



Designing Better Rocket Engines with ANSYS and PADT

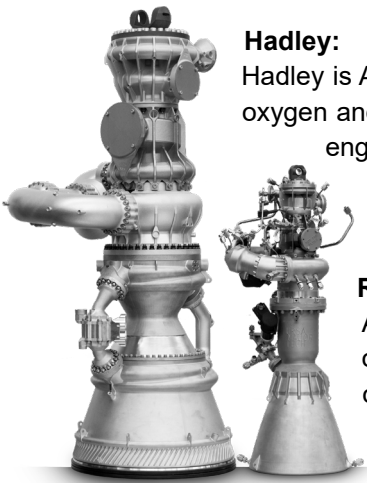
Phoenix Analysis & Design Technologies (PADT) Case Study

THE STORY OF URSA MAJOR TECHNOLOGIES

In February 2015, Ursa Major Technologies set out to build rocket engines for the aerospace industry. The Colorado-based company raised \$8 million in 2017 with participation from the Space Angels Network, a syndicate of early-stage investors. With this capital, Ursa Major Technologies put together an expert team of designers and engineers to realize its vision of providing the microsatellite industry with the best rocket engines in the business. Utilizing additive manufacturing and modernizing staged combustion, the company has successfully designed and built two liquid oxygen and kerosene engines and has a third engine in development.

BRINGING SPACE CLOSER TO EARTH

Ursa Major Technologies started its journey by relieving companies in the aerospace industry of some of the burden of spacecraft development. One of the key factors the company points to is in the aviation industry, even corporations as large as Boeing don't build their own engines. Ursa Major Technologies sees the space industry following a similar path with companies outsourcing engine development to avoid spreading themselves too thin. Since Ursa Major Technologies was founded, it has come out with two engines to serve this purpose - Hadley and Ripley.



Ripley (pictured left) Hadley (pictured right)

Hadley:

Hadley is America's first oxidizer rich staged combustion engine using a 5,000 lbf sea-level thrust, liquid oxygen and kerosene engine. It's designed for full-envelope service, simple integration, and is a reliable engine solution for a wide range of vehicles in the orbital and suborbital launch regimes. Integrated fluid controls and electronic subsystems accompany this turnkey propulsion package for rapid customer utilization.

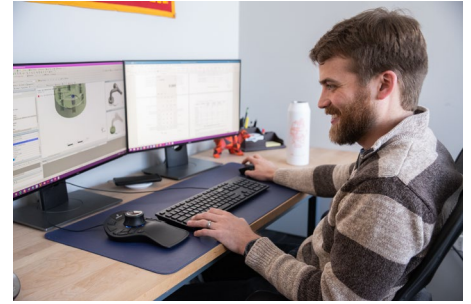
Ripley:

An evolution of the Hadley architecture, the Ursa Major Ripley engine is a 35,000 lbf class, liquid oxygen, and kerosene engine. Ripley leverages the manufacturing and design methodologies of the Hadley while providing a boost propulsion solution for an equally diverse set of vehicles.

A critical resource Ursa Major Technologies used in the development of the Hadley and Ripley engine was ANSYS simulation software. The company worked with the simulation experts at PADT, a globally recognized provider of Numerical Simulation, Product Development, and 3D Printing products and services, to select the correct simulation bundle that would allow it to develop its low-cost, high-end rocket engines.

FINDING A BETTER SOLUTION WITH ANSYS

Prior to purchasing ANSYS software, Ursa Major Technologies demoed a number of simulation tools to design its engines, however none of them were able to meet their needs. These tools weren't able to mesh to the quality the company wanted, took too long to run analyses, didn't have multi-threaded capabilities, and were neither user-friendly nor intuitive. Digging deeper, Ursa Major Technologies took a look at the ANSYS product family, and were pleased to find that the software checked all of the boxes. Shortly after they began working with this software, the company discovered the ANSYS Startup Program, a plan that gives entrepreneurs full access to simulation software bundles that are built and priced specifically to help them to grow their business quickly and cost-effectively. Not only did this package provide Ursa Major Technologies with the best tools to design complicated engines, the low-cost also allowed it to triple the number of simulation tools it could afford. Thanks to the Startup Program, the company now uses a full suite of tools including ANSYS CFD, CFX Mechanical, Thermal and Fluent.



After a year and a half with ANSYS, design engineers at Ursa Major Technologies met with the simulation team at PADT, and signed them on as their product support partner for ANSYS simulation tools. PADT helped the engineers by providing training classes for advanced multi-phased computational fluid dynamics (CFD), troubleshooting services on a case-by-case basis, and worked with the company to help them add more tools as needed.

“ANSYS is an incredibly powerful tool that has changed the speed at which we design and optimize our products and improved the quality and accuracy of our products. No other tool we have tried has been able to compete.”

- Bill Murray, director of design and analysis, Ursa Major Technologies

SIMULATION AT THE FOREFRONT OF ENGINE DESIGN AND OPTIMIZATION



With ANSYS, Ursa Major Technologies is accomplishing design goals faster and more efficiently than ever before. Using ANSYS Finite Element Analysis (FEA), the company can run models with 30-40 unique parts to analyze entire turbo pumps in one simulation. Thrust analysis, which the company had previously done with 2D models, can now be done all in the ANSYS CFX tool more cost-effectively. Ursa Major Technologies is also using ANSYS to optimize its additive manufacturing designs to create higher-quality prototypes. As the company looks towards the future and increases production, it's exploring new ways to maximize its use of ANSYS, and bring its engines to market quicker.

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