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TECHNICAL AND BUSINESS DESIGN OF A LEO SPACE FARM FOR SUSTAINING LIFE IN SPACE

Abstract

As space exploration evolves, the sustainability of long-duration missions in Low Earth Orbit (LEO) and beyond hinges on the ability to support human life independently from Earth-based resupply. A key aspect of this is the development of space farming systems capable of producing fresh food, oxygen, and other essential resources directly in space. This paper presents the technical and business design of a LEO Space Farm, focusing on how it can support human life during extended space missions while offering a viable business model. The proposed space farm leverages advanced agricultural technologies, including hydroponics, aeroponics, and bioreactor systems, integrated with life support and habitat systems. The business model emphasizes commercial opportunities, partnerships with space agencies, and the growing market for space tourism.