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SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Upper Stages, Space Transfer, Entry and Landing Systems (3)

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CARAVAN CARGO AUTONOMOUS RENDEZVOUS AND VELOCITY ADJUSTMENT/NAVIGATION

Abstract

Satellite communications markets continue to push the launch sector past the 7 ton to GTO (Geosynchronous Transfer Orbit) barrier. The CARAVAN (Cargo Autonomous Rendezvous And Velocity Adjustment/Navigation) orbital tug system will replace or augment upper stage launch elements enabling operators to realize payload capabilities double and triple their present values. CARAVAN transfers satellites from low earth parking orbits to their operational locations. This direct insertion capability allows manufacturers increase payload mass by eliminating high risk propulsion systems and reliance on inflated launch prices.

The cryogenic CARAVAN will utilize the proposed OASIS (Operations And Service Infrastructure for Space) network of Spaceports providing services such as propellant and consumable replenishment, as well as spacecraft repair and maintenance. From earth based applications such as telecommunications and navigation to the technical challenges of extending human presence throughout the solar system this network coupled with the flexibility of the CARAVAN stage will enable shorter mission durations and increased payload masses. An architectural solution is proposed with an emphasis on engineering and orbital efficiencies.

CARAVAN capitalizes on the orbital electrolysis of water. Water transfer to the International Space Station is common and serviced by multiple launch vehicles requiring virtually no integration or insurance. Autonomous rendezvous has been possible for decades and has been exemplified more recently in a numerous cases. The system design includes a robotic arm and universal docking adapter, an advanced reusable propulsion design with high fidelity attitude and control systems with a focus on minimizing risk and maximizing capability. The communications markets are demanding increased mass to orbit; CARAVAN is the only realistic solution to meet this need.