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PIONEERING SPACE POWER DYNAMICS: THE GEOSTATIONARY ORBITAL GARAGE

Abstract

In the dynamic landscape of space power technologies, our project, led by ISAE-Supaero engineering students, unveils an innovative solution – the Geostationary Orbital Garage (GOG). Positioned strategically in geostationary orbit, the GOG stands as a pioneering hub for redefining power dynamics in space activities, aligning seamlessly with the theme of "Advanced Space Power Technologies" for IAC 2024.

The GOG transforms space power dynamics by innovatively storing and converting key resources, Methane (CH4) and Water (H2O), delivered by space shuttles. Utilizing advanced electrolysis, Water is converted into Gaseous Hydrogen (H2) and Pressurized Liquid Oxygen (O2), establishing a sustainable fuel production cycle. This centralizes the GOG's role in refueling missions, acting as a strategic depot for Methane, Liquid Oxygen, and Gaseous Hydrogen storage, streamlining and enabling efficient refueling and resupply operations in geostationary orbit.

Solar power technologies take center stage as the GOG leverages high-efficiency solar panels to harvest energy from the sun, ensuring continuous and sustainable power for its multifaceted operations. This robust solar power generation not only supports the GOG's internal needs but also serves as a dynamic charging station for docked spacecraft, replenishing their power systems during their stay in geostationary orbit.

The GOG's docking port, designed for resource exchange, seamlessly integrates power and energy transfer. This port provides a comprehensive solution for fueling, power replenishment, and communication exchange during collaborative missions. The facility's multifunctional approach positions it as a trailblazer in addressing the power needs of various space missions.

To complement its power-centric functions, the GOG features a sophisticated robotic arm, aiding in in-orbit assembly and docking processes. This robotic arm showcases versatility by adapting to various spacecraft designs, demonstrating a holistic approach to advanced space power technologies.

The Geostationary Orbital Garage (GOG) marks a groundbreaking advancement in space power dynamics, revolutionizing resource refueling and presenting a sustainable solution for deep space exploration. With its cutting-edge solar power generation, efficient resource storage, and dynamic power replenishment capabilities, the GOG emerges as an ideal platform for future missions to destinations like Mars and Jupiter. The facility's commitment to innovation extends to its high-performance batteries, ensuring a reliable power supply in the challenging conditions of deep space. By showcasing the GOG at IAC 2024 in Milan, our project aims to contribute to the discourse on advancing space power technologies, presenting a holistic approach to redefine the possibilities of space exploration.