the only significant branch-like structure being a translucent "umbrella" located at the very top of the thin trunk. This umbrella structure is roughly circular, with narrow support ribs radiating out from the center. This center hub, where the umbrella connects to the trunk, is the location of the seed cache and other reproductive structures of the tree.

The tallest of the umbrella trees belong to a class dubbed "pop-tops." In these pop-tops, the umbrella consists of a perforated membrane supported by the radial ribs and a fine lattice-work structure branching out from the ribs. Towards the end of the growing season as the seeds mature, the underside of the umbrella becomes covered with a sticky sap exuded by pores in the membrane. When autumn arrives, the pop-top's umbrella becomes opaque and turns dark. The umbrella and the seed cache then detach as one unit and float away together on the wind, leaving behind only the pole-like trunk. When the umbrella lands, it sticks securely to whatever is underneath it, thanks to the sticky layer of sap on its underside. If the umbrella and seed cache land on top of other plants (as they usually do since the ground-cover in Heidelsheimat is often dense and lush), these plants die and are converted to mulch by agents contained in the umbrella's sap. The seed cache then has a fertile base in which to root when the next growing season starts.

This characteristic of the pop-tops has aggravated colonists to no end, as the detached umbrellas end up landing on crops, buildings, parked vehicles, and other valuable personal property. The sticky sap is tough to dissolve, making removal of the umbrella difficult at best and nearly impossible at worst. Windy conditions on Heidelsheimat allow detached umbrellas to float for significant distances before landing. Therefore, clearing out all the pop-tops in the vicinity of the colonists eliminates only a fraction of the problem. Given time, the umbrella will decompose into mulch itself, but few colonists are willing to wait until then to remove the things. The use of mesh "ceilings" hung above crop fields has helped in saving some late-harvesting crops from the pop-tops.

Some varieties of plants have evolved characteristics that help them flourish in spite of the pop-tops. One such class, known as the "pea-shooters," shoots its seed up from a gas-filled root chamber when triggered. The trigger, in the case of these pea-shooters, is the pressure exerted when a pop-top's detached umbrella lands on top of the pea-shooter plant. The seeds are then expelled with enough force and velocity to punch through the umbrella. The pea-shooter's seeds are also equipped with a sharp point to aid this penetration. Colonists on Heidelsheimat are advised to watch their step and to avoid stepping on these pea-shooters since some varieties of these plants are known to be capable of sending seeds right up through all but the most sturdy types of footwear.

Plants other than pop-tops have also caused trouble for the colonists. Many of the plant species utilize the wind to aid pollination. Pollen granules from these plants are often tiny, sticky particles which have a tendency to collect on and stick to just about anything. During the pollen season, the winds are full of these pollen grains, making breathing difficult and unhealthy without filter masks (nasal passages quickly become clogged) and causing just about everything to become coated with a stickyochrefilm. Air intakes on machinery require special filters to prevent them from becoming clogged during this time of year.

Seeds from many plants often cause similar problems since they, too, are often wind-borne. Some of these seeds are coated with a sticky sap, while others are equipped with tiny hooks to enable them to stay put once they have been deposited. A few seed types are able to take root on rock or other hard substances (such as brick, mortar, or concrete) and must be removed before sprouting since the plants, as they grow, will eventually start breaking up such materials. Colonists tend to find the task of removing seeds from their hair and clothing the most annoying aspect of these seeds.

Terrain and Natural Resources: Much of the terrain surrounding the colonies on Heidelsheimat is hilly and well-forested. The colonies themselves, however, are located in relatively flat areas that are more sparsely wooded. Both the Texans and Incas have located their colonies fairly close to some significant forests. Although the trees in these forests are useless as lumber (they are about as dense as and as sturdy as balsa), both the Texans and the Incas have found that some of the various tree saps are useful as glues (most notably, a surgical glue that is derived from a variety of pop-top). Additionally, some types of wood pulp from these forests have proven useful as putty-like compounds when properly processed.

Heidelsheimat is not particularly rich in mineral resources, which is why the Bavarians have concentrated their mineral exploitation efforts in the DM-56 328 system. Exploitation of biological resources on Heidelsheimat has been limited by the basic incompatibility of native lifeforms with Terran lifeforms. Importation of Terran crops (especially by the Bavarians), however, has proven profitable for the most part.

THE COLONIES

In 2219, a Bavarian exploration ship arrived in the Rho Eridani/DM-56 328 system. With only one colony of its own (garden in Alpha Centauri/Tirane), the Bavarians were interested in finding a world of their own on which to plant a second colony. Hitting the DM-56 328 system first, the Bavarians became very interested in the mineral resources present in the asteroid belt, but were thoroughly discouraged by the lack of a hospitable world for their colony. After checking out both of the planets at DM-56 328, they hopped over to Rho Eridani's immediate vicinity. Although the mining possibilities in Rho Eridani's system didn't seem potentially as profitable as those in its neighbor system, there was a planet at Rho Eridani that looked like prime colonization material. The Bavarians claimed this world as their own, christened it "Heidelsheimat," and began preparations for setting a colony on it.

While building facilities for a full-fledged colony on Heidelsheimat, the Bavarians were also constructing a base for mining operations over at the outermost planet of DM - 56 328. "Gerollblock" (or "Boulder"), as the planet was named, became home to a small community of miners engaged in prospecting the asteroids in the system. With Gerollblock possessing an atmosphere containing no oxygen to speak of, the Bavarian miners were forced to build a sealed base to live in. Intended to serve only as temporary quarters for miners in between prospecting runs, the community at Gerollblock would import water, air, and food from the colony on Heidelsheimat. Heidelsheimat would also handle any necessary maintenance and repairs on mining and freighter ships.

During the first years of construction at the colony (2213-2235), it was necessary for the Bavarians to import food (along with some other supplies) from the Japanese colony of Daikoku, which is in the neighboring star system of Beta Hydri. Construction emphasis during that period was on building living quarters and orbital interface facilities, with establishment of permanent, large-scale food production complexes scheduled for later. With Daikoku and

its extensive food supply essentially right next door, the Bavarians found that purchasing food from the Japanese was cheaper than either transporting food all the way from Earth or setting up makeshift food production on Heidelsheimat. Due to the demands of constructing simultaneously the facilities on both Gerollblock and Heidelsheimat, the colony on Heidelsheimat was not formally established until 2228, nine years after the first surveys of the world.

The year 2244 saw the arrival of a Texan expedition and the establishment of a Texan outpost on a continent well away from the one that the Bavarians settled on. Intending the outpost to be a stepping stone to the 82 Eridani system (still unexplored), the Texans moved in without giving the Bavarians much advance notice, nor even really asking their permission. Although the Bavarians had no really good reason for trying to keep the Texans off Heidelsheimat, the fact of the Texans moving in so blithely without consulting the Bavarians left a bad feeling in the minds of many of the Bavarian colonists. Consequently, the Bavarian colony does its best to keep contact with the Texans to the barest minimum.

In 2253, a group of Texan explorers scouting out the region to the south of their outpost discovered what appeared to be ruins of a sentient culture. Much of these ruins were little more than rubble (plant roots, having attached themselves to the stone structures of the ruins, had broken down much of the rock into unrecognizable chunks). Orbital photographs, however, showed foundation patterns of recognizably artificial origin. Comparison with the ruins found on Daikoku (Beta Hydri) indicated that both sets of ruins were built by the same species: the Ebers.

Although these ruins were in worse shape than those of Daikoku, considerable archaeological and sapientological interest was generated by them. Careful excavations were begun in early 2254 by an international party of archaeologists and sapientologists. Much of the funding for the digs was provided by the Texan Institute for the Study of Antiquities, with additional support provided by the various other institutions that sent scientists for the project. So far, the artifacts found have been fewer and in poorer condition than those uncovered in Daikoku. Some of the artifacts discovered on Heidelsheimat, however, are completely unlike any yet found on Daikoku and have sparked considerable debate about the differences in the Eber cultures that settled in the two planets.

The Texan settlement remained an outpost until 2258, when it was upgraded to colony status after a brief period of intensive expansion. Essentially a public relations move to enable Texas to declare the establishment of two colonies in one year, the upgrade to colonial status had been planned eventually, but the founding of the first Texas colony at DM - 3 1123 prompted an acceleration of those plans. To populate its settlements, the Texan government promoted the colonies as a chance to be "pioneers on the final frontier." The idea appealed to the hearts of many Texans, who held that idea as an important part of the history of their pioneering forbearers.

If it were not for the Texans and their colony, the Incas would probably not have been able to plant a colony on Heidelsheimat. A relatively poor nation, the Inca Republic had a space fleet comprised of a few second hand ships purchased from other nations. The Texans, who had given the Inca Republic moral support throughout their struggles with the Brazilians, suggested to the Incas that they try establishing colonies on the same worlds that the Texans had settled on. This would help to promote the legitimacy of the Inca Republic as an available member of space-faring society, and it would allow the Texans to help the fledgling Incas in building their colonial settlements.

The first Incan precolonization expedition arrived in 2280. Ill-equipped to perform much in the way of useful surveys, the Incas found that they had to call on the Texans for equipment and aid. The Texans provided both on the condition that such assistance was temporary. The Incas set about selecting a site for their colony (in an area well to the north of the Texan colony), and, by 2285, they had begun work on some facilities for it. In building their colony, which was formally established in 2289 (even though at this time, it was little more than an outpost with a large spaceport), the Incas repeatedly required assistance from the Texans in order to get anything done. The Texans have tried to decrease the Incas' dependence on the Texan resources, but they are still often pestered with requests from the Incas for Texan assistance in matters the Incas should be able to handle on their own. Consequently, Texan-Inca relations are currently somewhat strained, with a number of Texans regarding the Incas as bumbling freeloaders, while at the same time, the Incas feeling that the Texans have abandoned them.

Since the War of German Reunification, the Bavarian colony has had troubled relations with the new German government on Earth. The Bavarian colonists, with a strong sense of national loyalty, wish to remain Bavarians and not be considered Germans. The German government wishes all the German nations and colonies to be united under one flag, and they are currently negotiating with the Bavarians on Heidelshiemat to obtain these results. The Bavarians are adamant about maintaining their independence as Bavarians and are prepared to defend their position with military force if it should become necessary.

Facilities: The Bavarians have the most extensive space interface facilities among the three groups settled on Heidelsheimat. With several orbital interface stations plus a total of six spaceports (four public and two military), the Bavarians are well equipped to support travel to and from Heidelsheimat (especially travel between Rho Eridani system and the DM—56 328 system). The Texans rank second with three spaceports (two public and one military), and the Incas come in last with only one spaceport facility (which, although considerable in size, is not always in the best state of repair).

There are numerous airstrips on Heidelsheimat, although these are designed to support prop-driven aircraft and zeppelins since the pollen conditions conditions usually pose dangerous problems with jet intakes. Each of the three colonies has multiple airfields (varying in size), and, once again, a fraction of the Bavarian and Texan airstrips are devoted to military use: the Bavarians' because of the conflict with the new German government, and the Texans' because they feel military facilities should always be available when needed.

CHENGDU

Epsilon Indi

The moderate climactic conditions on Chengdu have attracted a productive population of Manchurian settlers. Their efforts will likely turn the Epsilon Indi system into one of Manchuria's most important off-world possessions within the century.

SYSTEM DATA

The Epsilon Indi system was first visited by a Manchurian exploratory probe in the year 2178. The probe returned with the expected stellar data (main sequence orange star without companions) as well as other more interesting information. The fact that there were planets in the system and that one of them existed in the predicted "life zone" for the star Epsilon Indi prompted a second, more detailed probe to the system. This second probe, concentrating on Epsilon Indi-2, later named Chengdu, "the planet to be found within the life zone," by scouts, conducted its planetary tests from orbit but still returned with enough information to excite scientists on Earth. Among the finds were planetary oceans, a nitrogen-oxygen atmosphere, large amounts of chlorophyll, and even life forms.

PLANETARY DATA

As a planet, Chengdu is very much like Earth. Weather patterns tend to be similar to Earth but less severe. For example, rain is frequent, but electrical storms are not. The average temperatures on the planet range from 0 degrees C to 10 degrees C, varying little due to seasonal change. Because of the planet's small axial tilt of 2.8 degrees, there is no perceptible change in the seasons. Chengdu is slightly larger than Earth but spins on its axis at a faster rate, causing its day to be slightly shorter than that of Earth—only 20 hours and 8 minutes.

Where Chengdu's weather patterns are less severe than those of earth, its terrain is more severe. The mountains tend to be larger and rougher. The forests tend to be thicker and lusher. The exceptions are the planetary oceans. Storms are few, tides are mild, and life is not particularly plentiful. Most attempts at fishing made by the colonists have failed.

The Continents

Wuqi: Wuqi is dominated primarily by the huge mountain ranges and the vast inland desert contained thereby. The mountains themselves are both numerous and large, commonly reaching heights of 11,000 meters. The inland desert is a expanse of territory, nearly 30,000 square kilometers, where nothing grows. The mountains surrounding it prevent planetary weather patterns from bringing rain into the area; consequently, no plant life exists. As of yet, no scientific expeditions have been mounted to explore this harsh land.

The western section of the continent consists mainly of plains and rolling hills. The land is covered mostly by strains of prairie grass as opposed to the hardwood forests that exist over most of the rest of the planet's surface. Biological studies have concluded that forests did exist on the plains at one time but had apparently been wiped out by some kind of plague. Further studies are being conducted in an attempt to prevent similar plagues at the other forests.

The eastern coast of the continent from the mountains to the ocean is covered by hardwood forests. The trees at Chengdu are most similar to the Terran broad-leaf trees, differing from them in that they do shed their leaves seasonally, causing them to grow to maturity quicker than do trees on earth.

Xi'an: The smallest of the four major land masses, Xi'an is an island completely covered by forests. Of its approximate 30,000 square kilometers, only 625 have actually been surveyed. Those surveyed areas have been found to be the thickest forests on the planet, made up entirely of the hardwood trees that grow on Wuqi. Currently, only one colonization effort of Xi'an is being planned and that is by the Sung, the alien race whose homeworld is DM+ 4 123. The colony is set to begin operation in the year 2305.

Yingjing: Of the four continents on Chengdu, Yingjing is the least explored. All expeditions thus have found the island nearly completely devoid of trees, much like the western coast of Wuqi. On the southern half of the continent, the temperature is typically too cold for many trees to thrive, but no official theories have been presented as to why trees don't grow on the northern half of the island.

Weifang: Weifang as a continent is physically less impressive than the other three continents in many respects. The central mountains, comprising much of the interior of the continent, are not as rugged or as high as the Qingdao Mountains of Wuqi are. The highest peak in the Central Mountains, Mt. Freeth, reaches only 8005 meters. Also, the forests of Weifang, although they cover much of the continent, are not as thick and lush as are those of the other continents. Some scientists have speculated that these two facts indicate that Weifang is the oldest of the continents. Consequently, a great deal of research is currently being done into the evolution of Chengdu.

HISTORY OF COLONIZATION

Planning for manned expeditions to Chengdu began almost overnight, but it was 2185 before the *Quingdou,* the first of many expeditionary ships, touched down on the planet surface. Hopeful expectations of an alien civilization in its early stages were not to be realized. Life was abundant on the planet, but the scouts found no signs of any species that had measurable levels of intelligence.

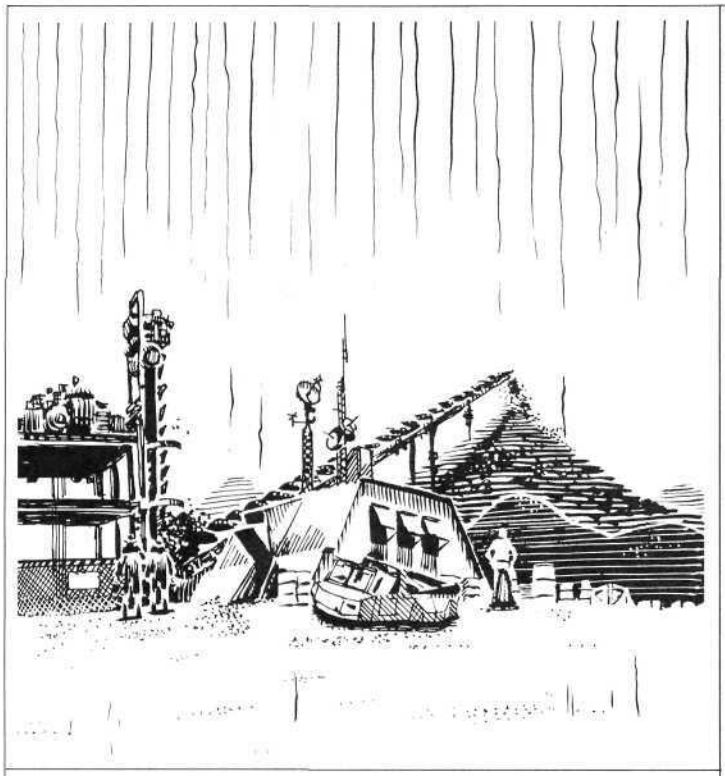
The scouts found the planet suitable in other ways, however. The nitrogen-oxygen atmosphere was quite breathable. Although the gravity was slightly higher and the temperatures were a little cooler, Chengdu's lush rolling hills, hardwood forests, and huge mountain ranges reminded them of Earth. Initial probes into those mountain ranges found them rich with minerals, particularly rare earths such as platinum. The lush plant life on the planet suggested that there might be petrochemicals buried beneath the ground. The Manchurians knew that they had made a find, and they were quick to plan their exploitation.

Colonization of Chengdu occurred in two independent processes. The first was aimed solely at exploiting the planet's mineral wealth. It was planned to be a fairly small operation with concrete results. The other operation involved setting up a separate community. Plans for a university and research laboratories were included. The results of this second colonization effort would be more abstract, but equally valuable.

The mining effort was much easier to organize. Consequently, the first colonization vessels arriving were those carrying the miners. The ships touched down on the site that is now the city of Anyou. They had chosen Wuqi, the largest of the four continents, for their primary site due to the fact that its mountain ranges were the most accessible and mineral rich.

The initial colonists numbered 8752 and were almost exclusively miners. It had been decided by the governing forces that the colony would be dependent on outside systems for other products so that it might concentrate on mining output. There were no industries or farms, at least not at first.

The second colonization of Chengdu took much longer to



organize, primarily because it was a joint effort of the Manchurian government and the Life Foundation, who were also interested in the planet's assets. The majority of the funding for the colony came from the Manchurians, but, at the request of the Life Foundation, invitations to join the colonization efforts were extended to many Terran nations. That the Canadians joined was no great surprise. Canadians had been cooperating with the Manchurians in that arm of space for quite some time. The surprise came when Nigeria volunteered to join the venture. Nigeria was just nearing the stage where it was ready to start its own off-world colony, and joining the Manchurians and the Canadians sounded appealing. Hence, the colonization effort of Chengdu was a multinational effort.

The first ships landed in the year 2421. It had previously been decided that the name of the second colony should be Shaoguan, named after the Terran city in which most of the colony planning took place. As opposed to the Anyou colonists, the Shaoguan colonists were a very diverse group. Among the 11,458 various nationalities were farmers and scientists as well as miners. Once a food source had been established, construction of both small industries and a university began.

Today Chengdu is nearly self-sufficient. Food is produced in a variety of forms at Shaoguan—enough food, in fact, to feed all 5.5 million people who life on the planet. The output of the Anyou mines is enough to keep all of the planet's industries running, as well as to create a surplus to export to other colonies. The separate governments operate in harmony, keeping both colonies functioning hand-in-hand.

THE COLONIES

Since their founding, the colonies have fared very well. The planet has become a frequented spot, and population is increasing steadily. The mines are producing well with no end in sight, while industries spread uncontrollably. Current predictions by the planetary governments are that Chengdu will be completely self-sufficient within 15 years.

The colonies have prospered well enough to afford a few luxuries. Power to the cities is now furnished almost entirely by expensive solar power satellites. Transportation in and around the colonies is provided by air film trains with very extensive nets, reaching to almost all points of the colonies. Transporting either goods or people between the colonies is done by the fleet of loadmaster aircraft recently purchased by the planetary governments to replace older, less efficient cargo vehicles. Moving goods and people into orbit is still accomplished by the use of shuttles. Most of the shuttles are old and in poor condition, needing repair or replacement. The planetary governments are currently looking into either replacing their current shuttles or upgrading to something more efficient.

One of the major reasons keeping people from immigrating to Chengdu is that it is not particularly well defended. Both colonies decided that they did not want large military forces present in their cities. Consequently, the two planetary defense bases are located on islands well off the coasts of the colonies. The two islands, Baoding and Lixiang, are each furnished with Mach 2 fighters that are supposedly capable of reaching the city in time to defend against any threat, but many people are not convinced. The system defense is currently carried out by the Manchurian government, which has a small fleet of ships stationed at Lajing. Plans are in the works for the colonial government to take over that responsibility.

Anyou: The first ships bringing Anyou colonists landed at the base of the Qingdao Mountains. This original landing point is where the Anyou Spaceport was constructed. From the spaceport, the colony began spreading in many directions, mostly up into the mountains. Its almost entirely Manchurian population is not located in any metropolitan area but is spread out into small mining encampments turned settlements.

The government of Anyou is fairly simple. An overseeing Committee is in charge of making laws and interpreting them. Each settlement has at least one Committee-appointed official to act as a government representative in addition to several law enforcement officials. The Committee and its representatives generally stay in the background of the colony, only intervening in extreme cases.

The Anyou colony has now grown to a population of nearly 1.4 million people. The colony has basically stuck to its first purpose: of those 1.4 million colonists, fully 75 percent are directly involved with the mines. The colony has spread its interests a little, however. Small industries have begun popping up over the years, and there are now three scientific research stations in the Anyou area.

The only agricultural attempts have been made in the hydroponics area, and even those have been limited. Some colonists have made attempts at growing Terran vegetables. They have, to date, had the most luck with potatoes, carrots, and radishes, but they find that, in general, it is too difficult to clear garden space out of the forests to make farming on a larger scale worthwhile. Fishing in the ocean has been met with little success, for it is good only for occasional variety in the typical diet. Hunting was considered as a possible food source, but the colonists met with the problem that the animals of Chengdu have particularly large carbohydrates and amino acids in their bodies that make them indigestible to humans. Consequently, almost all the food for the Anyou colony is imported from Shaoguan.

The mines of Anyou have turned out to be quite valuable. Since 2209 when they began operation, they have been producing a steady supply of platinum with occasional loads of gold and uranium. The majority of the products of these mines, not needed in large quantities in the planet's industries, are exported to other colonies and earth. Other mines at the colony have been geared toward mining nickel and iron for the planet's industries. Iron and nickel are not rare enough to make it profitable to export

them to other colonies, but they are both necessary to keep the industries in both Anyou and Shaoguan running.

The mines have not been entirely successful, however. As of yet, no tantalum has been discovered in the Anyou mountain ranges. Geologist reports say that the conditions for a tantalum deposit certainly exist, and the miners are still hopeful. Also, the hopes for large petrochemical deposits on Chengdu have not been realized. The large amount of plant life was apparently a false indicator, for petrochemical probes have met with no success thus far. The Anyou miners have all but given up hope on petrochemicals.

Shaoguan: The Shaoguan colonists have made good use of the fact that their forests are thinner. Much of the land around the original landing site has been cleared of trees to make room for farms. As there were no native food crops, the colonists experimented with strains of several Terran crops. They found that wheat seemed to grow better than most of the other crops they tried, probably due to the planetary climate and weather patterns. In addition to wheat, potatoes, radishes, and carrots are grown in large quantities. Many other fruits and vegetables are grown in large hydroponics facilities.

