Technology

The technology level is mixed. The knowledge of old technology and science is not gone, but often of little use because the devices cannot be built or are not economical. At the same time occasional relics exist and are often integrated as parts in a more primitive infrastructure. In most well developed areas the basic technology level is roughly early 5 in the Gurps system. Gunpowder and printing are available, steam power exists and certain forms of telecommunications like semaphores, telegraphs and radio exist. In rural areas such as East Arabia it is 3 or 4.

Resources

There are few resources on Mars. Iron is very common in the sand and rocks and can be mined in the traditional way. Magnesium, aluminum and titanium are also present but are seldom concentrated and refining these light metals requires too high temperatures to be feasible. There are few good ore bodies; the few sources of ores are meteors, leading to mines in craters in the uplands. Here gold, silver and copper can be found (often requiring backbreaking labor). Meteor iron is an excellent alloy and highly prized.

There are no fossil fuels on Mars. The only power sources are muscle power, burning wood, hydropower, wind power and solar power. A few old nuclear reactors exist, but no fuel to refill them. Windmills require large wings, but there are plenty of very windy canyons. Solar ovens are used in the barren uplands where it is hard to find firewood. In some places methane from dung or bacterial decomposition of organic matter is bottled or piped into homes and factories where it is used for heating and energy.

Biotechnology is known, although fine manipulations are not possible. Several remnants of old biotech still exist (such as bioplastic, the bloodfurs, blackening mold and Marinovska plants) and can be adapted or bred for new purposes.

Materials and Chemistry

The Xanthe Empire is the world leader in advanced materials. Thanks to its biotechnological plastics it can produce composites, decorative paints, very hard and resilient lacquer, light tools and many chemicals. Xanthian nacre coatings (a form of artificial nacre produced by bacteria) are highly sought after worldwide. The recent introduction of clear plastic into the Cimmerian region has caused a huge demand for it: among wealthy bioists it is the latest fashion to be buried within a clear tombplastic block.

Solar paper

Xanthian special paper, made using rare plants and chemicals to shine brightly and hotly when opened. Text, written in the right inks, appears to burn and move. After a few minutes the paper fades and becomes grey. Mainly used for invitations, love letters and other important messages,

Gelbombs

A weapon used to immobilize ships and block harbors. A specially treated highly absorbent form of cellulose (“Babesorb”) is kept as a powder inside shells. When detonated over or in water the cellulose absorbs water and turns it into a gel or thick syrup. This easily traps ships and makes harbor basins impassable until the gel dissolves a few hours later. While originally intended for air support in naval battles, it has become useful for other purposes: the powder can be used for drying flooded cellars, put in special compartments in life vests to create a floating gel raft which prevents waves from submerging a person and an edible variant is used to make sliced water.

Luminum

A chemical mixture that when ignited burns extremely hot and brightly. Named for the main component, aluminum filings; it is what the ancients would call thermite. It is expensive due to the aluminum content, but used to melt through metal or welding in some applications. "Bright as luminum" is sometimes used as an expression of total clarity and awe.

Biotechnology

Lightsoup: A species of algae has been modified to act as bioluminescent lights, especially streetlights. They are kept in glass bulbs, and accumulate energy during the day that makes them shine at night with a cold blue light. In Xanthe they are often used as streetlight. Since they are relatively easily cultured they have spread far and wide, but without addition of extra nutrients (provided by the Xanthian guild of distillers or some Elysian experts) they tend to die within a week. A variant that has been used turns the bulb into a miniature biosphere by adding a bit of sand and shrimps; while such biospheres shine less brightly they can last very long. The art of making pocket biospheres is popular whenever ecologists gather, and many courts boast very long-lived biospheres with exotic species.

Power

Electricity is used in some places, mostly major cities. Generators can be built and linked to waterwheels or windmills, but the price of copper and inefficiencies of most other metal conductors make cables expensive. Often old powergrids are used, and there is a thriving business of digging up old cables from deserted cities and installations.

Windmills are a common sight. While winds on average are slower than on earth, Mars is generally windier and has more predictable weather.

Waterwheels are a common energy source in temperate areas. Their main problem is water availability and a somewhat lower energy production (since the potential energy of water is less in Martian gravity). They drive mills, generators, pumps and other equipment.

Solar ovens are common in areas with little accessible firewood. They consist of reflective foil or metal plates which are arranged around a pot, heating it with sunlight. In many southern cities the rooftops are covered with reflectors heating water, turned by hand every hour and carefully folded together when the wind blows too strongly.

Methane power is used in major cities. Organic debris is gathered and allowed to ferment, producing methane gas. The gas is distributed along pipes or sold in compressed form in metal tubes used to heat methane stoves.

