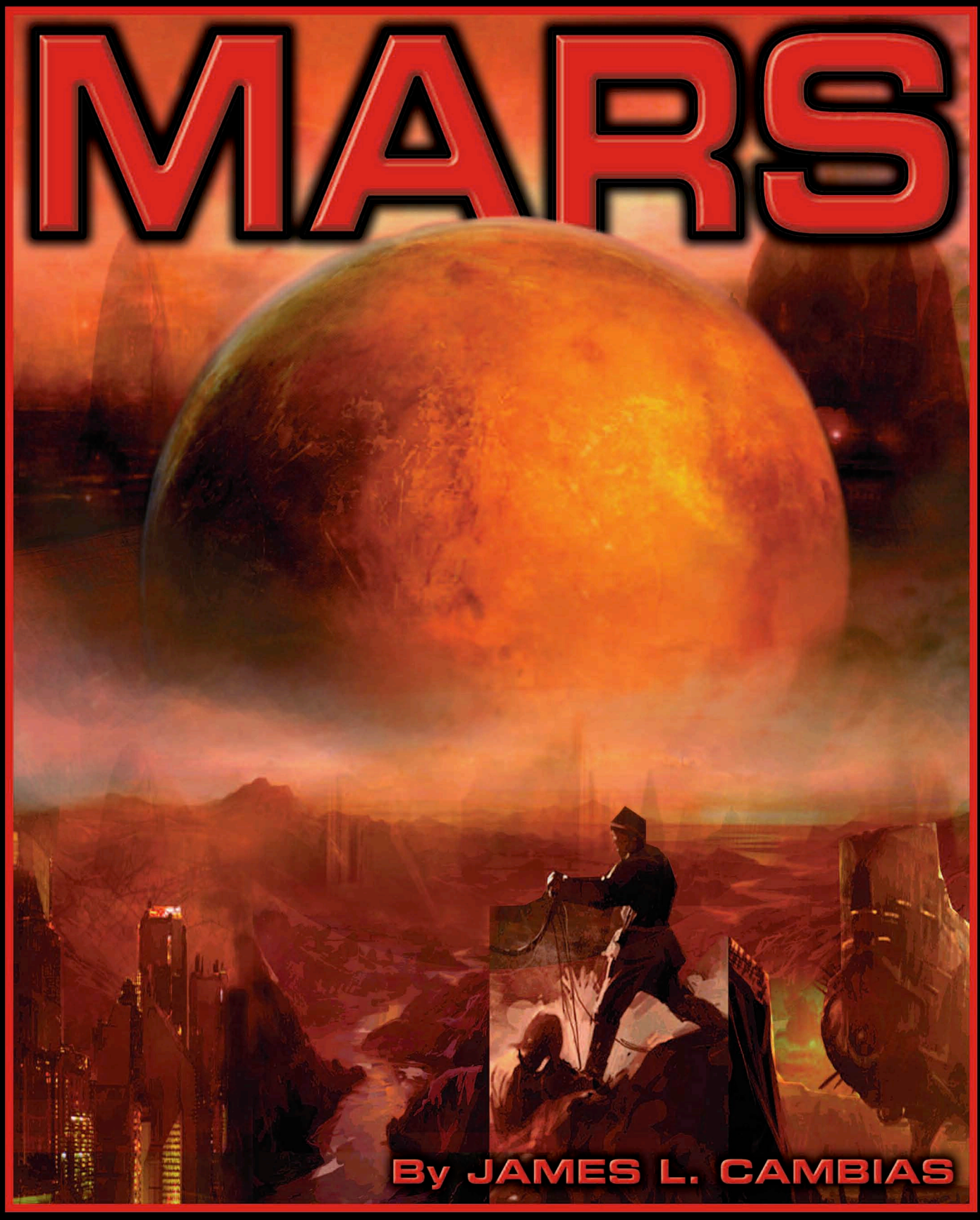
GURPS®

MARS



By JAMES L. CAMBIAS

STEVE JACKSON GAMES

GURPS®

MARS

The Red Planet

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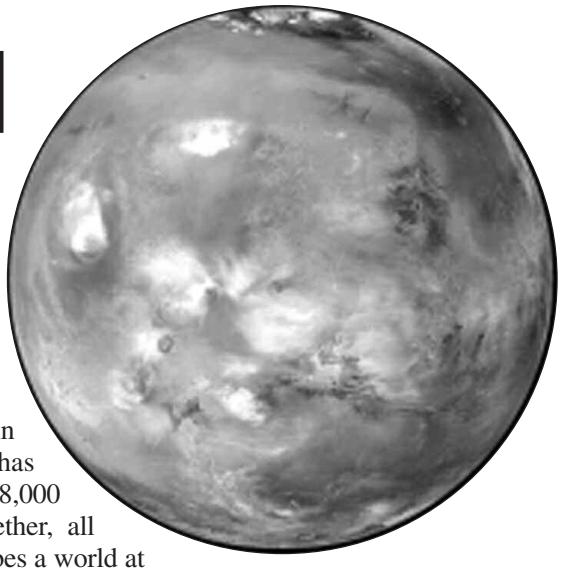
The ***GURPS Mars*** web page is at **www.sjgames.com/gurps/books/mars/.**

Page References

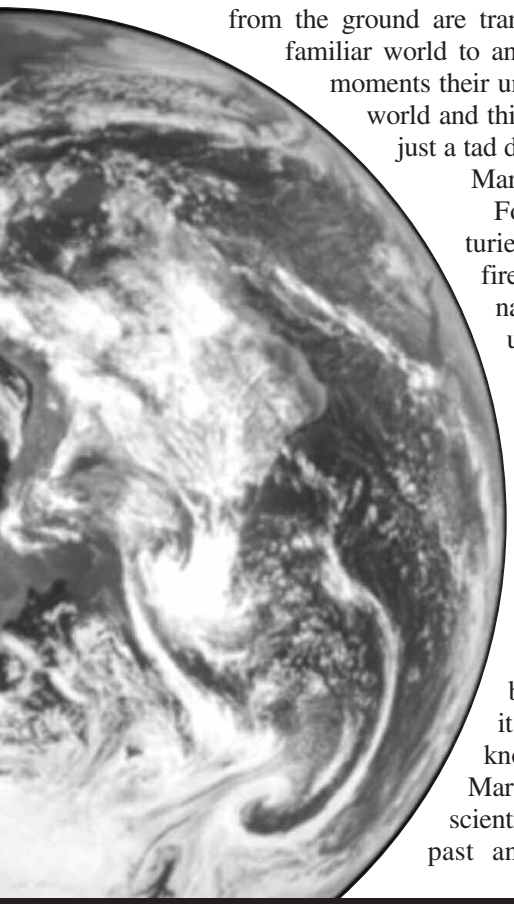
Rules and statistics in this book are specifically for the ***GURPS Basic Set,*** *Third Edition.* Any page reference that begins with a B refers to the ***GURPS Basic Set*** – e.g., p. B102 means p. 102 of the ***GURPS Basic Set,*** *Third Edition*. Page references that begin with CI indicate ***GURPS Compendium I***. Other references are BIO for ***GURPS Biotech,*** CY for ***GURPS Cyberpunk,*** U for ***Undead,*** and WWi for ***GURPS Who's Who 1.*** A full list of abbreviations can be found on p. CI181, or see the updated web list at **www.sjgames.com/gurps/abbrevs.html.**

INTRODUCTION



Here's the scene: Grand Central Station, New York City, 5:15 p.m. It's rush hour madness in the station on a sultry summer afternoon in 1976. Suits are darting across the cavernous expanse of the main terminal, heads down, briefcases held tight. Thoughts are focused on getting home, maybe snagging a seat on the train, maybe actually making the 5:17 to Greenwich, or Larchmont or some other suburban digs. Kodak's Colorama display looms over the scene, an outsized transparency nearly 20 feet high and 60 feet wide. It's been displaying Kodak moments for years, but right now it's showing something a tad different, something that's forcing heads up and slowing down the usual crazed pace. Quick strides melt into an ambling walk; conversations drift away momentarily as people gaze at the scene on display. A few simply stop and stare in momentary befuddlement. They're looking at Mars, as seen by the robotic eyes of the Viking 1 Lander.

At first sight it's a weirdly familiar scene, a desert-like expanse, barren and ruddy with ancient-looking chunks of rock littering the landscape. But it's the dull pink sky that catches the eye. It takes a smattering of time, maybe a few seconds, for people to realize that the reason the scene looks unearthly is because, well, it is unearthly. Looks of bewilderment melt into looks of astonishment and wonder. They entered the station to commute to the near suburbs of New York, after all. They hardly expected a quick commute to the near suburbs of Earth, and a glimpse of another world. For a few moments, those who chose to raise their eyes from the ground are transported from their familiar world to another, and in those moments their understanding of this world and this universe becomes just a tad deeper, a bit richer.



Mars does that to us.

For decades, centuries even, Mars has fired the human imagination and beckoned us to imagine worlds beyond our own, worlds we frequently populated with our own fears or dreams. It's tempting to say that the Red Planet is a blank page, but, as is well demonstrated by James Cambias, it's anything but. We know quite a lot about Mars. We've penned a scientific narrative of its past and present. We've collected reams of data concerning its atmosphere and surface environments. We've captured innumerable images of its surface (the Mars Global Surveyor alone, in orbit since 1997, has logged more than 78,000 images). Taken together, all that we know describes a world at once alien yet familiar. This isn't to say that we've written the book on Mars – far from it. There are plenty of questions to be answered, careers to be made, and perhaps a Nobel yet to be snagged from the study of the planet.

Mars is an intriguing canvas for the imagination. Tales ranging from space swashbucklers to hard science SF have drawn on the Red Planet as backdrop and inspiration. Within the realm of the imagination, Mars is what you make of it. Whether you play by the rules of science and what we know of the planet today, or bend them a tad, is your own call. Be assured, though, that you'll find enough information, ideas and imaginative scenarios between these covers to make you a master of the planet, at least in the short term.

For those with their eyes fixed on the long term, again, Mars is what you make of it. You can help make real a future where Mars is not simply an entertaining diversion, but a destination. The Mars Society (www.marssociety.org) is a global organization of individuals who share a passion for the human exploration of Mars. Society projects in the Arctic, the American Southwest and elsewhere are helping to define and test the skills and techniques human explorers will require.

GURPS Mars offers a solid introduction to Mars as a planet and Earth's near neighbor. More to the point for gamers, though, it's a grand introduction to Mars as an abode of the imagination. What's left to say?

On to Mars.

Richard Wagner
Robert Zubrin
The Mars Society

About the Author

James L. Cambias is a blatant poseur. He has never visited any planet other than Earth, but he didn't let that stop him from writing ***GURPS Planet Krishna*** and the upcoming ***GURPS Planet of Adventure.*** His experience with Mars is limited to watching it through a telescope from a distance of 40 million miles. Truly he has no shame. Mr. Cambias lives in western Massachusetts with his wife and daughter, who seem willing to endure his pretensions.

CHAPTER 1

MARS OBSERVED

Looking through the telescope, one saw a circle of deep blue and the little round planet swimming in the field. It seemed such a little thing, so bright and small and still, faintly marked with transverse stripes, and slightly flattened from the perfect round.

– H.G. Wells, The War of the Worlds

The Red Star

Humans have been watching Mars for thousands of years. Its dramatic red-orange color and erratic movements through the heavens drew the attention of the earliest astronomers. Its color naturally made humans associate Mars with other red things, like fire and blood, and those in turn linked Mars with war and danger in almost every human civilization. To the Babylonians it was Nergal, the god of plagues; in India it was Angaraka, the burning coal; the Persians called it Bahram, the warrior. Mars' role in astrology and mysticism is described in more detail in Chapter 3.

Early Theories and Observations

Mars played a key role in the development of modern astronomy. Using extremely accurate data gathered by Tycho Brahe, Johannes Kepler studied the motion of Mars through the sky and realized that it could not be explained by any combination of circular movements. Instead, Mars followed an elliptical path, leading Kepler to the discovery that all planets moved around the sun in ellipses. Had he been studying any other planet, Kepler might not have realized this, as among the naked-eye planets only Mars has an orbit sufficiently eccentric to be detected with the equipment available at that time.

Galileo made some brief telescope observations of Mars in 1609-1610 but the resolving power of his instrument was so low that he was unable to see anything but an orange blob. Francisco Fontana of Naples tried again with a better telescope in 1638, and made some rough sketches of dark spots on the surface. The Dutch astronomer Christiaan Huygens began to study Mars in 1659, and was able to recognize some surface features and estimate the planet's rotation period as being about the same as that of Earth; Huygens also speculated about life on Mars in his book *Cosmotheoros* (1698). The polar caps were discovered by Giandomenico Cassini in 1666. Cassini also refined Huygens' measurement of Mars' day length, producing a value of 24 hours 40 minutes.

In 1777-83 William Herschel (the discoverer of Uranus) did a systematic study of Mars using a very powerful refracting telescope. He measured the inclination of Mars' axis, observed seasonal changes in the polar caps, and observed changes in the atmosphere. Like most of his predecessors, he called the visible dark areas "seas."

The first maps of Mars were created by the German team of Wilhelm Beer and Johann Von Madler in 1830-39. Astronomers still use the coordinate system they devised. In 1868-1871, the British astronomer Richard Proctor created maps and named many of the features. Like Huygens and others, he called the dark areas seas, and named them in honor of his predecessors. Although this meant Mars could boast a "Beer Sea" as a prominent feature, other astronomers were not taken with Proctor's nomenclature.

Giovanni Schiaparelli, the director of the Milan observatory, created what became the most evocative map of Mars in 1877 and 1879. The 1877 opposition (when the Earth is directly between the Sun and Mars) was a particularly close one, and many astronomers with big new telescopes took the opportunity to study Mars that year. Schiaparelli used a Mercator projection to plot the features he observed, and adopted a naming system based on classical nomenclature, which became the standard for Mars thereafter. He also noted features which he called "channels" or *canali* on the surface of Mars. His *canali* became "canals" in translation, and completely changed the way people thought about Mars.

The year 1877 also saw the discovery of the Martian moons by Asaph Hall at the U.S. Naval Observatory in Washington. Hall named them for the mythological companions of the war god Mars, Phobos (fear) and Deimos (terror). Hall always credited his wife with encouraging him to take one more look at Mars despite poor viewing conditions in Washington's humid climate. In recognition of her key role in their discovery, the International Astronomical Union later named the biggest crater on Phobos "Stickney," Mrs. Hall's maiden name.

Schiaparelli continued his study of Mars at later oppositions in the 1870s and 1880s. In 1879 he noticed that some of his "canali" appeared as double lines. He named this phenomenon "gemination." Schiaparelli also saw dark spots where the canali intersected, and began referring to them as "oases."

The exact nature of the "canali" remained controversial. Some, like Percival Lowell and Camille Flammarion, were firmly convinced that they were artificial waterways or aqueducts. Others speculated they might be cracks in the surface of Mars (ironically, *Voyager* images of the Jupiter moon Europa revealed a system of real cracks which look a lot like old pictures of Martian canals). Others suggested the lines were the paths trampled out by herds of migrating animals moving between oases. There were always some astronomers who couldn't see them at all. Schiaparelli himself changed his mind several times. At first he was noncommittal, but when Lowell and Flammarion began loudly beating the drum for artificial canals he swayed in that direction. At the end of his life he became distinctly skeptical.

Percival Lowell: A Man, A Planet, A Canal

Percival Lowell was born in 1855 to a very rich and prominent Boston family. The Lowells lived in the rarefied heights of Boston society, "where the Lowells speak only to Cabots, and the Cabots speak only to God." He graduated from Harvard in 1876, helped to run the family textile business, and traveled extensively in the Orient. He wrote several books about Korea and Japan, concluding with *Occult Japan* in 1894. That year marked a tremendous shift in Lowell's interests.

Lowell had always had an interest in astronomy, and read with interest Giovanni Schiaparelli's description of the mysterious "canali" on the surface of Mars. By 1894, Schiaparelli's eyesight was deteriorating, and Lowell resolved to take up the challenge of studying Mars. He may have been influenced by a fellow Harvard man, William Pickering, who translated Schiaparelli's work into English and reported seeing lakes and snowfalls on Mars during an observing trip to the Andes in 1892.

Naming Names

Giovanni Schiaparelli's 1877 and 1879 maps of Mars included place names which have remained in use to the present. Schiaparelli had a good classical education, and used names from Greek mythology; he evidently had a poetic streak, for the terms he chose still have a wonderfully romantic sound. Dark regions got names like Sinus Sabaeus (Sabaean Gulf), Lacus Solis (Lake of the Sun), and Syrtis Major (Great Bay). Light areas were called Hellas (Greece), Chryse (Land of Gold), and Arabia.

Even when modern space probes got rid of Schiaparelli's canals, most of his old names were retained. The International Astronomical Union devised a standard system for naming features on Mars. One ironclad rule is that nothing can be named for a living person, and nothing can have a name from a living religion.

Many features simply use Schiaparelli's old names combined with a Latin term describing what the features are: Syrtis Major Planum, Elysium Montes, Hellas Planitia. New discoveries by the Mariner and Viking probes got new classes of names. Channels and canyons are named after words for the planet Mars in various languages – Kasei (Japanese), Simud (Sumerian) – or ancient names for rivers on Earth. Craters are named after astronomers (including a big one called Schiaparelli), explorers, science fiction writers (Kurd Lasswitz and H.G. Wells, among others), launch sites, tracking stations, and cities on Earth. A batch of features discovered by the Viking probes in 1976 were given names related to the settling of the thirteen British colonies that became the United States. A couple of unique features got unique names: Noctis Labyrinthus and Vastitas Borealis.

The Viking and Pathfinder probes returned pictures and analyzed samples from small regions around the landing sites. Scientists studying those images gave informal names to every rock and feature visible. Some rocks were named for things they vaguely resembled, or just got descriptive names; others were named for cartoon characters.

Future explorers are likely to use a mix of classical Latinate terms like those approved by the IAU and the sort of jokey nicknames employed by the Pathfinder team. At some point the wishes of astronomers on Earth will be superseded by those of the people who live there, and Mars will undoubtedly see people naming features too small for established names after themselves and their friends, people bestowing Biblical or Koranic names on things, and ambitious colony planners giving pretentious-sounding real estate development names to barren sections of red sand. A revolutionary government might even ditch the whole IAU nomenclature and dub Olympus Mons "Mount Freedom" or "Glorious Leader Mountain."

In the spring of 1894 Lowell set up operations atop Mars Hill, outside Flagstaff, AZ, with a well-equipped private observatory, a powerful 24-inch telescope, and a staff of assistants. From then on he studied Mars at every opposition, churning out a series of books chronicling his observations: *Mars* in 1895, *Mars and Its Canals* in 1906, and *Mars as the Abode of Life* in 1908. As the titles suggest, Lowell quickly became convinced that the "canali" seen by Schiaparelli were real, that they were artificial irrigation canals, and that they were the work of intelligent beings.

For the next two decades, Percival Lowell was the indefatigable champion of the existence of life on Mars. He wrote books and articles, and gave lectures in dozens of cities. When professional astronomers criticized his findings, he was quick to dismiss them: "Wolves hunt in packs, the lion stalks alone," he once remarked. Relatively late in life he married, and died in 1916. Having more or less "conquered" Mars, he turned his attention to finding the unknown Ninth Planet, and it was a Lowell Observatory astronomer, Clyde Tombaugh, who discovered Pluto in 1930.

The Canals and the Martians

In his books, Lowell described Mars as an old world, its surface worn smooth by erosion and its oceans long since dried up. Because Mars was a smaller world than Earth, it had cooled faster, its crust shrinking and fracturing and its oceans draining away into the interior. In effect, Mars was a look at Earth's future.

Much of the surface was a vast desert, so dry as to make the Sahara seem verdant by comparison. The dark features on the surface were ancient seabeds, still capable of supporting plants. Crisscrossing the dry plains were the thin lines of canals, carrying vital water from the melting polar caps down to the tropics each spring. Each year, a "wave of darkening" moved along the canals as vegetation bloomed with the coming of the waters. In all, Lowell charted and named 437 canals, creating maps and even a globe of Mars.

To Lowell, the canals appeared absolutely straight, clear proof that they were artificial constructs, which implied Mars had intelligent inhabitants. Since Mars was an older planet, this seemed entirely reasonable. As Lowell put it in *Mars and Its Canals,* "Within the bounds that make life possible, the smaller the body the quicker it ages and the more advanced its denizens must be." He believed the planetary scale of the Martian canal network showed that the inhabitants of Mars had a single planetary government, and wrote approvingly of the wisdom and determination which the Martians showed in such a huge project.

Given his ability to see canals where nobody else could, and his willingness to theorize about Martian vegetation and canal-builders, Lowell was remarkably reserved about what form life on Mars might take. Unlike just about every other popular work about Mars, his books have no pictures of hypothetical Martians or Martian animals.

Reactions to Lowell

Percival Lowell's vision of Mars was simultaneously enchanting to the general public and infuriating to professional astronomers. His discoveries were a standard of newspaper Sunday supplements and his books were widely read. His lectures were always well-attended. In the public mind, Lowell's version of Mars *was* Mars, right up until the Mariner space probe photographs revealed the true face of the planet in the 1960s.

Astronomers, on the other hand, were much less enthusiastic. Only Lowell and his followers could see the canals. Skilled observers using bigger telescopes didn't see canals, and nobody could photograph them. Some British astronomers tried an interesting experiment: they showed a group of schoolboys a picture of Mars without canals, but with dark spots speckled across the surface. The boys sitting close to the picture drew the spots, but those further away drew lines connecting the dark areas.

Gulliver's Travels and the Moons of Mars

In Jonathan Swift's satirical novel *Gulliver's Travels* there is an amazing description of the moons of Mars. In his wanderings, Lemuel Gulliver visits the flying island of Laputa, inhabited by somewhat impractical scholars and scientists. Among their discoveries:

"They have likewise discovered two lesser stars, or 'satellites,' which revolve about Mars, whereof the innermost is distant from the center of the primary planet exactly three of his diameters, and the outermost five; the former revolves in the space of ten hours, and the latter in twenty-one and a half . . ."

This is strikingly close to the real values: Phobos orbits Mars at a distance of 2.76 planetary radii (Swift apparently confused radius and diameter) and has a period of 9.6 hours; Deimos' orbital distance is 6.9 planetary radii and its period is 30 hours. The fit for Phobos is almost exact; the numbers for Deimos are about 30% off of the real values. What makes it amazing is that *Gulliver's Travels* was published in 1726, 150 years *before* Asaph Hall discovered the moons of Mars and determined their orbits. How did Swift know?

While Immanuel Velikovsky (see *Velikovskian Mars,* p. 47) theorized about Swift finding clues in old Irish manuscripts preserving the wisdom of ancient astronauts or Atlantean astronomers, the explanation is probably a bit simpler. Noting that Earth has one moon and Jupiter had four known moons in his day, the astronomer Johannes Kepler theorized that Mars must have two. (Kepler was a great believer in numerical ratios and proportions.) The notion gained currency among various writers; Voltaire used it in his *Micromegas.*

As to getting the periods so accurate, Swift may actually have been trying to be funny. To modern readers, the idea of a moon rising in the west and setting in the east several times a day, or a moon which doesn't move in the sky, seem perfectly plausible, but to 18th-century readers they would have been the height of ridiculousness. The whole Laputa section was a satire on the pretensions of scientists, and the moons may have been one bit of silliness which happened to be true.

A devastating critique came from Alfred Russell Wallace, who shared credit with Charles Darwin for developing the theory of evolution by natural selection. Wallace began a review of Lowell's *Mars* which turned into an entire book. In it, he pointed out some physical flaws with the whole canal idea: the rate of evaporation would soon empty them out, and the rapid melting of the polar caps indicated that they couldn't hold very much water to start with.

Paradoxically, Lowell's very success at arousing public interest made other astronomers reluctant to study Mars at all. The whole subject of life on Mars developed an air of quackery. Even half a century later, the astronomer Carl Sagan was considered something of a maverick in the scientific community for urging serious study of the topic.

Men and Martians

Once humans stopped thinking of Mars as a red star that wandered through the sky, and started thinking of it as another planet like the Earth, it was inevitable that someone would wonder if anyone lived on Mars. The German priest and polymath Athanasius Kircher speculated about people on Mars in his 1656 tour of the universe *Itinerarium Exstaticum,* while the Swedish mystic Emanuel Swedenborg claimed to have actually made a spiritual excursion through the Solar System in his 1758 book *De Telluribus.* Their Martians were human beings, and embodied spiritual ideas as much as scientific speculation.

Mars as a place to visit and have adventures came into prominence with the scientific romances of the late 19th century. Authors like George Griffith, Percy Greg, and Gustavus Pope sent intrepid Earthlings to Mars in a variety of more or less scientific spaceships. The beings they encountered there were generally humanoid, although in the wake of Darwin the idea that beings on other worlds would be different from humans was becoming widely accepted. The German author Kurd Lasswitz, in *Auf Zwei Planeten* (1897), took a leaf from the speculations of Flammarion and Lowell, and imagined the Martians as technologically superior; it was the Martians who came to Earth and established a base in the frigid Arctic where conditions were comfortable for them. Lasswitz wasn't the only one thinking about Martians visiting Earth.

The War(s) of the Worlds

In 1895, a young writer named H.G. Wells was walking in the suburbs of London with his brother, discussing the dreadful fate of the natives of Tasmania, who had been completely exterminated by British colonists during the preceding decades. As an analogy, his brother remarked "Suppose some beings from another planet were to drop out of the sky suddenly, and begin laying about them here?"

The idea struck a chord with Wells, and he began making notes toward a story on just that theme. He was learning to bicycle, so he pedaled all over Surrey, choosing locations for the invaders to land, and picking out local landmarks to be incinerated by the Martian Heat-Rays.

His novel *The War of the Worlds* is one of the wellsprings of modern science fiction, and so many of its themes and plot elements have been used by others that it almost sounds like a catalog of cliches (much as *Hamlet* could be described as a bunch of familiar quotations strung together). It begins with the fall of a mysterious meteorite in the London suburb of Woking. The tentacled, vampiric Martians emerge and use their deadly Heat-Ray against the humans of the vicinity. A party of naive scientists attempt to communicate with the aliens, but are wiped out. Overconfident military officers don't take the threat seriously and pay with their lives. The Martians advance on London and the city's inhabitants flee in panic. Heroic sailors aboard an ironclad ram one of the Martian tripod war machines to enable ships filled with refugees to escape. In a forebear of all the "post-atomic" disaster novels, the narrator wanders through the empty city, scavenging and hiding from the invaders. At last the Martians die because they have no resistance to Earthly microorganisms.

The War of the Worlds was first published as a serial in *Pearson's Magazine,* and was an immediate success. Wells expanded it for book publication in 1898, and it was a bestseller. Translations into other languages followed, and the story has remained in print for a century. In America, the New York *Evening Journal* and the Boston *Post* serialized the story, but in order to appeal to local readers they transposed the action to New York and Boston, without bothering to get Wells' permission. The newspaper versions also cut out everything but the scenes of destruction. A parody, *The War of the Wenuses,* by Charles Graves and Edward Lucas, lampooned the action and Wells' sometimes preachy style. Garrett P. Serviss, apparently angered by the effrontery of the Martians, published *Edison's Conquest of Mars,* in which Earth's greatest inventors launch a retaliatory attack on the Red Planet, wreaking havoc with superscientific weapons and slaughtering Martians like, well, Tasmanians.

Four decades later, in 1938, Orson Welles produced an adaptation of *The War of the Worlds* for his *Mercury Theatre on the Air* radio program. To give the story some immediacy, Welles and his co-author Howard Koch moved the action to New Jersey and told the story through a series of fictional "news bulletins." Unfortunately, many listeners tuned in late and got the impression the fake reports were real. A mild panic ensued: phone switchboards were jammed as people tried to find out what was going on, and at least some residents of the Martian landing zone tried to flee. (Anybody who bothered to stay tuned got to hear Orson Welles explain the whole thing as a Halloween prank.)

The War of the Worlds made it onto the movie screen in 1953, when George Pal produced a big-budget version directed by Byron Haskins. Although the film is a classic of sci-fi cinema, it surely would have made H.G. Wells grind his teeth if he had lived to see it. George Pal moved the Martian invasion to California (shades of the Boston *Post*), and gave the film a heavy-handed religious theme completely at odds with Wells' staunch rationalism. But the manta-shaped fighting machines floating gracefully through Los Angeles as they blast everything to smithereens are superbly done, and the hero is one of the better depictions of a scientist in cinema.

Sword and Planet

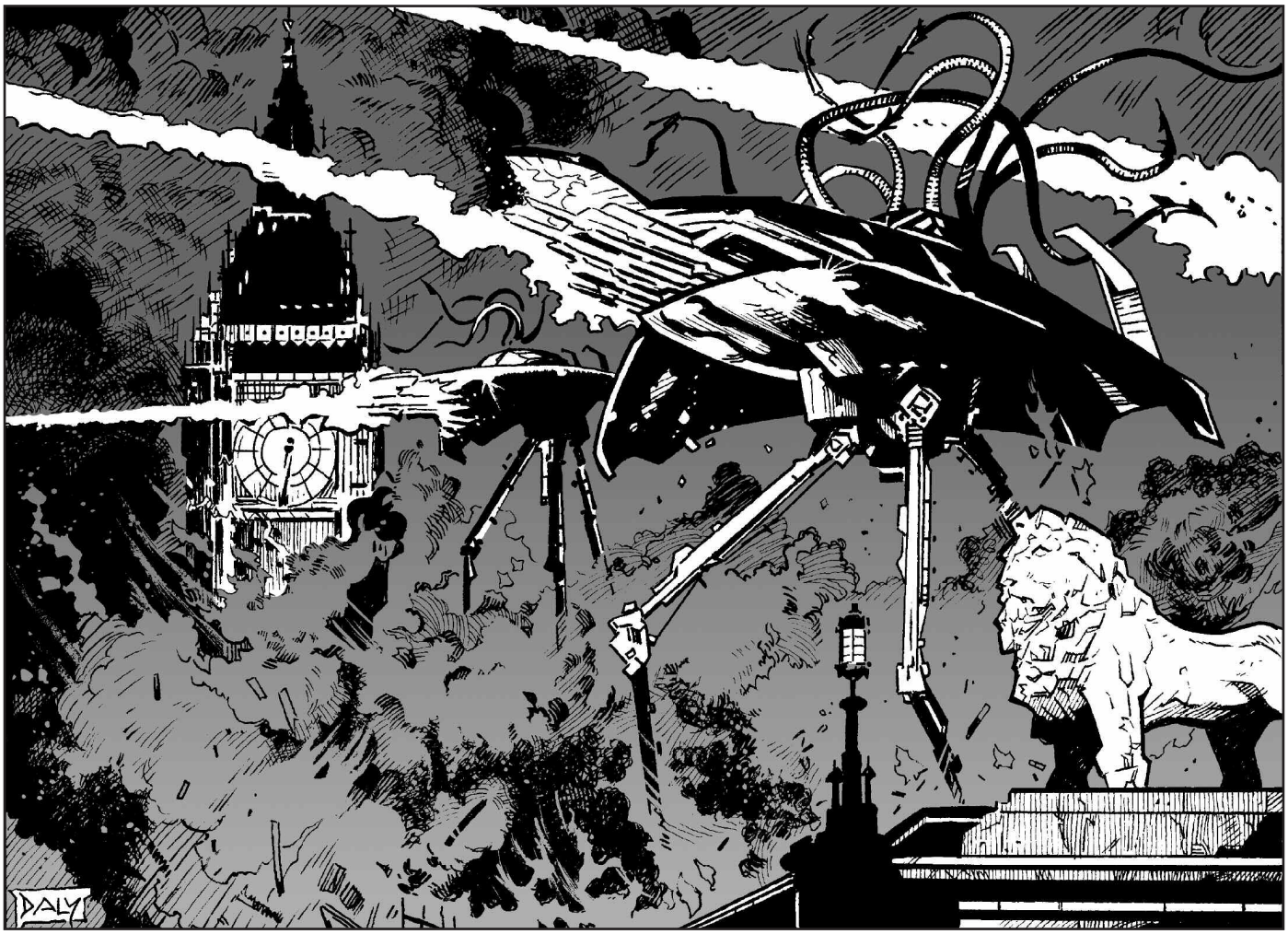
In 1912, the American writer Edgar Rice Burroughs painted a very different picture of Mars in his novel *A Princess of Mars* (originally published under the pseudonym "Normal Bean"). In that story, the mysteriously ageless Virginian soldier Captain John Carter wishes himself to Mars. There he gets involved with a tribe of four-armed desert nomads and the beautiful humanoid Dejah Thoris, princess of the Martian kingdom of Helium. Carter's exploits on Mars are made possible by his Earth-gravity muscles, his sense of decency, and a highly convenient telepathic ability which lets him understand the thoughts of Martians.

A flood of similar stories soon followed Burroughs, spawning the whole genre of "planetary romance" stories (also known as "sword and planet" epics). Interestingly, Burroughs himself may have borrowed some ideas from an earlier novel, *Lt. Gullivar Jones: His Vacation,* by Edwin Arnold. But it was the Burroughs Mars novels which attracted readers and imitators.

Between the two of them, Wells and Burroughs created the two visions of Mars which were to last for half a century in popular fiction: the Wellsian Mars was a place of menace, while that of Burroughs was a venue for romance. The simplest distinction is that things come *from* Wells' Mars, usually to conquer and destroy, while people go *to* Burroughs' Mars and have adventures there, generally involving beautiful princesses and dangerous animals.

Mars in Classic Science Fiction

As science fiction entered its golden age in the 1950s, writers began to develop a new version of Mars in place of the romantic Burroughs planet or the alarming Wells one. Authors like Robert Heinlein and Ray Bradbury imagined Mars as the New Frontier. In this version, the Martians were either absent entirely, or else a benevolent but declining elder race who had no objection to the Earthmen taking over their planet.



Heinlein and many others viewed this as a good thing, and often drew analogies between the Martian frontier and the history of America. Human colonists on Mars tended to wind up rebelling against Earth the same way the American colonists sought independence from Britain. When viewed from an increasingly crowded Earth locked into a menacing Cold War, the idea of a new frontier on Mars seemed very attractive indeed.

As scientists made more discoveries about inhospitable conditions on Mars, the idea of terraforming began to appear. In Arthur C. Clarke's *The Sands of Mars,* humans turn a marginally-habitable Mars into an Earthlike world by igniting one of the moons and spreading genetically-engineered plants.

Ray Bradbury and others took a more ambiguous attitude. Mars colonization might be inevitable, but there would be costs. In Bradbury's *The Martian Chronicles,* the Martians are fragile, highly-civilized beings who die of trivial childhood diseases brought from Earth. The human astronauts are often crude sorts, who drop beer cans in the canals and blow bits off the crystal towers with their sidearms to take home as souvenirs.

Space Age Mars

The study of Mars declined after the First World War. Part of the problem was the limits of Earth-based telescopes, and many astronomers were still reluctant to venture into what seemed crackpot territory. Spectroscopy did make it possible to learn a little about the composition of Mars' atmosphere; in 1952 scientists determined that the Martian atmosphere was largely composed of carbon dioxide. Estimates of the air pressure on Mars changed steadily, usually downward. In the 1920s the Martian atmospheric pressure was estimated at 26 to 66 millibars (3 to 6 percent of Earth's sea-level pressure); other results varied from 24 to 85 millibars until space probes could get better measurements in the 1960s.

As the Space Race between the United States and the Soviet Union got underway in the 1960s, the two spacefaring powers vied with each other to be the first to reach other worlds. Mars became an obvious goal, and the Russians wanted to be first. In 1960 and 1962 the Russians launched a total of five Mars probes, but bad luck dogged all of them, and it wasn't until the American Mariner 4 probe in 1965 that scientists on Earth could get a good close look at the face of Mars.

What they saw was startling, and completely overturned all previous notions of what Mars might be like. The surface of Mars was covered with craters, just like the Moon. That suggested a dead world, without rain or water to smooth away the craters. At a stroke, the Lowellian vision of Mars as a dry but potentially habitable planet was shattered.

But the real surprises waited until the Mariner 9 mission launched in 1971. Mariner 9 arrived at Mars during a vast planetary dust storm (two Russian probes orbited the planet at the same time and frustratingly used up all their film clicking photos of opaque yellow dust; a Russian lander plunged into the storm and was lost). As the dust settled, amazing new features began to appear. The first things to show above the dust were the spectacular peaks of the Tharsis volcanoes. Somewhat later the vast Marineris canyon system (named for the probe) emerged. When Mariner 9 finished its survey of Mars, it had established the modern picture of the planet – a world that wasn't like Earth, wasn't like the Moon, wasn't like anything except Mars.

Martians and Popular Fears

Wells' novel was a best-seller in the 1890s, reprinted in magazines and followed by imitations, parodies, and quasi-sequels. Orson Welles' 1938 radio version caused a panic in the United States, and two more panics when adaptations were aired in South America. While George Pal's 1953 film was only a modest success commercially, it helped define what became a dependable film genre: the story of alien invasion.

What made the idea of invasion from Mars so compelling?

Wells' novel was part of a whole series of novels in the pre-World War I decades about the invasion of Britain by a hostile power. *The Battle of Dorking,* by George Chesney, was the most famous fictional invasion, describing a Prussian landing which catches England unprepared. During those decades Britain's unchallenged position as the world's sole "superpower" was crumbling as Germany, America, and even Japan transformed themselves into major naval powers. British readers worried about their nation's declining position and worried about what might happen if a superior adversary were to appear.

Orson Welles' radio program hit the airwaves during another nervous period. Hitler had annexed Austria and Czechoslovakia, and was preparing the invasion of Poland which began World War II. In China, the Japanese had already sacked Nanking, killing hundreds of thousands of civilians. The world was moving toward war, and America no longer seemed safe. Welles' radio "news bulletins" about invaders were a lightning-rod for war fears.

In 1953, the United States had emerged from World War II as the most powerful country in the world, but already new threats were replacing the Nazis and the Japanese. The Berlin Airlift had just ended, United Nations troops were battling the Communists in North Korea, and the Russians had tested an atomic bomb. The prologue to the film *The War of the Worlds* described the destruction of World War I and World War II, which paled by comparison with what the film's Martians could do. The parallel with the Communist threat was obvious. And for anyone in the audience who missed the connection, the film *Red Planet Mars* hammered the point home.

Viking and Pathfinder

The Viking probes launched in 1975 were intended to settle the question of life on Mars once and for all. The two orbiters mapped the planet in detail, while the two landers gathered and analyzed soil samples. But the first results were puzzling: when treated with a nutrient solution, the Martian dirt gave off oxygen – usually a sign of life. But the rate of release was unexpected. After some laboratory experiments the researchers realized that the Martian soil was loaded with oxidant chemicals, which were reacting with the water and carbon compounds in the nutrient. Far from harboring life, the surface of Mars was a pretty good antiseptic!

The limits of the Viking probes were frustrating. They were static, and their digging arms could only reach a single spot on the surface. The experiments, which had seemed so thorough when the probes were designed, raised more questions than they answered. Still, they did return valuable weather and temperature data, information about the composition of the soil and atmosphere, and the orbiters made comprehensive maps of Mars. The Viking 1 lander is now known as Mutch Memorial Station, in honor of Tim Mutch, the leader of the lander imaging team, who died in an accident.

A delay of two decades followed. NASA was putting all its resources into getting the Space Shuttle operational, and then had to cope with the *Challenger* explosion and its repercussions. It wasn't until 1996 that the Mars Pathfinder probe reached Mars. Pathfinder carried a mobile exploring robot, the Sojourner rover, which could examine rocks close-up and study their composition with an X-ray spectroscope. Pathfinder was a kind of "garage band" project, intended to keep costs down and use off-the-shelf technology. It relied on a combination of aerobraking, parachutes, retrorockets, and giant air bags to bounce to a safe landing. To the surprise of NASA's brass, Pathfinder and the plucky little rover were overnight celebrities, and the Jet Propulsion Laboratory's website logged a record number of "hits" as people all over the world came to see the latest pictures from Mars. Mars was cool again.

The New Mars in Fiction

The images of Mars returned by the Mariner probes struck down the old science fiction vision of a dry but habitable planet, and for a time stories about Mars dwindled as authors tried to assimilate the new discoveries. The 1980s saw a resurgence, as Mars became a powerful symbol for SF writers urging a return to space and interested in the possibilities of terraforming. Kim Stanley Robinson's trilogy *Red Mars, Green Mars,* and *Blue Mars* is the most prominent example. Terry Bisson's novel *Voyage to the Red Planet* satirized the notion of privatized space exploration.

The end of the century brought a small spate of Mars movies, possibly inspired by the success and popularity of the Pathfinder mission. The films *Mission to Mars* and *Red Planet* (no relation to the Heinlein novel of the same name) had only lukewarm success at the box office.

Given Mars' key place in the history of science fiction and its status as the obvious next target for space exploration, it's likely that creators of fiction will continue to visit Mars in stories, books, movies, and even roleplaying games.

Mars Probes

Next to the Moon, Mars has been the most attractive target for space probes launched from Earth. The possibility of life there always intrigued scientists and kept the public interested. But the actual record of Mars probes shows a startling number of failures. NASA engineers began to joke about the "Great Galactic Ghoul" lurking between Earth and Mars back in the days of the Mariner probes, but the crash of the Mars Polar Lander in 1999 shows the Ghoul is still on duty. The list of hits and misses:

Marsnik 1 (Russia, 1960): failed on launch.
Marsnik 2 (Russia, 1960): failed on launch.
Sputnik 22 (Russia, 1962): failed to leave Earth orbit.
Mars 1 (Russia, 1962): telemetry lost in flight.
Sputnik 24 (Russia,1962): failed to leave Earth orbit.
Mariner 3 (United States, 1964): shroud failed to separate after launch.
Mariner 4 (United States, 1964): successful flyby.
Zond 2 (Russia, 1964): telemetry lost in flight.
Mariner 6 (United States, 1969): successful flyby.
Mariner 7 (United States, 1969): successful flyby.
Mars 1969A (Russia, 1969): failed on launch.
Mars 1969B (Russia, 1969): failed on launch.
Mariner 8 (United States, 1971): failed on launch.
Cosmos 419 (Russia, 1971): failed to leave Earth orbit.
Mars 2 (Russia, 1971): probe reached Mars, lander crashed.
Mars 3 (Russia, 1971): probe reached Mars, lander lost contact shortly after touchdown.
Mariner 9 (United States, 1971): long successful mission.
Mars 4 (Russia, 1973): failed to orbit Mars.
Mars 5 (Russia, 1973): successful orbiter mission.
Mars 6 (Russia, 1973): communication with lander lost.
Mars 7 (Russia, 1973): lander missed.
Viking 1 (United States, 1975): successful landing in July 1976.
Viking 2 (United States, 1975): successful landing in September 1976.
Phobos 1 (Russia, 1988): failed in flight.
Phobos 2 (Russia, 1988): reached orbit but systems failed.
Mars Observer (United States, 1992): contact lost in flight.
Mars Global Surveyor (United States, 1996): long successful mission.
Mars 96 (Russia, 1996): launch failure.
Mars Pathfinder (United States, 1996): successful landing.
Mars Climate Orbiter (United States, 1998): smacked into Mars due to guidance error.
Mars Polar Lander (United States, 1999): crashed.
Deep Space 2 (United States, 1999): crashed along with Polar Lander.
2001 Mars Odyssey (United States, 2001): in orbit October 2001.
Nozomi (Japan, 1998): due to arrive in 2003 – good luck!

CHAPTER 2

MARS IN REALITY

The secular cooling that must some day overtake our planet has already gone far indeed with our neighbour. Its physical condition is still largely a mystery, but we know now that even in its equatorial region the mid-day temperature barely approaches that of our coldest winter.

– H.G. Wells, The War of the Worlds

Basic Physical Data

The Planet

Mars is smaller and less dense than Earth; had it been only a little bigger or more massive, it might have had a very different history.

Mars has a mean radius of 3,390 kilometers, or 2,086 miles. Its surface area is 54.7 million square miles, or about 28% of Earth's surface area. But a lot of Earth is covered by water, so the area of Mars is only slightly less than Earth's land surface. There's plenty of room on Mars.

The density of Mars is 0.715 times that of Earth, or about four times that of water. This suggests that Mars has a smaller metallic core than Earth does, generating less heat and releasing smaller amounts of volatiles into the planet's atmosphere. Mars' smaller and less active core may also be the reason it has almost no magnetic field.

The gravity on Mars is 0.38 standard G, varying slightly between the poles and the equator because of the planet's rotation and its slightly irregular shape. The low gravity means relatively low orbital and escape velocities. To reach low orbit around Mars a spacecraft has to be going 2 miles per second, as opposed to the 5 miles per second required for low Earth orbit. Escape velocity for Mars is only 3 miles per second, less than half of Earth's. This could be an important fact in the economics of a colonized Solar System: it's much cheaper to lift things off of Mars than it is to lift them off Earth, so Mars, not Earth, may wind up the commercial hub of the system.

The Surface of Mars

Mars' surface can be divided into two main regions. The southern hemisphere is mostly high-elevation land, heavily cratered and very old. Most of the northern hemisphere is lowland, and appears to be smooth and relatively young. Overlaid on this basic geography are several major features which have shaped the face of Mars. In the south there are two big impact basins, Argyre and Hellas. The northern hemisphere has two immense volcanic formations, Tharsis and Elysium, where the surface has bulged upward. Both are studded with volcanoes and cut by channels carved by water.

The surface of Mars has several different sorts of terrain, depending on where you happen to be. In the southern highlands bare plains alternate with craters. Little is known about what the southern plains are like, but they are thought to be mostly basalt rock, shattered by impacts and frost heave (when the surface is cracked by water-laden soil beneath it that expands as it freezes), and covered with a layer of sand and dust.

The northern plains are where all of Earth's probes to Mars have landed, so we have a very good idea of what the terrain there is like: wide, level plains of red sand dotted with rocks. There are a good many craters, but they are less common than in the south and are generally smaller and younger. The northern plains are marked by old channels cut by water.

In the volcanic uplands, orbiter images show huge lava fields and numerous cracks and chasms. Craters are uncommon. The sides of the great mountains are gently sloping layers of ancient lava, overlaid with a little dust.

The canyons are slope-sided and generally flat-bottomed. At the bottom the canyon walls are shallow slopes of mixed dirt and rock from old landslides, getting progressively steeper as one goes up; the top edges are almost vertical in places. The canyon floors are probably much like the lowland plains – sand and rock marked by water flows. Craters are rare to nonexistent, suggesting that the channels are only a few million years old.

At the north and south poles of Mars are the polar caps. The two polar caps are quite different, because Mars' eccentric orbit, coupled with its axial tilt, gives more extreme seasons to the southern hemisphere. During the southern summer, the south polar cap is composed only of water ice, but during winter it grows tremendously as some 30% of the planet's atmosphere freezes out as dry ice. The northern hemisphere has a less extreme climate, so the north polar cap has a permanent core of water ice, which gains an extra dry ice layer during winter.

The Interior

At present scientists are unsure about the composition of the core of Mars (they're still arguing about the core of the Earth, for that matter). Either it is a metallic core like Earth's, about 600 miles across, surrounded by a layer of mixed liquid iron and sulfur, or else a larger core of mixed iron and rock. It is thought that the core itself is solid. The mantle of Mars is about 1,500 miles thick, composed of molten rock.

The crust is thick and composed of low-density material. The mean thickness has been estimated at 20 to 100 miles. The crust is generally thicker in the southern hemisphere and the Tharsis bulge region, thinnest in the bottom of the Hellas impact basin. Terraformers trying to warm up Mars by releasing some of its internal heat should dig their thermal taps in Hellas.

Mars has a very weak to nonexistent planetary magnetic field, no more than 1/3,000th as strong as Earth's (if it is there at all). This may be due to the planet's smaller, less active core. This makes it impossible to navigate on the surface with a compass, and it also means Mars doesn't have as much protection from cosmic radiation. Earth's magnetic field catches charged particles and funnels them into the polar regions (creating spectacular aurora displays). Interestingly, the oldest parts of the Martian surface are weakly magnetic, suggesting that in the distant past the planet had a stronger magnetic field.

Motion

It was the motion of Mars in the sky which first made humans aware that it was no ordinary star. Since Earth and Mars circle the Sun at different speeds, periodically Mars appears to reverse direction as it moves through Earth's night sky, a phenomenon known as "retrograde motion." All planets periodically do this as seen from Earth, but Mars' retrograde motion is the most obvious. Explaining this odd behavior eventually led astronomers to realize that Earth, like Mars, goes around the Sun.

Orbital Data

Mars orbits the Sun at an average distance of 141,700,000 miles, or 1.524 AU (one AU is the average distance from Earth to the Sun). Compared to Earth, Mars has a fairly eccentric orbit, its distance from the Sun varying from 1.38 AU to 1.67 AU over the course of the Martian year. The eccentricity of Mars' course around the Sun affects its climate. At aphelion, when it is furthest from the Sun, it gets only 70% as much solar energy as it does at perihelion. Martian aphelion comes at the beginning of winter for its southern hemisphere, so southern winters are much colder than northern ones. At perihelion, the northern winter is just beginning, and the combination of more solar energy and a generally thicker atmosphere over the northern hemisphere of Mars means northern winters aren't nearly as severe. (Though by Terran standards, they're still amazingly cold.)

Mars' orbit is inclined 1.85° to the plane of the Earth's orbit, which complicates the job of spacecraft trajectory planners but has no effect on Mars itself. Mars' mean orbital velocity is about 15 miles per second, as opposed to Earth's 18.5 miles per second speed. Spacecraft must be able to change their speed by 3.5 miles per second to get from Mars to Earth (vehicles from Earth can shed some of their extra speed at Mars rendezvous by aerobraking).

Axial Tilt

At present, Mars has an axial tilt of 25.19°, only a little more than Earth's 23° tilt. We say "at present" because Mars' axial tilt changes over time. Earth's axis is stabilized by the influence of the Moon, but Mars' moons are too tiny to help. So the Martian axial tilt changes over time, swinging between 15° and about 40°. The cycle takes about 100,000 years, and affects the entire planetary climate. When the tilt is at its greatest, the polar caps disappear and the water and dry ice they contain are dispersed across the planet. This in turn causes the axis to swing back towards vertical again, concentrating material at the poles. To make matters even more complicated, the changes in axial tilt are part of a much larger cycle linked to Mars' orbital precession (it wobbles as it spins) and the flexing of the crust under its polar regions. Over the course of about 2 million years the axis shifts go from extremely small changes to broad swings and then back again.

GMs who want to make Mars the home of some ancient lost civilization can use the axial tilt cycle as a convenient and relatively plausible explanation for why the planet might once have been more habitable. Perhaps Mars is just in the middle of an exceptionally severe planetary ice age, and the Martians are waiting in underground refuges for conditions to improve.

Conditions

So what's it like on Mars right now? The Viking and Pathfinder landers have sent back hard data, and scientists have used that as a baseline to determine conditions elsewhere on Mars based on orbital sensors, so we have a pretty good idea.

Time on Mars

One remarkably Earthlike feature of Mars is its day length. Mars' solar day, known to scientists as a "sol," is only 37 minutes longer than Earth's day. (They use the term "sol" instead of "day" to make it clear that they aren't talking about Earth days.) How explorers and colonists on Mars will deal with the extra half-hour has provoked some discussion. They could simply reset their clocks every noon or midnight to stay in synch with the sunrise, or they could ignore the Martian time and stick to Greenwich standard, going to bed and waking as convenient. Others have proposed adopting a Martian hour with 61.5 minutes, or perhaps a Martian second 2% longer than an Earth second. This seems very impractical, since the standard second is a critical unit in all physics and engineering calculations, so it is likely that only fanatical "Martian Nationalists" and other eccentrics would adopt it.

The Martian year is about twice as long as an Earth year: 687 standard days, or 668.6 Martian sols. Mars enthusiasts have already developed a Martian calendar, with "months" based on what sign of the zodiac the Sun is passing through. Because of Mars' eccentric orbit, the months are not uniform in length. The Martian calendar begins on the vernal equinox, the first sol of Gemini (61 sols). Then follows Cancer (65 sols), Leo (66 sols; Mars is at aphelion on Leo 24th), Virgo (65 sols, northern summer solstice), Libra (60 sols), Scorpio (54 sols), Sagittarius (50 sols; the autumnal equinox is Sagittarius 1st), Capricorn (47 sols), Aquarius (46 sols, the shortest month; Mars reaches perihelion on Aquarius 16th), Pisces (48 sols, the winter solstice is the first day of Pisces), Aries (51 sols), and Taurus (56 sols).

What to Wear

Visitors to Mars have to wear spacesuits not very different from those used on the Moon. Even on the rare occasions when it's not too cold outside, the air pressure is so low astronauts risk getting burst blood vessels, ruptured eardrums, and lung damage. The raw ultraviolet can burn exposed skin. Air tanks and a facemask are essential.

Calling Home

The distance between Earth and Mars means a significant delay in any kind of communication. At opposition, when the two worlds are closest, the time lag is only 4 minutes, but the average delay is 13 minutes. When Mars and Earth are on opposite sides of the Sun the delay is 21 minutes, and interference from the Sun itself may make relay satellites necessary. All this means space probes must be automated, and astronauts have to communicate by sending bulletins and email, rather than having real-time conversations with the folks back at Mission Control.

Climate

The simplest description of the Martian climate is "cold." The average surface temperature is 210.1 kelvins, or -80° Fahrenheit. On the warmest days of summer parts of the surface can reach highs above 80°, but don't bother packing any beachwear, because the temperature drops back down to subzero at night even on the warmest days. The daily temperature swing is about 110° Fahrenheit. At its coldest, Mars can be very cold indeed: as low as -200° Fahrenheit. That's cold enough to make the carbon dioxide in the air freeze into dry ice.

The thin atmosphere also means the temperature drops off very rapidly with altitude. As little as 6 feet above the surface the temperature may be 50° lower than it is at ground level.

Another term for the Martian climate is "dry." Although water may be relatively abundant on Mars, most of it exists in the form of ice. What little water vapor there is in the atmosphere never falls as rain, although it can sometimes form frost on cold rocks overnight. This doesn't mean that water *can't* exist on Mars, as the various water-sculpted surface features indicate, but it never comes in the form of rain. When geological processes do release water onto the Martian surface, it remains liquid only temporarily, either freezing or evaporating.

Atmosphere

The atmosphere of Mars is very thin – mean surface pressure is about 6.4 millibars. That's slightly more than half of 1% of Earth's air pressure. The air on Mars is 95% carbon dioxide, just under 3% nitrogen, 1.6% argon, and small amounts of oxygen, carbon monoxide, water vapor, neon, krypton, xenon and ozone. Since a large proportion of the carbon dioxide freezes out onto the south polar cap each southern winter, the atmospheric pressure varies by as much as 37% during the year. That means the trace gases make up a larger proportion of the atmosphere when the carbon dioxide is missing.

The Mean Datum

Mars has no seas, so it has no sea level. But scientists needed to come up with some standard yardstick for measuring altitude on Mars. The result is known as the "Mean Datum." Originally it was defined by air pressure, but the tremendous variation in Mars' atmosphere made this very hard to measure with any consistency. More recently the mean datum has been defined in relation to the shape of the planet determined by gravitational measurements.

The mean datum has recently been moved up, in the wake of more detailed mapping by the Mars Global Surveyor probe; where once the summit of Olympus was pegged at 27 kilometers, it's now 21, while the bottom of the Hellas basin has moved downward to -8 kilometers. Anyone using an older atlas should adjust all heights downward by about 5 kilometers.

Besides varying with the seasons, the air pressure on Mars varies with height. In deep basins like Chryse Planitia or the ancient Hellas impact crater, pressure can approach 7 millibars. Conversely, in high regions like the Tharsis bulge or the southern uplands, it can be as low as 4 millibars, and atop Olympus Mons or Ascraeus Mons it is only 1 millibar – about as thick as the "vacuum" inside a vacuum chamber on Earth.

From the surface, the sky on Mars is a pale gray, often tinted pinkish-brown by airborne dust. From time to time it is flecked by white clouds of water ice, or completely obscured by dust storms.

Winds at the surface of Mars are usually gentle, no more than 20 miles per hour. In severe windstorms it can gust up to 100 mph. Since Martian atmosphere is so much thinner than that of Earth, even a very strong Martian wind doesn't exert much force. To a human, Martian gusts feel about 1/100 as powerful as a comparable wind on Earth, so a 20 mph breeze is barely detectable and a 100 mph gale feels about as strong as a gentle breeze.

Soil

The soil analyzed by the Viking and Pathfinder landers was roughly half silicon dioxide (sand) and about 20% iron oxide (rust). The remaining third was a mix of oxides of aluminum, sulfur, magnesium and calcium. The abundant iron and sulfur mean that the Martian dirt really is red. There were also smaller percentages of sodium and potassium compounds, titanium and chromium oxides, chlorine, and about 1% water. Ultraviolet radiation has made the Martian surface rich in oxidant chemicals, salts, and alkaline compounds. Like the antiseptic hydrogen peroxide, they react vigorously with carbon compounds, releasing carbon dioxide gas as they tear complex molecules apart.

This means that the Martian soil is very inhospitable to life. The combination of antiseptic soil and deadly ultraviolet radiation makes the surface of Mars a very effective sterilizer. Mars explorers will have to protect themselves from contact with dust, as it would be a serious irritant and might cause respiratory problems if inhaled.

Water

The big question about water on Mars is how much is there. Scientists have calculated how much there *could* be, and where, but until somebody goes there to look, the matter remains in dispute. Recent probes have detected the mineral hematite, which on Earth only forms in the presence of water, and high-resolution orbital photographs show what appear to be recent channels cut by water.

There is water in the Martian atmosphere, and the polar caps do contain a substantial amount. There is even a tiny water cycle: during the Northern summer ice and water in the soil turns to vapor in the atmosphere, and during the winter it condenses out in the soil and the North polar cap. The South polar cap apparently contains much less water, and a greater proportion of frozen carbon dioxide. The constant heating and condensing tends to concentrate water in the

polar cap and the northern plains, and it is doubtful that there is any water on the Martian surface between about 30° north and 30° south latitudes.

The soil on the surface gets heated by the feeble Martian sunlight enough to cook out any moisture, but a few hundred feet down the temperature is stable – and cold: -60° Fahrenheit. Scientists have postulated a Martian "cryosphere," a layer of crust permeated by ice. The cryosphere would be 600 feet or so below the surface in equatorial regions, gradually rising to meet the surface at the polar caps. The base of the cryosphere is anywhere from a mile below the surface (at the poles) to 3 miles down at the equator.

On Earth, if you go deep enough underground the temperature starts to increase. The same is true on Mars. The cryosphere sits atop a layer of crust permeated by liquid water, about half as thick as the cryosphere itself. The frozen layer keeps the liquid water trapped, but from time to time the underground water can break through, which is thought to be the source of channels like Kasei Vallis.

The cryosphere is essentially an underground frozen planetary ocean; depending on how porous the Martian crust actually is, it represents enough water to cover Mars to a depth of 1,800 to 4,500 feet! Of course, that assumes the water is really there; all the calculations are based on how much there *could* be. The most conservative estimate, based on the amount of water in the surface analyzed by probes, suggests only enough water for a 100-foot ice layer; the amount of water needed to carve the channels observed on the surface would indicate a quarter-mile-thick ice layer. And based on the element ratios Mars should have had when it formed, the ice/water layers could be as thick as 4,500 feet.

One theory holds that the water on Mars all flowed into the northern lowlands and soaked into the soil, freezing into permafrost. Over time, windborne dust covered the dirty ice, creating the featureless plains of Acidalia and Utopia Planitia. Lowlands like Chryse Planitia and Hellas may also contain abundant subsurface permafrost, and some scientists think the smooth plains of Solis Lacus and Noachis may indicate ice. Features like the "splosh" craters suggest a surface rich in ice or permafrost, while sinkholes and features like Hebes and Juventae Chasma suggest subsurface liquid water.

What all this means for humans on Mars is this: there's water around somewhere. If it's relatively abundant, people only need to drill down a few hundred feet on the planet to hit ice. Deep bores can release hot subsurface water, and terraformers need only warm up the planet to create generous oceans. Life may exist in the deep liquid layer. If water is more scarce, then the cryosphere is likely to be patchy, with most of the water concentrated in places like the northern plains and the floor of Hellas; the deep liquid layer would exist only as isolated "lakes" trapped by ice domes. The campaign settings in Chapter 4 and Chapter 5 both assume relatively abundant water.

Resources

One of the things which makes the exploration and colonization of Mars so attractive is that it has so many of the things humans need. Astronauts and settlers won't have to bring along everything they require; they can live off the land. That's good, because the idea of supporting a base at the end of a 40-million-mile supply line is monumentally impractical.

Atmosphere

The Martian atmosphere is very thin and unbreathable, but it can still be a very useful resource. Carbon dioxide from the Martian air can be combined with hydrogen to produce oxygen and methane (this is the key to the Mars Direct mission plan). It can also be a source of breathing oxygen, either created by plant photosynthesis, or by brute force superheating to break up the carbon dioxide molecules. Carbon dioxide is essential for the growth of plants, and in fact green plants thrive in much higher concentrations of carbon dioxide than humans can stand. Experiments at the University of Florida indicate that some Terran plants can live at pressures of 25 millibars, and a little selective breeding might produce varieties which can survive at Mars surface pressure.

Plants produce oxygen, of course, but current Terran plants are adapted to an atmosphere containing free oxygen for respiration, so initially the greenhouses would need a little oxygen "feedstock" to keep the plants alive until they can start conducting photosynthesis. Since there are algae and other plants which thrive in oxygen-poor environments on Earth, some elementary genetic tweaking could produce plants capable of living in pure Martian air by the time large-scale colonization gets underway.

Other gases in the Martian atmosphere are potentially useful. Nitrogen makes up only 3% of the Martian air, but it can be concentrated and compressed to provide the basis for an Earth-normal atmosphere inside habitats. Argon is less abundant, but could be extracted to fuel ion-drive spacecraft.

Water

By far the most important resource on Mars is water. Humans need water to drink, water can supply oxygen for people to breathe, and water can supply hydrogen and oxygen fuel for rocket motors and fuel cells. In a fusion-powered future society, Martian water represents a source of deuterium. Estimates of the water content of Martian surface soil range from 1% to 10%, so astronauts anywhere on Mars could get at least a little water just by heating up dirt. It would take some 400 pounds of dirt to supply one human's daily water requirement, so explorers will probably want to look for richer sources.

The underground cryosphere and aquifer are a potentially abundant source of water. Tapping into the underground supplies would require drilling down at least 600 feet. One of the early pieces of heavy equipment NASA planners hope to send to Mars is a 1-kilometer drill to settle the question once and for all. If the water-rich cryosphere really exists, Mars bases can get plenty water by just pumping down boiling water to "prime the pump" and melt out some ice. If colonists want to get serious, they can use deep oil-drilling technology and go right down to the warm levels below the cryosphere in search of hot running water which can also supply power.

Dirt

Dirt is useful as protection from radiation, which is especially important given how thin the Martian atmosphere is. Mars habitats are likely to be sheltered under a layer of dirt several feet thick. Martian dirt is especially good as a building material – when wetted it forms a kind of natural concrete almost as good as the stuff used by builders on Earth. Reinforced with fibrous material (cloth, glass fiber, or plant cellulose) it would be entirely suitable for building permanent structures.

Growing plants in Martian dirt requires more than just filling a pot with soil. It's very salty and lacks organic compounds. See p. 75 for more on how to make Martian soil fertile.

Iron and Other Metals

Iron makes the Martian surface red, and iron is the easiest metal to extract and process on Mars. Using hydrogen gas or carbon monoxide (both of which are by-products of making oxygen from water or carbon dioxide), the red iron oxide in the soil can be turned into pure iron. This is fairly basic TL5 chemistry. The pure iron can then be smelted and worked using techniques known on Earth for millennia. This means that locally-built equipment on Mars won't be able to use any of the lighter "expensive" or "advanced" materials from ***GURPS Vehicles,*** sticking instead to cheap, heavy iron.

Other metals also exist in the Martian regolith (loose surface rock fragments): aluminum, magnesium, and titanium are fairly abundant. However, they're all bound up in oxygen compounds which take a *lot* of energy to break up. (On Earth, aluminum smelters are some of the most energy-intensive industries in existence.) It's unlikely they'll be useful until the Mars colony is big enough to support a large industrial base.

Smelters tend to be large machines, built for economy of scale rather than compactness. A small multipurpose electric smelting furnace designed for transport to Mars would probably weigh about 300 lbs., occupy 30 cubic feet, and cost $560,000. It could process a ton of Martian soil per day, yielding about 100 pounds of useful metal, requiring 100 kilowatts of power.

Energy

Solar power on Mars is about 45% as effective as on Earth. The actual power output is greater in summer and in the middle of the day, lower in winter and at sunrise or sunset, so bases probably should have about double standard capacity. One problem with solar power generation on Mars is dust accumulation on the solar cells (see p. 20). Their sheer bulk also limits their usefulness for highly power-intensive applications like heavy industry.

Another potential energy source on Mars is geothermal power. If Mars has a deep hot liquid layer, it could be a valuable source of power. The hot water boiling into steam at low Martian pressures could drive turbines directly, or the temperature difference could power solid-state thermocouples.

Windmills are another source of energy for Martian outposts, although the low mass of the Martian air means really big blades are necessary. A one-kilowatt wind turbine would be about 200 feet across! There may be good spots on the planet with strong, constant winds – the big east-west channel systems could act as wind funnels – and Mars colonists could well decide to fill them up with windmills.

Hazards

The four biggest dangers faced by astronauts on Mars are the unbreathable air, the low pressure, the extreme temperatures, and the high levels of radiation. Humans *must* have protection from those dangers at all times on Mars.

Air

Martian air is simply unbreathable by humans. There's no oxygen, and the pressure is so low it's almost a vacuum. Even at Earth-normal pressures, the carbon dioxide levels would cause swift death.

A human can't hold his breath in vacuum, and might rupture his lungs trying. The only safe way to enter vacuum is to exhale, leaving the mouth open. This allows a person to operate on the oxygen in his blood for (HT) seconds if active, four times that if moving slowly, or 10 times that if passive. Double these times if he hyperventilated first; quadruple them if he did so in pure oxygen. Halve these times if caught by surprise with no time for one deep breath.

Once out of breath, one point of fatigue is suffered per turn; when ST reaches 0, the victim falls unconscious. Four minutes later, he dies. There is a chance of brain damage (permanent -1 to IQ) if the victim is saved after more than two minutes without air; roll vs. HT to avoid this.

The chance of suffocation on the surface of Mars is actually fairly small, since carbon dioxide poisoning is likely to get you first. In addition to the suffocation damage above, humans exposed to the atmosphere take 1 ST damage per turn as fatigue; once 0 ST is reached, the character passes out and takes 1 hit of damage every (HT) seconds.

A sudden drop in pressure (say, from structural failure of a habitat, or being tossed out an airlock) can cause damage to all exposed tissues as blood vessels rupture and fluids boil. The most vulnerable parts of the body are the eardrums, eyeballs, and lungs. Characters suddenly exposed to Mars surface pressure suffer 1d damage; if they survive the incident they must roll HT+2 for each eye to avoid blindness, roll HT to avoid getting the "bends" and suffering a -1 DX penalty, and roll HT-1 to avoid ear injury causing the Hard of Hearing disadvantage.

The thin Martian air doesn't carry sound as well as Earth's atmosphere does, so it's hard to hear anything, especially with a helmet on. The speed of sound on Mars is 540 miles per hour (lower than on Earth). All hearing rolls or sound-based sensors suffer a penalty of -12. Geophones, which detect vibrations carried through the solid ground, have no penalty.

What Mars Doesn't Have

Mars lacks a great many resources which people on Earth take for granted. Besides the obvious lack of breathable air or liquid water, Mars is also missing anything created or concentrated by living things, flowing water, or plate tectonics. Here is a short list of things not to look for on Mars:

Carbon compounds: Most sources of carbon on Earth are created by living things. With no life, Mars doesn't have coal, oil, or natural gas. It probably doesn't have limestone or chalk, though it might have analogous materials created by inorganic processes. There is plenty of carbon, in the form of carbon dioxide or carbonate compounds in the soil. None of them can be used as a source of energy.

Water products: Though Mars probably did have flowing water at some point in its history, it obviously never had as much as Earth, and never as long as Earth. Besides being necessary for life, water on Earth served to dissolve and concentrate many minerals and substances. Most of Earth's metal ore veins are the result of water. Mars probably won't have as many easily-mined veins of ore as Earth does, but the few it has haven't been mined out the way Earth's have.

Geological Activity: It appears that Mars has been generally less active than Earth or Venus through most of its history. There are no signs of plate tectonics, no planet-girdling belts of fault lines, no subduction zones, and fewer volcanoes. Less geological activity means less material brought up from the planetary interior, and less recycling of material in the crust. This suggests the Martian crust is likely to be metal-poor, especially in radioactive elements, since any present have long since decayed away.

Dust

The surface of Mars is covered with dust, ranging from fine sand to particles like talcum powder. Because of the extreme dryness of the atmosphere, the dust doesn't stick together well. It poses a hazard to visiting astronauts for several reasons.

