

SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Future Space Transportation Systems (4)

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FIREFLY – FUSION-POWERED INTERSTELLAR RENDEZVOUS AND EXPLORATORY FLYING
LABORATORY

Abstract

The FIREFLY project is a proposal for the 100-year starship study. It is a long-range, fusion-powered, self-sustaining spacecraft intended to rendezvous with Alpha Centauri within a 100-year flight time. Due to the nature of the journey and potential hazards to both ship and crew, a variety of approaches to mitigating these hazards is necessary. This report highlights a few aspects of the FIREFLY project, and in particular, the following:

- (1) Ship construction and design: the methods and approaches used to construct FIREFLY.
- (2) Ship operation: integration of AI and automated processes into the day-to-day operations.
- (3) Sustainable processes: Applying recycling methods and potential resource gathering methods to extend onboard supplies for fuel and other necessities.
- (4) Redundancy setups and hazard mitigation: handling failures of critical ship systems.
- (5) Power and propulsion: the fusion-based propulsion system that will drive FIREFLY.
- (6) Adaptability: Providing resources and facilities for ship crew to improve and jury-rig the vessel as needed.

The FIREFLY project proposes a starship built in low-Earth orbit, relying on a fusion-based power system to provide propulsion and onboard power. In addition, it proposes an advanced AI system and robotic “crewmembers” to automate shipboard operations. The application of sustainable processes, redundancy systems and in-situ resource gathering systems further increases the ship’s lifespan, and finally, facilities and resources for adapting the ship as needed will keep the crew equipped for unexpected scenarios.