Interstellar Travel – from Daedalus to Dan Dare

by **Alan Aylward** on 24th September 2021

Professor Alan Aylward, of University College, spoke to us at our first face-to-face meeting at Mycenae House (since 21st February 2020) as Covid restrictions were being relaxed.

Professor Aylward said he would start with the comprehensible, but tell us of ever stranger ways interstellar travel might be achieved – and not to worry if we were not still with him at the end.

As a lad he greatly enjoyed the Eagle comic, in which the superman of the day was Dan Dare. A slide was shown from the comic, showing a diagram of Dare's spaceship.

Daedalus was an Athenian scientist whose reputation reached Minos, the king of Crete. He took Daedalus and his son, Icarus, to Crete to design a labyrinth such that no one could escape from it. When it was done Daedalus asked that they might leave – but this was refused. Daedalus made wings of feathers secured by wax for each of them. Icarus flew too close to the Sun and his wings came apart…

The Milky Way galaxy is about 13.5 billion years old, and has at least 200 billion stars. It would take at least 10,000 years, travelling at, say, a tenth of the speed of light to traverse it. There is evidence for Life on Earth from about 3½ billion years ago. Assuming conditions for life existed earlier, elsewhere in the galaxy, and a civilisation capable of colonising exoplanets developed in just one of them, one would expect civilisations to exist in all parts of the galaxy. None have been found – Fermi's paradox.

Rockets need fuelling before take-off – unsuitable for interstellar travel - energy for a spaceship needs to be scavenged from gravitational, electric or other fields in space. One possible means of propulsion would be magnetic repulsion – the spaceship could magnetise itself to the opposite polarity of a magnetic field it was flying through. Konstantin Tsiolkovsky, a Russian scientist, proposed space travel from 1880s and produced theories for rocket design. He was a founding father of modern rocketry and astronautics along with the Frenchman, Robert Esnault-Pelterie, the German, Hermann Oberth and the American, Robert H Goddard. Goddard launched a liquid fuelled rocket in 1926.

The British Interplanetary Society (BIS) designed a rocket powered *Lunar Space Vessel* in 1938 – comprising several sections each with multiple solid fuel rockets; as each section burnt out it dropped off. This was not built as materials were wanted for the war effort. In the mid-1960s Rolls-Royce and the British Aircraft Corporation (BAC) explored *The Multi-Unit Space Transport & Recovery Device* (MUSTARD), a reusable launch system concept, also using multiple rocket sections - but these were to land after take-off and be reused. It was not funded, but was estimated to be potentially many times cheaper than the American Shuttle programme.

In 1977 Voyagers I and II were launched to study the outer the Solar System and interstellar space beyond the Sun's heliosphere. Voyager I is now 150 AU (Astronomical Unit, the Earth-Sun distance), 41 light-hours, from earth and is still working – its nuclear generator will cease to provide adequate power in 2024. It has a relatively large (3.7m dia) antenna but even so the signal reaching Earth is buried in noise, only recognisable by its distinctive coding.

Interstellar Travel - The BIS did a 'Project Daedalus' study in 1973-78 for a probe to be able to reach its destination within a human lifetime, taken to be 50 years. Alan Bond, a seasoned rocket engineer, led a team who proposed using a fusion device to reach Barnard's Star 5.9 light years away. A pellet of Helium-3 & Deuterium if fused by a laser pulse will produce a burst of energy. A sufficient number of pellets could propel a spaceship. A two stage rocket was proposed, assembled in Earth orbit. The first stage would weigh 1690 tonne, and be loaded with 46,000 tonne of fuel, the second stage 980 tonne plus 4000 tonne of fuel. The source of the amount of deuterium needed would probably be Jupiter. Stage 1 would burn for two years, and Stage 2 for 1¾ years. The rocket would then travel at 12.2% the speed of light.

Another idea is to use tiny probes with a mass of tens of grammes, with a 'sail'. These could be accelerated using lasers to a speed perhaps 1/10th the speed of light. Sending results back to Earth remains problematic.

The US Navy investigated ‘laser compression fusion power’ in 1987-88 which would be beneficial.

Within 14 light years from Earth there are 33 stars with 16 planets, eight in habitable zones.

The Breakthrough Propulsion Physics Project (BPPP) was set up and run by NASA from 1996 to 2002 to study space propulsion techniques that would involve breakthroughs in Physical understanding. This ran for six years, and found four viable avenues for further research, but six that were not. Professor Aylward spoke of common errors to beware of: oscillation thrusters; electrostatic gravity shielding; gyroscopic antigravity; and the thruster antenna proposed by Roger Schlicher, which was tested but found to be reactionless.

When the BPPP closed the ideas were taken up by the Tau-Zero Foundation.

Ideas still being considered are: Zero Point Fluctuations - at absolute zero temperature there is still some energy which could be harnessed by a Differential Sail; Induction Sail – using cosmic background radiation (from the Big Bang); Casimir Effect - two parallel plates close together will exclude long wave energy, while short wave energy is unaffected. The external long wave energy will force the plates together.

Other ideas included finding a useful property of dark matter; and another that if antimatter had negative mass, and part of the galaxy was made of it then a pair of Matter/antimatter bodies would circulate round the galaxy.

Professor Alan Aylward closed by saying that it was probable that one of these ideas would work.