First of all, the dust is chemically reactive. It is rich in peroxide, salt, alkalines, and other active chemicals. Humans exposed to it will get irritated eyes and mucous membranes, and breathing dust is sure to cause lung irritation or allergic reactions. Mars explorers may need to wear simple filter masks even *inside* their habitat units if too much dust gets tracked in. In ***GURPS*** terms, anyone exposed to airborne dust must make a HT roll each day of exposure (under more severe conditions, like a heavy dust storm or poor cleaning protocols, the GM may require this roll more often, or at a penalty, or both). On a successful roll the dust has no effect; on a failed roll the victim suffers a -1 penalty to HT for the next 24 hours because of respiratory problems, and on a critical failure he also takes 1 point of damage.

Random air currents gradually deposit a film of dust on any exposed surface. This is a problem for solar cells and optical sensors. Performance degrades by about 1% for each day left unattended in the Martian environment. Anyone can easily restore such equipment to full function with a whisk broom or dust rag.

Dust becomes a serious hazard during dust storms. These are most common during the early summer months in Mars' southern hemisphere. As the frozen carbon dioxide in the south polar cap turns back into a gas, it makes the atmosphere considerably denser and churns up powerful winds in the process. Wind speeds of up to 100 miles per hour have been measured in these dust storms. The size of a storm is generally about half a million square miles, but at times storms can cover an entire hemisphere or even the entire planet (as happened in 1971 when the Mariner 9 probe first arrived). A typical dust storm will last 2d weeks (2d+2 for hemispheric or greater).

Smaller dust devils, resembling Earthly tornadoes but sometimes measuring half a mile across, are very common in the Martian plains. The thin air makes the winds relatively harmless, but as their name suggests, dust devils do kick up dust. Travelers on the Martian surface can avoid dust devils with a successful Driving or Survival skill roll. Driving through a dust devil is like experiencing a dust storm lasting only 1d minutes (3d minutes if caught on the surface on foot).

When the air is full of dust it naturally obscures the Sun, reducing available solar energy by 40% in a small dust storm and as much as 70% in a large one. The dust particles rubbing against each other can build up a powerful electric charge, making them adhere to surfaces. A solar array or the windows of a vehicle can quickly get coated with dust during a storm, becoming totally useless after about an hour. The low-tech way to solve this problem is to send someone out with a brush after the storm has passed. A more sophisticated method involves counter-charging the vehicle to repel dust (use the statistics for an electrified surface from ***GURPS Vehicles***, p. 93, dividing weight, cost and power consumption by a factor of 10). Astronauts driving a vehicle coated with dust, or trying to do anything with a dust-covered spacesuit faceplate, suffer the same penalties as characters operating in heavy smoke or thick fog: -4 to skill. Headlights do *not* help in a dust storm (they just show the dust more clearly), and the static electricity makes radar equally useless.

In high winds, airborne sand (larger particles than dust) can become a harsh abrasive, scouring surfaces like sandpaper. As on Earth, this only becomes a problem when the wind speeds are very high – 50 miles per hour or higher. Even then, sand can't harm most vehicles or habitats, but it can scratch up windows, solar panels, and helmet faceplates. For every hour a window is exposed to high-velocity windblown sand, it acquires a *permanent* -1 for all vision rolls or vehicle control rolls made by somebody looking through it. Solar panels lose 5% of their generating capacity for each hour of sandstorm abrasion.

The high-tech way to cope with abrasion is to add a layer of superhard transparent material (diamondoid or some similar high-tech material) which can withstand the windblown particles. This would cost about $10 per square foot (it's bought as DR 0.1 advanced composite armor with the Very Fine quality multiplier). The low-tech way is to add a removable outer layer of plastic film on all delicate surfaces; when the plastic gets opaque from sandblasting, just peel it off and slap on a new one. Plastic film costs 2 cents per 10 square feet.

Flying through a dust storm or dust devil causes the usual penalties associated with high winds: -2 to Piloting skill in a dust devil, -3 in a regional dust storm, and -4 in a hemispheric or planetary dust storm.

Temperature

Mars is very cold. During the day, the average temperature is 80° below zero. Since it's unlikely anyone will be out on the surface without a protective suit, this isn't a big problem. Explorers who have to dash outside without a suit during a crisis must make a HT roll to withstand the cold, as described in the ***Basic Set***, p. 130. Happily, there isn't much "wind chill" effect on Mars; if anything, the thin atmosphere acts as an insulator.

Radiation

The most insidious danger on the Martian surface is radiation. Humans on Earth are used to having the protection of a powerful planetary magnetic field and a thick atmosphere. Mars has neither. Ultraviolet radiation from the Sun is a minor danger (astronauts are unlikely to be going about in bathing suits), but there is also a risk from cosmic radiation, which can even affect astronauts bundled up in Mars suits.

Average exposure on the surface of Mars is about 1/4 rads per day at the zero datum altitude. This is for an unprotected person; such an individual would probably have more immediate problems than radiation! In lowlands like Chryse Planitia or the bottom of Hellas, reduce the radiation exposure to 1/8 rad per day. In high regions like the Tharsis bulge, double the exposure level to 1/2 rad per day, and on the volcanic peaks one is effectively in unprotected space, with a radiation level of 1 rad per day. Mars suits cut the dose in half (PF 2), and the habitats used by the first manned missions would be PF 20. Later permanent structures sheltered by bricks and dirt have a PF of 200 or more.

GURPS Space (p. 104) and ***Compendium II*** (p. 145) have detailed rules for radiation exposure. Any human who is exposed to 1 rad or more in a single day must make a check as per the rules referenced above.

For low-level exposure, make the check every time cumulative exposure reaches 1 rad, then reset to zero and start the count again. Even at the relatively low level of 1/4 rad per day, serious health problems are likely within a matter of weeks or months, so shielding is a survival imperative.

Gravity (or Lack Thereof)

With a surface gravity of 0.38G, Mars is a low-gravity world. This offers both advantages and problems. On the minus side, Mars' low gravity imposes a -3 DX penalty for most kinds of physical activity except those involving manual dexterity. Characters with the G-Experience advantage

suffer only a -1 penalty. On the plus side, humans can carry more. Multiply the weight of everything by 40% (or divide by 3 if you're in a hurry) before determining a character's encumbrance level. See ***GURPS Space*** (p. 99) for more detail. GMs may wish to allow Mars explorers to buy off the DX penalty after spending some time on the planet getting used to local conditions.

A potentially more serious problem in low gravity is the possibility of bone and muscle degeneration. Exactly how long periods in Martian gravity will affect humans isn't known, but at the GM's option any character who doesn't follow a steady exercise regime may find himself losing a point of ST.

Features

Mars has as much land surface as Earth does, so it would require a large book to minutely describe the entire face of the planet. Instead, this section focuses on the interesting parts of Mars – the places where explorers and tourists are most likely to go sightseeing, or where people are most likely to get into trouble.

Uplands and Lowlands

The northern hemisphere of Mars is considerably lower than the southern, with a difference of about 3 miles in height. Explanations for this vary: some postulate a massive impact early in the history of Mars that dug a huge basin. Others point to the difference between Earth's continental "highlands" and the deep ocean bottoms. The dividing line is roughly around 30° north latitude.

The difference between the lowlands and highlands on Mars is more than just one of altitude. The southern high country is older, thickly dotted with craters left over from the period of heavy meteor bombardment nearly 4 billion years ago. The lowlands have relatively few craters, suggesting a much younger surface. Something has worked to smooth the lowlands over the past couple of billion years.

Most planetary scientists suspect that water is responsible for the smoothness of the northern plains, though they differ over the exact mechanism – some suggest an ancient ocean simply erased any old craters and laid down layers of sediment, while others propose that the lowlands are mostly dirty ice, so that craters simply slump away and collapse over time.

The dividing line between the cratered highlands and the smooth lowlands is obvious in many places: a line of cliffs or hills, sometimes cut by gullies and trenches. The boundary looks for all the world like an ancient dried-up seashore.

There are some exceptions to the rule that the south is high and old and the north is low and young. In the northern plains are two large volcanic regions, Tharsis and Elysium, which rise to the highest altitudes on the planet. In the south are the two big impact basins Argyre and Hellas; the bottom of Hellas is the lowest point on Mars, and both basins show signs of recent resurfacing by water.

Tharsis and Elysium

Tharsis and Elysium are two large volcanic regions on the surface of Mars. They are places where rock from the interior has bulged upward to form giant domes. Both appear to have formed some time between 3 and 4 billion years ago, after the period of heavy meteorite bombardment ended. Volcanic activity has resurfaced both bulges until fairly recently; some of Mars' volcanoes may have been active 100 million years ago if not later. The smaller of the two is the Elysium rise, topped by the volcanic peaks Hecates Tholus, Elysium Mons, and Albor Tholus.

On the other side of Mars, straddling the equator, is the Tharsis bulge, which has pushed the crust up to the highest elevations on the planet. The apex of the Tharsis bulge is the fractured Noctis Labyrinthus region, a mass of interconnected rift valleys and canyons. Tharsis is capped by several impressive volcanoes – Arsia Mons, Pavonis Mons, and Ascraeus Mons. Off to one side is the mighty Olympus Mons, the tallest peak in the Solar System. There are also some smaller volcanoes amid the giants: Biblis Patera, Ulysses Patera, Jovis Tholus, Ceraunius Tholus, Uranius Tholus and Uranius Patera, and Tharsis Tholus. At the north edge of the Tharsis rise is the mysteriously flat volcano Alba Patera, which is as wide as Olympus Mons, but barely rises above the surrounding country.

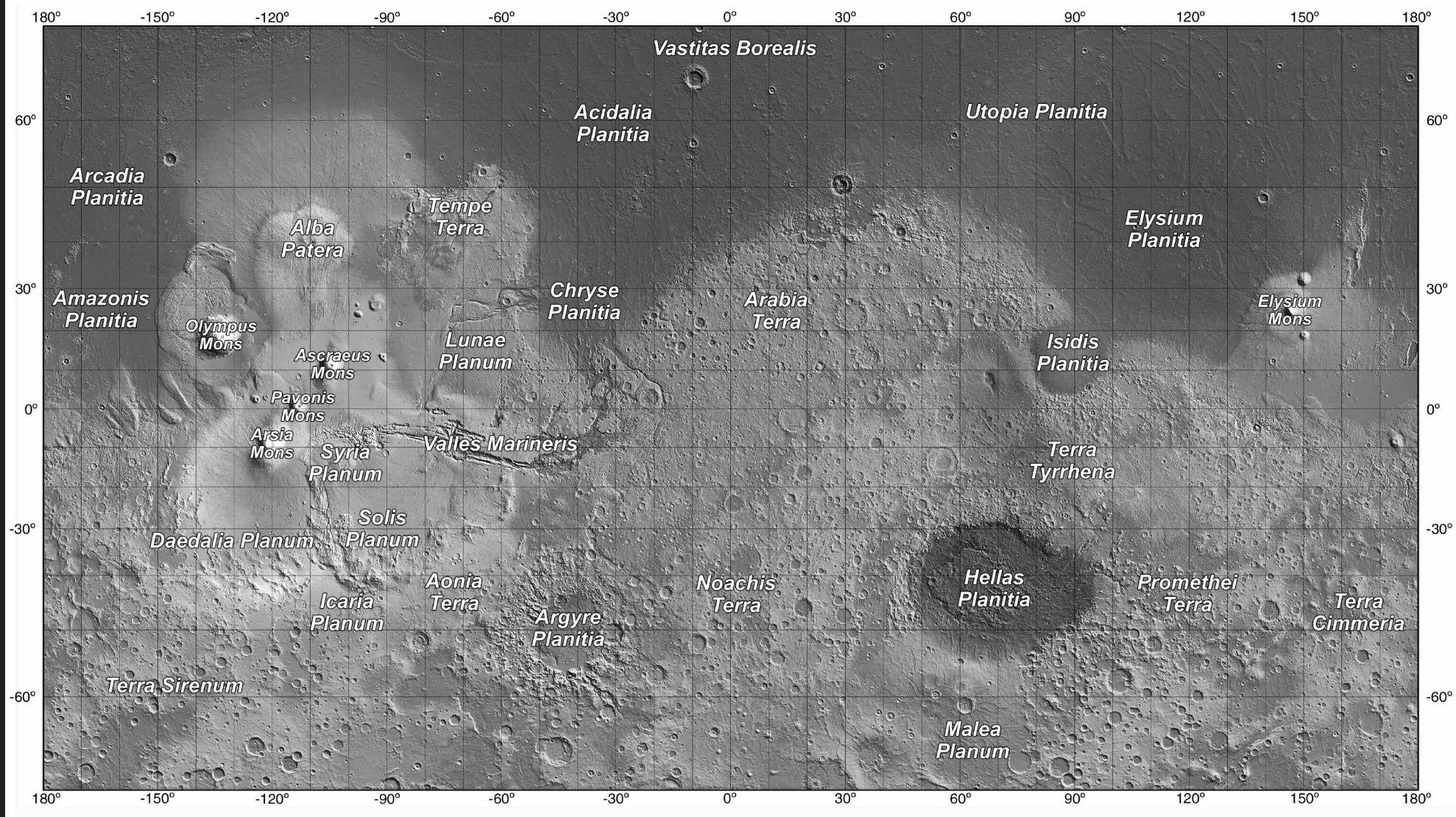
Both the Elysium and Tharsis bulges are surrounded by "moats" of lower terrain, which some scientists speculate was pushed down by the sheer weight of the crust in the volcanic regions. The depression surrounding Elysium is most obvious, since Tharsis straddles the lowland-upland boundary.

The Caverns of Mars?

One intriguing possibility is that Mars might have networks of caves and caverns underneath the highlands around the Valles Marineris. Features like Hebes Chasma and Juventae Chasma appear to have been formed by erosion, yet show no sign of outflow channels. At least, not on the surface. Could there be underground channels? On Earth, places like Yucatan and Florida are marked by sinkholes created by underground water. Perhaps similar processes on a much bigger scale worked on Mars. That would explain curious features called "catena" surrounding the Marineris canyon system – chains of craterlike depressions. The catena might be collapsed underground channels.

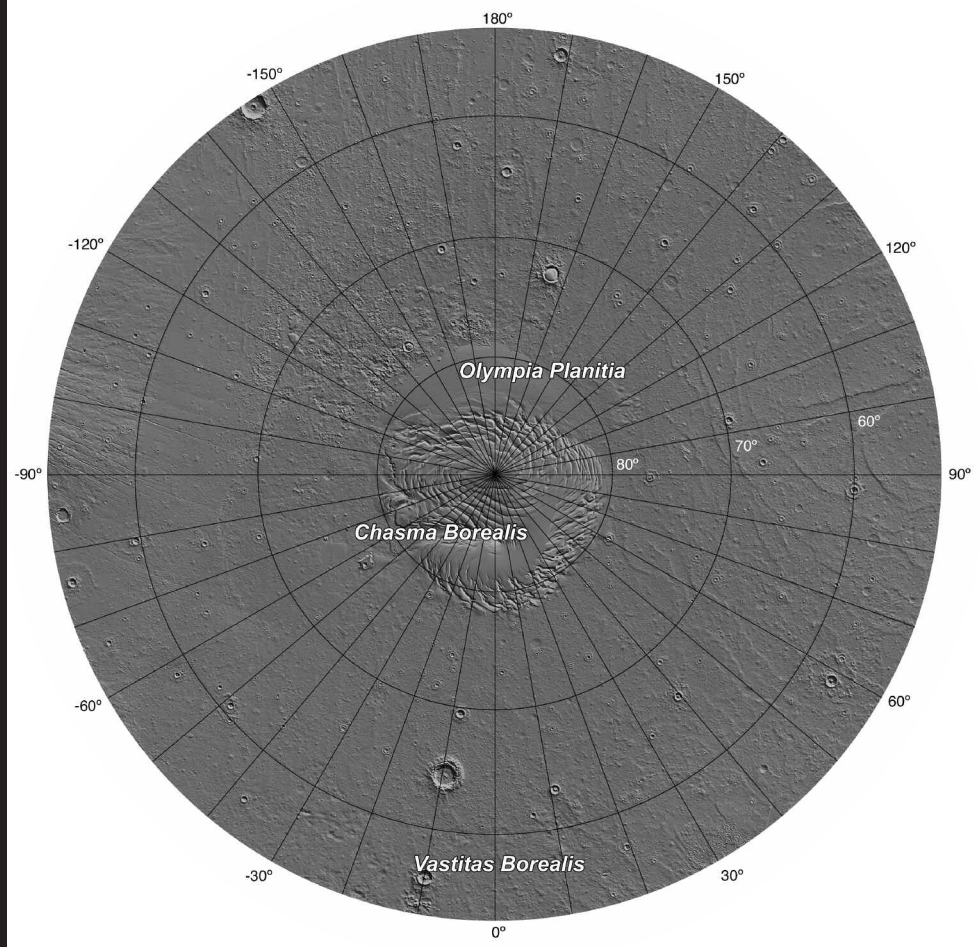
Caverns on Mars would be fascinating places to explore, and might even serve as sites for colonization. If the heat sources that melted the ice and created the runoff in the first place are still active, the caves might have underground lakes. GMs can use the Martian caves as a place for hidden human colonies, surviving enclaves of Martian life, or ancient alien outposts.

Topographic Map of Mars in 2002 – Mercator Projection

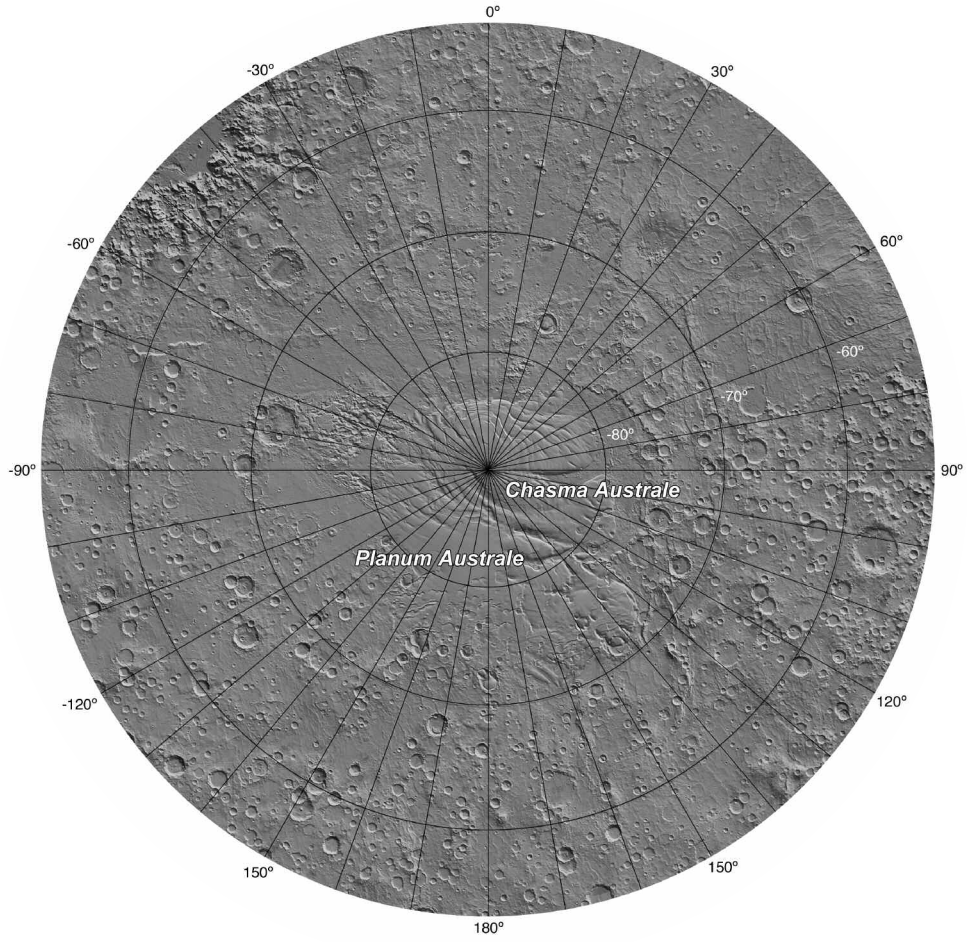


Topographic Map of Mars in 2002 – Stereographic Projections

Northern Polar Region



Southern Polar Region



Martian Geography

Place Names

The features on Mars were named by scientists who wanted to come up with specific terms to describe them which wouldn't be the same as words used for features on Earth. Saying something is a "canyon," for example, implies a lot about how it formed because canyons on Earth are cut by rivers. On Mars, canyon-like features are called "chasma" or "vallis." In some cases, features on Mars don't match their technical name very well, due to misinterpretation of early space probe images.

Catena: A chain of craters or depressions.
Cavi: A steep-sided hollow.
Chaos: A region of broken terrain.
Chasma: A very large linear chasm.
Crater: A round hollow with raised walls.
Dorsum (Dorsa): A ridge.
Fossa (Fossae): A straight linear depression.
Labyrinthus: A network of linear depressions.
Mensae: A small plateau.
Mons (Montes): A mountain.
Patera: A crater with irregular or scalloped edges.
Planitia: A low plain.
Planum: A large plateau.
Rupes: A cliff.
Scopulus: An irregular, degraded escarpment.
Sulci: A network of ridges and lines.
Terra: A general region of the planet.
Tholus: A small domed hill.
Vallis (Valles): A valley.
Vastitas: An extensive plain.

The Cydonia Face and Other Weird Places

The Face

The Face on Mars has replaced the canals as the one thing about the planet everyone has heard of. The Face is a small mesa in the Cydonia region of Mars, located at approximately 40° north latitude, 9.5° longitude, at the northeast end of Cydonia Mensae. It stands amid smooth plains studded by similar outcrops, looking much like islands that resisted ancient water erosion. What makes the Face an icon for conspiracy theorists and fans of the paranormal is that in the first Viking orbital photos of the region, the angle of sunlight and the poor resolution made the mesa look startlingly like a huge human face. Richard Hoagland and numerous others began cranking out a vast array of books, articles, and Web pages devoted to proving the Face was a sign of extraterrestrial intelligence.

Nearby features were identified as a "fort," a "city," and (of course) "pyramids." See Chapter 5 for more on the Face's place in the pantheon of weirdness. When the Mars Global Surveyor probe took higher-resolution pictures at a different time of day, the Face was revealed as nothing more than a natural geological formation. (Predictably, Face fans reacted to this by alternately claiming the new images were fakes and trying to find artificial-looking features in them.) Astronaut characters may be sent there by NASA to prove once and for all that it isn't a big artificial structure, or a well-funded crackpot might mount an expedition to prove that it *is*.

So what is the Face *really* like? It is a rectangular mesa with sloping sides, approximately 1.5 miles long by 1.25 miles wide. It is oriented north by northwest. The top of the mesa (the "headdress" of the Face) is about 700 feet above the surrounding plains, and the hills that make up the features of the Face reach another 600 feet above that.

The City

About six miles west-southwest of the Face is a complex of structures known as the "City." There are five pyramidal hillocks arranged roughly in a pentagon, with smaller objects in the middle space. The biggest of the pyramids has four sides, while the rest appear to be three-sided. They are all big features, on the same scale as the Face, with bases a mile or more across and altitudes in the 1,000-foot range.

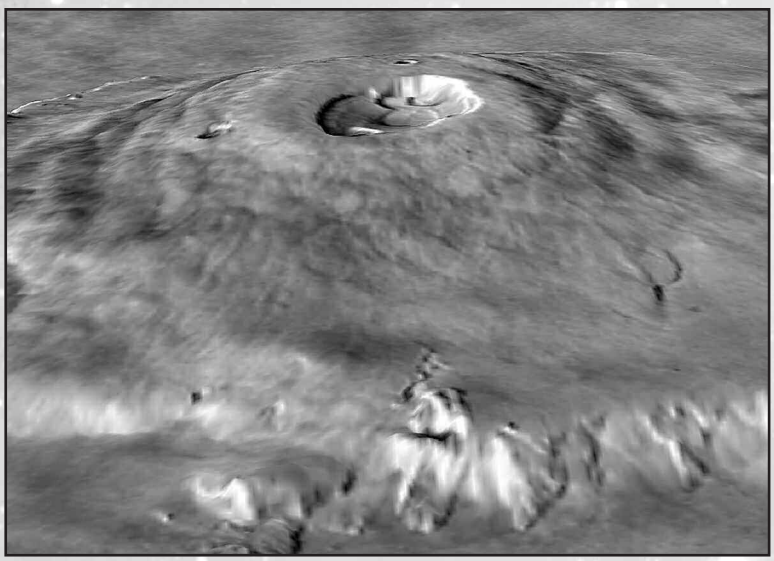
Just outside the City, in the direction of the Face, is a weird triangular mesa known in the trade as the "Fortress" because of its resemblance to defensive earthworks on Earth. A faded water channel appears to run between the Fortress and the City. Hoagland and others have worked out a complicated arrangement of sight lines among the objects in the City and the Face, claiming that they line up with the rising of the sun or important stars at the solstices, much like the stones of Stonehenge.

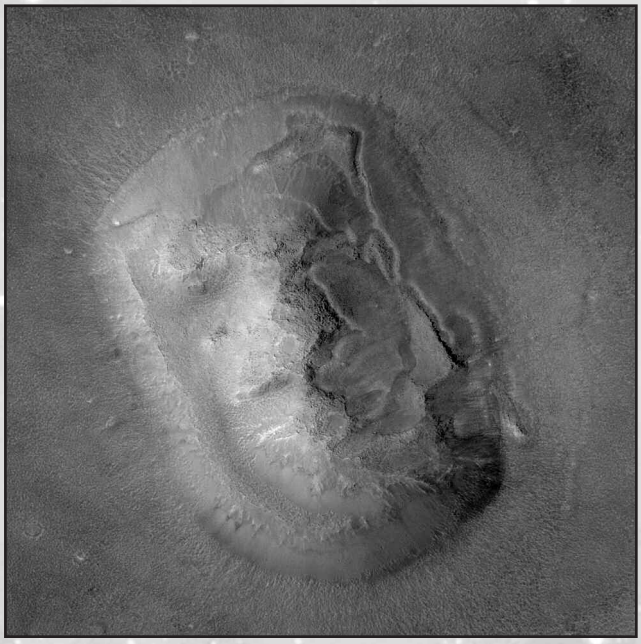
The D&M Pyramid

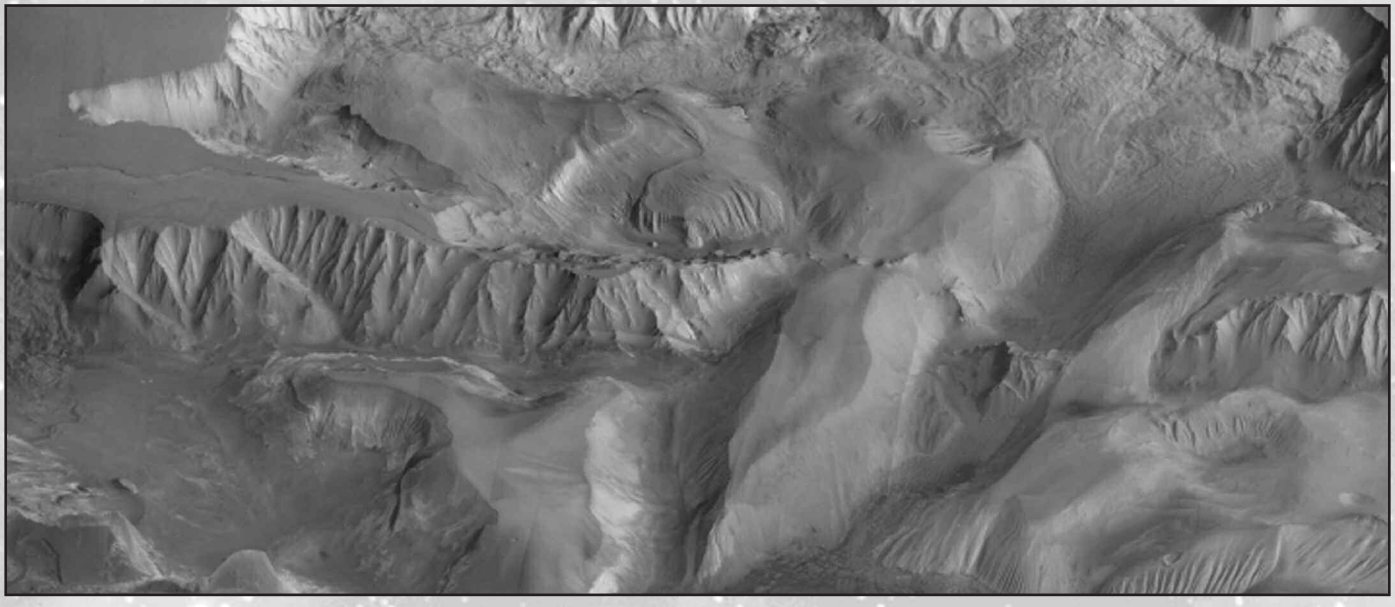
Five miles southeast of the City, forming a roughly equilateral triangle with the City and the Face, is a very big object called the "D&M Pyramid" by Face fans (named for its discoverers, DiPietro and Molenaar). The pyramid is about 3 miles across at the base, and is 1,500 to 2,000 feet tall. It looks like a slightly distorted five-sided pyramid. Mars Face aficionados are fond of pointing out that the Pyramid's longitude is exactly a third of the way around Mars from the summit of Olympus Mons.

Chaotic Terrain

On Mars the term "Chaotic Terrain" refers to curious regions of land which is broken and jumbled up on a scale of tens or even hundreds of miles. From space, a piece of chaotic terrain looks like a colossal gravel bed, except that the pebbles are sometimes miles across. Chaotic terrain often occurs at the head of channels or canyon systems, leading some geologists to speculate that it is caused when the surface collapses into underground voids left by melting ice.







The large Martian volcanoes are most likely fed by magma plumes originating deep in the planet's mantle. On Earth, continental drift moves similar volcanoes off the hot spots that form them, so that no volcano can grow forever. But the crust of Mars doesn't slide around, so the Tharsis volcanoes can sit and get bigger and bigger indefinitely.

Although the Tharsis volcanoes are very tall (up to 10 miles above the surrounding countryside for the smaller ones, and 13 miles high for Olympus), they are also extremely wide. Olympus has a base almost 400 miles across, and Pavonis and Ascraeus are each about 250 miles wide. That means the slopes of the great mountains are quite shallow, no more than 3 or 4%. Climbing Olympus Mons or any of the others wouldn't involve much mountaineering with ropes and pitons, just a long strenuous hike punctuated by occasional cliffs and chasms.

Olympus Mons

Olympus is the biggest and most massive of the Tharsis mountains, sitting alone on the northwest slope of the Tharsis rise. Its base covers an area about the size of the state of Oregon, and its crater is some 60 miles across at its widest. Olympus Mons is so big and flat that the summit is hidden by the horizon when one is standing at the base of the mountain. The base of Olympus is probably the steepest part; it rises very sharply from the surrounding country, as though the mass of the great mountain has caused the crust supporting it to flex downward and lift up at the edges. This rampart is most prominent on the western slope, where it is called Olympus Rupes and rises a mile at an angle of 45° or more.

Beyond the foot of Olympus to the northwest is a large, almost circular region 500 miles across, extending out to the edge of the Amazonis Planitia lowland. It appears to be a huge old lava flow, crisscrossed by cracks and etched by what may be canyons. A second lobe, almost as big, stretches north from Olympus Mons, and there are faint traces of smaller flows on the eastern and southeastern flanks of the mountain. What is interesting is that the lava flows have been partially erased, possibly by erosion.

Pavonis Mons

Pavonis Mons is a smaller volcano than Olympus, but it does have one very interesting feature. It sits almost exactly on the equator, making its summit the perfect place to anchor an orbital elevator. If Mars is ever extensively colonized, Pavonis Mons is likely to be the gateway to the Red Planet. (Chapter 4 has more information on the Martian orbital elevator.)

Like all the Tharsis mountains, Pavonis is so high that its peak is effectively above most of the Martian atmosphere. The air pressure atop the great mountains is only 1 millibar, a thousandth of Earth's sea-level pressure.

Tharsis Tholus

Although Tharsis Tholus is tiny compared with its giant siblings to the west and south (*only* 75 miles across at the base), it is likely to be one of the first volcanoes studied on Mars. That's because Tharsis Tholus is the closest to a potential landing site at Chryse Planitia or Eos Chasma. Getting to Tharsis Tholus involves a scenic rover drive up Kasei Vallis, then a 600-mile cruise across gently rising plains to the mountain.

Elysium

Elysium Mons and its sister peak Hecates Tholus are not as spectacular as the Tharsis mountains. They stand only 8 miles high and measure barely 200 miles across. That still makes them bigger than any mountains on Earth, of course. Northeast of the Elysium rise is one of the few mountain ranges on Mars that looks like ordinary Earth mountains. The Phlegra Montes are a linear mountain chain, apparently created by crust movements instead of cratering or volcanic activity like the rest of Mars' mountains. East of the Elysium rise is the very strange feature Orcus Patera. Orcus is a long oval structure about 200 miles long by 100 wide, with a raised rim and a smooth interior. It's either a partly erased pair of craters, or a volcanic feature, possibly flooded with hardened lava or ice.

Other Volcanoes

Mars has a few other volcanic features besides the Tharsis and Elysium complexes. Northeast of the Hellas basin are two obvious volcanoes, Hadriatica Patera and Tyrrhenia Patera. They may have been the source of the meltwater which flooded Hellas at some point in the past, smoothing and channeling the crater floor.

Channels and Valleys

The most impressive evidence for the existence of water on Mars is the huge channels which scar the surface. The biggest and best-known of them is the mighty Valles Marineris, but it is only the biggest of a whole family of channels, including Ganges Chasma, Echus Chasma, Ares Vallis, Kasei Vallis, Mareotis Fossae, Mamers Valles, Ma'adim Vallis, Harmakis Vallis, and others.

The Martian channels are true channels rather than valleys. The difference is that valleys are formed by erosion over time, while channels are formed in single large events. The feature on Earth that most closely resembles the Martian channels is a region of Washington state called the Channeled Scablands. The Scablands were formed at the end of the last Ice Age, when the ice dam holding back Lake Missoula suddenly gave way, releasing a huge volume of water that carved and sculpted the landscape before draining away. Similar features have been identified on the floor of the Mediterranean, formed when the ocean broke through the Straits of Gibraltar and filled the low-lying land between Europe and Africa.

The channels of Mars were formed by one or a few large events rather than ongoing erosion. The floods that carved them were *big:* on the order of 10 billion cubic feet a second of water. By comparison, the Mississippi River's average flow is only 100,000 cubic feet per second. So a hundred thousand Mississippis may once have roared down the Valles Marineris. The very scale of the necessary flood makes some scientists doubt that water was the sole factor in the creation of a feature as big as Marineris; other theories are discussed in the description of the canyon below.

Where did all that water come from? The best theory is that it came from underground aquifers – the liquid layer beneath the Martian cryosphere. Something broke through the ice seal and the water flooded out. It also appears that some of the larger chasms may have been lakes. Hebes and Ganges Chasma show layered deposits on their floors which could be sediment laid down over a long period. The large open chasms at the midpoint of the Valles Marineris, Ophir, Candor, and Melas Chasma, are also possible lake beds. The lakes were probably fed by groundwater, as the bottom of the Marineris is below the cryosphere basement, and were covered by an ice layer several hundred feet thick. Thin barriers of rock or ice held these lakes back, and when the barriers gave way, whoosh!

Where did it go? One theory holds that the water flowed into the northern lowlands and soaked into the soil, freezing into the cryosphere. Over time, windborne dust covered the dirty ice, creating the featureless plains of Vastitas Borealis, Amazonis, Arcadia, and Utopia.

The Labyrinth of Night

At the west end of the Marineris canyons, atop the highest part of the Tharsis bulge, there is a huge network of intersecting canyons called Noctes Labyrinthus – the "Labyrinth of Night." It appears to be a place where the crust of Mars was fractured by some kind of volcanic upwelling. But instead of forming a volcanic mountain, the underground activity must have melted ice in the crust, creating a torrent of water draining off along the fracture lines. The water scoured out the cracks, creating a web of canyons feeding into the upper end of the Valles Marineris.

Valles Marineris

The biggest and longest canyon in the Solar System is Valles Marineris, 1,600 miles long and 2 miles deep. It arises in the west from the tangled chasms of Noctis Labyrinthus, and runs almost perfectly straight in an east-southeast direction to the edge of the Tharsis bulge. There it widens out to form Eos and Capri Chasmas, and then the flow lines drain off northward toward Chryse Planitia.

It's likely that Marineris was once a crack in the planet's crust, before a torrent of water released by volcanic activity scoured it out, widening and deepening the valley. That would also explain how the shorter parallel valleys Melas Chasma and Ganges Chasma formed, since they also look like excavated faults. Some scientists even suggest that the floor of Marineris sank as magma underneath was drawn off by the Tharsis volcanoes.

The floor of Marineris is probably much like the plains photographed by Viking and Pathfinder: scoured smooth and dotted with assorted rocks. Here and there ridges carved by the waters run along the valley. There are unlikely to be any craters.

Kasei Vallis

North of Marineris is a smaller valley which looks much more like a Terrestrial canyon. Kasei Vallis empties directly into the Chryse depression, after cutting through the Lunae Planum highlands for about 600 miles. What's interesting is that the water which carved Kasei came from much farther away. It appears the flow started not far from the sources of Marineris, but ran northward, cutting the spectacular 2-mile-high Echus Chasma cliff face along the western edge of Lunae Planum. After running north for 1,000 miles, the flow drained off eastward, cutting the Kasei valley.

Since Chryse Planitia is one likely destination for the first Mars mission or a permanent Mars base, Kasei may wind up getting explored before Marineris. It's a pretty impressive valley in its own right, with walls a mile and a half high in places.

Crater Basins

Most of the craters in the southern regions of Mars are unremarkable. Every other solid body in the Solar System has craters, too. The Martian craters range in size from a few yards to giants 100 miles or more in diameter. The two biggest, however, are particularly interesting. They are Argyre and Hellas.

Argyre Planitia is an unremarkable crater, except for its size; it is almost 500 miles across, lying south of Valles Marineris. On the south its raised rim forms the Charitum Montes range, while on the north are the Nereidum Montes. Argyre's smooth level floor suggests it may have been filled with water at some point, and there are erosion features cutting through the rim on the northwest side.

Hellas Planitia is an even bigger crater – 1,100 miles across! Its floor is the lowest place on the Martian surface, 5 miles deep. Its rim forms the Hellespontus Montes range on the west. There are a great many signs of water erosion in Hellas. Two large channels, Harmakhis and Dao Vallis, lead into the basin from the northeast, and appear to have been fed by runoff from the volcanoes Hadriatica Patera and Tyrrhenia Patera. There are also smaller valleys on the southern edge of the crater.

In the northern plains there is an unusual type of crater known as "rampart" craters (or, more descriptively, "splosh" craters). These are fairly ordinary craters, but they are surrounded by raised lobes, somewhat like the petals of a flower or the walls of a fort. They look very much as if the meteorites struck a semi-fluid surface which splashed out from the impact and then solidified. Ice or permafrost are the usual candidates, and "splosh" craters are one of the leading indicators of water on Mars.

The Polar Caps

Mars' polar caps are still poorly understood. The failure of the Mars Polar Lander was a tremendous setback to their study. What orbital photos show is that the caps and the land around them are layered like colossal wedding-cakes, and cut by big chasms. Between them, the two polar caps hold an impressive amount of water. Even if Mars has no underground water supplies at all, its polar caps would supply enough to cover the planet under 100 feet of water, or fill a small ocean in the lowlands.

The south polar cap is composed at least partly of carbon dioxide snow, and during the winter extends over a large area, spreading 1,000 miles across. In summer, the dry ice boils off and the cap shrinks to a core only 200 miles wide. The north polar cap has less variation, going from 800 miles across in winter to 650 miles across in summer.

Missions to the Moons

Phobos and Deimos are likely targets for exploration. There are several factors that make them attractive. First, they are interesting in themselves, especially as potential sites for orbital facilities once Mars is colonized. Second, they strongly resemble the common carbonaceous asteroids, and so can be used to test out methods and train astronauts for exploring the asteroid belt. Finally, they make great ready-made space stations, especially low-orbiting Phobos. A base dug into the regolith of Phobos would be much better protected from micrometeorites and radiation than any orbiting tin can, and there's ten trillion tons of raw material available for construction, plus ice for drinking water and rocket fuel.

Exploring the moons of Mars does present serious challenges. The extremely low gravity means one can't so much "land" on them as "dock" or "rendezvous" with them. Astronauts will need tethers and safety lines to keep from accidentally jumping into orbit, but the loose regolith may not be very suitable for planting anchors. If Phobos is really a mass of shattered rock, there may be no real surface at all. The irregular shape of both moons means that "down" changes as one moves across the surface. Any contact with the ground is liable to churn up huge clouds of powdered dust, which won't settle for half a minute.

In ***GURPS*** terms, astronauts exploring the Martian moons must make a successful Free Fall skill roll every hour to avoid stirring up the regolith. A failed roll envelops him in a cloud of dust, making it impossible to see and coating his suit in fine powder. All skill rolls made in a dust cloud are at -4, and failure on any roll generates more dust. A dust cloud persists for 1d times 10 seconds. Fighters can use the regolith for protection: a dust cloud interferes with laser fire, halving damage. Firing any weapon into or out of a dust cloud is at a skill penalty of -5.

The Moons of Mars

Mars has two moons, but Earthlings shouldn't be jealous. Our moon is vastly bigger, closer in size to Mars itself than its moons. The Martian moons were discovered in 1877 by Asaph Hall, working at the U.S. Naval Observatory. He named them for the mythical companions of the war god Mars: Phobos ("Fear") and Deimos ("Terror"). Both are tiny, battered objects resembling asteroids.

The small size and low gravity of both Phobos and Deimos means that it is entirely possible for people to throw things into orbit, either deliberately or by accident. Orbital velocity for Phobos is about 76 feet per second, or just about 50 miles per hour, so an athlete with a good arm can put a baseball into orbit around Phobos (although orbital mechanics will bring the ball back to its launch point after one circuit). Escape velocity is 70 mph, so any fast-moving projectiles like bullets will become independent satellites of Mars. Deimos orbital velocity is only 30 feet per second, or 20 mph, and its escape velocity is 28 mph, so it would be possible for an athletic person to *jump* into orbit, or even off the moon entirely! Astronauts exploring the Martian moons will need tethers and safety lines, much like space station workers.

Both Phobos and Deimos are tidally locked to Mars, keeping one face to the planet as they orbit. From the surface of Mars, Phobos appears to be about half as wide as a full Moon in Earth's sky, and is visibly oval in shape. Deimos is hardly more than a bright point of light, a thirtieth of a degree across.

Neither Phobos nor Deimos has any appreciable atmosphere. The surface of both moons is a layer of regolith, mixed dust and gravel extending down several hundred feet.

Phobos and Deimos are similar in composition; both are much like carbonaceous asteroids – masses of silicon and carbon compounds, with very little metal. The low density of both Phobos and Deimos suggests they are rich in ice, though spectrographic examination of their surface shows no sign of water. The best explanation is that meteorite impacts and solar heat have cooked all the volatiles out of the regolith, but the core of both moons may contain large amounts of water ice. If this is the case, the moons could become very important as fuel stations for future Mars missions, since it is much less expensive to produce fuel already in orbit, than to haul it up from the surface of Mars.

Phobos

Phobos is a battered, potato-shaped ellipsoid, 16 miles long by 14 miles wide and 11 miles thick. By planetary standards its mass is tiny, but it is still a huge chunk of material, about 10 trillion tons. Its density is low, about twice that of water, suggesting that Phobos is poor in metals and heavy elements. The surface gravity of Phobos is very low, about 0.005 G.

Phobos orbits Mars low and fast: its orbit is only 5,800 miles from the center of the planet, and it circles Mars every 7 hours 39 minutes. Since Phobos orbits Mars faster than the planet turns, it rises in the *west* and sets in the *east* as seen from the surface, crossing the sky in 5 and a half hours (remember that Mars is turning as Phobos passes overhead). Because Phobos is in such a close orbit, it cannot be seen from the Martian polar regions above 70° north or south latitude.

The most impressive feature on Phobos is the huge Stickney crater (named for the wife of Asaph Hall, who discovered Mars' moons in 1877). The crater gapes 4 miles wide on the leading edge of Phobos, like a giant jet intake. It's remarkable that such a huge impact didn't smash Phobos to bits.

Stretching back along the surface of Phobos from the rim of Stickney are numerous mysterious grooves. Scientists don't quite understand what causes them, but there are two main theories. One camp holds that the grooves are immense cracks in the surface of Phobos created by the Stickney impact. If that's true, the interior of Phobos may be a maze of crevices and faults. The other theory suggests that the grooves were plowed through the regolith by grazing impacts with small objects moving too fast for Phobos to capture.

Seen from the surface of Phobos, Mars makes an impressive sight. It fills the sky, spanning 40°. From Phobos, an observer can make out many of the surface features of Mars without a telescope – anything more than 5 miles across is clearly visible to the naked eye.

Deimos

Deimos is smaller than Phobos and much farther out. It is also an irregular object, 15 kilometers by 12 kilometers by 10 kilometers. Its mass is only a tenth that of Phobos. ("Only" a trillion tons!) Like Phobos, Deimos has a low density, and a surface gravity of about 0.0016 G.

Deimos circles Mars at an altitude of 14,600 miles, which is just above Martian synchronous orbit. Its orbital period is 30 hours, 18 minutes, which is only a few hours longer than Mars' day. Seen from the surface, Deimos drifts slowly westward through the sky, taking two days between rising and setting.

Because Deimos is located so conveniently near synchronous orbit, and is small enough to be moved, it has been proposed as a natural terminus for an orbital elevator, and a potential source of material.

Life on Mars?

This is the big question that everyone has been asking since the days of Huygens. Is there life on Mars? The answer is a definite maybe. So far none has been found, but then again we haven't looked everywhere. The Martian meteorite ALH84001 (see p. 30) suggests that there might be at least microscopic life on Mars; other evidence is negative. We *do* know that Mars has no large complex life on its surface. The Viking and Pathfinder probes saw nothing, and the resolution of orbital cameras is now such that even something human-sized would be visible from space.

Conditions in the Past

Mars was once a good deal warmer and wetter. About 4 billion years ago the young Mars and the young Earth looked much alike: cratered surfaces covered with a dense atmosphere. The thicker air, rich in carbon dioxide and methane, provided Mars with enough of a greenhouse effect to keep it warm, even though the Sun was not as bright back then. Signs of water-carved channels even in the cratered uplands are strong evidence that Mars' early history involved a lot of water. But was Mars wet and warm long enough for life to evolve?

On Earth it took about 700 million years between the formation of the crust and the first identifiable traces of life. Mars probably cooled faster than Earth, but how much faster is still unknown. It's certainly *possible* that life got started on Mars before the planet became locked in ice. Once you get it started, life is tenacious. If Mars did evolve any native life, then it's very likely some descendants survive in odd corners of the planet to this day.

Where Life Might Survive

The surface of Mars is an intensely hostile environment. It's covered in oxidant chemicals, bathed in ultraviolet radiation, it's almost in vacuum, and most of the time it's below freezing. One scientist has pointed out that Martian surface conditions make a good sterilizer. Given that, it's no surprise that the Viking lander's life-detection experiments came up empty.

But there are other places for life to exist besides the Martian surface. In Antarctica, a group of organisms called cryptoendoliths (Latin for "hidden inside rocks") manage to survive living *inside* porous sedimentary rocks. They include types of algae, yeasts, lichens, and fungi, living in temperatures as low as -5° Fahrenheit. A few millimeters below the surface of the rock there's still enough light getting through the translucent material to support photosynthesis, and the rock is porous enough for microscopic life to grow and reproduce. If it works in Antarctica, why not on Mars? Recent discoveries indicate that Mars does have sedimentary rocks, so it's entirely possible for Martian cryptoendoliths to survive. The rock would provide protection from hostile conditions and radiation.

Another possibility is beneath the Martian cryosphere. Biologists have recently identified several entire new *kingdoms* of microorganisms on Earth which survive in underground springs and deep rock layers. They live by chemosynthesis in salt-rich waters; an example is the halophilic archaea. Current models suggest Mars has what amounts to a subsurface ocean of warm salt-rich water trapped below the cryosphere. So even if the surface is barren, Mars could have abundant life deep down, living by reducing sulfur or iron compounds.

Finally, there's the whole "not as we know it" problem. Maybe the evolution of life on Mars went in such a completely different direction that we have trouble even recognizing Martian organisms as alive. That's one big reason to send humans instead of robots to explore: a robot can only find things its designers expected to find, while the human can have inspirations and notice subtle patterns.

Looking for Life

To find Martian life, it appears any astronaut-biologists are going to have to dig for it. One of the first pieces of equipment for a planned mission is a one-kilometer deep drill to bore down into the cryosphere in search of living things.

Astronauts on Mars are going to be doing a lot of geology anyway, and will be paying particular attention to sedimentary rocks. If there are cryptoendolithic organisms living in Martian rocks, they can be found with a geological hammer and a microscope.

Having found some likely-looking samples, the researchers then try to culture the organisms by providing nutrients, water, and light. It may take some trial and error to find what conditions are best for a Martian organism. Then they can start studying the biochemistry, genetics, and ecology of Martian life.

Invaders from Earth

Even if Mars doesn't have life *now,* it may not be lifeless forever. Humans visiting Mars will bring along a whole collection of Terran organisms: plants for food and life support, internal microorganisms and parasites, and perhaps a few hitchhikers like mildew or ants. While the astronauts will undoubtedly try to prevent contamination of the Martian environment, accidents do happen.

Most Terran organisms released into the Martian environment won't do anything but die quickly. No animals can survive on a world without oxygen, and no plants can live in a place which never gets above freezing. But what about algae or bacteria? They could take up an existence in Martian rocks like their cousins in Antarctica, or drop down a borehole to colonize the underground aquifers.

If Mars has its own life, introducing Terran life would be almost criminal, much like transplanting creatures on Earth to different environments. In the "biologist's nightmare" scenario, Earthly life might crowd out Martian organisms entirely, until the last remaining specimens of Martian life survive only in carefully tended test tubes in some lab on Earth (just down the hall from the dodo skins). The politics of settling or terraforming a lifebearing Mars would be lively, pitting those who want to protect native Martian life against those who don't see all the fuss over some obscure chemosynthesizing bacteria.

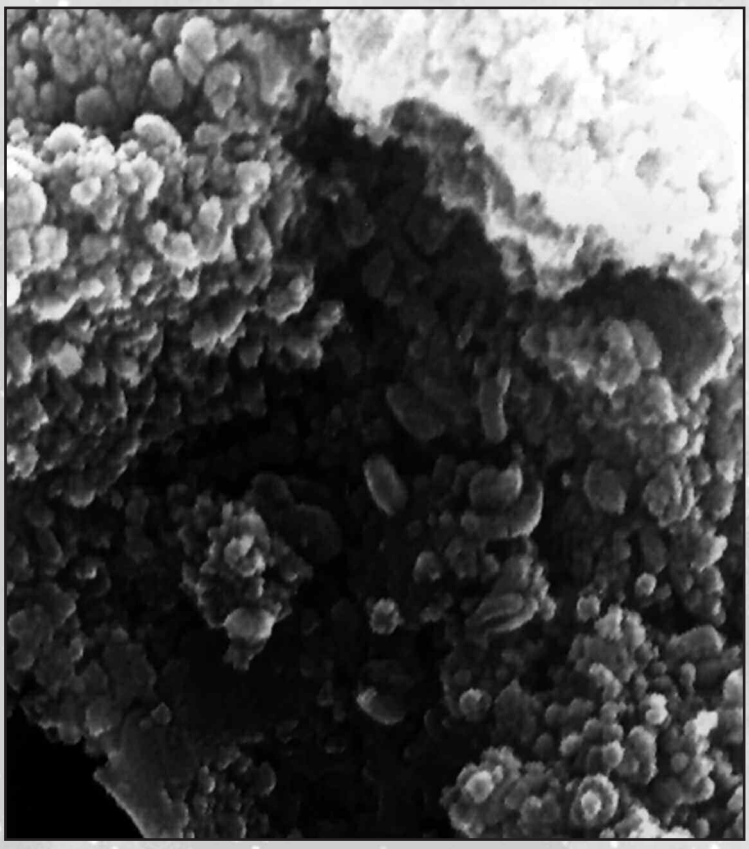
Of course, humans might want to introduce Terran life to Mars on purpose. Terraformers plan to do just that on a very large scale, after first altering the environment to support them. But *foes* of terraforming might do it, too. They could seed a lifeless Mars with some carefully-chosen Earth bacteria, and then claim they've found native life! The ruse would take decades to discover, and meanwhile the terraforming project would be under tremendous political pressure.

The Martian Meteorite

In December of 1984, a researcher named Roberta Score discovered an unusual meteorite in Antarctica. In a region known as the Allan Hills, Score uncovered a small, potato-shaped chunk of rock which had been frozen in the Antarctic ice for 13,000 years. The rock was tagged "ALH 84001," as the first meteorite found at Allan Hills that year. Geologists later identified the rock as a rare type of meteorite known as an SNC meteorite. SNC meteorites are fragments of the planet Mars knocked off into space by large impacts. For a couple of years the ALH 84001 rock was analyzed, sliced, and its composition studied with a spectroscope.

The results were interesting: ALH 84001 contained some minerals, including carbon compounds, which on Earth are the product of organic processes – life, in other words. When researchers looked at the meteorite with an electron microscope, they saw small carbonate globules and magnetite crystals which appeared to be biological in origin.

Other scientists were less sure; all the compounds could result from non-biological causes, or might be the result of contamination after the rock fell to Earth. At present, the issue is still being fought out in laboratories and scientific journals. If the ALH 84001 findings are confirmed, that means Mars had *some* kind of microscopic life millions of years ago. And that in turn suggests Mars may still have life today.



Getting to Mars

Getting to Mars is easy. All you have to do is get yourself up off the Earth (by attaining escape velocity of about 24,800 miles per hour), then survive in space for the months it takes to reach Mars, then find some way to match velocities with the planet (shedding the 10,800 mph difference between Earth and Mars orbital speeds). After that, all you have to do is set yourself down gently on the surface, and there you are! The devil is in the details, of course.

Mars Direct

For decades, plans for manned missions to Mars envisioned using multiple ships built in orbit, carrying landers for a quick "flags and footprints" landing and then a return voyage. That was the "default" mission plan until 1989. That was the year that President George Bush (the elder) tried to interest the U.S. Congress in funding a manned Mars mission. NASA engineers consulted their plans, made some cost estimates, and presented the bill: $450 billion. The Congressional response, needless to say, was not enthusiastic.

But Robert Zubrin, an engineer with the aerospace company Martin Marietta, thought that approach was entirely wrong. He and a group of like-minded scientists and engineers inside and outside of NASA began creating their own plan. They took their inspiration from the history of polar exploration on Earth during the 19th and early 20th centuries. Britain's Royal Navy sent large, well-equipped expeditions consisting of fleets of ships to explore the Arctic, but they came to grief. When the Poles were reached, it was by American and Norwegian explorers using techniques learned from the Inuits and Lapps – the people who *lived* in the Arctic full-time, and knew how to use local resources.

The "Mars Underground" began to plot a Mars mission which would make use of Martian resources as much as possible. While things like the availability of water on Mars are still in dispute, the composition of the Martian atmosphere is known. The carbon dioxide in the Martian air can be processed and combined with hydrogen shipped out from Earth to make rocket fuel. Making fuel on Mars instead of having to launch it all from Earth dramatically reduces the size of the spacecraft needed, and allows for longer and more flexible operations on the surface of Mars. The price tag: a "mere" $20 to $50 billion – expensive, but within the realm of possibility.

The Mission

The Mars Direct mission requires two launches of a large heavy-lift booster. At present the United States doesn't have such a rocket, but it wouldn't be hard to develop one (dusting off the Saturn moon rocket blueprints would do the job). The Russian Energia booster could fit the bill with some upgrades. The rocket needs to be able to loft 45 tons to Mars, or about 130 tons to low Earth orbit.

The first launch sends the Earth Return Vehicle to Mars. As its name suggests, the ERV is the mission's ticket home. It is a two-stage rocket capable of lifting off the surface of Mars and entering a trajectory back to Earth. The ERV has all the necessary supplies for the astronauts, and a nuclear-powered fuel plant. The fuel plant is the key to the whole project. Using 8 tons of hydrogen in the ERV's tanks, it uses Martian atmosphere to manufacture 96 tons of methane and oxygen propellant. The 88 tons made from the Martian atmosphere represents a mass nearly equal to the entire launched weight of the mission. *Half* of the Mars Direct mission is *made on Mars!* Upon arrival at Mars the ERV uses aerobraking to slow down for landing, and touches down on the surface at whatever point the mission planners wish to explore. The fuel plant starts making fuel. Once the ERV is ready, it's time to send the crew.

The second launch is two years after the first. The four astronauts don't leave Earth until they know their return vehicle is ready. Their Mars ship carries a large and fairly comfortable Mars habitat, along with scientific equipment, Mars rovers, and everything one might need.

For 6 months the astronauts cruise through space before braking in the Martian atmosphere and setting down near the ERV. For 17 months they live in the habitat and explore the Martian surface. They can study the rocks, look for signs of life, drill for subsurface ice, set up automated stations to gather data after they leave, and generally do a thorough job of studying the planet, rather than just planting a flag and leaving. Since the bulk of the mission is spent on Mars rather than in space, there is less risk from radiation and the effects of zero gravity.

Two years after leaving Earth, the astronauts board the ERV and blast off for home. They leave the Mars habitat and fuel plant behind, to serve as the nucleus for a permanent base. The voyage back lasts 6 months, and finally the astronauts splash down, 2 1/2 years after setting out.

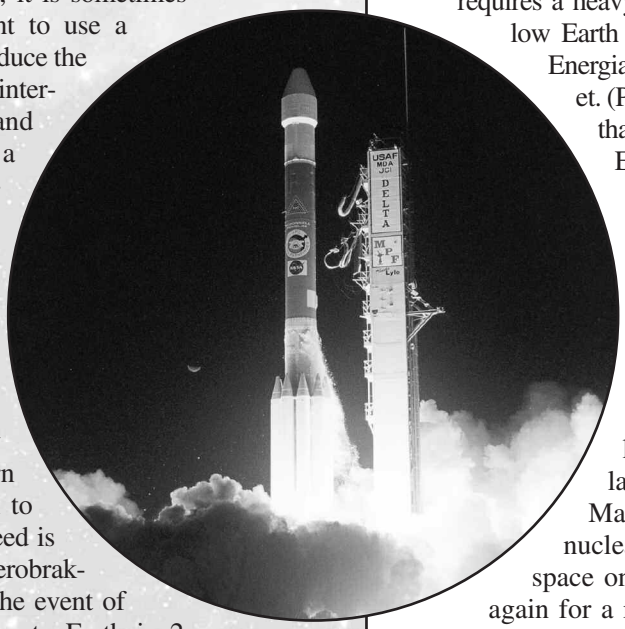
Many features of the Mars Direct plan have found their way into the current NASA Design Reference Mission – the "default" mission plan for getting to Mars. NASA did expand and alter the mission plan (see below), but an eccentric multi-billionaire in a modern-day or near-future ***GURPS*** campaign might be able to find the money to launch a bare-bones mission along the lines of Zubrin's plan. Alternately, a small nation, with leaders more willing to take risks in exchange for the chance to make history, might adopt Mars Direct and vault into the big leagues of the spacefaring powers. Mars Direct would also make a good "quick and dirty" mission if a space probe discovered something on Mars that required human attention as soon as possible – signs of alien intelligence, for instance.

The NASA Design Reference Mission

Zubrin's ideas found some supporters in NASA, and since nobody was going to Mars at a cost of half a trillion dollars, the agency began to study lower-cost proposals. The idea of using Martian resources caught on quickly, but space agency planners weren't happy about making the whole mission depend on the Mars fuel plant. If something were to go wrong, there should be some kind of "lifeboat" to get the crew home.

Trajectories

The most efficient way to get from one planet to another is a trajectory known as a Hohmann orbit. A Hohmann orbit's perihelion touches the orbit of the inner planet, and its aphelion meets the outer planet's orbit. The time required for a Hohmann trajectory from Earth to Mars is 258 days each way, requiring a delta-V (change of velocity) of 2 miles per second, or 7,200 mph (this is in addition to escape velocity for the planet of origin). Launch windows for Hohmann orbits come only when the two worlds are in a particular position relative to each other, every 780 days. Cargo missions to Mars will almost certainly be launched on Hohmann trajectories.



For manned missions, it is sometimes worth the extra propellant to use a faster transit, in order to reduce the crew's exposure time to interplanetary radiation and microgravity. It is also a very good thing if the mission can be launched on what is called a "free-return" trajectory, which will come back to Earth in the event of a malfunction. With a delta-V of 3.2 miles per second (11,520 mph), the crew can follow a free-return path which will get them to Mars in 180 days; this speed is still low enough to make aerobraking at Mars practical. In the event of disaster it will return them to Earth in 2 years. (Actually the fast-transit trajectory would carry the vehicle *beyond* Mars without any braking.) To get transit times less than 180 days requires considerably more booster power: a 150-day trajectory would need a delta-V of 4 miles per second, and the demand shoots up exponentially after that.

The chief drawback to Hohmann orbits is that launch windows come only every 2 years. A crew on Mars has to wait more than 500 days before the planets are properly aligned to leave for home. If you want to get home sooner, there is another possibility, involving a dive down into the inner Solar system for a gravity assist from Venus. Leaving Mars with a delta-V of 3 miles per second only a month after arrival, the spacecraft transits to Venus, uses that planet's gravity for a "slingshot" maneuver to aim at Earth, and arrives home after 430 days in space. The total mission time from Earth departure to Earth landing is only about 600 days, instead of the nearly 3 years required for an all-Hohmann plan. Drawbacks include very limited time at Mars, more time in space (with all its attendant hazards), and greater fuel demands. But if somebody's racing to get to Mars and bring something home, the Venus-assisted course is the answer.

The Design Reference Mission is the general plan for getting to Mars, which serves as the framework for all of NASA's engineering and research. Bits of it are certain to change before anyone actually blasts off for the Red Planet, but the overall mission plan will probably be along these lines. Much of the technology described in the Domed Mars campaign setting in Chapter 4 is based on the Design Reference Mission.

The Mission Plan

Like Mars Direct, the Design Reference Mission relies on multiple launches to put a habitat and fuel plant on Mars before the astronauts ever leave Earth. In general, it is about half again as big, and probably twice as expensive.

The Design Reference Mission requires six launches in groups of two, beginning with the 2011 launch window. Each requires a heavy-lift rocket with a capacity of 80 tons to low Earth orbit. That's about the size of a Russian Energia, and smaller than the Saturn V moon rocket. (Plans are afoot to develop a new launcher in that class, currently known as "Magnum.") Each pair of launches would put one Mars payload and one nuclear rocket stage into Earth orbit. The payloads and the nuclear boosters link up in orbit, then blast off for Mars.

The first four launches, in 2011, are unmanned, and put all the infrastructure in place on Mars for the first landing. The two cargo missions take a low-energy course, arriving about a year later. The payloads use aerobraking in the Martian atmosphere to slow down while the nuclear boosters swing off into interplanetary space on an orbit which won't encounter Earth again for a million years. One payload is the Earth Return Vehicle to bring the crew home; the ERV stays parked in Mars orbit for the next 4 years. The second lands a Mars Ascent Vehicle to get the astronauts off the surface. It arrives with empty fuel tanks, accompanied by a propellant factory, a small nuclear power plant, hydrogen feedstock, and various supplies for the mission. For just under 2 years, the Mars base sits waiting, the fuel plant making 30 tons of rocket fuel for the ascent vehicle, the power plants humming away, and everything ready for the crew to arrive.

The next launch window comes in 2014. Again, two rockets lift off and rendezvous in Earth orbit. One carries a crew of six and their habitat module, supplies, and science equipment. The other carries a nuclear booster. Once the two are joined, the Mars ship departs on a fast 180-day voyage. The crew travel in a habitat which lands on the Martian surface next to the fuel plant, creating an instant Mars base. They remain on Mars for more than a year, then take off in the Mars Ascent Vehicle, rendezvous in orbit with the Earth Return Vehicle, and blast off for home. They return to Earth in mid-2016, a bit more than 2 years after starting off.

If something goes wrong, the astronauts have several layers of safety built into the plan: if a failure occurs on the outward voyage, they have the option of remaining on their Mars Transit Vehicle for a free return, boarding the ERV in Mars

New Rocket Engines

TL	*Type*	*Weight*	*Fuel Usage*	*Power*
8	Nuclear Thermal	(0.26 × thrust) + 1,000	6.5H	0
8	Oxygen "Afterburner"	neg.	3.2O	0
8	VASIMR (low thrust)	(20 × thrust) + 50	.2H	500
8	VASIMR (thrust × 10)	–	2H	500

Volume is the standard 1 cubic foot per 50 lbs. For cost, use the ***Vehicles*** value of $100 per pound – but be aware that the real-world price is likely to be much higher because each unit is effectively a very fine quality prototype rather than an assembly-line production model.

orbit and going home in that, or else aborting to the Martian surface where there are supplies and better radiation protection. If something happens while they are on the surface, the fuel plant can provide air and water long enough for the next Mars mission's cargo lander to arrive.

Meanwhile, two more unmanned missions launched with the crew have carried another Earth Return Vehicle and Mars Ascent Vehicle to await the second team of explorers, who lift off before the first crew comes home in 2016. Their ship is accompanied by the ERV and MAV for the *third* expedition, and so on. Each manned landing adds another habitat module to the Mars base, making it bigger and more comfortable. The cargo missions can bring along greenhouses, inflatable habitat expansions, heavy drilling rigs to get at subsurface water, extra Mars rovers, and possibly even a Mars airship. Every mission would come with robots to extend the range of human explorers. The whole thing can go on as long as the funding holds out.

New Technologies

There are still numerous variants on the basic Design Reference Mission. Each type of propulsion (nuclear-thermal rocket, nuclear-electric or solar-electric, solar sail, and chemical) has its advocates, its unique advantages and disadvantages.

Nuclear rockets are powerful, and with minor redesign can be used to provide ample electricity for the mission in flight. The current mission plan calls for three nuclear-thermal rockets with a thrust of 15,000 lbs. each. When not boosting the spacecraft, the nuclear rockets can generate 50 kilowatts of electricity for life support. The exhaust is very hot – 4900° Fahrenheit – and is moderately radioactive. Power output is 0.0012 kW per pound of thrust. Adding generating capacity to a nuclear rocket increases the weight of the rocket by about 50%.

A hydrogen-fuel nuclear rocket can add a liquid-oxygen "afterburner" which can multiply thrust by up to 4 times, but requires liquid oxygen equal to half the hydrogen fuel consumption value. The weight of the oxygen injector is trivial, but it does increase the entire engine cost by 50%.

Another promising rocket design is an electric propulsion system called VASIMR (for VAriable Specific Impulse Magnetoplasmodynamic Rocket). VASIMR uses microwaves to superheat hydrogen or helium to plasma, which is then ejected at very high velocities by magnetic coils. What makes VASIMR more attractive than ion motors is that it can operate in two modes: a high-thrust configuration which uses a lot of fuel, and a low-thrust, fuel-saving setting. In high-thrust mode it can provide enough kick to boost a spacecraft out of Earth orbit without a tedious series of low-powered burns over weeks or months. In low-thrust mode it can furnish steady high-efficiency acceleration to speed the ship to Mars. The specific impulse of a VASIMR drive varies (naturally) from about 3,000 in high-thrust mode to a remarkable 30,000 in high-efficiency mode.

Solar-electric ion propulsion instead of nuclear rockets would avoid any unpleasant opposition from anti-nuclear organizations. The low thrust from most electric rockets means they couldn't simply blast out of Earth orbit, but would instead have to spiral out over several months, slowly picking up speed until they reach escape velocity. Obviously, for a manned vehicle, this delay would be intolerable, so the crew would come up in a fast "taxi" craft and rendezvous with their Mars ship shortly before it gets up to cruising speed.

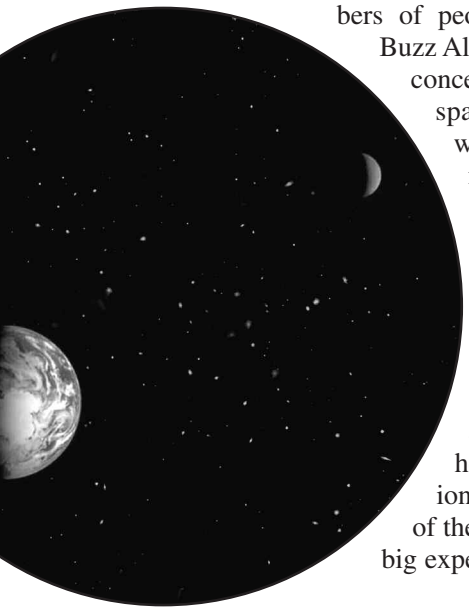
If really big heavy-lift boosters are available (something in the 200-ton class), the mission can be put atop only two launches: one sends the fuel processor, a spare habitat, and the Mars Ascent Vehicle; the other sends the crew in their habitat, along with the Earth Return Vehicle. This version has certain advantages – the crew can use the ERV's living space on the outbound leg, there are net savings in mass from shared aeroshell and structure, and there are fewer launches, which means fewer chances for a failure at that stage. However, building such a super-booster would require a major commitment from the government funding the mission.

