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Author: Mr. Kelvin Long
Initiative for Interstellar Studies, United Kingdom, kelvin.long@i4is.org

PROJECT ICARUS: CONCEPT DESIGN FOR AN INERTIAL CONFINEMENT FUSION DRIVE INTERSTELLAR PROBE.

Abstract

In the 1970s members of the British Interplanetary Society designed a deuterium-helium-3 fusion powered 450 tons two-stage interstellar flyby probe to reach the stars in half a century travelling at 0.12c, in a study known as Project Daedalus. Such a design would require jet powers of 40 TW and 3 TW, and specific powers of 42.4 MW/kg and 9.6 MW/kg for the first and second engine stages respectively. In 2009 Project Icarus set out to re-design the Daedalus with a reduced system architecture mass, carrying a 150 tons payload on an orbital insertion mission to the nearest stars at around 0.05c completing the journey in around a century. One of the concepts to come out of this study was a shock ignition based inertial confinement fusion powered system utilising a single engine stage (Resolution) and multiple engine stages (Endeavour). This results in reduced jet powers and specific powers and an overall more plausible design solution, compared to Daedalus, but also demonstrates that interstellar probe missions are hard to achieve. We summarise the study by comparison to the alternative propulsion system of GW and TW powered laser beamers that utilise Para-lenses in space to improve beam collimation, and show that although interstellar flight does appear to be possible from a physics perspective, it is never going to be easy from an engineering and economic perspective.