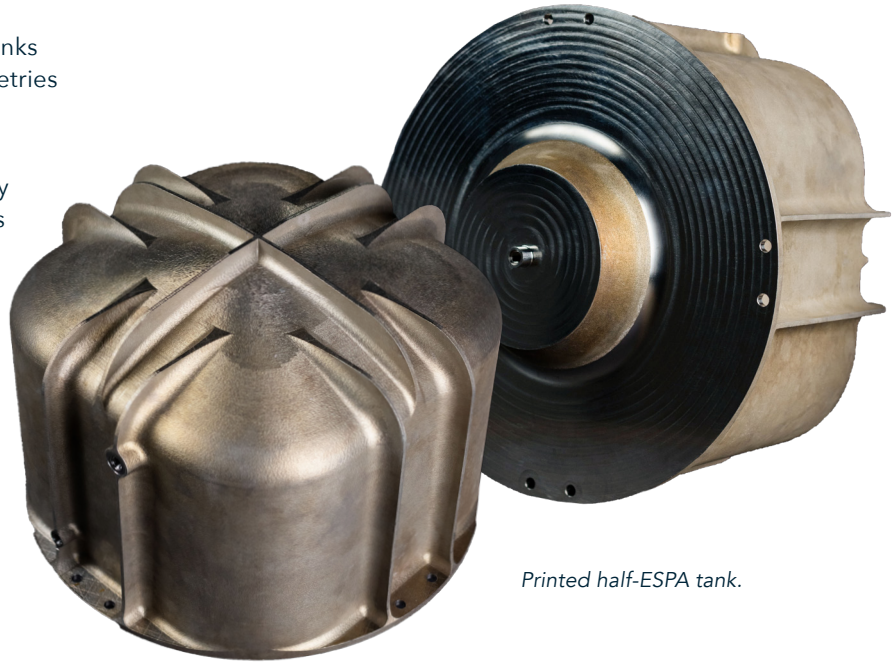
SMALL SATELLITE PROPULSION TANKS

Volume-Optimized Metal AM Solutions

Challenges in developing small satellite propulsion tanks include cost, long lead times, non-optimal tank geometries for cuboid envelopes, and restrictions on design and customization options.

The Space Dynamics Laboratory (SDL) has successfully qualified volume-optimized, titanium propulsion tanks with integral Propellant Management Devices (PMDs) for hydrazine or ionic liquid propulsion systems. Our metal Additive Manufacturing (AM) expertise and qualification testing capabilities enable SDL to deliver tanks with shorter lead times, decreased cost, improved delta-v performance, and expanded customization options.

SDL offers a proven, scalable tank development approach for spacecraft ranging from CubeSats to full ESPA.



Printed half-ESPA tank.

CAPABILITIES

SDL offers all services required to produce metal AM parts for spaceflight.

Design

- Design for Additive Manufacturing (DfAM) expertise
- PMD design & analysis
- Tank design & structural analysis
- Full implementation of industry standards & requirements

Manufacturing

- In-house metal AM expertise with laser powder bed fusion (L-PBF)
- Powder removal & heat treatments
- Proprietary post-machining & precision cleaning processes
  - Achieved better than Level 100 particulate cleanliness

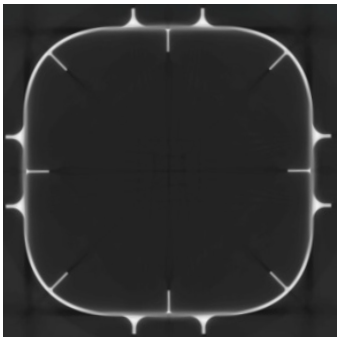
Full Qualification Testing

- Non-destructive CT inspection
- Destructive & non-destructive pressure testing
- Environmental testing
- ASTM-compliant material properties testing

HALF-ESPA TANK

Qualification Tested & Ready for AI&T

- Envelope efficiency: Up to 130% increase in delta-v compared to single spherical tank
- Volume optimized
- 11 L propellant volume
- Rated to 400 psi MEOP
- Patent pending integral PMD



Post-qualification testing CT scan of half-ESPA tank.

UTAH STATE UNIVERSITY
SPACE DYNAMICS LABORATORY®

416 East Innovation Avenue | North Logan, Utah 84341 | info@sdl.usu.edu | www.sdl.usu.edu

SDL/24-3291 Rev. -

SMALL SATELLITE PROPULSION TANKS Volume-Optimized Metal AM Solutions

FULL-ESPA TANK

- Demonstrates scalability of tank development approach
- Up to 48% increase in delta-v compared to four spherical tanks; up to 394% increase compared to one spherical tank
- Volume optimized
- 50 L propellant volume
- 400 psi MEOP targeted
- Patent pending integral PMD

Printed full-ESPA tank.

PRINTED TANK LINERS

SDL also offers AM capabilities for tank liners.

- Thin-walled liners
- High-pressure applications

Printed, post-machined tank liners.

COPV with printed liner.

Cross section of COPV with printed liner.

STREAMLINED SUPPLY CHAIN

SDL works with Velo3D (velo3d.com) as a metal L-PBF machine vendor with manufacturing and printing support, and ATI Materials (atimaterials.com) as a full-service metal AM part solutions provider for tanks and specimens.

Questions? SDL welcomes all inquiries. For more information about propulsion tanks, please contact:

propulsion@sdl.usu.edu

SDL