

21st IAA SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE FUTURE (D4)  
Strategies for Rapid Implementation of Interstellar Missions: Precursors and Beyond (4)

Author: Mr. Aditya Prakash  
Indian Institute of Technology Kanpur, India

INTERSTELLAR EXPLORATION USING “EXPLORER” SPACECRAFT - BUILDING THE  
FOUNDATION

**Abstract**

Humanity’s quest for exploration and discovery has driven our progress for thousands of years. Our ancestors, who ventured out on boats in search of new lands, continue to inspire us to pursue this legacy. In this spirit, we propose the development of a self-sustaining ecosystem spacecraft (EXPLORER) capable of interstellar exploration and human settlement. This research paper lays the foundation for the development of EXPLORER and identifies the areas of research required to make this vision a reality. The proposed spacecraft is designed to travel millions of light-years in search of habitable zones, containing a nuclear energy-based ecosystem that gets its energy from a nuclear reactor (or artificial sun). This miniaturized version of Earth will contain only the necessary resources, recycling mass to ensure sustainability. The EXPLORER will be protected by a shield to protect it from interstellar dust, debris, and radiations, and will use gravitational pull and advanced propulsion technology with the least mass consumption to reach its destination. One of the biggest challenges in interstellar exploration is to find the most dense place in the universe with habitable zones and the least energy path to it. A large part of the universe remains unknown and the journey will be purely based on exploration. Hence, the transportation technology must be advanced enough to handle these challenges. Our solution is to develop technology that can map the universe ahead of us and chart a path that minimizes energy consumption while maximizing speed and efficiency. The EXPLORER will be designed as a self-sustaining ecosystem capable of supporting human life for generations. The explorers on the spacecraft will grow, develop, reproduce, and pass down their knowledge and experiences, just as our ancestors did. Our ultimate goal is to establish human settlements on habitable planets and carry on the legacy of exploration and discovery that our forefathers started. The development of EXPLORER will require substantial time, resources, and knowledge, making it a task for future generations. Nevertheless, it holds the potential to expand human presence in the universe, establish new civilizations, and bring humanity closer to a sense of brotherhood in this vast universe. This research paper highlights the technological challenges and solutions for the development of EXPLORER and sets the direction for future research. It aims to bridge the gap between reality and science fiction and is a continuation of the legacy of our ancestors.