Attempts at bringing livestock to Chengdu have met with no success thus far. On seven different occasions, large herds of cattle have been brought to the planet on cargo vessels. On each occasion, the entire herd has been dead within a month, victims of some kind of plague. Similar attempts with sheep, goats, swine, and deer have met with the same fate. Biologists at the university have determined that some kind of microscopic parasite has been spreading the plague, which only seems to affect the animals. As of yet, the biologists have not come up with measures to counter the parasite.

Once the agricultural base had been established to feed the people, the colony began to branch out in other ways. Industries, foundations, research institutes, and merchants came to set up in Shaoguan. In 2247 the University of Epsilon Indi opened, sporting a surprisingly advanced and well-funded science college. The university, as well as the colony's other assets, have caused immigration to Shaoguan to increase steadily over the years.

Today the population of Shaoguan has just capped 4.1 million people, nearly half of them being Manchurian. The majority of the rest of the colonists are either Canadian or Nigerian. Those who are not of any of the three founding nationalities are a melting pot of races, many coming from the smaller Terran countries that have not established colonies of their own, such as the Philippines or Serbia. Others come from larger nations, drawn by Shaoguan's attractions. Shaoguan has dual official languages: English and Manchurian.

Considering its youthful age, Shaoguan has quite a metropolitan feel to it. Nearly 75 percent of the 4.1 million inhabitants live in the capital city (also called Shaoguan). The city is equipped with public transportation (air film trains), hospitals, arenas for sporting events, and a brand-new multi-million livre civic centre. Most newcomers to Shaoguan are surprised at how advanced the colony is, especially considering how far from Earth it is. Large amounts of money and effort have been pumped into Shaoguan by several governments to make it what it is today.

The actual government of Shaoguan consists of a council of officials elected by the colonists themselves. Although this independent government is given a fairly free hand at ruling the colony, the founding governments still have the right to intervene and have done so on occasion. Most of what the colonists do, however, such as introducing anti-pollution laws and strictly forbidding firearms within the city, meets with the approval of the founding governments.

One instance of the Manchurian government utilizing its influence was when they decided to locate a large genetic engineering research institute at the colony. In the year 2300, genetic engineering is still a touchy subject on Earth. Consequently, in 2258, the Manchurians moved their largest genetic engineering facility to Shaoguan, knowing that it would remain out of the public spotlight. Today, many other genetic engineering firms have followed the Manchurians' example and located their research facilities at Shaoguan, making the colony one of the leaders in genetic engineering research. Attempts are being made to, among other things, breed livestock that can thrive in Chengdu despite the "parasite plague," higher gravity, and cooler climate.

DORIS DM+ 20 5046

Canada's entry into the interstellar community has been a recent one. But the Canadians' efforts on Doris have been impressive, and their continued success in space is relatively secure.

SYSTEMDATA

Possibly one of the oldest systems in human-explored space, the main sequence of KV star of DM+ 20 5046 sports a family of four planets. Falling at an optimal location of 0.26 AU from the relatively cool primary, the second planet, Doris, is the site of the sole Canadian colony.

The innermost world of Nereus is a lifeless rock, some 8000 kilometers in diameter. It glides along in its orbit, tidally locked with one face forever staring at the primary, at an orbital distance of only 0.2 AU. Lacking an atmosphere, Nereus' surface is a panorama of the planetary bombardments which occurred early in the system's history.

A small, slightly irregularly-shaped world, Achilles is third in DM+ 20 5046's orbital hierarchy. At an orbital distance of .39 AU from its primary, this lumpy, 1000-kilometer-diameter worldlet provides the foundation for a complex of domes making up the system's Royal Canadian Armed Forces base. A contingent of about 300 men and women maintain this facility on a rotating basis, with relief crews arriving from earth once every 14 months. A small squadron of stutterwarp-equipped vessels are stationed on Achilles.

At 0.7 AU distant, Pontus marks the limit of significantly sized bodies in the system. This 3000-kilometer, ice-shrouded world clings to a thin atmosphere composed primarily of carbon dioxide and nitrogen. Residing out of the star's life zone, even the warmest of surface temperatures are far below that of human tolerances.

PLANETARYDATA

Doris is a 1 2,000-kilometer-diameter "garden world" in the system's second orbital slot. Surrounding the equatorial regions of the planet is an anomalous ring of rocky, orbital debris. Through analyses of ring component sizes and overall degree of spread, scientists estimate the age of the ring to be within one million years—recent history in terms of the system's age. Though there are markedly few examples of Terrestrial-type worlds exhibiting ring systems in explored space, the enigma of the Nereids (as the members of the ring are collectively known) is made more remarkable since the entire ring lies outside Doris' roche limit. Extensive studies of the Nereids have not yet been undertaken but are planned for the near future.

One of the largest of the Nereids is a two-kilometer juggernaut named Ellesmere. This rock serves as Doris' orbital terminal.

Doris is poor in heavier elements, though it does hold a wealth of such metals as aluminum, magnesium, and beryllium. The resulting planetary density is only 85 percent that of earth, thus giving a 0.316 kilometers per second escape velocity.

Planetary old age, coupled with the lack of any significant tidal stresses, has left Doris' core in a solid state. Danger to the colonists arises from this condition as Doris cannot generate a magnetic field to trap outbursts of high energy particles given off by stellar flares.

In the 27 years since colonization, there have been eight major stellar flares. The radiation levels rise dangerously on such occasions. The observatory at the orbital terminal gives warning to the best of its ability, sirens are activated, and the populace dives for shelters. For the safety of those caught out in the wilderness, Mounties are equipped with kits which include explosive tunneling charges. Given favorable terrain, they can create a moderately effective shelter in 10 to 15 minutes after receiving radio warning from Ellesmere observatory, though this is often a token safety measure at best.

The atmospheric pressure at sea level is 0.87 atmospheres, with a partial pressure of oxygen of 0.19 atmospheres. The remainder is made up of nitrogen and inert gases, so the atmosphere is quite easily breathed by humans without artificial aids, though there is a sour smell from a certain ubiquitous plant which some find hard to get used to.

Native Life: Due to its lack of a magnetic field, it receives a strong dose of cosmic radiation. This results in a lively mutation rate for the local flora and fauna.

Since oceans cover some 80 percent of the planet's surface, ocean life is very important to the planetary ecology. A striking feature of the oceans is that they are bounded almost entirely by forests. Upon closer inspection, it was discovered that these forests actually extend out over the coastal waters in a belt which is sometimes several miles deep.

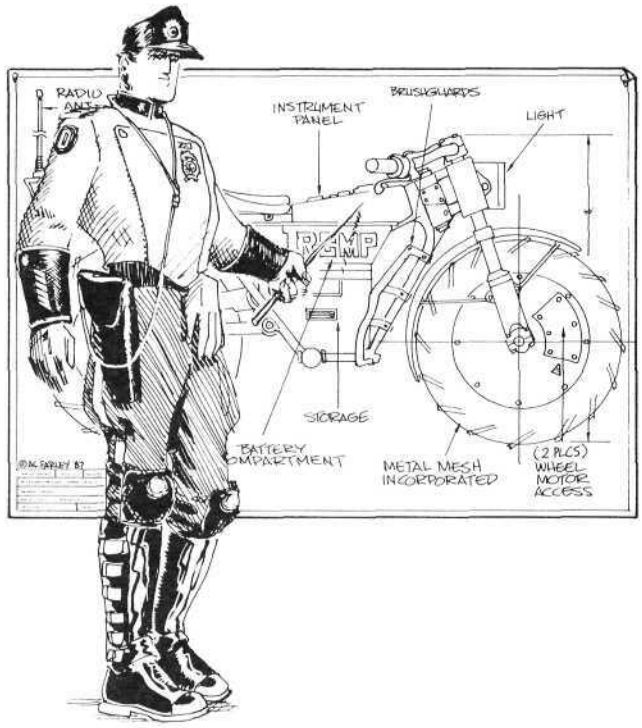
The forest **"floor"** is a mat of interwoven roots and woody flotation chambers. The trees send down strong cables to anchor themselves to the ocean floor and draw nutrients which they need to reach the mature phase. Thus anchored by their own cables and the floating roots of other trees, they grow to heights of up to twenty meters. The fruit which they produce underwater contains indigestible seeds which are transported far out to sea by aquatic animals which breed in the sheltering root systems.

The tiny seedlings float about, grow into seaborne shrubs, and are washed up to join the forests. The hollow structure of the mature trunks, supported by an internal truss-work reminiscent of that found in human bones, makes them very light and rigid. Because of these qualities, they are extensively harvested for local building, especially by independent prospectors constructing base-camps. The availability of these natural, internally braced beams gives even the rudest lumber-camp architecture a remarkably open and spacious quality.

Scientific investigation of the unique environment created by these floating forests has begun in earnest. The representative of the Canadian Institute for Oceanographic and Aquatic Studies has established a small facility near New Champlain and is preparing an investigation of the under-forest environment via mini-sub and remote drone.

In addition to those already mentioned, Doris harbors a wide variety of flora and fauna. The planet has become a subject of considerable interest for biologists because of the anomalies yet to be explained. There are large insectoid creatures which spin great tent-like cocoons up to three meters across and then put them to no use at all. There are mammalian creatures with large bioluminescent organs on their heads, which hunt by daylight. Also, there are trees that grow pods which create the most annoying whistling sound in the slightest *breeze,* the purpose of which has yet to be discovered. As a result, the planet is quickly becoming a center for biological study, and negotiations are underway on Terra to provide funding for an international center for xenobiology students on Doris.

Inland Doris presents a Terra-like variety of environments. Some 20 percent of its land surface is covered by the desert and tundra of the equatorial regions. These areas are characterized by a large number of impact craters spread across the surface. Many of these have become lakes, but others have become a remarkable haven for a wide variety of life. With spring-fed pools at their bottoms and their walls covered with a mat of intertwined vegetation, they are



like little jungles in the tundra. Although a two-man team has been lost to unknown hazards in one such "crater garden," some of the most fascinating archaeological finds have been coming out of them.

Five visiting archaeologists and biologists from Manchuria and her colonies are now working in cooperation with Canadian scientists to investigate the anomalies of these micro-environments (Manchuria has provided invaluable technical aid and equipment in exchange for full cooperation for her scientists). This arrangement has alienated members of the American Interstellar Science Institute, who are talking about boycotting the International Xenobiology Center project.

COLONY HISTORY

Canada, by managing to stay out of the major conflicts of post-World War Ill reconstruction, managed to get a head start in rebuilding its industry. Large oil deposits discovered in the Northwest Territories in the late 22nd century provided the foundation for advanced composite material and petrochemical industries.

Though economically strong, Canada recognized the need for interstellar expansion in order to maintain her independence from larger and more powerful countries. At the opening of the 23rd century, Canada occupied outposts at DM +19 5116 and DM + 1 5 4733, along a route which has become known as the Canadian Finger. These provided bases for probe missions to survey for promising colony worlds farther out along the finger. The culmination of this effort was the colonization of the second planet of DM +20 5046 in 2273 by 366 Canadian families carried in two old *York-class* colonization vessels purchased from Great Britain. The original outposts are still important in servicing the old *York-class* ships, which continue in service as cargo and communication vessels. The Canadian Government hopes to squeeze one more colonizing effort out of the old ships if Doris proves sufficiently profitable to fund it.

As there was not enough money in the Canadian private sector, the colony is a government-controlled venture. Its failure would be a serious blow to the national welfare, so the effort is characterized by tight, centralized control in all stages. The colonists were largely drawn from the industries, which simply transferred whole divisions to the colony project. The government offered tax breaks and control of some mineral rights to the corporations, and the corporations offered wage incentives and profit-sharing schemes to their employees.

The only military presence on the world is a squad of 50 Royal Canadian Mounted police. Their function, in addition to keeping the peace among the colonists, is to accompany and safeguard geological and ecological survey teams. The "Mounties" who shipped out with the colonists were given a crash course in handling the expected conditions on Doris, and in using some special equipment. Among other things, the course included outdoor survival, operation of their specially designed two-wheel-drive motorcycles, and the use of radiation detectors and shelter-building equipment to deal with the occasional flare.

With a year that is only some 33 Terran days long, the growing season is very short. Equipment for hydroponic farming was brought, but recent discoveries of indigenous plants which are extraordinarily well suited to food production have led to the establishment of large experimental farms. Some varieties actually mature during one short season; others grow underground like tubers for the first season, enter a dormant winter phase, then mature in the second season. These plants suffer from virtually no indigenous pests and promise food surpluses in the near future. No iron compounds occur on the planet, so iron and other dietary supplements must be imported.

Crops must be tended fairly intensively for a successful yield, so farmers remain awake for as much of the long daylight period of the 45 hour day as possible, usually taking a break in the middle of the day. Industrial workers end up being alternately awake in darkness and light, as the day is too long to fit into a normal human wake-sleep cycle.

This disparity of schedule is usually not cause for much concern, as the actual "dirt farmers" who grow the indigenous crops are the only ones obliged to keep odd hours, and they are a solitary lot to begin with. The hydroponic farmers growing Terran crops rely on automated systems for most functions, and keep the same alternating schedule as the industrial employees.

The metals that do exist on the planet's surface are heavily mined, with a large portion of the yield being used locally for the construction of dwellings and the fabrication of rocket booster shells. Approximately one-third of the population—some 100 families-live in the six mining camps scattered across the land surface of Doris. These scattered populations are in communication with New Champlain via satellite, and rely on light atmospheric craft for transportation of emergency goods or personnel. Ore is refined on site to reduce transportation costs, and is moved to the spaceport in New Champlain by 50-meter-long hover-trucks powered by petro-fueled turbines which drive on unpaved roads. There are plans for the eventual installation of a MagLev train system to replace the convoys, but the cost is prohibitive, and the current system works.

Automated oil pumping stations claim another 25 percent of the small population of Doris as overseers and repair technicians. Crude oil flows through aluminum alloy pipe sections produced at the Rocket Booster Division of Acadian Light Metals, just outside of New Champlain, to the huge petrochemical plants of North West and Interstellar, Maple Leaf DiversiChem, and Mendlesohn Fibre-Composites, which employ most of the remaining workforce.

Doris exports plastic and composite parts and certain unique biological products which are traded primarily with other colonies (Canada produces the same goods more cheaply at home, but Manchuria is a major customer). Among these is a plant which

produces a vegetable-fibre "fur" which is of a beautiful deep brown color mottled with gold. The fiber can be harvested in long strips from the trunks of treelike plants without apparent damage to the plant. If properly treated, the material is as durable as and more water resistant than animal hide. This material is exported extensively to Earth as a luxury item.

Due to the ready availability of petroleum, oil-fired electrolysis plants produce hydrogen and oxygen to fuel a fleet of heavy-lift rockets which boost export products into orbit cheaply, if inefficiently. Three space planes operate out of New Champlain Space Port. These are used for moving people and delicate or important cargo to the moonlet-based terminal in the ring.

New Champlain is the only major population concentration on Doris and is the home of all its industrial plants. Rocket fuel and booster shells are made there, as well as the petrochemical products manufactured for export. The population is very small, the plants are highly automated, and a fraternal outpost spirit prevails. Encouraged by the government, a baby boom is in progress which should result in a doubling of the population of working-age adults in the next 10 years. Only five of the RCMP are based at New Champlain, and those primarily handle administrative duties. The remainder are in the field settling claims, doing hard time at one of the polar weather stations, or accompanying survey teams.

There are a number of Sung on planet as guests of the Canadian government. Seldom venturing beyond the immediate vicinity of New Champlain, the Sung are here as both observers and ambassadors. Talks are currently underway for the reciprocal establishment of a Sung enclave on Doris.

The planetary governor has nearly dictatorial powers when handling emergencies or situations not encompassed by Canadian law. In other matters he must answer to the head of the RCMP and a board of corporate representatives.

The original governor, Barnard Themple, still holds office and is a vital and popular man. Experienced in civil government on Terra, he has a history of protecting the independent operator (see "the magnesium flare-up"). Caught out in the wilderness with a broken radio, Themple was exposed to a heavy dose of radiation in the first stellar flare experienced by the colonists, and it is now feared that he will have to undergo cancer treatment with the next few years.

Trouble can be looked for if Governor Themple is incapacitated by cancer. Several of the corporations have been maneuvering at home on Terra to put their men in position to be selected as his successor. The CEO of North West Interstellar in particular as ambitions to make up ground he lost lost over "the magnesium flare-up." The opposition is led by John Garvey, a lawyer who came over with Acadia Light Metals but went independent and made a small fortune on vegetable furs. He is backed by a coalition of workers and independents and may be expected to make a bid for the governorship using the colonial charter's emergency powers clause which states that "in times of real and present danger or crises, where immediate action is called for to safeguard the well-being of the colonists, where a civil post is vacant, it shall be filled by a majority vote of all colonists within reach of radio at the time of the vote, to be broadcast no less than one hour (Terran) before the votes are counted." This language clearly lends itself to abuse, should a given party find itself able to manufacture a crisis at the appropriate moment.

The key to the outcome of such a conflict would be the local contingent of the RCMP. If they swing behind Garvey and his crew, he would be likely to succeed, but it would take very little interference from them to scuttle his cause completely. Michael Courtland, the current head of the RCMP, has been showing a tendency to lean toward the part of the independents in the judicial decisions coming out of his department, but it is unlikely that he could be corrupted into actual complicity in any plot to create a convenient crisis.

Because of government incentives for the discovery of natural resources, a number of families have quit their industrial occupations to become prospectors. This has the effect of keeping the corporations honest, for they must please their employees to keep them.

The Magnesium Flare-up: The only significant outbreak of civil unrest so far occurred when technicians who had quit their jobs to become prospectors found that the necessary equipment was ruinously priced and strangely scarce. Corporation-sponsored survey groups, it seemed, were getting all the gear they needed, and the corporations were accused of squeezing out independent prospectors to keep them on the job and keep all the major mineral finds under their control.

After one violent incident occurred between angry prospectors and a corporate survey team (three dead, four wounded), the governor intervened to protect the independents. "Illegal hoarding of equipment necessary to colony prosperity and survival" was cited, and Northwest and Interstellar Petrochemicals Corp. was forced to relinquish tax breaks to induce the governor to drop charges. Since the dispute was over a magnesium deposit, "The Canuck," a paper in New Champlain, called it "the magnesium flare-up."

KWANTUNG Tau Ceti

After a shaky beginning, the Manchurian and Mexican colonists on Kwantung enjoy the benefits of peaceful coexistence. In this respect, Kwantung is a shining example of cooperation in space.

SYSTEM DATA

Aside from the single "garden" world, the Tau Ceti system has turned out to be rather unremarkable. The single G8 V star is host to seven worlds and a number of tiny moons.

Kwantung's people have been considering some space probes to other members of their system. Already two flights have been made to the satellites, Yin and Yang, which mapped the small rocky bodies and found them to be made of very light materials. Closer to Tau Ceti is a moderately-sized rocky body dubbed Lupei. Farther out, in much the same relation to Kwantung as Mars is to Earth, is a desert planet called Taonan. From these names, one can tell that the Chinese astronomers were very busy in the first decades of their colony. At 5 AU is a gas giant, Foshan, with numerous icy satellites. An asteroid belt circles at 9 AU, and two large chunks promise enough gravity to make a scientific expedition possible on their surfaces. A second gas giant, Sanhsing, is at 1 5 AU and is circled by at least six rocky and icy satellites large enough to be small planets. Two ice balls, Shuangcheng and Hsifeng, are the outermost members of the system, and their orbits are sufficiently inclined to the planet of the ecliptic to suggest that they first formed as comets and were drawn inward. A few periodic comets have been observed and charted in the planet's history, but the largest cometary displays have been from wanderers that will probably not return for 2000 years.

PLANETARY DATA

Kwantung is an almost earthlike planet in the Tau Ceti system. The planet circles the G8 V primary at a distance of .72 AU with a period of 225.41 standard earth days. Its rotational period of 35 hours is one of its least earthlike physical features. However, its average temperature of 8 degrees C will be familiar to any human settler used to the cooler temperate climates.

Kwantung is a little smaller than Earth. The world's mass has attracted a slightly thinner atmosphere, though it is sufficient to support people without artificial assistance. Kwantung has a somewhat lighter surface gravity than humanity's homeworld. Its .931 G is somewhat more than would have been expected from a 10,000-kilometer-diameter planet, and initial speculation suggested that the world might be rich in heavier elements.

Argon is so common in the atmosphere, due to the breakdown of radioactive elements, that it is collected and used for almost anything that requires a gas of no particular properties. It is used to flush tanks that have held other gasses, to inflate balloons (which sink, since it is heavier than air), as the pressurized contents of attitude control rockets in satellites, and as a fire extinguisher. The high argon content in the atmosphere also make spectacular auroras and fluorescent displays during electrical storms.

The native producers have adapted a type of symbiotic relationship with various topsoil bacteria. This relationship has locked up much of the soil's nutrition in forms which earthly plants cannot absorb. A typical area of vegetation on Kwantung consists of enormous, thin trees which keep their canopy foliage at least 20 meters off the ground. Ground cover in these areas is sparse, creating large shaded areas around the thin tree-trunks.

Animal life has developed similarly. Herbivores had to adapt to the great height of the vegetation and, thus, commonly have very long legs and necks. One herbivore which has been pressed into service by the colonists on occasion is known to the Mexican colonists as el alto rana (tall frog), a beast approximately twice the bulk of an elephant with a tall, thin neck that can reach over 1 5 meters. Predators have no need for such height and are instead typically built low to the ground for greater speed.

COLONIAL HISTORY

The speculation regarding Kwantung's unusually high density sped its development, and the planet was colonized in 2219 by the Manchurians in the hopes that the planet would have a large amount of exploitable metals and radioactives. These hopes were fulfilled in 2222 when large deposits of silver, platinum, cinnabar, iron, tungsten, and pitchblende were found in the Changchun mountains near Changpai. Since that time, other deposits of galena (lead) and tantalum have been found in other areas around the planet, though in extremely small quantities.

The original teams and colonists that were sent to Kwantung between 2219 and 2236 were entirely made up of volunteers. At that point, it was becoming increasingly difficult to meet quotas for colonists, and the Manchurian government of the day began to send criminals and draftees in increasing numbers. The original settlers did not appreciate this, but they put up with it since the labor shortage from opening new mining areas and agricultural sites was acute. Things came to a head in 2253 when a major would-be revolutionary and his chief followers who had been transported the year before attempted to take over the ground facilities of the spaceport in an attempt to hijack a ship back to Earth. In the fighting, the leader, Liang, was killed, and his lieutenant, Chen, negotiated with the planetary government for an end to the fighting in the spaceport.

This was the beginning of a move to secure more autonomy for the colonists. They were not trying to rebel against the mother country so much as to get some say in their local affairs and to block some of the involuntary immigration that was being forced on them. The Manchurian government tried for a couple of years to keep up the previous policies, but with mounting resistance, it gave up the idea and in 2257, negotiated a compromise.

The policy that came out of these negotiations is as follows:

1. The local congress will legislate the local laws in so far as they do not conflict with the Manchurian Supreme Law.

2. Criminals will not be transported if convicted of a violent crime. If convicted of a lesser crime, they can be given choice of a shorter sentence if they volunteer to emigrate to Kwantung to serve a labor sentence at minimum pay. They also have to volunteer for preimmigration training in some skill that the colony feels is necessary.

