

FIREFLY – Fusion-powered Interstellar Rendezvous and Exploratory Flying Laborator Y

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Overview

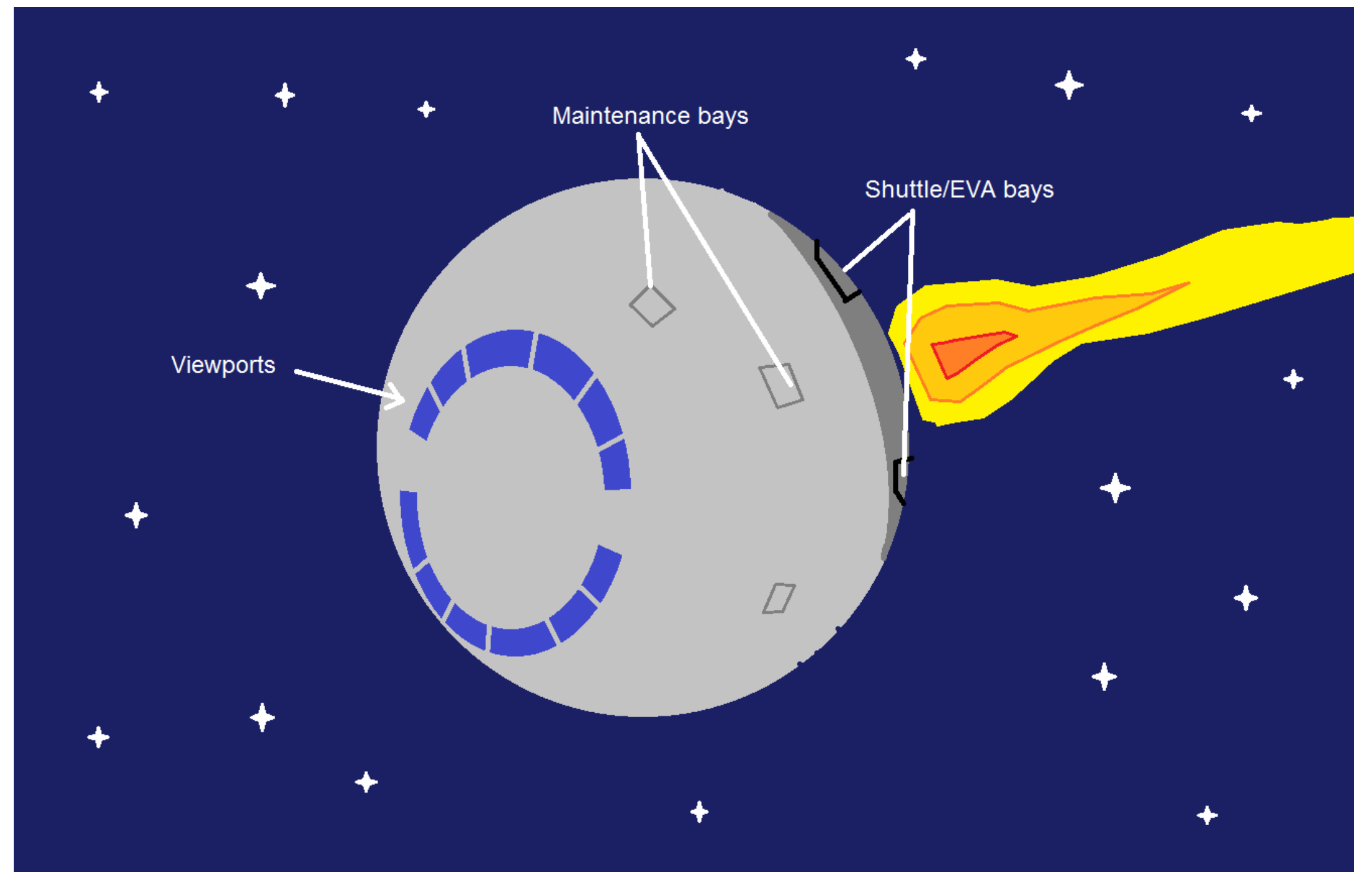
The FIREFLY project is a tentative proposal for the DARPA's 100-Year Starship Project. In summary, FIREFLY is a vessel designed for a long-term, interstellar trip to Alpha Centauri. Constructed in low-Earth orbit, FIREFLY will use fusion power to supply propulsion and onboard power, an advanced AI system that will govern most shipboard activities, and a rotating habitat ring to provide an artificial gravity environment, among other features.