The dry distillation of wood is a crucial source of raw materials. The resulting turpentine, tar and coal are used for a variety of other purposes.

Transport

> There shall be wings! If the accomplishment be not for me, 'tis for some other. The spirit cannot die; and man, who shall know all and shall have wings... - Leonardo da Vinci (1452-1519)

In the low Mars gravity flying is somewhat simpler than on Earth. Pedal-driven flyers are possible (at least in the lowlands) and glide flyers fairly common in some regions. They are mainly used for reconnaissance and messengers.

Hot-air balloons are also widely known if not used particularly often. In the Marineris region and the islands east of it they are sometimes used for lifting important passengers from the harbors to the mensas. More advanced zeppelins have been built, complete with steam-powered propellers.

In the seas most ships use sail power or rowers, although there are a few steam-powered ships, mainly in Xanthe and Amazonia. The Xanthe Empire boasts the infamous ironclad turtle ships.

The lower gravity does not affect buoyancy per se, but the higher waves make it preferable to have a high or large boat. Also, since the keel is less efficient at counteracting tangential wind forces on the sails, either the keel has to be weighted down with more ballast or a larger bulb or a catamaran shape used. Usually smaller ships are catamarans while larger ships look similar to Chinese junks.

There are few major rail connections; most rail is strictly local within a factory or on battlements, used to transport heavy machinery. However, some old rail systems from the Red Era remains where railways run, usually pulled by mammoths.

The lower friction losses make sleds useful in many circumstances. Mammoth or horse-drawn sleds are common. In some places where the ground is smooth sleds even have sails.

Military

Projectiles

Gunpowder is possible to make (charcoal is easy to get, sulfur can be gathered from many soils and saltpeter is a common by-product of methane production). This is the most common propellant across Mars. In the Xanthe empire peroxides are used instead, mainly because of the more strict soilbrewing traditions that tend to preclude the buildup of nitrates needed for saltpeter production. Instead peroxides are gathered from highland soil (a venture which also keeps it in the hands of a few, trusted groups rather than allowing propellants to spread throughout society). The peroxides are used as propellant, producing a satisfactory gun (and after some chemical work, even some explosives).

Artillery has greater range in Martian gravity, improving coastal and fortress defenses. A cannon emplacement can cover more than four times its terrestrial range. Coastal defenses become more powerful.

Large installations with working power systems are sometimes protected by railguns; the current loads a homopolar generator, which in turn propels projectiles along a track electromagnetically. Due to the presence of magnetite dust everywhere they have to be kept scrupulously clean, and tend to be somewhat “moody”. Railguns are especially common in Xanthe.

Thrown weapons longer range and missiles with dangerous mass can be carried more easily. Metal boomerangs, hurlbats (throwing axes) and throwing knives are common. Bolas are especially useful due to their long range. In Xanthe they are used as a police weapon. There also exist killing bolas that end in spiked or bladed weights and can be used both as hand weapons and throwing weapons.

Shuriken pistol

A spring-driven mechanical pistol launching throwing stars with great force. Advanced versions have small magazines with several stars. Since it is not a chemical projectile weapon it is more widely available in Xanthian society than real guns, and can still do serious damage.

Architecture

The lower gravity enables more radical or simple architecture: buildings can be three times as tall as similar Earth buildings, and smaller structures are more forgiving. Since lifting things and going up and down stairs is easier there are less constraints on building multistory buildings even under primitive conditions, and towers are common in cities to provide a well-ventilated and more restful place. Arches tend to be wider and lower than on Earth.

Bridges are also easier to build, although many river valleys can be rather broad. Dams require far less material, but hydroelectric power produces less energy

The lower gravity complicates plumbing construction. The pipes have to be slanted downwards to maintain pressure and flow to keep them clean. In Martian gravity they have to rise 2.5 times as much for a given run to maintain the same internal pressure, which increases the pipe length and the friction against the flow. The pipes have to be larger, and all this contributes to making plumbing harder. This was no problem for the old cities, but modern cities often have somewhat deficient plumbing.

Warm air rises more slowly, making chimneys less efficient. They have to be wider in order not to impair the flow, which in turn makes it hard to have many independent stoves within a building. Hence central heating or heavy insulation is used.

In desert areas buildings are often made rounded to avoid accumulating dust or causing dunes. It also helps with the powerful winds. A popular design is an “igloo” cupola above a dug out space, often surrounded by cave-like rooms and lit by a window at the top of the igloo. Entrance is through a descending passage leading to a spiral stair encircling the central space. The cupola can also act as a watertrap during the night.