Mars One-Way

One reason all Mars mission plans are so complicated and expensive is the need to get the astronauts home again. Any mission is thus burdened with the huge mass of the return vehicle and fuel. The Mars Direct plan solves that dilemma by making the fuel on Mars itself, but another solution is to simply do away with the return vehicle altogether! A quick look at the numbers suggests this isn't simply a kamikaze mission: an Earth Return vehicle would mass at least 50 tons, while an equivalent mass of provisions could supply a crew of four for 34 years! A sufficiently ruthless space agency might send a team to Mars with a couple of decades' worth of food, then use them to raise public support for a return mission.

Regular Service: The Mars Cycler

While the Mars Direct mission plan is relatively cheap and practical, it does have the drawback of relying entirely on expendable spacecraft. Each mission requires a new Mars vehicle, and the crews are small. To make passage to Mars cheaper and easier for large numbers of people, Apollo astronaut Buzz Aldrin devised the Cycler concept. A Cycler is a large spacecraft or station in what is called a "resonant" orbit, swinging between Earth and Mars over the course of 26 months. It uses a gravity slingshot maneuver at its encounters with the two planets to stay aligned (with a little help from an onboard ion thruster). The beauty of the Cycler idea is that the big expensive Mars ship has to be launched only *once* aboard a couple of heavy-lift rockets, and can then be reused by crew after crew. The Cycler can be expanded and renovated bit by bit over time, adding more habitat units (in pairs!), greenhouses, workshops, enclosed docking bays, and recreation facilities.



In later eras, when Mars is colonized and more people are traveling between the two planets, the Cycler is likely to become almost a city in space, with room for hundreds of passengers, immense self-sufficient greenhouses, and possibly even workshops and factories processing resources from the asteroid belt. There could even be permanent residents, never bothering to leave the station, content to spend their lives swinging between two worlds they never visit.

The Cycler vehicle itself is an interesting place for adventures. It's all alone in the emptiness of interplanetary space, there probably isn't any spaceship capable of reaching it, and nobody's getting off until the Cycler gets to Mars. It's a perfect setting for a murder mystery or a cat-and-mouse game between secret agents. In a horror game, one crewman aboard the Cycler might turn into a mad killer, or perhaps *something* has come aboard out of the black gulfs of space. A huge city-sized Cycler might be neutral territory, a "free city" where crooks wanted elsewhere can walk free, and all kinds of shady business gets conducted – a great place for *Casablanca*-style tales of intrigue.

The Cycler Spacecraft

This design for a first-generation Cycler is based on a design done under contract to NASA by a team at UCLA, using ***GURPS*** TL8 systems and the standard "TransHab" module described on p. 35. It can carry 12 people in spin-generated artificial gravity. It turns at 2.3 rotations per minute, creating 0.3 gees, roughly the same as Mars surface gravity. To get people to and from the Cycler requires a "taxi" using a nuclear-thermal rocket, or an aerobraking shuttle. The tunnels connecting the habitats to the core are simply enlarged armored passage tubes.

Subassemblies: Body +5, 2 TransHabs [Tunnels] +6, Command Pod [Body] +5, Fuel Pod [Body] +4, 2 Tunnels [Body] +2.

Powertrain: 10MW fission reactor powering a 15-lb. ion thruster.

Fuel: 3,600 gallons of argon.

Occupancy: 2 RCS, 12 cabins. ***Cargo:*** 160 cf.

Armor	**F**	**RL**	**B**	**T**	**U**
Body:	4/50	4/50	4/50	4/50	4/50
TransHabs:	2/100	2/100	2/100	2/100	2/100
Command Pod:	4/100	4/100	4/100	4/100	4/100
Fuel Pod:	0	0	0	0	0
Tunnels:	3/20	3/20	3/20	3/20	3/20

Weaponry

None.

Equipment

Body: Compact fire-suppression system. *TransHabs:* See "Habitat" description, p. 35. *Command Pod:* Extreme-range tight-beam radio, Inertial Navigation system, 3 compact hardened minicomputers, 2 terminals, compact fire suppression, 2-man airlock, 12-man radiation shelter.

Design Notes

Armor is ablative on body and command pod, nonrigid on TransHabs. Very Fine quality, limited-production vehicle.

Cycler Statistics

Size: 45'×400' *Payload:* 8 tons *Lwt.:* 122.5 tons
Volume: 17,068 cf. *Maint.:* 29 hours *Price:* $370 million

HT: 9 *HP:* 2,250 *TransHabs:* 4,500 *Command Pod:* 1,200
Tunnels: 150 *Fuel Pod:* 60

sAccel: 0.00006G *Burn Time:* 150 days *delta-V:* 4.8 miles per second

The Mars Lander

The Mars lander uses the same methane-oxygen rocket motors as the Mars Ascent Vehicle (to save on development costs), and can put down about 40 tons onto the surface of Mars, using aerobraking and parachutes to supplement the rockets. It comes in two parts: the crew habitat, which the astronauts live in during the voyage out and while on Mars, and the landing stage itself. Since the Mars lander is present-day technology, it's designed using TL8 systems without "advanced" materials. (Note: where design stats disagree with ***GURPS Vehicles,*** they are using NASA figures from the Design Reference Mission mass budget breakdown.)

Habitat Module

The standard Mars habitat unit, or "TransHab," is a squat cylinder about 20 feet across and 20 feet tall. It is made of light composites and relies on internal pressure to hold its shape. The outer walls are tough fabric lined with water tankage for radiation protection. Inside the upper level has small sleeping quarters, an exercise area, and sickbay; downstairs is the galley and dining/common area. The common room is open to the upper floor, creating a large space to keep the crew from feeling too cramped. Power for life support comes from the nuclear rocket stage during the Earth-Mars journey, and on the surface of Mars comes from the power plant attached to the fuel-making system. A solar panel provides emergency power.

Subassemblies: Body +6.
Powertrain: Solar cells generating 3kW at Mars, batteries holding 900 kWH.
Fuel: —
Occupancy: 2CS, 4S, 6 cabins. ***Cargo:*** 100 cf.

Armor	F	RL	B	T	U
Body:	2/100	2/100	2/100	2/100	2/100

Weaponry
None.

Equipment
Body: Medium-range very sensitive radio, Very long-range tight beam radio, compact hardened minicomputer, Compact fire-suppression system, 2-man Airlock, 4,400 man-days of provisions, exercise room, operating bed, 1,100-lb. rover carried externally.

Habitat Module Statistics
Size: 20'×20'×20' *Payload:* 8 tons *Lwt.:* 34 tons
Volume: 6,000 cf. *SizeMod:* +6. *Price:* $49 million

HT: 12 *HP:* 4,500

Lander Stage Statistics
Size: 14'×20'(plus payload) *Payload:* 40 tons *Lwt.:* 57 tons.
Volume: 2,800 cf. *SizeMod.:* +5 (+6 loaded) *Price:* $17 million

HT: 10 *HP:* 1,500 *Legs:* 375

sAccel: 0.5G *Burn Time:* 6 min. *delta-V:* 0.85
Stall speed 0

Design Notes
Armor is nonrigid. Price includes the modifiers for Very Fine quality and limited production.

Lander Stage

The same landing stage is used for all missions, with cargo in place of the habitat for supply landings. It uses aerobraking and parachutes to shed most of its orbital speed. A small crew compartment and a lot of extra fuel tanks turns a lander stage into a Mars Ascent Vehicle. Since the program gradually builds up a surplus of lander stages on Mars, in later years they may be converted to small suborbital "hoppers" for long-distance exploration, or pressed into service lifting small payloads to orbit.

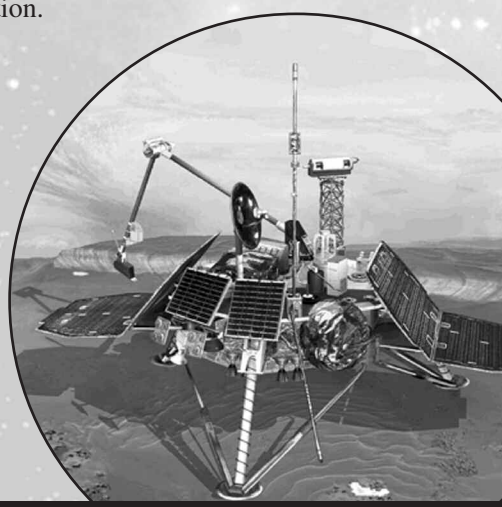
Subassemblies: Body +5, four Legs [U:Body] +3.
Powertrain: Advanced battery holding 1,000 kWS of energy; 60,000-lb. methane-oxygen rocket.
Fuel: 3,000 gallons of oxygen, 1,300 gallons of methane.
Occupancy: unmanned. ***Cargo:*** 40 tons on top deck.

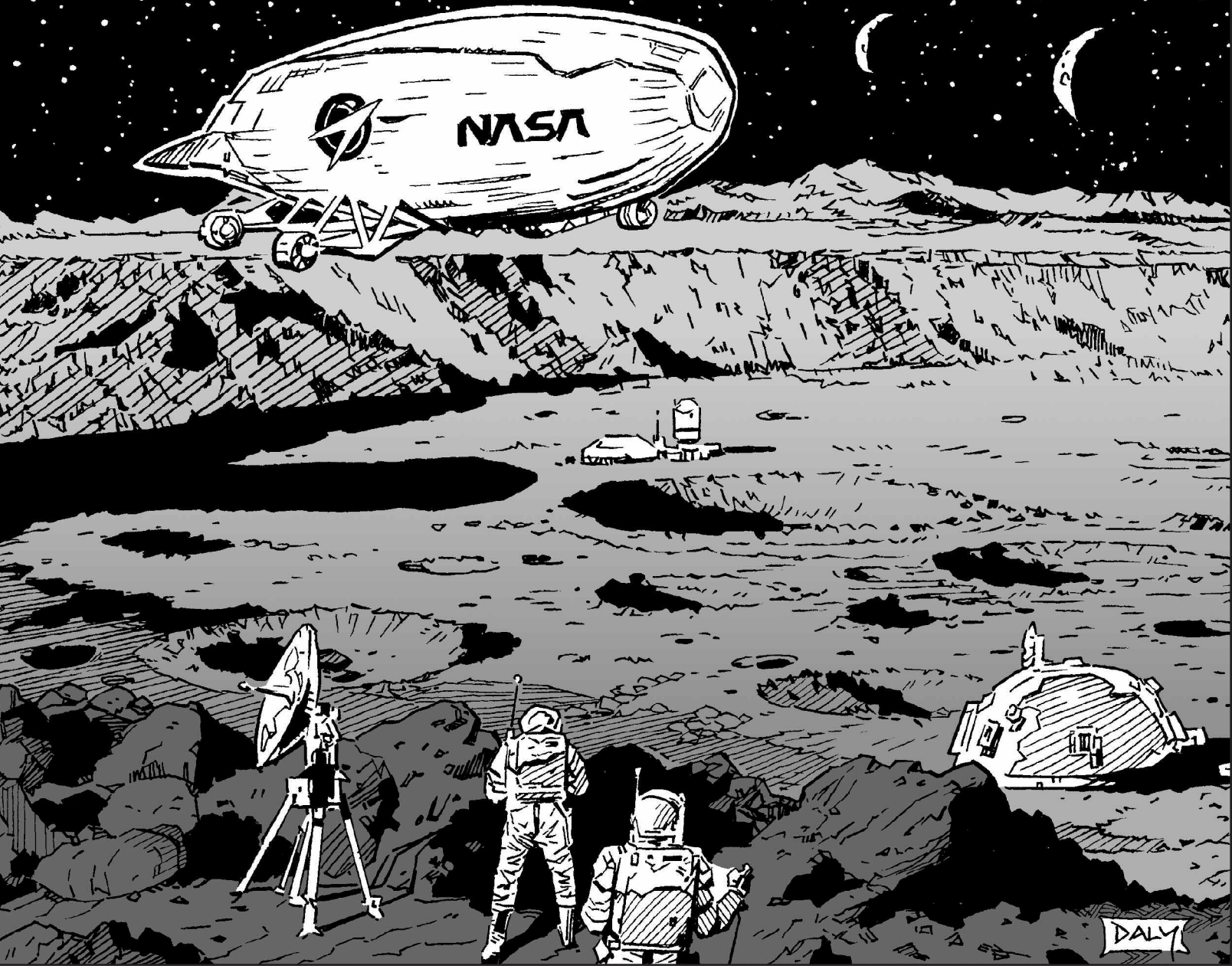
Armor	F	RL	B	T	U
Body:	3/15	3/15	3/15	3/15	3/15

Weaponry
None.

Equipment
Body: Terrain-following radar, inertial navigation system, compact dedicated hardened minicomputer.

Design Notes
Note that the lander stage itself is not sealed or radiation-shielded because it is unmanned. Only the crew habitats are protected. Armor is open-frame only. It has a guidance computer and a terrain-following radar to determine altitude, but a manned lander would be controlled from the habitat module. The cost includes the multipliers for Very Fine quality and limited production; the actual price is likely to be higher. The lander's total delta-V is 0.85 miles per second: half is used for orbital adjustments at aerocapture, the rest for the terminal descent after parachute and aeroshell separation.





Getting Around on Mars

The two simplest ways to travel on Mars are driving and flying. Driving is slow, but is the only way to move any heavy payloads. Flying allows one to cover more distance, and makes it immensely easier to cross difficult terrain.

Needless to say, there are no roads on Mars. All travel is off-road travel. The lowland basins of the northern hemisphere and the smooth floors of large craters like Hellas and Argyre are probably the easiest terrain for travel on Mars, and count as normal off-road movement.

Cratered uplands, chaotic terrain and old lava flows like those surrounding Olympus Mons are Broken terrain, slowing vehicles to half their usual off-road speed. Characters driving in Broken terrain must make a successful Navigation skill roll to avoid getting lost and losing a day's travel. Mars' polar regions are both Broken and Icy, slowing movement to 1/3 normal, although machines built with skis to run on snow can travel as if on a paved road.

The most difficult terrain to cross are the mountainous rims of large craters, or the fractured canyon network of Noctis Labyrinthus. They count as Broken terrain for movement purposes.

Unless travelers are following a marked route, they will encounter one hazard per day in open country, 1d/2 per day in Broken or Icy terrain, and 1d per day in very difficult regions. The vehicle operator must make a successful Driving skill roll to avoid mishap. On a simple failure the vehicle skids or hits a small rock; on a critical failure it hits a big rock or rolls down a slope.

Skids do nothing to wheeled vehicles except shake up the passengers. If a tracked vehicle skids, roll the vehicle's HT+2 to avoid shedding a track (requiring a Mechanic skill roll and one man-hour of work per 4 tons of vehicle mass). Colliding with a small rock inflicts a number of dice of crushing damage equal to half the vehicle's speed to one tread or forward wheel; hitting a big one does 10d times speed to the front of the vehicle. A roll sends the vehicle tumbling sideways down a slope. Roll 1d to see how the vehicle winds up. On a 1-3 it tips over on its side, on a 4-5

it lands upside down, and on a 6 it rolls all the way over and lands upright. Whichever side the machine ends up on takes 10d damage per ton of weight (remember to use Mars weight).

GURPS Vehicles

Designing ***GURPS Vehicles*** craft for use on Mars requires some adjustments for the lower gravity and the thinner atmosphere. For ground vehicles, compute performance normally, using the Earth values for loaded mass, but when figuring off-road speed, use the Mars weight (40% of Earth weight for simplicity's sake) to determine ground pressure. Vehicle Health also uses the Martian weight. This seems a reasonable compromise: a low-power motor won't suddenly be able to move tons of mass, but vehicles can bounce around the Martian surface without breaking an axle.

Airplanes benefit from the lower gravity, which reduces aircraft weight, but suffer from having to generate lift in the thinner air. A given volume of Martian air has only 1/60 the mass of a comparable amount of Earth air. Multiply stall speed by 8 when calculating whether or not a plane can fly (but remember to use the Martian value for weight). The thin air does reduce drag, so treat all aircraft as having Radical streamlining even if they aren't streamlined at all. To make matters worse, most aircraft motors don't work well on Mars. Jets are out because there isn't any oxygen to burn; and airscrews, ornithopters, or rotors divide thrust by a factor of 8 in the thin air. Rockets develop normal thrust.

Airships and balloons can make use of the fact that Mars' atmosphere, though tenuous, is composed of relatively heavy gases like carbon dioxide and argon. A cubic foot of hydrogen has a lifting power of 0.0004 lbs. on Mars. That may not sound like much, but recall that the entire weight of the airship is reduced by the lower Martian gravity. The cost of lifting gas is also lower: the amount of hydrogen required to fill 1 cubic foot at Earth atmospheric pressure can fill 30 cubic feet on Mars. That being said, it still takes a pretty big balloon to carry a useful payload on Mars – at least 20,000 cubic feet just to lift the gasbag. Because of the reduced efficiency of airscrews, in some circumstances airships may be rocket-powered!

On the other hand, Mars is a great place for launching spaceships. Getting off of Mars is a lot easier than leaving Earth. Low orbital velocity for Mars is only 7,900 miles per hour. Spacecraft don't need as much fuel to lift off, which in turn means they can be much smaller than an Earth ascent vehicle. The lower gravity means craft don't need as much thrust, either. Single stage to orbit craft are entirely practical. Use the Mars value for vehicle weight, and simply design something which can get up to 7,900 miles per hour. To reach Phobos, the required delta-V is 11,741 miles per hour from the surface of Mars, and for Deimos it is 12,850 mph. Getting to Earth is a little complicated, because of the difference in orbital inclination and axial tilt; for a minimum-energy Hohmann orbit the required velocity is 14,140 mph (this is also the velocity for a shuttle going to or from a Mars Cycler). Spaceships using solar power or solar sails are hampered by the fact that sunlight at Mars is only half as intense as at Earth.

Since Mars has no bodies of open water, creating boats or submarines seems like a waste of time. In a terraformed Mars campaign (see Chapter 5), boats and ships for Mars become possible. Use the mass in Earth units when figuring speed, but use the Mars weight when calculating buoyancy.

Most weapons require little or no modification to work on Mars. Guns may need protection from the extreme cold (a good coating of low-temperature lubricants to keep working parts from gumming up, for example), but can fire in Martian atmosphere normally. The low gravity and thin air do extend the range of projectile weapons: multiply maximum range by 2.6, but 1/2D range is unchanged. Increase the minimum strength for guns by 2. The thin, clear atmosphere helps the performance of lasers, as they lose less energy heating the air. Double the range of lasers in normal Martian air; atop high mountains use the 10× multiplier for vacuum. Treat dust storms as heavy smoke. Sonic weapons are severely impaired, reducing range by a factor of 100.

Mars 1956

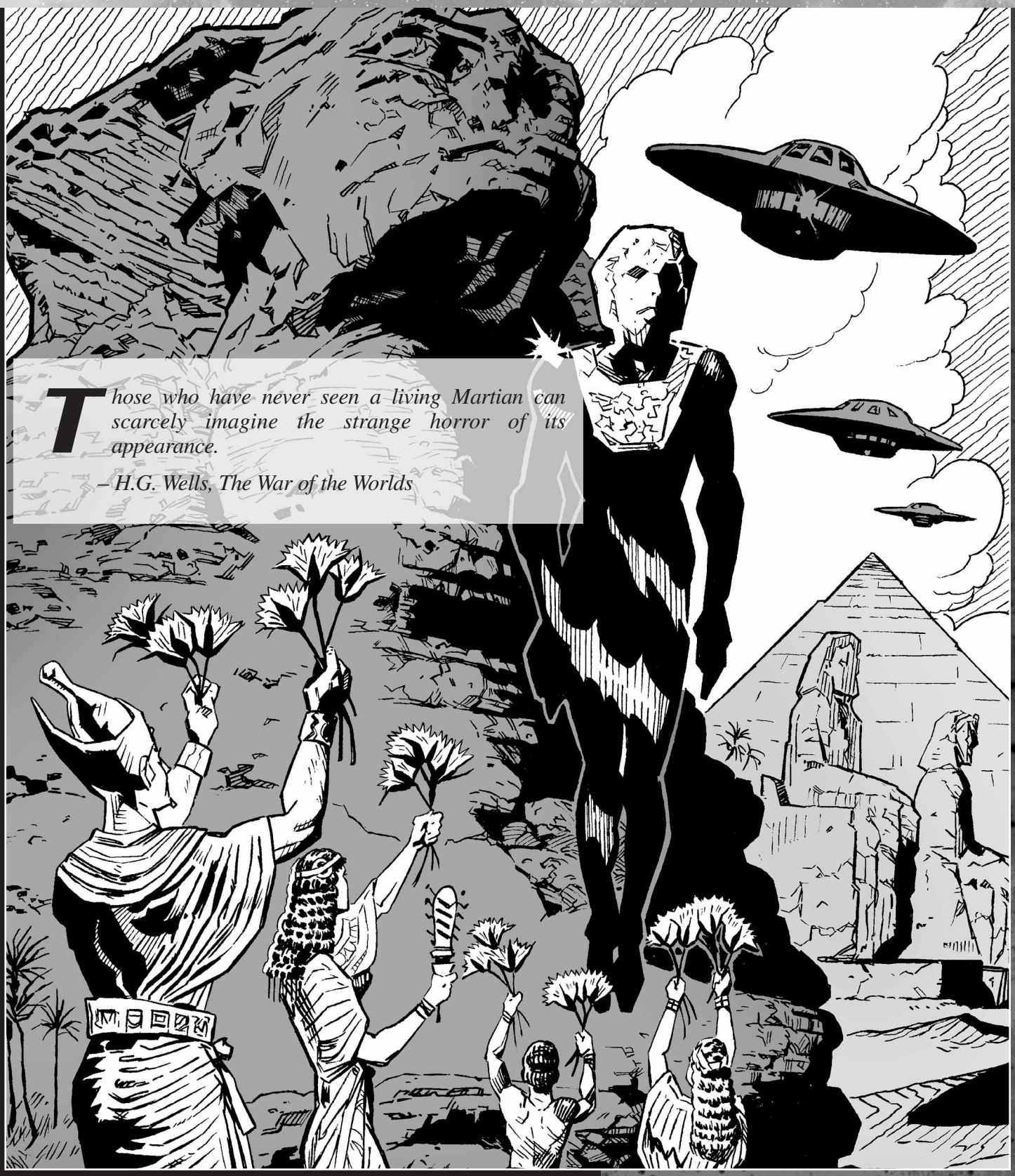
Even before the first satellites orbited the Earth, the rocket pioneers Wernher Von Braun and Willy Ley drew up an ambitious plan for a manned Mars mission. Their book *The Exploration of Mars,* illustrated by the legendary Chesley Bonestell, influenced space program planners and science-fiction writers for half a century.

Von Braun certainly did think big. His plan called for a 12-man expedition aboard two ships, with a winged Mars lander and a temporary base to house the crew for over a year before returning to Earth. The mass budget included 38 tons of supplies for the crew, 1,540 lbs. of navigation instruments and books, a 3,600-lb. telescope to study Mars from orbit, and 4,400 lbs. for a radio capable of signaling Earth! Each of the Mars landers would weigh a hefty 177 tons (nearly twice the size of the Space Shuttle), and the whole mission upon assembly in orbit would have a combined weight of 3,740 *tons.* (Compare that with the 90-ton total of Zubrin's Mars Direct plan.) Getting such a huge amount of material up into orbit would require a fleet of giant boosters on the scale of the Saturn V; Von Braun downplayed the expense of it all, comparing the effort to the cost of the Berlin Airlift.

Once on Mars, the space explorers (nobody had come up with the term "astronaut" yet) would study the soil, examine Martian life forms, and perhaps even survey the ruins of Martian civilization. ***GURPS Atomic Horror*** GMs who want to send their player characters to Mars can easily adapt Von Braun's ideas. On a more sinister note, the Von Braun plan's grandiose scale might appeal to a victorious alternate Nazi regime like Reich-5 from ***GURPS Alternate Earths.***

CHAPTER 3

MARS IN FICTION AND MYTH



Those who have never seen a living Martian can scarcely imagine the strange horror of its appearance.

– H.G. Wells, The War of the Worlds

Dial M For Martian

The biggest decision to make when using Mars in a role-playing campaign is which Mars to use. Percival Lowell's version? Ray Bradbury's? Kim Stanley Robinson's? What about the Mars of *Santa Claus Conquers the Martians*? There are several "dials" to twiddle when creating a Mars campaign – realism of the setting, technology level, and who the focus will be on.

Hard Science vs. Planetary Romance

The first dial is the realism level. It might better be imagined as a switch, since stories set on Mars tend to fall into two distinct camps. The hard-SF version of Mars uses the most accurate and up-to-date information on the planet, and focuses on the problems of survival and colonization in a hostile environment. The campaign settings in Chapters 4 and 5 are "worked examples" of the hard science Mars. Fictional depictions of a realistic Mars change over time – what was rock-hard science 50 years ago is now quaint science fantasy. Recent modern examples of a realistic Mars include Kim Stanley Robinson's *Red Mars* and sequels, or Geoffrey Landis' *Mars Crossing.*

A hard-SF Mars is unlikely to have any life at all, given what is known about conditions there, although sometimes authors or film makers are willing to fudge things a bit. Even if Mars is lifeless *now,* perhaps once it was more habitable, or maybe it was an outpost for visiting aliens from another star system. Signs of life or civilization on a realistic Mars shouldn't go beyond bacteria living in underground aquifers, with maybe some half-buried ruins billions of years old.

The converse of the realistic Mars is "planetary romance" Mars. This is the full-bore, damn-the-facts version of the planet which clings to the visions of Percival Lowell and Edgar Rice Burroughs. A romantic Mars has breathable air, canals, temperatures above freezing, and a good supply of exotic life forms. This is the Mars of classic adventures like *A Princess of Mars,* "A Martian Odyssey," *Out of the Silent Planet, The Sword of Rhiannon, The Martian Chronicles,* and countless others. (In recent decades the romantic Mars has found new life under a variety of aliases. L. Sprague de Camp's planet Krishna was an attempt to write Burroughsian adventures without violating scientific realism, and Luke Skywalker's home planet of Tatooine in *Star Wars* has everything but the canals.) On a romantic Mars the problems are usually not the technical challenges of surviving the environment, but instead are things like hostile desert tribes, scheming slave traders, interplanetary warlords with an eye for buxom Earth women, or big animals with lots of teeth.

Primitive vs. Advanced

The second dial controls how advanced the Martians are. There are four main possibilities. In descending order, they are: Martians as Elder Race, Martians as rivals, Martians as decadent survivors of greatness, and Martians as primitives.

If the Martians are more advanced than the Earthlings, they are the Elder Race. The all-time classic version of super-advanced Martians was the tentacled invaders of H.G. Wells' *The War of the Worlds.* Exactly how advanced the Martians are depends on the technology available to humans. Wells' Martians had armored vehicles and flying machines; half a century later George Pal's film gave them antigravity and force fields capable of withstanding atomic weapons. Space-faring Terrans with fusion rockets and lasers would require Martians of TL10 or 12, at least, whereas Martians attempting to conquer the Roman Empire might have nothing more astounding than cannon. A lead of one or two Tech Levels seems about right unless the whole point is that the Martian science is incomprehensibly advanced. Note that the Martians don't even have to be alive to be the advanced Elder Race; they may have died off eons ago, leaving the planets of the Solar System littered with potent doohickeys ready to be recovered by astronaut-archaeologists.

Martians as rivals to humans are best if their technology is roughly comparable. Perhaps they are more advanced in one or two fields, to make up for the Earthlings' advantage of numbers or Indefinable Human Superiority. Again, the exact tech level for the Martians depends on what the Terrans have. Often rival Martians have had their advanced science much longer than humans have, but don't progress as quickly. At the time of first contact the Martians have the scientific edge, but both sides can see that eventually the tables will turn. The Superscience Martians of Chapter 6 are either rivals or an aggressive Elder Race, depending on the tech level of the Earthlings.

Decadent Martians may have once had incredibly advanced science – ***GURPS*** TL12 or higher – but the struggle to survive as their planet dies has made them forget much of what they once knew. Decadent Martians are likely to be TL4, the equivalent of 18th-century Europe. This is arguably the highest tech level which can be maintained by a small population widely dispersed. Naturally, the decadent Martians can have plenty of relic technology left over from the old days. This allows the campaign to have cool stuff like battles between antigravity-alloy flying ships, using muzzle-loading cannon and boarding pikes in the approved swashbuckling style. Chapter 7 shows a decadent Mars in its last days.

Finally, the poor Martians may never have had the chance to develop much in the way of technology at all. Either the challenge of surviving in such a hostile environment has kept them primitive, or else they're still presentient. Primitive Martians can't pose a threat to Earth or even to visiting astronauts; the problems they pose tend to explore the limits and responsibilities of the powerful and advanced to the poor and weak.

Silly Mars

Mars has gotten the comic treatment many times. Martians can visit Earth and comment on human foibles, or they can have societies which parody our own. Silly versions of Mars can range from the absurdist Disney-sponsored expedition of Terry Bisson's *Voyage to the Red Planet* to the outright camp lunacy of *Santa Claus Conquers the Martians.* Some key silly tropes:

Mars Needs Women! Martians lust after comely Earth women, and sometimes after hunky Earth men as well. It gets especially interesting if the Martians reproduce via spores or budding.

Death Before Split Infinitives! Martians always speak in impeccably precise English, often with a British accent. They do not use contractions, they utilize hyper-scientific terminology, and a dangling participle is something up with which they will not put.

Mars Attacks! Martians aren't just aggressive, they're *insanely* aggressive, zapping cute fluffy animals and plotting to obliterate the Earth simply because it obstructs their view of Venus.

It Looked Okay From Earth. . . Humans don't bother to explore with any care at all before setting up colonies, melting the permafrost, or terraforming the planet. As a result they are often in peril from things a five-year-old might have warned them about. "I thought *you* brought the oxygen!"

Toon Mars: Perhaps the silliest Silly Mars is that of the classic Warner Brothers cartoons, starring the inimitable Marvin the Martian. With his unflappable demeanor, true scientific detachment, and inexhaustible arsenal of "A-1" brand superweapons, Marvin is an inspiration to all Silly Martians. (A stuffed Marvin doll even put in an appearance at JPL Mission Control during the Mars Pathfinder landing.)

Red Planet Mars! The Martians are Commies! They spout Marxist jargon and are plotting to destroy our way of life!

Three Little Men From Mars Are We

Music by Sir Arthur Sullivan, lyrics by Kenneth Hite
(with apologies to William Schwenk Gilbert)

Three little men from Mars are we,
Green as a Martian well can be,
Filled to the brim with malignancy,
Three little men from Mars!

Monitoring your TV feeds,
Growing from pods or from tiny seeds,
Women are just what dry Mars needs,
Three little men from Mars!

Three little Martians, oh so scary,
Come to invade, as is customary,
Once we've destroyed your military,
Three little men from Mars!
Three little men from Mars!

One Martian man is an army's worth,
Two Martian men trained to kill from birth,
Three Martians joined can rule the Earth,
Three little men from Mars!
Three little men from Mars!

To one Martian man give a common cold,
Briefly the two put their plans on hold,
Then they return all at once threefold,
Three little men from Mars!
Three little men from Mars!

Three little Martians, saucers flying,
Covet the Earth 'cause our planet's dying,
Made you believe Orson Welles was lying,
Three little men from Mars!
Three little men – from Mars!

Dying World vs. New Frontier

Over the years writers have imbued Mars with all kinds of symbolism. Is it a new home for humanity, an unspoiled Eden, or a dead world?

At one end of the dial is the idea of Mars as the New Frontier, the American West lofted into space. This Mars is just waiting for human settlement. Realistic treatments of the New Frontier vision are often terraforming stories, as in *Green Mars* or *Martian Rainbow.* The examples in Chapters 4 and 5 implicitly follow this view. Romantic versions of the Martian frontier include Heinlein's *Red Planet* and Moore's "Shambleau." If there are Martians, they fill the role of Apaches or possibly East Indians under the British Raj – either primitive savages or decadent ones.

One notch over is the notion of Mars as an Eden which shouldn't be sullied by human beings. C.S. Lewis was explicit on this point in *Out of the Silent Planet,* in which the inhabitants of Mars live in direct contact with God and only Earthmen are sinful. A more secular and hard-SF approach is the attitude presented in Brian Aldiss' *White Mars* or that of the Preservationists in ***GURPS Transhuman Space*** – the lifeless natural beauty of Olympus Mons or the Valles Marineris shouldn't be turned into a poor imitation of Earth.

Ever since Percival Lowell, Mars has been depicted as a dying world. Beyond the concept of Mars as unsullied Eden is the idea of Mars as a once-great world now in its last days. Often this includes a warning to humans about the potential fate of the Earth some day (as Wells noted in passing in *The War of the Worlds* and elsewhere). Dying, decadent Mars may be home to civilizations wiser than humanity, or may have nothing but the ruins they left behind. A ghost of this idea lives on in the continuing fascination with the Face on Mars beloved of pseudoscientists.

Twisting the dial all the way over, a dying world may be dangerous if the Martians aren't ready to go extinct just yet. The Martians may decide to look for a new home somewhere else, in which case it's *Earth* that is the New Frontier – and humans are the oppressed natives. Or perhaps the microorganisms which manage to survive in the tough Martian environment become a killer pandemic on Earth. More realistically, Mars could turn out to be a lethal dead end for human explorers, simply by virtue of being more hostile than they expect. The greenhouse plants die from toxic trace elements in the melted ice, dust causes respiratory illnesses and fouls up the vehicles – and no help can arrive for six months.

Mystic Mars

Mars has powerful mystical connotations. After all, it's named for a god, and a pretty high-powered one at that. Mars was one of the chief gods of the Romans, a protector of crops and patron of the army. In some versions of the legend of the founding of Rome, Mars was the father of Romulus. Throughout ancient Italy he was known variously as Mars, Mavors, Maurs, Mamers, Marmar, Marmor, Mamurius, and Marspiter. The month named for Mars, Martius (our March) was originally the start of the Roman calendar, before reforms moved the new year to January. The Ides of March (March 15) was the chief festival of Mars, marked by horse races on the Campus Martianus and processions by the Salian College of priests. (The fact that military leader Julius Caesar was assassinated on the Ides of March puts an interesting mystical spin on his career: was Julius somehow a sacrifice to ensure that the Empire's legions would be victorious for the next three centuries?)

The Salians carried a sacred shield called the Anchile, which fell from heaven at the feet of the early Roman king Numa. (A midget flying saucer?) To keep anyone from stealing the shield of Mars, Numa had eleven duplicates made, which the Salians kept. The genuine Shield of Mars would be a swell MacGuffin for some Indiana Jones-style archaeology in Fascist Italy, with Mussolini's Blackshirts as villains instead of the Nazis. Otherwise, it could be yet another item for Warehouse 23. The powers of the Shield of Mars weren't clearly specified, but it would certainly be appropriate for the God of War to give victory to the side bearing his shield.

The horse was sacred to Mars, and his bird was the woodpecker. Trees sacred to Mars included the oak (even today, majors in the Army wear an oak-leaf insignia), fig, dogwood, and laurel. Besides being a tutelary god of Rome, Mars was also the patron of Florence. Mars' consort was Bellona, a terrifying goddess of war and death, worshipped by ex-gladiator priests who wounded themselves in her honor. She was depicted as a wild-haired woman in armor holding a bloody lash.

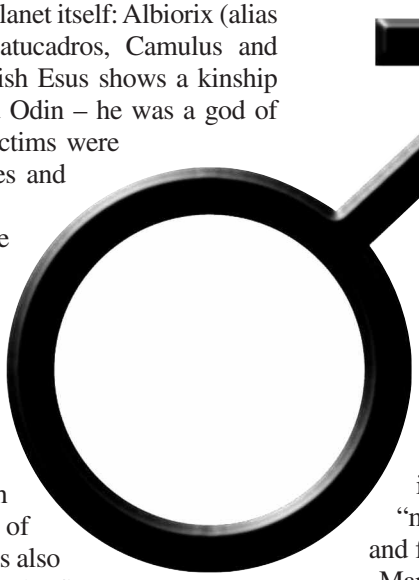
The Greek god Ares closely paralleled Mars, but lacked his identity as a patron of agriculture. Ares was a pure war-god, and as such was much less attractive. In early Sparta, prisoners of war were sacrificed to him. The cock, the dog, and the vulture were his animals. He was the brother or husband of Eris, and like all Greek gods had liaisons with several other women and goddesses. By the princess Astyoche he had twin sons, Ascalaphus and Ialmenus, who fought at Troy. With Aphrodite, Ares had several children, including the minor gods Phobos, Deimos, Anteros, Harmonia, and Eros. Through his liaison with the maiden Chryse, Ares was the grandfather of the hero Pirithous, and the ancestor of the Centaurs. In the later Roman Empire, Mars and Ares were essentially combined, and Mars increasingly took on his Greek avatar's boastful and semi-comic personality.

In the pre-Olympian cosmology of the Greeks, the Titans Dione and Crius presided over the planet Mars. Crius is something of a cipher, but Dione was a goddess of moisture and the oceans, whose name may be a cognate of Diana. This can be taken as an indication of the "Venus-dominated" tone of myths in the Age of Taurus (see the section on Astrology below). In a particularly mystic campaign, characters might be part of a "theological terraforming" project to exorcise the life-destroying influence of Mars and restore the planet to its watery, hospitable identity under Dione.

Other Mythologies

In Norse and Teutonic mythology, the planet Mars was identified with the god Tyr, or Tiwaz. Originally a sky-god similar to Zeus, Tyr became the god of war and order. When the gods tried to bind the wolf Fenris, it was Tyr who agreed to place his hand in the beast's mouth as a pledge of good faith, knowing it would be bitten off when Fenris discovered he was chained up. Though Tyr was gradually eclipsed by the more colorful Thor, he was nevertheless an important figure, and Tuesday is named for him.

Among the Celts there were several gods identified with Mars, either the Roman god or the planet itself: Albiorix (alias Rigosamos), the horned god Belatucadros, Camulus and Cocidius, among others. The Gaulish Esus shows a kinship with both Mars and the Norse god Odin – he was a god of both vegetation and war, whose victims were sacrificed by being hung from trees and allowed to bleed to death.



In the Hindu pantheon, there are two gods identified with Mars. Karttikeya is the son of the fire-god Agni and either the goddess Devasena or the Ganges river. Karttikeya is a mighty demon-slayer, riding his peacock Parvani. He is a god of war and a patron of thieves, and often is portrayed with six heads. Mangala, an avatar of Shiva, is also linked with Mars; he is also a warrior god, riding a chariot drawn by fiery horses.

The Egyptians called Mars Harmakhis, the "Red Horus," or "Horus of the horizon." In that form the Sphinx may be associated with Mars. (GMs who want to use the Face on Mars and prehistoric connections between Mars and Egypt should hit that reference as hard as they can.)

In Mesopotamia the planet Mars was associated with Nergal, a god of death and the underworld, who sent plagues to slay humans. Interestingly, Nergal started out as a sky-god, who took over the rule of the underworld from the goddess Ereshkigal. GMs fond of the Crick-Ponnamperuma theory that epidemics can come from space may find useful links among the plague-god Nergal, the planet Mars, and the possibly bacteria-bearing ALH 84001 meteorite found in Antarctica. Maybe Wells had it backward, and it's the Martians who are waging interplanetary germ warfare.

The Aztec war-god Huitzipochtli was identified with Mars, and had the usual associations of blood and manliness. The Aztecs, of course, took the blood aspect very literally. GMs with a particularly Lovecraftian bent might want to draw together all the similarities of Mars gods across various cultures – blood, death, masculinity, iron, heat – and postulate some still-living "Mars Entity" as the original source. This being, whether supernatural or merely alien, would be a genuine cosmic horror, uncomfortably close to the common idea of Satan. If the "Mars Entity" does live on Mars (under the big Face, or else in the molten bowels of Olympus Mons), then visiting astronauts are *really* going to have a hard time.

Mars in Astrology

The planet Mars has an important role in astrology. It symbolizes men, husbands, warriors, athletes, metalworkers, miners, and surgeons. The metal associated with Mars is iron, and its corresponding color is red (of course). Tuesday is Mars' day of the week, its direction is the South, and its gemstones are ruby and turquoise. Mars rules the libido, the muscles, the appetite and sense of smell, the voice and breath, and all forms of vital energy.

In Hindu astrology, Mars is known as Mangala, Angaraka, or Kuja. As in Western tradition, the planet is a symbol of masculinity, aggression, war, machinery, strife, and energy. Red coral is Mars' stone in that system. As the warrior Kartikkeya, Mars is connected with the Pleiades, the six goddesses who nursed his six heads.

Mars is considered an unfortunate planet by most classical astrologers, as it presages conflict or bloodshed. Modern astrologers view it more positively, as the source of vital energy, masculinity, and courage. Those born under Mars are said to be active, strong, brave, and tireless, but often lack imagination and patience. It is an overwhelmingly "male" symbol in astrology, with all the male virtues and flaws.

Mars is closely linked to the Zodiacal constellation Aries, the Ram, a very masculine and fiery sign. The period from 2350 B.C. to 200 B.C. was the "Age of Aries" (meaning the Sun was in the constellation Aries at the Spring equinox). That period was thus dominated by Mars. The dawn of the Age of Aries was marked by the building of the Pyramids. Jason sailed off to seek the Golden (Ram) Fleece with a crew of muscular heroes. Iron (Mars' metal) came into use, replacing the bronze of the Venus-dominated Age of Taurus (bronze is an alloy of copper, the metal of Venus). Warriors using iron weapons set up great empires, culminating with the world-conquering exploits of Alexander the Great (who was depicted as having ram's horns when he was deified).

Mars also rules the constellation Scorpio. The brightest star in Scorpio is Antares, a red star whose name means "Not Mars" or "Second to Mars." Evidently the ancient astronomers kept mistaking one bright red object in the sky for another. The presence of Antares is about the only reasonable explanation for Mars being the patron planet of Scorpio, as the constellation is traditionally associated with water, cold, and darkness (perhaps because scorpions often hide out in dark moist places). It is also a sign of fertility, governing the genital organs. Like the namesake animal, Scorpio indicates a quickness to anger, which may also explain the connection to Mars. More recent astrologers have given the planet Pluto dominion over Scorpio. (The shift could either be a recognition of the true "scientific" astrology, or the occasion for a mystical turf-war between Mars and Pluto. Is that the reason for the past century's litany of war and plagues?)

Mars and the Cabal

In the Hermetic magic scheme of ***GURPS Cabal,*** Mars is associated with the decans Charchnoumis, Bianakith, Eneuth, Ruax, Roeled, and Tepsisem. Their respective spell colleges are Animal, Body Control, Fire, Mind Control, Protection and Warning, and Unknown. In a spacefaring ***Cabal*** campaign, GMs may want to give all those colleges a +3 bonus when cast on Mars, or else simply declare Mars a normal or high-Mana zone for those colleges only. Mars and Venus are mystically opposed, so on Mars a corresponding penalty should be levied on the colleges of Communication and Empathy, Sound, and Water, all of which are the domain of Venus-associated decans.

Casting astrologically-influenced magic on other planets opens up a big can of metaphysical worms. How does the Earth itself fit into the decanic magic system? The simplest way to handle it is to assume that Earth is mystically "neutral" and doesn't have any astrological influence of its own. Those who like more complexity can posit that the Earth takes on the mystical associations of the Moon from the perspective of other planets. In that case, the Earth-Moon combination has power over spells of the Illusion and Creation college, and over Healing magic. Since both those colleges are very concerned with human minds and bodies, it's appropriate that they don't work as well on other planets where humans are scarce. Give them an extra -3 penalty away from the home of humanity.

Another astrological problem for Martian mages is where to fit Phobos and Deimos into the system. They whip through the signs of the Zodiac very quickly (with Phobos a clock is more useful than a calendar), and appear in different constellations from different positions on the Martian surface. Again, the simplest thing would be to ignore them as simply too small and astrologically insignificant. Masochistic GMs can assign them a college and track modifiers depending on where they are in the sky at the time spells are cast.

In a Cabalistic campaign, the fictional versions of Mars described in Chapters 6 and 7 may well exist within the Iconic Realm of Briah. Naturally they would have connections to the planetary sphere of Mars in Briah (see ***GURPS Cabal,*** p. 46, for a more detailed discussion of the mystical planetary spheres).

The Mars Effect

The "Mars Effect" was described by the French psychologist Michel Gauquelin in 1955, and at first appeared to be a scientific justification of astrology. Gauquelin divided the path of Mars through the sky into six sectors from rising to setting, and produced evidence indicating that outstanding athletes were disproportionately born at times when Mars was in sector 1 (rising) or sector 4 (just after zenith). Instead of the 17% one would expect from random chance, Gauquelin claimed 22% of champion athletes were born in those two sectors. Gauquelin also found correlations between professional excellence in other fields and the position of other planets at the time of birth, though the Mars effect was the most significant.

Space Gods From Mars?

If there's no sign of Martians coming to Earth nowadays, they may have visited us in the distant past. Most "ancient astronaut" theories involve interstellar visitors rather than Martians teaching humanity pyramid-building and other useful arts, but that changed with the discovery of the Face on Mars and nearby features which (kind of) look like pyramids. Graham Hancock took time out from locating the Lost Ark in Ethiopia and Atlantis under the Antarctic ice to draw all kinds of suggestive parallels between the Pyramids of Egypt and their Martian counterparts.

To explain the current lifeless state of Mars, ancient-astronaut theorists have to posit very rapid climate changes which plunged the planet into a permanent ice age. (The more baroque versions link it to the explosion of the fifth planet, which created the asteroid belt. Presumably the blast affected Mars' orbit and subjected it to a rain of huge meteorites, creating the crater-studded surface we see today.) The Martians fled to Earth, and either became our own ancestors or created them by genetic engineering of primate stock.

The advanced Martians did all the usual ancient astronaut things – putting up pyramids, building sacred sites at geometrically-significant points on the Earth, and leaving cryptic clues in myths and tomb carvings. Either the Martians died out or their civilization collapsed (perhaps when humans revolted against their alien masters), and all their mystic-scientific knowledge was lost until now.

Space Gods From Mars can enter a campaign in several ways. Discovery of unambiguous proof that there once were advanced Martians on Earth would certainly be a good pretext for a manned Mars mission to the Cydonia region, where a NASA team can play Indiana Jones in spacesuits amid the Pyramids of Mars. In a conspiratorial game, evidence of ancient Space Gods could ultimately lead to the discovery that some major Illuminated group are the descendants of the Martians, still ruling us from behind the scenes. Time travelers will get the surprise of their lives when a simple fact-finding mission to predynastic Egypt turns up Martians; this might even lead to time jaunts on Mars back to the glory days of Martian civilization. Finally, Earth under the Space Gods is a great place for adventuring, as early Bronze Age humans are pawns in the plans and conflicts of the Martians. The similarities among mythological depictions of Mars suggest the ancient astronauts weren't very nice people; maybe the player characters will be the ones to lead the human revolt against the Space Gods, freeing humanity (and destroying civilization in the process).

Unhappily for Gauquelin, subsequent investigations of the phenomenon and his methods cast grave doubts on his findings. For one thing, exact birth times aren't easy to find without exhaustive research (remember, this was before easy computer access), and for many individuals the time simply isn't recorded at all. Second, the definition of a "champion" athlete is somewhat subjective, as anyone who has ever had a sports argument can attest, and Gauquelin appears to have picked champions who were born at the proper times. When researchers use more objective criteria for their athletes and only use verifiable birth times, the correlation with Mars drops to the level of chance.

In a modern magic campaign, the Mars Effect can simply be scientific-sounding handwaving to justify astrology, or it could be a major leak of ancient Decanic wisdom the Cabal is trying to suppress. In a Weird Science or ***Supers*** setting, perhaps the mysterious influence of Mars can be studied and duplicated in the laboratory, leading to the creation of super-athletes (or super-soldiers) brimming with concentrated Martian energy. And what happens to explorers who actually *go* to Mars if the Effect is real? Do they come back with improved physiques? Or do you have to be born there? Finally, the analysis and debunking of Gauquelin's claims are a good example of how real-life "paranormal investigators" work.

Mars in Alchemy

Mars is rife with alchemical symbolism. The symbol for Mars is also the symbol for iron, and many alchemists used "Mars" to mean iron. But Mars has a deeper significance. As the fiery masculine principle, Mars represents sulfur, which unites with cool watery "feminine" mercury to produce the Philosopher's Stone itself. The masculine principle is also known as the Red Lion, the Red Man, or the Red Knight, in opposition to the White Queen. Echoes of these alchemical images might show up in chess, especially when one recalls that many older chess sets have red and white pieces.

Worlds in Collision

While the information about Mars in astrology and mysticism is of most use in a fantasy or Illuminated campaign, GMs can also use it to throw their players a curve in a seemingly hard-science campaign. After the astronaut characters have gone through training and blasted off on a NASA mission to Mars, the GM can hit them with a heavy dose of full-bore Martian Weirdness. Perhaps the whole crew gets steadily more and more "Martian" as they approach Mars, taking on his hyper-macho qualities. Perhaps women crewmembers start to take on attributes of Eris or Bellona – not a recipe for a successful mission. On their return to Earth, living avatars of Mars (or Ares, or Ogun, or Sammael) would be mystically supercharged agents of destruction.

If that doesn't appeal, how about a mission to Mars as alchemical wedding? The spacecraft is the White Queen to Mars' Red Knight; touchdown marks the completion of the Great Work.

The penultimate stage of the Great Work (the process of creating the Philosopher's Stone) is ruled by Mars. At this stage, the stone, blackened by the previous phase (governed by Venus) is washed with "mercurial water," so that it takes on all the colors of the rainbow. This step is known as the "Peacock's Tail" after the iridescent colors created. It should be noted that molten metals sometimes *do* develop a prismatic sheen when quenched. The "Peacock's Tail" stage then must undergo another heating in the refining fire to produce the "albedo," the final form of the Stone. (It is a curious coincidence that there is a Martian volcano called Pavonis Mons, alias "Peacock Mountain." Is it perhaps a giant alchemical furnace, where the ancient Martians attempted to create a Philosopher's Stone capable of restoring their planet?)

Mars in Magic

In Biblical mystical tradition, Mars is the sphere of the angel Sammael, alias Kemuel. "Sammael" can be translated as "poison angel," and Sammael is traditionally an angel of Death. "Kemuel" means "He who sees God." However his name is spelled, he's a potent and terrifying being. He is the chief of the order of Powers, God's seven regents (one for each planet, of course), and is sometimes identified as the angel who wrestled Jacob. He's also one of the Sefiroth. According to one legend, the angel Kemuel attempted to prevent Moses from receiving the Torah from the hand of God; for this bit of meddling Moses destroyed him.

Or maybe Moses just cast him down to Hell. Sammael/Kemuel is also identified as a *fallen* angel, one of the Counts Palatine of Hell. As a demon he appears as a crowned leopard, or as a great serpent with 12 wings. (***GURPS In Nomine*** players can make Sammael either a Balseraph or a Djinn, as they prefer.) Kemuel is also sometimes identified with the ancient Celtic war god Camulus; creative GMs can play on the possible derivation of "Camelot" from "Camulus" to make Kemuel the Martian guardian angel (or patron demon) of the Round Table.

In Kabbalistic lore, Mars is Ma'adim or Meadim, represented by the letter Thallet or Dallet. The Thallet aspect represents intelligence and purpose, Dallet embodies folly and wasted effort.

The Voodoo loa Ogun has obvious connections to Mars: he's a warrior, he's energetic and impetuous, and he has power over blood and metals, especially iron. The planet Mars might well fall under his rule. In a ***GURPS Voodoo*** campaign, a manned Mars mission could wind up being a spiritual steel-cage match between the Roman Mars, the angel (or demon) Sammael, and the loa Ogun. No time limit, no referee, and the winner gets to control the future of a whole planet.

Ley-lines are a major concept in modern magical theory (see ***GURPS Places of Mystery,*** pp. 25-27), and the idea of a planet-spanning network of Lines of Power has an obvious parallel in the Martian "canals" mapped out by Schiaparelli and Lowell. Maybe they were just psychic sensitives, seeing the Martian ley-lines instead of actual physical features. In which case one of Lowell's old maps might reveal high-mana locations on Mars, just waiting to power colossal spells to terraform the planet or swap it for a lifebearing parallel world.

Sailing Through the Crystal Spheres

Mars is usually a venue for science-fiction adventures. But why not use it in fantasy games? Edgar Rice Burroughs' early Mars stories are certainly more fantasy than SF: John Carter is mysteriously immortal, and gets to Mars by wishing himself there. In any fantasy campaign set on Earth, a magician could accomplish the same with the appropriate spells. If cruising the ether in search of new life and new civilizations is something your players can't live without, send them where no human has gone before aboard an enchanted flying ship.

When they get there, fantasy characters may find a Dying Mars world of deserts and canals (see Chapter 7), or a Spiritualist Mars inhabited by the spirits of the dead. Pump up the astrological symbolism by making the Martians aggressively masculine, and give them a mystical vulnerability to copper (Venus' metal). Fantasy-game Dwarves, with their warlike, male-dominated society, love of metalworking, and affinity for fire, make perfect Martians. Silly GMs can give them black skin, Roman helmets, and Marvin the Martian voices.

A nifty variant possibility is to have high-tech Wellsian or Superscience Martians drop out of the sky to invade a relatively low-tech fantasy Earth. Martian technology may clash with Earthling magic, or perhaps the Martians have their own potent sorcery (the associations of Mars with blood and the Wellsian Martians' vampiric habits suggest all kinds of creepy but powerful blood rituals as the source of Martian magical power). This can be either historical fantasy set in any period you want, or a standard elves-and-orcs genre fantasy. How do Heat-Rays stack up against fireball spells and dragon breath? Can Earth's wizards put aside their quarrels to banish the invaders?

In both ancient and modern pagan religions, the Earth itself is the source of life. What does that mean for humans born on Mars? Do they have souls? Do they maybe have *Martian* souls, inimical to Terran life? Characters in a perfectly hard-science Mars campaign may face prejudice or active hostility from cultish Earth worshippers who believe the Mars-born are somehow "soulless" or tainted by the planet's malefic influence. In a more supernatural campaign, maybe Mars colonies find themselves plagued by infertility until some kind of mystical Earth essence can be transplanted to the sterile Red Planet.

Weird Mars

Mars isn't all rationalist NASA science and ancient mystic symbolism. There's plenty of good juicy Martian Weirdness out there, ranging from conspiracy theories to fringe science to spiritualism.

Nikola Tesla, the patron saint of Weird Science (see his writeup on pp. WWi 110-111), has his own Martian connection: in 1899 while testing his "Magnifying Transmitter" in Colorado, Tesla picked up mysterious electrical signals which he believed were messages from Mars. The British writer Arthur Matthews claims that as a lad he helped Tesla construct a pair of bigger "Magnifying Transmitters" in Canada to communicate with space beings. And what's a big electrical transmitter in the far north nowadays? Why, Project HAARP, of course! Maybe the U.S. Navy is using Tesla's old Philadelphia Experiment files to build a method of communicating with Martians.

Nor was Tesla the only one. In 1919 Guglielmo Marconi picked up mysterious radio broadcasts which he speculated might be Martian in origin, and in August of 1924 the U.S. Navy even silenced all radio communication across the Pacific Ocean for three days in order to listen for Martian signals. They *said* they didn't pick up anything . . .

Pyramids of Mars?

Ever since the disappearance of the canals, the best-known feature on Mars is the equally illusory Face. First spotted on a muzzy Viking orbiter image, the Face appeared to be a noseless, grim-faced visage staring up from a mesa in the Cydonia region of Mars. Some of the more Egypt-obsessed fans of the paranormal saw a resemblance to the Sphinx, but what the Face really looks like is a Cyberman from *Dr. Who.* Richard Hoagland and other writers spent the next decade cranking out books proving the artificial nature of the Face and finding all sorts of cool-looking features in the surrounding landscape, including pyramids, a city, an amphitheater, and a fortress.

With the more detailed Mars Observer images, the Face was revealed as just an eroded mesa like thousands of others on Mars, which just happens to look like a human face when the sunlight hits it at a certain angle. Paranormal enthusiasts didn't let this slow them down one bit. One camp holds that the new pictures are fakes, and NASA is just hiding the *real* Face images which clearly show its artificial nature. The most baroque theory insists that the missing Mars Observer and Mars Climate Orbiter probes were really *missiles* launched to obliterate the Face.

Others take the more subtle approach that since the Face only appears when lit from a certain direction, obviously someone had to *build* it that way. Maybe it's intended as a *message.* Maybe there's something *important* about light hitting the Face at that particular angle. Perhaps that's when the Sun shines into a special shaft to illuminate a vital clue, or maybe the sunlight activates some kind of stargate or timegate at that instant, allowing unprepared NASA explorers to blunder into Mars' exotic past.

An interesting change-up in the conspiracy field comes from some fundamentalist Christians who believe that the Face is a put-up job, part of a plot by Satanists within NASA (the coven was founded by rocket pioneer/black magician Jack Parsons and is still going strong). Since the Bible clearly says that the Lord created living things *on Earth,* any signs of extraterrestrial life are just part of the Satanic plan to delude and mislead people. A variant lets NASA off the hook by claiming that the Face is real, but was *built* by demons for the same purpose. Mysteriously, adherents of both theories are still mad at Face debunkers, accusing them of trying to cover up the fake, or something like that.

Artificial Moons?

Mars has been seen since prehistory, but its moons had to wait until 1877 to be discovered. Given that people had been watching Mars through telescopes for 300 years by then, it's a little strange nobody noticed the moons. The Russian writer F. Zigel suggested that maybe nobody saw them because they weren't there before 1877 – the moons of Mars are actually artificial! Consider: one of them is in a low orbit, just like Earth's International Space Station, and the second is nearly in synchronous orbit, perfect for a defense platform or weather-control satellite. They have extremely low densities, just what one would expect if they were hollow.

Better yet, in August of 1877 the New York astronomer Henry Draper reported discovering a *third* moon of Mars, which mysteriously didn't move according to Kepler's laws of motion! It wasn't seen afterwards and was assumed to be an error. But a spaceship moving under power wouldn't move like a natural satellite either, and if it left Mars on a voyage to Somewhere Else, naturally it wouldn't be seen again.

Of course, photos of Mars' moons show them to be natural objects, and there is no sign of a civilization on Mars capable of launching satellites. But if the Face and other artificial-looking sites on the Martian surface are the work of intelligent beings, perhaps the moons are, too. Their appearance could simply be the result of centuries of impacts – or a deliberate deception by the scientific community.

Fortean Mars

Charles Fort loved astronomical anomalies, and Mars provided him with plenty of material. In 1893 the Scottish astronomer Andrew Barclay observed Mars as a double planet, surrounded by a ring of smaller bodies. Shortly thereafter Barclay was dropped from the membership list of the Royal Astronomical Society. This can be interpreted in two ways. . .

Red lights on the dark part of Mars were seen in 1864 and 1865 – at the same time that mysterious lights were also appearing on the Moon. A beam resembling a searchlight was seen projecting from Mars in June of 1892, and in August of that year mysterious flashes appeared in the skies over Manchester. In December of 1900 the Lowell Observatory described a whole series of flashes appearing on the face of Mars, long flashes alternating with short ones in what seemed to be a code sequence lasting more than an hour. Meanwhile Nikola Tesla reported receiving radio messages from Mars.

In 1895 the New York *Herald* reported that the features on the face of Mars spell out the Hebrew word for God. Writing the Name of God on a lump of clay makes a golem; what does writing it across the face of a planet do? The Name doesn't appear in more recent images; maybe the same minions of Satan who built the Face and the Pyramids erased it.

Charles Fort also uncovered a pattern of strange events happening on Earth whenever Mars is at opposition. In July of 1813, when Mars was particularly close, strange lights flashed in a clear sky over Tottenham, near London. Similar flashes were observed at oppositions in 1875, 1877, and 1909. (The fact that the flashes were seen in the same parts of England that Wells had his invaders land on seems pretty significant.)

At the June 1873 opposition, observers in Austria-Hungary saw a luminous meteor emerge from Mars and explode in the sky over Silesia. The object appeared to move from Mars to Earth in a matter of seconds (which would require near-light speed). Were the Martians testing a stardrive?

At oppositions in 1896 and 1911, mysterious explosions in the sky were heard – in Worcester, England and Madrid in 1896 and over southern Germany and Switzerland in 1911. The same regions saw bright meteors before the bangs. Perhaps this was a very ineffective planetary bombardment, or perhaps the Martians were just trying to get our attention. Or maybe someone on Earth was running a steampunkish SDI system to defend us from Martian projectiles (just the sort of thing for a reclusive scientific genius to do in his spare time).

In early 1928 a man appeared in New Jersey claiming to be from the planet Mars. What became of him is unknown, and 10 years later Orson Welles reported Martians landing in New Jersey.

Fortean events like mysterious flashes on Mars can be the impetus for a ***GURPS Steampunk*** or ***GURPS Castle Falkenstein*** expedition to the Red Planet, or can be the clue that leads to a Martian-led conspiracy here on Earth (another favorite notion of Fort's). Earthquakes and explosions when Mars is near call to mind the natural disasters spawned by the sinister Ming of Mongo in the old *Flash Gordon* movie serials. Crank up the romanticism as far as it will go and ignore the cardboard sets as the heroes blast off to Mars in a desperate quest to save Earth from destruction!

Velikovskian Mars

Had he lived to see it, Charles Fort would have loved Immanuel Velikovsky's book *Worlds in Collision,* in which the Russian-born psychologist mined ancient mythology and the Old Testament for clues to planetary movements. Ignoring inconvenient and boring stuff like Mayan and Babylonian astronomical observations, Velikovsky came up with an exciting theory which involved the planet Venus being ejected from Jupiter in the form of a giant comet, then careening about the Solar System. At particularly close approaches to the Earth, Venus stopped the Earth's rotation for Joshua, parted the Red Sea for Moses, and dropped manna on the Israelites in the form of hydrocarbons from its atmosphere.

Mars got into the cosmic pinball act beginning in about 900 B.C., when a close encounter with Venus disturbed its orbit, sending it into a series of fender-benders with the Earth. The first caused eclipses and earthquakes at the time of the founding of Rome, explaining why the Romans were so devoted to Mars. That same visit also caused the sinking of Atlantis. (To make the dates work, Velikovsky assumes either Plato or the Egyptians exaggerated the age of Atlantis by a factor of ten.)

Mars' next swipe at the Earth came on March 23 in 687 B.C., when it caused the fall of Troy and zapped the army of Sennacherib outside Jerusalem with an interplanetary lightning bolt. (Again, Velikovsky has to lop 500 years off of Homer's dates to make this work, but who are you gonna believe, him or some Greek guy?) Mars also saved Earth from another bumper-car encounter with Venus by body-slamming that planet into its current orbit, explaining the legend of Lucifer (Venus) being cast out of Heaven by the Archangel Michael (Mars).

It was during these periodic visits from Mars that the people of Earth saw its two moons, which they immortalized in legend as the two horses of his chariot, Phobos and Deimos. So when Asaph Hall named them, he was unwittingly giving them their original names! Mars apparently also sported a sword-shaped comet tail in its wanderings, explaining the association between Mars and swords in mythology.

Of course, Mars was suffering its own share of calamities as a result of all this cosmic pinball. It lost most of its atmosphere and water, and its surface got all cracked, explaining the canals (Velikovsky was writing in 1950, remember). Eventually it got shifted back to its proper original place in the Solar System by a hitherto-unknown electromagnetic effect analogous to the quantum jump an electron makes from one orbital to another within an atom.

Capricorn One

The original conspiracies-and-Mars movie, *Capricorn One* (1978), was written and directed by Peter Hyams, and starred Elliott Gould, James Brolin, Sam Waterston and O.J. Simpson. The plot follows the post-Watergate heroics of an investigative reporter (Gould) uncovering the truth about a faked Mars mission. The three astronauts (Brolin, Waterston and Simpson) have reluctantly agreed to participate in the hoax, but then must go on the run when the NASA chiefs decide to silence them with a tragic "space accident." Though the film plays off the perennial we-never-went-to-the-Moon conspiracy theory, the motives of the bad guys are oddly sympathetic: there's a technical glitch which will doom the mission, and the only way to save the Mars program is to fake it. One big problem is the utterly unconvincing depiction of the Mars project itself (the astronauts are visiting Mars aboard vintage Apollo Moon mission equipment).

As an adventure hook, the plot of the film is almost perfect. The PCs can either be the astronauts caught in the web of deception, or the dogged reporters seeking the real story. If the players have heard of the movie or can guess what's going to happen, throw them a changeup: maybe the fake is itself a fake. The player characters are going through the motions of pretending to go to Mars, but there's a real mission in space that Somebody wants to discredit. Can the hapless actor-astronauts get the truth out before the bad guys zap the Mars ship?

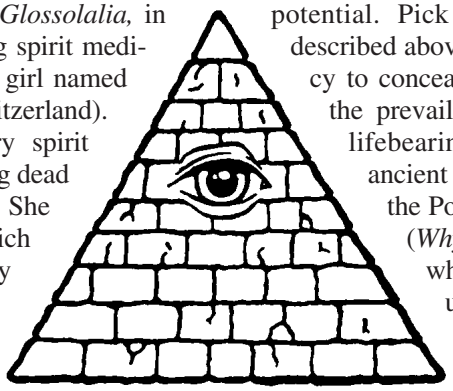
Or for a full *The Prisoner Goes To Mars* version, what if the fake Mars mission is being filmed at an actual secret Mars base? The characters think they're making a fake Mars mission video, until the artificial gravity fails and they realize they're really on Mars – a *habitable* Mars that the Secret Masters (human or Martian) want to keep hidden!

Working Velikovsky into roleplaying adventures is relatively easy. The rule is simple: all legends and myths, especially the Bible, are literally true, and astronomy and physics can be adjusted to fit. Contradictions can be explained by "racial amnesia," or by fiddling with the dates (since the planets were messing up Earth's rotation and the length of the year anyhow, one can drop whole centuries without working up a sweat). Any historical campaign can be livened up by a sudden visit from a wandering planet or two.

In a ***GURPS Black Ops*** or ***Atomic Horror*** campaign, Velikovsky's Weird Science explanations of planetary motions are true. If Mars threatens to collide with Earth, perhaps a team of heroic astronauts must somehow divert its orbit using the quantum electromagnetic effect. One could even run a 1950s-era terraforming campaign this way, since the same technology might be used to move Mars into a spot closer to the Sun's warmth. Of course, the same technology could be used to move the *Earth,* making it a perfect World-Threatening Menace for anything from ***Supers*** to ***Steampunk.***

Spiritualist Mars

In 1899 the pioneering psychologist Theodore Flournoy published a book called *From India to the Planet Mars: A Study of a Case of Somnambulism With Glossolalia,* in which he described sessions with a young spirit medium he called "Helene Smith" (actually a girl named Elise Muller, a shop clerk in Geneva, Switzerland). Initially "Helene" was a fairly ordinary spirit medium of the late 19th century, contacting dead people who spoke or wrote through her. She did not charge fees for her seances, which was one feature which attracted Flournoy to study her – she seemed less of a conscious fraud – but her spiritualist activities did gain her several well-to-do friends.



But while Flournoy was studying her, "Helene" (with the help of her spirit guide Joseph Balsamo, alias Cagliostro) began to have visions of people and places on the planet Mars, where apparently some Earth humans were reincarnated as Martians. Life on Mars appeared to "Helene" much like life on Earth. The Martians ate from square plates, lived in houses which flared upward like inverted pagodas, and built bridges of colored glass across their canals. They were otherwise identical to Earth humans, and infants on Mars were nursed directly by domesticated deer-like animals.

The really interesting part of the spirit voyages to Mars came when "Helene" started speaking and writing in Martian. Amid vague descriptions of Martian scenes she began suddenly rattling off passages like *"Mitchma mitchmon mimini tchouainem mimatchineg masichinof mezavi patelki abresinad navette naven navette mitchichenid naken chinoutoufiche"* and similar jargon. She later wrote in a Martian alphabet vaguely resembling the Indian Devanagri letters, and even provided Flournoy with some translations and the rudiments of Martian grammar. (Disappointingly, that big spoilsport Flournoy was able to identify "Martian" as having the same grammar and structure as French, and even decoded some of the Martian words as simple sound-substitutions for French terms.)

Nor was Flournoy's subject the only medium visiting Mars in the 1890s. In 1895, the American medium Mrs. Smead was in contact with dead relatives living on Mars, and in 1899, Carl Jung's 15-year-old patient "Miss S.W." was going to Mars during trances, and reported seeing canals and Martians in flying machines.

In a ***Steampunk*** setting, naturally the mediums are right on the money, and transcripts of "Helene's" sessions with Flournoy can provide Mars voyagers with a handy phrasebook and tourist dictionary. (This can be amusing even if it isn't true, when the intrepid explorers try talking to the Martians in some gibberish dreamed up by an occult fraud back on Earth.) For a weirder take, perhaps she was contacting an alternate universe's Mars, or a future terraformed Mars inhabited by the descendants of Earth humans. Or maybe "Helene" was perceiving a mystical Mars on a spiritual plane beyond human perception.

Illuminated Mars

In an Illuminated campaign, Mars has tremendous potential. Pick any of the weirdness or mysticism described above, assume it's true, and select a conspiracy to conceal that truth. In actual conspiracy theory, the prevailing notion seems to be that Mars is a lifebearing planet, jam-packed with ruins of ancient alien civilizations, and for some reason the Powers That Be are hiding the whole thing. (*Why* NASA would cover up the one thing which would ensure the agency almost unlimited funding is something clever GMs will have to come up with on their own; the conspiracy theorists are not much help.)

