



## Challenge

Space, the final frontier - and also the biggest challenge to mankind. Space travel: A challenge with a specific goal. Exploring strange new worlds, development of raw materials, colonization of planets and moons. And: The search for life in outer space, for "aliens" and extraterrestrial civilizations.

The bombshell dropped in the first week of August, 1996: Martian microbes, fossilized in a meteorite - proof of extraterrestrial life. The probable discovery of bacteria and other organic bio-markers in the Martian meteorite ALH84001 shows, for the first time and to a sufficient degree of certainty, that there may be - or, at least, might have been - life on other planets.

Even though these finds - like this most recent one in the Martian meteorites of Nakhla and Shergotty - will still have to be verified with respect to several factors and by several groups of scientists, there is an indication that we may have reached a turning-point in our scientific and social views of the world. Finding extraterrestrial life would put our image of being the "pride of creation" in a more realistic perspective; we would also have to redefine our position in the cosmos - even if such extraterrestrial life may be no more than bacteria, at first, or even just fossils...

This, invariably, raises a question that first came up twenty years ago: Is there still life on Mars? In 1976, two US space probes, Viking I and Viking II, landed on Mars: in Chryse Planitia and Utopia Planitia, respectively. One of their essential tasks was to analyze the Martian soil of the landing site. Did the soil contain bacteria? Did the stereo cameras of the probes detect any optical evidence of an existing Martian biology?

Interplanetary space travel is making progress. One by one, the mysteries of our solar system and of the universe are being solved - and each answer reveals even more mysteries. Mars is the closest destination for manned space travel. Europa, a Jupiter moon, seems to hold mysteries of its own: Scientists suspect that it may have an ocean, fully covered with ice, but, perhaps, also teeming with life. And then there is the phenomenon of reports that radio signals are being received from within our solar system. Are these our own, reflected, signals? Or is it that ETs have left behind a probe in our solar system?

But we are not only talking about our solar system anymore! Even now, NASA experts in the theory of space travel are seriously working on concepts of interstellar travel - that is, travel between the stars. Modern physics availed itself of mathematical models to study technological fundamentals in order to "outsmart" the immense distances of space and time.

Is it possible to travel on gravitational waves? Can travels in a four-dimensional space be shortened by going through a three-dimensional globe, instead of going a longer distance on the surface of such a globe? Are "warp drives", as seen on Star Trek, really nothing but science fiction? Another option - feasible with today's technology - would be to travel galactic distances by using generation spaceships - small artificial and independent "islands" drifting slowly through space. In other words, the barrier to stellar travel has been lifted - both ideologically and technologically. And what would be possible for us, would certainly be feasible for any other civilization - especially those that are way ahead of us in evolution. What is more: there seems to be some kind of evolutionary pressure or destiny that life should expand in all directions - and that includes colonizing outer space (through the evolution of intelligent life-forms).

Generation spaceships? Not science fiction! Even today, we could construct such gigantic space colonies. According to well-thought-out plans, millions of people could be fitted into such "habitats",

or small artificial worlds; at first, they could be stationed in our solar system like satellites around the Earth for the purposes of, say, manufacturing certain industrial products. They would contain expansive artificial landscapes with plants, animals and even rivers - gravity would be generated through rotation. People would live and love there; they would also be born and die there. Sooner or later - and there is nothing that would prevent them from doing so - they will be self-sufficient enough to set course for new regions (previously determined) of the galaxy. In other words, they would not simply head off to unknown parts of space.

They could investigate possible destinations and planetary systems with earth-like planets - in the future, there will be a lot more information available on such destinations before setting course. And then?

**It is quite elementary:**

Everyone is familiar with the US space shuttle. With each new launch, 30 tons of payload are catapulted into orbit. Currently, such payload is made up of satellites. But soon this could involve components for ever-growing space stations. There will be huge mirrors out there, and prefabricated parts will be welded and bolted together. Eventually, people will fly to the moon and settle down there. Moon craters will be covered with domes in order to mine natural resources. This is a job that robots could do, but it is sure that humans will not want to pass on that adventure. They will want to go up there themselves. From the moon, one will fly to the L-5 point between the Earth and the moon. (L-5 is that point where the earth's gravity and the moon's pull cancel each other out.) Such points will then be supplied with raw materials, minerals and insulation material to build ever-growing structures in space. At L-5, giant wheels will be set up. Why wheels? By rotating, these wheels would create centrifugal/centripetal forces. The centrifugal force is something that we all know - for example, the washing machine. The faster the drum rotates, the more strongly the clothes will be pressed against the inside of the drum. This is the principle applied to space stations. The wheels will be set to autorotate, and everything within the station will no longer float around weightlessly. You would always keep your feet firmly on the ground.

We may now start to calculate how to colonize the entire Milky Way from one central point:

A giant generation spaceship would be launched from Earth and sent to a point ten light-years away from us. Its speed would only be two percent of the speed of light. In order to travel a distance of ten light-years, such a ship would take 500 Earth years. Once they have arrived on a planet, the astronauts would have another 500 years to build a second spaceship. Subsequently, two ships would travel a distance of yet another ten light-years.

Again, after 500 years, two more ships would be built - resulting in a total of four, then eight and sixteen and so forth. This is referred to as the "snowball system". If we assumed a voyage of 500 Earth years over a distance of ten light-years and a stopover of an additional 500 Earth years, we would achieve an expansion speed of one light-year per century. So, we could cover a distance of one light-year within 100 years. This way, we could colonize our entire Milky Way within ten million years.