Impact

A number of significant research investments must be made, including:

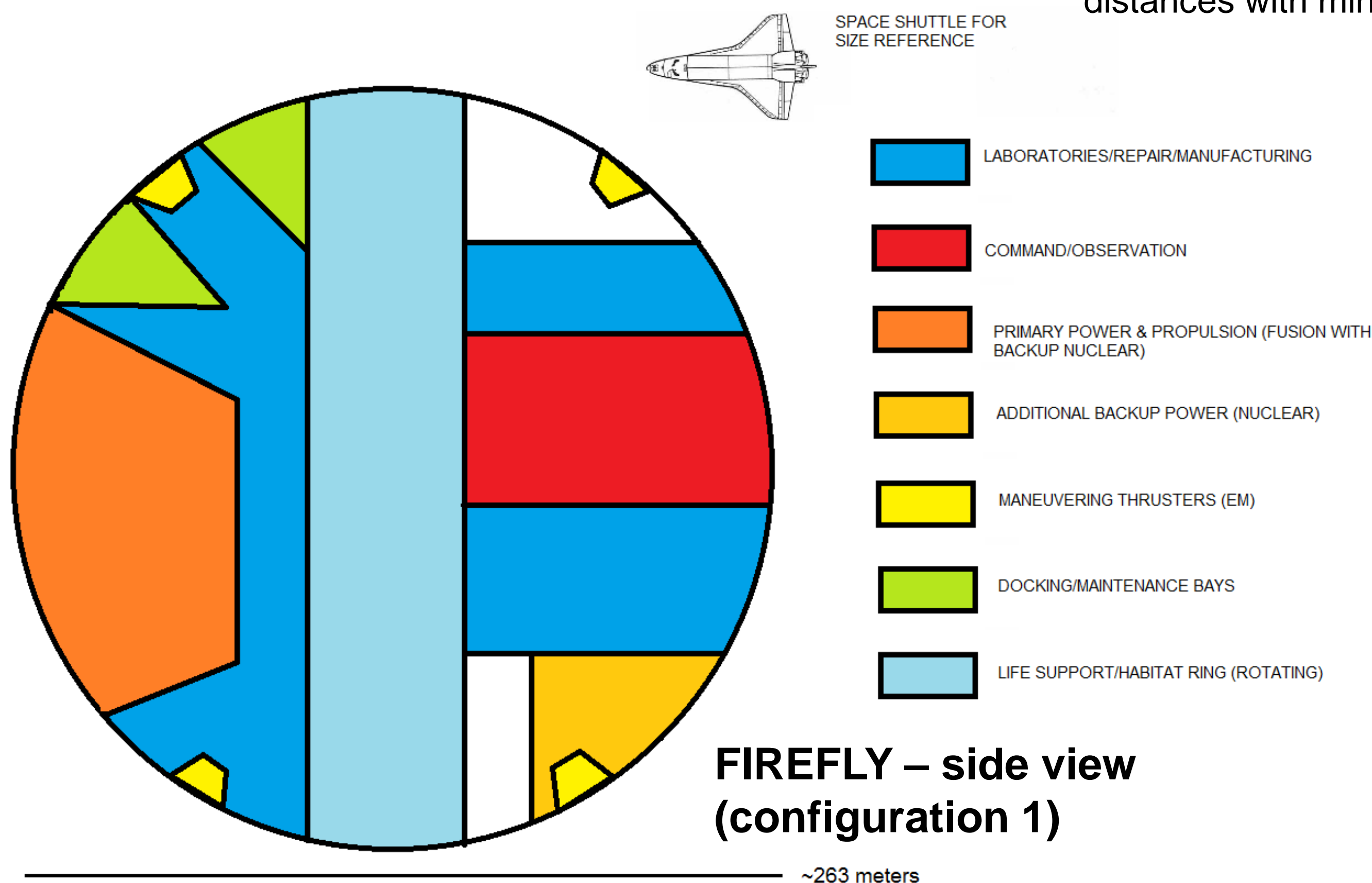
- Nuclear fusion and fission research: applying advanced fission reactor designs and developing the break-even fusion systems required to complete the mission.
- Advances in materials development and space habitat design, which will further drive costs for manned space exploration down.
- AI and robotics research that will drive the development of sophisticated maintenance and operation systems, operating for long periods of time without human supervision and adapting to new situations.
- Thruster technology, which will help better harness the ships's power production.

The FIREFLY project itself will help humans achieve the goal of visiting another star system, a significant milestone in manned space exploration. In addition, it will provide numerous insights into long-term spacecraft operation as well as new discoveries about interstellar phenomena and human physiology/psychology, among many other discoveries.



FIREFLY concept art
Key Findings

- A series of launch missions will be necessary to complete the project in LEO.
- Using an extensive AI system will reduce facilities needed for maintaining a human crew for shipboard maintenance. Combining this with redundancy systems and repair facilities, FIREFLY's lifespan can be enhanced.
- Aeroponics, water recycling and other processes must be employed to maximize the onboard food supply. In effect, a mini-biosphere must be established that is both robust and long-lasting. Constraints include the successful recirculation of carbon, oxygen, water and nitrogen.
- Fully-equipped fabrication facilities and resource-gathering equipment (EVA suits, vehicles, etc) are critical to not only maintain critical ship components but provide an opportunity to expand and adapt to new situations.
- A fusion core, coupled with advanced nuclear fission backups, can provide the power needed to maintain ship operations as well as propulsion.
- Advanced communications methods must be employed, to allow the transfer of information between FIREFLY and Earth over interstellar distances with minimal degradation.



Explanation

The FIREFLY project can help further the AAS's support of NASA's Vision for Space Exploration by necessitating the development of space-based infrastructure and manufacturing capabilities. In addition, it directly addresses one of the primary goals of the Vision for Space exploration by exploring the solar system and beyond.

Acknowledgements

The student would like to thank Dr. Jason Cassibry and the MAE department for assistance with this project.