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Champaign-Urbana Aerospace (CUA) is small business concern founded in 1998 with facilities located in Champaign, IL, a few minutes from the University of Illinois at Urbana-Champaign (UIUC) campus. The company has several different areas of specialization including space systems hardware and software, high performance software solutions, advanced aerospace materials, plasmadynamic systems, and high energy lasers; this diversification provides the company with a broad multidisciplinary knowledge base and the ability to rapidly advance new technologies and solutions for a wide variety of high-end problems.

In-Space Assembly

The Guideless Resilient Androgynous Serial Port (GRASP) mechanism provides a preloaded mechanical and electrical interface as a baseline to which other interfaces can be added to provide a tailored solution for a given application. Each assembly mechanism is equipped with physical connections (spring pins) for both power and data transmission between the different modules. While developed to enable the assembly of a persistent modular space platform, the GRASP interface is extendable to planetary robotics applications.

Navigation and Localization

CUA is currently developing a scalable, distributed sensor system providing a decentralized and resilient inertial measurement system that will provide the user with newly observable states, jitter detection and source determination, and noise reduction and bandwidth extension through advanced sensor fusion. The advanced self-awareness provided by the sensor system will provide added value during inspection, capture and servicing operations. If development targets hold, a protoflight version of the distributed sensor system will be integrated into the upcoming DUPLEX mission for flight demonstration in 2022-2023. A second technology in the early stages of development at CUA aims to provide an optics-free solution to close-proximity localization and navigation, sidestepping the challenges presented by the high-contrast environment and complex reflective surfaces prevalent on spacecraft.

Spacecraft Software

CUA's Dynamically Leveraged Automated (N) Multibody (DyLAN) trajectory optimization tool is an automated global trajectory optimization software for rapid preliminary mission design of impulsive/low-thrust multibody missions. DyLAN merges state-of-the-art automated global optimization algorithms with dynamical systems techniques to provide engineers with multi-objective solution sets, enabling new design concepts and tractable solutions for currently 'unsolvable' problems. DyLAN harnesses parallel processing for quick execution, solves at medium-high fidelity and will provide native export to NASA GMAT for a quick transition to flight fidelity solutions.

The SEPTER software toolkit provides architectural & configuration optimization and logistics definition/prediction for modular, reconfigurable space platforms based on commercially-available or user-provided parts and form-factor selections. SEPTER has a variety of features for configuration optimization, including the ability to consider factors such as component tradespaces, near-term and projected payload requirements, service life, upgrade horizon and many others on a platform-wide or module-to-module basis.

Spacecraft Propulsion

CUA has developed several micropropulsion systems that represent tipping point technologies for future integration and flight on micro/nanosatellites. These systems span the performance space of micropropulsion systems from high thrust to high specific impulse using micro-plasma discharge, resistojet, PPT and monopropellant technologies fed by solids, liquids and two-phase propellants. CUA is the recipient of a 2019 NASA Tipping Point partnership award for the design, fabrication, launch and in-space demonstration of Dual Propulsion Experiment (DUPLEX) CubeSat, in which the Monofilament Vaporization Propulsion and Fiber-Fed PPT systems will be demonstrated.