Medicine

Medicine is greatly aided by the awareness of germs and old medical knowledge. Blood transfusions are for example possible by checking beforehand whose blood clots whose, even without sophisticated antigen sensors. Still, the availability of sterile environments and many drugs is highly variable and the medical level in rural areas is early 19^{th} century. In some places simple vaccines are used.

Despite the medical knowledge many house cures and quacks flourish. One of the more popular medical superstitions is salt healing. The idea is that salt can draw out disease – it is a low entropy crystal, which can absorb the entropy of disease as it melts. Salt decoctions, pills and poultices are common, and certain types of salt are regarded as especially useful. Aureum Salt is said to be good for the stomach, and Noether salt should be put in wounds to sterilize them and speed healing. The huge multiply crystallised crystals made in Couturier are especially healthgiving and expensive, and often put in protective glass vials worn around the neck for ease of use.

Other forms of pseudomedicine are apitherapy, the use of bumblebee and other insect stings to treat symptoms of a number of ailments (which is not entirely superstition, as histamine and inflammatory responses sometimes can be useful) and ocular yoga, the rhythmic movement of the eyes in certain patterns to promote health.

Other

Paper is mainly made from hemp, rags and water (so-called paper-hemp is one of the most common hemp varieties farmed). While wood pulp paper is known, it is of low quality and expensive. In Xanthe certain bacterial processes are used to produce silk paper, expensive but with iridescent colors and textures.

In the winter the cold is used as an excellent preservative, and in the summers ice is often stored in underground ice warehouses beneath insulating wood shavings or hay. Equatorial lands such as Xanthe and Aeolis often import ice; freight ships gather pieces of icebergs and move them south.

Compasses do not work well; Mars has a too weak magnetic field. Sailors usually navigate by the stars, especially using the solettas as a visible sign of where they are.

Most Martian glass is “black” (dark green or dark brown), due to iron impurities in the sand used to melt it. “Dark as glass” is a common expression for something obscure or hidden. To make glass clear requires fairly uncommon minerals, making clear or light colored glass rare and expensive.

Lenses are somewhat easier to make in the lower gravity. Pendulums swing more slowly.

Mechanical gramophones are used in Xanthe to record information, mainly messages, lectures and music. They are status symbols in the office.

Ancient Technology

Old Red Era systems are still used whenever they function. But after several centuries few devices survive intact. Anything with moving parts tends to break down, and even the most carefully handled solid-state equipment might be hurt by wear and tear. Modern technology historians and archeologists

also blame the Stargazer Empire for having wasted so much precious resources; its glorious spurt towards the heavens cost Mars more technology than it brought home.

The most well preserved systems are the space systems. The solettas, survey and communications satellites are still quite functional.

Nanoassemblers and matter compilers were vital for the survival during the first dark ages, but couldn't be repaired and tend to break down after years of use. Today nearly nothing of these systems remains, except possibly carefully mothballed devices in hidden bases or the upper reaches of Aeropolis.

The mobile Factories tended to suffer breakdown in their more sensitive systems, gradually turning them from mining/factory work into power generation and eventually shelters. Most fusion reactors have long since lost power due to lack of fuel, but fission reactors remain workable (although often with low efficiency).

Computers and radio equipment are the most valuable old tech, carefully tended by technohistorians and the inner circle of noble families. Many of the radios of the Stargazers were rugged and simple enough to remain in use.

Installations such as the Worldhouses, the Clarke Dam and Syrtis Field are useful but require that the user stay near them.

Perhaps the most useful remnants today are advanced materials. Nanocomposites, diamondoids, sapphiroid, titanium alloys, air bricks and solar collector film are still largely useable and in most cases do not degrade over time. Especially diamondoid is highly prized – tools made out of diamond-like material are brilliantly hard and sharp, and many noble families have one or two heirloom diamond-edged swords. Even diamond edges get dulled, but fragments of the diamondoid can be used for arrows, surgical tools, abrasives or jewelry. The same goes for the wonderfully heat resistant sapphiroid and the tough nanocomposites. Air bricks are very light translucent and heat insulating bricks used for many dark age shelters, today very sought after for new buildings.

The existence of printouts and copies of ancient knowledge has been both a bane and a blessing. Much of the basic knowledge of the world has been retained, and some technological development can be done without blind alleys simply by recreating what is known to have worked once. But even when the ancient information is used to build technology it is often found to be slightly incomplete – nobody ever described all the subtle details of making a high-precision lathe or the tools used in making electronics. The presence of the ancient knowledge also inhibits independent research – should one undertake complex experiments or try to find where the answer surely must be written? The Infomerchants often try to break free from the canon, but with little success. Entire academic schools of brittanicists, encartists and wikists base their worldviews on interpretations of particular parts of the canon.

