Science fiction: space technology

Technology

Many ancient people, including the Aztecs, Egyptians, and the builders of Stonehenge, were interested in astronomy. Their writings and architecture indicate they studied the moon's phases and movement. They related the position and the perceived movement of the sun to earth and its seasons. Some chartered the stars, identifying the constellations. Through the ages, scholars suggested various explanations for the makeup, movement, and relationship to earth of these heavenly bodies. Like us today, they wanted to know more about those distant objects, but a lack of technology limited their ability to learn.

Over the centuries, scientists like Galileo and Newton described the structure of the solar system and the movement of the planets. Inventions such as the telescope permitted them to see the moon's craters, the canals on Mars, Saturn's rings, and other intriguing details. This knowledge increased their curiosity about the moon, sun, and planets, and they longed for more information. They even dreamed of expeditions across space to encounter them first-hand. In the early years of the space program, lightweight batteries, fuel cells, and solar modules provided electric power for space missions.

As missions became more ambitious and complex, power needs increased and scientists investigated various options to meet these challenging power requirements. By the mid-1950s, research had begun in earnest on ways to use nuclear power in space. These efforts resulted in the first radioisotope thermoelectric generators (RTGs), which are nuclear power generators built specifically for space and special terrestrial uses. These RTGs convert the heat generated from the natural decay of their radioactive fuel into electricity.

The low-power devices are designed to supplement a craft's primary non-nuclear power source, but as the technology progressed, they soon began shouldering many missions' entire power needs. Today, RTG-powered spacecraft are exploring the outer planets of the solar system and orbiting the sun and earth. They have also landed on Mars and the moon. They provide the power that enables us to see and learn about even the farthermost objects in our solar system. Thus, science fictions on space technology came into existence because of the endless imagination of man. This research would serve as an evaluation of these science fictions.

This study will explore just three: terraforming mars, asteroids as outposts, and space farming. Terraforming Mars This is the idea that no single technique for terraforming Mars can work in isolation, and that only a combination of several technologies, requiring a massive industrial effort on both the plant's surface and in space, can hope to succeed. McKay wrote a two-phase approach to terraforming, in which the planet is first warmed by a massive release of carbon dioxide, followed by a modification of the atmosphere to scrub out the carbon dioxide and increase the oxygen content in order to support complex life.

The time scale for such a two-phase approach was estimated to be about 100 years for the first step and up to 100, 000 years for the second. McKay explicitly stated in his paper that he had limited consideration in his study to technologies that were not far beyond the current state-of-the-art. The fact that a scenario for the full terraforming of Mars can be conceived within the parameter of space of current planetological models, and without violating any known laws of physics, demonstrates that such an idea is, at least, feasible in principle.

To bring such a project to fruition would require engineering capabilities greater than those of the present day, but not necessarily out of the question for a future civilization several centuries ahead of our own. Why Mars? Why not on Earth, under the oceans or in such remote region as Antarctica? Why not on the Moon or in artificial satellites in orbit around the Earth? The Red Planet may appear at first glance to be a desert, but beneath its sands are oceans of water in the form of permafrost, enough in fact (if it were melted and Mars' terrain were smoothed out) to cover the entire planet with an ocean several hundred meters deep.

Mars' atmosphere is mostly carbon dioxide, providing enormous supplies of the two most important biological elements in a chemical form from which they can be directly taken up and incorporated into plant life. Mars has nitrogen too, both as a minority constituent in its atmosphere (3%) and probably as nitrate beds in its soil as well. For the rest, all the metals, silicon, sulphur, phosphorus, inert gases and other raw materials needed to create not only life but also an advanced technological civilization can readily be found on Mars. Terraforming Mars will drive the development of new and more powerful sources of energy.

Settling the Red Planet will drive the development of ever-faster modes of space transportation. Both of these capabilities in turn will open up new frontiers ever deeper into the outer solar system, and the harder challenges posed by these new environments will drive the two key technologies of power and propulsion ever more forcefully. Asteroids as Outposts In the initial stages, a large asteroid could be selected and mined (for resources), using the slag from the mining as reaction mass for propulsion; the asteroid could be placed into Earth orbit (easier to get to).

The money from the sale of the materials mined from the asteroid would fund the project. For survival of the miners, a string of water stations could be used. Once the asteroid is in orbit, the hallowed out shell shall be used as a habitat, which will be relatively immune to impact of smaller space junk. The hollowed asteroid could have enough skin left for shielding and be spun along an axis. Possible problems if it isn't airtight, coating could be sprayed on the inside. Some sort of dynamic control system or the addition / removal of some external mass to produce a sensible axis should be used for it to rotate around.

The asteroid must be large enough to satisfy earlier concerns of maximum rotation rates. Cosmetically there would be no external windows but most of the outside could be covered with solar panels. A better plan is to retrieve a suitable asteroid for turning into a habitat and treat the raw materials produced as a happy by-product of the hallowing process. The whole project would possibly produce both a profit and a habitat. The following explain the significance of making asteroids as outposts:

* Large number of possible sites, with over 300, 000 asteroids identified to date. Isaac Asimov pointed out the advantage of building cities inside hollowed out asteroids since the interior area in square miles of all the asteroids put together is a great deal more than that of the surface are of Earth (viewed as series of cubes one mile by one mile resting on the surface

of Earth) and thus a large population could be accommodated in the asteroid belt.

* Several different chemical composition classes, including iron and carbonaceous, providing a variety of materials usable in building and fuelling spacecraft and space and space habitats. The Trojan asteroids in Jupiter's orbit may be primarily extinct comets. Some earth-crossing asteroids require less energy (delta-V) to reach form Earth than the Moon. * Material mined from asteroids could be a basis for a trade economy.

* A lot of asteroids (especially the extinct comet cores) contain large amounts (more than 5% of total composition) of volatiles and carbon, which are necessary for life support. Space Farming Developing such a system isn't as simple as planting some fruits, vegetables, and wheat in space or on distant planets. There is need for a bio-regenerative system for sustenance for twelve months, or five years. It takes a long time to build and evaluate these systems.

Scientists are investigating how different amounts of three factors – light, temperature, and carbon dioxide – affect plant growth. A fourth factor is the species and variety of plants. Inside closed plant-growth chambers at KSC, radishes, lettuce, and green onions grow " hydroponically" in nutrient-enriched fluid. Light, temperature, and carbon dioxide levels are carefully controlled. Scientists are comparing how plant species grow together in " mixed cultures" versus themselves in " monocultures". First, some plants give off chemical compounds that can poison their neighbours, clearing the way for the aggressive plant to spread.

Also, some plants may use nutrients more aggressively than others. For example, some species might be heavy nitrogen users that would be fine on their own but would take away from other species. Another concern is the competition of plants for light, based on how they grow. If one species grows taller and spreads out wider than the species beside it, the larger plant may block the light form the smaller plants. Apart from these environment variables, scientists are examining the effects of different types of lighting on plants to determine which color best helps them grow.

Another consideration is atmospheric pressure. Plants offer a promising solution in providing food to astronauts thousands of miles from Earth. They could grow crops that would not only supplement a healthy diet, but also remove toxic carbon dioxide from the air inside their spacecraft and create life-sustaining oxygen. But for future long-duration missions and colonies on the Moon or Mars, scientists believe a life support system with a biological component (such as plants) – called a “ bio-regenerative life support system” – has several benefits.