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DESIGN CASE STUDY OF A LEO TOURISM SPOT: ORBITAL, LOGISTICAL AND ECONOMIC
CONSIDERATIONS

Abstract

With SpaceX, BlueOrigin, Virgin Orbit and other upcoming players competing toe-to-toe to provide launch service, the utopian scenario of looking at the Earth, or other bodies from space is closer to reality. With RocketLab's Neutron promising human spaceflight, companies such as Space Perspective and Zero2Infini receiving funds and working towards setting up tourism plans for space, a mature point to begin with would be a commercial tourism spot in Low Earth Orbit, to protect the operational interests of the ISS and generate more revenue for the Space Economy. Yet, to truly democratize space access, the cost of reaching space has to be minimized. Moore's law and economies of scale assure this cost-decrement, but to scale the timeline to the near future, more efforts are needed towards providing a feasible destination in terms of technological and commercial operations.

This design case study utilizes a base architecture inspired from the ISS and scaled to address the requirements of 150 tourists utilizing Virgin Galactic's spaceplane, to operate at an altitude of 565-590 km at 61 degrees inclination with 5 trips a day, for a one-year operation to reach break-even and leading to high profit margin for five-year operations. The orbital design was performed considering eight prominent spaceport locations along with ease of access to and from the Tourist Spot from maximum locations worldwide, along with orbital velocity to be fast enough to support maximum trips but low enough to minimize vertigo and relevant discombobulation discomforts. Simulations have provided feasible hovering times for dock and undock of coordinated launches, along with feasible operational power requirements and capacities to operate for one year as well as five years in-orbit. 5-8 contact opportunities were identified in 24 hours for any of the spaceports at equal intervals.

The mission design was simulated successfully to provide a profit above 55 billion for five-years of operation in orbit at 8 trips per day with 3 hours per trip, for one Tourist Spot. This design case study, if supported by interested funders, and taken forward by the industry, could generate more revenues into the entire space ecosystem from launch to operations to hospitality and services. Modularity of the design allows for establishment of a chain of similar spots to increase access and reduce costs without losing profits, truly democratizing access to space for the world.