

Unibody Composite Pressurized Structure (UCPS) for In-Space Propulsion

Single, all-composite structure reduces spacecraft mass and cost

Microcosm, Inc., in conjunction with the Scorpius Space Launch Company, is developing a UCPS for in-space propulsion. This innovative approach constitutes a clean break from traditional spacecraft design by combining what were traditionally separate primary and secondary support structures and metal propellant tanks into a single unit. The all-composite construction is stronger, significantly lighter, more robust and reliable, and capable of supporting much higher pressures and smaller volume than previous approaches. The single, all-composite structure includes linerless high-pressure propellant tank(s), composite bosses, flanges, longitudinal and circumferential stringers with integral shelves, holding mechanisms, and attach features to support all of the spacecraft equipment. These features will replace the separate mission-critical primary support structure, tanks, struts, straps, braces, clamps, and brackets traditionally required to hold subsystem parts in place. The new structure has nearly 0 coefficient of thermal expansion over a temperature range from cryogenic to more than 100 °C.

The Phase II project refined the design of the UCPS integrated with a bladder; continued materials compatibility testing with hydrazine; fabricated two UCPS as positive expulsion tank (PET) structures; and completed expulsion, qualification, and burst testing on one of them.

Applications

NASA

- ▶ Science mission directorate spacecraft
- ▶ High-pressure liquid and gaseous propellants for chemical and electric propulsion systems

Commercial

- ▶ Aerospace
- ▶ Automotive
- ▶ Electrical
- ▶ Medical



Phase II Objectives

- ▶ Refine the system objectives and requirements for next-generation propulsion systems and how the PET can best meet current and future needs
- ▶ Refine the design for the new UCPS structure employing the unibody integrated tank/structure approach that includes a bladder as a PET
- ▶ Conduct more extensive materials compatibility tests with UCPS structural material and hydrazine
- ▶ Fabricate and test a transparent bottle plus bladder to characterize bladder mechanics
- ▶ Fabricate and conduct water-only qualification tests of the PET

Benefits

- ▶ Allows much higher pressure chemical propulsion systems (in excess of 2,000 psi) with less tank mass
- ▶ Uses all-composite structure combined with high-pressure, low-volume tanks

Firm Contact

Microcosm, Inc.
Markus Rufer
mrufer@smad.com
4940 W. 147th Street
Hawthorne, CA 90250-6708
Phone: 310-219-2700

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