3. No more draftees will be accepted, but the planetary companies and their Earthside reps will offer much higher incentives and bonuses to those who are willing to emigrate permanently to Kwantung. Again, the more unskilled laborers will be asked to take training in necessary skills that will be useful to the colony.

4. The colony will be consulted in any negotiations that might be conducted with other countries that want to colonize.

The first three provisions were adhered to with great success for all concerned. The Manchurian government was still able to send a sizable population to Kwantung, but the colonists were able to set their own policies to meet the different needs of their situation, and they were getting colonists with the skills that were needed instead of troublemakers. The latter helped lessen the tension in the Kwantung populace considerably.

Provision number four got its test in 2261 when the Mexican government started discussing the policy of starting another colony on Kwantung, which by this time was starting to have the

reputation of a fairly wealthy planet in terms of resources. The Manchurian government saw no problem with the idea and approved the plan. On the other hand, the colonists had an objection. Yes, the planet had plenty of mineral resources, but the colony was starting to have considerable trouble and expense keeping up with the need for food due to the weird agricultural conditions on the planet. The colonists wouldn't mind another colonization effort being made as long as it was an agricultural colony.

The Manchurians passed this on to the Mexicans, who objected. They needed more mineral resources, not agriculture.

Eventually, in 2263, all three parties came together on an agreement that would allow the Mexicans to form a new colony. The agreement allowed the Mexican colony to exploit the mineral wealth of the planet as long as at least 30 percent of the colonists sent were involved in agriculture. The Manchurians agreed to train a larger number of the newer colonists in the necessary agricultural techniques for Kwantung, and the Kwantung Council would allow the new colonists representation on the Planetary Council.

At first, there was considerable wariness between the "old" colonists and the Mexican colonists. To a large extent, this was due to the differences between Manchu Chinese and Mexican cultures. The newcomers soon proved themselves to be a hardworking and helpful addition to the planetary economy. The additional effort in agriculture soon turned the planet from a net food importing planet to an exporting planet.

The Mexicans, drawing on their centuries of expertise with alcoholic drinks, started brewing and distilling an absolutely fiery rum with a very distinctive flavor that was soon in demand over a large area of known space. This helped the balance of trade in the favor of the planet. By 2290, the export value of Kwantung Ron (rum) was about 1 5 percent of the overall exports.

What was the problem with agriculture on Kwantung that made it such a major factor in the earlier history of the colony? Simply put, the local plants were not edible to Terran organisms, and Terran plants would not grow in the local soil.

At first, the latter problem was somewhat of a mystery to the agronomists until they found that microorganisms were binding up all the nutrients in the soil. The local plants had evolved means of ingesting the microbes to gather the necessary nutrients. The Terran plants had not. Until new plants could be engineered that were edible and would grow in the local conditions, all agriculture had to be conducted in sealed domes where the local soil had been sterilized and then kept isolated from the outside environment. The local organisms were so insidious that workers had to go through extensive decontamination and in many cases, use protective clothing to prevent contaminating the soil. Many simply made their homes in the sealed domes and never left them, rather than go through daily decontamination.

The effort to modify plants for local conditions was not really successful until the late '50s when scientists at last were able to combine the necessary genes from local plants with the genes from Terran plants with usable results.

Naturally, with such a completely incompatible ecology, there is no worry about infection of Terran organisms with local bacteria. However, the modified plants are sometimes susceptible to local diseases, while animals and humans continue to enjoy immunity.

COLONIAL LIFE

With extensive cooperation between the colonies has come an interesting linguistic shift. The Mexicans were at first obliged to learn the Manchu language, since they were the newcomers and in the minority. This was the source of some resentment, but as the Mexican colony grew and became a business center, more Manchus began learning Spanish. Now the Spanish of the colony are acquiring some of the tonal characteristics of Chinese, while the Chinese vowels are opening out to the pure Latin sounds. Both languages are sounding more musical all the time as the two cultures mix, and all in less than the forty years since the two cultures were forced to work together. With the increased mixing and cooperation, joint cultural projects have started to increase markedly, including the building of a joint center for the performing arts. The Pengtao Center for the Performing Arts has several stages and concert halls which are used by both colonies. The Center is located in the city of Choupei on Choupei Island, equally accessible by water to both colonies. Works by Li Yong, Sun Mapei, Rolando Cespedes, and Jose Chen are being performed in the Chinese Arm and on Earth, as well as on their own planet.

Kwantung is, at this time, fully self-supporting, and exports many items to younger colonies in the Chinese Arm. Metals and machinery are the single largest export items, with rum, art objects, and clothing making up another large portion.

The excessively long day had caused the Chinese to adopt the siesta long before the Mexicans had arrived. A sleep period of four hours in the middle of the daylight period is universally observed, so there is no use trying to conduct any business at this time. Standard hours are still used for timekeeping, as they are all over known space (for what would happen to physics if the time unit changed in length?), but clocks are specifically made for local time and the few spare minutes at the end of the day are "thrown away" by a special resetting program in the clocks. Thus the day is always exactly 35 hours long, and noon does not wander through the day as the solstice used to wander through the year in old calendars.

Kwantung's power needs are met with a solar powersat that beams power to nine power net districts on the planet; five Manchurian and four Mexican. The largest power demand is in the Chanpei area, which constitutes two power districts, contains the heavy industries of the planet, the dirtside spaceport facilities for the scramjets, and the orbital catapult. The major reason for having major power networks elsewhere is the extreme dispersal of the other areas of colonization.

However, though there is a fair planetary power network, the transportation networks are still in the planning stages. A highway and airfilm system are both in the works for the next thirty years or so, but for now the colonists are basically left to their own resources for transportation. All-terrain vehicles, many of them built on the planet, have become quite popular in the more rural areas. Air travel is also quite common, and a high proportion of Kwantung's people either own or have access to private air transportation. In the most remote areas of the planet, some animal transportation is still employed, sometimes for work applications but more often for entertainment purposes.

Changpei's spaceport and catapult are considered to be among the best in known space. Though they started from the same humble beginnings as many other facilities, the inhabitants of Kwantung have slowly built them up to their present high quality, area, and volume of traffic. There has been some discussion of adding one or two more catapult facilities in the near future to handle the present high volume of cargo more easily.

Recently, an orbital factory was built to assist the planet in its efforts to become more self-sufficient. Most of the electronics and Pharmaceuticals used in this system are now being manufactured in this facility instead of being shipped in from out-system.

Another project being discussed and tested for the orbital manufactory is the manufacturing of foam metal members for various types of construction. In conjunction with this is a project to start a major starship building facility.

DUKOU

Epsilon Eridani

Potentially wealthy mineral deposits were the original impetus for colonization on Dukou, a world in the Epsilon Eridani system. However, being a chilly, high-gravity world, Dukou cannot be listed among the more hospitable colony worlds.

SYSTEM AND PLANETARY DATA

The *year 2182* saw a great many stellar probes visit new systems. One of these such systems was Epsilon Eridani, visited by a Manchurian probe sent from the orbital station at the Tau Ceti system. Initial reports were moderately promising, revealing a number of planets, including a gas giant and two other planets that were near the projected life zone for the star. It was certainly promising enough to send further scouts, as it looked as though going through Epsilon Eridani might be the best jumping-off point to the K1 Omicron 2 Eridani system.

In the years that followed, many scout crews visited the Epsilon Eridani system, trying to find some good in it. They had a tough time. Most of the planets were totally uninhabitable. The exception was Dukou, the first planet, which did have a breathable atmosphere but was also a huge ice-covered world with a very high gravity and low temperatures. As far as colonial prospects went, Epsilon Eridani had very little to offer.

Dukou is the single planetary body which lies within the narrow life zone of Epsilon Eridani, a K2 V star far less bright than Earth's Sun. Its bulk gives it more gravity than humans are used to, being slightly higher than one and a half G on the surface. The planet's rotation makes the days 37 hours and 1 2 minutes long.

HISTORY OF COLONIZATION

Epsilon Eridani gradually became a "way station system." No one actually wanted to go to Epsilon Eridani, only through it. At times, different companies announced their plans to place some sort of outpost on Dukou, but those plans fell through without exception. Both low temperatures and high gravity individually could be dealt with, but the cost of allowing for both of them proved to be too great.

However, in the year 2219, a Manchurian government-backed research station went into operation on the surface of Dukou. Among the responsibilities of the 12-person research team were routine tasks such as recording local meteorological patterns and searching for any kind of life forms. The prime function of the outpost, however, was to prove and determine what lay beneath the thick layer of ice that coated the planet's surface. The planet's high density suggested a great mineral wealth, and the Manchurian government needed to know how accessible those minerals were and whether or not it would be worthwhile trying to locate a mining colony on Dukou.

Using high-tech mining probes, the outpost's geologists were able to drill into the planet's surface. They were dismayed when the only minerals they encountered were fairly common ores, and even those were buried so far down that getting them out would be extremely unprofitable. What the probes did find, however, was a strange organic substance located in pockets deep within the ice, samples of which were brought up for analysis by the outpost biologist. There being no animal or plant life to speak of on the planet surface, she had not been particularly busy and was eager to have something to study.

The substance proved to be plant-like in nature although of no species discovered by man as of yet. The plant seemed loosely related to various Terran fungi and, although the biologist was not a pharmaceutical chemist, it seemed as though it might have certain antibiotic properties. Attempts were made at shipping samples of the plant back to Earth, but in each case, despite attempts to preserve the samples, the plants deteriorated completely during the voyage.

Enough interest in the plant was generated, and finally a team of chemists was sent to the outpost at Dukou to do an analysis of the plant on-site. After several weeks of studying, the chemists announced that the plant, dubbed pai-leng, was an enormous find and would be of great use as a natural antibiotic. It was also suggested that when an operation to extract pai-leng from the ice was set up, a refinement station be constructed on the planet to avoid the deterioration involved in space travel.

The Manchurian government offered both pharmaceutical and mining companies the first shot at capitalizing on pai-leng; neither, however, were interested. Pharmaceutical companies were not set up to mine material from ice worlds, and the mining companies lost interest when they found out that pai-leng was not a mineral. Left to its own devices, the government decided to establish its own colony on Dukou.

As the planning for the colony proceeded, a minor Manchurian official named Xixiang suggested that the Dukou colony be made a penal colony. He presented a report based on the overcrowded prisons and mentioned that a penal colony would not only put the prisoners to good use but would also teach them a valuable skill when the time for release came. Xixiang's report was very well received. The Dukou colony was termed the "Xixiang Project," and Xixiang was given an executive position on the planning committee for the colony. By the year 2230, the colonization process was nearly ready to begin.

The colonists were chosen through a rather selective process. Prisoners singled out tended to be healthy male prisoners aged 18-35 with a nonviolent nature, as it had already been decided that there would be no female or elderly "groundbreakers." Each of the selected prisoners was presented with the option of a slightly reduced sentence, the learning of a skill, and the chance to earn some money while still under sentence. Of those, 7318 volunteered to go.

While waiting for the process to actually start, the colonists went through rigorous training programs. Some were trained as mechanics or electricians, others to work in the hydroponics farms, and some were even trained to work in the pai-leng refinement plant. At the same time, a select few of the prisoners were being trained as colony administrators, officials that would be in charge of managing the colony. In other words, the government offered to find jobs for the prisoners that performed well under sentence.

Throughout the programs, attempts were made at installing feelings of companionship and loyalty in the prisoners. The colonists realized that they had been given an opportunity to redeem themselves and that they were going to have to work together to make their colony as efficient as possible. If they were going to expect help from the government, they would have to show results.

Systems for the division of profits from the colony were created. The largest share of the profits was to go to the Manchurian government, which, after all, funded the whole thing. Another large share became a fund that went back into the colony to be used to improve living conditions, upgrade equipment, or expand the operation. The smallest share of the profits was to be divided among the workers. The profit-sharing plan was chosen over direct salaries in order to inspire the prisoners to work harder for their colony.

The first colonies landed in September of 2235 at the spot that would eventually become known as the Xixiang colony. The initial years were spent constructing the colony. The majority of the

colony construction was left up to the colonists themselves, who worked under the supervision of a small group of Manchurian colonial engineers. Colonists were forced to wear environment suits while building the barracks, housing for the mining equipment, and the pai-leng refinement plant. The mining equipment and the orbital catapult that would be used to move finished products into orbit also needed to be constructed on-site.

By the year 2242, both the pai-leng mines and the refinement plant were operating, and both male and female prisoners were being shipped to Dukou. The first major shipments of refined pai-leng reached the core worlds late that same year. Earlier samples of the antibiotic had been well received, and the new shipments proved to be more effective in fighting infection than the original studies had predicted. This caused an immediate popularity for the new drug, something unforeseen by the Xixiang officials.

Demand for the drug soon exceeded current supply levels, and it became necessary to expand the operation at Dukou. Greater numbers of prisoners were shipped in to operate the pai-leng mining equipment and work in the refinement plants. As the years wore on, it became necessary for the Manchurian government to negotiate with other nations to get foreign prisoners to work at the Xixiang colony because they were running out of willing Manchurian prisoners.

By the year 2294, Xixiang's status as a penal colony had changed. The operation had expanded to the extent that it was necessary to send more colonists than the prisons could provide. The Xixiang Company opted to begin recruiting colonists from the general public and no longer accepted convicts. The official status of the colony was changed from "penal colony" to "semi-penal colony." Those colonists still under sentence would still be required to serve them, but once the last of the sentences had been completed, Xixiang would become a regular colony.

LIFE ON DUKOU

As a planet, Epsilon Eridani-1, or Dukou, differs from other ice worlds in the galaxy in two basic respects: it has an atmosphere, and it has a colony. The atmosphere is the result of a huge moon orbiting Dukou, a moon producing tidal forces strong enough to churn out an atmosphere. The colony, on the other hand, is the result of the discovery of the plant known as pai-leng. Colonists who come to Dukou to mine the pai-leng are forced to adapt to many of the more harsh features of the planet.

One such feature colonists have to adjust to was the landscape, which is uninteresting at best. Glacial oceans, vast sections of snow and ice, cover the planet. The planet's strong tidal forces actually cause the snow and ice to shift quite a bit, but changes in the planetary surface are practically imperceptible, resulting in a flat, icy landscape all year round.

Another feature of Dukou that proves difficult for colonists to adjust to is the temperature. As might be expected for a glacial world, Dukou is cold, having an average temperature of about -25 degrees C. Colonists have little cause to leave the colony's buildings, but when they do occasionally have to venture outside, they always wear environment suits. Unprotected exposure to Dukou's harsh climate has been known to cause frostbite in a matter of minutes.

The characteristic of Dukou that is most difficult to adjust to, however, is the high gravity. The planet's large size (17,000 kilometers in diameter) coupled with its high density give it a gravity of 1.565 G, causing anything with mass to weigh 1.565 times as much as it would on Earth. For example, a tool box that weighed 9 kilograms on Earth would weigh over 14 kilograms on Dukou, or a man that weighed 75 kilograms on Earth would weigh 117 kilograms on Dukou. Carrying around the extra weight caused by the high gravity proves to be very difficult to adjust to. Colonists find that they tire easily and that the simplest physical task can be overwhelming. After several months, however, colonists generally get used to the gravity. The notion of administering DNAM transformations to select colonists, like those done successfully on King, has been written off as impractical. The difference in gravity (King's is over 3 G) is not as severe—Dukou's gravity is uncomfortable and straining, but it is generally not life-threatening.

Dukou spins slowly on its axis and is larger than Earth, and, consequently, Dukou's day is 37 hours and 12 minutes, much longer than Earth's 24-hour day. The colonists have adapted to this fact by ignoring it. Since the colonists pay little attention to what goes on outside their buildings, the colony can still operate on a 24-hour schedule through manipulation of the interior lighting. Seasonally there is little change in the planetary climate. During the summer period of the 240-day year, temperatures can raise as much as 10 degrees C. Even at — 15 degrees C, it is nothing but winter to the colonists.

THE COLONY

The Xixiang colonists today number 217,000. Fully 90 percent of those colonists are Manchurian, the rest being of mixed nationalities, primarily French, Mexican, and Canadian. The majority of those colonists are still convicts despite the change in the colony's status as a penal colony. Many of the convicts who completed their sentence on Dukou opted to stay on and continue working at the colony, finding that they have adapted to the conditions well enough to continue living there.

The remainder of the colonists at Xixiang are either descendants of convicts or regular citizens who decided to come to Dukou of their own free will. Although the living conditions are somewhat less than optimum, the pay is very good. Workers are now paid through direct salary and profit-sharing incentives, and the starting annual income is Lv19,000.

But being a "semi-penal" colony, Dukou is often low on the list for receiving consumer goods manufactured on Earth or elsewhere in the arm. Consequently, there is very little for colonists to spend money on. The only things of interest at the colony are the pai-leng mines and refinement plants. Since there are no industries or farms on Dukou, there are very few luxury items available. Those wanted must be imported along with food and machinery and everything else necessary to keep the colony running. The reputation of "doing without" has spread and gone a long way toward slowing the flow of willing colonists to the planet.

The colony itself is made up of a series of buildings all connected by tubular passageways. The passages are included to avoid constant exposure to the harsh temperature. The exceptions to this rule are some of the newer pai-leng mine installations, which are located too far away from the original facility to make connection practical. Workers commute to and from these installations on winter-adapted trains.

The buildings themselves are generally of poor quality. The workmanship is not particularly good, and the materials are just adequate enough to withstand the high gravity. Most parts of the colony are not maintained. Passageways tend to be littered and vandalized. When something is broken down, it either goes unrepaired or is sloppily patched together.

As far as actual equipment goes, the colony is again poorly supplied. The original equipment provided by the Manchurian government was rather primitive, for the Manchurian government obviously did not want to supply a penal colony with the most

expensive equipment. Power is supplied by a rickety fusion plant. Transportation is carried out on standard railroads instead of on more advanced air film or or maglev trains. Recently, however, the Company has been able to afford better equipment, and there are plans now in the works to upgrade both the transportation network and the power supply plant.

Other than the Xixiang colony, there is only one other installation of note on the planet. That installation is a research station funded by the Manchurian government, actually an extension of the outpost that made the pai-leng discovery. The station is located nearly three-quarters of a kilometer beneath the ice within the glacial ocean. The staff of 1 1 researchers travels between the outpost and the colony in submarines capable of navigating around ice chunks.

Because of the extremely high gravity, things tend to move more slowly at Xixiang. The colonists are hard-working, but they are careful not to overexert themselves. For example, the typical work day allows for only five and one-half hours of actual work time with a two-and-one-half-hour break in between halves.

The Xixiang Company also acts as the government for the colony. Part of its administration is devoted to caring for the day-to-day needs of the colony. The police force, for example, consists of Company security guards. As might be expected for a formal penal colony, the laws are fairly liberal, but they are strictly upheld.

The colony still has very strong ties to the Manchurian government, mostly through the Company. This is probably in the best interest of both parties. The Manchurians still make a great deal of money from the colony. In return, they both protect the colony and keep it supplied at cut-rate costs.

MONTANA

Omicron 2 Eridani

Mexican and Argentinian interests in space have traditionally been linked. Their joint colonization of Montana is to date their most successful achievement.

SYSTEM DATA

Omicron 2 Eridani is a trinary system of relatively dim stars, with a K1 V primary orbited at 400 AU by a white dwarf and a main sequence M star whirling about each other with a mean separation of 34 AU. This outer pair of stars possesses no objects of planetary proportions, though the M class star, Omicron 2 Eridani C, has a sparse belt of asteroidal debris orbiting at 2.3 AU. In contrast to the B-C system, Omicron 2 Eridani A supports a relatively extensive planetary group composed of 6 planets and two asteroid belts. At .6 AU spins the planet Montana (meaning "mountain" or "mountainous"), home of a joint Mexico-Argentina colony.

Several small planets circle Omicron 2 Eridani A, and expeditions are planned to each of them in the near future. A tiny, tidally locked, rocky body is sunward of Montana, with no atmosphere and no satellites. It is never visible to the naked eye because of its proximity to the star, so it has been named Phaeton.

Two desert planets are beyond Montana, lying some one and two AU from the primary. These are San Martin and San Pedro, respectively. Though San Martin has a thin atmosphere, it is protected from the brunt of the K star's radiation by a considerable magnetic field. Surveys of this world are currently underway by the Instituto Nacional de Astronomia Practia to search for any exploitable resources. If such are found, the establishment of a small dome-station could result. Farther out, at 5 and 10 AU, there are two asteroid belts, but with the wealth of mineral resources available on Montana, these will probably be ignored for a long time to come. A gas giant circles the star at 20 AU, with multiple icy satellites and a ring system. It was named Gabriel, and its many satellites also bear angelic names. An ice ball at 40 AU is called Nieve, appropriately. Beyond the most rudimentary probe missions, this planet and its moon are unexplored.

PLANETARY DATA

The fairly mild garden planet of Montana measures 11,347 kilometers in equatorial diameter and exerts a pull of .98 G at its surface. The atmosphere's reasonably terrestrial mix of gases is bound with a sea level pressure of .965 atmospheres. The year is 103.6 local days long (155.44 standard days). Local calendars record one year of 103 days and two of 104 to compensate for the difference. Local days are almost precisely 36 hours, and local clocks are calibrated accordingly. The world's axial tilt is nearly 25 degrees from the ecliptic, but the year keeps seasonal variations from being too severe. The polar reaches are ice-capped in the winter months but become reasonably clear in the summer. This is due as much to the constant motions of currents as to the warming of the primary's more direct rays.

Montana lives up to its name admirably, since it is very active tectonically and has over 200 live volcanoes. The high mountain ranges of most recent geologic origin extend to the very limits of the atmosphere and thus wear down very slowly. High plateaus between the ranges and mountain valleys are the optimum places for human settlement.

Montana has one natural satellite: a moon 3544 kilometers in diameter, making it slightly larger than Luna. As with most lunar-orbited planets, the moon's pull has served to keep the planet's core in an active state. There is about a 19-hour stretch of time between the high and low tides of Montana's ocean.

There is only one major continent and three large islands to the east of it, while 90 percent of the planet is covered by water. Little has been done so far in the exploitation of the ocean resources, although aquacultural pursuits are being examined since the crops it would yield are more easily digested than Montana's land forms. The ocean plants need not protect themselves from violent weather. Some freshwater fish have been found edible, but cattle are still the most popular meat source.

The three large islands to the east of Chimborazo are Carmen, West Island, and Monte Patria. All are volcanic in origin and display active volcanoes, with the ranges on Monte Patria being the highest and most active. Clouds over the island regularly reflect the red molten lava in the craters. A subducting seafloor plate is responsible for the line of activity, running southwest to northeast, and it may eventually build enough seamounts to make the cluster of islands into a continent. The sea beneath the islands is always warm from the vents beneath. This sometimes creates small tidal waves as explosions of steam erupt when water seeps into cracks in the active region. This area is referred to by the colonists as the Smoking Sea.

Fortunately, the volcanoes of the islands are of the basaltic variety; they put out fairly thin lava at frequent intervals but never build up the great internal pressure that leads to eruptions. Regardless, only the tip of West Island is considered safe for habitation, being shielded from the lava flows by a series of east-west ridges. Monte Patria is inundated with fresh lava so frequently that the seashore often smokes and few trees escape the lava flows long enough to to grow to any respectable size. Only a few sheltered areas on the island have been spared the volcanic onslaught long enough for the lava to break down into the typically rich volcanic soil.

In contrast, some of the volcanoes on the main continent are of the andesitic type. While many of the peaks only exude gases and occasional ash clouds, seven major explosive eruptions have marked the 55-year history of the colony.