Secret Mars Colonies

Some conspiracy theorists believe Mars is the secret refuge of the Power Elite; maybe they've been building domed cities and underground bases there ever since Percival Lowell (an arch-Insider if ever there was one) discovered the canals. Is it just coincidence that rocket pioneer Robert Goddard (also from Massachusetts) began working on space travel after being inspired by Lowell's writings? After World War II Wernher Von Braun said that Goddard had been ahead of the German V-2 team all the way – just how *far* ahead was he? The Nazis may have reached the Moon in the Forties, but by then the Secret Masters of the Anglo-American Conspiracy were sipping champagne and plotting new plots along the canals of Mars. Astronauts exploring Mars will either be actors in the pay of the Conspiracy, or else innocent dupes puttering around a carefully sterilized "lifeless Mars" Potemkin village. But what happens when one of the player characters accidentally cracks his helmet visor and discovers there's breathable air out there?

For fans of the big Everything's-a-Lie conspiracy theory, the United States and the Soviet Union have been secretly colonizing Mars since shortly after the UFO crash at Roswell, using alien technology and funds from the international drug trade. The Mars colony is to provide a new home for humanity after the Earth becomes uninhabitable due to pollution. This is the version promulgated by John Lear (who in turn seems to have gotten the idea from a BBC April Fool's Day hoax). Since the Power Elite have been kidnapping people to serve as slave labor on Mars (you didn't think all those "missing" teens on the milk cartons are just runaways, did you?), getting a party of player characters involved with a secret Mars colony is child's play. Can a group of brave abductees overcome the sinister MKULTRA brainwashing, ditch the alien nose implants, and lead an uprising of the oppressed to free Mars?

The Lifeless Mars Hoax

Percival Lowell was right. After all, he saw the canals with his own eyes, didn't he? It's only those stuffy Establishment scientists with their "enhanced" photos who deny there's life on Mars. When their disinformation campaign neglected to airbrush the Face out of pictures of the Martian surface, they had to discredit and "debunk" the obvious truth: Mars has life, probably highly advanced life. To make sure nobody got any glimpses of secret information, the Illuminati even blew up the Mars Global Surveyor probe in flight and made sure the Polar Lander crashed.

Dr. Gerald Levin, one of the original Viking probe scientific team, is convinced that his experiment package did show evidence of life on Mars. Levin also insists the Viking cameras showed green spots resembling lichen on some of the rocks around the landing site, but NASA technicians "adjusted" the color spectrum on the images to make everything shades of red and brown. Barry DiGregorio, who wrote a whole book about Levin's battle with orthodox scientists (*Mars: The Living Planet*), has pointed to Hubble images of Mars showing the dark albedo features as dark green.

Why go to all that trouble? Good question. Why *would* NASA spend all that money looking for life on Mars, only to deny they found any? Unfortunately, most of the theories in the literature are pretty lame: DiGregorio suggests NASA is trying to save themselves the expense of sterilizing probes before sending them. Others accuse space colonization enthusiasts of hiding evidence of alien life in order to head off environmentalists who might want to protect Martian organisms. But to be brutally honest, a few lichens and bacteria aren't really the stuff of good conspiracy theories. The only reason to hide the existence of life on Mars is that there are *Martians* on Mars.

There are plenty of reasons to conceal the existence of intelligent Martians. Maybe they're hostile. Maybe *they* are the alien Greys who go around abducting people and implanting things in their noses. After all, the UFO "debunkers" love to go on about how it's impossible to cross interstellar distances; obviously the Greys come from *right next door!* Maybe H.G. Wells *wasn't* writing fiction, and those radio bulletins *weren't* the product of Orson Welles' fertile brain.

Another option is that the Martians are only a threat to the powerful. Consider: they are obviously tremendously advanced and super-intelligent, and have been around since humans were little better than apes. No Illuminati, no matter how subtle and well-organized, could possibly infiltrate a superior alien civilization. The Martians are beyond the control of the Secret Masters, and could ruin everything. Best to keep them a tightly-guarded secret.

Secret Masters From Mars

There's a third possibility for why the Conspiracy wants to hide the existence of Martians. The Secret Masters *are* the Martians. When they failed to conquer the Earth with their tripods and heat-rays, they simply applied their vast and cool and unsympathetic intellects to the problem of taking over quietly. (Is it just a coincidence that we speak of the *tentacles* of the worldwide conspiracy?)

In a game of multiple Illuminati competing for world domination, the Martians either are the UFOs, or else are bitter enemies of the Grey interlopers poaching on their private preserve. Most of the other conspiracy groups are enemies: the Bavarian Illuminati command too much power to be tolerated, Shangri-La would love to use the threat of Martian invasion to end conflict on Earth, the Adepts of Hermes possess powers the Martians don't understand, the Network encourages a pace of technological growth which could make Earthlings the equals of the Martians, and the Servants of Cthulhu are a threat to Mars as much as to Earth. The only conspiracies Mars can sometimes cooperate with are the Gnomes of Zurich (who'll take Martian gold even though it's slightly radioactive), the Society of Assassins (who can't really threaten them and love to swap the occasional wet work for a few cases of ray guns), and the inscrutable minions of the Bermuda Triangle.

Martians as alien masters work especially well in a steampunk-era campaign. Use the Wellsian tentacled Martians described in ***GURPS Warehouse 23*** for this scenario. Queen Victoria's ministers insist the Martian menace ended when the alien advance force succumbed to Earthly germs, but perhaps a team of crack scientists (led by creepy eugenics advocate Sir Francis Galton) managed to keep one of the invaders alive in a special sterile chamber. Mustn't let the public know about it, of course – no sense in alarming them. The Martian captive trades advanced scientific knowledge to the British government in exchange for the blood it needs to survive. All that talk about the Martian exerting a mesmeric influence on the Prime Minister is hysterical nonsense, of course. And there's simply no truth to the rumor of new cylinders touching down in remote parts of Cornwall, or secret construction going on in the wilder parts of Scotland. What *is* true is that nosy civilians have a habit of disappearing, only to turn up drifting in the Firth of Forth, mysteriously drained of blood. The only ones brave enough to tackle the mystery are an eccentric London criminologist and his skeptically rational sidekick. The Truth is Out There and the game's afoot!

DOMED MARS

CHAPTER 4

At most, terrestrial men fancied there might be other men upon Mars . . .

– H.G. Wells, The War of the Worlds

Domed Mars is a hard science fiction campaign background set on Mars in the early days of exploration and colonization. The time period is assumed to be 2020 to 2060 or so (earlier or later depending on how optimistic or pessimistic the GM is about the future of the space program). The main focus is 2050, when the first generation of Martian-born humans are reaching adulthood.

The number of people on Mars throughout the Domed Mars era is likely to be small. Population growth is limited by the capacity of the Cycler spacecraft and other means of getting to the planet. The long interval between favorable launch windows puts a severe constraint on how many people can go to Mars, but also encourages them to stay permanently. Ten years after the first permanent base is established, the population is about 100, including the first handful of Mars-born children. At the 20-year mark there are 600 Martians, with more than 100 children and teens. When the colony is 30 years old the total population is 1,200, with about 50 Mars-born adults. By the time the colony is 40 years old, there are 2,000 Martians, only half of whom came from Earth.

In keeping with a hard-science approach, the scenario doesn't require any major changes on Earth. The machines haven't taken over, the biosphere hasn't collapsed, and the missiles aren't flying. The only really unlikely assumptions are a substantial drop in the cost of surface-to-orbit transport and a willingness on the part of Earth's governments and corporations to spend money on Mars exploration. GMs who want to change some of those assumptions should consider how they would affect life on Mars: a poorer Earth means fewer colonists, international tension means tighter government control and more military presence on Mars, and a terrible catastrophe might cut off the colonies completely.

Colonies on Mars

The first colony on Mars is a permanent scientific base, much like present-day research stations in Antarctica. In time, the small and spartan outpost grows into a thriving town. This section provides snapshots of the early days of the base, and a generation later.

The First Base

The first permanent base on Mars is at Chryse Planitia, the site of the first Viking probe landing. Chryse's a good place for a colony – it's one of the lowest parts of the planet's surface, which means there's good radiation shielding from the atmosphere (see p. 20), and it seems likely that the Chryse depression once held water, some of which may remain underground. The Kasei canyon system is nearby, and both the north polar cap and the Valles Marineris are within range of exploring robots (conspiracy theorists and ancient-astronaut fans will be happy to learn the Cydonia Face isn't far off, either). Other potential early base sites include Eos Chasma, at the mouth of the Valles Marineris, or possibly Arcadia Planitia, which would allow easy access to the Tharsis volcanoes. Much of the Chryse station design presented here is based on the current NASA Mars mission plan; this is the base after four crews have visited Mars.

The Base

The Chryse base consists of four surface habitat modules, one from each manned landing, plus two inflated greenhouses. The habitats are fairly large and comfortable, and with four available the astronauts have been able to customize them. Two are devoted to living quarters, one is storage and a workshop, and one is lab space. The inflatable greenhouses provide food and oxygen. All five have been lifted off their original landers and now are partly buried for extra stability and radiation protection. The habitats are connected by pressure tunnels brought in a later mission. Each has its own life-support machinery, and a small radiation shelter in the center, to serve as a refuge during solar flares.

Each habitat is a cylinder 24 feet across and 20 feet high, with two levels. The living quarters units have two double-occupancy cabins on the upper level; and a kitchen, infirmary, and dining/recreation area on the lower level. The airlock is on the lower level, so entry is now via a shallow tunnel to the surface. The lab module has a geology setup on the lower level and a xenobiology/biochemistry lab on the upper floor. The storage and workshop unit has the workshop downstairs and storage upstairs. Both greenhouse modules are filled with hydroponics tanks and powerful lights.

Outside the modules, near the landing area, are the two fuel plants and the storage tanks for water, fuel, and oxygen. The fuel plants are *the* key element of the Mars project. By manufacturing methane and oxygen fuel on Mars, they drastically reduce the necessary launch weight from Earth. The fuel can also be used to power small rovers and equipment on the surface. In addition to rocket fuel, they also produce oxygen for the crew. With power and a local source of water provided by the deep drill, the fuel plants can keep working almost indefinitely. Working in combination, the plants manufacture 24 gallons of oxygen and 12 gallons of methane per day. Each one can work independently, so there is a margin of safety in case of accident, but it takes almost 2 years to completely fill up the Mars Ascent Vehicle. Water now comes from a deep well; boiling water goes down 200 meters to melt the subsurface ice, then the original water and the melted ice comes back up to be filtered and purified. The water plant can extract and purify about a gallon per hour; since the base uses closed-loop systems as much as possible, the water plant only has to run at full capacity when a Mars Ascent Vehicle needs fueling.

Power for the base comes from two 160-kilowatt nuclear power plants, supplemented by solar photovoltaic arrays generating 10 kilowatts each. For safety reasons the nuclear plants are located a kilometer away from the rest of the base. The two biggest power loads are life support and fuel manufacture. The life-support systems require about 150 kilowatts, and the two fuel plants consume a total of about 105 kilowatts, so there is a bit of extra margin. The water plant needs 40 kilowatts at full capacity. In an emergency the astronauts can also use the nuclear power plants on the pressurized rovers to run vital systems.

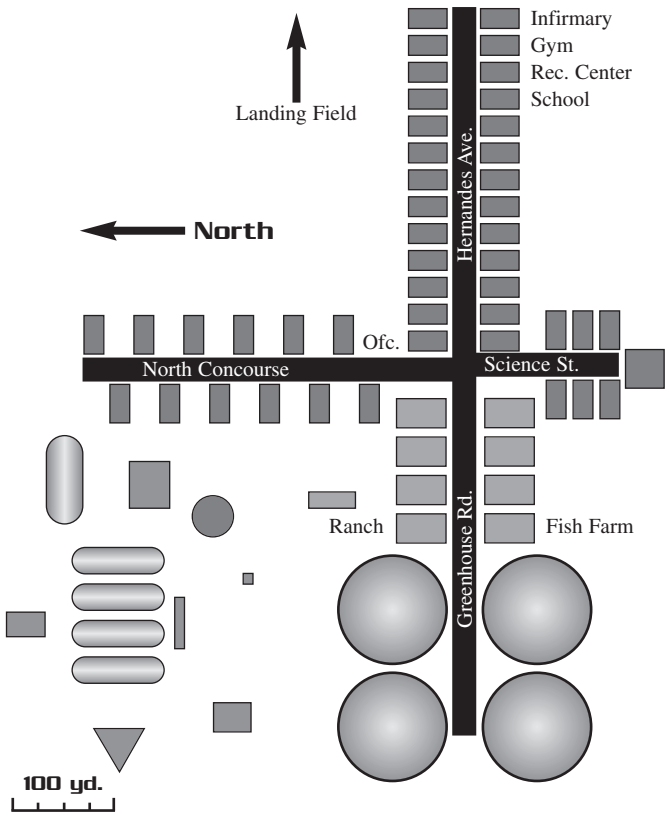
A communications mast next to the habitats supports dish antennas to communicate with orbiting spacecraft and with Earth, as well as rovers on exploring missions. The base can communicate directly with anyone within line of sight, but beyond that must use the orbiting Earth-return booster as a communications relay.

Life support at the base is still partly dependent on supplies from Earth, but the two greenhouses can now supply food and oxygen for up to 12 people (this is considerably less efficient, but more realistic than the ***GURPS Space*** TL8 total life support system). The greenhouses also play an important part in cleaning waste water.

The base has a small fleet of vehicles. The initial mission brought along a pair of unpressurized rovers and a big pressurized "crawler." Later missions raised the number of small rovers to four, and the pressurized rover fleet to four (this allows for very long-range expeditions, with a pair of pressurized rovers operating together and another back at the base available for rescue). There are also half a dozen robot rovers which can be remote-operated from the base for exploration. The Mars Blimp becomes available around 2030 (depending on whether or not the GM wants the Mars explorers to have aircraft).

Other equipment includes a heavy drilling rig capable of boring down a kilometer into the Martian crust. This is used for taking core samples, and dug the deep well used by the water plant. A bulldozer blade mounted on one of the unpressurized rovers was used to dig hollows for the habitat modules, and a trailer-mounted crane moved them into position.

Chryse Colony 2050



Chryse Planitia 2050

By 2050 the planet Mars has a population of some 1,250 humans; a fourth of that population are native-born Martians. There are 10 permanent enclaves: a mix of science stations, commercial operations, and some homesteading colonies.

The old base at Chryse Planitia has grown into a real town, with 440 people, thriving industries, and the beginnings of an economy independent of Earth. With roughly a third of the entire population of Mars, Chryse is the undisputed "capital city" of the Red Planet. Success has not been without costs, however: the colony is outgrowing its support systems, and the town is currently going through a wave of petty thefts. Chryse Planitia is a multinational settlement, operated in partnership by the United Nations, NASA, the European Space Agency, Japan's NASDA, and the Russian Space Agency.

Colony Structure

The physical layout of Chryse is fairly straightforward. There are four main concourses stretching out from the old core of the original base, forming a giant cross shape.

The concourse known as Greenhouse Road stretches westward for half a kilometer. Greenhouse Road is lined with farming units. Near the center are half a dozen old greenhouses, capable of supporting only 10 or 20 people each. At the end of Greenhouse Road are four big new farm domes, covering an acre each, which supply the bulk of the colony's food and oxygen. The farm domes are giant bubbles of polymer and glass fiber, with DR3 and 1HP per hex of surface. The domes are more resistant to blunt impact than to piercing; divide damage done by clubs, fists, kicks, and collisions by 2 since the dome simply flexes to absorb the blow. Air pressure (10 Martian atmospheres, or 7% of Earth's pressure) holds the domes up; if pierced, a dome deflates in (300/hexes breached) minutes. Conditions inside the domes are optimized for plants, not humans: the atmosphere is mostly carbon dioxide and water vapor, with only a third of the oxygen required by humans. Farmers must wear air masks to avoid suffocating.

The older farm units have a normal atmosphere, and are rigid structures of brick and glass. They are popular places for colonists to go when they are desperate to look at something green and alive. The Chryse colony administration rents out beds in the two oldest units, and 20 amateur gardeners and weekend farmers raise fruit, coffee beans and sugar cane as luxuries.

Between the older greenhouses and the farm domes are the two livestock barns. One is devoted entirely to raising catfish and algae, and plays a vital part in the colony's water purification system. The other is the Chicken Ranch, home to 300 chickens and 200 rabbits. The livestock eat table scraps and inedible (to humans) plant material from the farms.

The south concourse is known as Science Street. There are six habitat modules devoted to lab space along the concourse, and at the end is a large airlock capable of holding an entire crawler. Each of the lab units has its own surface airlock. Lab space is one of the most desirable commodities on Mars, and researchers are constantly struggling for more room.

The east concourse is named Hernandes Avenue, for the first man on Mars. The concourse is 300 meters long, with 21 habitat modules, a hospital, the school, the gymnasium, the recreation center, and an office unit.

Habitat units are each 50 meters long and 20 meters across, with a 2-meter central corridor. They are sturdily built of brick, glass, and metal, with DR5 and 30HP per hex. In addition, the habitats are covered by three feet of packed Martian dirt for insulation and radiation protection (PF 270), which isn't pressure-sealed but does provide an extra DR100 against external attack.

The standard apartment for individuals is 9 meters by 5 meters, or 490 square feet. That's enough room for a little kitchen, a bathroom with a shower, a living room and a bedroom. Interior walls and fixtures can be moved around easily, so couples can combine their quarters to make family apartments. Space in the habitats is allocated by a complicated formula involving seniority and number of people in the family, but the system is full of dodges and workarounds. Often a childless couple will share a single apartment and lease their extra room to a family desperate for more room; rent can be garden vegetables, housekeeping work, crafts – even money! The housing and lab space markets are intricately connected, and a scientist with extra room on Science Street can work out a deal for more living space.

The hospital is a well-equipped clinic with one full-time physician and two paramedics. There is a surgery, an intensive-care bed, a small lab, two examining rooms, and two isolation wards with four beds each. Because Chryse is such a small and crowded community, the medical staff do their best to keep diseases out. Everyone traveling to Mars gets a lavish array of inoculations, and the long trip serves as a very effective quarantine period.

Chryse's school boasts 70 students, ranging from kindergarten to college level. The colony can only afford one full-time teacher, so the school places a strong emphasis on students teaching themselves and each other. The library has a digital archive with virtually the entire intellectual history of humanity recorded – millions of books, films, works of art and recordings. Martian students are often the children of top researchers or highly-skilled technicians, so getting them to learn isn't usually a problem. It's getting them to *stop* that's hard.

The north concourse is the industrial section of the colony, and is called simply "North Concourse." It is 300 meters long, with 12 standard habitat modules spaced along its length. Modules include the electronics workshop, a machine shop, two automated factory units, a pair of units devoted to vehicle maintenance and repair, a biochemical synthesis facility, a suit maintenance shop, and four warehouses. Each unit has its own external airlock.

The industrial quarter extends well beyond North Concourse. Spread out across the surface north and west of the colony are the two fusion power plants, a brick and glass works, a metal smelting furnace, a chemical refinery, the water works, the rocket-fuel plant, storage tanks for oxygen and methane, and various piles of scrap and waste. Among the facilities on the surface are a handful of private for-profit operations – storage depots for prospectors, a ceramics studio, a textile maker, and some small repair shops.

Other Colonies in 2050

Chryse is the biggest settlement on Mars, but it isn't the only one. Various governments and private groups have scattered bases across the planet, either in order to study unique features or to lay claim to large patches of real estate.

Olympia

Olympia lies due west of Mons Olympus, where the mountain's old lava flows meet the Amazonis lowlands. It was established in 2035 by a consortium of large industrial and aerospace firms. The biggest partners are the Takahara Group, Eurospace, Pacific Minerals and Chemicals, and Lethbridge Holdings. The colony is only barely profitable, and the direction it should take has caused serious rifts among its backers. One faction takes the long view, hoping to develop Olympus as a center for industry and resource extraction. If nothing else, having a plant on Mars itself would give the consortium an incredible advantage when bidding for jobs on Mars. A smaller but louder group wants the colony to make more money sooner, and are lobbying to turn it into a tourist resort supporting expeditions to Mons Olympus itself.

The population of Olympia is 189, including 18 children. Most of the colonists are immigrants from Earth, but there are nine Mars-born adults. There is a serious imbalance between men and women in Olympia (106 to 65), since many of the workers are contract employees hoping to make a lot of money and go home. Though the colony is theoretically under UN administration, the actual administration is done by a manager employed by the consortium of owners.

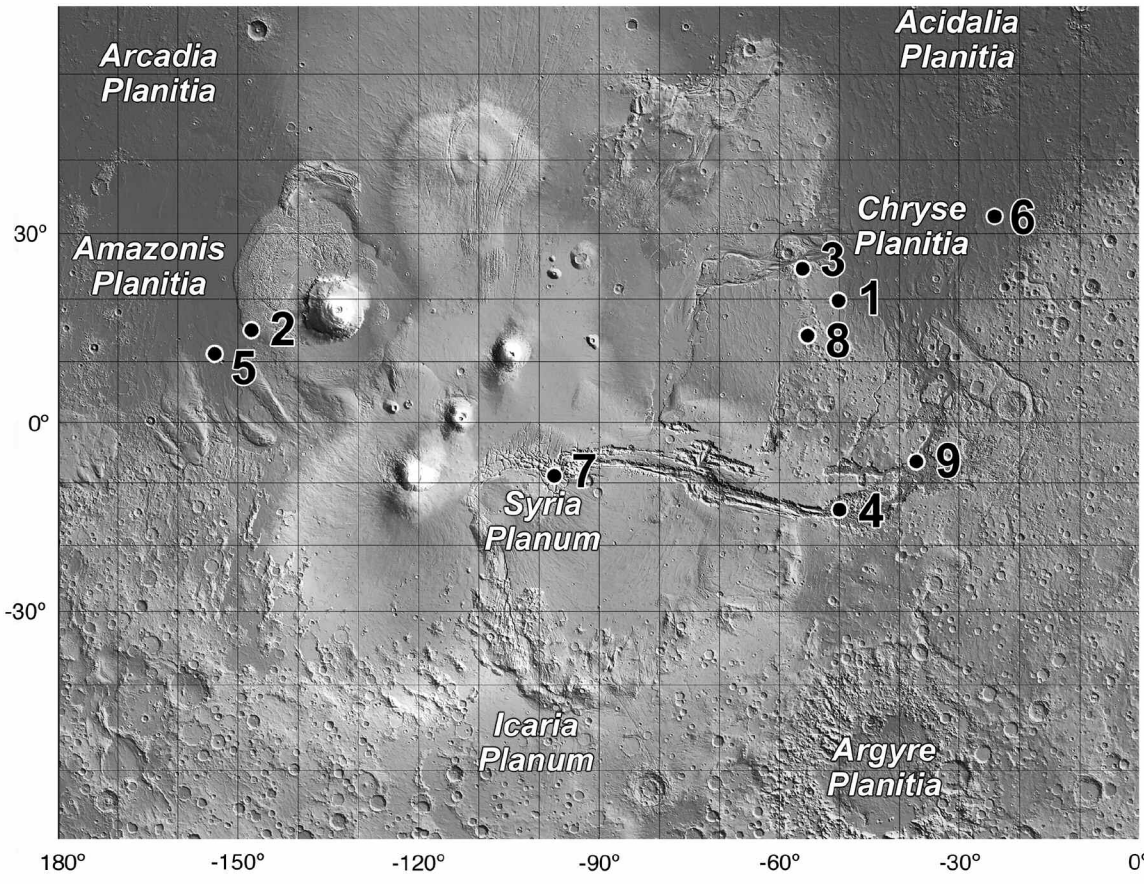
Helium

Helium is the largest pure settlement colony on Mars. It boasts 132 adults, including 10 Mars-born, and 107 children. The colony leaders plan to be the biggest settlement on the planet by the end of the century and are strongly committed to the idea of making Mars a permanent second home for humanity.

Helium is located at the mouth of Kasei Vallis, a large canyon system opening into the Chryse Planitia lowlands. It is just over 300 kilometers from the Chryse base, and the two are connected by a well-traveled crawler track. While the Helium colony could be self-sufficient, the settlers have made the pragmatic choice to trade with Chryse. Helium supplies agricultural products, especially luxury goods like milk, coffee, beer, and honey. Chryse pays for these things either by swapping manufactured goods, or by cash transfers the Helium colony can use to buy things on Earth.

The legal position of the Helium colony is not entirely clear. The colonists claim to be independent, a self-governing sovereign state, but they don't aggressively enforce their territorial claims, and have not negotiated any treaties or applied for UN membership. The United Nations claims all of Mars as the common heritage of humanity, but has no desire to either administer or shut down Helium. The colony is supported by a nonprofit foundation headquartered in Switzerland, and much of the colony's income derives from media rights and licenses.

Domed Colonies in 2050 – Western Hemisphere



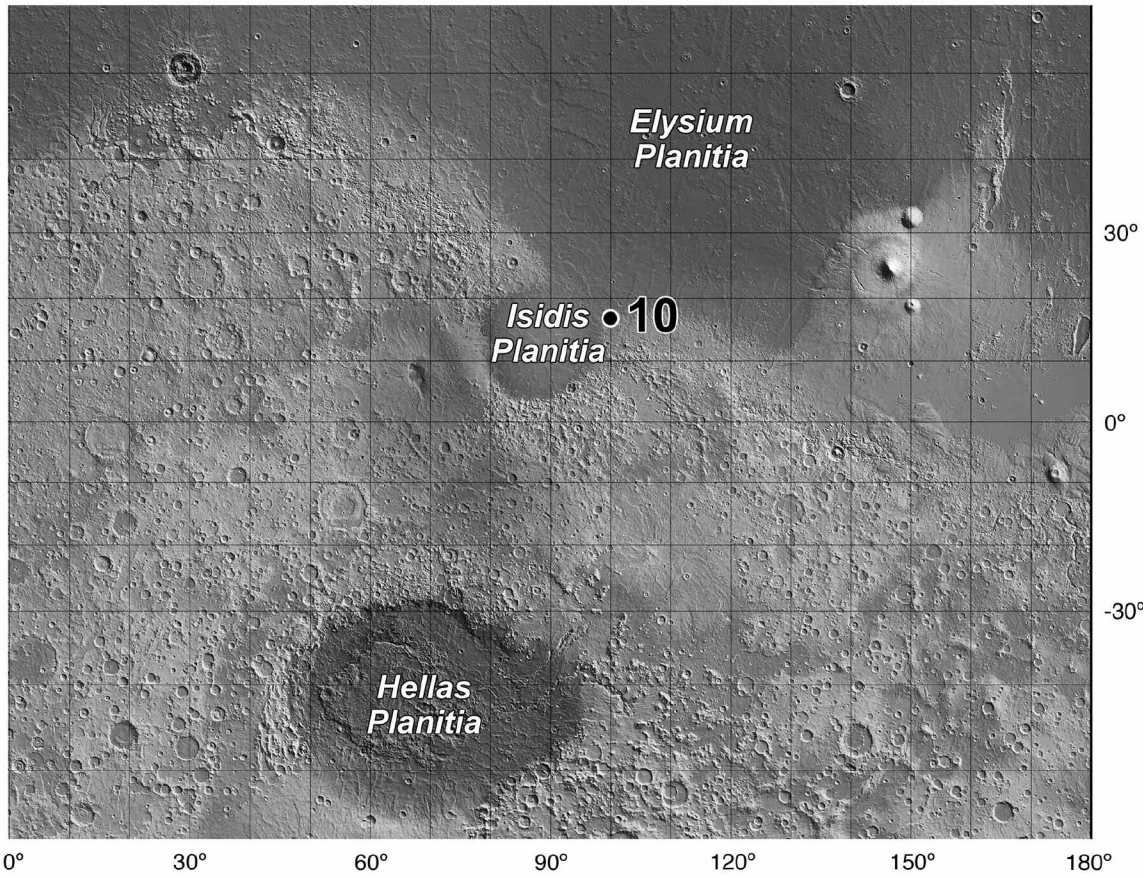
Colonies

1. Chryse
2. Olympia
3. Helium
4. Eos
5. Red Harmony
6. Horus
7. Minotaur Station
8. Bahram
9. El Dorado (secret)

Domed Colonies in 2050 – Eastern Hemisphere

Colonies

10. New Olduvai



Eos

Eos Laboratory is a scientific outpost at the mouth of the great Valles Marineris canyon system. From Chryse to Eos is a long haul of 1,400 miles by crawler, and supply runs usually travel in caravans of three or four vehicles. Eos serves as the staging area for expeditions into the southern hemisphere or up the canyon. The lab has a total of 98 inhabitants: 88 adults and 10 children. Four of the adults are Mars-born, including two of the research staff. Eos is marginally self-sufficient – it has its own farm dome and some rudimentary manufacturing facilities, but depends on Chryse or imports from Earth for anything complex.

"Red Harmony"

Red Harmony is a self-sufficient colony established by the Chinese government. It is a mixed industrial and farming settlement, with a total population of 110 people (62 adults and 48 children). Harmony is located 300 miles southwest of the Olympia colony, on the level floor of the Amazonis plain. The two colonies do a great deal of trade, with Harmony's food surplus going to feed Olympia's contract workers.

The existence of the Red Harmony colony is a direct challenge to the United Nation's claim of Mars as the common heritage of humanity. It isn't private or multinational; it's the property of the Chinese government, and that government has repeatedly asserted its claim to a substantial chunk of the Martian surface. The Chinese claim everything between latitudes 15° north and 15° south, and between 110° and 170° longitude; that includes Pavonis Mons, Arsia Mons, and a huge slice of Amazonis and Elysium Planitia – more than 4% of the planet's surface.

New Olduvai

New Olduvai is the most isolated colony on Mars, located in the Isidis basin near Amenthes Fossae, more than 4,200 miles from Red Harmony, the nearest other outpost. Because of its isolation, Olduvai has to be self-sufficient, and some observers are amazed that the colony has managed to survive for almost a decade. The population of Olduvai is 64; about a third of the colonists are children born on Mars. The Olduvai colony is led by the noted "posthumanist" philosopher Daniel Ra, and the avowed intention of the colonists is to create a completely new Martian species of humanity. The UN and various national governments have expressed concern about the Olduvai colony's treatment of its people, but so far nobody has been able to mount an expedition to check on their welfare. The Olduvai colonists reject all outside authority, and attempts at interference may well lead to conflict.

Horus

The Horus outpost is known to the other Martians as "Crystal City." It was established originally by a joint Arab-European project to settle the question of the "Cydonia Face" once and for all. Predictably, after the scientists determined that there was nothing to the Face and the Pyramids but wind-carved rock, the facility was purchased by a private foundation supported by true believers in the Face theory. Today, the Horus outpost has 28 adults and 14 children, and its people have devised a belief system incorporating ancient Martians, Sufi mysticism, Theosophy, and neopaganism. (Essentially the Horus colonists believe everything in Chapter 3 all at once.)

Horus stands about 100 miles west of the Face itself, where the rugged Cydonia Mensae gives way to the Acidalia lowlands. The colony has only two habitats and a greenhouse, and its inhabitants occasionally have to get replacement parts at Chryse and Helium for vital systems.

Minotaur Station

Minotaur Station is one of the smallest permanent facilities on Mars, and is certainly the harshest place to live. The base is dug into the wall of one of the many rift canyons that make up the Noctes Labyrinthus region. Even the food-production greenhouse is underground because of the high radiation levels atop the Tharsis Bulge. However, the colony does have the advantage of abundant power furnished by a geothermal vent, and the inhabitants have been able to use existing natural caves to make the place roomy and comfortable. At present there are 22 people at Minotaur, all adults.

Minotaur's purpose is to study the Noctes Labyrinthus region, the Tharsis volcanoes, and the Martian upper atmosphere. It also serves as a link between the Amazonis colonies and the Chryse cluster. From Minotaur to Olympia and Red Harmony is 1,900 miles by crawler, while to Eos it's 1,600 miles down the main canyon of Valles Marineris. Minotaur is administered and funded as part of the main Chryse colony, though in practice the base personnel are self-governing.

Bahram

The Bahram colony was originally a joint project of Iran and Kazakhstan, but the Kazakhs pulled out after the initial landing and the Iranian political party which backed the program has since been voted out of power. That leaves the 18 adults and six children of the Bahram colony virtually stranded on Mars. The Iranians occasionally send supplies, and the Chryse and Helium colonists have taken to adding anonymous "care packages" to shipments being hauled out to Bahram. The colony is 120 miles southwest of the Chryse base, and consists of a single overcrowded habitat and a hydroponic greenhouse which doesn't quite meet the dietary needs of the inhabitants.

El Dorado

The El Dorado colony is a secret settlement on Mars. Located in a cave system in the almost impassable Aureum Chaos region south of Chryse Planitia, it is home to 16 people, including five children. The El Dorado colonists launched their project in sections using private launch facilities in several countries, with very long transit times for the cargo payloads. The first eight colonists themselves traveled aboard a stripped-down version of the Mars Direct vehicle; the launch was supposedly an automated Lunar resource-extraction project which went astray due to a guidance error. Three more are personnel from other bases who "disappeared" on Mars, and the children arrived the usual way.

Deimos Base

The Deimos base was established in 2045 for research and to lay the groundwork for an industrial operation. By 2050 the outpost has a single standard Mars habitat unit (like the ones in the Chryse Base description), buried in the regolith for radiation protection. On the surface there is a large array of solar panels, a communications tower, and a docking tube for spacecraft. There are four people at Deimos, along with more than a dozen robots designed to tunnel through the moon and study its composition.

Once the interior of Deimos has been thoroughly studied, plans are afoot to use local ice deposits to set up a liquid hydrogen-liquid oxygen fuel station, and to begin building zero-gravity manufacturing facilities underground. The ultimate plan is to use Deimos as the orbital anchor for a space elevator to the surface (see Chapter 5); the people of Deimos Base have to determine how to move the moon, whether the elevator can be made of local materials, and how construction is to proceed.

El Dorado makes use of some natural caves in the chaotic terrain, formed when an ancient impact caused a sudden melting of the permafrost. As the ice drained away to the north it left behind tunnels and hollows. Most of the caves collapsed to form the chaotic terrain, but there are still plenty of good underground spaces for the colonists. The greenhouses are in caves, lit by powerful lamps. To prevent detection by infrared sensors in orbit, the colony's heat exhaust is concealed by using the underground cryosphere as a heat sink.

The motives for the El Dorado colonists are fairly simple: they are passionately committed to building a new life for themselves, and are deeply suspicious of all governments and large organizations. The Doradans want Mars to be a free haven for anarchists and libertarians of all stripes, although since all the colonists were fairly wealthy before leaving Earth, there is strong support for property rights and free trade. At present the colony is embroiled in a debate over contact with other settlements on Mars. One group wants to initiate clandestine trade with bases like Helium and Horus, another faction insists on strict concealment, and a small minority are planning to start hijacking crawlers bound between Chryse and Eos. Will El Dorado become the first pirate republic on Mars?

Life Under Glass

Life on Domed Mars is not easy. Although the colonists depend on cutting-edge technology just to stay alive, many of the luxuries available on Earth are too heavy to ship across interplanetary distances. The colonists are a handful of people on a vast empty planet, yet getting a little privacy is sometimes difficult. Wresting water and oxygen from the cold soil of Mars requires a lot of hard work, and the penalty for most mistakes is death.

What's for Dinner?

For any Mars colony to be at all viable it must be self-supporting, or nearly so. Greenhouses are also useful for life-support, to filter water and produce oxygen, so every outpost is certain to have its own garden. The early ones use hydroponics tanks, while later ones have beds of Martian soil mixed with fertilizer. The farms concentrate on fast-growing plants which produce high-energy foods: beans of all varieties, peas, Jerusalem artichokes, onions and leeks, garlic, peppers, cucumbers and squash, potatoes, sweet potatoes, tomatoes, peanuts, berries, grapes, cabbage and broccoli, spinach, melons, and breadfruit. Mushrooms are a good way to process waste. Grains require a lot of room to grow, so they probably won't be common on Mars at first; rye is the most likely variety. Things which grow on trees will have to wait a couple of generations.

What about meat? Shipping animals isn't that hard, if they can be transported as frozen embryos (or even eggs and sperm). But once on Mars an animal had better be worth the life-support cost. Humans do like a certain amount of meat protein, and animals like chickens or Vietnamese potbellied pigs can eat table scraps and plant parts humans can't process. By 2050 most colonies have a chicken coop and a pigsty. Fish can live in the hydroponic tanks, helping to keep them clean, so tilapia and catfish are going to be on the menu, along with shrimp and possibly mussels. Frogs breed quickly and can be raised in the hydroponic farms. Goats are hardy and can produce milk, so it's possible that a colony in the 2050 era might have a small herd of dairy goats. Cattle, and other big animals are unlikely, at least not until the population of Mars is much larger. Stingless bees are useful things to have when you're growing a garden, and honey would add a welcome dose of sugar to the Martian diet. For the sake of efficiency, no colony can produce everything, so they tend to specialize, one growing fruit, another raising goats, a third cultivating potatoes for export. Such simple food swaps are the basis of the Martian economy.

The Martian diet consists of a lot of vegetables, including things like tofu, gnocchi, and potato bread; some fruit, occasional eggs and dairy, and a little fish, chicken, frog legs, or pork from time to time. All in all, a pretty healthy diet, and one most people enjoy. What Martians *don't* get to eat (except on very special occasions when a care package arrives from Earth) are beef, apples or citrus fruit, sugar, and salt-water fish.

Given the number of biochemists on Mars, it wasn't long before somebody tried to make alcohol. There are several sources: wine from grapes, vodka from potatoes, and mead from honey or fruit. Beer, whiskey and sake have to wait for wheat and rice cultivation to get underway. Early efforts at Chryse Base created awful "jungle juice" concoctions, but by 2050, being able to sit down with a nice glass of Red Planet Red is a point of pride with the Martians.

Although people did manage to live for centuries without chocolate or caffeine, the Martians didn't want to try. The plants that produce them are hardly compact, and processing cocoa is a fairly complicated procedure, so both remained imports for the first couple of decades. Coffee cultivation began by 2030, and having a ready supply of caffeine could make some entrepreneur's fortune. Chocolate took longer to arrive, since it also requires sugar. Long after the Martians are waking up to locally-grown coffee, their chocolates are still carefully-hoarded treats from Earth.

Somebody Else Is On Mars

Human explorers and colonists on Mars may discover that they are not alone on the planet. For centuries people have wondered about intelligent life on Mars – what if it's truer than we know? Intelligent beings on Mars can either be native Martians, the last survivors of a once-flourishing biosphere, or else they may be interlopers from another star system who have established a base on the Red Planet.

If there is some form of intelligent life on Mars, it must be well hidden. Probes have mapped Mars from orbit with nearly spy-satellite precision, and any buildings or roads would have been spotted by now. (If the GM wants to have the Face and other purported ruins be genuine, then either NASA is part of a conspiracy of silence, or else the ruins must be very old and eroded.) The only place for anything more advanced than hunter-gatherers is underground.

Native Martians may have withdrawn to tunnels and existing caverns as their planet dried up. With a little judicious hand-waving on the part of the GM, there may be underground rivers and lakes, and a whole hidden biosphere underground. (See The Caverns of Mars?, p. 21.) The Martians themselves may have forgotten completely about the world above the surface. For humanoid "cinematic" Martians, use the Cave Martians or Sand Martians from Chapter 7 as natives. Otherwise, use these:

Hidden Martians

The Martians are the last survivors of their world, adapted to a life underground by genetic engineering and a million years of evolution. They are small creatures, about 60 lbs., with six retractable limbs capable of acting as either arms or legs as needed. Their huge light-sensitive eyes are set on a long retractable stalk. When frightened or cold, a Martian curls up into a tight ball, protecting itself from the world with a tough armored surface which is well-insulated and pressure-resistant. Martians are not oxygen-breathers, although at one time their ancestors were. Today's Martians are entirely anaerobic, capable of short bursts of activity between long periods of hibernation.

Martians have ST 6 [-30], DX 10, IQ 8 [-15], HT 12 [20]; they have the racial advantages Acute Hearing +4 [8], Extra Arms (4) [40], Fur [4], Night Vision [10], Sharp Claws [25], and Thick Hide (PD1, DR1) [28]. Their racial disadvantages are Anaerobic [-30], Dying Race [-10], Presentient [-20], Primitive (TL0) [-40], and Sleepy (75%) [-25]. Martians are -35 point characters.

The Martians live in the caves under Ophir and Aurorae Planum, feeding on small swimming creatures which in turn eat microorganisms. With their round bodies, big dark eyes and silky fur, Martians can be adorable ETs suitable for protecting against Evil Corporate Exploiters. Of course, with their sharp claws, uncanny senses and voracious appetite for protein, they make good silent killers as well. Debates about how intelligent they are can occupy PCs for years.

Of course, aliens on Mars don't have to be natives. Extrasolar aliens choosing to hide under the red sands of Mars may have sinister motives. Otherwise, why hide? They may have picked Mars because its gravity or climate is more like their homeworld. Robot emissaries of an all-machine civilization might prefer Mars as a place to settle: it's cool and dry, and there's no annoying life forms. Or they may have chosen Mars as a good staging area for monitoring Earth. Use your favorite aliens from ***GURPS Aliens*** or ***GURPS Uplift,*** or else make the Martians above more intelligent and give them spaceships and lasers.

Make Do or Do Without

Other items are in short supply. Cloth, for example. The Martians have no sheep, no cotton plants, and no silkworms. Using carbon extracted from the atmosphere and water from ice the colonists can manufacture ethylene, which is the base for polyethylene plastics (the stuff milk bottles are made of), and some synthetic fabrics. Once the farms are up and running, excess cellulose can be used to make rayon. But making fibers, weaving them into cloth, and sewing clothing requires a lot of time, skilled labor, and machinery. During the initial period of colonization, the bulk of Mars' textiles must come from Earth. This means that clothing on Mars is a vital resource, and the Martians must wear every garment until it completely falls apart. In the Domed Mars campaign setting only the Chryse colony has the capacity to make fabric, and the other colonies must resort to all sorts of alternatives.

Parachute fabric is eagerly sought after, and the lucky prospector or crawler jockey who recovers a cargo lander's discarded chutes can make a killing. A few colonists with spare time make yarn out of goat or rabbit hair, to provide a little natural-fiber comfort. Animal hides from the livestock provide leather for slippers to wear inside the habitats, and in some fabric-poor settlements the colonists resort to stitching together goatskins to make clothing. Some of the smaller Mars colonies present a strange picture to outsiders: half-naked, fur-clad people with atomic power plants and hydroponic farms!

Paper is another product that is chronically scarce; the Martians can do all their writing and note-taking using portable computers, but there are other uses for paper products which computers can't do, and by 2050 the Martians have had to come up with inventive substitutes. In place of toilet paper, for instance, they either use washable cloth wipes (often made out of clothing that's no longer wearable), or else just wash with water.

Metal is in limited supply during the early period. While all of it has to be shipped from Earth, the colonists can dismantle the landers and other surplus equipment when they need some raw materials. With the tools on hand they can weld and cut metal segments, but can't cast things. By 2050 there are electric furnaces capable of smelting iron out of the Martian soil, but the demand always outruns the supply.

Sophisticated electronic components like integrated circuit chips require large factories that don't scale down well. Martians won't be making their own computers for a long time, and may have to make do with bulky transistors and TL6-7 electronics. They can scavenge a lot of components from lander guidance packages and old science gear, so the historic first landing sites may well get looted for parts.

Secret Colonies

Realistically, the idea of sending a single mission to Mars in secret, let alone setting up a permanent colony there, is pretty hard to swallow. It requires a fairly busy private-launch industry on Earth, with enough traffic into orbit to hide a launch, and cheap enough space travel to make it affordable for a clandestine group. The launch could be disguised as a payload bound for the Moon or the asteroids which gets "lost," or else a legitimate cargo for Mars which doesn't go where it is supposed to.

Some colonists might prefer to keep their presence on Mars a secret. Political refugees, rogue terraformers, criminals, or adherents of a suitably paranoid ideology might plant secret enclaves on Mars. A secret colony could serve as a base for terrorist attacks, a site for illegal mining or experiments, a refuge from tyrannical governments or oppressive corporate overlords, or as the ultimate bomb shelter for survivalists worried about the fate of humanity. If powerful factions on Earth oppose any permanent colonization of Mars, all the Mars-born children may grow up in hidden settlements.

To remain hidden, a secret colony must stay fairly small – no more than 100 people or so. It must be physically hidden, either built underground or in an area of chaotic terrain. Large solar power arrays are too obvious, so secret bases will need nuclear power plants. The colonists will have to find ways to shield their infrared emissions and radio traffic, and to hide construction debris and vehicle tracks.

Of course, much depends on just how secret a secret colony has to be. If it's unknown to the authorities back on Earth but known to sympathetic settlers in the official colonies, then a secret colony can hide in plain sight, masquerading as just another mining outpost or research station. The covert colonies might trade with other settlements, supplying quasi-legal goods and luxuries in exchange for supplies and "surplus" equipment.

Even if nobody goes to the trouble of setting one up, the idea of a secret colony may become part of folklore among Mars colonists. If landers go astray because of guidance errors, obviously the hidden colony is responsible. If astronauts get lost and die out on the surface, they went to join the secret base. A paranoid government might even send an expedition out to search for the nonexistent hidden colony, but not finding anything just proves how well the colony is hidden.

El Dorado (p. 55) is a secret settlement, established by political idealists; the humans on Mars in ***GURPS Reign of Steel*** probably have a hidden colony of their own.

So what *do* the Martians have? Well, they have access to all of human knowledge, music, and film, for starters. At Tech Level 8, all that fits on a few disks. Combined with advanced searching and interface software, that means there is no question a Martian can ask that can't be answered in minutes – if the answer is known at all. The Martians also have abundant water, which is a luxury after the scanty supplies available in space. Mars colonists can take showers and wash clothes as often as they would back on Earth. With water, sunlight, and enclosed greenhouses they can produce plenty of food. By 2050 they can make brick and glass locally, so building new structures doesn't require anything from Earth. Power is relatively abundant, since each colony starts out with an oversized nuclear plant, and can add photovoltaic systems as needed; by 2050 fusion power is likely to be available, and Martian water can provide hydrogen fuel.

Technology

The technology level of Domed Mars is a fairly conservative late TL8 or early TL9, sticking firmly to the "Hard Science" and "Safetech" technology paths described in ***GURPS Ultra-Tech 2.***

As a concession to public fears about nuclear power, systems are designed to use solar power or fuel cells unless those sources are completely impractical, and Orion rockets (***GURPS Vehicles,*** p. 37) are politically impossible. (If the stakes in Mars colonization are high enough – if the settlers are refugees from a tyrannical Earth or the last survivors of an apocalypse – then the colonists can use anything that works.)

Ground Vehicles

Even wearing advanced space suits, astronauts on Mars have trouble walking long distances. To explore the surface they need vehicles, just as Lunar explorers used the electric Rover. The two most common types of ground vehicles are Mars Rovers and Pressurized Rovers, also known as "crawlers." All colonies have at least one crawler. In the early period of exploration all vehicles are imported from Earth; later on Martian workshops can produce buggies and crawler trailers, but only the biggest settlements have the capacity to build new crawlers.

Mars Rover

The Mars Rover is a small unpressurized vehicle suitable for short-term missions. It is powered by methane and liquid oxygen produced by the fuel plant. The overpowered drivetrain makes it useful for towing cargo trailers or allowing quick movement between habitation areas. Passengers and crew must wear Mars suits. The version shown here is the "deluxe" model built using components and materials available on Earth. It is built to Very Fine quality and is a limited-production vehicle. A simpler Martian-built version eliminates the electronics and uses locally available materials.

Subassemblies: Body +3, 6 off-road wheels [B:Body] +1, full-rotation open mount [T:Body] -3.

Vehicle Statistics

Mars Rover Statistics

Size: 12' long *Payload:* 2,935 lbs. *Lwt.:* 3,854 lbs. (Earth), 1,465 (Mars)
Volume: 169 cf. *Maint.:* 231 hours *Price:* $6 million
HT: 12 *HP:* 122 *Wheels:* 28 *Open Mount:* 4
gSpeed: 90 *gAccel:* 4 *gDecel:* 15 *gMR:* 1.75 *gSR:* 5
Very Low GP. Off-road speed 60 mph.

Pressurized Rover Statistics

Size: 16' long *Payload:* 2,400 lbs. *Lwt.:* 13.5 tons (Earth), 5.1 tons (Mars)
Volume: 840 cf. *Maint.:* 121 hours *Price:* $21.7 million
HT: 10 *HP:* 355 *Wheels:* 122
Solar Panel: 6
gSpeed: 15 *gAccel:* 1 *gDecel:* 15 *gMR:* 1.5 *gSR:* 5
High GP; off-road speed 5 mph.

Power Unit Trailer Statistics

Size: 9' long *Payload:* None *Lwt.:* 4 tons (Earth), 1.5 tons (Mars)
Volume: 324 cf. *Maint.:* 102 hours *Price:* $15.2 million
HT: 12 *HP:* 753 *Wheels:* 65
Low GP; off-road speed reduced to 1/3.

Mars Blimp Statistics

Size: 526'×131.5'×138' *Payload:* 900 lbs. *Lwt.:* 5 tons (Earth), 1.85 tons (Mars)
Volume: 9,500,600 cf. *Maint.:* 83 hours *Price:* $1,854,000
HT: 12 *HP:* 375 *Gasbag:* 270 *Pods:* 4.
aSpeed: 35 *aAccel:* 1 *aDecel:* 0.5 *aMR:* 0.125 *aSR:* 7
Stall speed 0

Powertrain: 50-kW closed-cycle methane fuel cell, 50-kW wheeled drivetrain with all-wheel drive, and 864 kWs advanced battery.

Fuel: 160 gallons of methane and 80 gallons of oxygen (24 hours endurance).

Occupancy: 1 XNCS, 3 XS. ***Cargo:*** 20 cf.

Armor	F	RL	B	T	U
Body:	3/5	3/5	3/5	3/5	3/5
Wheels:	3/10	3/10	3/10	3/10	3/10

Weaponry

None.

Equipment

Body: Medium-range radio, inertial navigation system, Complexity 2 small hardened computer, terminal, computerized controls, four crashwebs, 100-gallon water recovery tank. *Open Mount:* PESA with 3-mile range.

Design Notes

The Mars Rover has a light frame with advanced materials. The wheels have an advanced medium frame with improved suspension, all-wheel steering, smartwheels, and puncture-resistant tires. All tanks are ultralight self-sealing. The rover has a hitch and pin mounted on it for towing other vehicles. Cargo is open. Armor is advanced open-frame composite on body and advanced composite on wheels. Performance is for Martian gravity.

Pressurized Rover

The Pressurized Rover is a wheeled, pressurized "camper" for long-duration missions across the Martian surface. This design is based on current NASA plans. Early expeditions can use rovers to explore distant sites. During the colonization period they are known generically as "crawlers," and are the standard method of hauling people and supplies to remote bases. The first pressurized rovers are nuclear-powered, hauling along a compact 10-kilowatt reactor in a 4-ton trailer; Mars-built crawlers have a fuel-cell power unit instead. Note that since pressurized rovers are limited-production vehicles, the price is doubled, and they are built as Very Fine quality.

Subassemblies: Body +4, four off-road wheels [U:Body] +3, retractable solar panel [T:Body] +0.

Powertrain: 10-kW wheeled drivetrain with all-wheel drive, powered by external power unit.

Fuel: —

Occupancy: 2 RCS, 2 RS. ***Cargo:*** 80 cf.

Armor	F	RL	B	T	U
Body:	4/50	4/50	4/50	4/50	4/50
Wheels:	4/50	4/50	4/50	4/50	4/50

Weaponry

None.

Equipment

Body: Long-range radio, inertial navigation system, Complexity 2 small computer (hardened), computer terminal, computerized controls, four crashwebs, PESA with 2-mile range (facing forward), 1-man airlock, 2 bunks, ST300 winch, compact fire-suppression system, cPF 1 radiation shelter (covers all seats). 60 man-days limited life-support (4 people). *Retractable Panel:* 300sf solar cells.

Design Notes

The rover has a hitch and pin mounted on it for towing other vehicles. Armor is advanced composite on body and wheels. Body is sealed with advanced light structure. Solar panel is super-light with very expensive materials.

Wheels are medium framed with improved suspension, all-wheel steering, smartwheels, and puncture-resistant tires. The radiation shelter is DR100 cheap metal armor over all four roomy seats and crashwebs. Performance is for Martian gravity with an attached power trailer.

Local Variant

The locally produced variant is smaller and slower, but does not require a power trailer. On long-endurance missions it needs a trailer carrying additional fuel. The following lists one common variant; others have more powerful drivetrains, keep the PESA, or even have open cargo bays. Most variants retain the inertial navigation system.

Modifications: Replace structure in body and wheels with cheap materials. Remove smartwheels, computerized control, radiation shelter, and computer. Remove solar panel and PESA. Reduce limited life system duration to 32 days. Add 14-kW closed-cycle fuel cell and three ultralight tanks: 90-gallon hydrogen, 45-gallon LOX and 40-gallon water recovery. Armor becomes standard metal. Fuel endurance is 48 hours. Lwt becomes 12 tons on Earth and 4.5 tons on Mars; Volume becomes 763 cf.; Maint. is 55 hours; Price is $129,245; HT becomes 8; Body HP is 333 and Wheel HP is 114 each; GP becomes Moderate.

Power Unit Trailer

By 2050 cargo trailers are built on Mars using local or scavenged materials. They are unsealed but enclosed units with space for 250 cubic feet of cargo weighing up to 5 tons (2 tons Martian weight). Trailers are manufactured in sufficient numbers that they don't count as limited-production vehicles, and they are only average quality construction.

Subassemblies: Body +3, four off-road wheels [U:Body] +2.
Powertrain: 10-kW fission reactor.
Fuel: —
Occupancy: Unmanned. ***Cargo:*** None.

Armor	**F**	**RL**	**B**	**T**	**U**
Body:	4/40	4/40	4/40	4/40	4/40
Wheels:	4/40	4/40	4/40	4/40	4/40

Weaponry
None.

Equipment
Body: Complexity 2 small computer (compact, hardened, dedicated), fire suppression system.

Design Notes
Weight has been increased 8% to match NASA reference design. Structure is heavy on body, medium on wheels. Armor is advanced composite on body, advanced metal on wheels. The trailer is sealed with cPF1 radiation shielding, a towing hitch, and a towing pin. The reactor has long-term access space and 27.5 cf of extra room for access or emergency cargo storage. Wheels have improved suspension and puncture-resistant tires. Very Fine quality construction. All statistics are for Martian gravity.

Aircraft

Flying on Mars is complicated. The lower gravity is an asset, but the very thin atmosphere means planes need huge expanses of wing to generate enough lift. But the vast distances and the relatively slow pace of crawlers make aircraft essential to the Martian colonies. Since airplanes have difficulty flying in the thin Martian air, the primary aircraft in use on Mars is the Mars Blimp.

Mars Blimp

The Mars Blimp seems like a bizarre and dangerous design by Terran standards – an unstreamlined blimp bigger than the *Hindenburg,* filled with hydrogen. Of course, on Mars there's no risk of a *Hindenburg* -style fire, and the Mars Blimp has found a role exploring regions impassable to crawlers. The whole craft can be packed up and stowed in a single crawler trailer, so "piggyback" expeditions are possible. Like airships on Earth, it is vulnerable to high winds, especially when caught on the ground.

Subassemblies: Gasbag +12, Body +4, two Pods [RL: Body] -2.

Powertrain: 205kW methane fuel cell [Body] driving twin 100-kW propellers [Pods].

Fuel: 600 gallons of methane, 300 gallons of oxygen; 22.5 hour endurance.

Occupancy: 2 CCS, 2 hammocks. ***Cargo:*** 100 cf.

Armor	F	RL	B	T	U
Body:	3/5	3/5	3/5	3/5	3/5
Pods:	2/4	2/4	2/4	2/4	2/4

Weaponry
None.

Equipment
Body: 1,000-mile radio, low-light TV (magnification 5), 10-mile no-targeting radar, precision navigation instruments, Inertial Navigation System, hardened small computer, terminal , compact fire suppression, 1-man airlock, 2 crashwebs, limited 4 man-day life system.

Design Notes
Armor is advanced composites on body, combined ablative and nonrigid on pods. All statistics are for Martian atmosphere and gravity. Fine quality construction, unique vehicle.

Robots

Robots conducted the first exploration of Mars, and are likely to play a major part in all future development of the planet. The environment of Mars is hostile enough to make robots cost-effective, yet it isn't so hostile that even robots are impractical. Remote-operated science rovers can "leverage" the amount of exploring a small expedition can accomplish, and bigger construction robots can provide valuable labor during the colonization period. Robots can travel out in slow solar-sail cargo vehicles, they don't mind being out on the surface during a solar flare, and they don't add to the load on the life-support systems.

When designing Mars robots using the ***GURPS Robots*** rules, players should remember that Martian conditions do impose some design constraints. All Mars robots should be waterproofed or sealed to keep dust from getting into their delicate systems, they need radiation shielding and should have hardened computer brains, they must have a self-contained power supply, and any biological components must be in a sealed subassembly. The effects of Martian gravity and air pressure on vehicles described above also apply to robots.

The Mars Launcher

Since one motive for colonizing Mars is to support space-based activities in the asteroid belt or among the outer planets, the Martians need some easy way to get payloads into orbit. Initially, rockets powered by locally-produced fuel will carry Mars' exports of water and food into space. However, over time this represents a serious drain on available water supplies. One solution is an electromagnetic launcher to hurl payloads into orbit. The thin air and low escape velocity of Mars make such a launcher much more practical than on Earth. One design calls for a 13-mile track accelerating payloads at up to 100 Gs. It could launch a 1-ton payload into a Hohmann transfer orbit, making it possible to supply a Moon base from Mars. Power would come from a dedicated reactor pumping energy into a huge array of capacitors.

The payloads are simple, sturdy canisters of 50 cubic feet (about 4 feet across by 4 feet long), covered with DR20 ablative armor and equipped with a small solid-fuel booster for orbital adjustments. Obviously, with peak accelerations in the tens of Gs, no living thing could survive being hurled into orbit by the launcher, but bulk materials or carefully-packed cargo could withstand it perfectly well. And if the Martians ever get mad at Earth, they could toss bombs or kinetic-energy weapons in a kind of long-term bombardment.

Robot player characters are a little difficult to create at TL8; the robot either has to settle for a low IQ or else must be very big to carry around a neural-net mainframe computer. Since the Hard Science technology path includes the option for more rapid advances in computer technology, GMs may wish to allow TL9 computer brains, which are more compact and smarter.

Mars Pioneers

The selection process for astronauts is much less rigorous than in the early days of space exploration. Mars voyagers need not be paragons of mental and physical perfection. That being said, no space agency or private group will send someone to Mars who suffers from a genuinely crippling mental or physical disadvantage. Of course, hidden flaws may get by the screening process, and minor quirks can become serious psychological problems over the course of a 2-year voyage or decades in a cramped colony.

Administrator

Early colonies can be run by a "mission commander" or simple consensus of the inhabitants. But larger settlements need full-time administrators. They may be picked by the colonists, or sent out from Earth to run things. Either way, colonial administrators have to balance the needs of the colonists against the demands of Earth, and juggle concerns about growth, preserving Mars, terraforming, resource extraction, and long-range planning. An administrator may be a shy bean-counter, a rough and ready "frontier judge," or a scientist-explorer pressed into taking on a job he hates.

The most common advantage for a colony administrator is Administrative Rank, though some might also have Military Rank or Law Enforcement Powers. An Ally or an Ally Group (either a group of friends or a band of hired thugs) can keep a boss in power. Effective leaders have Charisma, and may have Empathy or Intuition as well. Disadvantages for colony administrators reflect their management styles: petty tyrants will have Bad Temper, Bully, No Sense of Humor, and possibly Sadism or Solipsist; more benevolent leaders have a Sense of Duty and may be Selfless; fanatics may have an Obsession, Megalomania, or even a Delusion or two. All are likely to have Miserliness as they try to stretch scarce resources. Skills needed to run a colony include Administration, Area Knowledge of the colony, Diplomacy, Law, Leadership, Merchant, Politics, and Savoir-Faire. Like all Martians, a colony administrator needs to know Vacc Suit.

Astronaut

Astronauts fly spacecraft and pilot landers. During the early stages of Mars exploration, astronauts may have to double as technicians and scientists on the surface. In later periods they may be called in on rescue missions, or could be stranded by an accident. An astronaut might decide to retire to Mars, especially if he's getting too old to fly in space but doesn't want to die on Earth.

Mars Suits

On Mars the explorers and colonists must wear vacuum suits for any activities outside their habitats and vehicles. The standard Mars suit is a TL8 vacc suit optimized for Mars surface conditions, durability, and ease of access. The helmet is PD2, DR3, and contains a radio with a range of 10 miles, a water sip tube, a heads-up faceplate data display, a built-in video camera, and a polarized gold-mirrored visor to protect against glare and ultraviolet light. The suit itself has a rigid chestplate which joins to the life-support pack; the wearer simply climbs in the back, locks the backpack shut, and walks away. The chest of the suit and the backpack have PD2, DR5, while the limbs are PD0, DR1. The Mars suit also provides some protection from radiation – PF 2.

The life-support unit is an integral part of the suit, but air tanks can be swapped out while the suit is being worn in the field. The air supply is 20 hours, using sophisticated rebreather systems to recycle usable oxygen. The suit's power supply lasts up to 40 hours, running off TL8 advanced "C" batteries. The whole suit weighs 35 lbs. on Earth, but only 14 lbs. on Mars. Suit systems have an effective HT of 14, and require a maintenance overhaul after every 1,000 hours of use. The base cost is $800, but since the suits are very well-made custom items the actual price is $32,000.

The suit imposes a DX-1 penalty on all tasks, as the gloves make delicate work harder, and the rigid chest and heavy backpack interfere with body movements. Putting on a Mars suit requires a minute with a successful Vacc Suit skill roll, but a failure simply means the wearer must spend another minute getting the suit's systems functioning properly. A *critical* failure means the wearer doesn't notice something is wrong until he gets outside.

Useful advantages for astronaut characters include 3D Spatial Sense, Acceleration Tolerance, Acute Vision, Alertness, G-Experience, Luck, and Strong Will. Military astronauts often have Military Rank and Security Clearance. Because they are carefully screened and trained, they cannot take any disadvantages which might interfere with the performance of their jobs. Minor physical problems like correctable Bad Sight, Missing Digit, and Skinny are acceptable, and because of the radiation hazard, being Sterile is considered a plus by mission planners. Typical mental disadvantages for astronauts include Curious, Glory Hound, Honesty, Pacifism, and Stubbornness. Characters who do take a disadvantage which would normally disqualify them from space duty (like Berserk, Sadism, or Voices) must also take a 10-point Secret.

The most important astronaut skills are Piloting (Space shuttle or Large Spacecraft), Free Fall, and Vacc Suit. Other useful skills include Computer Operation, Electronics, Electronics Operation, Engineer, First Aid, Mechanic, and Navigation.

Colonist

Colonists have come to Mars to settle and build a new world. They may have left Earth for ideological reasons, or just from a starry-eyed desire to be one of the founding fathers of a whole planet. Colonists can come from very diverse

backgrounds, and can know all kinds of odd and surprising things. All colonists need to know the skills for survival on Mars, and have to be well-rounded and able to solve problems with nothing but their own resources. Colonists may take all of their starting wealth as equipment, since the rest of their money has presumably been spent getting to Mars or buying a share in the colony venture.

There are no essential advantages for colonists, but useful ones include social benefits like Allies, Contacts, or Favors. Wealth may give colonists more money to start with when buying equipment, but once on Mars everyone has to struggle just as hard to survive. Interesting disadvantages for colonists include Pacifism or Charitable for idealistic ones, Greed and Selfish for the get-rich-quick types, and possibly Obsession or Fanaticism for the extremely dedicated ones. Skills common to most colonists are Agronomy, Driving, First Aid, Masonry, Mechanic, Survival, and Vacc Suit. Because relocating to Mars is fairly expensive, most first-generation Martians have high levels in various professional or business skills.

Mission Specialist

Mission Specialists are the people who accomplish the actual purpose of a space mission: scientists, construction technicians, zero-gee workers, or military payload operators. They are cross-trained in spacecraft piloting and the skills necessary to get back to Earth. Mission Specialists will be the stars of the first Mars expeditions, and in later years will be the elder statesmen of the Mars colony.

Specialists have most of the same limits on advantages and disadvantages as astronauts. They have many of the same skills, especially Free Fall and Vacc Suit, but add others which will be useful on the surface of Mars, like Agronomy, Computer Programming, Driving (All-Terrain Vehicle), Engineer, Navigation, Physician, Piloting (airship or ultralight plane), Planetology, and Xenobiology.

Prospector

Prospectors explore the Martian surface looking for valuable resources to sell. Potential "mother lodes" include gemstones and curiosities for sale back on Earth, high-quality metal or ice deposits, thermal vents and hot springs for colony sites, and sources of helium-3 or nitrogen compounds. If Mars has remains of ancient civilizations or alien outposts, prospectors may double as archaeological scavengers, looking for valuable alien artifacts and relics. Since prospectors wander all over Mars, they can easily get involved in rebel movements, smuggle supplies to secret colonies, or have to face bandits looking to hijack a valuable discovery.

Prospectors may have a wide variety of advantages, but some particularly useful ones are Absolute Direction, Fit, Luck, Patron, and Serendipity. Common disadvantages are Greed, Loner, Miserliness, Obsession, Poverty, Stubbornness, and Workaholic. Key skills include Vacc Suit, Driving, Prospecting (of course), and Navigation. Other useful skills are Area Knowledge, Climbing, First Aid, Geology, Hiking, Mechanic, Merchant, Planetology, Scrounging, and Surveying. Artifact-hunters add Archaeology and possibly Weird Science.

Rebel

As the Mars colony matures and an increasing number of the planet's inhabitants are native-born, the Martians are likely to start to resent being governed by a bunch of space agency bureaucrats and corporate bean-counters back on Earth. If the authorities aren't willing to give the Martians a voice in their own government, the colonists may decide to rebel. Planetary preservationists angry about terraforming or mining operations might also resort to "direct action." The skills listed for a rebel can be added to other character types, or beefed up with a selection of technical skills necessary for survival in the Martian environment.

Advantages useful for rebels are Ally or an Ally Group, Charisma, Combat Reflexes, Contacts, Danger Sense, Fearlessness, Imperturbable, Luck, Patron, Strong Will, Toughness, and Zeroed. Common disadvantages include Bad Temper, Bloodlust, Code of Honor, Duty (to the Movement), Enemy, Fanaticism, Glory Hound, Intolerance, Obsession, Paranoia, Secret, and Trickster. Skills include all combat skills, Area Knowledge, Demolition, Mechanic or Electronics for sabotage, Bard, Diplomacy, Politics, Leadership, and Tactics.

Kids on Mars?

The small but growing number of native-born Martians may seem odd to some. Why raise children in such a hazardous and confining environment? Wouldn't they be happier on Earth?

Reasons for having kids on Mars range from "accidents happen" to the desire to spread humanity to another home planet. Certainly once an astronaut gets pregnant on Mars, the safest thing for all concerned is for her to have the child there, since it's unlikely the mother could even get to Earth before the due date.

But there are practical reasons, as well. Governments with plans to claim part of the Martian surface as sovereign territory can point to the fact that *their* "native-born" Martian citizens give them a right and a duty to govern part of Mars. On a less elevated note, raising humans on Mars is the ultimate form of "in-situ resource utilization." Martian kids don't take up costly launch vehicle space.

As to the welfare and happiness of the children, they certainly have an enriching and interesting environment to grow up in. At first they won't have many other kids to play with, but they will have a dozen or so adults dedicated to their welfare. Children of pioneer families in the American West endured all the same problems, without the benefit of video messages from Earth and the complete Library of Congress on disk.

GMs can create an interesting "Martian Rascals" campaign centering on a group of children growing up in the Chryse colony. Adventures can range from simple pranks and attempts to raid the melon farm, all the way to kids getting involved in a nascent Mars independence movement or discovering hidden Martian life.

Scientist

Mars is a scientific treasure house. Researchers who are likely to be interested in going there include climatologists, geologists, geophysicists, chemists, biochemists, xenobiologists, and paleontologists. If the GM has put alien relics or the remains of an ancient civilization on Mars, then there will be linguists, archaeologists, and xenologists as well. Contrary to stereotypes, field scientists often have impressive physical skills along with their academic training, and are sometimes very good at scrounging gear and fixing balky equipment.

Typical advantages for scientist characters are Common Sense, Lightning Calculator, Mathematical Ability, Single-Minded, Tenure, and Versatile. Common disadvantages are Absent Mindedness, Bad Sight, Clueless, Curious, Glory Hound, Obsession, Pacifism, Shyness, Stubbornness, Truthfulness, and Workaholic. As with all characters on Mars, Vacc Suit skill is important, and naturally so are scientific skills reflecting the character's area of expertise. Geologists learn Geology, Chemistry, and Planetology; biologists study Biochemistry, Xenobiology, and Ecology; archaeologists need Archaeology, Xenology, and Surveying. Because researchers do a lot of cross-training in other fields, the Science! skill could turn up even in a realistic campaign.

