9 The Future of Mankind

The questions "Why don't we have contact with extraterrestrial intelligent life?" and "How will mankind evolve in the near future?" are intimately connected. Clearly, civilizations that are far behind our technological state would not be capable of communicating with us. But even societies more advanced than us would have difficulties in making contact, as radio waves or spacecraft take a long time to cross the huge distances in our galaxy. In addition, such advanced societies might no longer exist. They could have fallen victim to external or internal dangers, or they might not wish to communicate with us. The only way to gain some insights into the possible dangers afflicting extraterrestrial intelligent societies and their likely mode of behavior is to consider our own future development, because these civilizations are expected to have gone through our own technological state long ago.

Although it is very speculative to predict the likely evolution of human society, it is impossible to overlook three current developments that have particularly far-reaching consequences for our future: the advances in information technology, the conquest of space, and the mastering of the biological world. While the conquest of the solar system is expected to open up truly limitless economic prosperity and an unimaginable diversity of human society, information technology and the mastering of the biological world will not only enable us to change our own bodies and minds in a fundamental way, but may even result in the evolution of entirely new forms of intelligent beings. Yet this constant increase of knowledge and explosive growth of technological power also carries with it the rapidly rising danger of complete annihilation of the human life form. Due to this it is absolutely essential to develop survival strategies to counteract these dangers.

9.1 Predicting Mankind's Future

Predicting the future, as every stockbroker will readily admit, is notoriously difficult. Numerous wrong predictions, even by professionals in their fields, have demonstrated this. It suffices to recall the "scientific" prediction in 1895 by the famous physicist William Thomson (Lord Kelvin), president of the Royal Society, that "heavier-than-air flying machines" will never be possible.

Others include the 1977 prediction by Ken Olson, president of Digital Equipment Corporation, that "there is no reason anyone would want a computer in their home", or the financially devastating assessment of the managers of IBM a few years later, that personal computers (PCs) would never be important in terms of sales compared to mainframe computers. We are not only notoriously bad at predicting the future, but often even lack imagination when new inventions have been introduced. In addition, there is a tendency to overemphasize negative developments. This has a long tradition, going back to antiquity and medieval times, when "prophets of doom" delivered their end-of-the-world type messages.

Is it possible, despite these warnings, to make predictions about the future development of mankind? I think that by extrapolating far-reaching and fundamental trends in human history, it should be possible to make reasonable predictions. Let us consider the advances in information technology. In less than a quarter of a century, computers have mutated from specialized machines for some scientists to universal and absolutely essential tools in manufacture, process management, administration, commerce, communication, education, and recreation. Because of their usefulness, these machines have modified everyone's lives both at work and at home, and we no longer want to live without them. They allow us an almost instant contact with millions of people and databases around the world, and they permit access to the remotest places on Earth. There is little doubt that this progress in information technology will continue by making computers even more sophisticated and intelligent. They could be viewed as evolving external organs of our body, which greatly help to improve our interaction with the environment and other human beings. The full consequences of this evolution are impossible to predict, but the development in the other two areas mentioned above could turn out to be even more fundamental for mankind.

9.2 Settlement of the Solar System

The second, easily foreseeable development in the near future is the conquest of the solar system. But why go into space? Why not stop all growth and live in harmony with our environment here on Earth? The expansion of the Greeks into the western Mediterranean, the attack of the Huns on the Roman Empire, the search for the routes to the spice islands, the colonization of America and Australia: Have these activities all been driven by hunger and overpopulation in the homeland? Or were they not frequently initiated by the excitement of adventure, the possibility of untold treasure, and by the chance to shed the old and make a new beginning? I think that these adventurous aspects of our nature are deeply implanted in our minds in order to assure the survival of our species.

9.2.1 The Space Station

Since *Sputnik*, the first Russian satellite orbiting Earth in 1957, the conquest of space has steadily progressed. Technology has advanced in a staggering way: the first commercial communications satellites launched in 1965 could handle only 240 simultaneous telephone connections, but they now carry one third of the world's telephone traffic and essentially handle all TV broadcasts between countries. It is now common to receive TV directly from powerful satellites in geostationary orbits, 36 000 km above the Equator, parked at a fixed spot in the sky. With a series of new communication systems such as *Iridium*, which use cross-linked satellites that orbit the Earth at heights of less than 1000 km, our planet now has instant telephone connections and high-rate data transmissions from every location on Earth. Low orbits help to avoid the noticeable time-lags in voice communications currently encountered over geostationary satellites, and caused by the finite speed of radio waves.

While for telecommunications the conquest of space is now commercially rewarding, other Earth-observing satellite ventures are also on their way to becoming economically successful. Such space activities include weather prediction, navigation (with the *Global Positioning System*, GPS, and the forthcoming European navigation system *Galileo*), resource management, studies in the Earth sciences, and military defense.

The greatest endeavor to date, however, is the *International Space Station* (ISS). In 1998 (see ISS 2005), the first two modules of the ISS were launched and joined together in orbit. Other modules soon followed and the first crew arrived in 2000. Over the past five years construction proceeded and the station was continuously inhabited by a staff of 2–3 astronauts. After a considerable delay following the disaster of the space shuttle Columbia in Feb. 2003, the station is now scheduled to be completed by 2010 with an expected final weight of 460 t.

At a present height of 350 km above ground, in a so-called *Low Earth Orbit*, the ISS circles in 92 minutes around the Earth. This height varies because of atmospheric drag. As it has decreased by 50 km since 2003 it needs to be periodically reboosted to greater altitude. When completed, the station will provide a platform in space (see Fig. 9.1) that can house seven permanent staff in a pressurized living and laboratory environment the size of a large jumbo jet. Because of its huge cost, 16 nations are participating in the construction of the station.

Admittedly, many of the present tasks of the station could have been carried out more cheaply by unmanned satellites. Yet there are important future applications with humans being personally able to carry out investigations in situ, which make the ISS the next fundamental step in the conquest of space. If we want to conquer space, we must know how man reacts to weightlessness, how to combat undesirable changes in our bodies, how plants grow in space, how limited biospheres must be controlled to provide a suitable environment for life, how unhealthy or offensive emissions from machines and

Fig. 9.1. International Space Station ISS, photographed from the Space Shuttle Discovery in Aug. 2005 (courtesy of NASA)

materials can be managed, and how pests and microbes can be kept in check. In addition, the ISS is the place where industrial applications in zero gravity and space manufacturing will be investigated, with the aim of making these activities commercially successful.

Clearly, however, one main purpose of the space station is its future function as a way station to space: to serve as an extraterrestrial base and supply depot from which satellites and space vehicles can be repaired and serviced, and where large interplanetary missions can be given last minute checkups before departure. The ISS will also function as an emergency center from where help can be launched quickly when space projects develop difficulties.

Finally, in the more distant future, the ISS and similar stations in low Earth orbit will be the seat of industrial processing of materials brought from asteroids or the Moon. Here the most important industrial product will be rocket fuel. Its manufacture in the future will turn the ISS into a vitally important refueling station for space travel.

The essential importance of the ISS for the conquest of space was also recognized by the US space policy announced in Jan. 2004 under the name *Vision for Space Exploration* by President George W. Bush (see Space Policy 2005). The aims of that policy are to complete the International Space Station by 2010, retire the Space Shuttle by 2010, develop a so-called *Crew Exploration Vehicle* CEV by 2008 patterned after the *Apollo* capsules that were used in the manned Moon project 1963–1972, conduct a first manned mission with it by 2014, develop two launch vehicles for cargo and for the CEV using Shuttle components, explore the Moon with unmanned missions