Native Life: The majority of native animals are small and cold-blooded, diurnal in habits and hibernating in cold weather. A few large carnivores can be dangerous to humans if disturbed, but none will hunt humans by choice. Worthy of note is the lagartija puma (puma lizard), which masses some 70 kilograms and is capable of taking any type of livestock it fancies. It is fast but unarmored and has been hunted away from most ranches.

A featherless flyer dubbed the gallina desnudo (naked chicken) has been domesticated for its meat. It also helps control small pests. While the gallina has not developed a taste for Earth vegetables, there exist several species of crawling creatures which will happily decimate a young garden because of its extreme tenderness compared to native plants. The gallina preys on these small crawlers.

Earth plants and animals flourish on Montana's soil, but a number of native microorganisms can also flourish in Earth tissues. An airborne spore of a native fungus caused the first plague to hit the colony. More than 1000 colonists died of suffocation before a way was found to eradicate the fungus once it settled in the lungs. Cattle and sheep were also affected. Fortunately, the causative fungus was only found in a limited habitat and an immunization has since permitted humans to return to those areas safely. Less success has attended efforts to immunize against a local microorganism, so all water must be boiled and filtered before use.

Most native plants produce spores or reproduce by budding or runners. Terran bees were imported to fertilize imported crops, but artificial pollination techniques have proven just as effective, if not more practical.

The ocean is Montana's largest environment, harboring creatures from the near-microscopic to 10-meter-long hunters with 5-centimeter teeth. Several intermediate-sized species could become a primary food source for the colony. Not all of the undersea species are edible; a black and gold beauty that inhabits the Smoking Sea is violently poisonous. In fact, fewer than half of the species in this region are edible.

There are no aquatic air-breathers, like the Terran whale or seal families, but some species living in the shallows are true amphibians. Possessing analogues to both gills and lungs, they can be out of the water for hours at a time. These "walking fish" are encountered at the southern tip of Chimborazo and have strong, elongated fins which they utilize on their inland forays, sometimes measuring up to three kilometers, when in search of a type of fallen leaf they relish.

COLONIAL HISTORY

Montana was settled in 2245 with a jointly financed effort by Argentina and Mexico. After the initial surveys were performed (2234-2238) by the Instituto Nacional de Astronomia practical, the exploration agency formed by both countries, they agreed to consolidate their resources on this colonial venture. Colonists were recruited by a massive public campaign in both countries, appealing to curiosity, patriotism, greed, and anything else the PR men could use to appeal to the populace. In more recent years, both countries have been funnelling increased funds and resources to the world as the Latin Finger becomes more developed. Montana lies at the gateway to this minor branch of the Chinese Arm.

The first wave of colonists, arriving on surplus French colony ships, was almost entirely men, since the Hispanics thought that the work at first would be too dangerous for women. Later, of course, women were sent out to establish homes and families and begin making the colony into a true settlement. However, the ratio continued to be uneven, especially after one "bride ship" disappeared en route with no clue to its fate. First-generation colonists have approximately a three to one male-female ratio. Births, of course, are roughly even, but older men competing for younger women has kept the situation from evening out completely. Under the circumstances, the solution was obvious, if unpalatable to some: older colonists entered polyandries.

Despite efforts of the revived Church to suppress all alternate forms of marriage, polyandry has continued to be popular in some areas of Montana. It allows more male muscle to be brought to bear on the problems of one homestead without putting any of the men in a hired hand category (which most Montanans despise). The women find themselves more protected and cherished than ever and children are less likely to be orphaned by the harsh conditions of the colonial outback.

Montana is virtually self-sufficient, partly because of the broad range of resources available and partly because the planet is so hospitable to Earth plants and animals. Hence, the mother countries have had to yield considerable autonomy to the local government. One severe confrontation in 2278 was sufficient to point out that the colony could get along quite nicely without ships from Earth, but the ships needed to make port at the colony. Ships were turned away from Montana's terminal for two local years (one Earth year) after that incident before the Colonial Committee on Earth yielded the point. Henceforth, its exports to its home countries were made on a first-refusal basis.

The colonial government is housed in the city of Valle Alta and consists of a governor, who is now elected from the cities and villages. The council advises the governor and can override his decisions, but the primary power rests with the governor. Several lobbies have formed in an attempt to influence the council in different directions. The current leader, Rodrigo Soliz de Garcia, has been in office for 10 years and, if his popularity maintains its current high, may stay in until he decides to retire. The economy is flourishing, and all citizens are guaranteed access to the important technological resources. Soliz de Garcia makes a practice of being available to listen to any citizen who wishes to speak to him, and he sometimes even takes up citizen suggestions. He has attempted to keep the income tax low and has replaced a few judges whom he thought were being too arbitrary.

The Novo Catolico Church has a strong influence in the cities and has made some efforts at influencing the politics of the colony. The colonial constitution did not specifically forbid such involvement, though some now wish it had. As a pressure group, the church has managed to win from the governors some measures that impose standards of moral behavior beyond merely respecting one's neighbor. An awkward point of colonial law is that subsequent governors cannot repeal the acts of previous governors outright. They can pass other laws that mitigate the effects if they do not like the law, but every law, once passed stays on the books. On this point the current governor would like to see the constitution amended.

Local police are the only official militia, but a citizen posse can be quickly formed any time renegades threaten an outlying area. The governor tries to insist that bandits arrested by posses be shipped by rail to a population center for trial, but this plan is not always carried out in the case of more serious crimes. A fair number of bandits have been hanged or thrown from cliffs in the outback. If a retrospective investigation proves the accused guilty, the citizens responsible are not punished.

While Argentina and Mexico originally placed two separate colonies within cooperating distance of each other, the distinctions have long since vanished. Even newcomers to the colony sense that planetary and not colonial attitudes prevail. Three major cities have grown up: two near the fusion plant, in the area of the original colonies, and one on West Island, where a university has been started by the Life Foundation.

Rio Oro, on the major continent of Chimborazo, houses one and a quarter million people in its vicinity and is the primary industrial center, supplied by mines in the nearby mountain ranges. Its name derives from the rich deposits of gold-bearing rock, along with iron, copper, and tungsten. Uranium and silver are found in the same ranges. Several SCRAM craft are permanently based here to connect the surface with the orbital terminal. Gems can be found in nearby areas, and local jewelers produce some beautiful work for export.

Lying upstream from Rio Oro along the Rio Verde, Valle Alta, the colony's capital, has a population of about 300,000. It processes most of the agricultural output of the valley upriver, which stretches nearly 5000 kilometers to the source of the Rio Verde in the Sierra del Sur. Rail service connects several other agricultural valleys with Valle Alta. Still, nearly half a million people have chosen to live in small communities or isolated ranches, depending very little on manufactured goods from the cities.

Nueva Guadelajara, situated on West Island, is the smallest of the metropolitan areas, with 100,000 people including the university population. The Instituto Nacional de Astronomia Practica still maintains a base there staffed by Mexicans and Argentines, who are engaged in research on the ecology of Montana.

Mobility comes from the rail network and the use of private VTOLS. Beasts of burden are often used in towns and remote areas, so one may see a horse-drawn carriage pulled up beside a VTOL in many towns. Legged vehicles are used mostly in

exploration and for mining activities. Between the main continent and the archipelago, the primary form of transport is windjammers. These are cheap and easily built of local materials; hence they save the colony money for other improvements that are more needed or desired. Some of the boats have auxiliary hydrogen-fueled engines, but the trade winds in the latitudes of the archipelago are quite reliable. On the other hand, the ocean currents in this region can be a cause of great distress.

A scientific base engaged in the study of the volcanoes is found in the islands well away from inhabited areas. The scientists manning this facility are studying the nature of the planet's volcanic output; hence, the base is located precariously close to some of the planet's most volatile areas of vulcanism.

The 36-hour Montanan day has made the old Spanish custom of siesta a near necessity. Activity continues late into the night and begins again at first light, with a three hour hiatus in the afternoon. Factories, power plants and the like run four nine hour shifts.

Only in the cities is any class consciousness evident in the social order of the colony. Society tends to divide along intellectual lines, though not severely so: technical and scientific workers associate with scholastic people but not many miners, factory workers or farmers. Women are more stratified than men and somewhat sheltered; the least satisfied group on Montana is urban women.

Montana did not offer one "cash crop" resource for development but was a fairly well-balanced world with an ecology advanced to the equivalent of Earth's Mesozoic era. Most native plants are not digestible by humans since their stems and leaves are structured by a type of cellulose that is quite rigid. Cattle, however, find them nourishing if carefully eaten. Some roots can be cooked to edibility, and many of the planet's native creatures can be safely eaten. The stiffness of greenery means that brushing aside leaves in a forest can slice a coverall to threads in a short time. Extremely tough fabrics and machetes are standard equipment for a walk in the woods. Indeed, leather is now the most common clothing material on Montana. Some of the indigenous animals yield an excellent hide. The sword fern is the most common plant outside the agricultural areas. (Young hotheads have been known to duel with these plants as weapons, sometimes returning home in need of stitches. The government has imposed severe penalties for such duelling.)

Swampy areas are lush with plant life and form peat, but no other fossil hydrocarbons have been found. Chemical industries generally are able to get by through working with raw plant materials and minerals.

AUSTIN'S WORLD DM-3 1123

Having emerged as its own nation centuries ago, Texas has done well for itself in the world community. Its colony on Austin's World is a vital link along the Latin Finger.

SYSTEM DATA

Serving as a bridge to the Brazilian systems of DM — 21 1377, Ross 614, and the colony world of Paulo, DM —3 1123 is a solitary M1 main sequence star on the Latin finger. With an absolute magnitude of 9.12, DM — 3 1123 is only about half the size and mass of Sol. The result is an affective temperature of 3300 degrees K.

DM — 3 1123's gravity well embraces two worlds in a slightly quirky planetary system. The smaller of these is Austin's World, a 1 3,523-kilometer-diameter world circling the star at a distance of .18 AU. The planet's moderate, earth-like environment has resulted in three difference agencies directing colonial efforts there: the governments of Texas and the Incan Republic as well as the pro-expansionist Life Foundation. The second planetary orbit holds a moonless gas giant in a highly elliptical orbit with a 48-degree inclination to the system's ecliptic. Obviously a captured world and not originally formed with the star system, this adopted world swings from a perihelion of 1.5 AU to a maximum orbital distance of 3 AU. Some atmospheric probes have been dropped into the clouds of this curious 45,000-kilometer-diameter planet, but the data received showed nothing of any import.

PLANETARY DATA

Austin's World, huddling close to the system's primary, lies within the star's optimum life zone. The star's presence has kept the planet's core in a molten state, but it is considerably less tectonically active than Earth. The surface is protected from the star's radiation by a magnetic field of moderate strength. The radiation content is not as severe as that found around planets in a roughly similar orbit, most notably Ellis in the American Arm, since the planet's magnetic field is not quite as strong, and the star's output is not as potent. Although the planet exerts a gravitational pull of 1.25 G at its surface, it has, so far, yielded little in the way of heavy elements.

The planet has a year of only 41 days—not long enough to have distinct seasons. Its axis of rotation is inclined at almost a right angle to the ecliptic plane of the system; hence the planet passes from pointing one pole at the sun for several days at a time with a 16-hour day and night as the planet rolls, to pointing the other pole at the sun, and so on. The colonies are located near the equator, so they pass from constant twilight to a day/night cycle and back again. The uneven heating of the opposite poles produces violent winds that shift directions every twenty days or so, and heavy rains are frequent. The slightly thick atmosphere packs a lot of kinetic energy and can flatten transplanted Terran crops or trees in unprotected areas. Some of the winds are cold enough to frost developing plants.

With seas dominating 90 percent of the planetary surface, most of Austin's land area is concentrated on the continent of New Tarrant, which runs roughly in a north-south direction. To the continent's west lie a number of archipelagos, the largest of which is Bowie Island, site of the colonial town of New Cambridge. The vast open stretches of water provide an enormous fetch for winds which constantly blast the coastal areas, and an ideal breeding ground for storms of mammoth proportion. Nitrogen composes a majority of the world's atmosphere, with oxygen following and neon and assorted gases making up the remaining 9 percent. The average temperature is 10.5 degrees C, but this figure swings wildly due to the planet's extreme axial tilt.

Climatic factors have created a world which is shaped by a variety of erosional elements. All aspects of erosion, save those found in arctic environments, are much more severe on Austin's World than on Earth. Combined with the planet's relatively calm tectonic state, weathering has molded a world with little dramatic change in surface elevation and few notable surface features, such as the upland regions running the length of New Tarrant. The primary landscape of Austin's World's continent and islands is composed of smoothly undulating plains covered with broken rock and fairly sterile soil. Many have likened it to environs above the treeline on Earth. In this type of terrain, lightning from the planet's numerous storms poses a very real threat.

The planet's variable day/night cycle is enough to drive human circadian rhythms wild. No adaptation to the shifting daylight hours is possible, so people use a great deal of artificial light and follow their own rhythms. Not everyone has exactly the same built-in day, but many are running on a twenty eight hour cycle, ignoring all outside time cues.

The high partial pressure of oxygen on this planet makes exercise easier and combustion a little too easy. Fire protection and fireproof construction are major concerns of all the colonies. There are, of course, no forests to have forest fires, but grain crops and orchards are vulnerable. The practice of enclosing small areas in high rock walls helps to contain any wild fires that start.

Preventing erosion is another universal concern of colonists. Since there are no land plants, slopes are deeply worn by every rain and windstorm. Several types of spreading ground cover have been imported to slow down this process. Flat areas like the coastal plains have fairly deep soil washed down from the highlands of the interior, but grass is needed to keep it from blowing around in windstorms. A long-term project was started in 2270 to plant as much land as possible away from the population centers with varieties of grass and clover that could thrive unattended. The soil is also being seeded with necessary bacteria brought in pure cultures from Earth. The essentially sterile soil of Austin's World is a fine place to recreate Earth's land ecology in its entirety, though it will be in a simplified form. This process has demanded a large portion of the colonial budget, and the financial load is being shared equally by all the colonies present. All native life is primitive by the standards of most other life-bearing planets. Principal plant life is algae-like, with 53 cataloged genuses, including several multicelled types. Long-leaved seaweeds can be harvested for food and fiber. Tiny creatures feed on the algae and are eaten by larger swimmers. There are no vertebrate forms. Only in shallow waters near the islands and continent are any bottom-feeding varieties to be found. The deep sea waters apparently harbor no life at all; every form found so far inhabits the upper 50 meters of the ocean. A coral-like colony animal is building on the shallower rocky bottoms and will eventually produce small new islands.

All forms of Austinian sea life are edible by humans, though some are scarcely palatable. The aforementioned seaweed is the tastiest of the vegetables, and visitors to the world have spoken highly of one of the bottom-feeders. Colonists, especially of the Life Foundation, have learned to relish most of the possible foods from the sea. However, the only source of vitamin C is Earth fruits.

Only one native species of sea life is dangerous to humans. A large form resembling a squid with its arms fused together, it stings its prey with a venom that can put a human in the hospital with violent muscle spasms for a week. Two deaths from heart failure have occurred due to this creature, which is called a "stinger."

Fresh water on Austin's World may be safely drunk without purification, but if sea water is desalinated it must also be filtered or boiled to eliminate microorganisms that can infect humans. None have been found that can affect the skin of swimmers.

COLONIAL HISTORY

In 2258, Texas and the Life Foundation sent separate colony groups to Austin's World with quite different goals. For the Texans, the foundation of this colony signified the culmination of a multi-year plan to settle a planet of their own. This action would serve to elevate their status in the national community on Earth, especially since the comprehensive colonization program for Austin's World was conceived and executed entirely by Texas. With limited resources, Texas carried out the initial planetary surveys in 2253, then followed through by delivering 15,000 colonists to the world in January of 2258 in surplus transport ships.

Because they were conquering this distant world alone to show the world they could, the Texan government was outraged when, six months after the establishment of their colony, a Life Foundation expedition set down in the islands to the west and started laying the ground work for their own colony. It had been known that the Life Foundation was considering several worlds as likely targets for their experimental model colony, but the choice was not finalized till after Texas' program was well underway. Texas tried to make a case for themselves in the world court, but the statement of the Melbourne Accords was clear. In response to this tarnishing of their dream, Texas made the decision to upgrade its outpost on Rho Eridani to a colony later in the year, thus giving them credit for the establishment of two colonies in the same year—a distinction which seemed to matter far more to the Texans than anyone else.

Although the Texans had a rocky start with the Life Foundation, a cooperation, partially out of necessity, grew between the two colonies. The primary motive behind the Life Foundation members' ("Lifers") efforts were to experiment with oceanic colonization techniques. To this end, their activities were restricted to the archipelagos.

In 2294, the Inca Republic, aided by the Texans, set down a colonial population in the central highlands of New Travis. This being their second colonial venture, they were eager to prove their legitimacy as a nation of high standing, especially in the face of Brazil. Regardless of their colonies' existence, most were aware that, in both cases, they would be mere pipe dreams without the aid of the Texans.

Most agriculture is carried out in heavily-built greenhouses and utilizes soil which has been enriched with Terran bacteria. Orchards are shielded by rock walls in all directions, so the landscape from the air looks like a set of postal cubbyholes. Grains and other grasses have been engineered to have shorter, stronger stems to survive the occasional cold spells and high winds.

The difficulties of agriculture on the coastal plains are magnified on the high ground inland and are handled in much the same way. However, in the face of all these problems, there is one advantage to farming on Austin's World: there are no weeds. There is no competition whatsoever, nor any pests to destroy crops, because Austin's World has never developed any land life.

Large areas of grass were cultivated in the Texas colony to provide grazing area for its many cattle. Beef is exported to several other colony worlds in the Chinese Arm with less hospitable ecologies, but the surplus is still fairly minimal. Most of the soils need some fertilization to grow very good crops, especially on the Inca highlands and on the islands. The Life Foundation has tried introducing some freshwater plants and fish to the small lakes on their islands. This process has met with adequate success as long as the first batches of plants are supplied with artificial foods.

The individual colonies on Austin's world are very different entities. Each deserves further, unique explanation, which is given below.

THE LIFE FOUNDATION COLONY

Each of the planet's colonies acts as an independent nation, even if dependent on the mother country, and each has a different style of government. The Life Foundation is governed by the Council of Science and Engineering. They lay down the plans for development and research and assign parts to each ocean-going group. These groups are often widely scattered, though all are based in the one island archipelago on the planet. Daily governance is in the hands of the expedition leaders during such trips. All first generation colonists were scientists recruited for the program, but a large population of second and third generation colonists are pursuing other lines of work to support themselves and the colony.

One large, permanent city—with extensive power and road networks, and some land farming—houses 100,000 of the colony's 350,000 people. It is found on the coast of Bowie Island. Hydrogen-powered ground cars are the most common ground transportation, though people are not averse to walking a few miles if they have time. Sail- and hydrogen-powered ships ply the straits between New Cambridge and Travisville in the Texan colony on the mainland. Stair University, located in New Cambridge, is open to all inhabitants of the world and is noted for its land management curriculum.

The laws of the Life Foundation colony are for the protection of life and property. Property is usually communally owned by an expeditionary group or by the Foundation as a whole, but everyone has some private property. There are no taxes as such, but everyone must give part of his time to the research projects which benefit the colony as a whole.

The Foundation services the entire planet's population from its powersat, transmitting to an island rectenna. They are on amiable terms with everyone and try to stay strictly out of politics, whether based on Earth prejudices or colonial problems. They regard the

entire ocean as their domain, which is a lot of territory, but they will allow equal access to it if conservation rules are observed. They would resist any effort of one colony to deny another colony use of the ocean and its products.

The Foundation is carrying out a great deal of the mining being done on Austin's World. Some soluble minerals are extracted from seawater, but the percentages of solutes to water is quite low.

THE TEXAS COLONY

The Texan colony is a representative democracy based on the old United States' Constitution. The 1.3 million inhabitants are divided into geographic areas and elect representatives for their areas to two houses of Congress. A president is elected every four years, but in this case he is not the highest authority; he is answerable to the government of Texas on Earth. There are local and district courts as well as a supreme court.

Texan colonists are spread along the western coastal plain of the world's one continent. Two major population centers, Travisville and Crockett City, house heavy industry and orbital interface facilities. Much of this industry relies on imported equipment since there are few metals suitable for making factory machinery on Austin's World. A power network distributes electricity from the Lifers' powersat and from several small hydroelectric dams. The orbital catapult lies directly on the equator. A sizable ground terminal has been built to accommodate freight awaiting shipment. Treaties with the Incan Republic and the Life Foundation guarantee access to the orbital facilities.

THE INCA REPUBLIC COLONY

The Inca colony contains only 40,000 people and is governed by an appointed ruling class in feudal style. Rulers of small areas answer to rulers of larger areas, who are ruled by a colony governor, Lord Mamani. His mandate from the Inca Government on Earth is rather broad since the Inca Republic operates but four interstellar vessels, and the new country cannot keep a constant eye on its colony's affairs. The colony is not expected to pay off soon, and many of the improvements to the colony are due to hard work rather than to capital investment from Earth. Light element ores are the principal export to Earth as well as an on-planet trade item.

Inca colonists were recruited by offers of land grants and resource rights. On top of this, a patriotic duty was stressed. Not all seem to have been informed of the feudal government set-up, and there has been some unrest among miners especially.

The Incas have inhabited the highlands and valleys in the center of New Tarrant. Snow and ice is not unknown here. Roads to connect the valleys have been constructed, and a power net, with huge arrays of solar cells, supplies some of the power, the rest being purchased from the powersat. The major trade items produced here are minerals for fertilizer and the chemical industries.

COLONIAL CHARACTER

There is no one language used by everyone on Austin's World. The Life Foundation commonly speaks Esperanto, but most members are multi-lingual. Texans speak English and some Spanish. The Incas have revived Aymara and Quechua as their official languages, though Spanish is still commonly used, especially when dealing in intercolony trade.

Dress customs also vary widely. Incas are the most colorful and also the most warmly dressed, as befits their high altitude dwellings. Sheep's wool, dyed with mineral dyes in bright colors and patterns, is the norm here. Women favor skirts, and men wear trousers, but both will wear leggings if the temperature drops. Each area has its own color pattern which identifies the inhabitants.

Texans favor leather and cotton for clothing materials, with wool for warmer wear, in natural colors except for accents. Several vegetable dye plants were brought, but they are not prolific, and their products, at first, were expensive. The cost of colored clothing is dropping now. Women wear trousers most of the time.

Lifers, when seafaring, may wear nothing at all on warm days, but in the city most choose to dress. Seaweed fiber provides most of their clothing material unless they buy wool and cotton from the mainland colonies. Several synthetic fibers are also processed from sea products. The skin of the stinger can be used to make an excellent leather for shoes.

For the most part, monogamy is the family pattern on Austin's World, but only the Texan colony mandates if by law. Polygamy is occasionally found in Inca territory, and group marriage or looser arrangements occur among Lifers.

PAULO

Procyon

Procyon is a binary star system composed of an F5 sub-giant star and a white dwarf, orbiting their center of mass at a mean separation of 15 AU. The solitary dwarf has very little influence of the family of planets orbiting the sub-giant star, other than creating a brighter night for about half of their years. Sitting at a distance of 3.5 AU from Procyon A are the mismatched twins of Pedro and Paulo. The members of the enigmatic double-planet system share many similar characteristics but differ grossly in one respect: Paulo, home of Brazil's newest colony, is an abundant garden world, while Pedro, its partner, is a barren world with but a trace of atmosphere.