Weapons

Unless space explorers know that there are hostile Martians waiting for them on Mars, weapons are not going to be something worth wasting launch propellant on. On the first missions, NASA isn't going to send any guns, and any astronaut who wants to pack a firearm as "personal gear" will likely get yanked from the crew roster by the psychologists. This means that explorers who *do* come across something dangerous will have to improvise weapons out of tools and scientific gear. There are enough prybars, rock hammers, and lengths of pipe to outfit a team with melee weapons, and a merciful GM might provide astronauts with a laser cutting torch if they're going up against Elder Horrors on the Red Planet.

Once permanent settlements are established, a handful of weapons may get to Mars, either as "security supplies" or hidden in ordinary cargo. What with the risk of damaging vital equipment and the possibility of bad PR, security weapons are nonlethal items like tanglers, gyroc pistols loaded with tranquilizer darts, or tasers.

By the 2050 era, larger Martian settlements can probably make their own guns if necessary. The first models are simple, unreliable "zip guns," but eventually the Martians could probably turn out serviceable versions of most TL7 firearms. Of course, they would need to have a very good reason to waste time and resources making guns. Threats from rival colonies (perhaps stemming from international tensions back on Earth) could spark a Martian arms race, and rebels might do a little "midnight manufacturing" to create arms for an uprising. An isolated colony with a paranoid leader might arm to the teeth to keep real or imaginary enemies at bay.

Technician

Humans living on Mars depend on very advanced machinery to stay alive. The people who keep that machinery running are very important people. Because there aren't a lot of trained mechanics and technicians on Mars, they have to be generalists. Someone with a valuable skill may wind up spending a lot of time traveling to distant outposts in need of a quick repair job. Techs trained on Earth often have scientific and engineering skills to back up their technical knowledge, while Mars-born techs often have lots of field experience but little formal schooling. Because they are so vital, just about any project or operation on Mars needs at least one technician.

Good advantages for technicians are Gadgeteer (especially in cinematic campaigns), Intuition, Manual Dexterity, and Versatile. Common disadvantages include Bad Sight, Cowardice, Missing Digit, Oblivious, Shyness, and Workaholic. A technician with Jinxed, Klutz, or Weirdness Magnet might cause more damage than he fixes! Skills tend to be broad rather than highly specialized, with four or five from among the following: Armoury, Blacksmith, Computer Programming, Demolition, Electronics, Engineer, Glassblowing, Masonry, Mechanic, Metallurgy, and Photonics. Vacc Suit is essential for all Mars explorers, and technicians are likely to need to know Scrounging, Electronics Operation, First Aid, and Driving. Distilling skill is a great way to become very popular or modestly wealthy.

Vehicle Operator

Mars has a few people in widely-scattered bases, and a lot of empty space. To move passengers and supplies around, the colonies all depend on a handful of skilled crawler drivers and aircraft pilots. Mining and construction projects also rely on heavy-equipment operators. Vehicle operators spend a lot of time alone in the empty Martian landscape, and meet almost everyone on the planet. They make ideal organizers for rebel movements, and are likely to be the first to stumble across disasters or sinister goings-on. The stress and solitude of being a long-haul crawler jockey both attracts people with odd personalities and encourages the development of strange quirks and obsessions.

Vehicle operators often have the advantages of Absolute Direction, Acute Vision, and Less Sleep. Those who see a lot of different people across the surface of Mars may have Cultural Adaptability, and pile up a fair number of Contacts and Favors. They may not have disadvantages which would interfere with their jobs (like Blindness or Epilepsy), but otherwise are not limited. Loner or Shyness are common among solo pilots or crawler jockeys. Primary skills are Driving or Piloting for the appropriate vehicle type (most pilots are qualified on all available types of aircraft, and drivers are often experienced with a variety of ground vehicles), Navigation, Mechanic, Electronics Operation (communications or sensors), Area Knowledge, Vacc Suit, and Meteorology. Other common skills include First Aid, Scrounging, Merchant, Brawling, and Streetwise.

Advantages, Disadvantages, and Skills

Advantages

Claim to Hospitality see p. CI21

All Mars colonists, even the denizens of secret colonies, have an effective Claim to Hospitality at all bases and settlements on the planet. When someone shows up needing air, water, power cells, and a meal, you give it to him. Characters who turn away someone in need will develop a negative Reputation. Chronic freeloaders may find themselves getting more and more minimal hospitality, or else will be put to work by their hosts. Because this advantage is universal on Mars, GMs may decide to just assume it as part of the campaign background, so that characters don't actually have to buy it.

G-Experience see p. CI25

Characters with this advantage must have spent some substantial period of time living in non-standard gravity, either on Mars or on the Moon. Time spent in zero gee doesn't count, since the advantage reflects experience at operating in gravity rather than free fall. Not all Martians have this advantage: those born on the planet will only be used to Mars standard gravity.

Legal Enforcement Powers see p. B21

A Martian lawman whose jurisdiction is limited to a single colony has this advantage at the 5-point level. Someone with law enforcement powers in all Martian enclaves (an officer of a UN agency or someone deputized by all the spacefaring powers) has 10-point Legal Enforcement Powers. The 15-point version is rare, but the ruler of an isolated independent colony might have effectively unlimited authority there, and some nations might send undercover agents with broad powers to Mars.

Military Rank see p. B22

Military Rank is only useful if the character can actually give orders to subordinates and get support and equipment from the military organization in which he serves. Until nations establish armed forces on Mars, or the colonists organize some sort of militia, Military Rank should probably be purchased as Courtesy Rank (p. CI23) instead.

Patron see p. B24

In the early stages of Mars exploration, there can be no Patrons on the Red Planet at all. The colonists and explorers depend on the space agency which sent them there, but even that organization can't send help in time to deal with most emergencies ("hang in there, your backup will arrive in only 4 months"). Once there is a permanent settlement, Patrons become useful. A Patron on Mars can appear frequently, but is unlikely to have much in the way of resources – assume a limit of 10 points for the base Patron price, with no special powers or equipment available. Earth-based Patrons can provide some benefits to Mars colonists in the later era, by calling in favors with space agencies, or transferring credits on Earth to purchase equipment already on Mars. Assume any Earthbound Patron can only be available on a 6- to reflect the limits to what can be accomplished across interplanetary distances.

Reputation and Status see pp. B17-18

In a frontier society like a Mars colony, status is likely to be less important than one's reputation. Being a tycoon or a nobleman just doesn't matter much 50 million miles from home. With only a few thousand people on the whole planet, just about everyone on Mars knows about everyone else's notable exploits (or failures) and will react accordingly. Naturally, characters who operate on Earth much of the time get the full benefit of Status there, and so must pay the appropriate point cost.

Wealth see p. B16

Wealth is only good if you can spend it. An astronaut on the first expedition to Mars might be a multimillionaire, but that doesn't matter since there's nobody on Mars who'll take his checks. Unless a character's wealth on Earth can actually benefit him in play, being rich is simply a bit of background color. Later on, when a Martian economy has begun to develop, wealth becomes relevant again. Note that initially, Mars won't be able to support high levels of wealth – during the period of first exploration and settlement there's no wealth at all; a generation later characters can be Comfortable or Wealthy (or Struggling or Poor); a generation after *that,* Martians can be anything from Dead Broke to Filthy Rich. The Multimillionaire levels of wealth only become possible after Mars has been settled for a century or more.

Master Minds of Mars

Some believers in the existence of psionic powers claim that they are so hard to detect because of the massive interference of all the billions of human brains on Earth. It's like trying to hear a flute in a stamping mill. Mars, of course, is uninhabited, so GMs who want to inject an element of the fantastic into a Domed Mars campaign may allow characters to have psionic abilities. Either all humans on Mars gradually develop paranormal powers, or maybe it's just the Mars-born kids who have them. Depending on how the other humans react to them, Martian psis may have a Secret or a Social Stigma associated with their powers. And if a less-than-ethical government or corporation wants to examine thin slices of their brains, the psis may have an Enemy as well.

Zeroed see p. B237

In a society with only a few thousand people, being Zeroed isn't worth any points. Martian outposts don't rely on credit cards and identity checks, and Martian police find fugitives by asking people and following crawler tracks rather than searching computer records. As with Wealth and Status, Zeroed has its normal value in a campaign which includes a significant amount of adventuring on Earth.

Disadvantages

The screening process for the first astronauts sent to Mars is likely to keep out any serious disadvantages. Later on, standards will get more relaxed, and people who have already traveled to Mars will be able to acquire disadvantages there.

Enemy see p. B39

Obviously, an Enemy must be able to harm the character in some way. An astronaut on Mars really shouldn't get any points because a person on Earth wishes him harm. Enemies *on Mars* naturally get full value, as do Earthbound foes who *do* have interplanetary reach.

Fat and Overweight see pp. B28-29

Because of the expense of launching every pound from Earth, no characters can be Overweight or Fat at the time of liftoff, unless their presence on Mars is so important that the space agency is willing to expend the extra rocket fuel. Someone who has crash-dieted to qualify for the mission may put on the pounds after takeoff, however.

Greed see p. B33

As with Wealth, being greedy for money is meaningless during the early stages of Mars exploration. Astronauts on early missions may covet other things, though: data, mineral samples, fossils, alien artifacts, or scarce treats from the life-support greenhouses.

Honesty see p. B33

Honest characters on Mars try to obey the laws of their home nation, or of whatever nation claims jurisdiction over their current location. They will also follow the dictates of the space agency which sent them to Mars, and will honor UN regulations governing the planet. If an honest character

believes some country is *illegally* trying to claim jurisdiction over territory on Mars, he need not obey the rules of that country, at least not insofar as they conflict with the laws and customs of his homeland.

Lecherousness see p. B34

Like disadvantages relating to wealth, Lecherousness requires an outlet in order to be worth points. A heterosexual astronaut in an all-male (or all-female) expedition to Mars shouldn't get any points for being Lecherous (although one might qualify for the Odious Personal Habit "can't stop talking about sex").

Skills

Martian conditions affect many skills, especially for those recently arrived from Earth. The low gravity imposes a -3 DX penalty for most large motor tasks (manual dexterity is not affected), although the "negative encumbrance" created by the low gravity does increase a character's movement rate. Explorers wearing space suits suffer an additional -1 DX penalty to fine work due to the heavy gloves.

Agronomy/TL see p. B59

Agronomy is a highly useful skill for any long-term Mars project. Current plans for life-support systems include hydroponic gardens to produce food and oxygen, and any permanent base *must* have its own farms to avoid the expense of shooting all supplies up from Earth.

Driving/TL see p. B68

Operating a large Mars rover used the All-Terrain Vehicle specialization of Driving skill; small Mars buggies take the Mars Buggy specialization. They default from one another at -2 due to deliberate similarities in control systems.

Geology/TL see p. B61

During the initial phase of exploration, all Earth-trained geologists get a -2 skill penalty on Mars because of the unfamiliarity of the environment and the unique features of Martian geology. Once Mars has been studied in detail, Martian geology becomes part of the overall study of the science, and there is no skill penalty.

Masonry see p. CI136

The only building materials available on Mars are stone and brick, so Masonry is the most important skill for building structures there. The first expeditions will live in habitats launched from Earth, but any long-term settlement requires the ability to build living quarters from Martian materials. Knowing how to manufacture bricks and cement on Mars requires the Engineer skill.

Navigation/TL see p. B57

Navigation is tricky on Mars because magnetic compasses don't work in the feeble Martian magnetic field, and the celestial pole is different. Assume anyone unfamiliar with Mars is at a -4 when trying to navigate without the help of an inertial compass or satellite positioning system.

Prospecting see p. B62

Prospectors on Mars are often looking for very different resources than those on Earth, and the geology of the planet is quite different. Prospectors trained in Earth conditions have a -4 skill penalty on Mars (reduce the penalty by 1 for each month the prospector spends on Mars); those who have been specifically trained for Martian conditions have no penalty. The most common use of Prospecting skill on Mars is to search for underground ice deposits rather than precious metals or gems.

Science! see p. CI158

While this is normally confined to pulp or cinematic campaigns, GMs may wish to allow it as a way to reflect the broad cross-training given to all the early explorers of Mars.

Survival see p. B57

Survival on Mars presents a whole new set of problems, completely unlike those faced by someone on Earth. Living off the land on Mars means knowing where to find buried ice, how to limit oxygen consumption, and ways to minimize heat loss and conserve power. Martian survival defaults to Earth survival skills at -10 (combining the effects of a strange place and severe weather). It gets *no* default from Naturalist skill, but *does* default to Vacc Suit skill at -4. Survival on Mars without proper equipment (at the very least a space suit and life-support pack) is simply impossible; no amount of skill can allow a human to breathe without oxygen.

Vacc Suit/TL see p. B69

This is *the* skill for anyone planning to visit Mars. Every character should have Vacc Suit at 12 or better. Those brought up on Mars can learn Vacc Suit without taking Free Fall as a prerequisite, but astronauts who make the trip from Earth spend considerable time in zero gravity.

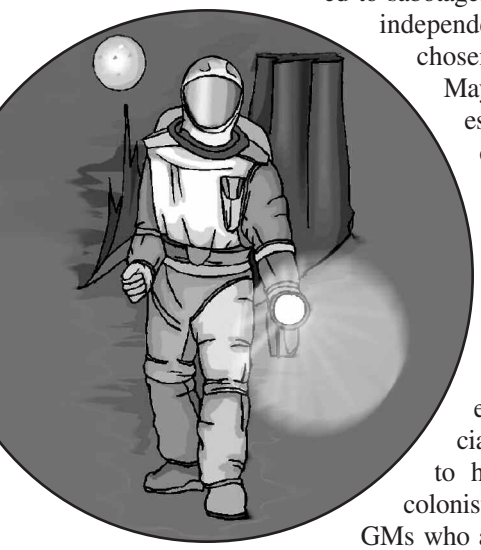
Campaigns and Adventures

Disaster!

All the Mars colonies, even the well-equipped Chryse outpost, are still fragile bubbles in a hostile world, and it wouldn't take much to put one at risk. Potential threats are many: a plague running unchecked with no vaccine available, a blight in the farming domes, failure or sabotage in a colony's power plant, or an out-of-control lander striking a colony structure.

If the player characters are in a colony struck by a disaster, they may have to organize the survivors, fix whatever went wrong, or travel overland to get help. There are certain to be complications – fear-crazed survivors who have decided to improve their own chances by resorting to violence, secondary calamities resulting from the first as overloaded systems fail, or opportunists from a rival colony trying to do some "salvaging" of unguarded equipment.

And perhaps a simple accident isn't really so simple after all. Maybe the governments in charge of the Mars colonies don't want any upstart independent settlements and have resorted to sabotage. Maybe radicals in the independence movement have chosen the same policy. Maybe the company bosses have decided to close down an unprofitable operation and save the expense of shipping everyone home. Or maybe the native Martians are restless.



Characters coping with a disaster can either be skilled technicians and medics sent in to help, or scientists and colonists caught unprepared. GMs who are fans of Irwin Allen films can assemble an eclectic cast of stereotypes (the Nun, the Arguing Couple, the Kid, the Aging Movie Star, the Black Guy Who Dies, etc.) and see who survives when the dome springs a leak.

Martian Gold Rush

While gold is probably rather scarce on Mars, there are several resources which might spark a "gold rush" and bring large numbers of colonists to the Red Planet in a hurry. Diamonds are one possibility; on Earth they're formed in unusual volcanic structures called "kimberlite pipes." Mars might have its own kimberlite formations in the Tharsis Bulge or Elysium. A more high-tech resource is helium-3, a valuable fuel for fusion reactors. Most helium-3 comes from the solar wind, and tiny amounts can be extracted by processing large volumes of Martian regolith. Martian gemstones and other curiosities would certainly fetch high prices from collectors back on Earth. If Mars once held intelligent life, fragments of alien technology could be worth billions.

Whatever sparks the "gold rush," the result is a mass influx of prospectors and entrepreneurs looking for a quick profit. The Cycler can only carry a certain number of passengers at a time, and can only be expanded when it passes near Earth. Desperate "2049ers" must put up with the tedium of spending 6 months in a tiny capsule crammed with other fortune-hunters, survive inadequate life support and radiation protection, or risk experimental freeze tubes for passage aboard a cargo mission.

Once on Mars the prospectors want vehicles, pressure tents, and digging equipment. The older Martian settlers can get rich themselves selling gear to the new arrivals – or find themselves being robbed blind by unscrupulous adventurers who simply "borrow" anything that isn't nailed down. The base life-support systems are strained to handle the new arrivals, and many of them wind up living in jerrybuilt habitats, eating decade-old emergency rations until the new greenhouses come on line.

Adventuring during a Martian gold rush can go in several directions. GMs who want to recycle all the old tropes of Klondike adventures can have crusty old planetary geologists, ill-prepared greenhorns just off the Cycler, claim-jumpers, con men, saloons, brothels, U.S. Marshals, and the inevitable Sinister Corporation trying to get the deed to the mother lode away from the love interest. This can be as fun or as gritty as you want to make it – at the silly end, all the Martian prospectors sound like Gabby Hayes, the villains have waxed mustaches to twirl, and the dance-hall girls all have hearts of gold.

At the gritty end, hundreds of people are trying to survive on a hostile planet where resources are scarce. Those with the power and control of the oxygen supply can virtually enslave the rest, turning Mars into a company town where all the profits go to the company store. The brothels are antiseptic places where bewildered young women from overcrowded Third World slums are horribly exploited to keep the workers happy. And from time to time a shoddily-built lander breaks apart in the sky, spilling the bodies of hopeful newcomers across the harsh landscape. This is an ideal setting for cyberpunk adventures as Mars colonists try to break the grip of the megacorps who are exploiting both the planet and its people.

A gold rush scenario can either bring the player-characters to Mars along with all the other tenderfeet, or it can face a group of PC scientists and explorers with a sudden influx of strangers. Colony administrators whose biggest problem was allocating laboratory space find themselves the only law past Luna, keeping order among desperate types with hidden agendas. Characters with an entrepreneurial streak can try to get rich by building habitats, setting up a rover factory, or producing black-market honey mead for the prospectors. And, of course, the heroes can try their hands at prospecting themselves, venturing out into the Martian wilderness in search of diamonds, helium-3, or alien artifacts.

Return of the Martians

That is not dead which can eternal lie,
And with strange eons even death may die.
– "Abdul al-Hazred," The Necronomicon

If Mars really was once lifebearing, perhaps the inhabitants simply went into hibernation when they found their planet dying around them. A whole campaign can be built around the process of discovering clues to the ancient Martians, locating their hibernation chamber, waking them up – and coping with the results!

Just finding out about the ancient Martians can take up several adventures, as the astronaut-archaeologists find potsherds, excavate ruins, and decipher Martian languages, all the while trading threats and gunshots with sinister rivals (Cydonia Face cultists, "Top Men" from the government, or minions of the Evil Corporation du jour). If the scientific authorities refuse to consider the possibility of ancient Martians, the PCs may have to do all their work in secret, snatching time from other projects to work on analyzing Martian artifacts, and hacking into the base computer in order to use

it to crack the Martian language. Once the secret's revealed, the heroes and villains race across the planet in a frantic scramble to find the tomb of the sleeping Martians.

Which Martians to use depends on whether the GM wants them to be friendly beings or a Menace Out Of Time. For friendly Martians, use the creatures described in the sidebar on p. 57; for menacing ones either bring out Superscience Martians from Chapter 6, or whatever scary aliens you prefer. The sleeping Martians don't actually have to be alive, of course: high-tech robots might well be able to wait in power-saving mode for millions of years until the PCs arrive.

If the Martians are friendly, or at least not immediately dangerous, the heroes must protect them from would-be exploiters or agents of the Conspiracy who want to conceal the whole business. Hostile Martians can presumably defend themselves against the forces of marketing, but may turn out to have vastly powerful weapons and a hankering to relocate to Earth.

The tone of a "Return of the Martians" campaign can be anything from hard science fiction to pulp adventure to Lovecraftian horror. For best results, start out in an entirely realistic vein, then throw the scientists into an action-adventure plot, and only when the adrenaline's pumping and they're racing for the MacGuffin should you start hinting that maybe what they're looking for is something which is best left alone.

Independence

The great distance between Mars and Earth and the expense of launching people to the Red Planet is a strong incentive for families to settle there permanently. Only a few decades after the first permanent bases are set up, native-born Martians will make up a big proportion of the planet's population. That's when the fun begins.

Other GURPS Settings

GURPS Black Ops

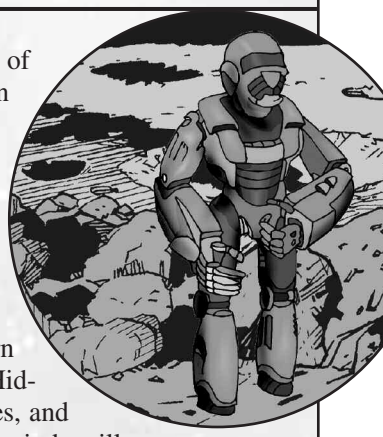
If the colonists on Mars discover signs of ancient aliens, or more modern traces of the Greys or their ilk, who ya gonna call? The heavily-armed men and women of Strike Force Barsoom, that's who. The Company may send out its operatives undercover aboard the Cycler, or it may have some next-generation fusion-powered ships capable of getting agents to Mars in a matter of days. If a permanent presence on Mars is needed, the Company could decide to hide in plain sight as a commercial operation or "research station," or go underground with a secret base. The Face in Cydonia would be all too appropriate as a site for the Company's Mars headquarters.

GURPS Cyberpunk

While most cyberpunk fiction focuses on the overcrowded cities of Earth or the orbital jungle in the Lagrange points, it's certainly possible to send a band of street samurai and netrunners on a trip to Mars. The cramped dormitories of the industrial colonies are a great market for crooks selling escape from tedium in the form of exotic drugs or virtual-reality tapes. Megacorporations might hide cutting-edge projects on Mars, or might even be preparing for a terraforming program. Rebels against the corps could be holed up in a secret colony. There are great dramatic possibilities in the contrast between jaded cyberpunks from Earth and the optimistic pioneer types building a new planet on Mars.

GURPS Reign of Steel

The missing Chinese-Japanese-Korean Mars mission apparently reached Mars successfully, and it's likely the astronauts went to ground after learning what happened on Earth. The crew has had several years to cover its tracks, and Mars is a pretty big place to hide in. The Kasei canyon system is one promising refuge, or maybe the deep bottom of western Hellas. Give them the resources of the initial Chryse base described above, plus whatever they might have been able to build out of scrap materials and Martian resources. The Mars colonists may be called upon to defeat an invading force of robots and bioroids sent by Zone New Delhi, or perhaps some humans from Zone Washington might be recruited by the Zonemind for a mission to learn the fate of the lost expedition. Hidden agendas, secret robotic spies, and opposition from the other Zoneminds will certainly make for an interesting trip.



GURPS Supers

Superheroes are always messing around in outer space, and Mars is no exception. A supervillain or Alien Menace might be trying to take over or destroy humanity's first outposts on the Red Planet, or perhaps some explorers have uncovered ancient technology there and gained superpowers of their own. Heroes with useful abilities might be asked to join the Mars program – super-strong heroes capable of flying through space could carry payloads no rocket could lift, mutants with environment-modifying powers could work wonders setting up a life support system or helping start terraforming, and gadgeteer inventors might be involved in designing or building a base. Some supers could even be Martians, either survivors of an ancient civilization or inhabitants of some secret underground land. Finally, Mars would be a pretty good place to put the headquarters of a superhero group: it's well out of reach of most Earthbound villains, it's not in any nation's territory, and there's a lot of room. The Martian Defenders will need teleport gates or some other way to reach Earth quickly, though – it's not much good fighting Evil if you show up 6 months too late to help!

There are dozens of potential sources of conflict between the colonists on Mars and the authorities back on Earth. Who owns Mars? Should Martian or Terran goals get priority? What do the Martians owe Earth? Should the planet be terraformed? Who's going to pay for it all? If the Earthlings are short-sighted and arrogant, they may simply try to dictate policy to the Martians without addressing any of their concerns. The result could be explosive.

Free Mars!

Would-be revolutionaries on Mars have to face tremendous disadvantages, but they do have a couple of strong advantages to make up for them. In a conflict, Earth has billions of people, trillions of dollars, and arsenals of really powerful weapons. But all of those advantages are more than 50 million miles from Mars, and can only be delivered in lots of 100 tons or so at tremendous expense. If the colonists can stay united and prevent Earth from establishing a beachhead on Mars to support an army, they can snap up "peacekeepers" as they arrive. *And* take their guns.

After the Revolution

Gamers who enjoy roleplaying and intellectual struggles may wish to skip the actual War of Independence and get down to the nitty-gritty of working out a system of government for the newly independent planet Mars. Will the colonies unite into a single nation, or will each remain its own country? Either way there will be exciting turf battles, dealmaking, skullduggery, and the ever-present threat of one faction inviting Earth back to Mars.

Squatters

Private colonists who decide to challenge the authority of the UN and national governments by establishing their own settlement are going to face all kinds of interesting problems.

First of all, a private group can't call on the resources of NASA or other national space programs. The settlers are entirely on their own, especially if it's difficult to arrange supply payloads on private launch services.

Second, the powers that be are certain to try various methods to bring an independent colony under their control, or else shut it down. Such efforts may be just trivial harassment – refusing to lend supplies or technical help, a ban on trade between official colonies and squatter settlements, and various legal hassles to prevent the settlers from earning money back on Earth. But tyrannical governments could employ more brutal tactics: shooting down supply shipments, arresting squatters who visit the government's outposts, or even waging a war of conquest against the squatter colony itself.

The other colonists on Mars are going to be caught in the middle of all this. Do they obey Mission Control, or do they side with their fellow Martians? Repressive measures against a squatter colony could turn into the opening shots of a Martian War of Independence, as colonists refuse to support tyranny.

Martian Marshal

Mars in the domed colony era is a frontier. The first wave of scientists and explorers are being replaced by colonists and entrepreneurs. Where once cooperation and comradeship were enough to regulate people's behavior, a bigger colony needs laws – and someone to enforce them.

The person selected for the job may be a police professional from Earth, sent out on the Cycler to clean up the Red Planet; a private security officer hired by companies with interests on Mars; or simply a colonist or researcher given a badge and a tangler by her peers. These are not mutually exclusive – different colonies might have different arrangements, and interesting tensions might arise when an easygoing elected sheriff has to work with an arrogant professional and a slightly shady rent-a-cop. At present, the United States has given the U.S. Marshals Service jurisdiction over law enforcement on aircraft, and might well extend that to American spacecraft and colonies. Facilities under Air Force control would be patrolled by Air Police. European settlements would either use the national police force of the biggest sponsoring nation, or else call in Interpol.

The actual laws of a colony depend on who controls it. Settlements under the flag of one nation naturally follow that country's legal code (American outposts would be under Federal jurisdiction or, possibly, considered part of Florida or Texas for legal purposes). Multinational settlements have their legal basis established by treaty, either assigning them to one nation's law code or else drawing up a set of rules. Corporate outposts follow the laws of wherever the owning company is headquartered; note that some companies may pick obscure and complaisant countries on Earth for this purpose, much as Liberia is the flag of choice for merchant shipping. Independent colonies can naturally make their own laws.

A lawman on Mars faces tremendous challenges: the vast distances between settlements, the need to balance the letter of the law against compromises demanded by the hostile environment, and whose interests the law is actually designed to support.

Cultural conflict is almost inevitable. The law officer must be able to operate in the tough dormitories of mining outposts, the laid-back scientific stations, and the deliberately bizarre societies of private colony settlements. A "by the book" person is going to have trouble very quickly trying to enforce uniform rules in such different settings, but an officer who is too flexible will be accused of laxness or favoritism.

One important consideration for a lawman on Mars is proper punishment. Many of the penalties used on Earth are either unavailable on Mars or else too expensive. In a virtually cashless society, fines are either impossible to collect or else would deprive the person of something vital for survival. Shipping a lawbreaker home on the next Cycler may mean a wait of a year or more, and means the colony will be short one person until a replacement arrives. Locking up a violator means the colony's limited resources have to support someone who isn't contributing anything. And capital punishment in a society with only a few hundred people removes someone the colony might not be able to spare.

Useful sanctions include electronically-monitored house arrest, which allows the prisoner to work but otherwise limits him to his bunk; physical punishment (either a formal caning or an ad hoc session of "subdual while resisting arrest"); or the use of advanced drugs to control behavior.

CHAPTER 5

TERRAFORMED MARS

"Dim and wonderful is the vision I have conjured up in my mind of life spreading slowly from this little seed-bed of the solar system throughout the inanimate vastness of sidereal space. But that is a remote dream."

– H.G. Wells, The War of the Worlds

Preserving The Old World

There is a tremendous ethical issue involved in transforming the face and environment of an entire planet. Some "Red Mars" preservationists argue that humanity has no right to change Mars. Even if the planet is completely lifeless, the unique Martian environment should be protected.

Preservationists can take heart in the fact that many of the most unique features on Mars are located on very high ground. The Tharsis volcanoes, the intricate canyons of Noctis Labyrinthus, and much of the upper Valles Marineris are all in a region which is up to 5 kilometers above the Martian mean datum level. Terraforming will thicken the atmosphere, but most of the noticeable effects will be limited to the lowest regions. Long after the Chryse Planitia region is green and dotted with crater lakes, Olympus Mons will look much as it did before humans ever came to Mars.

What if it Goes Wrong?

There are lots of ways for a terraforming project to go wrong, some quick and catastrophic, others slow and insidious. Big showy disasters include mistargeted asteroids smashing into inhabited areas, solar mirrors frying spaceships or colonies, geothermal taps releasing torrents of magma, or melting aquifers causing huge flash floods. Asteroid impacts certainly will cause tremors and seismic activity all over the planet, and could even awaken Mars' sleeping volcanoes,

Changing a planet's temperature and atmosphere composition *will* (not might) have tremendous effects on the weather. Mars during terraforming can expect planet-wide dust storms, tornadoes, snowstorms, and possibly the first hurricanes seen on the planet for a billion years. Increasing the amount of water on Mars will certainly lead to snowstorms, covering the planet in a reflective white frost layer and lowering the temperature again. Paradoxically, warming up Mars could cause an Ice Age!

Other problems might take longer to become apparent – and that much harder to find and stop in time. Since Mars' wobbling axis seems to be linked to the cycle of water accumulation at the poles, warming the planet could cause changes in its axial tilt, with unforeseen climate effects. Melting underground ice layers might turn large areas of the surface into chaotic terrain, or leave dangerous sinkholes for future generations to discover the hard way. Warming Mars certainly will make it lose atmospheric gases faster, which may make it necessary for terraformers to keep replenishing the Martian atmosphere.

On a smaller scale, erosion is certain to be a problem when terraformers release millions of tons of water into an environment of bare soil and rock. The seas of Mars will be choked with mud, and new rivers will carve up the surface in unpredictable ways.

TERRAFORMING

Terraforming is the process of turning a hostile world into a habitable one. It's a science fiction idea which has gradually become science – highly speculative science, but science nonetheless. One thing which has helped give terraforming new respectability is the discovery that humans may have already changed the planetary environment on Earth.

Mars is the planet at the top of the list of candidates for terraforming. (Venus used to be the main contender until new data revealed just how hostile that world's environment really is.) Mars has water, *the* essential substance for life, and its surface suggests that it was once warm enough for lakes and seas. If it used to be warmer and wetter, perhaps it can be once again – with a little help.

In a cinematic setting, the hero flips the switch, the gizmos go to work, the effects roll, and POOF! Mars has a breathable atmosphere. In the real world, scientists consider the job to be much more difficult and time consuming. But even if the most pessimistic views are correct, humans *could* make major changes in the Martian environment over a time scale of centuries. All that is needed is the money, and the will.

Why Terraform?

The biggest question about terraforming Mars is not how, but why. It is certain to be a vast, expensive and very long process, which will only benefit unborn generations of Martians. Policy makers on Earth may well ask why the money and resources involved shouldn't be devoted to solving Earth's problems. Even other space advocates may prefer to settle the High Frontier by building artificial habitats or hollowing out asteroids.

Despite the ambitious dreams of planners, Mars terraforming is likely only if it satisfies one of three reasons: it will be profitable, it will avert some disaster, or enough people can be persuaded that it is the right thing to do regardless of expense.

Profit

As a simple real-estate venture, Mars represents a large chunk of land. Its area is equal to all the dry land on Earth. If terraforming makes even a quarter of Mars habitable, then at a reasonable price of a thousand dollars per acre Mars would be worth more than 8 trillion dollars. If terraforming can be accomplished for less than that sum, some ambitious developer might be tempted to try it. As a source of food and volatiles for space habitats in the asteroid belt or Jupiter orbit, Mars might become more valuable. And that's not counting the value of Mars' mineral resources, which could be more easily extracted on a more habitable planet.

Averting Disaster

If some great peril threatens the long-term viability of Earth, Mars would make a great "lifeboat" planet. However, the choice of disasters which could menace Earth but not Mars is rather limited. If climate change (caused by either runaway greenhouse effect, asteroid impact, or changes in the Sun's output) is the problem, then "re-terraforming" Earth is

the more likely response. Two particularly nasty possibilities are Earth becoming infested with some deadly and incurable supergerm, or succumbing to a devastating nanotech "gray goo" weapon. Or perhaps the "disaster" is social or political: Earth under some tyrannical government might allow dissidents to flee to Mars as a way of getting rid of them. (The humans in ***GURPS Reign of Steel*** could perhaps cut a deal with the Earth's ruling Zoneminds, enabling them to turn Mars into a terraformed human preserve while the robots take over the rest of the Solar System.)

Sheer Coolness

Finally, if human civilization is sufficiently wealthy, ideological fervor might be able to motivate people where there isn't enough profit or danger to make the venture practical. The Apollo program didn't make a dime, either, but enough people agreed that it was worth doing, and America had the resources to spare. If humans eliminate major conflicts on Earth, people might take up terraforming Mars simply because it provides a challenge. Alternately, some dictator or one-party state might decide that transforming Mars is the ultimate destiny of the One True Way.

All of the Above

For a huge project like terraforming a planet, no single reason is enough. The Mars Terraforming Consortium is likely to include members with all the reasons given above as well as private motives of their own. Corporations hoping to pull off the biggest land deal in history will work together with groups worried about providing a second basket for humanity's eggs, governments in it for prestige, starry-eyed idealists, and probably more than a few crackpots.

What Mars Needs

Mars needs air, water and warmth. Specifically, to support humans it needs an atmosphere with an oxygen partial pressure of at least 70 millibars. (Partial pressure of a gas is calculated by multiplying the percentage of the gas in the atmosphere by the atmospheric pressure.) It needs a surface temperature higher than the freezing point of water, at least in the lower latitudes, which means it must be about 100° warmer than it is right now.

Happily, it appears that even small increases in either temperature or atmosphere can be "leveraged" to produce even bigger changes. More air means a bigger greenhouse effect and heat trap, which warms up the planet. Warming the planet cooks more volatiles out of the crust and polar caps, thickening the atmosphere. Small-scale terraforming operations can make Mars more comfortable, even if they can't make it completely Earthlike. A thicker atmosphere makes a better shield against radiation, while a warmer planet overall means it's easier for inhabitants to go about on the surface without bulky suits. This short-term payoff might help colonists justify a massive long-term program.

Giving Mars the things it needs is likely to require both colossal engineering projects and the creation of custom-built organisms. This chapter assumes a ***GURPS*** TL of 9 or better (limited to the "hard science" technology path), beginning around 2050.

Big Jobs

Some of the things Mars needs will simply have to be brought there from someplace else: more heat and more atmospheric gases. Doing that will require engineering on a scale never before attempted.

Turning Up the Heat

The simplest way to heat up Mars is to increase the amount of solar radiation it receives. Increasing the temperature to a global average above freezing requires multiplying the solar radiation reaching the surface of Mars by a factor of 2.5. Since it's impossible to raise the output of the Sun (and doing so would have rather unpleasant effects on Earth), terraformers need to make Mars catch and absorb more sunlight. This can be accomplished fairly easily by the construction of giant mirrors in space, to bounce extra sunlight onto Mars.

How big do the mirrors have to be? Assuming 50% efficiency, they need to be 3 times the size of Mars: an area of 40 million square miles. The solar mirrors form a giant ring 8,000 miles in diameter with a central hole 4,000 miles wide. While this sounds huge, it's not beyond the ability of humans to construct. The mirrors are essentially solar sails – vast films of thin plastic, with a metal coating a few atoms thick. At TL9 the mass is only 400 lbs. per square mile, so the whole array would weigh 8 million tons. That's the same scale as a dam or a large bridge – big, but not inconceivable, and the job can be done in small increments. The manufacturing plant for the mirrors is on Deimos, and segments use the solar wind to sail into position. Solar-sail cargo vehicles from Earth get "recycled" into the mirror farm.

A good place to park the mirrors would be behind Mars, about 15,000 miles away, where Mars' gravity and the force of the solar wind on the mirrors balance out. They are set up in a ring so that Mars itself can't block the sunlight reaching them. Steered by computers, the mirrors hover there like a ping-pong ball atop a current of air. The mirror farm grows incrementally, adding panels steadily year after year. At first the temperature effects are minor, but gradually the light in the midnight sky grows brighter and Mars begins warming up. From the surface of Mars, the mirrors form a shining circle in the sky, 30° across and as bright as the Sun. Mars becomes a planet of eternal day.

Another way to warm up Mars would be to make its surface darker, reducing its albedo and increasing the amount of energy it absorbs. This could either be done using tailored organisms (see below) or by launching dark surface material from Phobos to cover the Martian surface. It would take about 40 billion tons of dust to give Mars a dark coating a tenth of a millimeter deep. That represents about a third of a percent of Phobos' mass. The scale of the project is a little daunting, though: transporting that much material would require a mass-driver on Phobos launching 10-ton loads of powdered regolith every minute for 7,600 years! It might be simpler to just blast Phobos apart and sent the fragments tumbling into the Martian atmosphere. If the terraformers have a sentimental attachment to Phobos, they can use some other carbonaceous asteroid, though it will cost more.

Keeping Mars warm is mostly a matter of improving the atmosphere's greenhouse effect. Initially, this is very easy: carbon dioxide and water vapor released from the regolith and polar caps thicken the atmosphere, and both are effective greenhouse gases. The problem arises once humans release plants to transform the Martian atmosphere into a breathable mix of oxygen and nitrogen. Breaking down the carbon dioxide reduces the atmosphere's greenhouse effect, cooling the planet. That in turn reduces the amount of water vapor, cooling it still further. Mars could potentially plunge into a runaway ice age again.

The runaway cooling can be prevented by either pumping still *more* heat into the system to keep temperatures up by brute force, or by releasing artificial greenhouse gases into the Martian atmosphere. One interesting candidate is the family of carbon-fluorine compounds called "perfluorocarbons." They are relatively inert, and would help Mars retain heat, and are tremendously more effective than carbon dioxide. Perfluorocarbon compounds don't occur naturally, however; the terraformers must set up factories on Mars to extract fluorine from rock and combine it with carbon. Since a certain amount of perfluorocarbons will be lost each year from photodissociation in the upper atmosphere as energetic photons break up the molecules, the greenhouse gas factories must run nonstop, another ongoing cost of keeping Mars habitable.

Whatever methods are used, they will take time. Something the size of a planet has a lot of thermal inertia: even after Martian surface temperatures reach the melting point of water, it will take thousands of years for the heat to penetrate down through the frozen crust. The process can be speeded up by drilling down to the water trapped beneath the cryosphere, but the time scale is still years to decades.

Factory Air

To give Mars a surface pressure half as great as Earth's, the terraformers will need to make the atmosphere a *lot* more massive. Currently Mars' atmosphere is about 1.5% as massive as Earth's per unit volume. The terraformers have to get hold of some 30 trillion tons of gas or ice. Water and carbon dioxide in the Martian surface could supply some of that, but a breathable atmosphere needs a large proportion of nitrogen, which Mars just doesn't have. Planetary engineers either have to settle for a thin atmosphere, or go looking elsewhere for more volatiles.

Possible sources for light elements include the comets of the outer solar system, or Saturn's outer moons Phoebe or Hyperion. Comets are probably the easiest to maneuver into a Mars impact orbit, but getting out to the region beyond Pluto is a long, long trip. Saturn's moons are closer, but need to be broken apart and shifted out of the ringed giant's deep gravity well. There are political problems, as well: people might object to losing even a small moon, and by the time Mars terraforming becomes feasible, those moons might have inhabitants of their own!

No matter what the source, thickening the Martian atmosphere will require a lot of ice: either a single icy moon or asteroid 23 miles across, or more than a dozen comets with a diameter of 10 miles each. The richer in ammonia the objects are, the better, since ammonia can be broken down into nitrogen and hydrogen. The hydrogen can combine with free oxygen liberated from carbon dioxide and form water, so that's not a problem, and nitrogen is the main component of Earth's atmosphere. About two-thirds of the ice from space should be frozen ammonia, with as much carbon dioxide ice as possible.

Moving asteroids and comets around is a job for either big bombs or big mass-drivers. Bombs are relatively cheap and quick, but for some reason they do make people nervous. Moving a 30 trillion ton comet into a path that will strike Mars should take about a hundred 1-megaton thrust bombs. Boosting Phoebe out of Saturn orbit would require considerably more thrust: about 200 1-gigaton devices. To hit Mars exactly, a gravity assist from Jupiter may be needed.

Mass drivers are less dramatic, but take longer. To move a comet would take a battery of 1,000 mass-drivers, each launching one-ton payloads every second for 95 years! However, once built, such a giant "planet mover" could be reused for other cosmic engineering projects, such as moving metal-rich asteroids into Earth orbit, or supplying Moon colonies with comet volatiles. In practice, terraformers are likely to combine the techniques, using a few large thrust bombs for major course changes, then mass-drivers for precision steering.

All these volatiles raining down from space at interplanetary speeds won't make Mars a very safe place. Colonists may simply evacuate the planet entirely, or else the comet pilots are going to have to do some pinpoint bombing to hit uninhabited areas. The rugged southern hemisphere is a good target to aim for – who'll mind a few extra craters?

The impacts are certain to shake things up all over the planet: the Tharsis volcanoes may be jolted into eruption, shockwaves may cause titanic outflows from the sub-cryosphere aquifer, carving new channels on the surface, and the dust from the impacts will fill the newly dense atmosphere, causing unwanted cooling. Unless the engineers are careful to blast the incoming fragments into relatively tiny chunks, the blast of each impact will rival a large nuclear warhead in effect. Really *big* fragments could generate shockwaves capable of cracking habitat domes halfway across the planet.

Biology

Genetic engineering and biological technology will certainly play a large part in terraforming Mars. Depending on the assumptions one is willing to make, the whole job might be done with biotechnology.

Mars Needs . . . Um . . .

The oxidant chemicals in the Martian soil aren't very good for growing plants. To make the Martian surface material more fertile, humans have to combine it with water and carbon-rich compounds. The water will come from rain or irrigation, but the carbon is a bit more tricky. One excellent source of carbon is human waste. Mixing waste products with Martian soil solves two problems at once: the toxic soil kills bacteria and sterilizes the waste, while the carbon, water, and nitrogen compounds in the wastes make the barren red soil into something plants can use. Assuming a mix of three parts Martian soil to one part waste, a human can "terraform" about one square foot of Mars per day. Even with several million inhabitants, sewage disposal on Mars won't be a problem for millennia!

Terraforming Organisms

To pump gases into the atmosphere and increase the temperature, genetic designers create specialized forms of algae or lichen which can survive in the harsh Martian conditions. The tailored organisms are very dark, helping the planet absorb more sunlight and warming the climate. Meanwhile, other types of tailored algae living in the soil use sunlight to break down oxides in the soil, releasing oxygen. The algae must be very hardy indeed: able to withstand intense cold, survive with almost no water, resist ultraviolet radiation, store oxygen in their cells, and live in the presence of toxic oxidant chemicals. Happily, none of those things are actually impossible. There are species living on Earth today which can withstand each of those conditions. The trick is creating organisms which can do all of them at once, and still breed quickly enough to be useful in terraforming.

The advantage of using biological methods is that they are relatively cheap. Once the design work is done, just breed up a few billion algae and spray them across the Martian surface. They reproduce themselves, so after the initial investment there's no more cost.

The disadvantages to biotechnology are the limited scale and the possibility of unforeseen consequences. No organism, no matter how complex its genome, can change the basic parameters of the planet. Mars only gets so much energy from the Sun, and even if all of it is absorbed, the planet's still going to be very cold. Organisms may release chemicals bound up in the soil or frozen below the surface, but they can't supply things which just aren't there. And biological systems have a habit of doing unexpected things. Mutations in the algae are certain to occur, especially with all the radiation flooding the Martian surface. Variant strains which don't help the terraforming process could crowd out the carefully-designed organisms. By themselves, terraforming organisms could even do more harm than good: plants breaking up the carbon dioxide in the atmosphere would reduce the greenhouse effect on Mars, making the planet even colder.

The New World

Terraforming Mars is going to change more than just the atmosphere composition and the temperature. Mars will become a new planet, as different from its current state as it is from Earth. Conditions on the surface of Mars change dramatically as the terraforming process goes ahead. The effects of those changes range from nuisances to life-threatening.

Phase One

The initial phase of terraforming includes all the big engineering projects, and the most dramatic short-term changes in the planet's environment. After the comet bombardment, the seeding with tailored algae and lichens, and a few decades of increased solar radiation from the mirror farms, Mars is a very different world. It isn't habitable yet, but certainly the conditions for life are better than they once were.

It's a lot wetter, for one thing. Thickening the atmosphere adds a lot of water, both directly in the form of ice, and indirectly as ammonia breaks down into nitrogen and hydrogen. All told, the terraforming will add about 11,000 cubic miles of water to Mars, or about 14 inches of rain over the whole surface. Warming up the planet should also release some of the frozen water locked up in the cryosphere and below. As the ice melts, the land above it will slump and collapse, and the new low spots will become lakes and seas. There will be a *lot* of erosion at this stage, and sudden bursts of underground water may carve out huge new channel systems. The deepest parts of the northern lowlands fill with water to form new seas up to half a mile deep. Even from space, the planet looks different.

Making the atmosphere thicker provides better radiation protection. In the lowlands the radiation level drops to Earth normal levels. Very high regions like Tharsis and the slopes of Olympus get radiation protection about equal to pre-terraforming lowland Mars (see p. 20). The thicker atmosphere means more weather. Winds become more powerful, and as the moisture in the atmosphere increases Mars sees snow and rain for the first time in billions of years. Mars will also begin to see *dangerous* weather: blizzards, tornadoes, and thunderstorms. Travelers in canyon country may encounter flash floods, as dangerous on Mars as they are on Earth. Flying becomes easier (see the box "Red Planet, Blue Sky") but wind and weather also make it trickier.

With the mirrors in operation, Mars is also getting warmer, and no longer has night and day. During the "day" the light comes from a bright point in the sky, the Sun, while at "night" the light comes from a bright ring in the sky, the mirror farm. It never really gets dark at all.

Phase Two

The second phase of terraforming sees the transformation of the Martian atmosphere from mostly carbon dioxide and nitrogen to a breathable nitrogen-oxygen mix like Earth's, the spread of tailored plants, and a major *drop* in temperatures with the decline in carbon dioxide levels.

The spread of plants cuts down on erosion, so that Martian streams and rivers become steady-flowing and clear, and the oceans begin to turn from brown to blue as the sediment settles out. Stream water will be saltier than river water on Earth, if only because the Martian soil hasn't had millions of years of leaching going on. The water level rises considerably as the planetary warming continues. In the northern hemisphere everything below the -1 kilometer contour is flooded; in the southern hemisphere the Hellas basin fills up to the brim, as do many smaller craters.

As plants turn carbon dioxide into oxygen, Mars gets a mini-ice age caused by the reduction in greenhouse effect. The terraforming engineers will have to bring more orbital mirrors into operation or start manufacturing perfluorocarbons to combat this, but several decades of cold temperatures are likely. The oceans will ice over, and much of the surface will be covered by snow and ice. Humans exploring or working on the surface need skis and serious cold-weather gear.

To balance the temperature drop, being able to breathe the air marks a major milestone in terraforming Mars. There won't be one day when suddenly everyone can open their windows and inhale. First people will be able to go about with compressor masks instead of air tanks. Then the genetically modified "Martians" will be able to start going without masks for short periods. Then longer periods. Then even unmodified Earth humans will start being able to tolerate brief exposure without masks. Finally, only asthmatics and heart patients will need breathing equipment.

Phase Three

Phase Three is the longest part of the terraforming job, and the least glamorous. Mars is habitable, but it takes a lot of work to keep it that way and make the planet into a nice place to live. The seas are full of mud, the soil is full of salt, the cryosphere is still slowly melting, the ecology is always a work in progress, and the planetary heat budget needs constant tweaking. But this part of the terraforming is also the most fun for people who actually live on Mars. They can go sailing on the new rivers and seas, climb the mountains, farm the plains, and hike in the deserts. Mars is a *place* where people can live.

The New Landscape

What will Mars look like after terraforming? On the planetary scale the most noticeable changes are the thicker atmosphere flecked with white water-vapor clouds, the silty Boreal Ocean and numerous round crater lakes, and a green or brown color over areas that once were red.

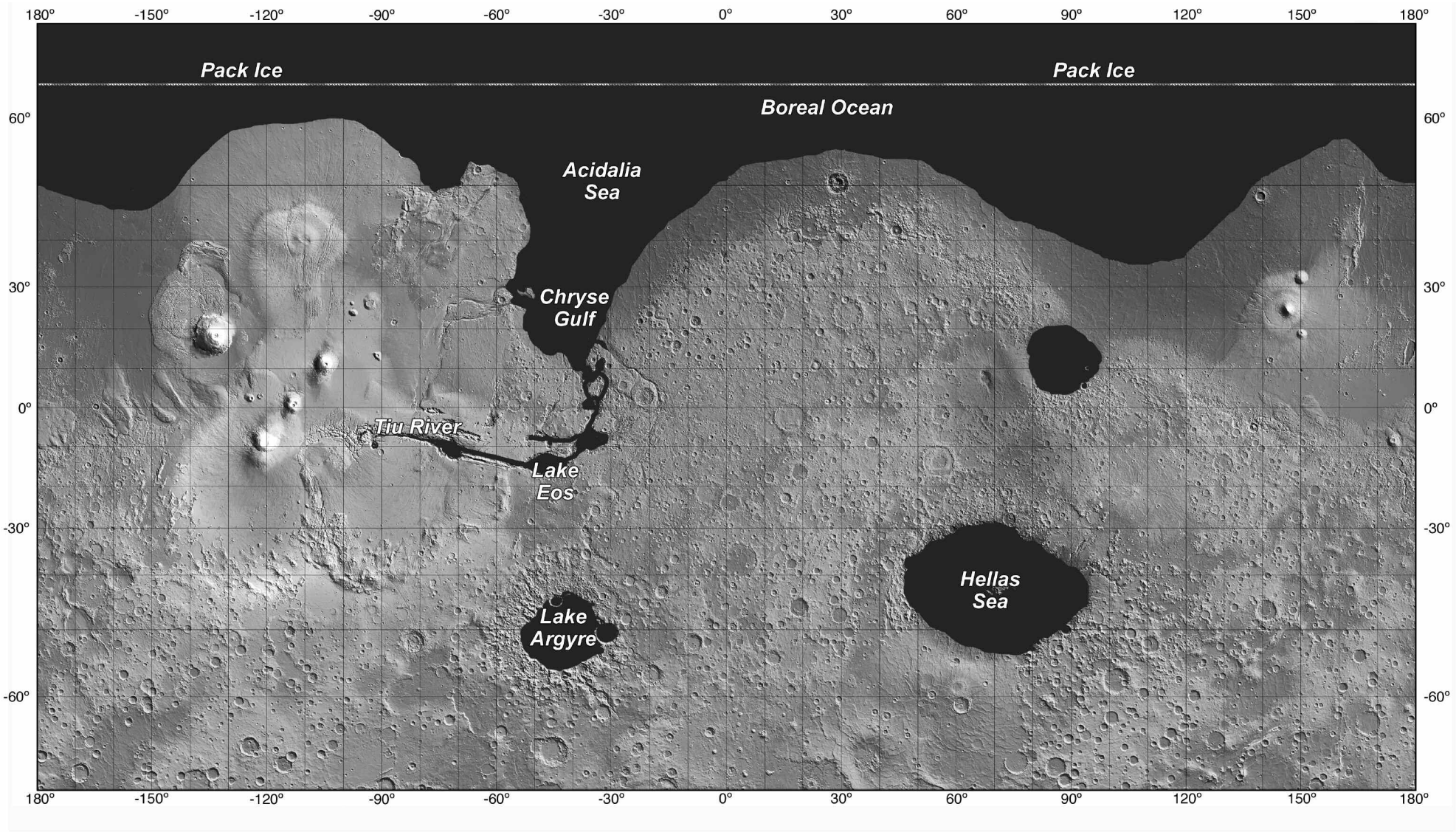
Locally, Mars shows the effect of erosion and life. Gullies and canyons are more common, and in many regions the loose topsoil has washed away to expose bare rock knobs and badlands. Existing channels and waterways are wider and deeper, and many now have permanent streams flowing along their bottoms. Sinkholes are frequent where the underground cryosphere has melted and run off, and human explorers may find new cave systems the hard way – by falling in! Low regions are filled with dirt and sediment washed down by floods, so much of the familiar rock-studded Martian landscape is replaced by more Earthlike sandy deserts.

Life changes the scenery, as well. Plants and lichens cover the lowland regions, breaking up rocks, stabilizing slopes, and generally smoothing the landscape. In the short term plants prevent erosion by holding soil in place; in the long term they help it by shattering rocks and creating biomass. Even after terraforming, much of Mars is a desert, and visible life is limited to coatings of moss and lichen on rocks, scattered clumps of pampas grass, and occasional tough pines or cacti.

The Seas of Mars

Even after terraforming, Mars doesn't have enough water for oceans on the scale of Earth's. Instead, the surface is dotted with small lakes and seas, either old lowlands or craters. To keep the vital water supplies from getting locked up in highland crater lakes, the Martians fall back on lots of brute-force physical engineering: blasting gaps in crater walls, and digging channels by fusing the surface with concentrated sunlight from orbit. Mars will finally have canals.

Hydrographic Map of Terraformed Mars



Time Scale

How long is all of this going to take? Phase One – the "brute force" portion of the terraforming program – requires time to set up but brings relatively quick results. Assuming the terraforming project starts out in 2050 (probably a wildly optimistic scenario), it takes about a decade to set up the mirrors and construct the ships and bases needed to start comet-moving. The mirrors start heating the planet in 2060. Realistically, the temperature increase would be slow, no more than half a degree or so per year, but for a playable roleplaying setting we assume they warm the planet by about 5° Fahrenheit per year. Mars gets its first lakes by 2090 or so. Melting the ice layers thaws down about half an inch per day, so after another decade of heating the planet has seas 100 feet deep.

Moving comets takes time, simply because the distances in the outer system are so vast. It takes a good 10 years just to get the ships and workers out there. The mass-drivers and bombs start work in 2060, the same year as the mirrors, but the first impacts don't come until 2070, when comet fragments and ammonia payloads from Saturn begin slamming into Mars' southern hemisphere.

The planet's going to be getting pounded pretty hard for the next 10 years, so there won't be many settlers arriving. Shifting the orbit of Deimos is done in 2070, and construction of the orbital elevator starts in 2080, now that the biggest comet impacts are over. The elevator's done in 2090 (again, this is probably optimistic, and GMs may prefer to have it still under construction decades later), and from then until 2100, the terraformers are adjusting the atmosphere composition with carefully-selected comet fragments, and waiting for the dust to settle.

Phase Two begins in 2100 with a flurry of activity. To stabilize the surface and prevent erosion, Mars needs to be seeded with a *lot* of plants in a hurry. Cloning labs on Phobos turn out spores by the ton, which are dropped from orbit via mass-drivers. More careful planting is accomplished by blimp, crawler, and thousands of robots. With a combination of careful seeding and unchecked growth in an environment without any predators or diseases, plant life is established all over Mars by 2130. A more realistic growth rate might take 50 or even 100 years, but we'll assume 22nd-century genetic designers can make quick-breeding organisms suitable for Martian conditions.

Once the "greening" of Mars is over, the terraformers can begin winding up the big and expensive parts of the program. After 2120, it's mostly a matter of waiting for the plants to convert the atmosphere, adjusting the composition with synthetic greenhouse gases and imported nitrogen, and getting ready to introduce Earth species to the new ecosystem. Converting the atmosphere gets faster as the plant biomass increases. The oxygen levels are breathable with compressor-filter masks by 2140, and by 2150 a growing number of humans can go without them. (Again, this is optimistic, but not wildly so; once the biomass on Mars gets into the billions of tons, converting the atmosphere goes pretty quickly.)

GMs who want to follow a more brutally realistic timetable should take the longer times listed above: 300 years to raise the temperature, 100 years to establish life, and about 100 years to transform the atmosphere, for a completion date some time in the 26th century. If fewer resources are available for the project, all the times increase proportionally.

The main body of water on Mars is the Boreal Ocean, surrounding the north polar cap and covering the former Vastitas Borealis. It fills a belt between about 75° north latitude and 60°, occupying everything below the -1 kilometer altitude contour. Three large gulfs extend southward. The new Acidalia Sea extends down to the Chryse Gulf, and almost reaches the equator. The Utopia Gulf reaches about 40° latitude, just to the west of Elysium, and the Arcadia Gulf extends about the same distance to the south, separating Elysium from Tharsis.

Most of the Boreal Sea is about 3,000 feet deep, with depths of up to 10,000 feet in the Acidalia Sea and the Chryse Gulf. It's a respectable body of water even by Earthly standards. The Boreal Sea serves as a crucial heat reservoir, keeping the Martian climate from swinging wildly, and sea life is one of the planet's most important ecosystems. Its northern shore is permanently girded by ice shelves, and during the winter pack ice covers the entire surface of the sea. Icebreakers and beams of reflected sunlight from the orbital mirrors keep channels open for shipping and climate regulation.

The other main sea on Mars is the Hellas basin, which is filled right up to the mean datum contour. The southern half of Hellas is always covered by pack ice, but the northern half of it is clear during the summer (orbital mirrors make sure of this). Because of its isolation and tendency to get frozen over, Hellas serves as a kind of "water bank" for the planetary water cycle. The terraformers can control the evaporation level over the sea fairly precisely, and use Hellas to fine-tune the water content of the atmosphere and the level of exchange between the northern and southern hemispheres.

Other important bodies of water on terraformed Mars include Lake Isidis, Lake Eos, and the crater lakes Holden, Lyot, Nicholson, Sharonov, Trouvelot, Becquerel, Jones, and Beer. Lake Eos lies at the eastern outlet of the Valles Marineris, which empties into the Chryse Gulf through the Tiu River. The Tiu is by far Mars' biggest river, as it counts as its tributaries the Marineris, Gangis, Samara, and Ladon rivers. The Chryse also takes in the water of the Kasei river, the Ares river, and the Becquerel-Trouvelot outlet canal, so the Chryse is the saltiest body of water on Mars. (On Mars it is the lakes and seas which are fresh water, while the rivers and streams are full of salt leached from the soil.)

The Winds of Mars

After terraforming is complete, Mars has an entirely new weather pattern and wind system, similar to Earth's. The planet's rotation breaks its air circulation up into big cells, spanning roughly 30° of latitude each. In the north polar regions the prevailing winds are from the northeast, and in winter drive powerful snowstorms against the southern shores of the Boreal Ocean. South polar winds blow from the southeast, and are dry and very cold, carrying dust from the southern highlands.

Between 60° and 30° north latitude the winds blow from the southwest, so that most rainfall is on the eastern shores of the Acidalia and Elysium gulfs. The huge Tharsis rise is a barrier to the winds, forcing the air to moisture on the lower slopes of Olympus. This makes the regions east of Tharsis very dry, with only a narrow belt along the Acidalia seacoast suitable for open-air agriculture.

In the southern hemisphere the corresponding belt has winds from the northwest, which form the prevailing breezes over the Hellas sea. This helps keep Hellas from getting iced over completely, and circulates some moisture to the south and east.

Between the equator and 30° north, the winds are generally northeasterly. In the Chryse and Eos regions this blows moist air into the well-populated lowlands at the mouth of Kasei Vallis and the Tiu River, and keeps Syrtis Major Planum green on the other side of the planet. In the southern hemisphere the southeast winds blowing off the highlands are dry and cool, but they do shed some moisture at the Eos lowlands when they encounter the edge of the Tharsis rise.

Since most of Terraformed Mars' oceans are in cold regions, there are no good breeding-grounds for hurricanes. There are bad sandstorms, especially in the southern hemisphere; the denser atmosphere can now carry good-sized grains and there are still large expanses of land covered with windblown deposits to provide fuel for sandstorms. In the northern hemisphere the worst weather is over the Acidalia Gulf, where extremely cold winds descending from the west meet the warm north-flowing ocean current. The result is frequent waterspouts, sudden snow squalls, and amazingly fast drops in temperature.

Martian Organisms

The other job facing genetic engineers is to select and devise life forms which can live and thrive on Mars. (The ultimate version of this is to skip terraforming altogether and simply create a whole ecology suitable for current Martian conditions.)

Plants are fairly easy to adapt to Martian conditions. The thin, unbreathable Martian atmosphere actually has about the same partial pressure of carbon dioxide as Earth's air does, which is what plants need. However, terraformers can't just scatter seeds across the red soil and expect anything to grow. Plants for Mars need several genetic modifications to allow them to survive: oxygen storage (to support the plant's own respiration), protection against low pressure, cold-resistance, radiation tolerance, and the ability to tolerate the toxic chemicals in Martian soil. The Martian prickly-pear (see box) is one example of a plant which could grow on an unterraformed Mars.

Animals are more difficult. With no oxygen in the air, Mars is not a good place for complex animals. If genetic engineering is up to the task, a whole new kingdom of anaerobic animals might be created to thrive on Mars. Creatures which could live without oxygen would need to store up energy in their cells for sudden bursts of activity punctuated by long rests, giving them the Sleepy or Slow Metabolism disadvantages. Possibilities include creatures like grubs, which attach to plants and live on their fluids, or some kind of pouncing predator which could remain barely alive and immobile for long periods, then come awake to snatch prey when it comes near. None of these animals would be very big, simply because the low-energy Martian ecosystem can't support large animals. Mars-adapted animals would be like insects and arachnids. If humans decide to seed Mars instead of terraforming it, this kind of ecosystem is what the planet will have.

After Terraforming

Once the planet has been terraformed (at least to the point of having a breathable atmosphere), it becomes possible to import all sorts of native Earth organisms with little or no genetic modification. The most suitable animals and plants are those which inhabit cold, dry, high-altitude environments: pronghorn antelopes, Bactrian camels, short-needle pine trees, Arctic foxes, llamas, guinea pigs, coyotes, lichens, cactus and yucca plants. Those are just the visible ones, of course: there would also be all manner of worms, mites, insects, spiders, and rodents. The Martian ecosystem is likely to wind up looking like a cross between Central Asia and Peru.

The Martian ecosystem will never be as truly "wild" as any part of the Earth. Animals and plants are carefully chosen to serve a purpose in maintaining the climate and atmosphere. Dangerous predators like bears or large cats don't have any place there. Populations must be carefully tracked and managed, with constant tweaking by the planetary ecologists. Perhaps over millions of years Mars can develop its own "native" ecology as imported species adapt to local niches, but on any human time scale Mars must be run like a gigantic farm.

If genetic engineering is advanced enough to create organisms for the terraforming program, it's also sophisticated enough for genetic designers to indulge their whims. Creatures out of the imaginations of H.G. Wells or Edgar Rice Burroughs may indeed walk the dry grasslands of a terraformed Mars. The low gravity and thick post-terraforming atmosphere make all kinds of flying creatures possible: real-life winged dragons, humanoid "angels," and perhaps even titanic birds like the roc of Arab legend. Ornamental "monsters" of this sort (especially if they're given near-human intelligence) could go feral and take over the large carnivore roles left vacant by ecosystem planners. The knowledge that the animal's descendants probably won't last more than a couple of generations is scant consolation for hikers attacked by a hungry griffin in the mountains of Elysium.

Mars Colonists

The only reason to terraform Mars is to make it a place where humans can live. What kind of people will live there, and what kind of society will they create? The Terraformed Mars campaign setting takes the optimistic view that humans on Mars will produce a civilization which learns from Earth's history and avoids many of the mistakes made there. Of course, that still leaves room for the Martians to make *new* mistakes.

Planet of Roofs

One interesting alternate method for terraforming Mars would take an incremental approach. The planetary engineers would simply cover large areas with huge roofs of transparent plastic, then pump in atmosphere to suit. The pressure of the air inside would support the dome at a height of 100 feet or so, and the clear plastic film would create the necessary greenhouse effect to warm the area underneath, as well as providing ultraviolet and radiation shielding. A typical roof section might measure 100 feet on a side, held down by strong cables. Eventually, the domes would spread to cover all the Martian lowlands.

The big advantage to the roof method is that it's incremental and relatively cheap. Nobody has to shoulder the cost of transforming the whole planet at once; the terraformers can work one dome at a time. A new dome would cost something in the neighborhood of $10,000 if built using locally-produced materials. A square mile of domed land would cost $25 million – a large sum, but not too much for a syndicate of homesteaders to put together.

There are disadvantages, of course. The roofs need maintenance, and are vulnerable to windstorms, meteorites, and simple wear and tear. Each square yard of roof has 1 hit point and no DR. Aircraft can only operate between open areas, and some people might object to living "indoors" all the time.

There's no reason why dome-based terraforming can't go on while others are trying to remodel the whole planet. Roofed areas of lowland could provide food and living space for decades or centuries until conditions outside are favorable. The "de-roofing" day would undoubtedly be a major event.

Moving Mars

Instead of messing around with huge mirrors to make Mars warmer, why not just put it in a more convenient place? Setting Mars in the same orbit as Earth, in a stable Trojan arrangement 60° around the circle from Earth, would increase its temperature to Earthly levels, melting the ice caps and permafrost.

Of course, moving a planet is not an easy job. They tend to be heavy. Mars has a mass of 600 billion billion tons, which means any change in its orbit requires something on the order of half a trillion tons of thrust running continuously for a thousand years!

Mounting rockets on the surface and turning the planet into a giant spaceship isn't really practical. First of all, the planet rotates, so that one would need a whole array of thrusters along the equator, firing in sequence. Second, there are unpleasant environmental effects of having giant nuclear fusion motors running constantly, spewing superheated plasma into the atmosphere.

James Oberg has come up with a method of moving planets by spraying them with water. The terraformers collect a large ice asteroid and maneuver it into position over the planet they wish to push. The asteroid is equipped with two very powerful jets of water, one directed toward the planet, the other aimed into deep space. The thrust of the two jets balances to hold the asteroid on station, and the stream of high-velocity water striking the planet below gradually imparts momentum to the planet (and adds megatons of useful volatiles). The whole process is very slow, but with sufficient patience, Mars could be placed in a better neighborhood.

Society on Terraformed Mars

Terraformed Mars is a collection of more than 40 colonies struggling to become a single world. Their total population is still small – less than half a million people worldwide. Most colonies are independent states, but a few still owe allegiance to governments or corporations back on Earth. Their political systems cover the entire spectrum. There are representative democracies, anarcho-capitalist enclaves, communitarian collectives, theocratic religious communities, one-party dictatorships, and at least one hereditary monarchy.

Despite their differences, the Martians have managed to create a few planetary institutions. The Terraforming Consortium is the most powerful – if any organization can be said to "rule" Mars it's the people who are reshaping the entire planet. Others include the Mars Defense Force, the Currency and Customs Community, and the Cooperative Planetary Law Commission. Like the United Nations of Earth, all are organizations of *states* rather than bodies governing *individuals.* Since Martian government is so decentralized, there are also a number of very influential private organizations: the Martian Unity Party, their rivals the Pan-Human Society, the Red Mars movement, the Martian Schools Cooperative, and several large corporations.

Important Colonies

The biggest colony on Terraformed Mars is also the oldest. Chryse incorporates five towns spread along the southern shore of the newly-formed Chryse Gulf, between the Tiu and Ares river deltas. Chryse colony has a total population of 60,000. The chief city is New Chryse, which replaced the original Chryse settlement, now underwater. New Chryse is the closest thing to a capital city on Mars, as it is the headquarters of both the Terraforming Consortium and the Mars Defense Force. Chryse colony is governed by a council of bureaucrats and technical experts, balanced by a few elected representatives.

The next-biggest is Hellas, occupying the shore of the great impact basin in the southern hemisphere. Hellas has 40,000 people in four well-planned new cities, and is poised for rapid growth as the planetary climate improves. The colony has no capital city as such, since its government is a participatory democracy involving all the citizens, who discuss issues and vote in an on-line forum.

Eos is the third-largest colony, and the only one which relies primarily on tourism as a source of wealth. The Eos colony has two cities, Capri and Eos, located at the mouth of the Valles Marineris canyon system. Just over 25,000 people live in Eos, and the colony is an entrepreneur's dream. The inhabitants have almost no restrictions on businesses, and most functions of government are contracted out to private firms. The Valles Marineris itself is a planetary preserve, with no permanent construction allowed, but the Eosians run an extensive tour industry along the canyons in luxury blimps and crawlers.

Pavonis is the fourth-biggest colony and is growing fast. As the "downstairs" terminal for the skyhook, Pavonis has become the chief port and trading center for Mars. It is connected by rail with industrial facilities in the Amazonis lowlands to the northwest, and has almost half the manufacturing capacity of the planet. There are 20,000 people in Pavonis, half in the lowlands and half in the domed city atop the mountain. On paper, the government of Pavonis is a standard parliamentary system with a Chief Minister and an elected President. In practice, the elected officials are in the pocket of the Skyhook Company. So far, most inhabitants of the colony are willing to go along with the notion that "what's good for the Skyhook Company is good for Pavonis."

