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SPACE LIFE SCIENCES SYMPOSIUM (A1)
Biology in Space (8)

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STANDARD SMALL SATELLITE ARCHITECTURE FOR SPACE MICROBIOLOGY

Abstract

Study of growth and behavior of microorganisms in micro-gravity is a subject of important research today. But the scope of this research is highly limited because of the difficulty in getting access to a micro gravity system. This paper proposes a standard satellite architecture for conducting microbiology experiments in space. Such a small satellite will need to house a cultivation chamber which shall incorporate a growth medium and also maintain the temperature within limits of living creature tolerances. The chamber can be filled with an inert gas to ensure anaerobic conditions for growth of anaerobic microorganisms. Temperature sensors will be placed strategically for thermal monitoring of culture. Temperature control can be done using passive thermal control like thermal paints, coatings on the outer surface of the satellite and active thermal control using heat-pipes and radiators. Culture growth will be monitored via high magnification lens whose images will be captured by a camera sensor and sent to earth using radio frequency telemetry. Low power mechanisms for lens focus adjustment have been proposed. Infrared data from thermal camera will be used for mapping the growth of bio-films over time. A lighting source might also need to be incorporated if insufficient lighting hampers camera activities. The primary structure of the satellite is advised to be a mono-block thereby minimizing the number of joints and thus leak points, with panels covering the faces and is made air tight by sealing all the joints using sealants. Panel material may be chosen to be Ultraviolet resistant or UV filters will be installed behind primary panels to ensure survival of UV sensitive organisms. Solar panels of the deployable and fixed type are advised to fulfill the power requirement for active thermal control, observation apparatus, RF telecommand- telemetry and mechanisms use. A life support system thus developed within a small satellite will open whole new avenues for low cost, space based microbiology research especially for university students and professors allowing greater participation of biologists in the field of small satellites. A standard architecture will ensure that microbiologists can choose a microorganism of their interest as the payload without having to worry about satellite development, also decreasing their reliance on International Space Station for space microbiology data. Scientists working on similar microorganism can come together to fund the project thereby reducing the burden on any single party.