SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT (D3)
Strategies & Architectures as the Framework for Future Building Blocks in Space Exploration and Development (1)

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INTERSTELLAR RANGE SPACECRAFT PROPULSION AND AUTONOMOUS SYSTEMS ANALYSIS FOR INTERSTELLAR EXPLORATION WITH MULTI-GENERATIONAL SPACECRAFT

Abstract

Travel to the stars has been a mysterious but compelling idea for mankind. Since the dawn of time, humans have looked at the twinkling lights at the sky and they have imagined what resides there in the heavens. One detriment to interstellar flight is the extraordinary amount of time that it will take to travel to these destinations. Travel to some stars may take generations even close to the speed of light. As a result, one of the concepts in overcoming this problem is to travel with a large group of people who will travel in a community environment who can be self sustaining during the flight. A world ship is a concept for manned interstellar flight designed for group travel. It is a large, self-contained and self-sustained interstellar vehicle. It travels at a fraction of a per cent of the speed of light and needs several centuries to reach its target star system. The well known world ship concept by Alan Bond* and Anthony Martin* (*of ICARUS interstellar program) was intended to show its principal feasibility. However, several important issues haven't been addressed so far such as the relationship between crew size and robustness of knowledge transfer, reliability, and alternative mission architectures. This paper addresses these gaps. Furthermore, it gives an update on target star system choice, and develops possible mission architectures. The derived conclusions are: a large population size leads to robust knowledge transfer and cultural adaptation. These processes can be improved by new technologies. World ship reliability depends on the availability of an automatic repair system, as in the case of the Daedalus probe. Special propulsion systems as well as energy distribution systems are also required for these ships and the autonomous management of these systems is also examined in this paper. Algorithms and protocols dealing with these systems will also be mentioned. Star systems with habitable planets are probably further away than systems with enough resources to construct space colonies. Therefore, missions to habitable planets have longer trip times and have a higher risk of mission failure. On the other hand, the risk of constructing colonies is higher than to establish an initial settlement on a habitable planet. In summary, multi-generation ships remain an interesting concept, although they require a space colony-based civilization within our own solar system before becoming feasible. Overall, this paper will discuss the techniques as well as the feasibility analysis for spacecraft.