SYSTEM DATA

The primary star of the system, Procyon A, is brilliant, yellow-white sub-giant 1.7 times the mass and radius of Sol. One of the brightest stars visible in Earth's night sky, Procyon A shines with a magnitude of 2.64 and has a surface temperature of 660 degrees K. It supports a family of three planets (four planets, if you wish to include Pedro) and an extensive asteroid belt.

In the first two orbits are the rocky bulks of Atlanta, a 2500-kilometer-diameter world at a 1.0 AU orbital distance, and, at 2.1 AU, the 3000-kilometer Hippomenes. These two inner planets were so named since they appeared to race each other across Paulo's sky.

Encircling the primary at 7 AU is a rather extensive belt of asteroidal rock. Though this region shows great promise for future mineral exploitation, it is unexplored this early in the colony's life, save for the large planetesimal holding the Brazilian armed forces base.

Patrolling the outer reaches of the system is the white dwarf, Procyon B. Possessing no planetary system of its own, Procyon B, at 1 5 AU, is the most distant element of any substance in the Procyon system.

PLANETARY DATA

Pedro and Paulo orbit their common center of mass with a 42-day period, which the colonists of Paulo have adopted as their equivalent of a month. Each month, therefore, the twin planets take turns blanketing each other with an eclipse of considerable duration. Pedro appears about as large as Luna from Terra, and, at 3.5 AU, it covers almost twice a much sky as Procyon A.

Paulo's companion world of Pedro poses some puzzles for planetologists to wrestle with. Although it is of similar size to Paulo and rests at the same distance from the primary, it is devoid of any substantial atmosphere. Although Pedro's mass is slightly less than that of its twin, the difference is not enough to account for the disparity in planetary evolutions. Gaseous sulfur and carbon compounds from out-gassing are the atmosphere's primary constituent. Since the world is almost as tectonically active as its neighbor, it exhibits some striking surface features.

Some preliminary surveys of Pedro were performed during the system's initial exploration, but in more recent years, there have been no significant follow-ups to this effort.

With a major continent around the north pole and three major continents in the tropical and temperate zones, Paulo has about the same water-to-land ratio as Earth. Esperanca do Norte is the largest of these landmasses, with the smaller continent of Esperanca do Sul connected by a swampy landbridge to the south and the island continent of Terra do Fogo westward. A minor continent is widely separated from the others lying on the equator. Other than being given the name Islagerais, it has been largely unexplored to date.

Though it is not a very hostile environment, Paulo is an unmistakably alien world. Its day is 28 hours long, to which humans can readily adapt. Its year is 1797 days long and its base temperature (8 degrees C) quite cool, which makes for long hard winters (lasting about one and one-half Earth years apiece). Four to six crops can be put in during one warm season; thus, fruit trees can mature in one Paulan year. Unfortunately, agricultural pursuits are complicated by the near constant threat of frost. The ice-shrouded polar regions are totally uninhabitable, with temperatures averaging -40 degrees C.

Paulo and Pedro would have become tectonically dead a long time ago if it were not for each other's presence. Revolving with a 42-day period, they create massive tidal strains in one another, causing earthquakes and mountain-building faults. The cores are actually somewhat cooler and the crusts thicker than Earth's, so volcanic activity is not as common.

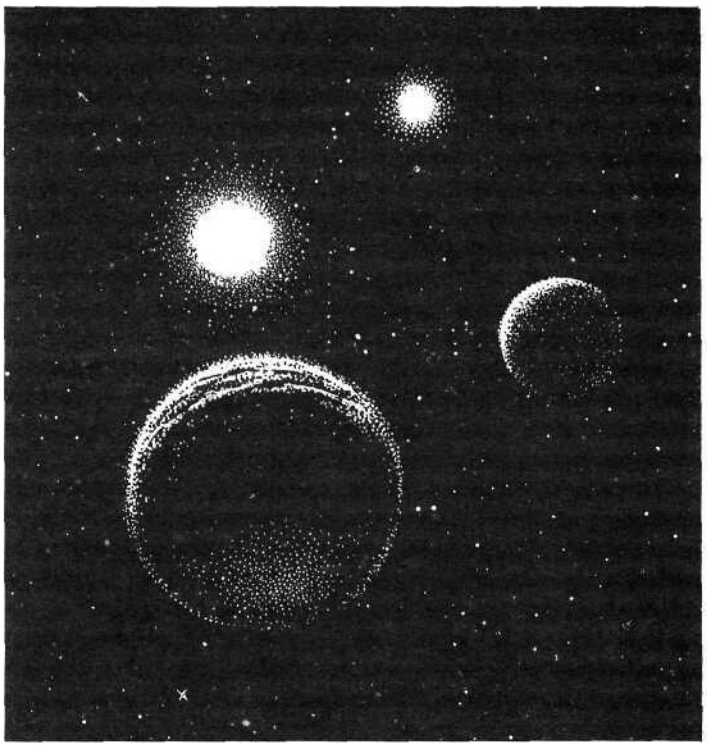
The Mar Negro, a large, inland sea between the two continents of Esperanca do Norte and Esperanca do Sul, brews violent tropical storms and hurricanes, which can cause some damage as far north as the town of Novo Belem. All of the central plain of Esperanca do Norte is subject to extremes of temperature and huge thunderstorms. Because of the high argon content of the atmosphere, such thunderstorms produce dramatic fluorescent displays which can be seen over many miles.

Life on Paulo evolved utilizing dextro amino acids, thus leaving it of no nutritional value to any Earth-born entity. The planet's environs hold analogues to both terrestrial plant and animal life. Life is slightly more prevalent in Paulo's vast oceans than on its continents. The predominant pattern of vertebrate organisms is eight-limbed. Most forms that live in temperate or frigid zones are warm-blooded and do not hibernate. One of the major herbivores of Paulo's plains is the cervo draku, which migrates from arctics to tropics every fall. Farmland relegated to growing fodder for the colony's livestock hardly affects the grazing land of the indigenous species since the plains are so vast. However, the clearing of forest has changed the habitats of woodland life forms.

The largest predator of Paulo is the gattinho da seva, which makes its home in the temperate forests and mountains. At 20 kilograms, it is easily large enough to handle the largest herbivores alone, but the gattinho most often hunts in family groups of three to eight, running down its prey in shifts. Gattinhos have been frequently known to attack Earth cattle, apparently unaware that they are deriving no nourishment at all from their kills. Poison baits were tried as a means of clearing them away from human settlements, but they seemed to be immune to most of the common poisons. Hunters now go into the wilderness regularly (in parties, for the gattinho is an excellent stalker and may hunt the hunters) to search out and shoot any gattinho that may have moved into the area. A smaller and faster cousin of the gattinho hunts the open plains.

Some carnivores and scavengers remain in the colder zones in the winter, and several small creatures are far advanced in the gathering and storage techniques for grains and fruits. The conejo negro is judged the most intelligent of the food-gatherers and is protected by colonial law.

Paulo's forests are a riot of competing plants, including strangling vines and mobile plants which jockey for position. The latter have two ends that can take root. If one location becomes too crowded or shaded or the soil is exhausted, the plant extends its end to the farthest limit and puts down its roots. The original end loosens itself from the soil and swings up into the air to make



another step. This process takes about four standard hours per step. Most astonishing is the sight presented when a whole meadow of andeadores (walkers) finds its soil too poor and goes on migration. Time-lapse films of these migrations have proven to be a big favorite in the mother country.

Another mobile plant is the volador (windrider), which is blown from place to place any time a fresh breeze comes up. When it alights, it puts down tendrils into whatever is beneath it to absorb water and nutrients. If the source is rich, it will cling as long as possible, but it has extreme water conservation capabilities for tougher times. It can also absorb water from very humid air if it comes to rest in a tree. Because of its water sucking habits, it is extremely dangerous to permit a volador to rest on one's skin when the breeze dies down. They are easily brushed off at first, but if a person sleeps in the open and awakens with one already attached, he must tear it off at considerable cost to his skin, or seek medical assistance to poison it and detach it.

The tiny, isolated continent of Isla Gerias has been developing its own independent evolutionary branch for millions of years. Few expeditions to this land have been mounted. If is covered with high mountains, warm, rain-forested valleys between them in the west, and near-desert valleys as one travels eastward. Virtually every valley has a distinction in its ecosystem which makes it different from the others.

Unique to this continent is a group of related species of large, omnivorous flying forms. Flight is an uncommon adaptation within the rest of the planet's ecosphere. Also found here are small creatures, almost insectoid, which cocoon for the long winter and metamorphose to emerge in the spring.

A number of long-limbed arboreal species, almost looking like giant, furred spiders, inhabit different valleys on Isla Gerais. Each of these species are dependent on the common type of tree in their valley habitat and are unable to move to another valley without starving.

A creeping vine takes up most of the space on one valley and climbs the trees without harming them. It is all one plant, with roots put down at each branching on the ground. Although it is attractive, importing it to any human-settled areas may prove unwise.

COLONIAL HISTORY

Before the advent of the Third Rio Plata War, Brazil's commitment to the interstellar expansion was minimal, with its single colony founded in 2184 on Tirane. An effort leading to the eventual colonization of Paulo was underway but proceeding at a leisurely pace. A Brazilian outpost was established on DM — 21 1377 with the purpose of studying the system's anomalies, as well as establishing a Brazilian presence in the Latin Finger. Brazil's reach was lengthened in 2267 with the establishment of facilities in the Ross 614 system, but the colonial effort was losing interest and support, as more pressing domestic matters presented themselves.

On March 21, 2275, Brazil found itself at war with the Inca Republic and Argentina in the Third Rio Plata War. Brazil's final ticket in the war was an armistice with embarrassing ramifications, as well as the loss of territory at Amazon headwaters. To save face and boost the moral of the general populace, Brazil renewed their goal of colonization in the Latin Finger. This would also serve to demonstrate that Brazil was a nation of superior caliber to the Inca Republic, as it had the capability to establish and expand its presence on humankind's stellar frontier. Of course the Inca Republic would later respond to this by the establishment of its colony at Rho Eridani, and later at DM — 3 1123.

Almost three decades after the initial surveys, Brazil planted its colony in the Procyon system. Although they could have set the colony in motion a year earlier, Brazil opted to wait till the year 2284 in order to maximize the affect of the event by its concurrence to the Centennial celebration of Brazil's Tirane colony. Also, Brazil had only recently completed a complicated exchange with Great Britain in which the South Americans purchased three gigantic *York-class* colonization vessels, the very backbone of this colonization effort. Colonists were drafted according to a master plan conceived in Brazil to provide a range of skills and ages with physical health and strength a limiting factor. Women and men were sent in equal proportions since the planet was not deemed unusually hostile.

The first colonists came prepared with ample stores of food for the cold season and enough seed for Terran crops to get in one or two harvests before winter came. Nothing native to the planet was edible to the humans or their domestic animals, as all of Procyon's life is based on mirror-images of Earth's organic compounds.

The first cold season was unexpectedly fierce, taking its toll on colonists, herd animals, and crops alike. Urgent messages to Ross 614 brought both seed and additional support to make sure the colony was up to enduring the next winter. With the loss of so many animals, livestock shipped in from Earth helped make ends meet. Additional aid came from some of the Life Foundation-sponsored colonies on DM —3 1 123. The next winter, though almost as harsh, found the colonists well prepared to meet nature's onslaught.

Once adequate food was assured, the transports began coming again, so that now the population is nearly half of a million, with a very enthusiastic baby boom in progress. Elementary and secondary education are available in every city or village, with correspondence or radio providing material for children in isolated areas. Short distance travel within a community is facilitated by a hydrogen road network, but much of the trans-settlement traffic is achieved by passenger zep. Cargo zeps are the most common mode of transporting commercial products.

Paulo is strongly loyal to Brazil. Everywhere one looks, the Brazilian flag is flown, and children are taught national songs in school. The planetary administrator and his deputies operate on orders from Earth and operate with a constitution which is a carbon

copy of Brazil's. Paulo's government sends a representative to the Congress on Earth and has been promised statehood in Brazil when population reaches one million. By encouraging such attitudes, Brazil hopes to avoid the difficulties other nations have experienced with colonies making a bid for autonomy. However, human nature may be expected to interfere with this carefully developed plan after a few generations.

The colonists pay a head tax to Brazil and are committed to export only to Brazil and her interstellar settlements. Also, an income tax goes to support the local militia (police), public schools, and road maintenance. Most towns have volunteer fire departments wherever construction makes homes vulnerable to fire. The more isolated towns are apt to have stricter laws.

Most of the colonists are concentrated near the equator on Esperanca do Norte. Some farmers are across the swampy isthmus in Esperanca do Sul, but none have moved across the Madeira Verde River. The first town established was Novo Sao Paulo, near the seashore, with mountains and mining areas within easy reach and farmland to the south. The city and its surrounding settlements have now grown to 200,000 people, and it houses the planet's spaceport. From this facility, a small fleet of rocket planes interfaces with the orbital terminal. A network of roads spreads out from it to smaller settlements along the coastal plain.

A second major city was placed two Paulan-years later at the confluence of the Nova Amazona and Ria Branca Rivers. Nova Belem serves a major agricultural area and houses 150,000 people in its vicinity. Some light industries have been established here, with aluminum and tin being found in the mountains to the northeast.

Gravity and atmospheric pressure are lighter than Earth's, so the mountains cannot be settled higher than 2000 meters. Most raw materials are available for mining, but prospecting and exploitation are just beginning to pay off. Most heavy equipment is still being imported, and the colony is deeply indebted to the mother country.

Some organic products are helping to close the credit gap while the colony gets on its feet. The sap of the derrilho tree hardens on contact with air into a translucent gem of unusual beauty. This sap can be made to change colors by feeding the plants different trace minerals early in the spring. Many Paulan women can be seen with a sparkling, multicolored necklace gathered by admirers, a local courting custom. Mineral gems are to be found in the Serra do Fogo range on Terra do Fogo, for adventurous souls who will cross the straits and the wilderness to look for them. Also valuable to the colony, and sometimes exported, is a native plant fiber that is both soft and strong. It can be utilized to produce a cloth which is both durable and very comfortable to wear. Local hardwoods are starting to become highly esteemed on Earth for the colorful pattern of their grains and their pleasant aroma.

As Paulo also has a good deal of usable resources undersea, it has imported a number of SQUID submersibles from the Bronnen Corporation to aid in harvesting these. On Paulo, these submersibles are presently being mainly used for resource survey, but their use in undersea mining and marine research is on the increase.

A proportion of Paulo's marine life is being studied for use in some of the synthetics industries under consideration for the colony's future. Some also have potential uses for oils and waxes. In the meantime, interests continue to focus on the harvesting of undersea mineral deposits, especially in the undersea canyon at the mouth of the Nova Amazona.

Electronics were some of the first products which colonial industry directed its efforts toward, following clothing, lumber, and similar necessities. These are rarely exported but supply the colony's needs and save import costs. The colonial government has a schedule for introducing new types of industry and weaning the colony from dependence on imports, and so far they are close to being on schedule. However, colonists are anxious to find ways of producing valuable trade items and are restive about following the plan to the letter.

A base of the armed forces of Brazil is positioned in the asteroid belt on a 50-kilometer-diameter chunk of rock named Todos los Santos. The facility has four military craft regularly at its disposal, but the actual number of ships at the base can vary as supply and transport ships come and go. The Kafer threat in the French Arm has served to build a contact paranoia in many of Earth's interstellar nations. Also, the Incan and Argentinian presence in the Latin Finger have led to a number of incidents related to transport ships passing through their systems. Though these actions have thus far amounted to little more than unnecessary harassment, Brazil has been considering the use of military escorts for its supply and transport ships plying the Latin Finger.

Local militias are based in both cities and several smaller towns. These are primarily for police functions, but they have an *esprit de corps* of their own. In one case the militia decided to set up a local government and had to be conquered by other units.

The American Arm

KING

DM + 2 3312

The horrible conditions on King have gained it the reputation of being as close to hell as man will ever get. However, it has things to offer—enough so that the Americans have taken a terrific interest in the planet's development.

SYSTEM DATA

King is the first world in orbit around a main sequence orange star some 26 light years from Sol. The star, DM + 2 3312, is smaller than Earth's, with a radius and mass roughly half that of the sun. Its luminosity is .057, and its surface temperature is 3600 degrees Kelvin, making it much weaker than Sol. Its absolute bolometric magnitude is 8.15.

There are five worlds in the King system, all of which have been named for American recipients of the Nobel Prize for Peace. Despite the fact that the system's life zone is much narrower than Sol's, it engulfs the orbital realms of the first two planets.

Dawes, the second world, orbits in the outer fringes of the ecosphere at a distance of .32 AU. Although it may have been much warmer at some point in the past, Dawes is now covered in an endless shell of ice. The planet is just under 12,000 kilometers in diameter and has a very thin atmosphere which is composed almost wholly of nitrogen. There is almost no free oxygen in the air, and life never seems to have evolved on Dawes. Due to the efforts required to survive on this frozen world, no attempt at long term settlement has ever been made, and the planet is almost totally unexplored. Dawes has no moons.

The third planet, Borlaug, hangs in space .67 AU from the system's star. This world is a gas giant of average size (roughly 100,000 kilometers in diameter) circled by five barren moons (ranging from 2,500 kilometers to 5,000 kilometers) and a fairly common ring of ice and dust. However, despite the Jovian's somewhat typical statistics, it is unique amongst worlds of its type in human space. The swirling clouds of Borlaug's upper atmosphere are home to a diverse and fantastic ecology of hydrogen-utilizing life forms. An orbital station has been set up above the red and orange world to study these creatures. Funded by the American and Australian governments, the facility (known as The Borlaug Institute for the Study of Jovian Xenobiologies or BISJX) is staffed by over 200 people. Most of the scientists stationed at the BISJX are members of the North American Research League, American Interstellar Science Institute, or L'Institut Des Etudes Xenologiques, but other groups are well represented.

Almost exactly one astronomical unit out orbits the planet Kissinger and its asteroidal moon Tho. This planet has a *severe* axial tilt (roughly 80 degrees) and is in a very eccentric orbit. Past exploration of Kissinger indicates that it is a valuable world with fairly good mineral resources. In any other system, Kissinger would no doubt be the subject of mining activity by the colonials. The vast metal and mineral resources of the planet King, however, have left Kissinger untouched and forgotten.

The outermost world, Carter, floats alone in space 1.71 AU from its mother star. This planet is a small gas giant (referred to as a "gas midget" by some in the astronomical community) spanning only 25,000 kilometers in diameter. *Carter* is circled by three small moons only slightly larger than asteroids. This world has never been extensively investigated and is considered to be of limited economic value by both America and Australia.

PLANETARY DATA

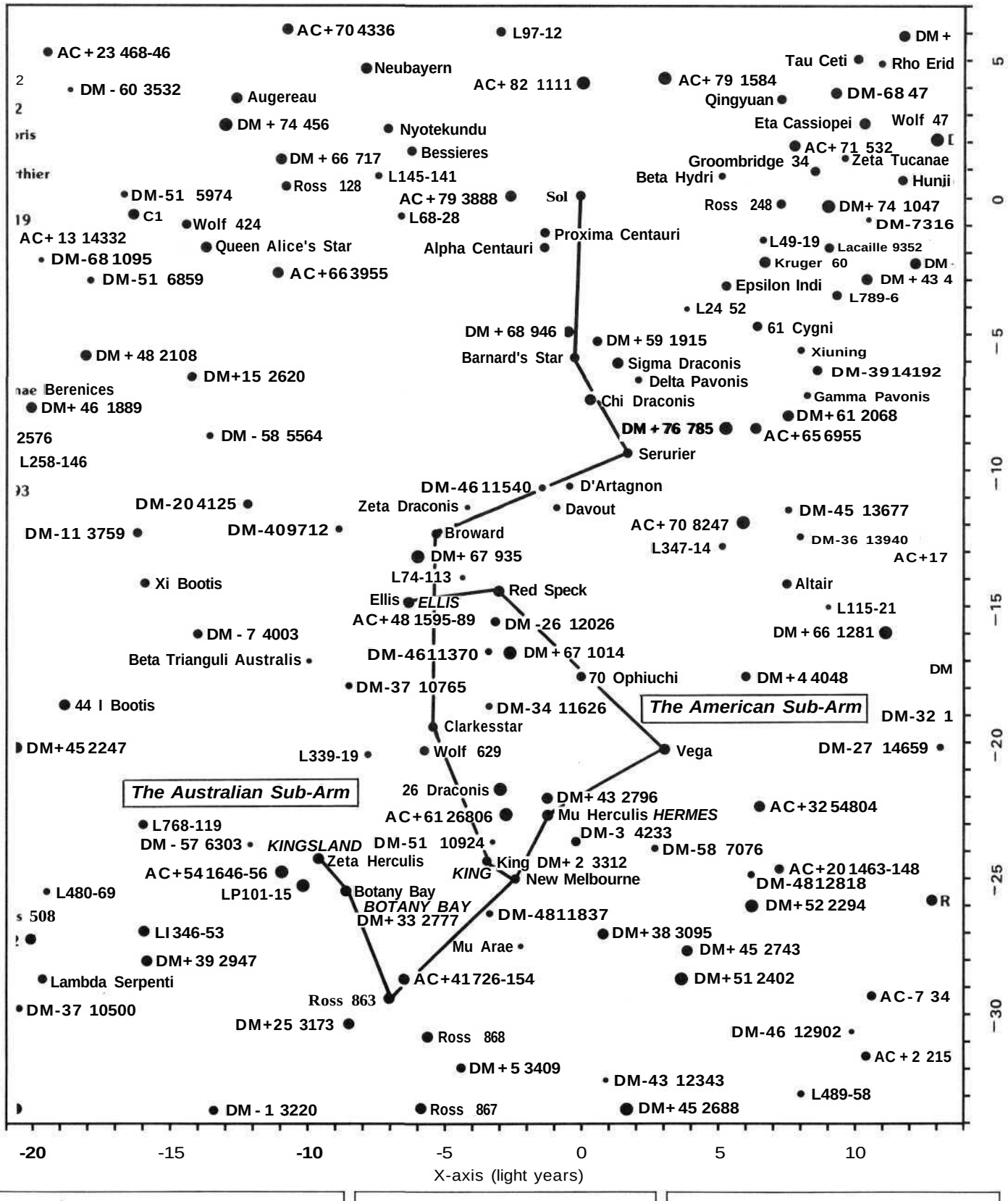
The planet King is one of the most inhospitable worlds ever settled by mankind. Currently home to the American colony of New Columbia and the Australian settlement of Huntsland, this world has a crushing gravity, violent seasonal changes, and harsh surface temperatures. Neither nation would have built any kind of extensive base on King if it were not for the tremendous natural resources found here. Currently, King is the source for nearly all of the tantalum used by both nations in their space agencies.

King is one of the most impressive worlds in human space. Orbiting at a distance of .2 AU from its star, the planet is just over 30,000 kilometers in diameter. Its density is 1.3 standard, giving it a mass over 1 7 times that of Earth. The surface gravity on King is a crushing 3.08 G. Abernathy, a moon of 4500 kilometers, closely orbits King and hosts both American and Australian space force bases—crucial to the security of both the tantalum interests in the King system and the colonial approach route of the American Arm. Exploratory missions toward Altair also utilize this installation as their starting point.

King completes one rotation on its axis every 1 9.65 standard hours and one revolution about its star every 29.04 local days. It has an axial tilt of just over 37 degrees. The orbital eccentricity is negligible.

The planetary atmosphere is composed mainly of nitrogen (75 percent) and oxygen (19 percent) with scattered traces of other gases making up the last 6 percent. The extreme volcanic activity on King has unleashed a great deal of sulfur over the years. In

The American Arm



The X and Y axes on this page are approximate. For precise stellar coordinates, see the near star list in the basic game. The positive Z-axis extends straight up out of the map, the negative, below the map.