These calculations may appear to be amazing, because they illustrate clearly the exponential growth. Another immanent quality that also progresses exponentially has, however, been overlooked so far, even though it would inspire us in a most magical fashion as far as the speed of expansion of a space-faring species was concerned.

Keep in mind: in addition to our purely numerical expansion, the technological and civilizational evolution of ETs would progress as well. In the course of their cosmic existence, the "aliens" would develop more effective and faster spaceships or accelerate the construction of new ships; possibly even discover completely new forms of space travel that their ancestors - those that had started the "Star Trek" - would have never dreamed of. But who would even think of something like that?

Yet, everything is relative. The ten million years of our previous calculations make up only one thousandth of the age of the Milky Way. The Milky Way is ten billion years old. It is certainly

possible to do all that, if we want and if we do not have to think in terms of those ridiculous timelines employed by politicians. Have others tried it before? Have we been visited by them?

Have other civilizations left behind their traces and symbols on good old Earth? The future of space travel is still ahead of us.

But do extraterrestrial civilizations exist? And are they really more advanced than we are? Have they mastered interstellar space travel, and could we, too, travel from star to star? And: what is the probability that others have been to our solar system and our planet, assuming that their civilizations are much older? If, in fact, extraterrestrial intelligent beings visited us in the past, then surely we should find some traces. The history of mankind is full of mysterious accounts of such visits. Or, maybe, they have left their "business cards" somewhere else in our solar system?

Exobiology, dealing with extraterrestrial life, and SETI (Search for Extraterrestrial Intelligence), which uses radio astronomy to detect ET civilizations, are new scientific disciplines. The fundamentals of these disciplines were already defined back in November 1961.

At a conference in Green Bank, West Virginia, a mathematical formula was worked out which allows to estimate, with a fairly high degree of certainty, the possible number of technologically advanced civilizations in our galaxy. This formula contains all the data relevant to this context: the number of newly formed stars per year, the number of suns that have planets revolving around them, the number of such planets that are similar to Earth and finally those that might have life. In addition, an attempt was made to determine the number of planets that might have intelligent (humanoid?) life-forms and the number of such planets that might have advanced to such degree that their inhabitants could contact us. The final item of this formula is the expected lifespan of such civilizations. Today, at the dawn of the 21st century, with each discovery of new planets orbiting around distant suns, the individual components of the formula are being specified and refined. The validity of the main parameters, however, still holds true to this day. Depending on whether minimum or maximum values are applied to the individual parameters of the formula, the result will be positive, optimistic or pessimistic. Even from the most pessimistic perspective, according to this formula, there could be as many as 40 or more equal "humanoid" civilizations. Otherwise, this number could shoot up to almost 50,000,000. A remarkable result.

The search for evidence of traces of life in outer space has become the main topic nowadays. Exobiology, however, takes multiple approaches: radio astronomy, satellite-based research, biochemical lab experiments, etc. And again and again, scientists come across promising findings. But what matters to the wider public the most is this question: Is there intelligent life out there? What do these "aliens" look like? What do they think, how do they act?

In amazement, we take note of the discovery of new worlds and see our horizons expand; we are also aware that research is possible and necessary in order to tackle those challenges or mysteries. If we believe that ETs have managed to overcome distance, then we must also acknowledge: that our solar system and Earth have never been isolated systems. We might have a "close encounter" with the unknown at any time - maybe even today. SETI is about "listening" to signals from outer space; SETA, on the other hand, is engaged in looking for extraterrestrial artifacts left behind in our solar system or on Earth.

Of course, this does not mean that we should start looking for bits and pieces of alien spaceships or that we should compare this to "Stargate". There are other, equally odd, discoveries...

The news ticker of "Bild der Wissenschaft", a German science magazine, reported the discovery of an object with a diameter of about thirty to fifty meters in an orbit close to the Earth's orbit - this report referred to an article published in "New Scientist".

**The report was as follows:**

"On February 10, a telescope located in New Mexico, used for automatically searching for asteroids as part of the LINEAR project, captured an object moving close to the Earth's orbit. Its diameter measures about thirty to fifty meters, and it circles the sun. It is only about nine million kilometers farther from the sun than the Earth. For celestial bodies, it is quite unusual to have such a circular orbit. Up to this point, scientists have known of only one asteroid whose orbit was similar to the Earth's. However, that asteroid, known as 1991 VG, was substantially smaller than this new object, which has been named 1999 CG9. Given the size of CG9, it can be ruled out that it is a terrestrial artifact, such as the final stage of a rocket.

The most probable explanation is that it might be a piece of the moon," said Gareth Williams, from the Harvard-Smithsonian Center for Astrophysics in Cambridge, when asked by New Scientist. Williams calculated the orbit of CG9. Since the moon's pull is considerably weaker than that of the Earth, fragments of the moon's surface may be torn off, which then escape the moon's gravity and settle into a moon-like orbit around the sun. Sometimes, some of these moon fragments can also hit the Earth. Twelve smaller meteorites have been found so far that came from the moon. In order to determine whether they are rocks from the moon's crust, spectrographic analyses of their surfaces will have to be carried out (their composition would have to be identical, or almost identical, to that of the moon's crust).

At this point, however, this is the most probable explanation. There is also another mysterious object in close proximity to the Earth (in addition to "1991 VG" mentioned before) as well as "1996 PW" farther out in our solar system - these should be studied from an ETI (Extraterrestrial Intelligence) point of view.

"Contact with aliens" - a topic that has fascinated people throughout time; it is also especially interesting, because everyone - and not only scientists - can take an active role in investigating this phenomenon. One is actually tempted to say "ought to take an active role". Space, space travel, the future... the search for extraterrestrial life and intelligent alien life-forms is also a quest to find out more about ourselves.