Military Forces

When the first Martian colonies became independent, they needed protection, and began organizing armed forces. For a time this created more tension than it eased: small colonies feared the power of the bigger ones, loyalist colonies under Earth control feared aggression from the independents, and Earth's space powers began preparing for the worst. Happily, the Mars colony leaders (under heavy pressure from the Terraforming Consortium) found a solution which calmed the situation. The independent colonies combined their armed forces into a joint Mars Defense Force, and agreed to limits on troop strength and armament which mollified Earth's leaders. Since then, the Mars Defense Force has evolved into a professional and well-respected service, specializing in counterterrorism, search and rescue, and planetary defense.

The Mars Defense Force is not large, with a total of only 4,000 men and women organized into four specialty groups of about a thousand each (exact numbers vary depending on what is going on). The Security Group does counterterrorism and protects Mars' cities; they have also taken on the MDF's intelligence and counterintelligence missions, since that dovetails well with tracking Red Mars activity. The Patrol Group includes all the surface rangers and the MDF's three air squadrons, and concentrates on rescue work. The Defense Group plans for planetary defense against attack from Earth, and so operate the MDF's small orbital force; they also have hidden equipment caches scattered across the surface and do most of the force's strategic planning. Finally, the Operations Group provides training, logistics support, communications, and transportation to the other three.

Defense Force troopers are typically lightly armed. The standard sidearm for Patrol or Security Group personnel is a gyroc pistol, usually loaded with tranquilizer rounds. When facing armed opponents like Red terrorists or blimp raiders, they upgrade to caseless assault rifles. The standard duty uniform is TL9 light monocrys armor, but in battle the MDF wears TL9 medium combat armor with full life support.

The Economy

The economy of Terraformed Mars is based strongly on exports. It has to be, since there's no other way for Mars to pay off the huge costs of the terraforming project. Mars exports rocket fuel, agriproducts and manufactured items to the Asteroid Belt, and ships minerals back to Earth. Tourism is becoming a major source of revenue as the skyhook and large Cycler spacecraft make it relatively affordable for Earthlings to visit Mars. Because of Mars' strategic position in the Sun's gravity well, it is the hub for all trade with the outer system, and it is often cheaper to set up a manufacturing facility on Mars or on Deimos instead of shipping items out from Earth. The biggest employer on Mars is the Terraforming Consortium itself, but as the planet becomes habitable more Martians are shifting to other jobs or striking out on their own.

Mars has a common currency and no tariffs among colonies on the surface. The money is the "marsmark," but almost as much business is transacted in euros, yuan, and US dollars. The Currency and Customs Community is the board with regulatory power over money and trade, and has members representing the colonies serving in rotation. Since some of the colonies have very weird economic policies, CCC meetings are always loud and prolonged. Occasionally the CCC has dabbled in slightly unethical policies, using industrial espionage and winking at violations that give Mars an economic advantage over Earth.

Humans into Martians

Instead of going to all the trouble to change Mars, why not just change humans? Use genetic engineering and maybe cybernetic implants to create people who can live in the current Martian environment. Modified Martians need to be able to live without oxygen, withstand ultraviolet radiation and very low temperatures, and find food somewhere on a lifeless world.

Ignoring the question of food for a moment (presumably the engineering which can create humans capable of surviving on Mars could also create food plants for them), how could humans meet those requirements? The ultraviolet rays and low temperatures are easily solved: a dense coat of opaque fur with a thick hide beneath should do the trick. But living without oxygen is another story. The Martians would either need an internal power source to make respiration unnecessary (in effect turning them into a race of cyborgs), or else would have to exist as anaerobic creatures, with metabolisms producing less than half as much energy as oxygen-breathers can.

In ***GURPS*** terms, the Martians have Thick Fur [29 points], Thick Hide [28 points], and Temperature Tolerance 6 (including the 2 free levels from Fur) [4 points]. Their combination of fur and hide gives them PD1 and DR2. Cyborgs with internal power supplies get the equivalent of the Doesn't Breathe advantage [20 points] for a total of 81 points, while anaerobic Martians have the disadvantages Very Unfit [-15] and Sleepy (66 percent of the time) [-20] for a racial cost of 26 points. Note that anaerobic Martians *don't* have the Anaerobic disadvantage, since they must be able to interact with oxygen-breathing humans. At the GM's option, genetically-engineered Martian humans may also have a Social Stigma because they are "alien."

The Skyhook

Because of its low gravity and the orbit of its moon Deimos, Mars is almost the ideal place to build an orbital elevator connecting the surface with synchronous orbit. Mars' low surface gravity means that a tether hanging down from orbit would weigh less, and so wouldn't require unrealistically strong materials. The low gravity also means that synchronous orbit is lower – 12,660 miles as opposed to Earth's 26,500. Deimos orbits Mars every 30.3 hours, so only a little nudging is needed to boost it into a synchronous 24.6-hour orbit to act as an anchor for the tether and a source of construction materials. Setting off 15 teraton (million-megaton) nuclear warheads would do the job. And finally, as if to underscore the point, one of Mars' tallest mountains, Pavonis Mons, is located right on the planet's equator, the perfect site for the base of the elevator.

There is one small problem faced by elevator builders: a mass of ten trillion tons of rock careening around Mars every 7 1/2 hours, named Phobos. Moving the moon is impractical, and destroying it would simply turn a single large mass into millions of small ones. The solution is to oscillate the elevator itself, setting it flexing in a huge slow standing wave with a period equal to twice Phobos' orbital cycle. The engineers can dampen or amplify the oscillation by controlling the movement of payloads up and down the elevator.

The elevator itself consists of a central structural core of fullerene tubes and synthetic diamond, covered with a layer of DR 50 ablative armor for protection against meteoroids and space junk. Each linear yard of the elevator has 300 hit points. On either side of the core are the rails used by elevator cars going up and down. The rails supply power to the cars and provide something for the linear induction motors in the cars to grip. Cars also have both a simple mechanical brake which can lock onto the rail if the drive motors fail. It requires a force equivalent to ST 100 to pull a car off its track, and the rails themselves have 100 hit points per yard.

Going to or from orbit aboard the elevator takes about 4 hours. Cars accelerate to a maximum speed of about 1 mile per second, which is maintained by linear-induction motors drawing power from the rails. It requires four hours to make the trip up or down. Cars going down feed electrical power back into the system, but since Mars is a net exporter of mass via the elevator, there are big power plants both on Deimos and Pavonis Mons. At any given time there are 8 elevator cars in operation, 4 going up and 4 coming down. They leave the station atop Pavonis hourly.

The cost of shipping by elevator is cheaper than rocket launches, but it's still expensive – $4 per pound (standard weight) to Deimos going up, $2 coming down. Passenger fare is $1,000 going up or $500 coming down, but people who have to shuttle between Pavonis and Deimos regularly can get a monthly pass for $6,000.

Elevator Car

Individual elevator cars are large cylinders, 24 feet high and 18 feet across. They have three levels; the lower level is devoted to cargo space, the middle level has emergency power, the linear-induction motor, life-support equipment, the airlock, space for passenger baggage, and control systems. The top level is the passenger deck, with space for 50 people in comfortable seats. The elevator cars can survive atmospheric reentry, and are equipped with parachutes, but even the designers agree that trying to land one like a space capsule is extremely risky, and should only be attempted if there is absolutely no alternative.

Subassemblies: Body +6.
Powertrain: 5.36 MW electric contact power system, 12,000 kWH rechargeable batteries, 5.3 million lbs. lift maglev motor.
Fuel: —.

Occupancy: 50 RS. ***Cargo:*** 1,000 cf.

Armor	**F**	**RL**	**B**	**T**	**U**
Body:	4/100	4/100	4/100	4/100	4/100

Weaponry

None.

Equipment

Body: Medium-range radio, small Complexity 3 computer, computerized controls, full life system (50 people), 50 crash-web, 8-man airlock, 2-man airlock, compact fire-suppression system, 75,000-lb. vehicular parachute.

Design Notes

The batteries can power the life support for 24 hours or power the entire vehicle for 13 minutes. Body is a super light frame with very expensive materials and sealed.
Armor is expensive metal.

Elevator Car Statistics

Size: 24'×18' *Payload:* 30,000 lbs. *Lwt.:* 98 tons (Earth gravity), 37.25 (Mars gravity)
Volume: 8,300 cf. *Maint.:* 5.8 hours *Price:* $11.8 million
HT: 6 *HP:* 369
mSpeed: 1.800 *mAccel:* 110 *mDecel:* 10 *mMR:* .25 *mSR:* 6

The Terraforming Consortium

The most important single organization on Mars is the Terraforming Consortium. The Consortium is the body in charge of the entire terraforming project. As its name suggests, the Consortium is a cooperative venture. The list of Consortium members is long, and includes the United Nations of Earth; the governments of the United States, China, Canada, India, Brazil, Japan, and Egypt; the Skyhook Company, Singapore Biotech Holdings Ltd., Macrodynamics, Mars Properties, Eurospatiale, and Leung Asteroid Enterprises; the Mars Society, the High Frontier Foundation, the Panspermia Society, and the Hermosa Charitable Trust.

All these partners mean that the Consortium must cope with powerful centrifugal forces. Without strong leadership, the Consortium would rapidly disintegrate into squabbling petty "empires" as each partner and each project scrambles for money and resources. For much of the project's history the charismatic terraforming expert Isadora Braudel has provided that leadership, first as the most outspoken member of the Science Advisory Board, then as Chief Scientist, and finally as Director of the whole Consortium.

The Terraforming Consortium's operations are spread all over the Solar System, with 10,000 employees on Mars or in Mars orbit, another 2,000 at Saturn or aboard comets in the outer system, and 15,000 on Earth working as administrators, lobbyists, and researchers. The biggest single assets belonging to the Consortium are its two deep-space vehicles, the *Persephone* and the *Athena.* The two identical ships support comet-herding operations in the outer system, and ice mining on Saturn's moons. Each is a mobile industrial base in its own right, equipped with automated factories to build mass-drivers, habitat modules, and just about anything else needed to capture a comet or set up a mining base. Each ship has a crew of 32, with room for another 32 technicians and workers.

Other Organizations

The Skyhook Company is the biggest purely private company on Mars. It is part of the Terraforming Consortium, but owns the Pavonis elevator outright (along with Deimos and most of the Pavonis colony). Skyhook's business plan is much like that of the railroad companies in the American West: spend a lot of capital building the transport system, then find ways to encourage traffic and discourage competition. The Skyhook Company favors anything which promotes Martian trade, since each elevator load means another $10,000 profit. At times Skyhook expresses its disapproval of Red activism, small independent space transport companies, and labor organizers through physical threats and intimidation.

The Martian Unity Party is a political party with chapters in all the colonies which allow free elections. The goal of the organization is to form a unified planetary government for Mars. The Unity Party is pro-terraforming, but anti-Earth sentiment is fairly strong and this means the party often reflexively opposes the Terraforming Consortium and the Skyhook Company simply because of their roots on Earth. At its most extreme end, the Unity Party overlaps with the "Brown" and "Pink" factions of the Red Mars movement. The Unity Party's main rival is the Pan-Human Society, which urges Martian membership in the United Nations. The Society is regarded by most Martians as a mouthpiece for Earth interests.

Genetic Engineering Packages

Approximately half of the children born on Terraformed Mars have some form of genetic modification. Human engineering is something of a political statement among Martians: adapting your kids to Martian conditions means you believe in "Mars for the Martians" instead of close cooperation with Earth. Spending the money to have a parahuman who can survive where humans can't often reflects Red Mars sentiments (especially those of the panspermist "Pink" faction).

Modified Human ("Carter" Series) 23 points

The Carter genemod package is a favorite among parents who want their children to be relatively comfortable on Mars but don't want to cross the species boundary. Carter-series humans are as cold-tolerant as Eskimos, have lungs and blood like an Inca or Tibetan, and are as resistant to dry conditions and strong ultraviolet as any Australian Aborigine or Sahara dweller. Like many commercial genemod templates, it also edits out several undesirable traits, particularly alcoholism and epilepsy. Carter humans are tall and very dark-skinned, with massive chests and a layer of subcutaneous fat which makes them look stocky despite their height. They have beaky noses and eyes with a distinct epithicanic fold. A Carter-type embryo costs $48,000.

Attributes: ST 10 [0]; DX 10 [0]; IQ 10 [0]; HT 12 [20].
Advantages: Breath Holding [2], Temperature Tolerance-1 [1].
Features: Taboo Trait (No Genetic Defects). Home gravity of 0.38G.
Cost: $48,000.

Martian Parahuman ("Thoris" Series) 46 points

The Thoris parahuman template was created by the Mars Terraforming Consortium to produce ideal inhabitants for the planet's new conditions. Thoris parahumans are not obviously inhuman, although they cannot breed with humans without help from a genetic engineer. Like the Carter parahumans they tend to be barrel-chested and dark-skinned. Many Thoris Martians deliberately take cosmetic treatments to make themselves look less like Earthlings (a green skin tinge or implanted antennae are common choices). The Thoris template includes oxygen storage ability and allows Martians to live without life support equipment even on the Tharsis Bulge (although even they still need compressor masks for a climb up Olympus Mons). Though they can survive in conditions which would suffocate a normal human, Thoris Martians do need at least 30 millibars of oxygen to breathe. Buying a Thoris genemod embryo costs $96,000.

Attributes: ST 10 [0]; DX 10 [0]; IQ 10 [0]; HT 12 [20].
Advantages: Breath Holding [2], Decreased Life Support (Halved oxygen requirements) [10], Early Maturation 1 [5], Filter Lungs (filters CO_2 instead of particulate matter, +0%; Nuisance effect: Doubled Food Requirements, -20%) [4], Temperature Tolerance-5 [5].
Features: Low Pressure Lungs, Taboo Traits (Genetic Defects, Unattractive). Home gravity of 0.38G.
Cost: $96,000.

Characters

Many of the same character types found in the Domed Mars setting (Chapter 4) are also appropriate for Terraformed Mars. Astronauts and mission specialists are less common, except on the moons, and scientists are now specialists rather than all-purpose field explorers. New character types reflect the importance of the terraforming program, the opposition to changing Mars, and the resulting need for security and military protection.

Genetic Designer

The terraforming program needs an army of genetic engineers to create or modify organisms to populate the new ecology. Genetic designers can be either lab-bound tinkerers or field scientists observing how the organisms function in the wild. Either type might be called in to deal with a rogue organism or bioterrorist attacks.

Important advantages for a genetic designer character are Patron (in the form of a government laboratory or corporation sponsoring research), Security Clearance (if the work is secret or tightly controlled), and Versatile. Some designers try to acquire all the latest genetic and body modifications; others keep themselves as "control normals." Common disadvantages are Callous (especially for those working on modified humans), Glory Hound or Jealousy, Obsession, Overconfidence, Truthfulness, and Workaholic. Key skills include Genetics, Biochemistry, Physiology, Ecology, Botany, and Zoology. Many designers are medical doctors with high levels of Physician and Pharmacy, as well. If Mars has native life,

Xenobiology is essential. Electronics Operation and Computer Operation are also important, and senior investigators need Administration or Diplomacy to find funding for projects.

Mars Defense Force (MDF) Trooper

The men and women of the Mars Defense Force are actually more police or planetary rangers than soldiers, trained in search and rescue, law enforcement, and counterterrorism. They do have some heavy units intended to protect Mars against invasion, as well as a growing space arm tasked with protecting the space elevator and the mirror farms. If relations sour between Mars and Earth, the MDF might become more overtly military, and could start operating far from home to protect Martian interests among the asteroids and outer planets.

All MDF personnel will have some level of Military Rank, using the service's innovative Command Web system. Those assigned to police duty are deputized and possess Legal Enforcement Powers at the 5-point level. Other common advantages include Composed, Combat Reflexes, Fit, G-Experience, and Toughness. The only required disadvantage is Duty (almost all the time) but many MDF troops have various levels of Intolerance (Earthers) or Sense of Duty (fellow Martians).

Basic training includes First Aid, Guns (gyrocs), Judo, Soldier, and Vacc Suit at the half-point level. Specialists have additional skills depending on their assignment; GMs are encouraged to use ***GURPS Special Ops*** for more detail.

Red Activist

The Red Mars faction wants to preserve the planet's original environment, and opposes all terraforming and planetary engineering schemes. The "Pink" wing is willing to accept seeding the planet with tailored organisms, and some colonization by modified humans. The more radical "Infrared" wing wants Mars left as it was before the arrival of humans – no colonization, no terraforming, no permanent outposts at all. As the terraforming project continues, the Red Mars activists either give up their campaign or become more radical, resorting to bioterrorism and acts of sabotage against the mirrors and the skyhook.

Advantages for Reds depend on how they operate. A peaceful political activist needs Charisma, Contacts, Patrons, a good Reputation, Status, Strong Will, and possibly Wealth. A more violent eco-warrior should have Allies or an Ally Group, Alertness, Combat Reflexes, Danger Sense, Daredevil, Fearlessness, Luck, Strong Will, Toughness, or Zeroed. Disadvantages for both types include Fanaticism, Intolerance, Social Stigma, and Stubbornness; undercover terrorists add Callous, Enemies, On the Edge, Overconfidence, or Paranoia. Skills include Area Knowledge, Bard, Diplomacy, Law, Leadership, Philosophy, and Politics. Terrorists add combat skills, Demolition, Tactics, Camouflage, Stealth, Streetwise, and whatever thief skills seem appropriate for infiltrating terraforming stations and control centers.

Settler

As Mars becomes more habitable, people from all parts of Earth and all walks of life travel there in search of a new life. Most will naturally try to bring along all the comforts and advantages of TL9 civilization, although some may seek a simple low-tech existence. There are few absolute requirements for settlers other than a willingness to work very hard in order to make a living.

Red Planet, Blue Sky

One good result of the first phase is that flying on Mars gets a lot easier. Airplanes only multiply stall speed by 1.5 instead of 8, and divide propeller thrust by the same amount. On the other hand, streamlining becomes more important, since now there is air to provide resistance. When calculating airspeed, treat the streamlining of an aircraft as one level better than it is: none becomes Fair, Fair becomes Good, etc.

Combined with the low gravity, flying now becomes easier than on Earth. Human-powered flying machines are a possibility for people in merely average physical condition.

Pedal Ultralight (TL9)

Pedal-powered ultralights are a common recreational aircraft on Terraformed Mars; a variant for lazier pilots replaces the pedals with an array of solar cells on the wings. Pedal ultralights are very light and flimsy, vulnerable to high winds and bad landings.

Subassemblies: Body +1, STOL wings -1, 3 small wheels -2.

Powertrain: 0.2 kW muscle engine, 0.2 kW ducted fan generating 0.53 lbs. of thrust, 0.04 kW solar cells.

Fuel: —

Occupancy: 1 XCCS. ***Cargo:*** 2 cf.

Armor	F	RL	B	T	U
Body:	0	0	0	0	0
Wings:	0	0	0	0	0
Wheels:	0	0	0	0	0

Weaponry

None.

Equipment

Body: Medium-range radio, GPS unit, crashweb, electronic controls.

Statistics

Size: 8'×18' *Payload:* 207 lbs.
Lwt.: 250 lbs (Earth), 95 lbs (Mars)
Volume: 16 cf. *Maint.:* 108 hours
Price: $34,130

HT: 9 *HP:* 5
Wings: 2 *Wheels:* 1

aSpeed: 10 *aAccel:* 1
aDecel: 8 *aMR:* 2
aSR: 4
gSpeed: 20 *gAccel:* 1
gDecel: 10 *gMR:* 1
gSR: 3
Stall speed 7.5. Very Low GP; half off-road speed.

Martian Prickly Pear

One sample Mars plant is a highly modified cactus called a Martian prickly-pear. It has a very thick (1/8 inch) transparent cuticle layer covering its surface. The cuticle provides radiation and thermal protection, and serves as a pressure seal to keep the plant's internal liquids from evaporating. Martian prickly-pear plants are small and spherical, typically 6 inches to a foot across, although their root system can extend for yards. They are colored very dark green, as the genetic engineers tweaked their chloroplasts for greater light-absorbing efficiency. Martian prickly-pears are not edible; their internal fluids are laced with ammonia and alcohol to prevent freezing. They do help retain topsoil and create oxygen, and spread across the planet during the early stages of the terraforming project. As conditions on Mars become more Earth-like, the range of the Martian prickly-pear becomes limited to the high-altitude regions of Tharsis.

Advantages for settlers are tremendously varied. Claim to Hospitality among other colonists is still common (though less so than in the domed era), Common Sense and Strong Will are traditional for no-nonsense frontier dwellers, and many pioneers have families or neighbors who count as Allies. Genetic modifications like Oxygen Storage and Temperature Tolerance are also common. Disadvantages found among settlers include a Code of Honor, Dependents in the form of family members, Fanaticism about the settlement of the new frontier, Pacifism (among idealistic or religious colonists), Primitive (in low-tech settlements), Stubbornness, and Workaholic. Useful skills include old-fashioned pioneer knowledge like Agronomy, First Aid, Masonry, Mechanic, Navigation, Prospecting, and Survival – along with high-tech skills like Chemistry, Ecology, Engineer, Genetics, and Vacc Suit.

Terraforming Specialist

Terraformers are the stars of the new Mars, and their successes and failures shape the landscape and environment of the whole planet. Successful terraformers are a combination of scientist, engineer, environmentalist, real-estate developer, and God. The high-level planners have enough clout to indulge their own whims, creating odd little micro-ecologies or curious landscapes; the rank and file spend their time in the field, tracking the progress of the planet's transformation and tweaking the process.

Useful advantages for terraforming specialists include Eidetic Memory, Mathematical Ability, Patron (in the form of corporate or government sponsors), Status, Strong Will, and Versatile. Field operatives may also value Absolute Direction, Fit, and Toughness. Disadvantages common in the profession are Enemies (Reds or rival terraformers), Fanaticism, Glory Hound, Jealousy, Loner, Megalomania (practically a requirement for anyone reshaping a whole planet!), Obsession, Overconfidence, Sense of Duty, Stubbornness, and Workaholic. Important skills are Chemistry, Computer Operation, Ecology, Meteorology, and Planetology. There are specializations, of course: experts at creating new organisms learn Biochemistry, Botany, Genetics (Genetic engineering), and Zoology; space-based macroengineers get Demolition, Engineer, Free Fall, Physics, Pilot (spacecraft), and Vacc Suit; the ecologists who tramp about the surface monitoring the environment need Area Knowledge, Cartography, Driving, Navigation, Survival, and Vacc Suit.

Advantages, Disadvantages and Skills

The growth in population and wealth on Mars have changed the value of many advantages and disadvantages. Wealth and status are more important, and disadvantages like poverty are more of a handicap. A broader range of disadvantages are possible in the more diverse society.

Advantages

Claim to Hospitality see p. CI21

Sadly, the old Martian tradition of granting aid to anyone who asks has declined as the planet's population has grown. In developed areas where day-to-day survival is not a pressing problem, attitudes are much like those on Earth: it's nice to be charitable, but helping the down and out is mostly left to institutions (either private or government). Out in the wide open spaces, however, most Martians will still give a stranger a spare powercell or oxygen tank, but only until a Mars Defense Force rescue plane can arrive. Having an actual claim to hospitality is now an advantage with the usual point value.

G-Experience see p. CI25

This advantage is much more common in the Terraformed Mars setting than during the Domed Mars era. A visit to Deimos' microgravity is just an elevator ride away, and travel between Mars and Earth has gotten easier and cheaper with the advent of fusion rockets and giant Cyclers.

Legal Enforcement Powers see p. B21

Now that Mars has a large population, enforcing the law can't be left to a few half-trained security officers and deputies. Martian cities have their own police, with 5-point Legal Enforcement Powers. Officers may also be lent to the Cooperative Planetary Law Commission to investigate crimes which cross colony boundaries and affect all Mars. Police on CPLC business have 10-point Legal Enforcement authority. Mars Defense Force personnel specializing in counterterrorism or customs enforcement can get the same level of authority as CPLC officers.

Military Rank see p. B22

The Mars Defense Force has a very non-traditional rank structure. Since almost everyone in the force is a highly-trained individual on a world which is still desperately short of people, the MDF has abandoned the old top-down system of Earth militaries in favor of a decentralized "command web." Personnel can give orders to others based on the situation and their area of expertise. A character's Military Rank reflects his seniority and aptitude in his area of specialization. As a rule of thumb, Military Rank should equal half of (highest military skill minus 10), so an individual with Forward Observer-18 would have a rank of 4. This rank would apply in situations involving artillery combat and reconnaissance, but in a firefight that character would be subordinate to a trooper with Tactics-14 and Rank 2. This kind of decentralized system works for the MDF because it is a small force which values individual competence and initiative; if the Martians ever need to raise a mass army they may revert to a more traditional command structure.

Although the men and women of the Defense Force are well-regarded by their fellow Martians, being a soldier is not a very high-status occupation and consequently brings with it no Status bonus. The MDF's decentralized "command web" only reinforces this attitude among civilians and soldiers alike.

Panimmunity see p. CI28

Panimmunity comes into common use at TL9, and would be very useful in a society like Terraformed Mars. GMs may wish to assume all characters have Panimmunity at the 5-point level for no cost. This effectively makes "No Panimmunity" a 5-point disadvantage.

Disadvantages

Cyber-Rejection see p. CI81

Cybernetics are common in the Terraformed Mars setting, but aren't usually essential. This disadvantage is worth -10 points. One interesting possibility for GMs is to make Cyber-Rejection an associated "nuisance effect" of Panimmunity.

Illiteracy and Semi-Literacy see pp. B33 and CI94

Not knowing how to read well is surprisingly common on Terraformed Mars: some of the more isolated colonies and settlements don't have much education available for kids, and voice-operated computers make it possible for people to operate high-tech equipment without knowing how to type or read text. Nevertheless, both are still disadvantages, -5 for Semi-Literacy and -10 for Illiteracy.

Primitive see p. B26

A few of the more remote societies on Terraformed Mars are still getting by with carefully-maintained TL8 equipment and homemade gear. Often their technicians have no formal training, having learned their trade by apprenticeship on the job. Characters from isolated habitats can take the Primitive disadvantage at the 5-point level to reflect their unfamiliarity and bewilderment with the wonders of TL9 technology.

Vow see p. B37

In the Terraformed Mars world, life itself is still just getting established on Mars and many humans are incredibly protective of the fragile ecosystem. It is perfectly possible to take a 10-point Vow of "harm no living thing outside." This requires the character to avoid damage to any animals, plants or even microorganisms beyond the confines of a habitat or domed city. Note that this means a lot more than just keeping off the grass: Martians with this disadvantage must only drive on roads, can't use wild organisms for food, and can't leave any waste products in the wild which might be harmful (sanitary waste is okay, but power cells or laser cartridges are definitely a hazard).

Skills

Naturalist see p. B57

Mars' environment is entirely man-made in the Terraformed Mars era. It corresponds to no Earthly biome, and includes many genetically-modified species, so Naturalist skill's usefulness is reduced. Characters in Martian ecosystems take a -2 penalty for the unfamiliar environment.

Survival see p. B57

After terraforming, humans can learn two new specialties of survival for Terraformed Mars: Survival (Martian basins), and Survival (Martian highlands). The Martian basins specialty defaults to Terran desert survival at -7. The Martian highlands are still much like the planet's original environment, and default to Basins at -3 or any Terran survival skill specialty at -10.

Vacc Suit/TL see p. B69

While vacuum suits are still very useful on Terraformed Mars, the thicker atmosphere and warmer conditions mean humans can get by with only breathing masks and warm clothing (although TL9 skinsuits are sufficiently comfortable and useful that many use them as standard outdoor clothing). The Vacc Suit skill is no longer mandatory.

Campaigns and Adventures

Greens vs. Reds

Terraforming a planet creates some serious ethical questions. Do humans have the right to make such huge changes in the natural world? Altering a planet's environment and seeding it with custom-built lifeforms makes it impossible for native organisms to ever evolve there; shouldn't humans act as stewards, protecting and guarding the natural environment on Earth and in space?

Other GURPS Books

GURPS Bio-Tech

Given the high level of genetic engineering and biotechnology needed to terraform Mars and establish a working ecology there, it's likely that the human inhabitants will have access to a wide range of biological modifications. ***GURPS Bio-Tech*** covers the subject in detail; just about any modification listed in Chapter 3 (pp. 60-85) are available, provided they are TL9 or lower. The two most common surgical refits are Hyper-Lungs (p. BIO68, for the Breath-Holding and Extra Fatigue advantages) and Bone Marrow Upgrades (p. BIO76, for Extra Fatigue).

GURPS Cyberpunk Terraformed Mars can be a "Cyberprep" (p. CY13) campaign world: artificial implants and modifications are available, but are made as natural-seeming as possible. Weapon implants are rare, except among spies and the like. Overt displays of "chrome" cybernetics aren't shocking or horrifying; what they are is unfashionable.

Common cybernetic augments include Parabolic Hearing (p. CY36, to compensate for Mars' thin air), Biomonitor (p. CY34), Internal Oxygen Supply (p. CY35), and Neural Interface Jack (p. CY41).

GURPS Technomancer

The availability of magic in the ***Technomancer*** setting makes space travel and terraforming *considerably* easier. ***Technomancer*** Mars is a normal-Mana zone (GMs may want to put high-Mana pockets at suitably mystic sites like the Face), and the ambient magic can drive some very potent terraforming spells. Artifacts enchanted with the Create Air spell and sufficient powerstones can create a new atmosphere out of thin air, so to speak. A wand with a 3-point dedicated powerstone could pump out 100 million tons of new atmosphere a year, so the project would need 10,000 magical airmakers to get the job done in a few decades.

Similar applications of Create Water could provide a planetary ocean, and spells like Manipulate DNA could be used to adapt Terran organisms to the Martian environment. Spells from the Plant college (particularly Create Plant, Plant Growth, and Bless Plant) come in very handy to get the new biosphere established. A sufficiently gigantic Shape Light or Continual Sunlight spell could serve the purpose of a solar mirror. The ease of space travel in a world with magical life support and teleportation means colonists can swarm to Mars in the way immigrants moved to the Americas in the 19th century. ***Technomancer*** Mars will be a fast-growing, exciting frontier world much sooner.

Transhuman Space

The world of ***Transhuman Space*** has a different version of terraformed Mars, using radical genetic engineering and moving Kuiper Belt objects to do the job faster. The sourcebook detailing the Red Planet, ***Transhuman Space: In The Well,*** focuses less on the work of terraforming but does have elements that can translate directly to any hard-science campaign set on Mars. GMs can mix and match elements of the two settings if they so desire.

GURPS Ultra-Tech

The two ***Ultra-Tech*** books have a great many useful TL9 tools and gadgets for the inhabitants of Terraformed Mars. Items from those books likely to be in common use include Anti-Glare Goggles, Inertial Compass, Pressure Tent, Respirator, Skinsuit, and Spinneret. And guns, of course.

GURPS Uplift

Mars doesn't even rate a mention in ***GURPS Uplift,*** where the big exciting terraforming project is on Venus. GMs who want equal time for the red planet can drop Terraformed Mars into the ***Uplift*** universe with only minor changes. Uplifted chimps are likely to be common on Mars, especially in the Orbital Elevator project (Neo-Dolphins, on the other hand, will be scarce on Mars). Friendly alien races like the Kanten may provide technical assistance in getting the biosphere set up. Given the existence of ancient nonhuman civilizations, Martian sites like the Cydonia Face or the Pyramids might actually be real alien ruins – potential treasure-troves of Galactic technology for the wolfling Terrans. Needless to say, hostile races like the Soro or Tandu would just *love* to humiliate the Terragens by sabotaging the terraforming project or snatching away ancient artifacts for study by the "proper authorities."

Terraformers answer that the only way the planets beyond Earth will ever have life is through human intervention. And they ask, is it right to deny future generations another world to live on, simply because some people today think the original environment should be preserved?

When the terraforming project begins, all these arguments become hotly-debated concerns. Suddenly there are billions of dollars, thousands of jobs, and the future of a planet riding on the outcome of an ethical debate. The Terraformed Mars setting assumes the pro-Terraforming camp wins that debate, but it probably won't be an easy or quick victory. And the losers of hard-fought debates sometimes won't admit when they're beaten.

"Red Mars" activists are a perennial thorn in the side of the terraforming project. The most responsible members of the movement lobby against continued funding for terraforming operations in the halls of the UN and other Earth governments, bring huge lawsuits to halt or delay the project, and wage a massive public-relations campaign against the whole idea in Terran media. In this they are opposed by the lobbyists, lawyers, and PR flacks of the terraforming consortium. The more radical Reds have given up on legal means and employ direct action to stop the terraforming program – sabotage, terrorism, and sometimes even murder. Their opponents and victims are often the same: colonists, terraforming technicians, and security forces on Mars and in space.

The Red Mars Movement

Despite the more paranoid claims of its opponents, the Red Mars movement is not a tightly-organized cadre of fanatics taking orders from some central command. Far from it. Most Red cells have very limited contact with other Reds, both from a desire for secrecy and because of doctrinal disputes.

There are probably as many shades of Red as there are people in the movement. At one end are the "Brown Mars" group, who have accepted that some terraforming will take place and are trying to preserve portions of the planet in their wild state. This wing attracts many old settlers and native-born Martians, who don't want to see the dramatic beauty of Valles Marineris or Olympus Mons turned into a second-rate imitation of Earth. Browns are most concerned with changes to the landscape, and are particularly opposed to the orbital elevator atop Pavonis Mons.

The "Pink Mars" faction is opposed to any change in the planet's environment, but favor colonization by genetically-modified organisms suited to natural Martian conditions. The Pinks have a strong base of support among modified Martians, and have ties to other "Pantropist" movements and to groups in favor of large-scale genetic engineering of humans. The mirror farm is the chief target of Pink hostility.

"Infra-Reds" oppose *all* human presence on Mars, and are closely tied to other groups which want humanity to leave the rest of the Universe alone. As one might expect, most Infras are on Earth, but they are also the most willing to advance their views through indiscriminate terror and violence.

Red Heroes

An exciting campaign can be built around the exploits of a Red Mars cell, working to preserve the planet from the short-sighted and greedy plans of the developers. At first, the activist player characters will be working with some more experienced members of the Movement, who can serve as advisors and patrons. As they become more skilled, the characters can start picking their own targets and making their own plans. Activists, by definition, have to be *active*; members of a Red Mars cell have to take the initiative and do things, rather than reacting to outside events.

Reds have to keep their identities secret (no easy task given 22nd-century DNA scanning and forensic nanotechnology). If they are ethical "monkey wrench" sorts, they must plan operations which *won't* cause human casualties. They must find ways to cooperate with other Red factions, even as the various splinter groups plot to advance their own agendas.

Red Villains

If fighting to keep Mars cold and barren doesn't appeal to your players, the Red Mars movement makes a great set of villains. As the terraforming process goes on the activists get more and more fanatical and dangerous. They are decentralized, so rooting out one nest of terrorists doesn't end the menace. They do include some very bright people with access to cutting-edge technology, so Red plots can be subtle and well-hidden.

Because just about everyone on Mars is potentially a target in the war between Reds and Greens, anyone can become involved in thwarting a Red plot. Law enforcement specialists are the ones who actually spend time hunting the Red menace, but just about any random group of civilians can stumble across a Red plot – examples include crawler jockeys seeing something they shouldn't in the empty landscape, or terraformers sent to monitor the spread of tailored bacteria finding anomalies.

The Reds can be used as a faceless menace, almost a force of nature to be survived rather than defeated. The Reds have blown up the orbital elevator and the heroes have to find a way to keep their elevator capsule from crashing to the surface before a rescue craft can reach them, or the Reds have turned the mirror farm into a deadly heat beam, making it necessary to travel overland to safety before the whole region becomes a plain of glass. The authorities may deal with the Reds, but it's the player characters who have to deal with the effects of the disaster.

Alternately, the Reds can be presented as sympathetic but misguided. After all, their motives are fundamentally based on a strong sense of ethics. They may warn populations in danger, and send in a dozen threats for every real operation they pull (if nothing else, it's a great way to "leverage" the effectiveness of a small terrorist band). In a small society like Mars, where everybody knows everybody else, the Reds aren't sinister foreigners . . . they are people the player characters know and trust. Characters may even sympathize with the Red position, even as they struggle to survive an incident of sabotage. Given the schisms within the Red movement, pro-terraforming characters can find themselves working along with "Pink" activists to halt a genocidal "Infra-Red" scheme.

Finally, Red is a good color for a herring. If the heroes have been battling sinister Red Mars terrorist plots, they may be fooled when a Terran megacorp opposed to Martian independence disguises its "dirty tricks" operations as the work of Reds under the bed. Or when a scientist in a remote biosphere monitoring station is murdered, the PCs may suspect the closet Red activist on the staff rather than the real killer.

Mars vs. Earth

As Mars becomes the second homeworld of humanity, Martian interests will inevitably come into conflict with those of Earth's governments and people. The whole terraforming program is one potential source of friction. It's a big expensive job that requires Earth's support, but the Martian colonists may not be willing to see all their labor going to repay the project financiers. Environmental groups on Earth may oppose terraforming, causing resentment among Martians about outsiders trying to dictate what they can do with their own planet. Mars needs a steady supply of ice from the outer system, which could well conflict with Terran plans to exploit those resources. Finally, once the Martian skyhook is finished, it will be much cheaper to export food or goods from Mars to other worlds than from Earth. Terran interests may not want the competition.

Ski Olympus Mons!

Mars after terraforming offers more than heroic planetary engineering and battles of Reds and Greens; it also has the potential to be lots of *fun.* Once the air gets thick enough for humans to go about in nothing more than air masks and winter clothing, they can have adventures in the new Martian landscape, pitting themselves against the challenges of the planet itself.

Mountaineering

Mars boasts some of the highest mountains and deepest canyons in the Solar System – an irresistible lure for mountaineers and rock climbers. The low gravity makes the actual work of climbing a little easier, but the new and unfamiliar geology will probably claim some lives before climbers learn to read the rocks on Mars.

Climbing the Tharsis volcanoes is mostly a matter of walking up a long incline, punctuated by occasional escarpments or gullies. Even after terraforming is complete, climbers will need pressure suits and life-support backpacks. At the very summits the slope gets steep enough to require more traditional ropes-and-pitons mountain climbing. During the second phase of terraforming, the soil on the mountains is likely to be unstable, as rainfall carves new gullies and whole masses of waterlogged soil go sliding down in vast mudslides. Ascending in such unstable conditions would be a challenge for any mountaineer.

Though the great volcanoes hold the height records, other features on Mars might actually be more difficult to climb. The steep walls of the Valles Marineris rise three or four kilometers above the canyon floor, and are nearly vertical at the top. Mountain chains like the Hellespont and Phlegra ranges offer climbing conditions more like the mountains of Earth.

Flying and Skydiving

The thicker air of Terraformed Mars makes flying much easier, as described in "Red Planet, Blue Sky" (p. 85). The combination of low gravity and relatively thick air opens up all kinds of possibilities for recreational flying. Human-powered flight is feasible, requiring no more training or fitness than weekend mountain biking on Earth does. Pedal-powered biplanes and ornithopters become a common sight above Martian cities. Lazier citizens may prefer to use personal helicopters or powered flight packs.

Combining flight with mountain climbing, some daredevils may try base-jumping from the walls of Martian canyons or craters. Advanced TL9 parawings are almost as maneuverable as gliders, and with the addition of a backpack ducted-fan propeller, climbers can fly all the way home.

Boating

Once Mars has water, people are sure to go boating on it. The Boreal and Hellas Seas may be too ice-choked for sailing, but the Chryse Gulf and Lake Eos are certain to get their share of sailboats and powerboats even before the oxygen levels are high enough for humans to breathe. But the real boating thrill on Mars is likely to be white-water rafting down the old flood channels. Erosion hasn't had millions of years to flatten out the Martian landscape, so the new rivers will have plenty of rapids and waterfalls to attract daredevil rafters. The low gravity means boaters can go over drops of several feet without injury.

In the first stages of terraforming, as the planet heats up and the underground aquifers break through to the surface, particularly thrill-crazed boaters may want to ride a flood surge like the one that carved Valles Marineris. Imagine rafting in a gush of water as big as a thousand Mississippi Rivers, churning with mud and boulders. Needless to say, one can't do that in an ordinary Zodiac; flood-riders will need special armored, sealed boats equipped with crashwebs and a full bottle of motion-sickness pills.

Diving under Martian seas won't be very interesting at first: the water's muddy and cold, and there aren't many living creatures to look at. Divers on Mars are likely to be working – fixing sunken cables or water intakes, recovering crashed aircraft or spacecraft, and studying the ecological balance of the seas. One possible activity for recreational divers is underwater archaeology. Given that the early landings and bases on Mars are all in low-lying areas, many of the most historical sites on the planet are likely to wind up flooded out. Portable items like the Viking and Pathfinder probes will certainly get removed to museums, but a large facility like the Chryse base described in Chapter 4 may be just too big to save. Divers in drysuits can swim about the ruins where their ancestors walked in vacc suits.

CHAPTER 6

SUPERSCIENCE MARS

No one gave a thought to the older worlds of space as sources of human danger, or thought of them only to dismiss the idea of life upon them as impossible or improbable.

– H.G. Wells, The War of the Worlds

Superscience Mars is the Red Planet as it appeared in classic science fiction B-movies. This is Mars as a naturally habitable world, home to a powerful advanced nonhuman civilization.

Superscience Mars resembles the real Mars in size and superficial geography, but is considerably more dense and massive. Its composition includes a surprising quantity of heavy metals, giving the planet a density 1.5 times that of Earth, and a mass of almost 0.2 Earth masses (twice its real value). The surface gravity is higher, too – 0.8 standard G. The dense interior of Superscience Mars generates more heat and gave the planet a thicker atmosphere, which in turn keeps the climate warmer. For most of its history, Superscience Mars was only a little colder and drier than Earth, and was a fertile habitat for life.

All that has started to change over the last few million years. Superscience Mars' interior has cooled, and gas lost by the atmosphere is no longer being replaced. The oceans have receded, locked up in polar icecaps and underground aquifers. Once fertile regions are now desert. The planet is dying.

But Superscience Mars is inhabited by an ancient race of highly intelligent beings. They had a sophisticated civilization with atomic power in the days when Earthmen were building the first cities of mud brick in Mesopotamia. The Martians aren't going to let their world die without a fight – and if it does, they will find someplace else to live.

Geography

The geography of Superscience Mars is similar to that of the real planet. Many of the same features exist in the same places. The big difference is that Superscience Mars has a much smoother landscape, worn down by water and living things. Only in the highest and driest uplands are there any craters (although the huge Argyre and Hellas impact basins still exist). Hellas and the northern lowlands were an ocean only a few million years ago, and even today small intensely salty lakes survive in the Chryse depression and the lowest parts of Hellas.

The other notable feature of Superscience Mars is the canal system. The Martians have built huge atomic reactors to melt the polar ice and pump it southward through giant aqueducts. The path of each aqueduct is marked by a line of irrigated farmland, making a pattern of lines across the surface of Mars. Use the map of Dying Mars (see Chapter 7) for physical details and place names, but the canals are not open waterways and the cities are covered with domes to maintain a habitable environment.

The Martians

The intelligent inhabitants of Superscience Mars are a race of large insectoid beings, descended from their planet's analog of beetles. The early Martians rose to sentience roughly five million years ago, as the upland forests gave way to steppe and desert. They learned to hunt game and raise crops, and they built cities in the fertile Valles Marineris, the lush river deltas along the Chryse Sea, and the great Hellas basin.

Other Kinds of Martians

The insectoid Martians presented here are one possible race suitable for a Superscience Mars. They're alien in looks and habits, and work best as adversaries for Earthmen in a pulpish retro-SF campaign. There are other possibilities, however.

Humanoids: With a little handwaving it's possible to justify Martians who are almost exactly like humans in appearance, save for certain minor features like green skin or antennae. These are especially appropriate for campaigns in which inter-species romance is a likelihood. The Martian races of Dying Mars (see Chapter 7) are good candidates for humanoid Martians, as are the Alphans from ***GURPS Atomic Horror.*** Humanoid Martians should have large bald heads with a crease down the middle.

Tentacled Martians: Ever since the Martian invaders in H.G. Wells' *The War of the Worlds* there has been a tradition of tentacled Martians in science fiction. They usually resemble big octopuses with huge brains, many arms, and shocking habits. See ***GURPS Warehouse 23*** (p. 98) for tentacled Martian statistics.

Trilateral Martians: Since Earth is the third planet from the Sun and is inhabited by creatures with bilateral symmetry, logic suggests that Mars, the fourth planet, would have trilateral inhabitants. Use the Metarans from ***GURPS Atomic Horror*** (p. 52) with an extra arm and leg and psionics instead of shapeshifting, or pick your favorite alien race and give them additional limbs to suit.

Really Weird Martians: Since Mars is such a popular world in science fiction, over the years writers have given it all sorts of strange inhabitants. Olaf Stapledon populated Mars with sentient cloud-beings (best represented as an intelligent nanoswarm), and others have suggested energy beings, silicon-based beings, vampires, amorphous blobs, Yeti, and creatures of pure thought. GMs can put just about any alien race on Mars and call them Martians.

Biology

An adult Martian stands just over seven feet tall on spindly-looking legs terminating in three-clawed feet. Their bodies are made up of two segments, the abdomen and the thorax. Two arms extend from the thorax, and end in three-fingered hands. The head is a long oval, with two large compound eyes and a pair of sharp mandibles. Two antennae rise from between the eyes, and serve both as organs of smell and as transmitters for the Martian psionic force.

Martians are omnivores, but most of them nowadays live on a diet of food paste synthesized from lichens, supplemented by synthetic protein. They *can* eat meat, but prefer to use animal flesh as feedstock for the protein synthesis vats. Martian biochemistry is similar enough to Terran that inhabitants of either planet can eat one another's food with no ill effects (though living on nothing but alien food for a long period may

cause problems from vitamin and trace-element deficiencies). The "wild" Martians of the mutant gangs eat anything they can catch, including other Martians.

Martians lay eggs, usually in clutches of a dozen or more. The young hatch as limbless larvae and spend four years as ravenous eating machines before metamorphosing into small adults. After metamorphosis they begin to learn language and telepathy, and enter the tightly-regimented Martian society. In ancient times Martians formed family groups and raised their own young, but nowadays individuals are selected for breeding based on their physical and mental qualities, and their eggs are hatched in great communal incubators.

A generic adult Martian has base racial ST 8 [-15], a Carapace (PD 2, DR 2) [56], Peripheral Vision [15], Sharp Teeth doing cutting damage [5], Telepathy at power 6 with the limitation Martians Only (reducing its cost by 50%) [15], and the racial skills Telesend and Telereceive at IQ [8]. They have the disadvantages Attentive [-1], Chummy [-5], Hidebound [-5], Weak Immune System [-30], and Weakness to bright (Earth-normal) sunlight (1d Stun per minute, mitigated by thick sunglasses or tinted windows for a 60% cost reduction) [-12]. It costs 31 points to be an ordinary Martian.

Superscience Martians are native to a 0.8 G environment, which means that Earth's gravity counts as one increment of high gravity. Martians on Earth suffer a DX -1 penalty unless they have G-Experience.

Since Martians have only three digits, they naturally don't use the base-10 number system favored by humans. Instead, the Martians use a base-9 system, in which 9 is "10" and 81 is "100."

History

The first Martian cities were built in the Valles Marineris about 10,000 years ago, and in time larger cities subjugated smaller ones to form kingdoms (though even then the characteristic system of government was a council of leaders). Great empires rose and fell, and the scientific knowledge of the Martians advanced slowly but steadily. They developed the steam engine in 4000 B.C., and half a millennium later were taking their first tentative steps into space.

By 3000 B.C. the Martians had unlocked the secret of atomic power and promptly suffered the first of several atomic wars. The wars and their aftermath lasted two millennia, and ended when the surviving nations of Mars formed a unified planetary government. This was not a moment too soon, as the decline of the planet's ability to sustain life was accelerating. The "nuclear winter" caused by dozens of massive exchanges of missiles combined with the natural cooling and drying of the planet in a deadly feedback effect. The oceans were soon little more than salty lakes, and the highlands became almost entirely uninhabitable. Cities needed protective domes to shield them from sandstorms and icy winds, and each year the crop yields were smaller.

The Martian Chief Planners determined that a massive effort would be needed to halt the death of their planet. Under their direction, engineers designed a worldwide network of aqueducts to draw water from the polar caps and carry it to the thirsty equatorial regions. Construction of the huge system began in about 500 B.C., and work went on for centuries, interrupted by famines, civil wars, and tremendous migrations of refugees. In the end, the engineers fought their dying planet to a draw: the aqueducts and domed cities could support the Martian population, but there was no way to reverse the process and restore Mars to a more fertile state.

Martian Psionics

All Martians have at least rudimentary psionic ability, as noted in the templates. When communicating with one another, Martians use a combination of telepathy and spoken words, enabling them to exchange information very efficiently. (It also means Martian speech tends to be terse and telegraphic without the added depth provided by telepathy.) Approximately 1% of the Martian population exhibit unusually strong psionic ability, including various "wild talents" such as psychokinesis or ESP. Hatchlings which are identified as having psionic potential are inducted into the Brain Science Institute, where their powers are studied and developed.

In ***GURPS*** terms, basic Martian psionic abilities have the limitation Martians Only; they cannot read the thoughts of humans or other living beings. Martian psions trained by the Brain Science Institute have from 10 to 100 extra character points devoted to psionic powers and skills. Some of these psions *can* read Earthling minds, and others can have any other psionic ability the Gamemaster wants to allow.

For Martians in a ***GURPS Supers*** campaign, give Martian psionics access to any superpower which could plausibly be a mental power, and set the power levels at about 100 points less than the Earthling superheroes in the campaign (the Martians have advanced technology and allies to balance things out).

The aqueducts kept Martian civilization alive for another 2,000 years, but now the domed cities and underground warrens are overcrowded, the lichen farms and protein vats are straining to keep up with demand, and the polar caps simply cannot give up any more water. Martian leaders have begun to cast their eyes toward a warmer, wetter world, swathed in white clouds and covered in blue seas and green lands.

Martian Society

Martian society is divided into hundreds of occupational castes, each of which is filled by individuals trained and molded since birth. The Science Lords study demographic data and projected needs to determine how many hatchlings are assigned to each caste in a given year. Martians live their lives surrounded by other members of their caste. A team of workers live in the same dormitory, eat in the same cafeteria, work in the same factory, and spend what little free time they have at the same recreational stimulus center. The castes fit into five basic blocks.

Martian Names

Superscience Martians are raised in communal incubators, so have no family names. Instead, each Martian is assigned a randomly-generated name followed by an identifying string of nine numbers. The name is always three syllables long. The first four numbers after a Martian's name indicate its hatching date, while the last five indicate which facility the Martian came from. In common usage only a Martian's name and birthdate are important; the incubator number is only used in formal communications and records. High-status Martians like generals, chief engineers, and of course the Science Lords tend to drop the number as well. Some sample Martian names include Evodar-0821/70118, Kaleda-0113/60637, Ovanek-0312/27705, and Zaxero-0452/14850.

At the bottom of the Martian social pyramid are the farming and laboring castes. These are among the oldest castes, dating back to the earliest agricultural settlements. Farmers tend the lichen beds and fungi pits, and carefully work the few remaining cactus farms. Workers operate the protein vats, dig in the uranium mines, maintain the aqueducts, and extend the underground galleries when more living space is needed. Many tasks once performed by these castes are now automated, and their numbers are stable at about 40% of the total Martian population. The workers are probably the least satisfied of the Martian castes, and each year a handful abandon their monotonous lives to join the mutant gangs in the highlands. But the vast majority of workers are content to take the calming drugs and electrical pleasure-stimulation provided by the scientific caste and dream their unhappiness away.

Soldiers are an expanding caste. For generations after the atomic wars and world unification they were reduced to a remnant, and at times some planners argued that the soldier caste should be abolished as a waste of resources. They are more than simply fighters, however – soldier subcastes also pilot flying saucers, drive tripods, and perform police functions, fire fighting and rescue, and civil defense. Anything which involves protecting other Martians and facing danger is the task of the soldiers. In recent years the population of soldiers has soared on Mars, as more troops are needed to maintain order in the crowded cities, and the Martian Saucer Fleet and Tripod Expeditionary Force prepare for battles on other worlds. At present the various military subcastes amount to 10% of the Martian population, giving Mars an army in the millions. Soldiers and technicians tend to be rivals for resources, and have different ideas about how to solve Mars' problems, but they both have a strong stake in the status quo and accept the leadership of the scientists and planners.

The technical castes include all the engineers, mechanics, electronics operators, and machinists of Mars. They perform nearly all tasks involving machinery, which means they now handle the bulk of all economic activity. The technical castes are respected by all, as they were the ones who built the aqueduct system and the domed cities. If any segment of Martian society is genuinely indispensable, it is the technicians. Technicians view soldiers as a "lower" caste (just as soldiers view technicians), and consider military adventures a waste of scarce resources. At present the technical castes make up about 30% of the total Martian population.

The scientific caste was once a relatively small group entrusted with educating and testing the young, gathering and preserving knowledge, and advising the planners. Since the end of the atomic wars, the scientific caste has gained in importance and prestige until it is now the ruling caste of Mars. Since so many of the issues of importance to Mars hinge on highly technical scientific matters, the scientists have gradually edged the planners into a subsidiary role. Where once they advised, they now dictate. The growth in numbers and importance has broken the scientific caste into six subcastes: educators, researchers, historians, explorers, theorists, and the powerful psionic subcaste. The highest members of the scientific caste are the 27 Science Lords of Mars, who assemble in a council to decide the course of Martian civilization. Scientists have a close relationship with the technical caste (they were once part of that caste in the preatomic era), enjoy the confidence of the soldiers and workers, and have effectively browbeaten the planners into following their lead. The scientific caste are the most individualistic Martians, especially the high-status Science Lords. Some dissatisfied members of other castes complain that the scientists are sacrificing the collective good for individual rivalries and ambitions, but they suppress those thoughts when the Mind Police are about. Currently close to 10% of Martians are members of the scientific caste; the bulk of them are in the education subcaste, preparing the next cohort of hatchlings for their role in society.

The planning caste were once the leaders of Martian society, but suffered a drastic loss of prestige in the wake of the atomic wars and the climate shift, when they proved unable to handle the difficult new conditions. While planners dithered, the scientific and technical castes solved the problems and reaped the rewards of success. Nowadays the planning caste occupies mostly "middle management" positions. Long-term goals and policies are devised by scientists, and planners carry them out and coordinate the other castes. Many in the planning caste have accepted this new role, and delight in bureaucratic empire-building. There are about as many planners as there are scientists.

The total population of Superscience Mars is half a billion, up 20% from a century ago but less than a sixth of the planet's peak population before the atomic wars. Since Martians reproduce by laying eggs, the scientific caste has prudently stored billions of fertile eggs in cryogenic chambers. This means Mars could recover much more quickly than Earth from an interplanetary war, and the Martians could rapidly populate a conquered Earth.

Domed Cities

Martian cities are all domed to protect the inhabitants from the thinning atmosphere, freezing temperatures, sandstorms, and lingering radioactive fallout. Where the inhabitants live depends on their status and caste. Workers live in the tunnel complexes underground, and farmers live in greenhouse farms lining the aqueduct routes. Within the city domes, individual towers are segregated by caste, and an individual Martian's status determines what floor he gets to live on. Low-status members of the favored castes live just below street level, while the chief planners, military commanders, and skilled technicians enjoy private apartments on the upper floors. The tallest towers are now reserved for the scientific caste, and the Science Lords each reside at the top levels of the biggest cities.

The architecture of Martian cities runs to very tall towers, often linked by sky-bridges on many levels. The external skin of a tower tells who lives inside. Military-caste towers are matte black metal, and serve as fortresses, prisons, or planetary-defense ray gun emplacements. Technical towers tend to be mirror-finished metal, often chrome or copper, and are usually connected to manufacturing complexes. Planning towers are all smooth white synthetic stone with translucent windows. Science towers are prismatic glass or crystal.

By contrast, the tunnel complexes under the cities are cramped, dimly-lit warrens, often extending down dozens of levels and spreading miles beyond the domed center. The Martians mix worker housing and manufacturing centers to maximize efficiency, which means that some workers spend their entire lives without ever seeing the surface. Although tripods can't come down into the tunnels, the Science Lords and the soldier caste have other ways to maintain order: squads of armored Shock Troopers, clouds of poison or knockout gas, or simply shutting off the life-support systems to smother rebels in the dark.

Martian Technology

Martian technology is more advanced than Earth science, but scientific progress on Mars is very slow. Martians are generally TL8, with TL12 contragravity, force fields, and reactionless drives appearing as "emergent superscience" four tech levels early. Gamemasters may want to use the "Retrotech" option described in ***GURPS Ultra-Tech 2*** (pp. 8-9) for Martians with a good 1950s feel. Although the Martians do have nuclear fusion power, they rely heavily on advanced fission because of the relative shortage of deuterium and helium on Mars.

Martian weapons are TL8: electrolasers ("ray guns") are the preferred hand weapon, while big infrared lasers known as "heat beams" are the standard heavy weapons. Martian spacecraft also make use of atomic missiles. Besides these mainstays, Martian Science Lords love to deploy exotic "secret weapons" in battle, often unreliable experimental devices from TL9 or beyond. Potential superweapons include weather control devices, earthquake or volcano inducers, energy dampers to paralyze high-tech societies, explosive meteor bombs, orbital mind-control lasers, polarizer beams to block out sunlight, stasis field projectors to trap entire towns in frozen time, and even methods of reanimating the dead.

Martian computer technology is also TL8, but they never developed the concept of personal computers or a distributed Internet. Instead, they build very large macroframes, some of which have spontaneously "awakened" to full sentience. They also employ robots, though so far no AI robots have been built.

Flying Saucers

Saucer-shaped spacecraft have been the mainstay of the Martian space program for thousands of years. There have been thousands of different saucer designs over the years, but today the Martians rely on three main types. Attack Saucers are swift, maneuverable craft armed with heavy ray guns and protected by force fields. They are used to battle other ships in space or attack ground targets.

Transport Saucers are larger than Attack Saucers, and only lightly armed. They carry personnel or freight. As an assault craft, a Transport Saucer can land three combat tripods and 18 Martian battlesuit troopers (an infantry variant carries 48 soldiers). Transport Saucers are also used to carry prisoners or valuable resources back to Mars.

While Attack and Transport Saucers can manage interplanetary voyages, they are somewhat cramped. Most missions taking Martians beyond orbital space are carried aboard Battle Saucers, which serve as flagships and tenders. A single Battle Saucer carries nine smaller craft grouped in squadrons of three ships each. One squadron is always three Attack Saucers, to escort the Battle Saucer; the others can be Attack or Transport saucers as needed. Any major operation involves at least one Battle Saucer, and a full-scale planetary invasion would require a three-ship task force.

The Martian fleet also has three titanic Fortress Saucers. Each one can carry three Battle Saucers and three escort squadrons of Attack Saucers. The Martians prize their Fortress Saucers, and would never commit more than one to an operation.

Attack Saucer

The Attack Saucer is the workhorse of the Martian Saucer Fleet for space and air combat. It is designed at TL8, with TL12 reactionless drives and deflector screens. It is very stealthy, with radical emissions cloaking and area jammers. The laser cannons are fully concealed inside the body. Attack Saucers are not designed for long-term space missions; they have no artificial gravity and very rudimentary crew quarters. For any operation lasting more than a few days, an Attack Saucer needs a Battle Saucer to support it. An Attack Saucer is a dangerous opponent for spacecraft of equal TL, especially if they don't have access to deflector shields or reactionless drives. Against lower-tech opponents like TL6 jet fighters it is devastating and almost untouchable. The Heat-Beam cannons do 6d × 5 damage each, and have a rate of fire of 8.

Subassemblies: Body +7.
P&P: 31-MW nuclear fission reactor with 300,000 lb.-thrust vectored reactionless super thruster; energy bank holding 3,500 MWS.
Fuel: —
Occupancy: 3 NCS, 3 NS. ***Cargo:*** 1,500 cf.

Armor	**F**	**RL**	**B**	**T**	**U**
Body:	4/100	4/100	4/100	4/100	4/100

Weaponry

3 IR laser cannons [F] (160 shots each) +2.

Equipment

Body: Million-mile tight-beam radio, AESA (+23), PESA (+29), inertial navigation system, terrain following radar, 3 HUDWACs, area radar jammer (-8), 3 TL8 compact hardened microframes, 2-Martian airlock, full fire suppression, full life system for 6 Martians, 600 Martian-days of provisions, 6 crashwebs, 6 G-Seats, 6 gravity webs, 6 bunks, radical emission cloaking, radical stealth, TL12 deflector field.

Statistics

Size: 50'×12'	*Payload:* 15 tons	*Lwt.:* 125.7 tons
Volume: 15,700 cf.	*Maint.:* 2.5 hours	*Price:* $71.1 million
HT: 10	*HP:* 6,000	
aSpeed: 4,750	*aAccel:* 24	*aDecel:* 6
aMR: 1.5	*aSR:* 5	
sAccel: 1.2G		

Transport Saucer

Transport Saucers use many of the same basic systems as Attack Saucers, but have a thicker hull and more cargo room. They are not as well-armored or shielded, but do mount a single heat beam. A fully-loaded transport saucer can carry 3 tripods ready for deployment, and 18 foot soldiers; an all-infantry variant can haul an extra 30 troops instead of the tripods.

Subassemblies: Body +7.
P&P: 18-MW nuclear fission reactor with 300,000 lb.-thrust vectored reactionless super thruster and 600,000-lb. contragravity; energy bank holding 576 MWS.
Fuel: —
Occupancy: 3 NCS. ***Cargo:*** 5,000 cf.

Armor	**F**	**RL**	**B**	**T**	**U**
Body:	4/100	4/100	4/100	4/100	4/100

Weaponry

1 IR laser cannon [F] (80 shots) +2.

Equipment

Body: Million-mile tight-beam radio, AESA (+23), PESA (+29), inertial navigation system, terrain following radar, 3 HUDWACs, area radar jammer (-8), 3 TL8 compact hardened microframes, 2-Martian airlock, full fire suppression, 3 tripod bays, 24 bunks, full life system for 24 Martians, 2,400 Martian-days of provisions, 3 crashwebs, 3 G-Seats, 3 gravity webs, radical emission cloaking, radical stealth.

Statistics

Size: 50'×18'	*Payload:* 117 tons	*Lwt.:* 202 tons
Volume: 23,520 cf.	*Maint.:* 2.3 hours	*Price:* $75.5 million
HT: 9	*HP:* 7,500	
aSpeed: 4,240	*aAccel:* 15	*aDecel:* 6
aMR: 1.5	*aSR:* 5	
sAccel: 0.75G		

The Tripod Expeditionary Force

While the saucer pilots have the most prestige among the Martian armed forces, the ground troops are formidable in their own right. The most deadly units in the Martian army are the famed Tripod Expeditionary Force, mounted in agile combat tripods armed with powerful heat-beams. Tripod operators are the elite of the Martian army, and often are granted higher status and perquisites.

Martian Tripod

Tripods can move quickly over almost any terrain, and their weapons can overawe most primitive civilizations. They have protective force fields, and their armor can bounce most TL6 artillery, but TL7 guns and superscience beam weapons can pose a threat. Tripods have three folding legs; when fully extended the tripod stands 50 feet tall. They can also operate with the legs at half-length, which cuts the tripod's speed in half, as well. The body of a tripod is a disk shape with sloping sides to deflect shells. A tripod has a single pilot, but there is space for one passenger – usually a high-ranking officer or a scientific observer. Standard tripod armament is a heavy heat-beam in a Cyberslave mount, but variants exist equipped with superscience weapons devised by the Science Lords. Tripods have a chameleon outer covering, and a favored tactic of pilots is to wait in concealment with the legs folded, then suddenly rise up and strike. The tripod's energy bank holds enough power to run the heat-beam for 30 seconds; once drained it takes 5 hours to recharge while running all other systems, or about 15 minutes with the force field shut off.

A tripod's legs are its most vulnerable feature: they are less heavily armored than the body and don't have deflector fields. Under heavy fire a tripod can sit down and wait out the barrage under its deflector dome, but surprise attacks can sometimes cut them down. In Earth gravity it requires a strength of 75 (using extra effort) to topple a tripod by lifting up one leg – an ideal tactic for superheroes battling Martians.

Subassemblies: Body +4, 3 Legs [U:Body] +2.
Powertrain: 2,500-kW fission reactor with 600-kW leg drivetrain; energy bank holding 1,728 MWS.
Fuel: —
Occupancy: 1 NCS, 1 NS. ***Cargo:*** None.

Armor	**F**	**RL**	**B**	**T**	**U**
Body:	5/200	5/200	5/200	5/200	5/200
Legs:	4/100	4/100	4/100	4/100	4/100

Weaponry

IR laser cannon ("Heat Beam") [F] (240 shots) +1.

Equipment

Body: 10,000-mile radio, Thermograph (+11), Inertial navigation, HUDWAC, TL8 small hardened computer, compact fire suppression, 2 crashwebs, 2 Martian-days limited life support, basic chameleon skin, TL12 deflector field. *Legs:* Basic chameleon skin.

Statistics

Size: 20'×50'	*Payload:* 400 lbs.	*Lwt.:* 19 tons
Volume: 730 cf.	*Maint.:* 10 hours	*Price:* $3.9 million
HT: 9	*HP:* 750	*Legs:* 188
gSpeed: 55	*gAccel:* 14	*gDecel:* 20
gMR: 1	*gSR:* 3	

Low GP; off-road speed 45 mph.

Accompanying the mighty tripods are battlesuited Shock Troopers, wearing climate-controlled TL8 armor (the equivalent of standard TL8 Medium Combat Armor, as described in ***GURPS Space,*** p. 85 – PD4 DR20, with life support and built-in short-range radios). Shock Troopers carry electrolaser pistols and portable heat-beams (TL8 military laser rifles). Besides their role as support for the tripods, Shock Troopers also act as elite commandos and guards for high-ranking leaders and Science Lords. On Mars they are called in to back up police forces and are ruthless in suppressing rioting laborers.

The rank and file of the Martian army are ordinary infantry, wearing only PD4 DR20 helmets (and their own natural armor, of course). Martian infantry carry the same weapons as Shock Troopers, though support troops like combat engineers or artillery crews have only sidearms rather than rifles. Officers wear distinctive cloaks of shiny metallic fabric, both as a badge of rank and as reflec armor protection against laser weapons (PD6, DR2 against lasers, PD3, DR0 against other beams).

Characters

Martian Character Types

Superscience Mars can fill several roles in a campaign. It can be the adversary, in which case the Martians are bad guys for heroic Earthmen to battle. Or players can run Martian characters, either in conflict with humans or simply living and adventuring on Mars. The Martians in this section are designed as worthy adversaries for small groups of 100-point "heroic" humans; some of the templates may need some extra character points (usually in the form of advantages and improved stats) to serve as PCs.

Diplomat 125 points

Martian diplomats are drawn from the planning caste, but their training is more eclectic. They are probably the most flexible and innovative of the Martians. Diplomats may be encountered as formal ambassadors, sent to deliver Martian ultimatums or trick the Earthlings into agreements which will leave them defenseless, or as first contact specialists trying to learn about human society and discover its weaknesses. Senior diplomats have higher Status and IQ 13.

Attributes: ST 8 [0]; DX 11 [10]; IQ 12 [20]; HT 10 [0].
Advantages: Diplomatic Immunity [20], Martian [31], Not Hidebound [5], Status 4 [20], Strong Will +2 [8].
Disadvantages: Duty (to Mars) [-15], Fanaticism (Mars) [-15].
Skills: Administration (M/A) IQ [2]-12, Beam Weapons/TL9 (Electrolaser) (P/E) DX+2 [1]-13*, Cryptography/TL9 (M/H) IQ [4]-12, Detect Lies (M/H) IQ [4]-12, Diplomacy (M/H) IQ+4 [12]-16, Language (English or Japanese) (M/VH) IQ-1 [4]-11, Savoir Faire (M/E) IQ+4 [8]-16, Stealth (P/A) DX [2]-11, Xenology (M/H) IQ [4]-12.
*Beam Weapons skill includes the +2 bonus for IQ 12.

Outcast 110 points

Outcasts are those Martians who have fled or been driven out of the hive-cities to make a precarious living in the rugged uplands of their dying planet. They protect themselves against cold and radiation with suits made of scavenged vacc suit parts and animal hides, and hide out in caves or ruins of cities destroyed during the atomic wars. Many are mutants or freaks, but they also show remarkable adaptability and toughness unknown among civilized Martians. Outcasts live as scavengers, hunter-gatherers, or bandits. When they grow too bold in their robberies and pilferage, the Science Lords send out tripod troops to burn them out of their lairs; otherwise the outcasts are ignored. Mutant outcasts add 50 or 100 points of psionic powers or super abilities, along with the Hideous or Unnatural Feature disadvantages.

