



Space Technology Mission Directorate Game Changing Development Program

Additively Manufactured Oxidizer Turbopump

Challenging the status quo in the manufacture of rocket engines

Additive Manufacturing, or 3D printing, is a key technology for enhancing rocket engine designs and making them more affordable for future exploration missions.

The Oxidizer Turbopump (OTP) offers the ability to demonstrate additively manufactured rotating, vaned, and critical pressure vessel components in relevant oxygen turbopump environments. The additively manufactured components of the OTP include the main housings, impeller, and turbine components.

A key technology development goal is to understand the benefits and limitations of additive manufacturing as it applies to the complex geometries needed for a rocket engine turbopump.

FABRICATION COMPLETE



- Fabrication of custom hardware (roughly 90 parts including tools)
- Additively manufactured parts made up 70% of the turbopump (by mass)

ASSEMBLY COMPLETE



- Procured "off-the-shelf" parts (seals, fasteners, fittings, instrumentation, etc)
- Assembled and balanced the rotor assembly
- Cleaned parts for oxygen service
- Assembled the OTP

TEST RESULTS

Component Test Series completed 8/22/2018

Liquid Nitrogen Testing:

- 4 tests
- Cumulative runtime: 65 seconds
- Rotor Speed: 16,000 rpm to 28,000 rpm

Liquid Oxygen Testing:

- 2 tests
- Cumulative runtime: 35 seconds
- Rotor Speed 22,000 rpm to 24,000 rpm

Preliminary results
are close to predictions.

Detailed Data
Reduction and
Post Test
Inspections In-Work