Another reason of the slow rate of technological growth was the end of research during the Red Era. The parts of humanity that were most into technological advance and science for its own sake went posthuman, while the MTN and CSRE belonged to the post-scientific worldview that merely exploited the fruits of science and technology without trying to improve on them. The MTN merely applied nanotechnology, advanced biological modelling, automated design-manufacturing and artificial intelligence to terraforming, not finding it worthwhile to learn the immensely complex underpinnings of the technology (and in fact discouraging scientific inquiry as leading away from the Project and humanity). This was of course another reason the Crash was so devastating: without an understanding of the advanced technology it could not be maintained without other advanced technology, and the whole techno-ecology unravelled. There was also no living scientific tradition, and the attempts to resurrect it has also proven harder than expected – the institution of science has proven just as fragile as the institution of technology.

Weapons

In stories and the public imagination, the Ancients left behind awesome weapons. At any time a sufficiently angered technoble with the right codes can make fire and radiation descend from the skies, or annihilate a city with their inherited nukes. The reality is far less dramatic. Most Red Era weapons

systems were destroyed during the invasion and dark era, and the control codes of the remaining have largely been lost. Even if a technoble family still retains the codes for an anti-meteor laser or orbit-ground kinetic kill station they would have to find a way to send them, recall the correct system of aiming and pray that the ancient device has not degraded.

The popular story about the diman of Sfax (or some other suitable place, depending on location) is a good example. The diman family had inhereited a powerful orbital weapon and demonstrated it about every 50 years. When the old diman died, her daughter decided to hold a new demonstration. The control system consisted of two devices: a fire control unit and a positioning unit. She knew she was to enter some numbers from the positioning unit into the fire control unit, but did not remember which. So she used the numbers it was currently displaying. On the next pass over the region the station fired – destroying the diman and half her city. The moral is that old technology can be dangerous, and it is doubly dangerous to those who do not know how to use it.

Terraforming nukes are also beyond their prime. The original nukes were a fission bomb primer that was placed at the end of a long tube containing deuterium. The tubes could be very long – tens of kilometres - for canal digging or releasing certain aquifers, and were usually nanofactured in place before the primer bomb was placed at the end. Today the fission bombs have had plenty of time to go bad, both due to radioactive decay and decomposition of their primer explosives. They would most likely not to devastate a city but rather fizzle like a big dirty bomb. Still, the families controlling the few remaining units are doing their best to leverage them into real power.

On a more local level Red Era guns and explosives still remain in many collections. Few work or have much ammunition. Among the best-retained are the railgun cannons, which have been replicated in Xanthe and Alexandria.

Fabzyme

Artificial enzyme for industrial processes, made using nanotechnology during the Red Era. A few fabzymes are fairly stable and can still be used if found. Some technobility and infomerchants still retain caches of useful fabzymes. Typical fabzymes can be used to dissolve cellulose into sugar, convert sugars into diamondoid plating or drugs etc.

Crystex

Design style popular among the CSRE, based on nanofactured smart materials looking like crystal. Crystex constructs could change stiffness from hard to soft and bend, as well as change their optical properties (showing pictures and holograms, as well as acting as windows, mirrors or opaque screens). Crystex matrix contained powerful distributed computer systems that controlled the devices and linked to other systems in the vicinity. While not as efficient for many uses as dedicated machinery or the horrendously expensive tility fogs, crystex appealed to aesthetics and lent itself to elegant furniture, equipment or even buildings. Today crystex devices are nearly always “dead” and fragile, although their peculiar optics makes them popular gems. Old crystex objects such as glasses or chairs are expensive antiquities.

Knobjects or knowstones are crystech data storage units. During the first dark era they were often treasured, containing vital information for the future. Over time this practical hope turned into traditional reverence, and today knobjects are regarded as somewhat holy relics. Any knobject is seen as hiding ancient and powerful knowledge, not the inventory backup software, pornography or timetables they most likely contain. They are unusable without advanced nanotech infrastructure and the right encryption keys, so for all practical purposes they are just decoration. Still, not just infomerchants adore the idea of gems that can be held in the hand containing all the knowledge of the Ancients, however inaccessible. The most famous knobject is the Dferatpo, a emerald-like disk that is said to be a copy of the master plan for martian terraforming. It is kept at the main shrine at Roscommon Island and seen as a symbol for the ability of Life to conquer death.

Tility fog

Near-mythical nanotech device that acted as a mist in the air that could move objects, show pictures, assemble/disassemble things and general make magic work. Tility fog were designed by the posthumans and rarely used outside the Dyson. Today it is a standard attribute in stories and pictures of nanowizards; they were said to be surrounding by sparkling tility fog.