All names in upper-case italics are either colony worlds or alien homeworlds.

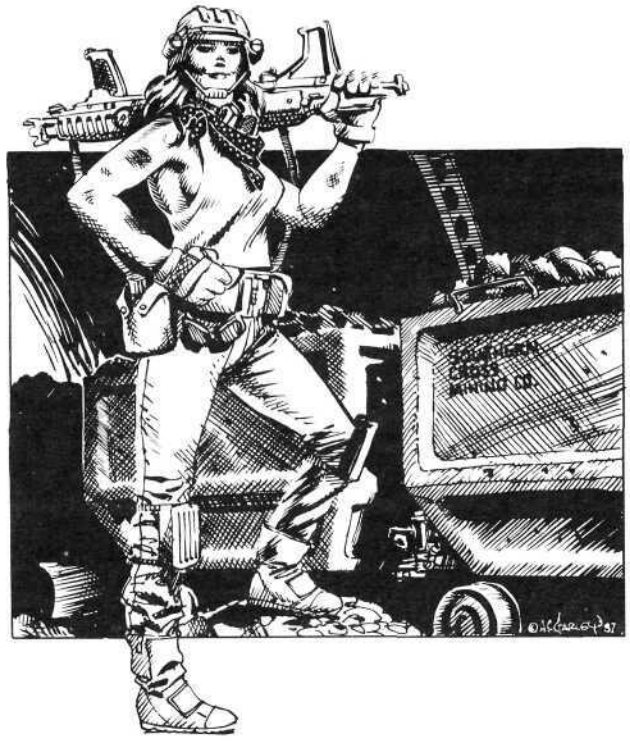
Z-axis distance is the value above or below the map plane. Symbols represent perspective distance, not stellar size.

- ● 30 to 50 ly
- ● 10 to 30 ly
- • 10 to -10 ly
- •– 10 to -30 ly
- •– 30 to -50 ly

Once coordinates are obtained from the near star list, the distance between any two stars can be found by the formula:

$$D = \sqrt{(X_1 - X_2)^2 + (Y_1 - Y_2)^2 + (Z_1 - Z_2)^2}$$

Scale: one light year = 5 mm



its current state, the atmosphere is toxic for human beings and most other terrestrial life forms. The air pressure at sea level is 2.7 atmospheres, making breathing by humans very difficult.

Roughly 67 percent of the surface is covered by vast seas of liquid water. Although unfit for Terran aquatic life, these oceans, heavily tainted with metals and sulfur compounds, are filled with a diverse array of native creatures. The toxic nature of a majority of these creatures has served to limit the extent of aqua-culture on the planet.

CLIMATE

The environment of the planet King is, to say the least, inhospitable. The surface temperature averages about 45 degrees Celsius—the upper end of normal human tolerance. However, the planet's severe axial tilt, great size, and short orbital period bring about radical shifts in temperature. On the equator, the temperature ranges from an average of 91 degrees C in the summer to 67 degrees C in the winter. On the poles, the hottest summer days only reach an average of — 1 7 degrees C and the coldest winter nights plunge to a frigid -67 degrees C. In the narrow "temperate zones" halfway between these two extremes, where the American and Australian colonies are located, temperatures range from 45 degrees C in the summer to -5 degrees C in the winter.

NATIVE LIFE

Plant life on the planet King tends to be of the area producer type on both land and sea. There are no towering forms like trees due to the high gravity. In many cases, the plant will be mostly underground with photosensitive portions thrust up through the surface to collect light. This relieves the plant of any need to support itself against the pull of the planet. The few point producers found are all very squat and massive in structure. In the seas, point producers are somewhat more common. Most employ buoyant gasses to lift portions of themselves into the lighted surface regions of the water.

Animal life is very abundant in the seas but somewhat less common on the land. The aquatic life can grow to be relatively large, but few forms mass over 150 kilograms. On land, creatures larger than 50 kilograms are unheard of. All of the non-aquatic creatures are short and squat in construction.

By and large, life forms native to King are toxic to human beings as they contain far more trace metals and sulfur compounds than Terran life. The reverse, however, is not true. Although the animals of King seem to find Earthly life bland, they are quite able to consume it without harm, provided they get the opportunity.

RESOURCES

A planet as uninviting as King would never have become the target for a colony—let alone two—if it did not have some positive aspects. On King, those were the metals and minerals found in the planetary crust. Early orbital surveys and later surface probes found that this hostile world was by far the richest ever found for mining. Most of the current activity centers around the exploitation of such valuable elements as gold, molybdenum, platinum, iridium, tantalum, and a host of radioactives. Though profitability is often impaired by a planetary gravity well, the extensive nature and purity of these deposits has offset this established norm.

High above the planet, a number of orbital factories have been established to process the raw materials found on or below the surface. Most of these are dedicated to the manufacture of various alloys and compounds that are easier to create in zero-gravity than on the surface.

EXPLORATION HISTORY

In 2190, the first of five joint American Space Force (ASF)/Royal Australian Space Navy (RASN) preliminary survey missions set out from Clarkesstar. Making a single pass through the system, the crew performed a slingshot around the orange star and returned to their base with their data. Information on King was indeed a shock to both the American and Australian space programs, and additional missions were planned for the near future. By 2192 an outpost was established and plans for colonies were underway.

ASF engineers arrived in early 2193 to establish the support systems needed for the future colonists. Nearly two years later, on November 21,2194, the American colony on King was founded with the arrival of the colony vessel Peregrine White and her fleet of support craft.

As the colonists moved into their new homes, the engineering crews headed south. Less than a month after the arrival of the White, construction began on the Australian colony in the southern hemisphere. Exactly two years after the American colonists came to King, the Australian ship Southern Cross entered orbit around the immense planet.

ADAPTATION

At first, the extreme gravity of the planet made any form of extensive colonization unthinkable. Despite these problems, the lure of King's natural resources demanded that the scientific community find some way to overcome this problem. After numerous attempts at mechanical compensation had proven impractical, a team of researchers working in conjunction with the Canadian government found a solution. In 2192, they created a new form of life, known as DNA Modifiers (or DNAMs), that was to open King up to colonization.

Similar in structure to Terran viruses, DNAMs enter the cells of the host's body and make changes in the structure of their DNA. When the altered cells reproduce, the offspring are unlike their parents in some way. One of the changes induced by all forms of DNAM is the rate of reproduction. The modified cells multiply much faster than their normal counterparts in a manner that has been likened to a controlled cancer. Once all of the cells are

changed, the rapid growth slows to normal, and the intruding microbes die off. In most cases, it takes just over a month for the DNAMs to do their work in a human body. During this time, the host is normally kept sedated in a medical facility.

The task profile to undergo DNAM transformation is as follows:

To undergo DNAM transform: Simple. - Physical Endurance. 3 days.

DNAM transformation is a hazardous task. If the task results in failure, a roll of "retry" means the DNAM was rejected by the body and "check determination" indicates the DNAM was rejected with unpleasant side effects. If a mishap is incurred, "superficial damage" results in serious, permanent medical complications as a side effect of the DNAM rejection. Any result more serious than this level indicates death. It should be noted that Physical Endurance acts as a negative modifier since a stronger immune system will act to resist and complicate the transformation process.

If the task is successful, the character's body type is converted to "mesomorph" (this change is in game terms and not so much in appearance). To reflect this, the original physical attribute modifiers should be neutralized and the mesomorph modifiers applied. Beyond that, DNAM modified characters receive +(1D6-3) to Strength and Physical Endurance and -(1D6-4) to Dexterity. In each case, the minimum modifier result is 1.

This task process should be performed during character generation (at the end of step three in the character generation checklist) if a player wishes to run a King colonist as a PC.

The DNAMs given to the American and Australian colonists were designed to affect changes in several of the body's systems. Most importantly, they were designed to alter the host's skeletal and muscular structure. Bones were made denser and muscles strengthened to make operation in the high gravity environment of King easier. Other areas where the DNAMs went to work were in altering the cardio-vascular system of the colonists. The heart was strengthened and the circulatory system modified to insure efficient flow of blood at all times. Alterations to the lungs enabled the colonists to breath more freely in the high pressures found on the surface of the planet.

When examined superficially, DNAM modified individuals seem to be veritable supermen, but the transformation imposes significant limitations on its host, both within the environs of King and without. Beyond the shortening of the average lifespan (50 years is the average maximum age for King colonists), the requirement a greater nutritional intake, and the severity of lacerations due to the supercharged cardiovascular system, DNAM modified individuals travelling off planet require a respirator to breath in the thin atmosphere that other humans would consider Earth-normal.

Since DNAMs modify the entire cell structure, this affects human reproduction as well. The progeny of two DNAM humans will also have DNAM modified characteristics. Due to the accelerated growth of DNAM modified fetal tissue, all births must be accomplished via cesarean section. Furthermore, the surface conditions of King are not such that an infant can tolerate during the first month or so following birth. It is for this reason that the Orbital Maternity Complex (or "Birth Boat," as many of the natives refer to it) was constructed. In geostationary orbit, the Birth Boat is a controlled environment designed specifically to fit the needs of a DNAM birth. All King births occur at the OMC with the medical costs being absorbed by the planetary government.

In order to eliminate the need for mechanical filters when breathing the sulfur laced atmosphere of King, new citizens are also implanted with a colony of microscopic creatures known as Atmospheric Filter Symbiots. These creatures live in the lungs of the colonists and feed on the sulfur compounds inhaled by them. By removing these chemicals, the filters eliminate the risk which they impose for colonists. The AFSs will die within about a 10 hour period if the host is subjected to an atmosphere which lacks the critical sulfur compounds. This means that colonists travelling off-world must be "re-infected" when they return. The environment of the Birth Boat is free of the sulfur compounds, since AFSs are not transferred genetically.

Despite the modifications made by DNAMs to the colonists of King, they do not appear greatly different from normal human beings. Only upon closer examination does their true nature become obvious. The limbs are generally somewhat shorter and stouter than usual, but are much more powerful than they appear. A modified colonist of King will usually weigh between 15 and 30 kilograms more than a normal human of similar physical build.

COLONIAL HISTORY

Despite the ability to use genetic alterations to make colonists better suited for the environment of King, both Australia and America found it virtually impossible to recruit a large work force to make their mining operations on the planet feasible. To this end, similar programs were developed in both nations to recruit the poor and underprivileged to fill the void. A large media blitz was put into action, promising jobs and homesteading rights to all who qualified for enrollment in the "force to develop the new frontier." The response was considerable, especially within the American campaign. It was these volunteers who boarded the first colonization vessels bound for King.

Though many of the colonists came from backgrounds where scruples and self-respect were vanishing commodities, a strong sense of pride and comradeship quickly developed as the colonists fought to tame their new home. Where many had had little on Earth, they now had a world they could justly call their own.

The actual growth rates of both colonies were less than anticipated—staggeringly so—due to the maternity problems encountered before the need for the OMC was recognized. In turn, this led to a lower than expected production rate on the harvesting of King's resources: specifically tantalum. Under pressure from the defense department and the rapidly growing Trilon Corporation, the United States government was forced to seek new means to increase production on King. This could not be accomplished without first increasing the colonial headcount. Since the route of recruiting volunteers and the lower class had been functionally tapped out, the government developed a new program for shipping a work force of prison inmates to King in order to supplement the existing population.

When the colonists learned of this program, they were outraged—not only by the potential threat of genetically modified criminals running amok on their world, but by the negative image this action would give to the world that they had struggled so hard to build. Nevertheless, the prisoners were loaded up and shipped out. When their vessel assumed orbit about King, the colonists took action. Laying down their equipment, the colonists initiated the Tantalum Strike of 2215. The untrained and unruly prisoners could hardly properly operate the equipment needed to farm King's resources, let alone come to any significant fraction of the production rate of the colonists. The U.S. government made several proposals to the colonists, but they would settle for nothing less than a complete halt to the prisoner exportation program. Unwilling to yield to the colonists' demand, the government tried to recruit "scab" workers to train the prisoners and fire up the production facilities. Expectedly, even with monetary incentives, the program

fell short of a functional response. After 16 months, the U.S. government was forced to concede to the colonists' demand, with the only exception being that the existing prisoners were kept on. The King colonists had few qualms with this plan, since the prisoners (a minority) could be forced into acceptable patterns of behavior and moral attitudes by the constant threat of "frontier justice."

This situation lead to an almost fanatic attitude of judicial adherence among King's citizens as they strove in an effort to set themselves apart from the lower criminal elements and as they set high standards for those who were taking the route of reformation.

SOCIETY

The population is almost 4.5 million, with a third in the Australian colony in the southern hemisphere and two thirds with the Americans in the north.

The American colony of New Columbia is halfway between the north pole and the equator. With a population of roughly 2.8 million, the colony is divided into three major cities, including the capital of Mayflower. The site was selected because it is one of two regions where the surface temperature stays within human tolerances. Huntsland, the Australian colony with its capital of Windslow, is located in a similar position in the southern hemisphere.

HERMES

Mu Herculis

Though overshadowed by the success of the Ellis colony, the American colony on Hermes has had an interesting history. Its shaky start and imperfect conditions have restricted the world to second-rate importance along the American Arm.

SYSTEM DATA

Mu Herculis is a trinary star system composed of a GO IV and its two M4 V companions. The secondary stars, orbiting their mutual center of gravity at a great distance from the primary, are of little interest, possessing no worlds of their own. A yellow subgiant star, Mu Herculis A is larger and much more powerful than Sol. Its absolute bolometric magnitude is 3.89 and it has a luminosity of 4.9 standard. The surface of the star is estimated to have an effective temperature of 5200 degrees K. Physically, Mu Herculis has double the mass of Terra's mother star and has roughly 2.8 times the radius. There are six worlds and an asteroid belt in the system, each named for various American manned space programs. The third world, Hermes, is home to an American colony of over two million people.

Gemini, the innermost world, is just over one and a half thousand kilometers in diameter. Only 119 million kilometers out from the star, Gemini bears the scars of heavy bombardment on its cratered surface. A small astro-physical base operated by the American Interstellar Science Foundation has been established on the bright side of this tidally locked planet to study the system's primary.

Apollo, the second world, circles Mu Herculis at a distance of one and a half astronomical units. It is quite similar to Gemini in appearance but is about twice the size of its inner neighbor. Apollo has two asteroidal moons. There has been little formal exploration of this world, as it shows no potential for exploitation.

Occupying the fourth orbit is the 1000-kilometer-diameter rock planetoid named Tangent, after the manned Galilean satellite survey missions. Tangent's airless surface is home to the primary operations center of the American Space Force's exploratory activities. Personnel from this base often take leave on Hermes.

Phoenix, the fifth world, was named for the mission of 2151 which marked the return of American astronauts to space after their long absence following the Third World War. Orbiting at 3.2 AU, it is almost 5000 kilometers in diameter and has an atmosphere of nitrogen and oxygen. However, the ratios of the two elements on the world are such that condensation often forms as nitric acid. No settlements or outposts of any kind have been considered for Phoenix.

An unusually dense asteroid belt rings Mu Herculis A at 4.5 AU distance. There have been finds of radioactive ores in this area, but no commercial harvesting of this resource has yet been undertaken. The American military holds periodic naval training operations here.

The last world, which hangs far out in space at a distance of 18 AU, is named Odysseus after the first American manned mission to Pluto. Odysseus is similar in size to Terra, but is covered in layers of frozen gases. To date, there have been only a handful of manned or unmanned missions to explore this distant world, and it is considered uninteresting by the American government.

PLANETARYDATA

Hermes, named for the first series of American stutterwarp equipped spacecraft, is 9600 kilometers in diameter. Its density of .98 standard gives it roughly half the mass of Earth and a surface gravity of .73 G. Hermes has an axial tilt of just under 33 degrees and rotates once every 9 hours and 4 minutes. It completes one revolution about the primary star every 8.1 standard years (7809 local days). Hermes has no moons.

The atmosphere of Hermes is composed primarily of nitrogen (73 percent) and oxygen (25 percent) with an assortment of other inert gasses making up the remaining 2 percent. The atmospheric pressure at sea level is 1.5 atmospheres. This is unusually heavy for a world as small as Hermes, and scientists have found no absolute evidence to indicate how it came to be, although several different theories have been proposed.

The average surface temperature on Hermes is -33.65 degrees C, making it one of the coldest planets ever to be settled by mankind. At the poles, this ranges from almost 90 degrees below freezing on winter nights to -55 degrees C on summer days. On the equator, this range is somewhat more hospitable, reaching as high as 13 degrees C on summer days and dropping only to -38 degrees C on winter nights. As the planetary year is very long, the changes from one season to the next are slow and drawn out. In the northern- and southern-most regions of Hermes, dry ice snow often forms and accumulates on the ground during winter.

The "comfortably" habitable region of the planet's surface is contained within a narrow band circling the equator and extending some 30 degrees into the north and south latitudes. Most of this area is tundra, but the land within five degrees of the equator in both hemispheres actually experiences sufficient thawing of the soil to plant Terran crops. Four-fifths of the planetary surface is covered in water. Except for the equatorial regions, this is almost always in the form of ice. Although it is not obvious due to the frozen seas, there are three major continents and nine minor ones which rise above the ocean.

The planetary crust is composed of seven major tectonic plates and roughly a dozen minor ones. Across the surface of the world there are seven regions of major volcanic activity. Earthquake activity is common over much of Hermes, causing the planet's icy shell to fracture and become very rough. Travel across these regions by ground vehicles is almost impossible.

NATIVE LIFE

The seas are home to a wide variety of aquatic life beneath their frozen surfaces. Heat from geothermal vents has kept the oceans from becoming solid masses of ice, and now they provide many of the elements needed for life. The largest forms of sea animals mass as much as thirty tons.

On the surface, plant life is sparsely scattered across much of the oceanic ice sheet and is quite common on the exposed land areas of the equatorial region. The most interesting of the ice-based plants is a species called Seastalks. These are point producers which thrive by a heat exchanging process with the hot geothermal vents on the bottom of the sea. When fully grown (after about two local years), they reach from their bulbs on the surface through the icy ocean crust and down through the water to end in heat collecting pods around the hot springs. The body of the plant can be almost a meter in diameter. If broken or cut, both halves of the Seastalk begin to grow again. In time, there will be two plants where one once stood. The sight of clusters of Seastalks on the surface of the ice fields is a sure sign of ocean bottom hot springs below. These clusters have been of great assistance to geologists studying the structure of the planet.

Beyond the fact that the native life is inedible due to nature's choice of right-handed amino acids in their composition, much of the Hermetian flora contains a sort of biological antifreeze enabling it to endure the planet's low temperature extremes. This

substance gives the plants an extremely bitter taste.

The unusual combination of a heavy atmosphere and low surface gravity has given Hermes a number of flying life forms. Some of these are quite large and can be very dangerous. Perhaps the best known example of these creatures is the White Wing. White Wings can mass as much as 250 kilograms and are very dangerous carnivores which remotely resemble furry white pterodactyls. Some visitors to the planet spend a portion of their time by joining an expedition of hunters to pursue these elusive and deadly creatures.

EXPLORATION HISTORY

In 2202, the ASF sent its first survey mission into the Mu Herculis system. Suspicion and fear arose when the ship, *Carolina Dream,* failed to return. Though humankind had yet to experience its first contact with an intelligent, extraterrestrial species, the scientific and military communities exhibited a certain amount of paranoia in regard to the possibility of encountering a hostile, starfaring race. The response to the *Carolina's* disappearance was to send a follow-up mission consisting of an initial survey vessel with two military escorts.

When the survey task force entered the system, they were delighted to find that the American Arm held yet another garden world, albeit of limited potential. Remaining in orbit about the planet which the captain of the survey ship Diana had named Hermes, the small fleet carried out extensive remote sensing studies as well as dropping a number of surface probes. This resulted in the discovery of reasonably extensive indigenous life. With this news, the fleet returned to the ASF facilities on King's moon of Abernathy, but no trace of the *Carolina Dream* was uncovered. The fate of the ship remains a mystery to this day, but the most plausible theory which has been put forth is that, while traveling at stutterwarp speeds, it collided with an object: possibly an element of the system's Oort cloud. Such accidents are not unheard of and usually result in the total obliteration of the vessel.

COLONIAL HISTORY

In the eyes of the American government, Hermes' environment presented some interesting possibilities for further development and growth in the American Arm. If a settlement to grow crops could be established on the planet's surface, any food beyond that needed by the colonists could be shipped off-world. Worlds such as King and many of the American outposts could profit from having a food source local to the Arm. With this goal in mind, the year 2215 saw America, with some financial support from Australia, send about 1500 individuals to Hermes to establish the foundations for an agricultural economy.

The colony was set up with the help of materials and advisors from the Alberta Farmers' Cooperative. Support and farming equipment was shipped at great expense from Earth. A small orbital station was established to provide meteorological and environmental observations for the surface community, as well as to serve as a coordination center for expected exports.

The life to be led by the farmers of Hermes was quite unique with respect to their Terran counterparts. Where agriculture is usually considered a sedentary occupation, Hermes' farmers were forced to lead a nomadic lifestyle. The planet's long year enabled three growing seasons to be held within the Hermetian summer. As the 200 day-long season would draw to a close, the ground would once again start to harden and the temperature drop. The farmers would then pack up their entire operations and move to a position about 90 degrees ahead of their previous location, where the planet's summer would just be dawning.

Life was very hard for the planet's colonists, as Hermes' environment was not kind. The extremes of temperatures, the threat of native predators like the White Wing, and the lack of permanent support facilities such as hospitals, all took their toll. Even under the most ideal conditions, Hermes' soil did not easily facilitate the growth of native Earth crops. The goal of producing an exportable surplus was de-emphasized, as the colonists were hard pressed to grow enough usable food to support themselves.

Finally, with the arrival of some genetically modified seed stock, the colony's agricultural pursuits took hold. By 2223, a trickle of food surplus was starting to find its way off-world, but the Australian government had since withdrawn its backing of the colony due to lack of results. Over the years, the surplus continued to grow, but at a crawling rate—well below the expectations at the colony's outset.

When news of the colonization effort at Ellis arrived, it made little impact on the Hermetian colonists. After all, how important was a dying world lying at the far end of the American Sub-Arm? Indeed, in Ellis' early years, it too was utilizing Hermes' resources. As a result, the colonists were taken completely by surprise when, in 2245, Ellis burst upon the scene with crop surpluses in excess of anything yet produced on Hermes. Ellis' first exported crop marked the beginning of the Hermes Depression.

With the bottom of the agricultural market removed, many of Hermes' colonists moved off-world—some to Ellis, where farming was easier and more profitable, and a few back to the Core. With the declining population, a drop in production rates obviously followed. Critical financial support was disappearing, and the Hermes colony began a fatal spiral toward economic doom.

It seems probable that Hermes would have been America's first failed colonial effort were it not for the actions of Jennifer Storher and Kim Silva. These two ex-industrialists were immigrants from Earth seeking a quieter, more satisfying life on America's interstellar frontier. Seeing that the pursuit of agriculture on Hermes was a dead end proposition, they formulated an idea to fill a void in the resources of America's far-flung colonies. Presenting a proposal to the Life Foundation, Storher and Silva obtained a grant to help them start the now famous Mule Corporation. Mule's goal was to start an industry to supply heavy machinery to both American and Australian worlds along the Arm at prices less than that of similar products imported from the Core. Situated on the planet's first true city, Hope, the Mule Corporation's production facility, employing 47 men and women at that time, rolled out its first vehicle in 2257. Called the Mule-Apache, this tractor's first sale, ironically, was to a farming cooperative on Ellis.

