

# Testing of Selective Laser Melting Turbomachinery Applicable to Exploration Upper Stage

## Project Manager(s)/Lead(s)

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## Sponsoring Program(s)

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Human Exploration and Operations Mission Directorate  
Space Launch System Advanced Development

## Project Description

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This task is to design, fabricate, and spin test to failure a Ti6-4 hydrogen turbopump impeller that was built using the selective laser melting (SLM) fabrication process (fig. 1). The impeller is sized around upper stage engine requirements. In addition to the spin burst test, material testing will be performed on coupons that are built with the impeller.

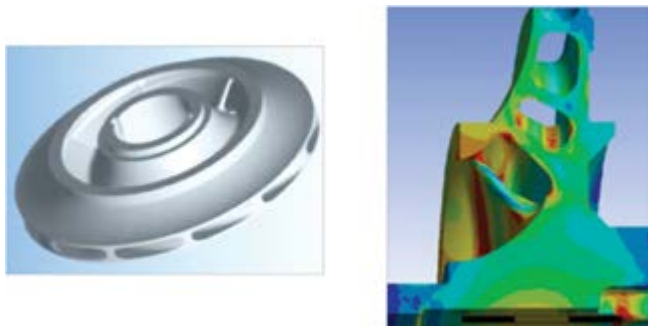


Figure 1: SLM turbopump impeller design.

## Notable Accomplishments

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Accomplishments for this task include the design of the impeller, SLM impeller, and material coupon fabrication, final machining (fig. 2), structured light scanning and inspection; spin burst testing, material strength data development, and data analysis. The spin test was successfully performed and operated up to 147,600 rpm, with the result that the impeller could not be failed with the equipment used.



Figure 2. SLM Ti6-4 manufactured turbopump impeller.

## References

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Crumbly, C.M.; Bickley, F.P.; and Hueter, U.: "Space Launch System Spacecraft/Payloads Integration and Evolution Office Advanced Development FY 2014 Annual Report," NASA/TM—2015-218201, NASA Marshall Space Flight Center, Huntsville, AL, January 2015.