Attributes: ST 9 [10]; DX 12 [20]; IQ 10 [0]; HT 12 [20].
Advantages: Martian [31], No Weak Immune System [30], Not Hidebound [5].
Disadvantages: Social Stigma (Outcast vermin, -3 among civilized Martians) [-15], Status -1 [-5].
Skills: Beam Weapons/TL9 (Electrolaser) (P/E) DX+1 [1]-13*, Brawling (P/E) DX+1 [2]-13, Camouflage (M/E) IQ [1]-10, Spear (P/A) DX [2]-12, Stealth (P/A) DX [2]-12, Survival (Martian desert) (M/A) IQ+2 [6]-12.
*Beam Weapons skill includes the +1 bonus for IQ 10.

Psionic 150/151 points

While all Martians have basic psionic competence, a few are hatched with unusually powerful abilities. Because rogue psions could pose a tremendous threat to the rule of the Science Lords, all hatchlings are carefully tested for psionic aptitude, and those with high potential are assigned to the Brain Science Institute for training and indoctrination. Afterwards they serve with either of two rival agencies. The Mind Police employ Martians skilled at Telepathy and ESP to maintain social stability and counter threats to the Science Lords. The Psychic Intelligence Agency uses psionic agents with a variety of talents to spy on Earthlings and conduct covert operations. A few psionic Martians remain with the Brain Science Institute, seeking out new recruits and hunting down rogue psionics before the Mind Police find them. Note that the character type presented here is a relatively low-powered psionic, suitable for use in a pulp or steampunk campaign; in a Supers game add another 150 to 200 points worth of psionic power levels and skill.

Attributes: ST 8 [0]; DX 11 [10]; IQ 12 [20]; HT 10 [0].
Advantages: Legal Enforcement Powers [10], Martian [31], Status 1 [5].
Disadvantages: Bully [-10], Duty (to agency) [-15].
Skills: Beam Weapons/TL9 (Electrolaser) (P/E) DX+2 [1]-13*, Interrogation (M/A) IQ-1 [1]-11, Stealth (P/A) DX-1 [1]-10, Psionics/TL9 (M/VH) IQ [8]-12, Weird Science (M/VH) IQ-1 [4]-11.
*Beam Weapons skill includes the +2 bonus for IQ 12.
Psi Powers: Mind Police have Martian-only Telepathy-18 [30] and ESP-10 [30]; PIA agents have Telepathy-8 without the Martian-only limitation [25], and one of the

following powers: Psychokinesis-9 (with Telekinesis skill only) [36], Psychokinesis-12 (with Levitation or Pyrokinesis skill only) [36], or Teleportation-7 [35].

Mind Police Psi Skills: Telesend (M/H) IQ+2 [4]-14, Telereceive (M/H) IQ+2 [4]-14, and 16 points spent on any of the following: Mental Blow, Mind Shield, Sleep, Mindwipe – all (M/H) IQ+2 [4]-14 because of Martian-only limitation – Clairvoyance, or Precognition (M/H) IQ+2 [8]-14.

PIA Agent Psi Skills: Telesend (M/H) IQ+2 [4]-14, Telereceive (M/H) IQ+2 [4]-14, and any two of the following: Mental Blow, Mind Shield, Sleep, or Mindwipe; one of Telekinesis, Levitation, or Pyrokinesis (due to one-skill limitation on Psychokinesis power); or Autoteleport. All optional skills are (M/H) IQ+2 [8]-14.

Saucer Pilot 90 points

Saucer pilots are highly specialized members of the military caste, trained and molded from hatching to have quick reflexes and alert senses. They spend thousands of hours practicing in simulators before they are allowed to take the controls of an actual saucer. In space combat they are devastatingly accurate with ray-gun fire and can execute complex maneuvers with great precision. If they have a flaw, it is their tremendous dependence on battle plans developed in advance by the Science Lords. Initiative among saucer pilots is not encouraged, and if the battle plan is disrupted they have little idea what to do.

Attributes: ST 8 [0]; DX 12 [20]; IQ 10 [0]; HT 10 [0].

Advantages: Alertness +2 [10], Composed [5], Martian [31], Military Rank 3 [15].

Disadvantages: Duty (to the Saucer Fleet) [-15], Fanaticism (Mars) [-15], Overconfidence [-10].

Skills: Beam Weapons/TL9 (Electrolaser) (P/E) DX+1 [1]-13*, Computer Operation/TL9 (M/E) IQ [1]-10, Electronics Operation/TL9 (Sensors or Communications) (M/A) IQ+2 [6]-12, Free Fall/TL9 (P/A) DX [2]-12, Gunner/TL9 (Heat ray) (P/A) DX+2 [8]-14, Language (English or Japanese) (M/VH) IQ-3 [1]-7, Mechanic/TL9 (Spaceship Drive) (M/A) IQ+1 [4]-11, Navigation/TL9 (M/H) IQ+2 [8]-12, Piloting/TL9 (Saucer) (P/A) DX+2 [8]-14, Tactics (M/H) IQ [4]-10, Vacc Suit/TL9 (M/A) IQ+2 [6]-12.

*Beam Weapons skill includes the +1 bonus for IQ 10.

Science Lord 233 points

The Science Lords are the ruling caste of Mars, selected for intelligence and augmented by drugs which stimulate brain growth. Although in recent centuries the Science Lords have been occupied with governing Mars, it is still customary for members of the ruling council to maintain private laboratories and conduct research. This often leads them into the more bizarre frontiers of Weird Science: creating monsters, developing evolution rays and mind-control lasers, or inventing bizarre robot war machines. There is much more variation among Science Lords than other Martian castes, and GMs should not hesitate to customize individual Lords with quirks, mental disadvantages, and unique skills. Any Science Lord is a very formidable character, suitable more for use as an evil mastermind or powerful patron rather than an adventurer.

Attributes: ST 8 [0]; DX 10 [0]; IQ 14 [45]; HT 10 [0].

Advantages: Composed [5], Eidetic Memory [30], Gadgeteer [25], Lightning Calculator [5], Manual Dexterity +2 [6], Martian [31], Mathematical Ability [10], Not Hidebound [5], Status 7 [35], Strong Will +2 [8].

Disadvantages: Callous [-6], Fanaticism (Self) [-15], Megalomania [-10], Paranoia [-10].

Skills: Acting (M/A) IQ [1]-14, Administration (M/A) IQ+4 [5]-18, Beam Weapons/TL9 (Electrolaser) (P/E) DX+2 [1]-12, Computer Operation/TL9 (M/E) IQ+4 [4]-18, Computer Programming/TL9 (M/H) IQ+4 [3]-18, Detect Lies (M/H) IQ-1 [1]-13, Diplomacy (M/H) IQ+2 [4]-16, Intelligence Analysis/TL9 (M/H) IQ+2 [4]-16, Language (English) (M/VH) IQ [4]-14, Language (Japanese) (M/VH) IQ [4]-14, Leadership (M/A) IQ [1]-14, Mathematics (M/H) IQ+4 [3]-18, Piloting/TL9 (Saucer) (P/A) DX [2]-10, Politics (M/A) IQ+2 [3]-16, Research (M/A) IQ+4 [5]-18, Science! (M/VH) IQ+4 [12]-18, Strategy (Space) (M/H) IQ+2 [4]-16, Weird Science (M/VH) IQ+2 [8]-16. (Mental skills include the Eidetic Memory point reduction; Computer Programming and Mathematics include the +3 bonus from Mathematical Ability; Beam Weapons skill includes the +2 bonus for IQ 12+.)

Soldier 106 points

Martian soldiers are members of the Soldier caste trained for offensive operations against the enemies of Mars. Tripod operators pilot the deadly war machines, while battlesuited Shock Troopers mop up behind them and deal with insurgents and partisans. On Mars itself, infantry guard important sites and accompany the Science Lords to ensure their safety. Shock Troopers in full battle gear carry a load of 50 pounds, which counts as Medium encumbrance and reduces their Move to 4 (5 with Running skill). Ordinary infantry carry only 15 lbs, and so have no encumbrance penalty.

Attributes: ST 11 [30]; DX 12 [20]; IQ 10 [0]; HT 12 [20].

Advantages: Combat Reflexes [15], Martian [31], Military Rank 1 [5].

Disadvantages: Bloodlust [-10], Duty (to the Martian army) [-15], Fanaticism (Mars) [-15].

Skills: Beam Weapons/TL9 (Electrolaser) (P/E) DX+2 [2]-14*, Brawling (P/E) DX+1 [2]-13, Camouflage (M/E) IQ [1]-10, Gunner/TL9 (Heavy heat ray) (M/A) IQ+2 [6]-12, Tactics (M/H) IQ [4]-10, and one of the following specializations:

Shock Troopers: Beam Weapons/TL9 (Laser) (P/E) DX+2 [2]-14*, Running (P/H) HT [4]-12, and Throwing (P/H) DX [4]-12.

Tripod Pilots: Driving/TL9 (Tripod) (P/A) DX+2 [8]-14 and Mechanic/TL9 (Tripod) (M/A) IQ [2]-10.

Palace Guards: Intimidation (M/A) IQ [2]-10, Polearm (P/A) DX+1 [4]-13 and Stealth (P/A) DX+1 [4]-13.

*Beam Weapons skill includes the +1 bonus for IQ 10.

Military officers add more levels of Military Rank, and the skills Administration, Leadership, and Strategy at 12 or better.

Advantages

Appearance see p. B15

Nearly all Martians of a given caste look pretty much alike, even to one another. Centuries of eugenic policies and mild genetic tinkering by the Science Lords have created a very uniform-looking species overall. A very few Martians are either Attractive or Unattractive, but there is no variation beyond that.

Carapace see p. C157

The Martian carapace is a tough layer of chitin covering the entire body and acting as both armor and skeleton. It is rigid on the head, chest, limb sections, and shoulder plates, but softer and flexible at the joints and abdomen, giving the Martians PD2 and DR2. The main drawback to a Martian's carapace is that it heals very slowly, taking about as long to heal as a vertebrate Earthling's broken bone.

Cultural Adaptability see p. C123

This advantage is unknown among Martians. Their own culture is so uniform and their relations with others are so limited that no Martians ever get the kind of mental and social flexibility needed to adjust quickly to different societies. Players who want to create a "cosmopolitan" Martian with Cultural Adaptability should also take the 10-point Unusual Background "raised off world."

Diplomatic Immunity see p. C124

Obviously Diplomatic Immunity is only valuable if the host nation respects it. Martian diplomats get the benefit of Immunity if Mars and Earth are at peace, or at least technically at peace in the middle of a "cold war" situation. Otherwise, they're just hostile Martians. Similarly, Martians at peace with Earthlings will respect the diplomatic status of a human ambassador, but during wartime anything goes.

G-Experience see p. C125

Martians who have spent some time on Earth or other worlds may acquire G-Experience, negating the -1 DX penalty imposed by Earth's heavier gravity. In an invasion scenario, the Martians probably *won't* have G-Experience until they've been on Earth for at least a few weeks.

Legal Enforcement Powers see p. B21

The legal authority of Martian psionic agents is slightly different in the Psychic Intelligence Agency and the Mind Police. Mind Cops can conduct covert operations and ignore civil rights, while PIA operatives have planetary jurisdiction and can also act covertly (since they're spies and counterspies, civil rights are scarcely an issue). Neither type may kill without orders, but both can carry weapons and arrest just about anyone of lower Status.

Panimmunity see p. C128

If the Superscience Martians conquer Earth, they'll be able to study Terrestrial germs and develop some sort of broad-spectrum vaccine to supplement their weak immune systems. Assume they develop TL9 Panimmunity (5 character points) within a year or two of landing. Most (but not all) Martians on Earth will get Panimmunity shots. Note that the weaker Martian immune system halves the effectiveness of Panimmunity.

Teeth see p. C167

The Martian teeth are actually mandibles like a Terrestrial insect's. They can be used for a cutting attack doing damage equal to the Martian's Thrusting damage. Martians are usually too civilized to attack by biting, so most Terrans will be unaware of this interesting feature until the Martians reveal it.

Martian Mutants

Because of the unusual abundance of heavy metals in the core of Superscience Mars, and as a legacy of the planet's history of atomic wars, Martians have a high mutation rate. Most mutants die as hatchlings or are assigned to menial duties. A rare few possess powers which the Brain Science Institute can't detect. Rogue mutants are caught and dissected by the Science Lords to study the origin of their powers, or escape to the rough country of the highlands, to join the gangs of bandits and outcasts.

In a straightforward pulp science fiction game, mutants have classic "atomic mutant" features like extra limbs, deformed miniature twin heads, boneless tentacle arms, or distended braincases. If they have any paranormal abilities, they are mostly increased psionic powers or "natural" superpowers like armored skin or unusual strength. In superhero games, anything goes – Martian mutants can have just about any superpowers, though always accompanied by an appropriate deformity.

The mutant gangs are the only significant opposition to the rule of the Science Lords. However, they are widely scattered across the surface of Mars, and do not cooperate well. A few are active rebel groups, dedicated to liberating all Martians from the tyrannical and regimented government of the Science Lords; some simply want to live undisturbed in the wilderness; most are simple bandits, interested only in loot. How a mutant gang might react to a rocket full of Earthlings depends on their goals. Revolutionaries would be cautiously friendly, hoping the aliens might help them in their struggle. Mutants seeking solitude would be hostile but not aggressive, content to drive away the interlopers or hide from them. Bandits would see the Earthlings as just another source of plunder, and possibly protein as well.

Versatile see p. CI31

This is another unknown advantage among Martians; their closest equivalent is simply buying off the racial Hidebound disadvantage. Martian civilization emphasizes specialization rather than synthesis and adaptability, and has for thousands of years.

Disadvantages

Code of Honor see p. B31

Since honor is generally a personal matter rather than something imposed by society, Martians generally don't have any Code of Honor. The possible exceptions are those Martians who are permitted the most individuality – Science Lords, diplomats, and a few colorful military heroes. They are likely to follow something resembling the Pirate's Code of Honor, but a few especially noble sorts might behave like Gentlemen.

Hidebound see p. CI91

This is a racial disadvantage for Martians, and appears to be a genuine feature of the Martian brain rather than something imposed by society. Science Lords are deliberately modified as larvae to be innovative (at least as innovative as the average Earthling), and others who manage to score well on tests of creativity may be assigned to the diplomatic service.

Weak Immune System see p. CI85

Confined to sterile cities, fed on synthetic foods, and living on a planet irradiated by atomic wars and half-frozen, Martians have a virtually disease-free existence. Over the centuries they have lost much of their ability to resist infection, and a Weak Immune System is a racial trait. The only Martians who may not have it are the rough-living mutants and bandits.

Weakness see p. CI105

All Martians are vulnerable to bright sunlight, the result of living mostly indoors and underground on a world which only gets half as much light as Earth. On Earth, or anywhere within 1 AU of the Sun, Martians suffer terribly from exposure to sunlight. They take 1d Stun damage each minute, but this can be avoided by wearing protective goggles or having a tinted or silvered vehicle viewport. Martians on Earth can function normally on cloudy days. A sufficiently bright artificial light source might have the same effect as sunlight – car headlights or house lighting are *not* bright enough, but a searchlight or the intense lamps used for indoor gardening could stun a Martian.

Skills

Courtesan, Erotic Art, Sex Appeal see pp. CI153, CI159, and B64

The sexless nature of Martian society has completely eliminated these skills from the populace, and it would require the equivalent of a major research program to recreate them. Only in a very silly campaign should Earthling versions of these skills work on Martians.

Detect Lies see p. B65

Humans and Superscience Martians have very different body language and responses to stress, so they have a -2 penalty when trying to use Detect Lies skill on the opposite species.

Disguise see p. B65

Humans and Martians are roughly the same size and shape, but the differences in mass and proportions are such that any attempt by a human to disguise himself as a Martian, or vice versa, is at -5 to skill. Highly advanced plastiskin disguises can offset the penalty, and might be used to equip an infiltration party. Since Martians themselves are so similar, any Martian gets an effective +1 to any attempt to disguise himself as a member of the same caste.

Driving/TL see p. B68

Operating a Martian tripod uses the Driving/TL9 (Tripod) skill; that defaults to driving Terran wheeled vehicles at -5. Terrans trying to drive a Martian saucer are also at -5, but since tripods are very unforgiving vehicles, any failure is likely to lead to disaster, as the 'pod either reels off out of control or topples over.

First Aid/TL, Physician/TL, etc. see p. B56

Martian and Earthling physiologies differ greatly. An Earth doctor's training helps him treat a Martian about as well as it would let him heal an injured lobster. Medical skills across the races get a -5 penalty, although access to appropriate medical references and databases can reduce this to -2 in campaigns where humans and Martians have relatively peaceful contact.

Psi Skills see pp. B165-176

While all Martians learn Telesend and Telereceive the same way humans learn to speak, other psionic skills are carefully controlled by the Brain Science Institute. Among civilized Martians, only trained psionics and Science Lords can learn other psi skills. Mutants and outcasts on the surface aren't subject to those restrictions, but have nobody to teach them.

Science! see p. CI158

Martian Science Lords learn this skill to reflect their wide-ranging but often quirky and unsystematic study of science and technology. It's a cinematic skill, but this is a cinematic setting anyway. Few other Martians have Science! skill because of the social emphasis on specialization.

Campaigns and Adventures

Superscience Mars is a consciously pulpy, "cinematic" setting, and as such is best for fun, light-hearted adventures presented with tongue slightly in cheek. It can be used either as a source of sinister Martians or a destination for venturesome Earthlings.

Invaders From Mars

This is the classic alien invasion scenario, as presented in *The War of the Worlds, Independence Day,* and a thousand movies and stories in between.

The Advance Party

The invasion begins with a small landing in an out-of-the-way place: rural California, the Sussex countryside, or whatever small town the player characters happen to live in. A mysterious meteor lights up the night sky: the Martian scout ship has arrived. A crusty old recluse or eccentric amateur astronomer discovers the Martians, but he won't live to tell anyone about it. If the player characters are the local police (or inquisitive local teens), they may stumble across the Martian menace while investigating the meteor.

Martian commanders are smart and prudent. They won't commit to a massive invasion without scouting out a landing site first. The first ship down is likely to be a Transport Saucer, carrying a trio of Tripods and a team of Martian scientists. The Tripods go to work isolating the surrounding region, attacking rail lines, cutting phone and power networks, destroying bridges and blocking roads, and dealing with any sign of opposition from the Terrans. Meanwhile the scientists gather specimens of Earth life, including a few Earthlings, to learn their strengths and vulnerabilities. If the Martians want to be especially subtle, they may deploy some science-spawned monsters to distract the Earthlings.

Human characters caught up in this stage of the invasion can try to fight against the superior weaponry of the Martians, or simply escape to warn the rest of the world about the invasion. Brilliant scientists may even try to get samples of Martian equipment in order to learn how it functions and perhaps discover some way to counter the irresistible weapons of the invaders. Tough veterans can try to stop the invaders using improvised weaponry and unorthodox tactics. Spunky teens can try to outrace the tripods on the highway to get the news out, or escape captivity aboard the Martian saucer.

The Main Force

After the scouting expedition has secured a landing site and learned something about the capabilities of the Earthlings, it's time for the main invasion to begin. The Martian invasion fleet consists of a Fortress Saucer (with its full complement of Battle Saucers and Attack Saucers), accompanied by 9 more Battle Saucers. The total fleet strength, including all carried craft, amounts to 63 Attack Saucers, 54 Transport Saucers, 12 Battle Saucers, and the Fortress Saucer. The landing force consists of 162 Tripods and 972 shock troopers in battle armor.

This force's objective is to carve out a substantial base of operations on Earth – an entire state or country. Guarded from space by the Fortress Saucer, the Martians secure a perimeter and begin advancing on key Earthling centers of industry and government. The Battle Saucers shuttle back and forth between Earth and Mars, bringing down more troops and tripods (presumably the Martians would put as many tripods as possible in the first wave, so the reinforcements will consist mostly of infantry and replacements for lost tripods). During this stage, the Martians dig underground bunkers and prepare any superweapons that require delicate assembly.

For the Earthlings, this is when the war is at its height. Earth's nations hurl everything they can scrape together at the Martian foe. American jets fly wing-to-wing with Soviet MiGs (or British Tommies fight alongside Germans and Irish volunteers), all quarrels forgotten for the duration. If Earth has atomic weapons, they will be used (although the Martians can intercept most TL6 and TL7 weapons with little difficulty). Terran scientists gather in some safe locale to study captured Martian devices in the hope of preparing a counterweapon. Superheroes (if they exist) charge into battle. Crack teams of commandos attempt to slip past the Martian lines and steal or sabotage their equipment. Ordinary folk in the conquered zone can simply try to escape the fighting, or turn partisan and do their best to smuggle out vital intelligence to Earth's defenders. Taking one of the invaders with you when you go is the ideal of every resistance fighter.

Under Foot

If global unity and secret weapons can't stop the Martians, they will eventually overrun the entire world. Earth becomes a Martian colony planet, and the new masters can go about setting things up to suit themselves. Most Earth cities are in ruins, so the Martians build new ones for themselves in Alaska, Canada, Greenland, Iceland, Scandinavia, northern Russia, Siberia, Mongolia, and Tibet.

There is still a place for Earthlings in the new world order; the Martians need slave labor to work the mines and grow crops in the warm regions. Guarded by Martian troops in air-conditioned armor, the humans are treated relatively well as long as their labor is valuable. Sick, weak, or elderly humans go to the protein vats. Opportunist humans may well decide that the winning side is best, and join the Martians as overseers, internal security spies, and general toadies.

Other Earthlings won't give up so easily. Bands of hardy rebels gather in hidden redoubts, building bases and collecting weapons. The centers of the resistance are scattered across the globe: the Amazon basin, the ruins of New York, Switzerland, the coast of West Africa, the Caucasus mountains, the jungles of Burma and Thailand, a hidden fortress in Japan, and aboard a fleet of submarines cruising the Pacific. Resistance fighters can infiltrate Martian-held territory to smuggle out slave workers and spy on the Martians. When Martian tripods and saucers go in search of rebels, the humans can fight to defend their refuges. They can explore ruined human cities haunted by bandits and Martian-spawned horrors in search of clues to a lost superweapon. And finally they can lead the oppressed Earthlings in a great revolt to overthrow the Martians and reclaim Earth.

Invaders From Earth

In an interplanetary conflict, it might well be the Earthmen invading Mars, instead of the other way around. Give the Earthlings laser guns and cheap interplanetary travel, and let good old-fashioned human pluck and adaptability trump Martian discipline and advanced science. Earth invaders can come in force, attacking Mars in the standard manner. (For an odd campaign, try running heroic Martians caught up in an Earthling invasion.) Or they can corrupt Martian society with strange ideas about freedom, equality, and love.

Red Planet Revolution!

One convention of early pulp science fiction was humans voyaging to distant worlds in order to help the locals overthrow a tyrannical regime. Flash Gordon did it on Mongo, and a party of early Soviet cosmonauts did it in the indescribable silent movie *Aelita, Queen of Mars.* Often the humans don't set out to topple anyone's government, but if the rulers are hostile, the rebels are likely to be the only way to get home again.

Superscience Mars, with its all-controlling Science Lords and rigid castes, is a natural target for Earthlings devoted to spreading democracy (or Marxism, or Objectivism, or Phonics, or whatever). The downtrodden working castes and mutant gangs are the natural rebels, although many in the Planner caste might also support a bid to overthrow the upstart Scientifics. Martian soldiers would only get involved in a coup if the current system is too pacifist – in which case the Earthlings may not like the results of their revolution! Technicians on Mars tend to be loyalists, but in many cases their loyalty is to a specific project or plant rather than the whole system of government.

The Solar Federation

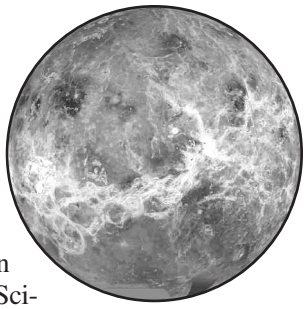
There's no reason Earthlings and Martians *have* to fight like rabid wolverines on first contact. The Science Lords of Mars are nothing if not pragmatic, and would be quick to see the advantages of peaceful cooperation (especially if the Earthlings look too tough to conquer). A Solar Federation of Mars and Earth would benefit both worlds – Mars could trade advanced manufactures and metals for agricultural goods. The two worlds could even collaborate on the settlement of other planets, or stand together to battle a common foe from beyond the Solar System.

A Solar Federation campaign would allow Earthling characters to serve as "exchange officers" aboard Martian saucers as they explore the methane seas of Titan, battle hostile energy creatures on Mercury, and excavate lost cities amid the rubble of the exploded Fifth Planet. If the Solar System seems too confining, perhaps a multi-species expedition could set out to explore the stars with an experimental warp drive.

Of course, political alliances don't always translate into interspecies friendship. Martian and Earthling members of a joint crew may have very different agendas, and when something goes wrong far from home, knowing who to trust becomes a matter of survival. A mixed settlement on Ganymede or Triton could become a powder keg of racial tension, which makes a deadly distraction if the Plutonian ice-men are secretly plotting against the colony.

Even in the most oppressive system, it takes some persuading to get the underdogs to rebel. A bunch of weird-looking aliens from Earth ranting gibberish about "individual freedom" isn't going to win over the Martian workers right away. A practical demonstration that it is possible to defeat the Science Lords and outwit the Mind Police is needed. The Earthlings must win a few victories on their own before the Martians begin joining their side.

A Martian revolution isn't just a matter of raising the banner and storming the citadel of the Science Lords. The Martian military has tripods, saucers, and no reluctance to fire on unruly mobs. The Mind Police can detect disloyal thoughts before a rebellion can even get started, and the Science Lords themselves are all highly intelligent and have their own monsters and superweapons. Earthlings attempting to stir up rebellion on Mars must find a way to neutralize the regime's supporters – get the Mind Police hunting traitors in the Technician caste, say, or convince the Science Lords that the army is planning a coup. Terran superheroes or Martian mutants with super-powers may be able to offset the psionics of the Mind Police and the weird science devices of the Science Lords, or a suitably brilliant Earthling scientist could whip up some counter-measures. Only then is it time for the workers to rise up.



Rival Planets

In a pulp-style campaign set among the worlds of the Solar System, the Martians make good "Cold War in Space" villains. Assume Earth and Mars are roughly matched in scientific knowledge and military power. The Science Lords of Mars aren't going to start any fights they might lose, so the two worlds maintain an uneasy peace. But Martian operatives are at work among the less civilized planets, trying to gain more resources and allies to enable the Red Planet to dominate space.

There are several ways to play this. If Earth and Mars really are evenly matched, then every cliche of Cold War spy thrillers and adventure stories can be played out among the jungles of Venus and the rings of Saturn. If Mars is more powerful and well-established, then Earthlings can be the pesky upstarts trying to crack the Martian stranglehold on the Solar System. That situation can even be reversed, as Earth's stalwart spacers preserve the Terran empire against Martian interlopers.

No matter what the situation, a "peaceful" rivalry between Earth and Mars means lots of espionage, proxy wars on other planets, covert operations and counter-operations, and attempts to score propaganda points. Earthling characters may be crack United Nations operatives engaged in the endless chess game against the Martians, or they could be scientists or traders caught up in the shadow war of the worlds.

The Martian Campaign

For a very unconventional campaign, players can create Martian characters and run an all-Martian campaign set in the domed cities and flying saucers of the Red Planet. The tone of a Mars-based campaign is unlikely to be very serious, and GMs can take advantage of abundant opportunities for satire.

. . . And Kill Them

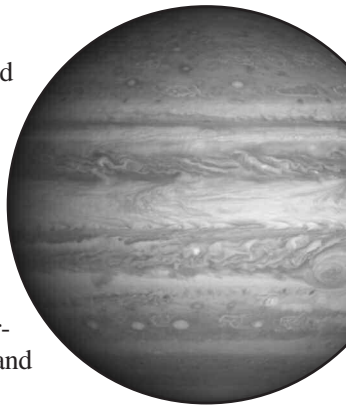
The Martian armed forces offer excellent adventuring possibilities. Characters can be members of the Martian Saucer Fleet or the Tripod Expeditionary Force, serving Mars by vaporizing Earthlings. A standard Attack Saucer crew of six is about the right size for a gaming group, or the PCs can be aboard a larger Assault Saucer and play its heroic Tripod Troopers.

The primary mission of the Saucer Fleet is military. Brave and obedient Martians strike at the spaceships or cities of the upstart Terrans, or else try to carve out a new home for the species among the barbarians of Venus. Martians may also find themselves in conflict with invaders from beyond the Solar System. If the Earthlings are too powerful for an interplanetary war of conquest, Saucer Fleet crews may go on covert missions to Earth or Venus, trying to learn about the enemy and weaken alien defenses.

For a completely comic "reverse ***Atomic Horror***" campaign, Martians equipped with the latest in rubber flesh disguises could be inserted as spies to study the Earthlings of 1950s America. There they must avoid being arrested as Commie agents, survive the hazards of suburban life, and penetrate the mysteries of this thing called "rock and roll."

Science Lords Are Your Friends

If zapping Earthlings isn't entertaining enough, Martians can also zap each other. Take the campaign down into the overcrowded warrens of the Martian cities, give the PCs ray guns and conflicting agendas, and let them try to survive and gain status in a world of telepathic secret police and tyrannical mad scientists. A group of Martian characters willing to bend the rules of their regimented society may go far with the right patrons – or wind up in the protein vats if they overreach themselves. Trust no one, and keep your ray-gun handy.



Other GURPS Settings

GURPS Alternate Earths

Just about any alternate world can be livened up by the arrival of a bunch of heavily-armed Martians. The world of Gernsback in ***GURPS Alternate Earths*** (p. 107) makes a perfect complement for Superscience Mars, with inventive Terran devotees of Weird Science matching their wits against the Science Lords of Mars. Superscience Mars could even serve as a "dreadful warning" for Gernsback, showing the potential for evil in a society completely devoted to the pursuit of Science.

Aeolus, in ***GURPS Alternate Earths 2*** (p. 90), has a similarly pulpy feel to it, and it would take something as dreadful as a Martian invasion to unite that world's factions. Daring Aeolus pilots can pit their retrotech jet fighters against a Martian scouting party in Central Europe, while American Puritan traders might uncover the alien advance guard in some remote corner of Asia or the South Pacific.

GURPS Atomic Horror

This is the primary Terran sourcebook for use with a Superscience Mars. The Martians may drop out of the sky to ravage a defenseless Earth until a band of two-fisted adventurers and pipe-smoking scientists can develop a weapon to defeat them. To soften up the Earthlings for invasion, the Martians might seed the planet with a variety of giant monsters bred in the laboratories of the Science Lords. Or they might try a more subtle form of conquest, using their psionic powers to control human minds and take over small towns before the main invasion begins.

Contact can go in the other direction, of course. Scientific pioneers from Earth testing an atomic spaceship might find themselves on Superscience Mars, battling mutant gangs, trying to evade the Mind Police, and perhaps inspiring the downtrodden masses to overthrow their collectivist overlords. Earthmen visiting Venus or the moons of Jupiter may run afoul of Martian plots there, setting the stage for an interplanetary Cold War between the brave defenders of democracy and the sinister legions of the Red Planet.

GURPS Autoduel

The Autoduel world of the 2030s is certainly ripe for invasion. The Science Lords may have developed the grain blight as a way to destabilize Earth's governments before launching the Saucer Fleet. Car warriors in some remote corner of the American southwest may find themselves the first line of defense when the saucers come down. After the invasion is complete and the Earth is under the heel of the Martians, brave drivers in fast, heavily-armed cars could serve as the backbone of the human resistance movement. It's hot-rods vs. tripods out on the highway as Road Warriors pit themselves against the cream of the Martian Soldier caste.

GURPS Ogre

In an all-out interplanetary war, the Earthlings are certain to deploy their mightiest weapons against the Martian menace, and what could be mightier than an Ogre Mark V? Giant cybertanks like the Ogres would be more than a match for even an army of Martian tripods, but the Martians could build their own "Atomic Robot Super-Tanks" soon enough. Instead of waging self-destructive global wars among Terran superpowers, Ogres, GEV jockeys and battlesuit troopers can battle the Martians in an all-out invasion of Earth. Give the Martians the advantage of a devastating surprise first strike so that Earth's defenders are scattered and poorly supplied, then let the shooting begin!

GURPS Supers

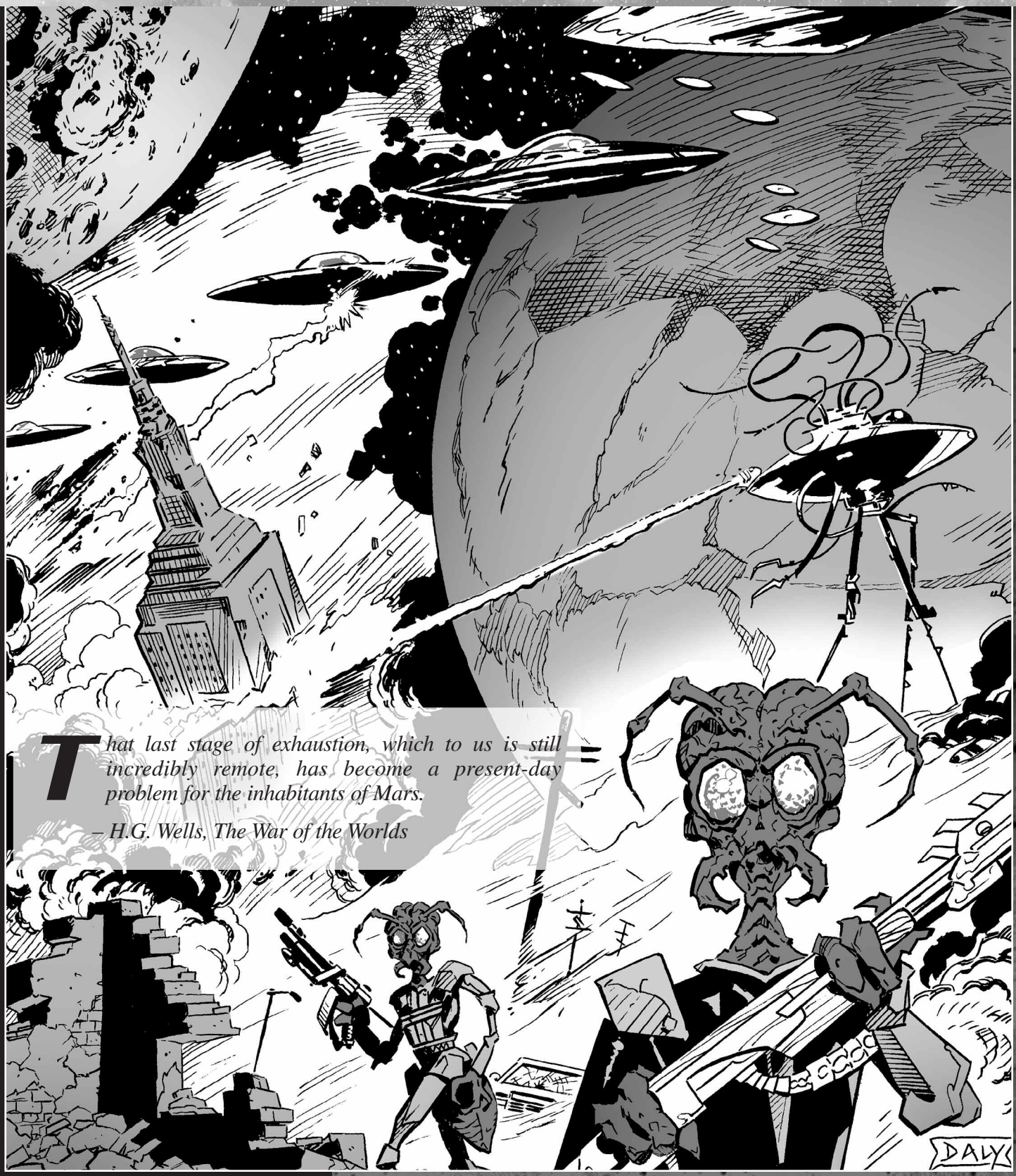
In a Golden Age supers campaign, Martians can be the primary alien menace, forever seeking to conquer Earth and forever thwarted by a few brave souls in tights. Alternately, a Martian mutant with superpowers might flee Mars to seek freedom on Earth, only to wind up fighting crime and supervillains (like the Justice League's J'onn J'onnz, the Manhunter From Mars). Even an ordinary Martian trooper's combat suit and ray-gun are powerful enough to make him a superhero on Earth in the 1940s. The Science Lords of Mars could even be patrons to a group of superheroes dedicated to guarding the Solar System from various evils.

GURPS Y2K

It's hard to find a better way to end The World As We Know It than an alien invasion. The Martians can come down and destroy civilization, but it's a *limited* destruction, without all that pesky radioactive fallout or nuclear winter. Cities are either left in ruins or taken over by the new overlords, while the countryside just teems with survivalists and resistance fighters. ***GURPS Y2K*** has plenty of useful information on post-disaster societies and survival, perfect for use in an Earth Under the Martians campaign.

DYING MARS

CHAPTER 7



That last stage of exhaustion, which to us is still incredibly remote, has become a present-day problem for the inhabitants of Mars.

– H.G. Wells, The War of the Worlds

Dying Mars is either a far-future terraformed Mars or an alternate version of the planet which evolved intelligent life. But now the world is dying, becoming too cold and dry to support life. Much of the surface is now desert, and only the efforts of the inhabitants keep it habitable. As their world declines, the Martians increasingly take a fatalistic view and abandon the struggle. Though they live surrounded by relics of advanced science and depend on the canal system for survival, the Martians have forgotten most of their knowledge and are slowly drifting into decadence and savagery. Perhaps contact with another civilization might restore hope and inspire the Martians to fight for their world.

This is a world inspired by the Mars of Burroughs, Brackett, and Bradbury – an exotic place of relic superscience, swordplay, tyrannical rulers, daring desert pirates, and shimmering canal-side cities. Romance and adventure trump scientific realism here. Players can either take the roles of visiting Earthmen, struggling to survive and learn about this strange world, or they can play adventurous Martians seeking their fortunes in the harsh deserts and decadent towns.

The Landscape

The geography of Dying Mars is essentially that of the real planet, taking into effect millions of years of Earthlike climate. The northern lowlands were once ocean; the southern highlands were rugged country crossed by great rivers. Today all that is gone. The southern highlands of Dying Mars were abandoned thousands of years ago, and have reverted to nearly lifeless desert. Most of the highlands are stony badlands, with sand-choked valleys between bare rock hills. The only exceptions are the large basins of Argyre and Hellas. Argyre is a sandy wasteland, but Hellas is still fed by the canal system and remains green and fertile.

In the north, the ocean has retreated, leaving smooth plains in the lowlands. Most of the northern plains are dry steppe, though where the canals or rivers supply water, cultivation is possible. The lowest parts of the northern plains are lakes surrounded by salt marshes. A few of the old rivers still flow in the Marineris and nearby valley systems, but most depend on water pumped south along the canals.

The frozen polar regions are advancing as Dying Mars cools, and the tundra around them now extends as far south as 45° latitude – the old coastline of the Boreal Ocean. Only in the narrow band between the advancing northern cold and the edge of the dry south is civilization still able to thrive.

The Climate

Dying Mars is getting colder and dryer with each passing year, but there are still comfortable regions. Currently the equatorial regions have a uniformly mild, dry climate not unlike the Mediterranean or California – daily temperatures between 75° and 80° Fahrenheit, and infrequent rain.

In the northern lowlands, the climate is colder but still tolerable, about like central Asia on Earth: brief hot summers, long cold winters. Northern mountain regions and the southern highlands are bleaker still, approximating high-altitude desert climates on Earth like Mongolia or Utah. Even in summertime the nights can dip down to freezing, and the winters have howling cold dust storms in place of Earth's blizzards.

How a Planet Dies

Planets are huge masses of metal and rock, and as such neither live nor die. But they do age. As a planet's interior cools, there is less volcanic activity. This means no release of volatiles into the atmosphere. Meanwhile, the Sun still heats the planet's atmosphere, and ultraviolet radiation splits complex molecules into basic elements. When the gases of the atmosphere are heated, a few molecules reach escape velocity and boil off into space. The amounts are tiny, but the process never stops. Over time, all the lighter elements can simply evaporate if the planet doesn't have enough gravity to hold on to them. That's what happened to the primordial Martian atmosphere, and it would happen to a terraformed Mars over the course of several million years.

As the atmosphere gets thinner, the temperature on the surface drops. Water gets locked up in the polar caps or in permafrost again. The cooling slows down the rate of atmosphere loss, but can't stop it. Life on the surface has to endure progressively dryer and colder conditions, as well as more radiation. Once the temperature drops below freezing over most of the surface, water becomes unavailable and plants gradually die off. The oxygen content of the atmosphere begins to drop with no plants to renew it.

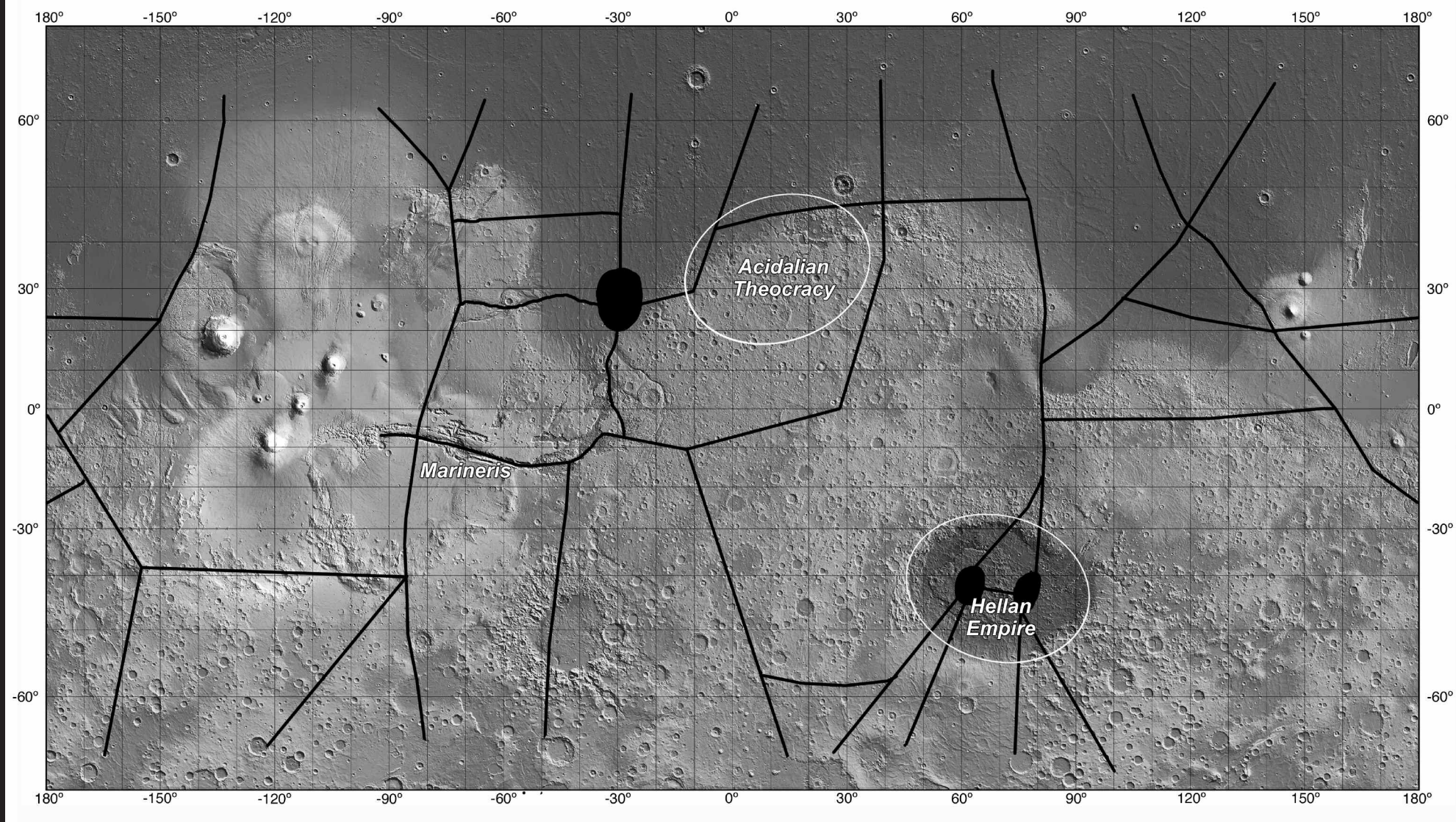
Dying Mars is still millions of years away from that fate, but its days as a life-bearing planet are certainly numbered. The GM can fine-tune exactly how long Mars has left to suit the demands of the campaign. A pure adventure game of swords and rayguns could have hundreds of thousands of years left before conditions get really severe, while a Science Priest campaign centered on saving the planet might have only centuries remaining.

The Past – or the Future?

Dying Mars can either be an alternate Mars like the world presented in Chapter 6, or it can be a glimpse of the very far future. The Martians may be the remote descendants of humanity, living on a terraformed planet slowly reverting to its prehuman state. If Dying Mars is a terraformed planet, then its gravity should match the "realistic" value. Otherwise, use the denser, habitable planet of Superscience Mars for physical parameters.

Of course, if Dying Mars is a far-future terraformed world, its decline into decadence raises the question of what's going on back on Earth. Obviously the rest of humanity must be unable (or unwilling) to help the Martians restore their planet. Perhaps Earth has likewise declined into barbarism – or perhaps the Earthlings have advanced to some "higher form" and no longer concern themselves with mere physical reality. Or maybe some disaster has made humanity extinct on Earth. The possibilities are endless, and it's up to an intrepid party of Martians with a relic-tech spaceship to find out the truth.

Canals and Territories of Dying Mars



The polar regions begin at about 45° latitude north and south, and range from tundra to bleak icecap. It does snow – a little – in the polar regions, just enough to feed the planetary water cycle. Some animals and nomadic Martians live in the tundra, but the poles themselves are virtually lifeless.

The Canals

To keep the vital water from getting locked up in the polar icecaps, the First Race completed a vast engineering project thousands of years ago. Surrounding the north and south polar caps are geothermal taps dug deep into the planet's mantle. Pumps circulate water to the planet's interior, where it is heated and gushes to the surface. There it melts more ice, and the pooled water runs toward the equator along titanic aqueducts. Most of the waterways are simple gravity-powered flumes, taking the water into the northern lowlands or the Hellas basin. A few more ambitious canals have pumping stations to get water into the Tharsis region and parts of the southern hemisphere.

Each canal is surrounded by a belt of lush (for Mars) vegetation, and these darker strips can be seen from Earth, proof that Mars is home to intelligent life. Whenever possible the canals run straight, to avoid energy loss on curves, which would require pumps to keep the water going. A few canals feed into ancient river systems, like the Marineris and others.

Time has not been kind to the canal network. Once it irrigated the entire surface, and if the Martians had been as dedicated to upkeep as they were to construction, the whole planet might be much more habitable today. But the effort of building the canals seems to have taken something out of the Martians, and with each century more of the canals get silted up and stop flowing, more of the pumping stations die for lack of maintenance, and more of the planet goes dry.

The Science Priests are the only Martians still struggling to maintain the canal network, as part of their mandate to preserve all ancient Martian knowledge. Even they can't do any kind of systematic upkeep, but from time to time parties of Science Priest technicians will undertake a sacred pilgrimage to restore a pumping station or repair an aqueduct. They constantly badger rulers of Martian kingdoms to help keep the canals dredged, but the priests have little influence among the uplander nomads, who couldn't spare the labor to dredge the canals in their lands even if they wanted to.

Inhabitants

The ancient Martian species has fragmented into five highly divergent sub-races. It is possible that ancient Martian genetic tinkering or selective breeding programs may be partly responsible for the variation among the races.

Martians are basically humanoid, appearing as delicate-looking people with large round heads, barrel chests, and large eyes. All races but the Sand Martians have six fingers on each hand. Like Earth humans, Martians are mammals, and Martian women nurse their young (interestingly, male Martians have no nipples). Their blood is iron-based, but has a much higher oxygen-carrying capacity than that of humans; instead of bright red it is nearly purple or maroon in color.

In addition to the major races, there may be pockets inhabited by minor variant races or hybrid communities. The Swamp Martians inhabiting the salt marshes of Chryse are one minor race, and the seldom-seen Ice Martians of the north pole may be another.

The First Race

The First Race are the most ancient and handsome of the Martian races, considered by themselves and others to be the apex of evolution on Mars. They are the product of genetic engineering and eugenic breeding to create perfect, nearly immortal Martians. However, the First Race are few in number and slowly declining. They are tall (over 7 feet on average), graceful humanoids with large heads and golden skin and eyes, idealized versions of the ancestral Martian species. Both by nature and through advanced medical treatments, members of the First Race can live to incredible ages: some individuals are more than a thousand Martian years old. As the nearly immortal scions of an ancient and powerful civilization, the First Race tend to be languid and decadent, devoting their long lives to pleasure and petty intrigues. Some First Race Martians live in lowland cities as the ruling class, while others have withdrawn to remote redoubts to study ancient science.

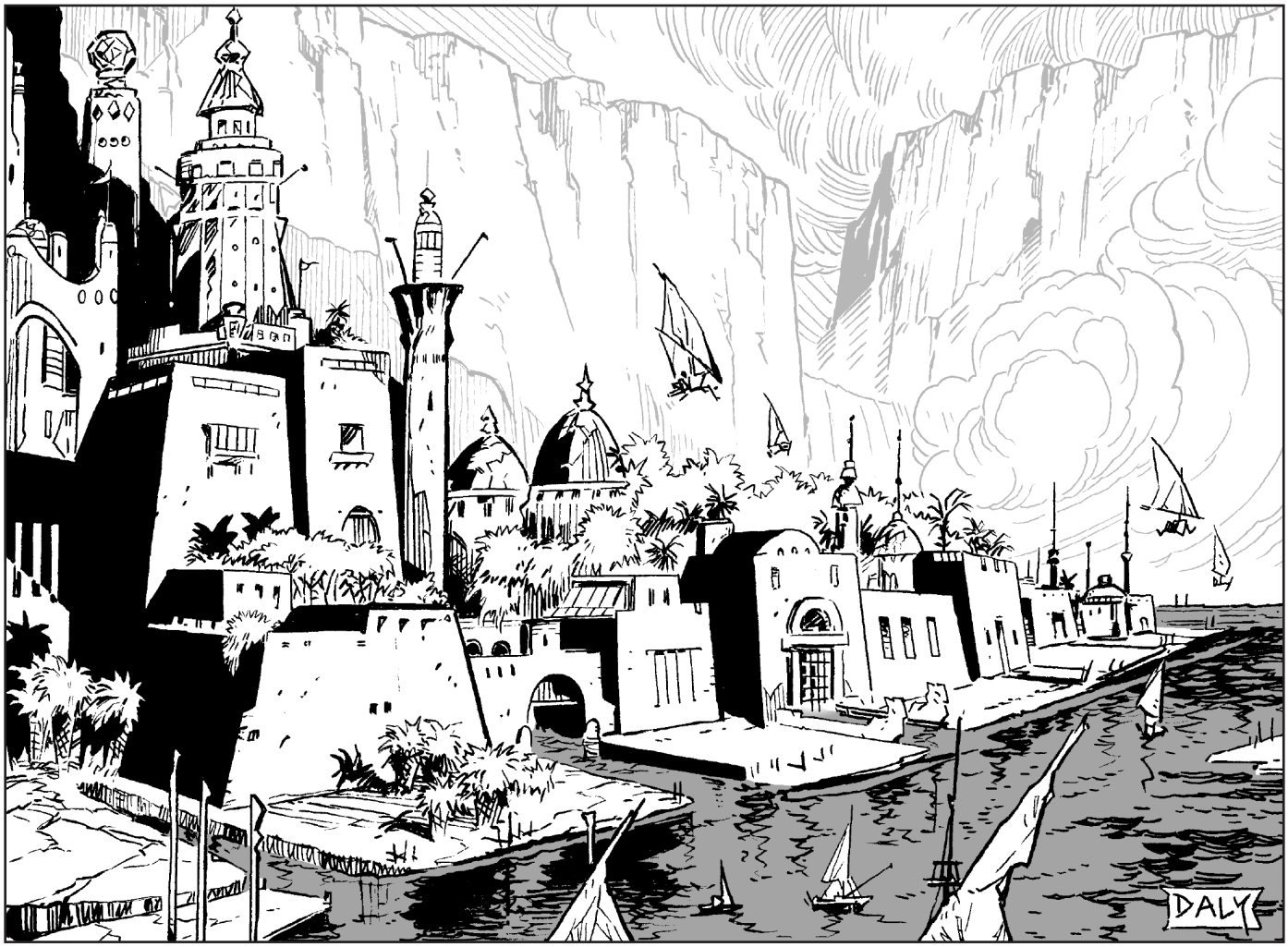
Martians of the First Race have a base racial ST 8 [-15], IQ 11 [10]; the advantages Attractive [5], Immunity to Disease [10], Sanctity [5], Status 2 [10], and Unaging [15]; and the disadvantages Dying Race [-10], and Laziness [-10]. Most have a few levels of Wealth and Allies in the form of faithful retainers. It costs 20 points to be a Martian of the First Race.

Lowland Martians

Lowland Martians are similar to their First Race ancestors, though they are a little shorter and stockier in build, standing only 6'6" to 6'9" tall, and have darker, bronze-hued skin. Lowlanders are the most numerous race on Mars, but across much of the planet they are subject to more warlike peoples. Lowlanders inhabit the northern lowlands, the Hellas basin, and the Marineris valley, though small colonies of them can be found in every city on the planet. They tend to be patient, peaceful, and pleasure-loving. Lowlanders usually live in large extended families, and can often count their relatives as an Ally Group; however, a Lowlander who leaves his family to go off adventuring with a bunch of dubious companions may find they no longer accept him at home. Lowland Martians have racial ST 8 and are worth -15 points.

Upland Martians

The people of the highlands are the most physically powerful of the Martian races, with reddish-brown skin and pale silvery hair which they wear long. Uplanders are as tall as the First Race, standing over 7 feet, and unlike their ancestors give no impression of being fragile. They live in nomadic bands all across the southern highlands, and can be found in the Tharsis mountains and Elysium as well. Individual Uplander merchants or mercenaries are not uncommon in lowland cities. In the high desert and badlands the Uplanders live as herders and hunters, but periodically a large tribe will sweep down into the old sea-beds and carve out an empire. Consequently many lowland aristocrats are of Uplander stock.



Most Uplander bands practice strict separation of the sexes; children are raised by their mothers until they are 5 Martian years old, and then boys join the males, who live apart. Adult couples pair off at night, but all men are the "husbands" of all the women. Uplander women who want more independence sometimes disguise themselves and go to live among the Lowlanders. Uplanders have ST 9 [-10], HT 11 [10]; the advantage Fit [5] and the disadvantages Code of Honor (Pirate's) [-5], Semi-Literacy [-5]; and the racial quirk Proud [-1]. It costs -6 points to play an Upland Martian.

Cave Martians

The Cave Martians live in the vast cavern system north of the Valles Marineris, and are adapted for life underground. They are very short for Martians – no more than 4 feet in height – and have huge light-sensitive eyes allowing them to see in anything but complete darkness. Their skin is a very dark purple, almost black, making them nearly invisible in their cave homes. Cave Martians are entirely hairless. Despite their small size, Cave Martians are aggressive and warlike, launching raids on surface settlements for loot and slaves. They have preserved much of the ancient technology and scientific knowledge, though they have little interest in learning for its own sake. The marriage habits of the Cave Martians are very loose: anyone can marry anyone else, regardless of other spouses, gender, or age. The kicker is that divorce is not allowed, and so once married, an individual has a responsibility to protect and support a spouse forever. This knits each Cave Martian into a bewildering web of alliances with in-laws, co-spouses, and children. (Some Cave Martians evade this by taking concubines or lovers of other races who don't know the custom.) Cave Martians have ST 7 [-20], DX 11 [10], and Night Vision [10]. It costs 0 points to be a Cave Martian.

Sand Martians

The Sand Martians are perhaps the most alien of the Martian races, with bodies specialized to survive in the harsh deserts. Their skin is exactly the reddish-brown of the Martian desert sand, and their golden eyes are protected by a nictating membrane. Their hands are adapted for digging and fighting, with the fingers fused into three fearsome-looking claws. Sand Martians live alone or in small troops in the desert, usually hiding under the sand or in caves during the day and venturing out at night to forage and hunt. The mating habits of Sand Martians are obscure.

Sand Martian characters have ST 8 [-15], DX 11 [10], HT 12 [20]; the advantages Nictating Membrane-1 [10], Night Vision [10], Talons [40]; the disadvantages Illiteracy [-10], Primitive (3 levels) [-15], Reduced Manual Dexterity -2 [-6], and Uneducated [-5]; they have Survival (Martian deserts) at IQ [2]. It costs 41 points to be a Sand Martian, but in campaigns centered in the lowlands they get a Social Stigma worth -15.

Hybrids

Inevitably, some members of different Martian races have children together. Some such pairings are fertile, others produce sterile "mules," and some produce no offspring at all. The First Race can interbreed with all other subraces (although only a particularly twisted or decadent First Race member would take a Sand Martian for a lover). Lowland Martians can crossbreed with Upland Martians and Cave Martians normally, but have only mules with Sand Martians. Upland Martians produce mules with Cave Martians and Sand Martians, and Cave Martian-Sand Martian unions cannot produce offspring at all.

The role of hybrids in society varies, depending on the nature of the hybrid and the location. Most First Race hybrids wind up in the nobility, and their mixed ancestry is only considered a mark of distinction. Lowlander-Uplander hybrids are probably the most common type of all, and generally suffer no stigma. Cave Martian crosses with Lowlanders or Uplanders often are uncomfortable outside the Underground Empire, and wind up serving as mercenaries or overseers in the caverns. A few who achieve wealth or distinction can manage to marry back into a pure Cave Martian clan. Sand Martian hybrids are considered eerie and unusual everywhere. Among Uplanders they are thought to be favored by the spirits of the desert and often serve as priests or oracles; in other cultures they are simply freaks.

Cities and Kingdoms

Dying Mars is still home to a variety of states and cultures, and it would take an encyclopedia to catalog them all. Some of the more prominent are the rich Marineris valley cities, the aggressive Acidalia Theocracy, and the remote Hellan Empire.

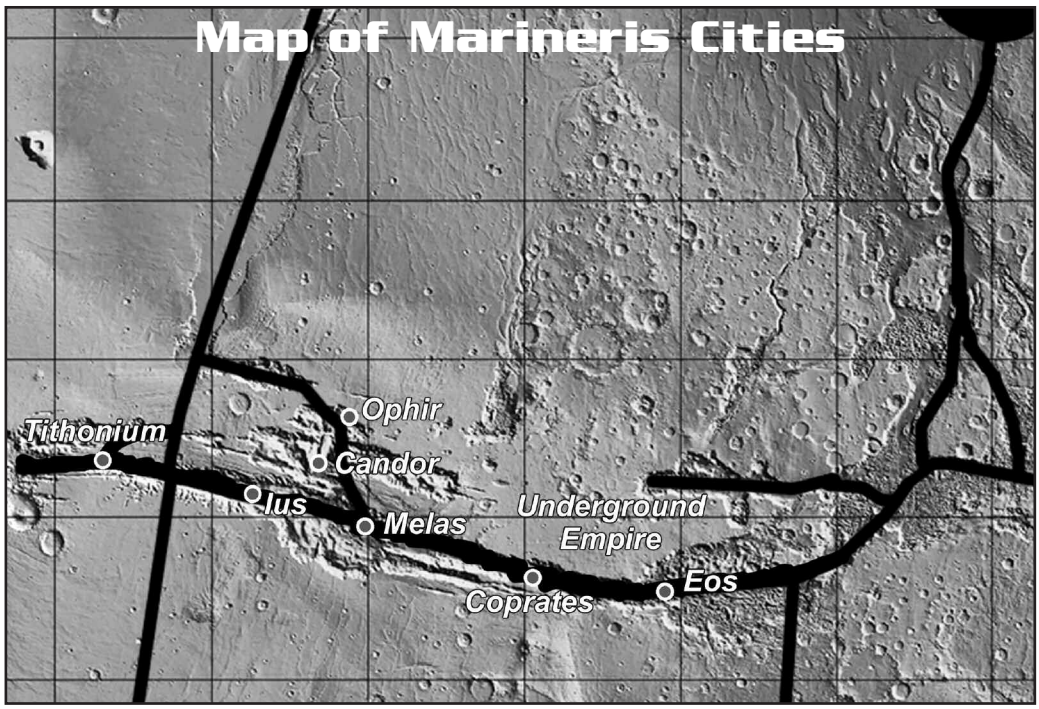
The Marineris Cities

The cradle of Martian civilization, the city-states of the Valles Marineris are still among the richest and most cultured societies on Mars. Each city is surrounded by tracts of farmland, irrigated by a system of canals and dikes. The greatest cities of Marineris are (from west to east) Tithonium, Ius, Candor, Ophir, Melas, Coprates, and Eos.

Tithonium guards the western approaches to the Valles Marineris, and is the smallest and poorest of the great cities. Tithonium has a seasoned army and strong fortifications, and this combined with its relative poverty often leads the Warlords of Tithonium to attempt military adventures against Ius or Candor. Tithonium's hinterland is the wooded valley of Tithonium Chasma, and the city's chief sources of income are timber and the caravan trade to Tharsis. The entire province has a population of about 400,000 people, of whom 100,000 live within the walls of Tithonium.

Ius stands on a ridge in the center of the narrow Ius Chasma, where the waters of the Marineris River run swift. It is chiefly a center of crafts and industry – the river provides water power for textile spinning and triphammers, the gorges feeding into the valley still yield usable deposits of minerals, and wood from Tithonium is available for fuel. Consequently, Ius is much gloomier and dirtier than the cities downstream, its smoke-stained buildings crowded on steep hillsides and its narrow streets deep in filth. The city and its tributary towns have a total population of 600,000, half in Ius itself. Though Ius has a hereditary First Race Overlord, he is ancient and senile and leaves government to the Patrician Council, which is dominated by commercial interests.

Candor is built in the broad and fertile Candor Chasma, and is the second-biggest and second-richest city in the valley. It is certainly the most beautiful: canals fed by the river flow between tall towers of glass brick and white tile, and gardens bloom everywhere. Amid all this beauty Candor's rulers are cruel and despotic. For centuries the Shadkar dynasty of First Race Martians have held the Overlordship, and by now are terribly decadent and depraved. The current Overlord, Nomac XI, is a connoisseur of beauty, and his collection includes half a dozen of the loveliest women on Mars carefully preserved in jars of alcohol. Candor has a population of 400,000, and the surrounding province has a total of 1 million inhabitants.



Ophir stands at the entrance to the fertile Ophir Chasma, and exercises loose control over Hebes Chasma. It is a trading city, where the caravans from the north meet barges coming up the river and canal system. The population of Ophir itself is 350,000, with an equal number living in tributary towns. Ophir is ruled by a hereditary Warlord from an ambitious dynasty of Lowlanders, and the city's soldiers see a lot of action against upland bandits, Cave Martian raiders, and Candor's legions.

Melas is the greatest and richest city in the valley, and several times in its history it has ruled over great empires. It stands at the meeting place of the Coprates and Marineris rivers, and controls the wide central part of the Valles Marineris. Melas itself holds a million people, and rules over close to 1,500,000 more people in the fertile lowlands. The government of Melas is highly unstable. When the last of the hereditary First Race Emperors died four (Martian) years ago, several contending factions tried to seize power. The priests had the support of the poorer citizens, the great nobles hired mercenaries, and the army was split between two generals claiming the Imperial throne. In the end, an Upland-born mercenary commander named Detericon outmaneuvered the other forces on the battlefield and betrayed his noble employer to seize the crown himself. So far Detericon's skills at intrigue and treachery have kept him in power, but he has many enemies. Recent rumors of a surviving heir to the old line have him very worried.

Coprates stands at a narrow point in the lower Marineris valley, and the city's massive fortifications form a barrier across the entire chasm. It is a compact city built on a radial plan, with 300,000 people in Coprates and another half million along the river. Coprates has a great deal of contact with the underground empire of the Cave Martians, and is the chief point of entry into that black domain. The Sovereign of Coprates is the young and beautiful Queen Tealia, a First Race-Lowlander hybrid who is struggling to eliminate corruption and improve conditions in her realm, against the opposition of Cave Martian agents and the conservative priesthood.

Eos is nearly as large as Candor, and sits in the fertile plain where the Valles Marineris opens out before turning northward. It is a very rich city, as it controls large agricultural territories and important trade routes. The Sovereign of Eos is King Iolus, a good-hearted but lazy young Lowland Martian who leaves most of the affairs of government to his vizier, the devious Lord Uleric. Iolus and his neighbor Queen Tealia are strongly attracted to each other, but Uleric and the priests of Coprates are determined to keep them from marrying, as it would only strengthen the royal couple against their advisors.

The Underground Empire

North of the Valles Marineris, in the caverns that honeycomb the Ophir and Aurorae highlands, is the Underground Empire of the Cave Martians.

Food for the empire comes from fungus-farms, blind fish of the underground lakes, and tribute from the surface-dweller communities in Juventae and Ganges Chasma. The Cave Martians do a good deal of trading, as well, moving goods between the Marineris valley and the Kasei region to the north aboard barges which sail the underground rivers.

When they don't trade for things, the Cave Martians go raiding. Any surface-dweller traveling above their empire's tunnels without permission is fair game, and crews of Cave Martians or hybrids sometimes venture out onto the waters of Lake Marineris or the Aureum swamps aboard swift galleys to snatch merchant ships by night. This has the added benefit of encouraging merchants to send their goods safely through Cave Martian tunnels.

The Cave Martians themselves make up less than a third of the empire's 1 million inhabitants. The rest are slaves. The birth rate among the slaves is low, so that the Cave Martians must constantly buy or capture new ones on the surface. The slave market in Candor is their biggest source.

Cave Martian technology is mostly late TL4, but they do have some working TL5 machines. A lack of fuel keeps them from making much use of steam power, but the Cave Martians do have a fondness for elaborate clockwork gadgets. They also actively seek out advanced relic technology, and have made good progress studying some of the operating principles of high-tech items.

Government in the Underground Empire is an oligarchy of important nobles and their extended families by marriage, who maintain private armies and divide up trade routes and industrial operations through politics, skullduggery, and occasional civil wars waged in the caves and tunnels. The six largest noble houses have a combined military strength of 5,000 Cave Martian troops; for wars waged against surface-dwellers they usually hire an equal number of mercenaries from the Tharsis mountains or the deserts of Solis Planum.

Ruins and Lost Cities

Martian civilization has moved from the uplands down into the old seabeds over thousands of years, and many once-great cities now stand at the edge of the desert, abandoned and buried by sand. Most old cities stand along the escarpments of the old seashore, or else in the dry river valleys of the uplands.

Despite legends of vast treasures, the ruined cities have been pretty thoroughly gone over by scavengers. Any treasures that remain are either very well-hidden, or else protected by lethal deathtraps or dangerous creatures. (And no doubt lie in the center of a labyrinth of ten-foot-wide corridors.) Often the treasures hidden in lost cities is not a hoard of gold or gems but ancient technology or books of scientific lore.

A good many "abandoned" cities are not completely empty yet. Where the canals have dried up there may be a few wells still capable of supporting a tiny settlement amid the ruins of a great city. Bandits and raiders sometimes make their lairs in abandoned places, as they are usually close to trade routes and offer good shelter and protection. Some of the rumors of ghosts and monsters haunting the ruins may be spread by bandits to keep away meddling outsiders.

The Acidalian Theocracy

The eastern half of the fertile Acidalia region is controlled by an empire of priests who suppress all signs of heresy or dissent. The Theocracy extends as far north as the Acidalian Gulf and the icebound remnants of the Boreal Sea. On the south it extends down to the fiercely independent kingdoms beside Lake Chryse. Its western border is the channel of the Chryse River. On the east it controls the Cydonia uplands as far as Mamers Vallis.

The largest city in the Theocracy is the great metropolis of Acidalia itself, where the Chryse River empties into the Acidalian Gulf. But the center of government and religion is the sacred city of Cydonia, located at the edge of the eastern highlands. The great Face of God and the ancient pyramids are just outside the city, and no outsiders may visit the region without permission.

Everyone in the Theocracy worships in the Temple of the Divine Visage, adoring God in the form of the stern and inscrutable Face. The religion of the Temple is gloomy and fatalistic, teaching that it is Martian sin which is causing the gradual death of the world, but that the virtuous will be taken to a better world after this one is gone. (An ongoing argument among the Temple's theologians is whether the better world is some sort of spiritual afterlife or the warm and water-rich Blue Star in the sky.) The corps of Inquisitors enforce orthodoxy; on the job they wear masks in the form of the Face of God and are considered to embody divine justice.

All government in the Theocracy, from the local level to the sovereign power, is in the hands of priests. In any town the chief priest of the local temple is also the lawgiver and administrator for the community. Priests rise through the hierarchy by demonstrating the right combination of piety, orthodoxy, administrative talent, and skill at political maneuvering. The exact mix varies depending on where one is in the empire, but in general piety is most important at the lower levels, talent can take one to the middle ranks, while ruthlessness tends to rise to the top. Orthodoxy (or at least the appearance of it) is vital at any level. Since none of the First Race follow the cult of the Divine Visage, the Theocracy is ruled entirely by Lowland Martians; only a few First Race scholars even remain within the borders.