Success followed the Mule Corporation as its line diversified and its clientele expanded, producing specialized equipment for mining efforts on King and supplying the Australian worlds with much needed heavy equipment.

As Mule prospered, it set an example of how the colonial venture may yet succeed and, little by little, more industrialization sprang up. The industrial revolution of Hermes was well underway.

Hovering at about two million persons, Hermes' current population is primarily scattered between the three cities of Hope, Burgess, and Grey Hill. Though its industry is not nearly as extensive as anything found in the Core, Hermes produces a wide variety of products needed by the worlds of the American Arm and is home to Mule Corporation, Lawson Mechanicals, and the regional operations center of Trilon Corporation.

POLITICS

Being a U.S. dependency, Hermes has a planetary governor who is appointed by the President. He is responsible for

coordinating the planetary level bureaucratic infrastructure. The current governor, Malcom Durran, has served in the post for three years.

Recently, there has been much talk of Hermes following in Ellis' footsteps by petitioning for statehood. The idea has much support on Earth and with Governor Durran. His pressure to pursue this goal has brought him eye-to-eye with the upper echelon of Hermes' industrial sector, who oppose this move. The reasons for their objections are the fear that statehood would bring about greater limitations and control over industrial growth and practices on Hermes, though their publicly stated reasons are far more altruistic.

The result of this difference has been an escalating PR war between Durran and the industrial sector, from both vying for the support of the working population of the planet. It seems that tensions in this conflict of interests could escalate, but it is too early to tell in what direction that scenario would go.

FACILITIES

A trio of three solar power stations have been set up to provide continuous electrical energy for the colony on Hermes. These are in geosynchronous orbit around the planetary equator. Power from these units is directed to ground receivers by high power microwave beam and then distributed by the colonial power relay network to the cities and industrial complexes of the planet.

In a geosynchronous orbit over the capital city of Hope is the Nesmith Orbital Interface Terminal. This facility handles all incoming and outgoing traffic to and from the surface of Hermes, as well as providing some limited warehouse space. Unlike many similar facilities in other systems, the Nesmith Interface prides itself on a record of minimal delays on docking and departure schedules. Its record for rapid processing of spacecraft and their passengers is often held up as an example by the American government.

Access to the Nesmith Interface is usually by SCRAM aircraft for passengers and fragile cargo, or by orbital catapult for more sturdy goods. Orbital catapults are located in the cities of Hope and Burgess, with the former being the most heavily used. Descent from the Interface is usually by SCRAM aircraft or by deadfall gliders for both cargo and passengers. There is almost no use of drop capsules.

Transport between the world's cities is accomplished mostly by suborbital rocket planes. Surface vehicle cargo convoys are not uncommon, providing slow but cheap transport of manufactured goods. The environmentally unstable surface conditions make fixed transport systems, such as air-film trains, unworkable.

THE CHANDLER UNIVERSITY

One of the most noteworthy institutions in the system is the Chandler University at Grey Hill. This school was founded in 2276 by Eva May Chandler with a grant from the American Interstellar Science Institute and the American government. It has become one of the most highly regarded schools in colonial space for the study of liberal arts and life sciences. The students who attend this institution come from several of the worlds in the American Arm as well as a small number from the Core worlds.

The school is noted for its very liberal political views and its willingness to make public statements about them. Student groups on campus are encouraged by the staff to explore any new concepts and weigh each idea on its own merit. The staff works vigorously to maintain a tuition assistance program which allows even the most underprivileged students to attend if they are truly devoted to their studies. The dean of the school, Dr. Robert C. Wright, is considered to be one of the most talented administrators of the day. His educational background is also quite extensive and he claims to have spent "more time in the classroom than any other American citizen."

In addition to its facilities on the planetary surface, the Chandler University at Mu Herculis also maintains an Orbital Biological Studies Lab and has students at the Borlaug Institute for Jovian Xenobiologies in the King system. Graduates of Chandler University are hired by various foundations almost as quickly as they receive their degrees. The school has an active placement assistance program to help its former students find jobs when they leave the university.

ELLIS AC+48 1595-89

Proud to have become an off-planet state of America, Ellis is an extremely productive world on the very edge of the American Arm. Its future seems bright as the colony is growing to be the largest in the region.

SYSTEM DATA

Lying at the far end of the American Sub-Arm, Ellis is the first world in orbit around AC + 48 1 595 89, a red dwarf some 23.6 light years from the Sol system. The star, an M3 VI, is very faint and weak. Its luminosity is only .0065, and it has an absolute bolometric magnitude of 10.97. In addition, it is a cool star and has an effective surface temperature of only about 3150 degrees Kelvin. AC + 48 1595 89 is also very small, with a mass of only .013 and a radius of 0.018 standard.

The second world from the star is named Oyster. This colorful Jovian is just over 90,000 kilometers in diameter and orbits at a distance of 0.15 AU. It has four major moons and a bright ring of dust and ice. One large, Titan-like moon, Carlton, serves as training facility for the USMC, giving troops experience in operations under low-gravity, non-terrestrial conditions.

Boise, a large asteroidal member of Oyster's trailing trojans, acts as the system's primary spaceport. To *create a* more comfortable environment, it has been extensively tunneled and a spin has been induced to give a simulated gravity. All customs operations are also handled at Boise's facilities.

The outermost world, at a distance of 0.27 AU, is Gibbet. Like Oyster, it is a gas giant. Gibbet is roughly 80,000 kilometers in diameter and has six major moons. The largest (and inner most) of these has a small research base on it dedicated to the study of the jovian which it circles. This station is jointly funded and operated by American and Australian scientific concerns.

PLANETARY DATA

Along the lengths of the American Arm, there are few worlds as important to the daily survival of the colonies as Ellis. Once a fairly Earth-like world, Ellis has been in a constant spiral toward ecological ruin for thousands of years. The bold colonists who have chosen to settle there, however, are engaged in an effort to halt the ecological decline and restore the planet to some semblance of its former state. As the 24th century dawns on humanity, this once barren world is now the pride of the United States, producing a great amount of food which is shipped across the entire American Arm.

Ellis orbits its primary at a distance of 0.07 AU, which is near the center of the star's narrow ecosphere. The planet is 1 2,850 kilometers in diameter and has an average density of 0.9 standard, giving it a mass and gravitational field almost identical to Earth's. It rotates on its axis once every 18.02 standard hours and circles its star once every 3.25 local (2.44 standard) days. Despite the rapid change from summer to winter, the planet's minimal axial tilt (about two degrees) and nearly circular orbit make for a stable climate over most of the surface. Ellis has no moons.

The atmosphere of Ellis is composed mostly of nitrogen (80 percent) and oxygen (16 percent) with various inert gases making up the remaining 4 percent. The sea level air pressure is very high, at 1.4 atmospheres, but it is breathable without assistance by most people. The average surface temperature is roughly 8 degrees C. This drops to as low as 26 degrees C below zero on the poles and climbs to as much as 36 degrees C at the equator.

Only 7 percent of the surface of Ellis is covered with water, making most of the planet a dry wasteland. The efforts of colonists, however, are increasing the productivity of the lands around these scattered lake regions. Various efforts are underway to irrigate the wastelands, and each year additional farmlands are opened up to homesteaders.

Ellis is very stable geologically. The planetary crust has only four major tectonic plates and a scattering of minor ones. Volcanic activity is minimal and restricted primarily to a narrow region near the equator.

The colony on Ellis is possible only because of some most unusual natural occurrences. The most noteworthy of these is the near proximity of the planet to its star. Because AC + 48 1 595 89 is a red dwarf, it is far too feeble to support an earth-like world unless its orbit is unusually close. At a distance of roughly 10.5 million kilometers, Ellis is in almost the perfect position to maintain an Earth-like temperature range.

However, the very nearness which makes the climate comfortable for human colonists creates some very hazardous side effects. The first of these is the radiation output of the star. At a range of 0.07 AU, this can be quite dangerous to unprotected individuals. Luckily, the extreme proximity of the star has kept Ellis' core in a molten state, due to tidal stresses. An unusually strong magnetic field is the result, which adequately serves to protect the surface from the radiation hazard. This is not a blessing without price: the magnetosphere traps the star's particles in belts of high radiation, where only specially fitted, heavily-shielded craft may operate safely. All incoming starships are routed to Boise, where custom-designed shuttle buses run passengers and cargo to Ellis regularly. The shuttle buses are two-part craft, divided into drive/cargo and space plane sections. Remaining in orbit as the spaceplane drops to the surface, the automated, heavily-shielded drive/cargo section can capture and load catapult packages sent up from Ellis.

Additionally, planets this close to their primary are vulnerable to the surface conditions of their primary. If AC+ 48 1595 89 were an average star, it would almost certainly annihilate the entire planet with solar flares. Again, the colonists on Ellis are quite fortunate as the primary is one of the most stable stars in known space.

CLIMATE

The lack of surface water on Ellis greatly limits the amount of precipitation which falls. In fact, rain is all but unknown by native colonists. The majority of the planet is dominated by barren stretches of desert and sun-baked ranges of barren stones. There are scattered riverbeds, now dry, which speak of a bygone age when Ellis was a far more pleasant place to live.

The vast, open areas force the colonists to deal with some very severe winds and dust storms. In order to counter this, man-made wind breaks have been erected at the edges of all human settlements which might be exposed to these hazards.

On Ellis, the short orbital period causes a rapid transition from summer to winter. A world with a greater axial tilt or eccentricity would suffer from a sudden and radical shift in climates, but Ellis is spared such extremes. As there is little change in temperatures from summer to winter, and as the seasons are so brief that they are over almost as soon as they begin, the climate on the surface is very stable. What alterations do occur have little effect on the imported Terran crops and livestock which have been bio-engineered to withstand such an environment.

Although Ellis was once home to a great diversity of life forms, most of them have now become extinct. Currently, there is no known native form of animal life above the microscopic level and very little plant life more advanced than lichen. Paleontology has

become the major field of study on the planet's surface, as more and more of Ellis' colorful biological past is being revealed.

RESOURCES

The primary export of the American colony on Ellis is food. Long ago, much of this world is believed to have been covered in grasslands and light forests. Recently, in planetary terms, Ellis has begun to lose much of its surface water. There are several theories regarding this event, ranging from variation in the star's output to localized chemical recombination. When the first mission to explore the system unexpectedly stumbled across the planet in 2220, Ellis was well on its way to becoming a post-garden world. With the help of the Alberta Farmers' Cooperative, the Canadian government, and several commercial interests, the American government began a program of careful ecological control. While far short of the terraforming projects planned for some other worlds, this restoration program has proven to be quite successful. With the establishment of an irrigation network and extensive soil reclamation efforts, vast areas of arid land are once again supporting life. Food from the colony on Ellis is shipped across the American Arm.

Although much of the food grown on Ellis is transported off-world in its natural state, the colony has a fairly large facility devoted to the manufacture of processed food products. Perhaps the most profitable output of this industry in recent years is a variety of liquors and wines of the highest quality. Exported to the Core worlds, as well as across the American and French Arms, the vintages of Ellis are becoming acknowledged as some of the finest in human space.

In addition to the increasingly bountiful agricultural resources of the planet, Ellis has fairly large petrochemical reserves. These are only beginning to be exploited as the 24th century opens, and they hold much promise for the future. Due to the fragile ecology of the planet, however, extreme care is being taken to avoid damage to the environment which might be caused by this new industry.

EXPLORATION HISTORY

Late in the year 2220, the first mission entered the system from the newly established outpost at Red Speck. It came as a complete surprise that a garden world was circling this insignificant red sub-dwarf. The unexpected news that a world which could sustain life had been found quickly prompted additional surveys.

In December of 2220, Captain William "Buck" Mossburg commanded the exploration vessel Kathryn Lynn on a follow-up mission into the system. Remaining in-system for 67 days, the crew made several manned landings on Ellis and conducted extensive scientific research. They returned with recommendations that an outpost be established to examine the failing ecology of the planet.

Pressure from the North American Research League, however, forced the American government to look at ways to revive the dying planet. With each passing year conditions on Ellis grew worse, and the end of life on the planet was not far off. A panel was formed to investigate what might be done to save this dying world. Based on the recommendations of that group, the American government contracted with the Alberta Farmers' Cooperative to establish a small colony on the world and to work on a restoration program.

In 2228, a large team of engineers arrived on Ellis and began the process of laying out the settlement. In just over a year, the first colony ships arrived, and the capital city of Liberty received its first breath of life.

COLONIAL HISTORY

During the first decade of settlement, the colony was headed by leaders appointed by the American government. Most of this time was taken up with the establishment of the planetary bureaucracy. Once the control and support structures were in place and functioning smoothly, the appointed leaders stepped down and democratic elections were held. Members of the appointed government proved to be so popular, however, that many of them remained in positions of power for years to come.

Farms were established as soon as the colony ships arrived, but these were intended only to support the populace. After the colony was established and settling into a routine, the expansion of the farmlands began. Irrigation systems began to spread outward from the lakes like fine spider webs. Gradually, soil was restored and crops planted in the once again fertile regions. By the close of 2245, the farms were producing enough food to begin exporting.

The colony continued to grow at a fairly good rate. The environment of Ellis was not harsh, and homesteading was quite popular. New immigrants came from all across the American Arm. In 2270, the population of Ellis passed one million (amidst planet-wide celebrations) with the arrival of the Barbara Ann.

In 2275, a referendum was passed by an overwhelming majority which called upon the United States government to grant statehood to Ellis. On July 4, 2276, the president of the United States, Norman Isaacs, signed the papers to make it official—America celebrated the addition of its newest state. To this day, the American colonies on King and Mu Herculis remain territories of the United States, and only Ellis has attained (or even sought) statehood.

In the quarter of a century since that historic event, Ellis has continued to grow in importance. Its agricultural industry has been vital to both the American and Australian colony efforts all along the American Arm. The petrochemical reserves which have recently begun to be exploited promise even more influence for this aspiring new state.

SOCIETY

The population of Ellis is estimated at 3.5 million persons. The majority of these are farmers, living along the shores of the planet's

few remaining bodies of water or along the traces of the irrigation network.

The largest city on the planet is Liberty, the capital, with a population of just over 90 thousand people. There are over forty cities of roughly similar size scattered around the planet. Each of these cities is at the center of an irrigation network and is surrounded by farmlands. Beyond the cities, there are numerous settlements and small towns clustered around the land-locked seas.

As with any American state, Ellis is a democratic republic. On the planetary level, the citizens elect a Governor (who serves for six years) and a Senate (whose members serve for four years). Members of the judicial branch are appointed by the Governor, subject to approval by the Senate, and serve for life. Each city or town has its own local government, which is set up in the same manner.

Although there are many political parties on Ellis, as in the rest of the United States, only one can be considered major: the Popular Conservatives. This group usually draws between 60 and 80 percent of all votes in virtually every election. As the name implies, the party is very conservative and firmly supports what it calls "the American ideals of hard work, a strong defense, and faith in the Almighty." Nearly all of the planetary laws and policies reflect this belief.

By and large, the colonists on Ellis are an honest and peaceful group. They are often homesteaders (or their children) who are working "to make it for themselves." Ellis has the lowest crime rate of any state in the union. The colonists of Ellis are known across the American Arm as conservatives and patriots and are fiercely proud of their heritage and their national history.

Currently, the population of the colony continues to grow at a rate of about 3.9 percent per year. Homesteading is the primary source of immigration, and life on Ellis is often promoted as a true example of "the traditional American Dream." All land grants for would-be settlers are dealt with by the United States Department of Extraplanetary Resources (USDER).

FACILITIES

Due to the problem of Ellis' radiation belt, there are no orbital facilities present. Difficulty has resulted in regard to setting up a global communications network. Communication satellites were not a feasible option. The solution arrived at by Ellis' inhabitants was to set up a network of microwave communication towers linking the major settlements together. At each of these microwave nexuses was built an omnidirectional transmission tower which could effectively send to all settlements within line-of-sight. This ComNet was vital to the coordination of personnel and resources, as well as to providing a reliable information source.

Electricity for the colony comes from several fusion reactors scattered about near the colony's larger cities. Power is transmitted around the planet along a relay grid to individual homes and farmsteads. Some of the more remote farms are not connected to this network, despite the best efforts of the government to make it a planet-wide system, and they must maintain their own MHD generators or solar arrays.

In addition to the ComNet and the power grid, other systems have been established to link the scattered clusters of population together. All of the larger cities (those with populations in the tens of thousands) are connected by an air-film rail network which safely glides above desert and farmland on a trestled track. Transit on this system is inexpensive and comfortable, making it a very popular means of transportation. The primary purpose of this network, however, it to convey crops and farm equipment from one point on the surface to another.

Ellis maintains three catapults on the surface of the world for easy transfer of cargo to orbit. The first of these was built in 2241 just outside of Liberty. Named for the appointed first governor of the planet, the Farley Launch Platform is still the most heavily used of the trio. The other two launchers, located in the cities of Justice and New Boston, are somewhat smaller and less frequently employed than the primary one. These were built in 2246 and 2278, respectively.

BASES

As they are involved heavily in the planetary restoration program, the Alberta Farmers' Cooperative has established a fairly large presence on Ellis. Although they have scattered facilities in all of the major cities, their headquarters is located in Liberty. Additional major branches can be found in Victory, Orem, and Northbeach. Due to the proven success record of the cooperative, it has come to have an important voice in local government. Any decision which impacts the ecology or farming industry on Ellis is of great interest to the foundation, and they lobby very heavily for their positions.

The United States Marine Corps has established a small base on Ellis. Located just outside of the city of Victory, this facility also incorporates a small United States Aerospace Force station as well. Additional bases are scattered around the planet, but these are mainly small recruiting and training centers. Ellis proudly boasts the highest enlistment rate of any other U.S. state.

ADVENTURES

Ellis holds a variety of adventuring situations, ranging from travelling the uncharted areas of the planet's surface with petrochemical survey crews to maintaining order in the outlying settlements as a lawman. The active paleontology studies can also serve as a source of scientific mysteries for player characters to solve. More possibilities lie in the outer system, at the lively facility located in rocky Boise or, if the characters wish to play military personnel, at the USMC training ground on Oyster's moon, Carlton.

BOTANY BAY DM+ 33 2277

The muddy seas of Botany Bay have spawned an interesting living kingdom. The Australians have seized upon the world as a vital site for their budding space presence.

SYSTEM DATA

DM+ 33 2777 is a K7 V star with a typical collection of planetary bodies. The first planet is a small, rocky world, as is the third planet. Between them is a larger rocky world which has become a hot house due to its dense atmosphere and proximity to its parent star. The fourth orbit is occupied by Botany Bay, the only garden world in the system. The fifth and sixth planets are rocks, and the seventh and eighth are ice balls. In the ninth and final orbit is a gas giant, dubbed the "Outworld" by the Australian colonists in the system. Less than four and one-half astronomical units out from Botany Bay, Outworld can be easily seen in the night sky. Outworld also has a system of seven small moons.

PLANETARY DATA

When Australian explorers first encountered the world that would become known as Botany Bay they found a warm, watery world that just might be capable of sustaining a colony. Further study of the system revealed a world in many ways like Earth, but in many ways much different.

Botany Bay is covered over 90 percent by oceans. The oceans consist of water and are churned by strong ocean currents. However, the oceans are very shallow, and the actual amount of water on the world is less than on Earth—the currents churn up the ocean floor and make the oceans heavily silted and muddy.

The land surface of the world is limited to several islands and island chains. Due to the shallowness of the oceans, these islands are more hilltops than mountaintops and never attain great height above the ocean floor.

The islands in the muddy seas of Botany Bay rise slowly from the ocean floors. Their coastlines are typically very long tidal plains which run directly into a wide coastal shelf. The ecological distinction between shore and shelf is commonly blurred in thick plant life which grows equally well in either part of the environment. Further from the shore on an island, this "interface" ecology slowly gives way to the veldt and mountainous areas of the inlands. The shoreline itself is a tangle of life more dense than a common Earthly rainforest. Further out to sea this interface life continues to a distance of several miles, teeming with life, though hidden from view by the surface of the water.

Beyond the interface, however, the thick foliage typically gives way to large areas of grassland or veldt terrain. Of course, the grasses and plants on Botany Bay are not at all similar to those on Earth, but the term "veldt" has been adapted by the inhabitants, and it has stuck.

The interface is alive with all sorts of life, though amphibian and triphibian life forms are the most common. Burrowing animals often make their homes far out under the sea floor, making tunnels back into the undergrowth on either side of the water line. The strong ocean currents further out to sea help stir the shelf-life, calling swarms of ocean life to these waters for excellent feeding.

Biologically, many of the animals and plants on Botany Bay are similar to those found elsewhere. But their ecological niches and overall characteristics bear some explanation.

Darts: A common predatory technique on Botany Bay is that of darting. A dart-capable animal is characterized by a large, heavy, pointed boney structure. The boney point is the lowest portion of the animal as opposed to the sensory and manipulative organs toward the higher end. A dart must use its limbs to attain higher ground, usually the upper canopy of a rainforest or a rock outcropping. When it has spotted prey below, the dart will fall, using flaps of skin for limited directional control. Few creatures on Botany Bay have sufficient armoring to withstand a direct hit from a darting predator.

Wheels: Though limbs have evolved on most creatures, the universally accepted form of locomotion on Botany Bay is the wheel. The evolved wheel is a complicated but efficient means of transportation, especially for animals in the veldt regions.

The typical wheel is secreted and moulted once per year, much like the horns of many terrestrial animals. A damaged wheel would mean the ultimate end of the animal. The wheel grows around an axle bone, near lubrication glands. The wheel itself is recessed into the bottom of the creature, though not penetrating the body cavity, and out to the ground. In this recession, the outer skin of the animal creates friction against the wheel in only one direction, and muscles within the creature's body flex this outer skin in order to set the wheel spinning.

Wheeled animals can attain great speeds in the proper environment. Most have also evolved smaller limbs for manipulation and maneuvering. Many animals in the interface ecology have no wheels and use only manipulative limbs to move around the canopy.

Looping Plants: Many plants on Botany Bay reproduce in long, linear progressions. These looping plants send up a limb, which, when it reaches a certain size, dives back to the surface and begins a new plant. From each ground source one or more new plants will repeat the process. In most cases, each loop of plant is semi-independent and will go on growing when previous loops die off.

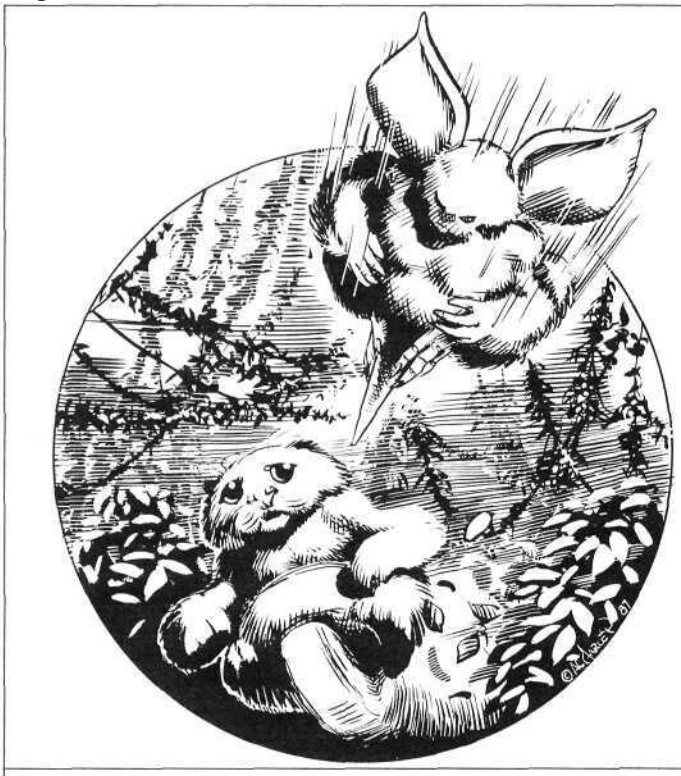
The groundcover on Botany Bay typically grows in this manner, making it very difficulty to traverse on foot.

