GUIDELESS RESILIENT ANDROGYNOUS SERIAL PORT (GRASP) FOR ON-ORBIT SERVICING, ASSEMBLY, AND MANUFACTURING (OSAM)

JULY 2022

There is growing interest in the space industry for the design and application of space architectures that are capable of satisfying multiple mission profiles. Contemporary satellite systems exhibit substantial inefficiencies in the long term, owing chiefly to the difficulty of repairing/modifying the architectures once on orbit. A more modularized design enables the architecture to reuse core subsystems for a variety of payloads, reconfigure the system's layout at will, and replace faulty or outdated equipment.

CU Aerospace (CUA) has developed a multifunctional payload interface for future flight demonstration. CUA's guideless resilient androgynous serial port (GRASP) combines androgynous "hard" dock capability along with power and data transfer into a single package. The GRASP interface is capable of in-space modularized assembly and re-configurability enabling a variety of payloads to be integrated into a multi-module platform for a wide variety of missions.

Prior government-funded efforts allowed CUA to advance their patented GRASP technology to TRL 5. The goal of future work is to create a hardware design for a flight-like demonstrator.

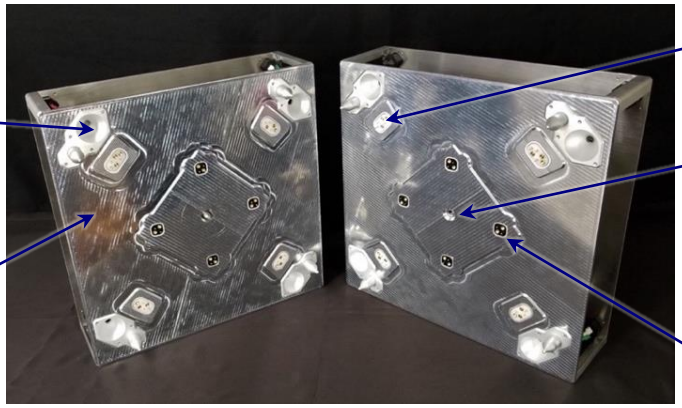
GRASP will enable hosted payloads to be docked to existing permanent stations such as ISS, while simplifying the design for the payload builders. GRASP allows a platform to simultaneously support a large number of docked payloads, conducting a wide variety of missions including scientific experiments, space situational awareness, remote sensing, communications, and satellite servicing. This technology can also help enable and expand modular structures such as the Lunar Gateway.

GRASP technology will further the commercialization of space systems in LEO, GEO, or cislunar orbit by enabling modular architectures that require in-space assembly, reconfigurability, maintenance, and replacement of modules. This technology also supports a largely missing piece of the commercial space market: satellites with modular structures that can be used as a rentable support platform.

GRASP Performance	V4 (2020)	V5 (est. 2023)
Hard docking	√	√
Androgynous	√	√
Retractable / Reconfigurable	√	√
Rotational Symmetry (90°)	√	√
Preload [N]	2,500	> 2,500
Data Transfer [Mbps]*	100	> 1,000
Power Transfer @ 115VAC [W]*	1,350	1,500
Power Transfer @ 32 VDC [W]*	627	1,000
Mass [kg]	2.0	TBD**
Volume [cm³]	35 x 35 x 5	TBD**
TRL	5	6

**Via single data/power port. **Customer adjustable.*

GRASP-IV ASSEMBLY



Adjustable hardware configuration:

- Designed for PODS module size, but monolithic bas plate adjustable larger or smaller to accommodate different customer needs

Options:

- 2x or 4x alignment pins w/ 4x cones provide 90° rotational symmetry
- Data connectors optional
- Power connectors optional
- GRASP docking screw mechanism and motor can be adjusted to handle higher pre-load force if desired

Thermal Expansion:

- System designed to accommodate temperature range of –30 to +80°C
- Data and power connectors specially designed with "float" system to accommodate potential for local connector misalignments due to thermal expansion, structural warpage, & target-to-chaser mismatch.

Robotic Demonstrations:

- Demonstrated simulated modular assembly
- Demonstrated simulated free-flyer capture w/ floating sled
- Demonstrated capture 2° pitch + 2° roll mismatch

