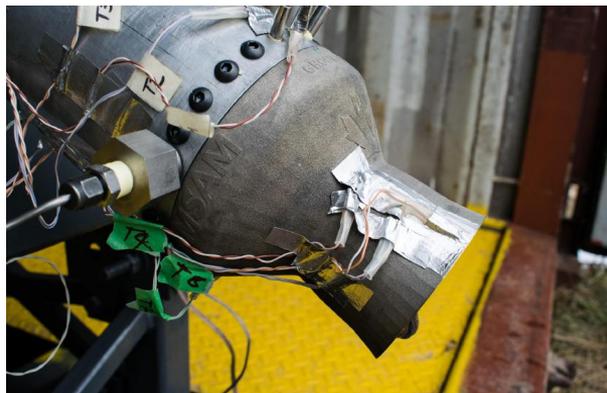


High-throughput
Microscopy



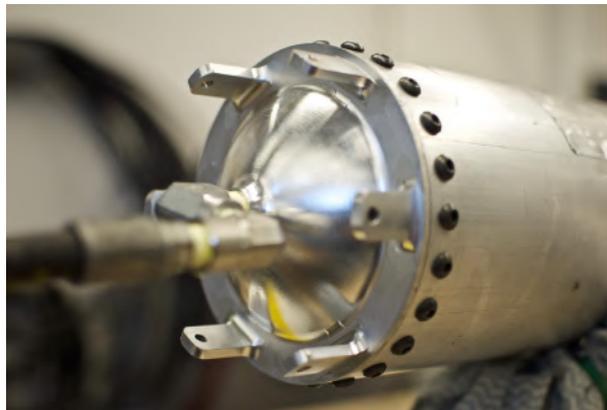
3D-Printed Rocket Nozzle



Self-Mixing Interferometer



Inflatable Earth-Entry
Decelerator



Rocket Oxidizer
System



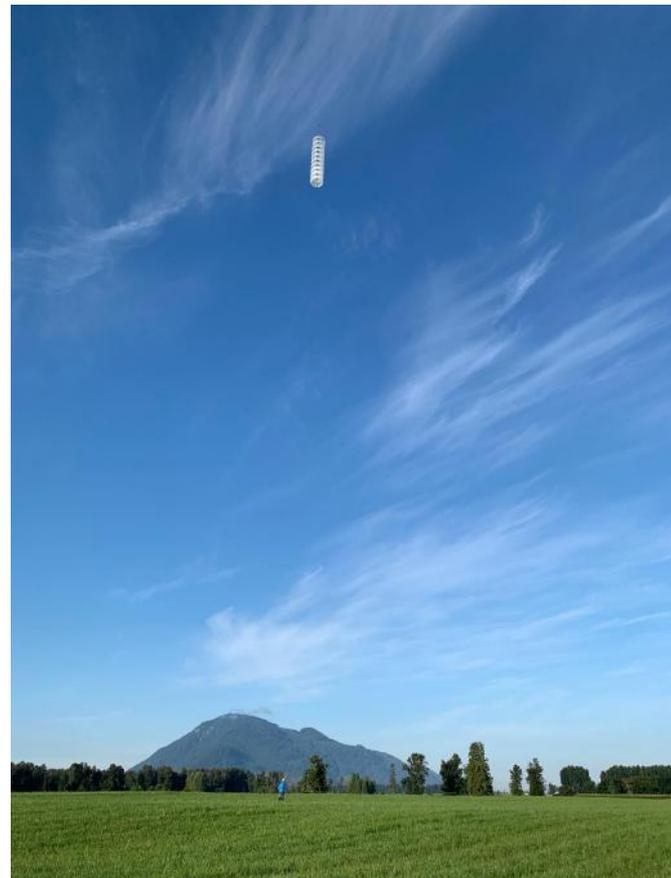
Prototype Venus
Aerobot

Mechanical-Compression Venus Aerobot

Development and **flight testing** of a venus aerobot for JPL



Miniaturized flight computer with telemetry downlink and autonomous altitude control