THE COLONY

Botany Bay presented the Australians with their first opportunity to colonize an entire world for their own purposes. Agreements with their American allies at the time allowed them exclusive rights to populate and explore the entire DM+ 33 2777 system. Naturally, their first garden world was named Botany Bay in a unanimous vote of the Australian legislature three years earlier.

If the Australians can be blamed for the failure of the first colony on their new world, they can only be damned for their enthusiasm. Using many of their own ships, but a good number of American vessels *as* well, the Australians began a huge lift of equipment, supplies, and people to a single island in a southern hemisphere chain called Cook. Modeling their efforts on those colonies that had gone before, their large scale build-up did not take into consideration the possible settling-in problems on this strange world. Many areas of veldt terrain on Cook were not as productive as promised, and the local ground cover proved terribly difficult to clear. Equipment designated for that job and shipped to Botany Bay simply couldn't stand up to the strain. New ground clearing equipment had to be designed and constructed, but two years of local agriculture were basically lost. Business and industry intended to support a growing agricultural community went out of business, and volunteer settlers dwindled to nearly nothing. In two quick years the colony on Cook Island had both begun and collapsed from a lack of prior planning. The population was furious, and a change of government on Earth soon followed.

Today the remains of the colony on Cook Island are overgrown



and rusted. A salvage company has rights to the island and keeps a watch over it—entry is strictly prohibited. Scrap from the remains of the colony commonly find their way off planet.

A second colony on Botany Bay was begun two decades later, in 2233, again with government and popular backing, and with massive intellectual support. Australia had a program of superior higher education and planned to cash in by putting its best minds up against the problems of colonization on Botany Bay.

For mostly political reasons, the second colony was placed on a northern hemisphere island. Darwin Island promised to be distant enough from the failed colony on Cook to put people's minds at ease. The plan this time, however, was not to make the Botany Bay colony agricultural in nature, but industrial. Spearheading this colonization effort was Alfred P. Montgomery, a popular botanist and industrialist at the time, on contract with the Australian government to coordinate and establish this colony. Of course, Montgomery had also staked a great deal of his personal fortune behind the project, so it was to both his national and personal interest to see the colony on Darwin Island succeed.

It was reasoned that sufficient food products could be cheaply obtained from other worlds along the Arm, especially from the worlds of Hermes and later Ellis. The Americans were certainly interested in supplying their goods to the Australians, as it furthered their long range plans in their neighborhood of space. So, since food was not considered a problem, the colony could be established without wasting several additional years adapting farming techniques to the land and climate of Botany Bay.

Montgomery saw a clear vacuum in the productivity of the outer reaches of the American Arm. Agricultural goods were plentiful, and their continued supply could be counted on. The world of King was beginning to make its shift into rather extensive industry, mainly in the area of vehicle construction. However, the entire range from medium to light industry was a complete void, and products of that nature were both very much in demand and very expensive since they had to be brought all the way from Earth.

Montgomery's plan to begin the Botany Bay colony as a medium industrial facility was also based heavily on the use of indigenous materials. He knew that bringing raw materials all the way from another world would cut heavily into the profit margin and possibly drive a commodity off the market. A three part plan was introduced.

The first part of the plan involved the construction of a pharmaceutical plant, operated under the direction of Montgomery himself, a skilled and practiced botanist. The local vegetation and biology did not yield any miracle cures, but could be adapted to produce a variety of marketable medical products.

Special machinery was constructed on Earth and shipped to Botany Bay for the clearing of portions of the veldt. A phalanx of shredders were set loose to clear sections of land for homesteaders while at the same time supplying pulp material for the second part of the industrialization plan, a paper mill. Large portions of Darwin's 2000-square-kilometer area are selectively planted and managed to supply the paper mill.

These two areas of industrialization supported a colony of nearly 10,000 people for its first few years of operation. Only when the colony was thus established and certain not to fail did the private sector become involved, the third and final step toward completing the medium industry colony. Montgomery himself emphasized the construction of micro-electronics plants on Botany Bay, and Darwin Electronics is today one of the greatest suppliers of such equipment along the American Arm.

LIFE IN THE DARWIN COLONY

Darwin Island is an oblong land mass about thirty kilometers across and seventy long. When first explored, the island was typical of the untouched islands on Botany Bay, with a great band of dense interface foliage along its entire coast and lush but thick veldt lands toward the interior. The western end of the island is somewhat more hilly than usual, attaining a height of a hundred meters above sea level in some places. Of course, these are very gentle, rolling hills typical of the landscape of Botany Bay.

Prior to bringing colonists down to Darwin, the Royal Australian Engineering Corps did some large scale landscaping. Using huge dredges dropped from orbit (and still on the planet since it would be ridiculously expensive to get them off the planet), they cleared an area of the interface foliage and built up levies to form a man-made bay for the site of the main settlement. Both the pharmaceutical and paper plants were constructed here, and a city grew up known as New Cairns, since the mud shallows left by the engineers were reminiscent of the tidal flats common to north Queensland.

During its early days, the Darwin colony attracted very few agricultural homesteaders. As the local industries expanded they recruited new employees from both Tirane and Earth, and the population grew very slowly. Lands cleared of thick veldt drew many of the newer settlers, but these became bedroom communities for the businesses of New Cairns rather than the domain of sod busters one might have expected.

The Darwin colony did not have a great "boom town" era until private industry began making its move to the world between 2250 and 2260. New settlements sprang up all over the island as new businesses took hold. The population base grew, mostly because of the pleasant climate on the world and the ample opportunity to find employment. The veldt was easily adapted to a highway system which today criss-crosses the entire island, linking all settlements with the spaceport facilities at New Cairns.

A space plane port was established in New Cairns in 2264, linked to a small orbital way station for transport ships. A catapult was considered for the colony, but it was rejected because industrial products were too fragile for the sometimes bumpy ride of a catapult package. Tourism has become quite important in the New Cairns area, as beach front property is becoming a common holiday spot.

Today, several other islands in the vicinity of Darwin (there are five others of approximately equal size and potential within 200 kilometers) are hosting budding new communities. The man-made bay at New Cairns has never been busier as new products, mostly raw materials, are brought in from these other islands. Scientific expeditions have been setting sail for these other islands in the first attempts to better understand the diversity of life and geography on Botany Bay.

THE ABORIGINAL COMMUNITY

Though pretty much absorbed into the Australian mainstream, the Aboriginal culture is still held dear by many thousands of people. On Botany Bay there are over five thousand Aboriginal settlers, many of whom are concentrated into a culturally segregated community along the veldt edge of the hilly western part of the island which they call Ranipawab There is no schism between the Aborigines and the other colonists. On the contrary, Ranipawab is considered to be one of the more productive cities on Darwin, populated by intelligent, aggressive business people who happen to enjoy an ethnically separate community.

A very small portion of the Ranipawab community is heavily involved with the ancient customs and crafts of their people. They create carvings and pieces of native art using ancient Earth designs and native Botany Bay materials, which bring a good price outside the community. The Aborigines attempting to keep alive their more primitive roots are wary of becoming a tourist attraction and have taken steps to keep the curious at a distance.

THE DARWIN LIBRARY

Typically, early colonies are stretched to the limits to find transport for the bare essentials such as food and equipment. There is seldom room for any sort of luxury such as non-essential computer equipment for a library. The Darwin Library is one notable exception.

Originally brought along with the first colonists, under the direction of Montgomery himself, were five technicians and several data computers to set up a primitive library within the settlement. There would be no universities to draw upon for any information needed, and Montgomery knew a library would be a useful tool at times. Little did he know the extent to which the Darwin Library would grow.

The first wave of colonists were mostly young professionals, recruited for their knowledge, background, and lack of children. There was no need for a school system with the original colony, and none was provided. But in a few short years the colonists came up against a void, and they had no organized means to educate their children. Many resorted to the wealth of information in the Darwin Library, either teaching their children themselves or organizing into small groups to use the facilities. As the colony grew, the need for more educators became obvious, and the library technicians began to take a greater and greater role in the education of young citizens.

Today the Darwin Library is the center of the entire education system on Botany Bay. A strange conglomeration of traditional education and information processing techniques, the Library provides an information-intensive education for every child in the colony. The educators there have been noted for their innovative use of materials to produce a stimulating learning environment, and teachers from as far away as the core have come to Darwin to try to emulate these extraordinary results.

KINGSLAND

Zeta Herculis

The huge world of Kingsland has become Australia's new outback. The scattered villages and families have only begun the taming of this enormous chunk of extraterrestrial real estate.

SYSTEM DATA

The Zeta Herculis system is a double star relationship. The two stars, Zeta Herculis A and B, and their systems are approximately 8 AU distant.

Zeta Herculis A is a GO subgiant, massing 75 percent more than the Sun. There are four planets orbiting this star.

The first planet, Zeta Herculis A-1, is a rocky core world 5000 kilometers in diameter retaining a thin atmosphere. This desert world has one satellite chunk. Zeta Herculis A-2 is similar in composition, though smaller than its inward neighbor. It retains no atmosphere and thus is classified as a rock. The third planet, on the other hand, is much larger, being 9000 kilometers in diameter and retains a standard atmosphere. This hot house world has one tiny satellite classified as a chunk.

Zeta Herculis A-4 has been renamed Kingsland, the Australian colony in this system. The rocky core world is in size and density very similar to Earth—the difference in gravitational attraction is indistinguishable to a human being. Kingsland is the only world within the life zone of Zeta Herculis-A. Kingsland has a variety of features which make it unique, habitable, and valuable that are explained in the bulk of this essay entitled "Kingsland."

Orbital positions beyond Kingsland are tremendously unstable due to the proximity of Zeta Herculis B and its star system—there are no planets beyond Kingsland.

Zeta Herculis B is a KO main sequence star with a system including four worlds.

Zeta Herculis B-1 is a small rocky core world with a thin atmosphere, making the world a very hot desert planet. The second planet is similar. Zeta Herculis B-3 is an icy core world classified as a failed core. The last planet in the system has retained almost no atmosphere and is therefore an ice ball.

Again, orbits beyond the fourth planet in the Zeta Herculis B system have been made unstable by the presence of the other star and system.

PLANETARY DATA

A decade of satellite and surface exploration preceded colonization of Zeta Herculis A-4. Many crews were assigned immediately after gaining considerable experience surveying Botany Bay. Of course, their duties included pointing out difficulties to colonization, ideal sites for colonization, and mapping and understanding the physical characteristics of this new world. The first colonization site was established in 2217 during the reign of King George VIII of England, and Zeta Herculis A-4 was inducted as the eighth Australian state as Kingsland at that time.

Kingsland is 12,000 kilometers in diameter and is slightly more dense than Earth. Its mass is 0.90, and its gravity is 0.991. The atmosphere retained is slightly more dense than that of Earth and has been transformed by native carbon-based plantlife into a form breathable by human beings without assistance. However, the oxygen content of the atmosphere is not as rich as is necessary, so humans doing heavy labor must supplement their oxygen intake.

Kingsland is officially classified as a glacier world. However, since there is considerably less water available on the planet, the glaciers only cover the northern and southern sixth of the planet. Also, since Kingsland has almost no axial tilt, there is an area around the equator which is not only ice free, but has lakes of freestanding water and its own weather patterns. These areas have spawned life and are quite hospitable. Therefore, the surface of Kingsland is largely unusable, and is split into three distinct types—glacier, tundra, and equatorial.

Glacier: Typical of any ice field, the glaciers on Kingsland are particularly unremarkable, supporting little in the way of life and changing imperceptibly since colonization began.

Virtually the only life form on the glacier is a producer known locally as a Bunyip's Hat. Each plant springs quickly from a seed on the surface of the ice to form a circular mat from one to five meters in diameter. The living mat is very dark in color, either dark green or nearly black. Light absorbed by the plant is used both for photosynthesis and to heat the mat, melting some of the ice underneath and supplying water for growth. At three spots on the edge of the mat are new seed growths, which will grow at the end of a compressed gas bag. When the seed is ready, the compressed gas in the bag fires the seed away from the parent plant to grow a new Bunyip's Hat where it won't compete with the parent plant.

The Bunyip's Hat is playing a key role in the passive terraforming efforts currently underway on Kingsland.

Tundra: The areas between the poles and the equatorial regions are known as tundra. Much of the tundra is broken, difficult terrain, never smoothed by the mighty glaciers which could not extend that far for lack of ice. Producer life on the rocky tundra is characteristically rugged in design, typified by trees which grow from a single spot, low over the ground, held down by the weight of wide, thick leaves capable of retaining water and gathering sunlight. The daytime sun (which lasts for about 33 hours—the local day is 66 hours long) warms the tundra areas during the day, but the water in the area freezes during the long night.

Herbivores and carnivores have adapted to the tundra, evolving from life forms originally spawned in the equatorial regions. The most common herbivore is known as a sixgoat, a rugged beast massing about 100 kilograms. Often described as big, shaggy landshrimp, their jaws are particularly strong to aid in eating tough plants on the tundra. Sixgoats are good sources of meat and skins and are sometimes grazed on large plantations called stations.

The bane of the sixgoat station manager is an unlikely carnivore known as a rockrat. Rockrats mass only about one kilogram, but they attack in swarms. A swarm on a sixgoat station could cost a manager ten animals, eaten to the bone in seconds by the tiny teeth of the rockrats. Barriers and poisons have thus far been only marginally effective, so a cooperative of ranchers are petitioning to introduce a bio-engineered predator to take care of the problem.

Other than the occasional sixgoat station, the tundra is virtually a wasteland without value to a human colony. Only after generations of passive and active terraforming will areas of tundra be tamed for use by settlers.

Equatorial: The lifegiving heat of the sun is sufficient to provide liquid water which lasts through both day and night only in the equatorial regions. All life which has evolved on Kingsland originated in the pools and lakes of this region. Area producers provide ground cover virtually everywhere, supplemented by larger plants to *create a* green band running around the planet. Native life forms have broken down the ground into a tillable soil which, once cleared and fertilized, allows many native Earth cereal grains to grow quite nicely despite the difference in day length.

One quite remarkable native plant is known as a flat tree. It grows to a height of roughly two hundred feet. However, the trunk of the tree can be up to 50 feet across, tapering up to the top of

the tree. As the tree matures, the base of the flat tree grows into a hard wood and is taken over from the inside by another life form, a large amoeba-like creature which matures with the flat tree. The amoeba-like creature helps the plant digest certain enzymes from the soil while the flat tree provides it with protection—a perfect symbiont. When the tree ages and dies, the bottom portion of the plant petrifies, the upper portions of the tree die and fall away, and the amoeba-like animal dies and decays, leaving a chamber inside the petrified trunk of the tree.

The original colonists discovered the flat tree early in their history, and found that particularly large flat tree remains made nice homes large enough for a good sized family. Good saws and acids could be used to make openings into the chamber, and standard carpentry techniques were used to partition them as desired. Considering the stale, bland prefabricated housing generally available to colonists, it is not surprising that the Australian colonists sought out flat trees to make their homes in and give their existence a unique Kingslander stamp.

Weather: Though winds sweep over the tundra and glacier areas alike, the only weather systems generally hover around the equatorial regions of the planet. A dominant stream of air moving west around the planet (in the direction of spin) draws moisture along a single path which affects the entire equatorial and portions of both tundra regions of the planet. The resultant high winds (which are usually between 20 and 40 kph constantly around the equator) dictate the character of the successful producer and animal life forms on Kingsland.

Plants: A common collector will use its own bags or nets to catch leaves and organic matter blowing in the strong winds. In these bags the material collected forms a mulch which can be used to nourish the plant. Root systems on these plants are still extensive, but are more adapted to holding the plant in place than they are to gathering nutrients from the soil.

Area producers are not unlike their counterparts on other worlds and generally are too small to be collectors. They must rely on the nutrition of the soil and rains.

Animals: Native Kingsland animals vary greatly. They are for the most part, however, bilaterally symmetrical, four- or six-limbed, and built low to the ground. Tall creatures would have trouble maneuvering in the winds. Fur and bony coverings are common. More often than not, an animal has the capacity to change its direction of movement without changing its attitude toward the wind—it can either pivot its means of locomotion, or it can rearrange its shape to reduce energy loss to the wind.

There are no naturally evolved flyers on Kingsland.

THE COLONY

Kingsland is a relatively new colony world, celebrating only its 83rd birthday in 2300. But for the first fifty years or so, only rugged Australian frontier families made their homes there: the census of 2280 recorded a mere 11,250 people living on Kingsland. The bulk of the present populace has come in the last twenty years with the blessing and support of the Australian government, but to date the total population is quite low, scarcely more than one million. To put this in perspective, this is the equivalent of sprinkling the population of a small Earth city across the entire world. On Kingsland, there are nearly 500 square kilometers for every man, woman, and child, most of whom are first generation settlers of this new world.

Kingsland has drawn colonists for two chief reasons. First, it was and is a matter of pride among the Australian people to be a colonial power—their origins as a colony and the benefits they received being a part of the British Commonwealth reinforce public opinion that colonies only strengthen the owning power, provided relations can be kept friendly. The second reason for colonization is potential mineral wealth, both on Kingsland and on its larger satellite, known as Kingsland Prime. Still, primary reasoning behind colonization is for race-wide prestige. The possibility that Kingsland's resources or output will greatly benefit its mother nation are recognized as being quite small. But, in the eyes of the Australian government, being a stellar colonial power will bring benefits which are less tangible from the human community on Earth and beyond.

Some mining, with marginal success, has begun on Kingsland. There are deposits of iron, bauxite, and tantalum on the planet. Eventually it is hoped that Kingsland will be able to support mining operations on Kingsland Prime as well, but such plans are still decades in the future.

Colonial Life: Kingsland is still an agricultural world, by far. There are just over a million colonists on the planet, 90 percent of whom are directly involved in agriculture. The single city of consequence is Hogan—all others are considered to have a rural lifestyle.

City Life: Hogan contains around 90,000 people. Their occupations range from bankers and businessmen to starport facility personnel. Immigration to Kingsland is open to all Australians, and the ten thousand or so who arrive from Earth each year arrive in Hogan.

The government mining operation is run just outside of Hogan, and all its personnel also live there. Mining is the biggest industry on the planet. A steel mill is under construction near the mine site and should be completed in another year.

Concern over water dominates the city life. Though there is plenty of water in the local reservoir, if it should dry up it would take many years to replenish itself. Water conservation in the area of the city is enforced. Homes have their own water collectors and cisterns to take advantage of the infrequent rains. In Hogan, power from windmills is cheaper than water power. Plans to build and fill another large reservoir near the city are in the works.

Hogan is the capital city of Kingsland, and as such, employs a large number of government workers. Administration for the entire colony is coordinated from the city, where representative bodies congregate to decide on important political issues. Meetings of the world's legislature are renowned for their rowdy atmosphere, since a hundred and fifty headstrong frontier people gather to argue and sometimes fight over their particular points of view.

Rural Life: To human farmers, the native plants are not readily adapted to human consumption. However, the mulch they collect and create is very good for the crops they wish to grow. Often a Kingsland farm will consist of two fields. The first consists of native collectors making mulch for the second field, which grows terrain crops in an area protected from the winds by walls or baffles.

Sixgoat stations dot the tundra near the equator, and these employ and support perhaps five thousand people. They trade their animals for food from the farmers and other goods from the city, usually on a strict barter basis, transporting their animals as best they can.

But whether on a farm or herding sixgoats, rural life on Kingsland is at once isolated and difficult. The typical landscape is a range of stones and boulders, some as large as a meter in diameter, strewn over the sandy soil. Individual homesteaders clear their land for farming, but to clear a path for air film trains has thus far been considered impractical. Scattered across the tundra, every homesteader family or community has to provide its own transportation. Air transport is impractical due to the high winds and dust storms, though emergency vehicles sometimes fly over the tundra.

The most common form of transport is the rough ground vehicle or "rock buggy." A typical rock buggy is a large, heavy vehicle held up to five meters off the ground on a heavy-duty suspension and enormous balloon tires. A buggy can roll right over most medium size stones on the tundra and make a bumpy journey from homestead to city when necessary. However, the pounding these vehicles take is enormous, and quite often buggies are laid up about half of the time in need of repair. Rock buggies are most often operated by alcohol, and every homestead has a still as part of its everyday equipment. Any machinery for farm work is usually brought in from Hogan in pieces carried on rock buggies and then assembled on the spot.

In the absence of mechanical transportation, an indigenous animal has been pressed into the service of the homesteaders. The "fair cow" is a six-legged herbivorous beast which has become a draft animal mostly because it is not any good to eat. A fair cow has a broad back which can be mounted with a seat for a passenger or simply packed with goods. They are sometimes attached to wagons in cleared areas. A fair cow can carry about twice as much weight as a horse, but the homesteaders would gladly trade them all in for horses. A fair cow is typically a stubborn, bad-tempered beast which exhibits a host of strange habits. For instance, when confronted with the color red, they freeze up until the red is out of sight, probably as a hard-wired defense against a now extinct predator.

Passive Terraforming: The amount of water frozen in the glaciers at either pole constitutes nearly all of the water on Kingsland. If the planet could be warmed sufficiently and more water be released, the planet would become much more habitable and pleasant.

The only efforts toward this end have been undertaken by a single biology firm operating out of Hogan. They have taken the Bunyip's Hat plant, already a native to the cold glaciers, and engineered it. They have a version of the plant now which is slightly bigger and produces more offspring (four seeds instead of three per plant). They have also increased the fertility of the plant, and a new generation will emerge every 20 local days (or about two months of standard time). They have been seeding and tending these plants for several years and hope to begin affecting the planet's temperature within the next century.

Colonial Atlas

Since the first colonies were placed on Tirane in the mid-2100s, the human presence in space has expanded wildly. With each new garden world discovered, the nations of Earth scramble to place their seed and expand their power base in the stellar civilization.

Every one of Earth's 29 colony worlds is described in *Colonial Atlas*, with information on each of the following:

System Data: The colony worlds are, for the most part, nestled upon the cream of explored planets. But the rest of the worlds within a star system can have a great impact upon the colony and may even have been the original impetus for human settlement. This section describes the primary or primaries of the system, and its family of planetary bodies, some of which are quite valuable to the human effort in distant space.

Planetary Data: Every planet has its own unique character. Some planets are tectonically active, while others are more stable, or are manipulated by nearby gravity wells or recent meteor impacts.

Nearly all the colony worlds have their own biosphere, evolved individually on the worlds to create a variety of life forms, most of which are still barely understood. From the great silted seas of Botany Bay to the Eber ruins of Beta Hydri, each of Earth's colony worlds offers a wealth of unique characteristics for exploration and adventure.

Colonial Data: Man has travelled to the stars and settled the more hospitable planets but failed to leave balkanization behind. More than a dozen of Earth's nations have established off-world colonies, many sharing planets under the protection of the Melbourne Accords. Some generalizations apply, as exemplified by the names given to the three arms of human space, but virtually every nation on Earth is now represented throughout man's stellar community.

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