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Strategies for Rapid Implementation of Interstellar Missions: Precursors and Beyond (4)

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TECHNOLOGY DEVELOPMENT PACE COEFFICIENT FOR RELIABLE INTERSTELLAR TRAVEL TIMELINE

Abstract

Establishing a timetable for interstellar travel requires assessing the elements of a sequence of interdependent missions from LEO to Lunar, interplanetary, all the way to interstellar. Such evaluation must account for a grid of interconnecting components and milestones including the current and anticipated advancements in space travel technology. Space travel projects belongs to an extraordinary projects category of relatively novel and complex projects that usually run behind schedule. Furthermore, the interstellar timeline extends over a century exposing it to more influence from elements of rare occurrence with projects of shorter duration. Thus, there is more possibility for scientific breakthroughs, technology developments, political and funding variations, inconsistent public and sociopolitical interest, wars, and pandemics among others. This study investigates quantifying the space technology development pace based on the parameters involved, and developing a coefficient that could be applied to make interstellar travel schedules more realistic.

The Integrated Space Plan (ISP) and the Roadmap to the Stars (RMTS) utilized comprehensive plans with incremental progress to assemble decades-long schedules. The large number of unknowns involved in the assessments require constant revisions to the timeline. In the past few decades there was a pattern of delays in space technology and space travel development while some telecommunication evolutions were relatively rapid. RMTS applied a technology development pace coefficient (TDP) in 2022 among measures to improve projection of technology advancement in space travel. This study itemizes the coefficient factors' quantification, expands the static model equation, and runs 50 iterations of Monte Carlo simulation to compare results.

The factors utilized in the technology development pace coefficient include the (i) scientific breakthrough occurrence, (ii) lag time in rebuilding a technology, (iii) political events and funding fluctuation, (iv) specific technology connexion with common technology, (v) intrasellar roadmap progress, (vi) private space travel progress, (vii) sociopolitical affairs and public interest, and (viii) global events including pandemics, natural disaster among others. The ratio of the elements is based on their occurrence, duration, and effects. While such elements are not easy to quantify, it was possible to assign numeric figures and derive equations for the coefficient based on the number of years they delayed/saved. The basis for the quantification of the elements will change with time requiring revisions and adjustments. Applying the TDP coefficient to interstellar travel which has a relatively longer interval allows to factor in events that are rare enough to be considered for shorter term projects.