An integrated, generic unibody composite pressurized structure (UCPS) combined with a positive expulsion device (PED), consisting of an elastomeric bladder for monopropellant hydrazine, has been quasi-standardized for space-craft use. The combination functions as an all-composite, non-metallic, propellant tank with bladder. The integrated UCPS combines several previous innovations — specifically, the linerless, all-composite cryogenic tank technology; all-composite boss; resin formulation; and integrated stringer system. The innovation combines the UCPS with an integrated propellant management device (PMD), the PED or bladder, to create an entirely unique system for in-space use.

The UCPS is a pressure vessel that incorporates skirts, stringers, and other structures so that it is both an in-space hydrazine tank, and also a structural support system for a spacecraft in a single, all-composite unit. This innovation builds on the progress in the development of a previous SBIR (Small Business Innovation Research) Phase I with Glenn Research Center and an SBIR III with Johnson Space Center that included the fabrication of two 42-in. (=107-cm) diameter all-composite cryogenic (LOX and liquid methane) UCPS test tanks for a lunar lander. This Phase II provides hydrazine compatibility testing of the elastomeric bladder, a see-through PED to validate the expulsion process and model, and a complete UCPS-based PED with stringers and skirts that will be used to conduct initial qualification and expulsion tests. This extends the UCPS technology to include hydrazine-based, in-space propulsion applications and can also be used for electric propulsion.

This innovation creates a system that, in comparison to the traditional approach, is lower in weight, cost, volume, and production time; is stronger; and is capable of much higher pressures. It also has fewer failure modes, and is applicable to both chemical and electric propulsion systems.

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Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Innovative Partnerships Office, Attn: Steven Fedor, Mail Stop 4–8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-19042-1.