Life span: Designed for 10+ years

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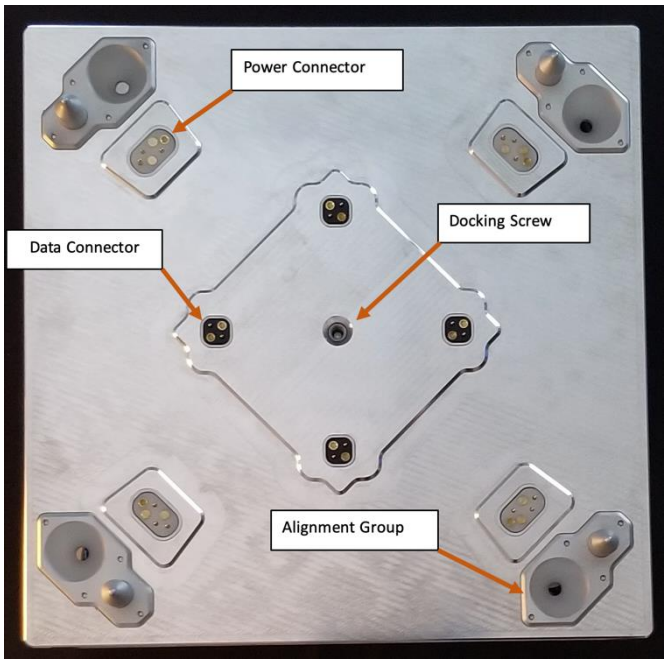
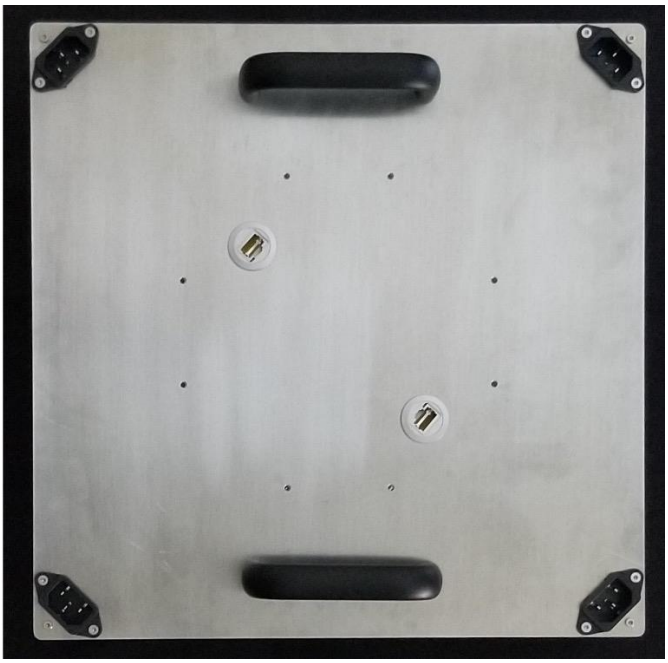
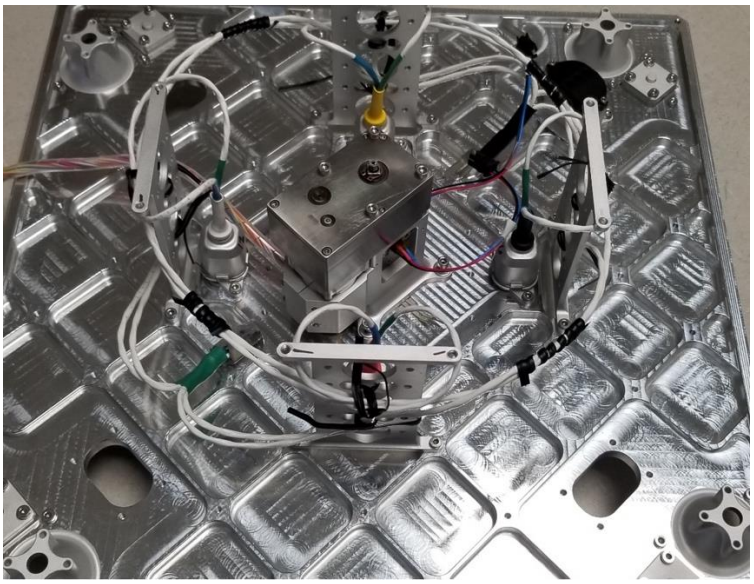
IMAGES OF GRASP-IV ASSEMBLY INTERFACE – GROUND DEMONSTRATOR FOR PODS-SCALE MODULE

FRONT FACE W/ GRASP DOCKING SCREW, 4X DATA, 4X POWER, & 4X ALIGNMENT PINS/CONES



BACK FACE W/ 2X RJ-45 HEADERS & 4X IEC-60320 C14 SOCKETS & HANDLES





Mounting face of the GRASP Assembly Interface (ground demonstrator for PODS-scale module) is a monolithic base plate with GRASP mechanism (center), data connectors (centered around GRASP), and alignment groups (corners). Note the large amount of open volume available on the GRASP-IV monolithic base plate that is readily adjustable in size.

The GRASP interface is highly adaptable to a wide range of customer-specific geometries. Inquire to see how CUA can adapt GRASP to meet your mission requirements.