

GLOBAL TECHNICAL SYMPOSIUM (GTS)
Human Spaceflight Global Technical Session (2-B3.9)

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FEASIBILITY STUDY FOR A COMMERCIAL SPACE STATION IN LOW EARTH ORBIT

Abstract

Successful space exploration demands innovative solutions. However, this sector currently relies mainly on governmental agencies with limited industry support. NASA spends a substantial portion of its budget on International Space Station (ISS) operations. Nevertheless, as per the ISS Transition Report 2022, switching to a self-sustaining Commercial Space Station (CSS) in Low Earth Orbit (LEO) could save the agency approximately \$1.8 billion annually by 2033.

A CSS in LEO would replace the ISS and create new opportunities for human space exploration. Upcoming stations like Orbital Reef, Axiom Station, and Starlab cater to a diverse range of customers and offer prospects for scientific research, in-space manufacturing, space tourism, and creative industries and education. However, research is necessary to ensure their financial viability. Our study aims to evaluate a CSS's financial and economic sustainability for achievable activities within this decade, with a minimum Technology Readiness Level (TRL) of 7. This assessment encompasses analyzing costs, funding sources, market and competitor trends, business models, and revenue streams while focusing on legal, political, and cultural factors.

Our findings reveal that space-based research will likely be LEO's most significant revenue generator within the decade, thanks to existing government grants and contracts. According to Deloitte, space tourism could become the most profitable revenue stream at the beginning of the next decade, with an estimated annual revenue of up to \$3.3 billion . Furthermore, once the industry overcomes technical challenges and the demand for in-space manufacturing becomes sufficient, it will likely become the primary revenue stream. Finally, our analysis reveals that fine arts, live events, TV Film, and STEAM education have the potential to generate \$242 million as additional revenue streams.

In conclusion, our study offers a comprehensive and detailed roadmap of future business prospects and actionable recommendations outlining various activities, demands, and possibilities that can be carried out in a CSS within this decade and beyond. The report can serve as a general guideline for commercial space entities to leverage emerging prospects in the space industry. Moreover, our study can be a valuable source of inspiration for space agencies seeking to expand their activities and optimize their resources. By clearly understanding the financial and economic sustainability of a CSS, our study can help shape the future of space exploration and pave the way for a new era of space-based research, in-space manufacturing, space tourism, and other commercially viable ventures.