At the very top of the Theocracy is the Archpriest, who presides over a council of high priests of the major urban temples and sacred sites. Strong Archpriests rule as autocrats, but under weak ones the council functions as an oligarchy. All appointments to the council or the Archpriesthood are for life. The current Archpriest is Lothayaal, a vigorous and active ruler who has the council firmly under his thumb. Lothayaal has big plans to extend the Theocracy's influence across the Chryse River to incorporate the entire Acidalia lowlands. His strategy emphasizes destabilizing the kingdoms of western Acidalia with missionaries and covert agents, so that the invading armies of the Theocracy will appear to be restoring order instead of conquering.

The Theocracy has 30 million inhabitants, of whom almost half a million are members of the priestly caste. All priests are male (because the Face appears to be that of a male divinity), but are allowed to marry. The children of priests usually become priests themselves, or go into the officer class of the army. It is unheard of for people born into the priestly caste to lower themselves to mere commerce. The Theocracy's army is relatively small, with just over 100,000 troops, but the Inquisitors and lay police under their control are almost as numerous, and the Theocracy can call upon more than 50,000 highland nomad fighters for offensive operations.

The Hellan Empire

Isolated among the southern highlands, the great Hellas basin is home to a powerful and rich empire. The Hellan Empire is ruled from the capital city, also named Hellas, which is located between the two lakes which hold the Empire's vital water reserves. The Empire occupies all the lowlands of the Hellas basin, and a line of fortresses in the Hellespontus mountains marks the western border. To the east, the Empire's rule extends into the highlands to incorporate the Harmakhis and Dao-Reuli river systems and the volcanic peak of Hadriatica Patera. Of course, a powerful state like Hellas has influence well beyond its formal borders. The tribes of the rugged Noachis country send a token tribute to Hellas (and, more importantly, furnish the bulk of the Empire's cavalry and scouts). The struggling kingdom of Tyrrhenia is allied with Hellas, and at times the Hellan ambassador there behaves as much like a colonial governor as an envoy to a sovereign power. To the east, the barbarians of Cimmeria alternate serving the Empire as mercenaries with raiding and pillaging the poorly-defended upland provinces. South of Hellas a chain of powerful forts guard the vital canals from the south polar cap.

Pirates of Mars

Though Martian seas are small, there are still pirates on the Red Planet. Martian pirates come in three varieties. Canal pirates cruise the rivers and canal system aboard innocent-looking flatboats, robbing other boats and isolated farmsteads. They depend on constant mobility and anonymity to avoid capture, which means they are merciless toward captives and do not hold prisoners for ransom.

Swamp pirates infest the wetlands of Aureum and Margaritifer Chaos and the reed-choked shallows of Lake Chryse. They strike by surprise and rely on the trackless wilderness of the swamps to prevent anyone from retaliating against them. Swamp pirates do take prisoners for ransom, and are active smugglers, so they cultivate good relations with the people of nearby towns and cities.

Desert pirates cruise the sandy basins of Solis Planum, Icaria, Argyre, and Isidis aboard swift sand-boats, and combine banditry against caravans and isolated settlements with legitimate trade and occasional mercenary service. They are by far the most honorable and romantic of the Martian pirates, if only because several nobles from Marineris and the Elysium lowlands have occasionally taken to sand-boat raiding, which gives the trade a bit of upper-class cachet.

Society in the Hellan Empire has been shaped by the country's isolation and the contrast between the fertile and civilized lowlands and the harsh uplands surrounding them. All Hellans, from the Emperor to the lowliest slave, know as a simple fact that their land is the richest and most civilized place on Mars, and everything beyond the borders is nothing but barbarian-infested desert. Foreigners are automatically viewed as savages. An outsider who cultivates Hellan manners and customs can win some grudging acceptance for at least *trying* to be civilized, but even that tolerance would be mixed with amused contempt.

The ruler of Hellas is Mephinellear II, who commands the life of the Empire from a tower of alabaster in the center of Hellas city. In the tower he is served by hundreds of slaves who never leave the building alive. Service to the Emperor is one way for talented individuals to rise above their hereditary station, but at the price of their freedom. The Imperial court consists of the extremely numerous Imperial clan, some other nobles related by marriage, and a few senior bureaucrats and military commanders. Internal politics at the Hellan court involves nobles and bureaucrats vying with each other for important or lucrative appointments. The Imperial regime itself has no opponents – few people in Hellas could even imagine a different ruling dynasty, let alone another form of government. The Imperial clan and most of the nobility are hybrids of the First Race and Upland Martians, but they have been inbreeding among themselves for so long that they almost constitute a separate race of their own.

The population of the Hellan Empire is 50 million, and the Emperor's army can boast 400 regiments of a thousand men each. This is a powerful force, but its strength is chiefly defensive, if only because there are few enemies within reach. Imperial troops man fortresses on the borders, garrison key cities to keep the lower orders under control, guard the canal routes from the south, and occasionally help allies like Tyrrhenia against internal or external foes.

Nomads of the Desert

In the southern highlands of Mars, nomad bands of Upland Martians are the most common form of social organization. The land is too cold and dry to support fixed agricultural communities, even along the canals. Instead, bands of herders follow their animals with the seasons. In winter most nomads cluster in settlements or oases near the equator, then travel south with the spring to the edges of the South Polar cap. At the end of summer they reverse the process and begin the long trek north with the coming of frost.

Nomads depend on their animals. They do a little gathering of edible plants, but the bulk of their food supply comes from herds of shaggy grazing lizards called Shoans. Nomads eat Shoan flesh and eggs, drink Shoan blood, wear Shoan wool and skins, make spears of Shoan bone tipped with Shoan teeth, and heat their tents with burning Shoan dung. Some tribes follow the herds on foot, but the majority of nomads have wagons drawn by teams of Shoans or riding-lizards.

Life among the Uplander nomads is harsh and violent. Tribe members must be able to keep up with the migration; anyone who cannot travel is left to die. Nearly all adults must be warriors, since a raid by another tribe could take away all the band's Shoans and doom them to starvation. Almost as important as actual fighting ability is a warrior's reputation for ferocity and implacable vengeance: nomads must avenge all wrongs or insults (real or imaginary), for to do otherwise might tempt enemies to attack.

Most nomad bands are no bigger than 100 adults and 30 children, traveling in 30 to 40 wagons with a herd of some 200 Shoans. Leadership is usually exercised by the most accomplished warrior, though some tribes insist on strict seniority and a few make rulership hereditary. In Cimmeria and Sirenum the tribes are grouped into confederations, and sometimes a single "Chief of Chiefs" can unite all the nomad bands into a formidable army. The total population of the Uplander nomads is just over a quarter of a million, but since all adult males of the tribes are skilled warriors, they are the equal of populous states like Hellas or the Marineris cities.

Swords and Superscience

The technology level of Dying Mars is generally TL4 in the lowlands, TL3 in the uplands, and TL0 among the enigmatic Sand Martians. There are enclaves of higher technology, usually "relic tech" which cannot be manufactured. The Cave Martians can build some TL5 gear, and show a great fondness for weird "steampunk" style gadgetry. The First Race has access to astoundingly advanced equipment – TL13 or higher – but cannot manufacture anything beyond TL8 or so. Some First Race devices, like air-boats or heat-beams, are sufficiently common and rugged that all Martians treat them as familiar technology and get no tech level penalty when using them.

Ancient Wonders

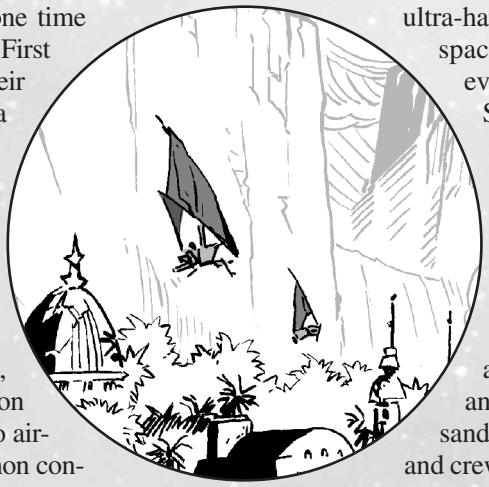
The biggest and most obvious ancient technological wonder is the canal system itself. For thousands of years the canals have carried vital water away from the poles each spring, bringing life to the dry equatorial regions.

Other relic technology falls into two categories: useful personal items and huge incomprehensible machines. Relic personal equipment is generally quite valuable, and includes things like energy weapons, force swords, personal force shields, portable AI computers, camouflage cloaks, antigravity belts or air-boats, vapor canteens, various wonder drugs, flashlights, monowire blades, or advanced body armor. See ***GURPS Ultra-Tech*** and ***Ultra-Tech II*** for more relic item ideas. This kind of relic tech has often been in continuous use for centuries. Any power-using relics are assumed to have some kind of permanent power supply (or at least *very* long-lived power cells). For energy weapons and other devices with a limited number of shots, assume the power cell can recharge itself within 24 hours using "cold fusion" or some other doubletalk technology.

High-Tech Transportation

Air-Boats

The skies of Mars are still crossed by the air-boats of the First Race. These marvels have antigravity devices and reactionless drives powered by cold fusion units which can operate for centuries without refueling. At one time there were thousands of them, but now the First Race make only a handful each year for their own use. Occasionally one will be given as a gift or a bribe to some potentate, and both the Science Priests and the Cave Martians have found ways to keep old boats running for centuries. Many older air-boats have lost their reactionless drives and rely on aerial sails or crude steam engines instead. The original tech level of most air-boats is TL8 (with TL11-12 superscience drive systems), but later additions are TL3-5. The version shown here is a lightly armed passenger-cargo air-boat with four cabins and four bunks, a common configuration used as merchant craft, scouts, and couriers. It has a crew of five (Captain, pilot, gunner, deckhand, cook) and can carry up to six passengers in cabins, plus deck passengers. Dedicated military boats mount additional guns and carry troops in hammocks instead of passengers in cabins.



Subassemblies: Body +5, rotating Open Mount [T:Body] +1.
Powertrain: 130-kW nuclear power unit powering 2,000-lb. thrust reactionless thruster and 30,000-lb. contragravity.
Fuel: —
Occupancy: 2 XRCS. ***Cargo:*** 500 cf.

Armor	F	RL	B	T	U
Body:	4/20	4/20	4/20	4/20	4/20

Weaponry

50mm swivel gun [OM:F] (16 rounds of shot).

Equipment

Body: Precision TL4 navigation instruments, 500 sf half-covered top deck.

Statistics

Size: 50'×10'×6' *Payload:* 8 tons *Lwt.:* 15 tons
Volume: 3,012 cf. *Maint.:* 27 hours *Price:* $535,000

HT: 12 *HP:* 1,125 *OM:* 80.

aSpeed: 140 *aAccel:* 1 *aDecel:* 8
aMR: 2 *aSR:* 4
Stall speed 0

Design Notes

The reactionless thruster is TL11, the contragravity and NPU are TL12. Navigation instruments and swivel gun are TL4. The hull has fair streamlining and is armored with advanced ablative.

Sand-Boats

Sand-boats swiftly cross the open desert basins of Dying Mars, using tall and complicated arrays of sails to catch the wind as they glide across the sand on ultra-hard ceramic runners. The skids are spaced wide apart for stability, and everything is designed for lightness. Similar vehicles are found on the ice-covered plains of the poles, and in wintertime on frozen canals. Most sand-boats carry some armament, and the main difference between a commercial passenger boat and a pirate raider is that the latter is crammed with armed pirates instead of passengers and freight. Accommodations aboard sand-boats are minimal; the passengers and crew bed down wherever there is space, and travelers are expected to bring along their own food. Sand-boats cruise at 10 to 20 miles per hour on sand, and can reach 60 mph on smooth ice!

Subassemblies: Body +4, four Skids [U:Body] +0, Mast [T:Body] -1, rotating Open Mount [T:Body] +0.
Powertrain: Fore-and-aft rig sails, thrust 144/288/432/576/720/864 lbs.
Fuel: —
Occupancy: 1 XCS, 1 XCCS. ***Cargo:*** 360 cf open.

Armor	F	RL	B	T	U
Body:	4/16	4/16	4/16	4/16	4/16
Skids:	4/20	4/20	4/20	4/20	4/20

Weaponry

50mm swivel gun [OM:F] (30 rounds canister).

Equipment

Body: Precision navigation Instruments, 45 sf top deck, 9 sf covered deck.

Statistics

Size: 20'×5'×4' *Payload:* 2,600 lbs. *Lwt.:* 6.5 tons
Volume: 428 cf. *Maint.:* 154 hours *Price:* $17,000

HT: 10. *HP:* 300 *Skids:* 27
Mast: 26 *Open Mount:* 36

gSpeed: 30/40/50/55/65/70 mph *gAccel:* 5
gDecel: 5 *gMR:* 0.25 *gSR:* 4
Low GP; 1/3 off-road speed.

Design Notes

The body is armored with wood, the skids with metal. There are no cabins or bunks; the crew and passengers have to sleep on deck.

Peroxide Pistol

The peroxide pistol is a TL(5+1) (see ***GURPS Steampunk,*** p. 9) "weird science" weapon devised by the Cave Martians, which has become popular in many places on Dying Mars because it needs almost no metal, and its propellant uses none of the increasingly scarce sulfur or charcoal required for gunpowder. It is a mechanical repeater made of high-quality tempered glass. A reservoir under the barrel holds liquid hydrogen peroxide, which combines with a silver mesh in the combustion chamber to produce a burst of steam capable of propelling a poisoned dart. The peroxide reservoir can fire up to 100 darts before it needs refilling. The darts can be filled with a variety of poisons or drugs; the most common is a neurotoxin extracted from the glands of a canal eel, doing an additional 2d damage on any hit which penetrates the target's DR. Peroxide pistols are not used by battlefield troops because they are somewhat fragile and can't penetrate armor well, but assassins often use them, and many merchants or courtesans carry one for self-defense.

Malf 16, damage 1d (impaling), SS 9, Acc 2, 1/2D 66 yards, Max 720 yards, RoF 3~, Shots 10, ST 8, Rcl -1, Holdout +1, LC 3. O.85 lbs., $45; ammunition 0.002 lbs. per shot, $1 for 125 darts.

Or Is It Magic?

While Mars has traditionally been the venue for science fiction adventures rather than fantasy, there's no reason why Martians can't have supernatural powers. Perhaps "magic" is simply their name for poorly-understood relic technology and psionics, or perhaps (as in Jack Vance's *Dying Earth* stories) science eventually leads to an understanding of magic.

Martian sorcerers can use whichever ***GURPS*** magic system the GM likes best – the spells from the ***Basic Set*** and ***GURPS Magic*** for a high-magic genre-fantasy feel, or the ritual traditions from ***GURPS Spirits*** and ***GURPS Voodoo*** for an "esoteric" magic hidden in the shadows. In the latter case, the GM will have to create a set of appropriate spirits for magicians to invoke: ancient and forgotten gods, the ghosts of great heroes, and the super-intellects of the Canal Builders. The Hermetic magical system of ***GURPS Cabal*** needs a lot of refitting for a Martian setting, but Gamemasters willing to put in the work can make that the basis for Martian sorcery. See p. 43 for a discussion of Mars and decans.

Whichever magic system you prefer, keep in mind that Dying Mars is very old, and magic there is a mature field of study. All the interesting applications of spells have been thought of and tried already. Magicians know all the tricks and "Murphy's Rules," while the rest of society has had centuries to learn countermeasures and ways to minimize the effect of spells.

Huge incomprehensible machines are less common and considerably more dangerous. They are most often found in ancient ruins, and are usually very big, very complex, and with no immediately obvious function. Safety features are either nonexistent or have long since broken down, so anyone tinkering with or exploring such a device is in great danger of getting crushed, accelerated, cast into other times, mutated, super-powered, shrunk, or vaporized.

Ceramic Guns and Glass Daggers

Metals are scarce on Dying Mars, for several reasons. First, all the good-quality ores were found and mined out long ago. Even the good deposits of metal scrap and buried junk are depleted. To make matters worse, Mars is chronically short of fuel – the oil and coalfields are all gone, and even wood is scarce. As a result the Martians have based a lot of their technology on non-metallic substances like ceramic or jade, or else on nonferrous metals like bronze and copper.

Martian Weapons

Lowland Martians have relearned (or never forgotten) the effectiveness of slender thrusting swords, and nobles often carry rapiers or slashing rapiers. In battle they may prefer a thrusting broadsword; commoner troops get shortswords. Cave Martians are too small to use rapiers well, so rely instead on hand axes and ranged weapons. Upland Martians prefer spears and compound bows. The First Race has access to advanced firearms or energy weapons; if those are not available the Martian elders often show remarkable prowess at unarmed combat like Karate and Judo. Sand Martians have claws and know how to use them.

The most common firearm is a single-shot muzzle-loading flintlock pistol, similar to the .45 caliber Wogdon pistol described in the ***GURPS Basic Set.*** The barrel is ceramic-lined bronze, the grip is carved bone, and it fires bullets of baked clay or glass. Because the materials are relatively brittle, the gun can't use as powerful a charge of gunpowder, so its range and damage are lower than a comparable pistol from Terran history. On the other hand, all Martian guns are Fine quality, and the ceramic barrels are very resistant to corrosion and fouling. The fragile bullets do not penetrate armor well, but they do tend to fragment after hitting a target, making wounds very nasty and hard to treat. Increase the Acc bonus by 1 for high-quality Martian pistols, and treat the ammunition as hollow-point rather than TL4 solid shot.

Larger firearms are scarce, because of the difficulty in making a long ceramic gun-barrel that won't simply explode upon firing. Instead, Martian heavy weapons tend to be large single-shot black-powder rockets, more or less like low-tech bazookas. Fire-siphons using a mixture of refined animal fat and alcohol are common, as are sling-tossed grenades.

Martian Armor

The scarcity of fuel for metalworking means Martian warriors tend to wear armor of leather or bone. Only the richest Lowland nobles can afford bronze helmets or cuirasses, and only kings and emperors have carefully-maintained armor of steel. Cave Martians favor bone armor, often using the bones of slaves for extra psychological impact. Uplanders seldom wear anything more than leather. First Race military commanders sometimes have access to amazing suits of high-tech fibers, and legends tell of "magical" ancient suits of armor which could turn any weapon, increase the wearer's strength, and even fly!

Martian Beasts

Martian animal life is divided into four main orders. The mammal-analogues have four limbs, bear live young, and have hair, just like Earth mammals; many of them have beaks. Martian reptiles are six-limbed and lay eggs. Mars has no direct analogues of Terran insects or arthropods, and many of the same ecological niches are filled by tiny winged mammals or legless lizards. Fossils found in the seabeds indicate a once-abundant sea life dominated by creatures resembling squids and nautiluses – a few of which survive in the salt marshes and in the underground lakes of the cavern systems.

Centuries of advanced civilization followed by a deadly climate shift have not been kind to Mars' animal life. Most species today are either domestic animals or their feral descendants. A few especially tenacious wild species have hung on, and now are moving into new niches left open by the changing conditions.

Sand-Sharks

By far the most fearsome predator of Mars is the dreaded Sand-Shark. Derived from a burrowing desert scavenger, the Sand-Shark has evolved into a fierce hunter, lying in wait beneath the sand for days at a time and then suddenly springing up to ambush passing prey. Sand-Sharks have a sharp, saw-edged beak and powerful jaw muscles, enabling them to snap a full-grown Riding-Lizard's leg in half. A related species is sometimes found lurking in the waters of the lowland canals. Though Sand-Sharks are stupid and aggressive, many folk tales depict them as clever talking beasts trying to fool unwary cottagers into unlocking their doors. They tunnel at a speed of 2 and have Camouflage-12 skill.

ST: 40	**Move/Dodge:** 4 (2 burrowing)	**Size:** 2
DX: 14	**PD/DR:** 2/4	**Wt.:** 600 lbs.
IQ: 3	**Damage:** 2d+1 cut	
HT: 12/20	**Reach:** C	

Riding-Lizards

The most common riding animal on Mars is a species of large desert lizard with six long legs and broad feet which don't sink into loose sand. Riding-lizards are hardy beasts, able to feed on just about anything, including meat or carrion. They are cold-blooded animals, and in cold weather become sluggish and lazy. Tribes in the polar regions have learned to cloak their riding-lizards in heavy furs to keep them lively.

ST: 30	**Move/Dodge:** 8	**Size:** 3
DX: 9	**PD/DR:** 0/1	**Wt.:** 1,000 lbs.
IQ: 3	**Damage:** 1d cut, 1d-2 trample	
HT: 16	**Reach:** C	

Night Horrors

The origin of the Night Horrors is unclear. They may be a species related to the ancestral Martians, adapted to a nocturnal existence as hunters and scavengers in the desert. Scholars in the lowland cities speculate that they may be the product of ancient science, a hybrid with genes from Martians and certain extinct predators. Shamans in the highlands whisper that the Night Horrors are a race of Martians, cursed by the gods with bestial fury and a taste for Martian flesh. Night Horrors have a mouth full of needle-sharp teeth, and huge slashing claws. They can see in the dark and are capable of moving swiftly and silently. When hunting, Night Horrors work in pairs and small groups, communicating by eerie whistles and clicks as they cut off and surround their prey before moving in for the kill. They have the Night Vision advantage, and Stealth skill at DX.

ST: 16	**Move/Dodge:** 7	**Size:** 1
DX: 14	**PD/DR:** 1/1	**Wt.:** 200 lbs.
IQ: 6	**Damage:** 1d-1 cut (bite), 1d+1 cut (claws)	
HT: 14	**Reach:** C	

Characters and Abilities

Character Templates

All character templates given here are based on Lowland Martians. Add the racial differences for other types.

Assassin 105 points

Assassination has a long and distinguished history on Mars, and even today is widely practiced. Nobles of the First Race jockey for position with poison and dagger, merchants eliminate rivals, and the Science Priests send out killers to keep their technical secrets. Assassins can be of any race, though Lowland and Cave Martians are most common. Most Martian assassins are skilled professionals, and many follow a professional code of honor: never give up until the target is dead, minimize collateral damage, kill quickly and with a minimum of pain. They hardly ever kill when they haven't been paid for it. (Note that this template includes the cinematic advantage Weapon Master; in a more realistic campaign replace it with 20 points' worth of other advantages.)

Attributes: ST 9 [10]; DX 12 [20]; IQ 10 [0]; HT 12 [20].

Advantages: Ambidexterity or Night Vision [10], Combat Reflexes or Danger Sense [15], Weapon Master (crossbow or knife) [20].

Disadvantages: Callous [-6], Lowland Martian [-15]; and either Bloodlust, Solipsist, or any two of Code of Honor, Edgy, Loner, Post-Combat Shakes, or Stubbornness [-10].

Skills: Acting (M/A) IQ [2]-10, Climbing (P/A) DX [2]-12, Crossbow (P/E) DX+3 [8]-15, Disguise (M/A) IQ [2]-10, Garrote (P/E) DX+1 [2]-13, Holdout (M/A) IQ [2]-10, Knife (P/E) DX+3 [8]-15, Poisons (M/H) IQ [4]-10, Savoir-Faire (M/E) IQ [1]-10, Shadowing (M/A) IQ [2]-10, Stealth (P/A) DX+1 [4]-13, Streetwise (M/A) IQ [2]-10, Traps/TL4 (M/A) IQ [2]-10.

Courtesan 85 points

Among the Lowland Martian and First Race upper classes, marriages are matters of business and politics, not love. Courtesans supply the missing element of romance. Both men and women are courtesans (males are usually called "escorts"), and they are much more than simple prostitutes. Courtesans are expected to master all the social arts as well as (or better than) their aristocratic patrons. They are witty conversationalists, experts on cuisine and wine – and uninhibited partners. Most courtesans are drawn from the ranks of bankrupt petty nobles or the middle class. Their somewhat shabby private lives contrast with the luxury in which they "work." Courtesans are inevitably drawn into political intrigues, and make natural spies and assassins. Most courtesans are Lowland Martians, though a few exotic Uplander exiles have found a niche in the trade. Cave Martian courtesans are common only in the underground empire, while Sand Martians and the First Race never become courtesans.

Attributes: ST 8 [0], DX 12 [20], IQ 11 [10], HT 12 [20].

Advantages: Handsome/Beautiful [15]; and either Charisma +2, Voice, or increase appearance to Very Handsome/Beautiful [10].

Disadvantages: Lowland Martian [-15], and any two of Bad Temper, Bully, Extravagance, Gregarious, Impulsiveness, Jealousy, Laziness, Miserliness, Self-Centered, or Short Attention Span [-10 each].

Skills: Carousing (P/A) HT [2]-12, Chess (M/E) IQ [1]-11, Courtesan (M/A) IQ+3 [8]-14, Dancing (P/A) DX+2 [8]-14, Erotic Art (P/H) DX [4]-12, Holdout (M/A) IQ [2]-11, Make-Up/TL4 (M/E) IQ+1 [2]-12, Poetry (M/A) IQ [2]-11, Savoir-Faire (M/E) IQ+3 [6]-14, Sex Appeal (M/A) HT+2 [6]-14, Singing (P/E) HT+2 [4]-14.

Merchant 55 points

Trade is difficult on Dying Mars, but there are still some who are brave and greedy enough to venture out to a distant city with a cargo of goods in search of profit. The safest trade

routes are the canals, but barge commerce is usually a monopoly granted by the local ruler and fiercely guarded by the family holding the grant. More adventurous merchants can try carrying goods by caravan across the uplands. To be a success, a trader has to be tough enough to make the trip, brave enough to fight off raiders and thieves, and canny enough to avoid losing his shirt! Lowland Martians make up the bulk of merchants, though some Uplanders start out as caravan guards and wind up making deals of their own. Cave Martians control much of the trade in the region around their empire, but are uncommon elsewhere. The First Race never dabble in commerce, and Sand Martians find the whole concept incomprehensible.

Attributes: ST 8 [0], DX 10 [0], IQ 12 [20], HT 10 [0].

Advantages: A total of 40 points from among the following: Charisma +1 [5], Common Sense [10], Cultural Adaptability [25], Lightning Calculator [5], Luck [15], Status +1 [5], Wealth (Comfortable or Wealthy) [10 or 20].

Disadvantages: Greed [-15], Lowland Martian [-15], and either Honesty or Miserliness [-10].

Skills: Animal Handling (M/H) IQ [4]-12, Area Knowledge (trade route) (M/E) IQ+2 [4]-14, Brawling (P/E) DX [1]-10, Carousing (P/A) HT [2]-10, Crossbow (P/E) DX+2 [4]-12, Detect Lies (M/H) IQ [4]-12, Law (M/H) IQ-2 [1]-1, Merchant (M/A) IQ+2 [6]-14, Navigation/TL4 (M/H) IQ-1 [2]-11, Packing (M/A) IQ [2]-12, Streetwise (M/A) IQ [2]-12, Teamster (M/A) IQ [2]-12, Savoir-Faire (M/E) IQ [1]-12.

Noble 84 points

Nobles are the rulers of Mars. Some noble families are pure-blooded members of the First Race, with pedigrees stretching back thousands of years. Others are the descendants of Upland warlords who established themselves in control of a canal-side realm. Cave Martian nobles have little contact with the surface world, but are just as proud and status-conscious as the others. Lowlanders seldom achieve more than the lower levels of the aristocracy, and then only in the most egalitarian societies. Among themselves, the Uplanders have no nobility, nor do Sand Martians. As written, the template is for a minor noble, either high-status but not wealthy, or rich but low-status. For a genuinely powerful aristocrat, raise the point value to 100 and allow extra levels of Wealth and Status.

Attributes: ST 8 [0], DX 10 [0], IQ 12 [20], HT 10 [0].

Advantages: Status 3 [15], and up to 30 points from among the following: Alcohol Tolerance [5], Heir [5], Longevity [5], Military Rank +1 [5], Status +1 [5], Unfazeable [15], or Wealth (Comfortable, Wealthy, or Very Wealthy) [10 per level].

Disadvantages: Lowland Martian [-15], and either Bad Temper, Bully, Code of Honor (Gentleman's), Extravagance, Impulsiveness, Obdurate, Overconfidence, or Self-Centered [-10].

Skills: Area Knowledge (Kingdom) (M/E) IQ+2 [4]-14, Black Powder Weapons/TL4 (flintlock pistol) (P/E) DX+3* [2]-13, Carousing (P/A) HT-1 [1]-9, Cloak (P/A) DX+2 [8]-12, Diplomacy (M/H) IQ [4]-12, Fencing (P/A) DX+2 [8]-12, Law (M/H) IQ-2 [1]-10, Leadership (M/A) IQ [2]-12, Politics (M/A) IQ [2]-12, Riding (Lizard) (P/A) DX+2 [8]-12, Savoir-Faire (M/E) IQ+2 [4]-14.

*Black Powder Weapons includes +2 for IQ 12+.

Sand-Sailor 105 points

The windswept Martian deserts are traversed by swift sand-boats, gliding across the dunes on tough ceramic runners, their tall sails designed using ancient principles of aerodynamics to reach astounding levels of efficiency. Similar vehicles slide over the polar ice caps and the salt flats of the ancient seabeds. The Martians who pilot these unique craft are tough and bold, unafraid of sandstorms or raiders. Sand-Sailors are mostly Lowland Martians, but Uplanders are also found aboard sand-boats. Because sand-boat crews are small, sailors tend to be generalists, able to fill any position on board. During voyages they may spend days without sleeping, with every nerve taut; small wonder that when the desert is crossed their drinking bouts and tavern brawls are legendary.

Attributes: ST 10 [20]; DX 12 [20]; IQ 10 [0]; HT 12 [20].

Advantages: Absolute Direction [5], Acute Vision +2 [4], and either Danger Sense, Daredevil, Luck, or Serendipity [15].

Disadvantages: Code of Honor (Pirate's) [-5], Lowland Martian [-15], and either Compulsive Carousing, Loner, or Stubbornness [-5].

Skills: Area Knowledge (Desert) (M/E) IQ+2 [4]-12, Black Powder Weapons (flintlock pistol) (P/E) DX+1 [1]-13*, Brawling (P/E) DX+2 [4]-14, Carousing (P/A) HT [2]-12, Carpentry (M/E) IQ [1]-10, Driving (Sand-boat) (P/A) DX [2]-12, Fast-Draw (weapon) (P/E) DX [1]-12, Fencing (P/A) DX+2 [8]-14, Gunner/TL4 (swivel gun) (P/A) DX [2]-12, Knife (P/E) DX [1]-12, Merchant (M/A) IQ+2 [6]-12, Navigation/TL3 (M/H) IQ+5 [8]-15*, Survival (Martian desert) (M/A) IQ+2 [6]-12.

*Black Powder Weapons includes +1 bonus for IQ 10+; Navigation includes +3 bonus for Absolute Direction.

Science Priest 85 points

The few members of the First Race who bother to study the technology and engineering of the ancients become members of the Order of Sacred Knowledge, the Science Priests of Mars. A few Lowland Martians or Cave Martians are allowed to join the order, but never advance to the higher levels of initiation.

As a rule of thumb, a Science Priest can only learn skills at a Tech Level equal to his rank in the order plus 4. So a Novice (Clerical Investment 0) knows no secrets, but an Initiate (Investment 1) understands steam machinery, and one of the High Sages (Investment 6) can use TL10 relics. The more advanced relic devices are beyond the understanding of even the Science Priests – they may learn how to use them, but cannot fix them or build new ones. Note that knowing how to work something and having access to it are very different things: the Order keeps its artifacts for study, and only a few TL6 items are available for favored members to use.

Attributes: ST 8 [0]; DX 12 [20]; IQ 12 [20]; HT 10 [0].

Advantages: A total of 40 points from among the following: Clerical Investment [5 per level], Gadgeteer [25], High Technology (TL6) [20], Lightning Calculator [5], Mathematical Ability [10], or Versatile [5].

Disadvantages: Curious [-5], Lowland Martian [-15]; and one of the following: Absent-Mindedness, Charitable, Fanaticism (preserving knowledge), Pacifism (self-defense), or Weirdness Magnet [-15]

Skills: Archaeology (M/H) IQ [4]-12, Hidden Lore (Lost technology) (M/A) IQ [2]-12, History (M/H) IQ [4]-12, Philosophy (Order of Sacred Knowledge) (M/H) IQ [4]-12, Research (M/A) IQ+2 [6]-14, Science! (M/VH) IQ [8]-12; and 12 points from among the following: Beam Weapons/TL* (choose type) (P/E) DX+2 [1]-14, Chemistry/TL* (M/H) IQ [4]-12, Diplomacy (M/H) IQ-2 [1]-10, Electronics Operation/TL* (choose type) (M/A) IQ [2]-12, Engineer/TL* (choose type) (M/H) IQ [4]-12, Mechanic/TL* (choose type) (M/A) IQ [2]-12, Nuclear Physics/TL* (M/VH) IQ-2 [2]-10, Physics/TL* (M/H) IQ [4]-10, Traps/TL4 (M/A) IQ [2]-12, Weird Science (M/VH) IQ-3 [1]-9.

*Beam Weapons skill includes the +2 modifier for IQ 12+; TL for all tech and scientific skills depends on rank.

Warrior varies

Warriors on Mars come in many varieties, from lizard-riding desert raiders to armored infantry of the lowlands to deadly Cave Martian night fighters. They are respected in all cultures (except that of the peace-loving lowlanders), and proficiency with a blade is one way for a humble Martian to become wealthy and powerful. Each culture has its own characteristic weapons: Uplanders favor short bows and spears, Lowland soldiers are generally armed with short swords and either pikes or crossbows, while Cave Martians carry muzzle-loading guns and hand axes. Warriors of the First Race are usually officers, or operate powerful relic weapons. All warriors learn to survive and forage in their native terrain.

Attributes: ST 10 [20]; DX 12 [20]; IQ 10 [0]; HT 12 [20].

Advantages: Either Combat Reflexes, Danger Sense, Daredevil, or Luck [15]; and one of Absolute Direction, Alertness +1, Collected, Fit, Hard to Kill, Military Rank, or Status +1 [5 each].

Disadvantages: Duty (12-) [-10], Racial Template [varies].

Skills: Brawling (P/E) DX+2 [4]-14, Camouflage (M/E) IQ [1]-10, Fast-Draw (weapon) P/E DX [1]-12, Knife (P/E) DX [1]-12, Riding (lizard) (P/A) DX [2]-12, Running (P/H) HT-2 [1]-10, Savoir-Faire (Military) (M/E) IQ [1]-10, Scrounging (M/E) IQ+2 [4]-12, Survival (Martian desert, mountain, or tundra) (M/A) IQ+2 [6]-12, and one of the following racial skill sets:

Cave Martian: Axe/Mace (P/A) DX+2 [8]-14, Black Powder Weapons (flintlock pistol) (P/E) DX+3 [8]-15, Fire-Siphon (P/A) DX+2 [8]-14. With Cave Martian template [0 points], total cost is 115.

First Race: Beam Weapons (P/E) DX+4 [8]-16 (includes +1 modifier for IQ 10+), Fencing (P/A) DX+3 [16]-15. With First Race template [20 points], total cost is 135.

Martian Status Table

Status	Level
7	Acidalian Theocrat, Hellan Emperor
6	Major lowland city ruler, Cave Martian great lord, Hellan vizier, Upland chief-of-chiefs
5	Minor lowland city ruler, Cave Martian lesser lord, major upland chief
4	Aristocrats in Hellas and lowlands, wealthiest merchants
3	Doctors, judges, minor lowland aristocrats
2	Guild leaders, successful mercenary captains, upland nomad clan chiefs, lowest First Race
1	Skilled craftsmen, scholars, First Race hybrids
0	Farmers, craft workers, most merchants, upland nomads, lowest Cave Martians
-1	Landless peasants, urban poor
-2	Slaves, beggars

Lowlander: Crossbow (P/E) DX+3 [8]-15, Polearm (P/A) DX+2 [8]-14, and Shortsword (P/A) DX+2 [8]-14. With Lowland Martian template [-15 points], total cost is 100.

Uplander: Bow (P/H) DX+2 [16]-14, Spear (P/A) DX+2 [8]-14. With Upland Martian template [-6 points], total cost is 109.

Advantages

Acute Hearing see p. B19

This advantage is very common among both Cave Martians and Sand Martians, though it is not universal enough to be a racial trait. Because of Mars' thin atmosphere, all Martians gain a level of Acute Hearing when in Earth's thick air.

Appearance see p. B15

The Martian races vary in physical appearance, but all of them (except Sand Martians) share the same standards of beauty and attractiveness. Martians with any Appearance bonus or penalty apply it to all Martians without modifiers. Sand Martians and Earth humans are sufficiently alien that all reaction modifiers are halved when dealing with other Martians, and Sand Martians encountering humans ignore all bonuses or penalties due to looks.

Claim to Hospitality see p. CI21

Martians make great use of family and clan ties when they travel, and so Claim to Hospitality is a common advantage among all Martians. It is rare for a Martian to have a Claim to Hospitality with a different race or social class. Sand Martians never have this advantage, because their bands are territorial and they never travel among other races.

High Technology see p. CI26

Members of the Science Priests can acquire this advantage, gaining access to TL6 gear, and some members of the First Race have learned some of the technical secrets of the ancestral Martians and can use even more advanced items. Otherwise, High Technology is unknown among Martians. A

human adventurer from a TL6 or higher culture should buy this advantage if the campaign is set entirely on Mars and if the humans can repair or replace their devices easily.

Immortality, Longevity, and Unaging see pp. CI58, B21, and CI69

Although the First Race are potentially immortal, they don't have the Immortality advantage. They are Unaging after adulthood, and are immune to all known Martian diseases. They *aren't* immune to poison, though, and heal from injury at the normal rate. GMs may encourage Martians who are hybrids of the First Race with one of the other Martian races to take the Longevity advantage as a form of "watered down" immortality.

Literacy and Semi-Literacy see pp. B21 and CI29

Literacy is the default state for most Martian races. The exceptions are Uplanders and Sand Martians. Uplanders are Semi-Literate, although most of them who spend much time in the lowlands buy off the disadvantage fairly quickly. Sand Martians are completely illiterate, and appear to have no interest in learning to read.

Night Vision see p. B22

Both Cave Martians and Sand Martians have Night Vision, although there are some slight differences. Cave Martians have naturally huge and sensitive eyes, which they must protect with goggles or tinted spectacles in daylight. Sand Martians can adjust easily between day and night vision. Both races do require *some* light to see by – Sand Martians see by the light of the moons when they hunt at night, and Cave Martians light their caverns with oil lamps, daylight reflectors, and glass pipes of luminous liquid.

Psionic Powers see p. P10

Psionic abilities and skill are not part of the default Dying Mars setting, although GMs may want to allow a few mysterious "wizards" or "witch-queens" to use mental powers. They should probably pay a fairly stiff Unusual Background cost for the ability.

Sanctity see p. CI29

All Martians of the younger races have a near-instinctive reverence for the First Race, and believe they are all wise and benevolent. In practice this gives them the Sanctity advantage. Other members of the First Race are likely to have a more realistic reaction, but the First Race are so few and scattered that most of their interactions are with other races anyway.

Status see p. B18

The highest Status available varies depending on a being's race. Cave Martians can have a maximum Status of 6 (the great lords of their cavern empire). Lowlanders can be Status 7. Upland Martians are functionally limited to Status 6 – though occasional leaders may command kings, they tend to be first among equals rather than a superior rank. Martians of the First Race start at Status 2 and go as high as Status 8. Sand Martians have no real status ranks.

Disadvantages

Code of Honor see p. B31

Upper-class members of the Lowland and Cave Martians generally have the Gentleman's Code of Honor; all Uplanders have the Pirate's Code. Some Uplanders who rule lowland kingdoms have adopted an exaggerated version of the Uplander code which approximates the Chivalric Code of Honor. Interestingly, few if any of the First Race bother with notions like honor at all.

Dying Race see p. CI102

The First Race are gradually dying out. Although they don't die naturally, there is attrition through accidents and assassination, and their birth rate is microscopically low (most First Race Martians prefer to take adoring and submissive lovers of other races instead of dealing with the arrogance and cynicism of their own kind). The First Race are all aware that they are declining in number, and use that as a pretext to avoid getting involved in anything which would take them beyond their citadels of high-tech comfort.

Illiteracy and Semi-Literacy see pp. B33 and CI94

Mars is a generally literate society. Uplanders are Semi-Literate and Sand Martians are Illiterate, and both are racial Disadvantages. Some poorly-educated Lowlanders or Cave Martians may be Semi-Literate, in which case it is a -5 point disadvantage.

Primitive see p. B26

Though Upland Martians live a generally TL3 existence, they are aware of higher-technology items and concepts; their low tech is imposed on them by poverty and their nomadic lifestyle rather than ignorance. Consequently they do not suffer from the Primitive disadvantage when dealing with Lowlander or Canal Martian equipment. Sand Martians *are* Primitive, because they live almost entirely without technology and have difficulty adjusting to it.

Social Stigma see p. B27

All Sand Martians take the 15-point "barbarian" stigma when encountered in societies other than their own. Uplanders *may* get a 10-point Stigma as "uncouth highlanders" in the most ultra-refined Lowland cultures, but it's not universal. *All* outsiders in the Hellan Empire get a 5-point Stigma as foreigners.

Terrans on Dying Mars may or may not suffer a Social Stigma, depending on when in the history of Earth-Mars contact the campaign takes place. The first explorers get no stigma because they are simply unknown and startling. Once regular contact is established, Terrans get a -5 stigma among upper-class Martians as powerful but uncouth beings who don't understand the niceties of Martian society. If hostility ever develops, give Earth people a -15 stigma as "evil aliens," which may persist for decades.

Xenophilia and Xenophobia see pp. CI95 and U35

Although the Martian races are very different, they have a common background and share many of the same standards of beauty and attractiveness. Martians of one race who prefer partners of other races merely have an interesting Quirk, and Martians who hate other Martian races are simply Intolerant. *Earthlings*, of course, are aliens, and so come under the purview of Xenophilia and Xenophobia. (In a particularly pulpish campaign, many Martian rulers may discover strong latent Xenophilia for Earth humans on first contact.)

Skills

Blind Fighting see p. CI138

This art is widely studied among the Cave Martians, and makes them especially deadly in their dark tunnels. Among Cave Martians *only,* this skill can be purchased without the usual prerequisites.

Fencing see p. B50

Swordsmanship among Lowland Martians is much like fencing in Earth's age of swashbucklers. Lowland fighters may learn Fencing skill as described in the ***Basic Set,*** or take one of the styles described in detail in ***GURPS Swashbucklers.*** Uplanders tend to fight with spears or axes, and Cave Martians prefer short swords and guns.

Languages see p. B54

Despite the tremendous differences among Martian races and cultures, the First Race have managed to unite the planet linguistically. All Martians speak the tongue of the First Race. The prevalence of literacy helps keep the language uniform, but isolated societies like Uplander tribes or the Cave Martians may speak a dialect which defaults to standard Martian at -1 to skill.

That's the easy way to play it. GMs who want a more linguistically diverse Mars can assume the various Martian dialects have diverged over time from a common First Race origin. In that case, assume a penalty of -1 for different races, and an additional -1 for every 1,000 miles which separate the two languages. This means that different races on opposite sides of the planet would be at a -7 to understand one another. An interesting and elegant option might be to keep *written* Martian as universal across the planet, with variation only in the spoken forms due to shifts in pronunciation.

Earth languages are Hard skills for Martians to learn, and vice versa. In a multilingual Mars setting, Martian languages are all Average skills for other Martians.

Medical Skills/TL see p. B56

The Martian races descend from a recent common ancestor and are physiologically very similar. Lowlanders, Uplanders and the First Race are sufficiently alike that there is no penalty for physicians trained on one race working on another. Cave Martians and Sand Martians do have some minor physical differences, and impose a -1 penalty on medical skills.

Martians are humanoid and mammalian, so many of the same basic principles of Earth medicine apply to Martians. Terran doctors trying to treat patients from Dying Mars are at a -3 penalty to skill, as are Martians treating Terrans.

Riding see p. B46

Martians learn Riding skill with the specialty Lizard. Riding-Lizards are cranky beasts, and skill at riding them defaults to riding Terran mounts at -4.

Sex Appeal see p. B64

Martians and humans are similar in many ways, and interplanetary seduction is entirely possible (it is, after all, a cliche of the fiction which inspired Dying Mars). Earth-Mars Sex Appeal attempts are at a -1 skill penalty with most Martian races, -3 with Sand Martians.

Survival see p. B57

Dying Mars is still a fairly habitable world compared with places like Superscience Mars or the real planet. Terrans get only the -2 "unfamiliar planet" penalty when using Survival skill in Martian environments.

Campaigns and Adventures

Men From Earth

A decadent and dying Mars was frequently the destination for brave adventurers from Earth in Victorian scientific romances and 20th-century pulp science fiction. Just as European explorers and colonists once took over in places like Egypt, India, and China, bold Earthmen venturing to Mars can try to conquer and "civilize" the decadent Martians. Less aggressive sorts may still want to uncover the ancient mysteries of the Red Planet, and perhaps help the Martians recover their own lost technology to make the deserts bloom again. Either way, the Earthmen have a higher average level of technology, but are few in number and far from home, while the Martians have numbers, local knowledge, and some staggeringly powerful items of relic technology.

Roughly paralleling the course of European interactions with other human cultures, contact between Earth and Dying Mars is likely to follow three stages: first contact, conquest, and independence. Each period has its own attractions as a campaign setting.

To Mars With Gun and Camera

The first explorers of Dying Mars must be highly competent and resourceful characters, capable of making their way across an unknown world millions of miles from home. No matter what ultimate goals they may have (conquest, peaceful exploration, or whatever), the initial visitors don't have much in the way of resources beyond their own skills and abilities. A small party of alien beings may well be

hunted by the warriors of some decadent Martian king looking for exotic creatures for his Death Arena, or possibly wooed by a beautiful desert princess impressed by their high-gravity muscles and their wealth in metal tools.

One interesting possibility is that the Earthmen may be mistaken for magicians or even gods by the Martians. It worked for Hernan Cortez and the Wizard of Oz, among others. While being acclaimed as a god may solve the immediate problems of survival, it can be surprisingly hard to live up to the expectations of people who think you're immortal and omnipotent. Humane-minded characters who don't like the idea of misleading the Martians must balance their love for truth with the potentially hostile reaction when the natives learn their visitors aren't gods after all. See Kipling's story "The Man Who Would Be King" (or the excellent film based on it) for the definitive treatment of this scenario.

Earth Man's Burden

Once regular contact is established between Earth and Mars, it's all too likely that the Earthmen are going to start taking over. This can be deliberate imperialism (in a ***Steampunk*** or ***Cliffhangers*** campaign), or a more well-intentioned "intervention" to end chronic warfare and encourage peaceful development. No matter their motives, the Earthmen on Mars will likely be perceived as alien invaders, inspiring rebel movements to drive them off Mars.

Adventures on a Dying Mars dominated by Earthmen can replay all the great standard tropes of Kipling, John Ford, and the Foreign Legion – remote outposts assailed by hordes of hostile Martians; grizzled old Mars hands trying to thwart an uprising of the desert tribes; cunning spies playing the Great Game against rival powers in Martian lowland cities; or callow youths just out from Earth trying to keep the peace in a land of ancient hatreds and mysteries.

For a more horror-oriented campaign, Dying Mars has tombs that were old and monster-infested when the Sphinx was young, and some of the inbred lords of the lowlands have taken decadence to levels the Marquis de Sade could only dream of. And who knows what abominations spawned by forbidden science still lurk in the upland wastes or gibber in the caverns of Melas?

The Fourth World

If the Earthmen aren't interested in territorial conquest – or if the Martians get enough guns – the kingdoms of Dying Mars might someday throw off the yoke of rule from Earth. That doesn't mean the Earthmen are going away, of course. It just means Gamemasters can add all the complications of "banana republic" politics to the list of available plot elements. In an alternate-historical campaign, the perennially unstable Martian republics can become venues for the Cold War, with rival Communist and American-backed factions of sand warriors battling it out with swords, AK-47s, and heat-beams. CIA officers in sweat-rumpled linen suits arrange shady deals with ex-Green Beret mercenaries and Martian sand raiders in seedy dives along the canal in Eos. Cuban "advisors" train highland Martian guerrillas in order to disrupt the trade routes into Hellas and thereby encourage revolution.

Other GURPS Settings

GURPS Arabian Nights

The Arabian lands of medieval Earth share many features with Dying Mars – vast deserts inhabited by nomads, teeming cities, ruins of past civilizations, and cultures which seem strange and exotic to modern Westerners. Following the lead of pulp writers going back to Edgar Rice Burroughs, GMs can transplant any and all features of Arabian Nights romances to Mars. Note that some things make the trip more easily than others: the vital, expansive nature of medieval Islam doesn't mesh well with the jaded culture of Dying Mars (though desert tribes motivated by an inspired Prophet could conduct the equivalent of a jihad).

GURPS Cliffhangers and Steampunk

Dying Mars as presented owes a lot to late Victorian and early 20th-century depictions of the Red Planet, and as such is a perfect destination for eccentric inventors in home-built spaceships. If the Terrans are two-fisted pulp adventurers in experimental rockets, the Gamemaster may want to give the Martians more weird technology and advanced relics to reduce the impact of Tommy guns and automatic pistols. Explorers can drop in for a brief but exciting visit before returning to Earth, or they may "go native" in the manner of Captain Carter of Virginia, forsaking Earth completely and becoming heroes of Mars.

GURPS Planet Krishna

The green-skinned Krishnans have about the same level of technology as the inhabitants of Dying Mars (which is not surprising given that L. Sprague de Camp was inspired by Burroughs). GMs can import kingdoms and societies whole from Krishna to Mars, or adapt adventure hooks and NPCs. One feature of Krishnan life which probably *won't* translate well to Mars is the prevalent nudity; Mars is just too chilly for that. Gamemasters who simply can't live without egg-laying Martians may replace the inhabitants of Dying Mars with the oviparous Krishnans.

GURPS Swashbucklers

Swashbucklers has a vast amount of useful information on pirates and piracy which could easily be applied to the Sand Raiders and similar groups on Mars. The technology of Dying Mars is much like that of 16th-century Europe, which means that combat techniques and tactics are likely to be similar, as well. Game masters can even adopt entire campaign plans to a Martian setting, chronicling the exciting exploits of the King of Elysium's elite Pistoleers and their deadly rivals the High Priest's Guards.

Sand Raiders of Mars

The great sandy deserts of Dying Mars are home to a unique breed of brigands. Cruising the wastes of Hellas, Argyre, and Isidis in swift sand-boats, the Sand Raiders rob caravans and raid outlying settlements, occasionally banding together to assault a major city. The great kingdoms of Mars alternate quietly subsidizing the Raiders as a way of harassing their enemies with sending punitive expeditions aboard air-boats to wipe them out. But the Raiders know of secret refuges and hidden oases, and when powerful enemies appear they can seemingly vanish into the nearest chaotic terrain until the heat is off.

A typical band of Sand Raiders consists of perhaps a dozen Martians and a light or medium sand-boat. The brigands are armed with crossbows, a few guns, and some melee weapons. Most Raiders are Lowland or Upland Martians; a very few Cave Martians or Sand Martians take to the life. Raider bands are generally organized by a successful captain, who gets a sand-boat and attracts followers. Less common are privateering companies in which the Raiders and some silent partners own shares in the venture and pay out a dividend when it is done. The great majority of Raiders are male, but there have been some notable female captains and warriors over the years. Female Raiders sometimes disguise themselves in male costume, and a few keep their true identities secret even from comrades.

Raiders are fierce and valiant fighters, but they are not wanton killers or senseless vandals. A looted farm can be looted again in a few years, but a village reduced to wasteland is of no value to anyone. Raiders prefer to take prisoners, since they can be ransomed or sold off into slavery. Very rarely captives are adopted into a Raider company, if they show unusual fighting ability or have valuable skills.

In a Sand Raiders campaign, the player-characters are tough and hard-bitten fighters on the seas of sand. They may be the dregs of society, illiterate barbarians, escaped slaves, or perhaps exiled aristocrats in disguise. An Earthman whose capsule lands in the desert could be captured by Sand Raiders and rise to become a full member of the crew. While most Raiders are apolitical and fight purely to get rich, others have goals beyond wealth: gaining vengeance on some wicked lord, helping the downtrodden, or restoring the fortunes of a fallen noble clan. Adventures for Raiders include set-piece battles against caravan guards and village militia, daring raids on seemingly "impregnable" fortress cities, escapes from pursuing military forces, quests for lost treasure, good turns like defending a village against vicious barbarians or oppressive lords, encounters with ghosts and monsters in abandoned ruins, or simply surviving in the harsh desert wilds after a disaster wrecks the sand-boat.

Merchants of Mars

The merchants who keep the flow of trade between Martian cities going are a colorful and varied lot. Doing business on the Red Planet is not for the faint of heart. Since communication is limited to the speed of couriers on riding-lizards (or the occasional express sand-boat), a merchant has no way of knowing what market conditions in his destination are going to be like. A cargo may bring in a fortune, or it may be nearly worthless. Consequently merchants must be willing to take enormous risks, both personal and financial.

A perfectly entertaining and exciting campaign can simply chronicle the travels and adventures of a band of traders as they go from city to city speculating on cargoes and battling bandits. If that gets old, traveling merchants are natural recruits for espionage plots or diplomatic intrigues. Finally, a party crossing the wilderness may stumble across any number of wonders: ruined cities, still-functioning ancient devices, or mysterious spacecraft from a blue planet.

The Last Engineers

The Science Priests of Mars are constantly struggling to recover and maintain ancient technology. While much of this work goes on in libraries and laboratories, Science Priests do occasionally go out on quests or pilgrimages to accomplish some technological feat. The two most common sorts of quests are to restore some ancient machinery (usually a canal pumping station or one of the polar geothermal taps), or recover some ancient device for study. Both sorts have plenty of adventurous potential.

Restoration missions usually take the Science Priests out into dangerous territory, since machines in civilized regions get better maintenance. The intrepid Science Priests must travel through hostile country and convince the local inhabitants that they aren't looking for treasure or planning some blasphemy. Sometimes this doesn't work, and they must escape imprisonment or battle hostile warriors. Once at the work site, the Priests are likely to make some unpleasant discoveries: there may be dangerous animals or bandits in residence, or the ancient builders may have included some kind of subtle defenses which must be evaded. Finally, the task of doing major engineering jobs in remote locations is not to be sneered at.

Recovery adds elements of detective work and archaeology, as the Priests must first locate the items to be recovered, often by searching through ancient archives which are guarded as carefully as the ancient relics themselves. Ancient tech is often well-protected, and is usually hidden in very remote places. There are the same problems with the locals as on restoration missions, except that this time there *is* a "treasure" and the locals may well want it for themselves. Science Priests on recovery quests can be as two-fisted and daring as any fedora-hatted pulp archaeologist, or accomplish their task by shrewd diplomacy and clever con games.

Obviously, with all the dangers involved in field quests, Science Priests need help. They often hire warriors, professional thieves, or merchants as assistants, making for an ideal adventuring party. It isn't even necessary for one of the PCs to be a Science Priest for adventurers to get involved in their missions – a Priest makes a good patron, and that way the GM doesn't have to worry about the party getting too many powerful ancient tech artifacts.

BIBLIOGRAPHY

General

Bergreen, Laurence. *Voyage to Mars* (Riverhead Books, 2000). A look at recent developments in Mars exploration, with a great deal of material on the Martian meteorite controversy.

Burrows, William E. *This New Ocean* (Random House, 1998). A history of real-world space exploration, with some interesting insights into the Soviet space program and NASA's internal rivalries.

Wilford, John Noble. *Mars Beckons* (Vintage Books, 1991). A readable history of human exploration of Mars in fact and fiction.

Real Mars

Baston, R.M., Bridges, P.M., and Inge, J.L., editors. *Atlas of Mars* (NASA, 1979). A very useful collection of USGS 1:5,000,000 scale maps of Mars, based on Mariner and Viking data.

Carr, Michael H. *Water on Mars* (Oxford University Press, 1996). A relatively readable scientific book which exhaustively covers the subject of Martian water.

Kaplan, David. "Environment of Mars" (NASA Technical Memorandum 100470, 1988). Discussion of Martian surface conditions for future missions.

Kieffer, Hugh; Jakosky, Bruce; Snyder, Conway, and Matthews, Mildred, editors. *Mars* (University of Arizona Press, 1992). A vast compendium of work by 114 authors, covering the state of Martian science at the time it was published. Slightly dated, but still the standard work on the subject.

Lewis, John; Matthews, Mildred, and Guerrieri, Mary, editors. *Resources of Near-Earth Space* (University of Arizona Press, 1993). Another vast compendium of papers in the same series as *Mars,* above, with 86 authors. Lots of useful stuff about Mars and its moons, with a more practical focus than *Mars.*

Getting to Mars

Lewis, Richard S. *Space in the 21st Century* (Columbia University Press, 1990). A good rundown of near-future possibilities in space exploration.

Ley, Willy, and Von Braun, Wernher. *The Exploration of Mars* (Viking, 1956). A detailed mission plan for getting to Mars with 1950s technology, illustrated by the inimitable Chesley Bonestell.

Meyer, Rudolf, et al. "Ion Engine Propelled Earth-Mars Cycler with Nuclear-Thermal Propelled Transfer Vehicle" (UCLA, 1994). A NASA technical paper describing one design for a Cycler spacecraft.

Zubrin, Robert, and Wagner, Richard. *The Case For Mars* (Simon & Schuster, 1996). A detailed description of the Mars Direct plan, with lots of other useful information about colonizing and terraforming Mars.

Terraforming

Fogg, Martyn. *Terraforming: Engineering Planetary Environments* (Society of Automotive Engineers, 1995). The biggest and most complete survey of the subject.

Oberg, James. *New Earths* (New American Library, 1981). A smaller and less technical discussion of terraforming.

Fictional Mars

Since Mars has been one of the main tropes in science fiction for more than a century, there isn't even space here to list all the *good* novels and stories set there. For several pages' worth of Mars in SF, see:

Clute, John, and Nichols, Peter, editors. *The Encyclopedia of Science Fiction* (St. Martin's Griffin, 1995). Massive and highly readable tome about SF authors, themes, history, and fandom. It's available on the Web at **http://www.ansible.demon.co.uk/sfview/**.

The following list of titles and authors is entirely subjective and by no means complete. Many of the books and stories have gone through different publishers and editions over the years.

Barnes, John. *Orbital Resonance* (Tor, 1991). Life aboard a large Cycler station orbiting between Earth and Mars.

Bisson, Terry. *Voyage to the Red Planet* (Morrow, 1990). Satiric look at a corporate-sponsored Mars mission.

Brackett, Leigh. *The Coming of the Terrans* (Ace, 1967), *The Sword of Rhiannon* (Ace, 1967), and various other stories. Some of the best pulp-SF depictions of Terrans on a decadent Mars.

Bradbury, Ray. *The Martian Chronicles* (Bantam, 1994). Nostalgic fantasy treatment of Mars.

Burroughs, Edgar Rice. *A Princess of Mars* (Del Rey, 1982) and 10 sequels. The original sword-and-planet stories, featuring the stalwart John Carter of Mars.

Clarke, Arthur C. *The Sands of Mars* (Warner, 2001). A pre-Mariner hard-SF examination of Mars colonization and terraforming.

Dick, Philip K. *Martian Time-Slip* (Vintage, 1995), *The Three Stigmata of Palmer Eldritch* (Vintage, 1991), and "We Can Remember It For You Wholesale." Surreal, proto-cyberpunk visions of grim Mars colonies and distortions of perception and reality.

Heinlein, Robert A. *Red Planet* (Del Rey, 1991) and *Podkayne of Mars* (Baen, 1995). Entertaining juvenile novels which were the default picture of Mars for a generation.

Landis, Geoffrey A. *Mars Crossing* (Tor, 2000). A recent novel about an ill-fated expedition, by an SF writer who is also a NASA scientist.

Lewis, C.S. *Out of the Silent Planet* (Scribner, 1996). A very different take on Mars and the theological aspects of interplanetary exploration.

Moore, C.L. *Scarlet Dream* (Grant, 1981). A collection of stories featuring tough guy Northwest Smith, including the classic "Shambleau." A perfect depiction of a "Cliffhangers" Mars.

Piper, H. Beam. *Federation* (Ace, 1981). Contains his pioneering short story "Omnilingual," about deciphering ancient Martian language; indispensable for any Red Planet archaeology adventures.

Pohl, Frederick. *Man Plus* (Baen, 1994). Thoughtful novel about adapting humans to live on Mars.

Robinson, Kim Stanley. *Red Mars* (Bantam Spectra, 1993), *Green Mars* (Bantam Spectra, 1995), and *Blue Mars* (Bantam Spectra, 1997). A truly epic depiction of the colonization and terraforming of Mars; very much the new "standard version."

Serviss, Garrett P. *Edison's Conquest of Mars*, collected in the anthology *Treasury of Science Fiction Classics* (Hanover House, 1954), edited by Harold Kuebler. A violently chauvinistic "sequel" to *The War of the Worlds* which is so bad it's good.

Stapleton, Olaf. *Last and First Men* (Dover, 1968). A truly mind-expanding work, highly influential on later science fiction, which includes some of the most innovative Martians devised.

Steele, Allen. *Labyrinth of Night* (Ace, 2001). Near-future hard-SF depiction of life on Mars.

Varley, John. *The Persistence of Vision* (Tor, 1991). Contains his dazzling story "In the Hall of the Martian Kings," about slumbering life on Mars and bioterraforming.

Weinbaum, Stanley. *A Martian Odyssey* (Sphere, 1974). An anthology which includes the title short story, a landmark in SF for its sympathetic and complex depiction of alien life.

Wells, H.G. *The War of the Worlds* (Indiana University Press, 1993). A critical edition with lots of useful footnotes; there are many, many other versions in print.

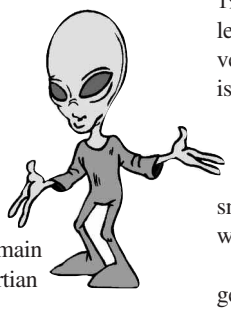
Zelazny, Roger. *Four for Tomorrow* (Baen, 1991). Contains his short story "A Rose for Ecclesiastes," a nostalgic farewell to the Lowellian Mars.

Weird Mars

Abraham, Lyndy. *A Dictionary of Alchemical Imagery* (Cambridge University Press, 1998). A good quick reference on how Mars and a lot of other things fit into the Great Work.

Ma'sar, Abu (Burnett, Charles; Yamamoto, Keiji, and Yano, Michio, translators). *The Abbreviation of the Introduction to Astrology* (E.J. Brill, 1994). A very readable translation of a medieval Arabic work on astrology, along with a later Latin version by Adelard of Bath.

Carlotto, Mark J. *The Martian Enigmas: A Closer Look* (North Atlantic Books, 1991). An otherwise run-of-the-mill treatment of the Face and Pyramids, but with cool computer-enhanced 3D images so the Face is *in your face!*



Davidson, Gustav. *A Dictionary of Angels* (The Free Press, 1967). The main source for the alarming Martian patron angel Sammael.

DiGregorio, Barry E. *Mars: The Living Planet* (Frog, Ltd., 1997). An attempt to prove that the Viking probes *did so* discover life on Mars.

Flournoy, Theodore. *From India to the Planet Mars: A Case of Multiple Personality with Imaginary Languages* (Princeton University Press, 1994). Originally published in 1899; first English edition 1901, with an introduction by Carl Jung. Study of a spiritualist's visions of Mars, from a refreshingly rationalist point of view.

Hite, Kenneth. ***Suppressed Transmission*** and ***Suppressed Transmission 2*** (Steve Jackson Games, 2000). Lots of gameable High Weirdness backed by solid research.

MacNeice, Louis. *Astrology* (Doubleday, 1964).

Lowell, Percival. *Mars and its Canals* (New York: MacMillan, 1906). It was science fact when he wrote it, but now it's a good introduction to the Mars used in classic science fiction for half a century. Lowell's earlier book *Mars* is available on the Web at **www.bibliomania.com/NonFiction/Lowell/Mars/**.

Recordings

The War of the Worlds (Orson Welles and the Mercury Theatre on the Air, 1938). This is the broadcast that scared the bejeezus out of radio listeners, both in the United States and in Latin America. It's available on cassette and compact disk in several versions, and is still entertaining to listen to.

Movies

The Adventures of Buckaroo Banzai Across the Eighth Dimension (W.D. Richter, 1984). Cult sci-fi adventure story reveals the real truth behind Orson Welles's "Martian Invasion" broadcast.

Aelita (Yakov Protazanov, 1924). An early Soviet silent film about a Mars voyage, with Martian tyrants, comic secret police spies, heroic Red Army veterans, and a very disappointing resolution.

Capricorn One (Peter Hyams, 1978). The seminal Martian conspiracy/coverup movie, with O.J. Simpson and lots of running around in the desert.

The Conquest of Space (Byron Haskin, 1954). Based on a book by Willy Ley and Chesley Bonestell's artwork, this is almost a film version of Von Braun's original mission plan. It is kind of dull, though.

Invaders From Mars (William Cameron Menzies, 1953). Above-average Fifties kid movie; genuinely creepy Martians invade a small town, and only a young boy knows what's happening.

Mars Attacks! (Tim Burton, 1996). Energetic and deliberately cheesy pastiche of classic sci-fi movies, with brain-headed Martians and plenty of low comedy.

Mars Needs Women (Larry Buchanan, 1966). The title says it all. Rife with alchemical symbolism but dangerously boring.

The Martian Chronicles (Michael Anderson, 1980). Ambitious but disappointing TV miniseries adaptation of Bradbury's short story collection. Attempts to shoehorn Bradbury's nostalgic quasi-fantasy into a kind of *Star Wars* adventure.

Mission to Mars (Brian De Palma, 2000). Made with the cooperation of NASA and the Mars Society, this film somehow failed to click with the public, but has enough scientific howlers to annoy purists as well.

Red Planet (Antony Hoffman, 2001). Released almost simultaneously with *Mission to Mars,* this film touches on terraforming by tailored organisms, but is mostly an *Alien* knockoff.

Robinson Crusoe on Mars (Byron Haskin, 1964). A surprisingly good low-budget sci-fi picture about a stranded astronaut; Mars is a lot like Death Valley and has Martians.

Santa Claus Conquers the Martians (Nicholas Webster, 1964). Really cheesy kid movie with sanity-damaging theme song and a downright creepy Santa.

Total Recall (Paul Verhoeven, 1990). Big-budget Arnold movie based on a Philip K. Dick short story; includes a vaguely cyberpunk Mars colony and the amazing 10-second terraforming method.

The War of the Worlds (Byron Haskins, 1953). Good but flawed adaptation of the Wells novel, with great visuals, decent acting, and a ham-fisted religious theme.

Games

Chadwick, Frank. ***Space: 1889*** (Game Designers' Workshop, 1989). Now back in print from Heliograph Games. In an alternate history 1889, Kipling meets Burroughs in the British colonies on Mars.

Rowland, Marcus. ***Log of the Astronef*** (Heliograph, 2000). Adapts the Edwardian scientific romance "Stories of Other Worlds," by George Griffiths to a very entertaining role-playing game.

Websites

Much of the most interesting and up-to-date information about Mars is found at various Web sites. There are thousands of Mars-related sites, but these were the ones most useful in compiling this book.

www.nasa.gov/nasaorgs/index.html is a meta-index for all NASA Web sites.

The main Jet Propulsion Laboratory Mars site is **mars.jpl.nasa.gov/**, and has all manner of pages about Mars and current space exploration programs.

The Center for Mars Exploration at NASA's Ames Research center has lots of useful stuff; its home page is **cmex.arc.nasa.gov**, and the page at **cmex.arc.nasa.gov/atlas96/atlas96.htm** features a "clickable atlas" of Mars.

spaceflight.nasa.gov/mars/reference/hem/marsref.html is another NASA site which outlines the current Design Reference Mission plan.

www.marssociety.org is the home page for the Mars Society, with links to their projects and other Mars colonization activities.

www.enterprisemission.com is Richard Hoagland's outpost on the Web, and is the nexus of a whole array of Weird Mars theories.

www.mt.net/~watcher/ has links to a large number of fundamentalist Christian Mars theories.

www.skepsis.nl/mars.html is a good analysis and debunking of the "Mars Effect."

INDEX

MISSION TO MARS!

GURPS Mars covers every aspect of the Red Planet, from hard-science NASA plans to the role of Mars in ancient mysticism and alchemy. ***GURPS Mars*** contains *four* complete campaign settings for Martian adventures:

- *Domed Mars:* a scientifically accurate setting based on the latest findings from the *Mars Pathfinder* and *Mars Global Surveyor* probes. Includes designs for spacecraft based on current NASA mission plans and the Mars Society's "Mars Direct" proposal.
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- *Superscience Mars:* straight from the B-movies, with insectoid Martians ruled by mad scientists, mutant rebels and outcasts hiding from the Psychic Police, Martian flying saucers and assault tripods, and what brave Earthlings can do when Mars attacks!
- *Dying Mars:* a swashbuckling setting inspired by classic pulp science fiction stories, with cities beside the life-giving canals, sand-boat pirates, science priests, and a Martian bestiary.

Featuring an introduction by Richard Wagner and Robert Zubrin of the Mars Society.

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GURPS Basic Set, *Third Edition Revised* and ***Compendium I*** are *required* to use this book in a ***GURPS*** campaign. ***Compendium II*** and ***Space***, *Third Edition* are recommended to those who desire detailed rules for environmental hazards. The factual and campaign material on Mars can be used with *any* game system.

THE MARTIANS:

Written by **James L. Cambias**
Edited by **Scott Haring**
Cover by **Christopher Shy**
Illustrated by **Paul Daly**

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