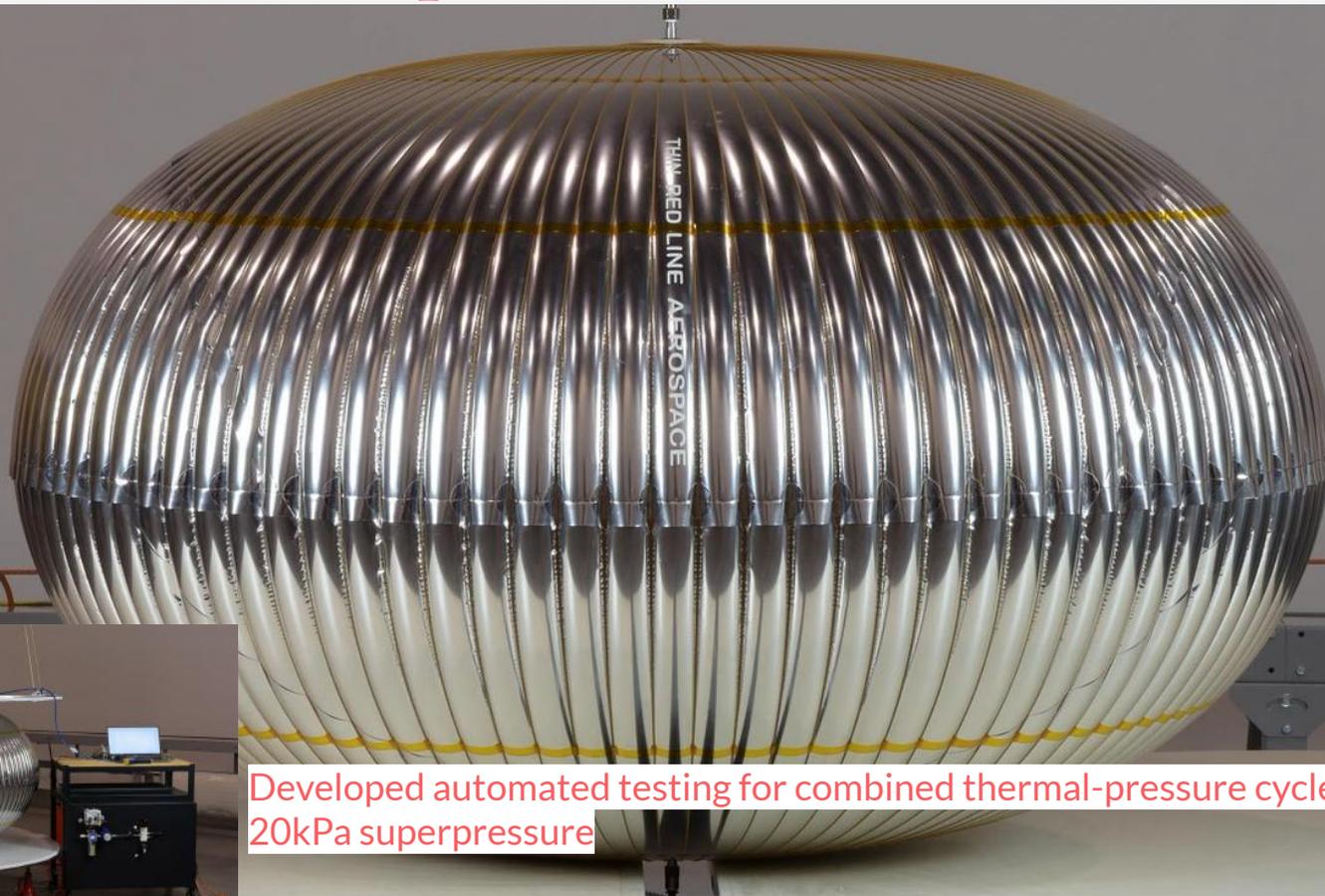
EFESTO: Hypersonic Inflatable Aerodynamic Decelerator Pathfinder

Simulation and hand assembly for a inflatable sphere-cone decelerator.

1.5m diameter Kevlar+Zylon load structure, total weight <8kg



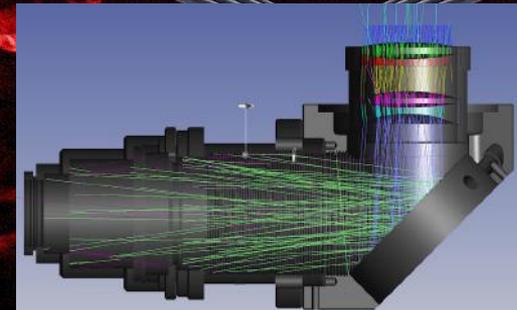
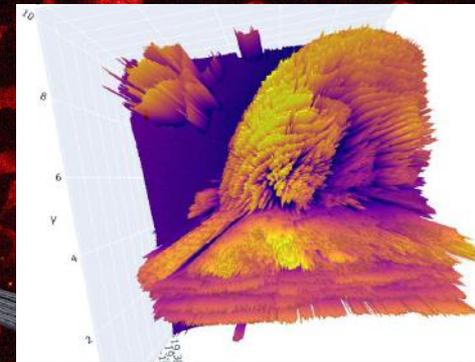
MARVEL: Temperature Tolerant Venus Balloon



Developed automated testing for combined thermal-pressure cycles up to 135°C and 20kPa superpressure

Methodology for measuring helium barrier performance and specific energy

Nucleus: Automated epi-fluorescence microscope



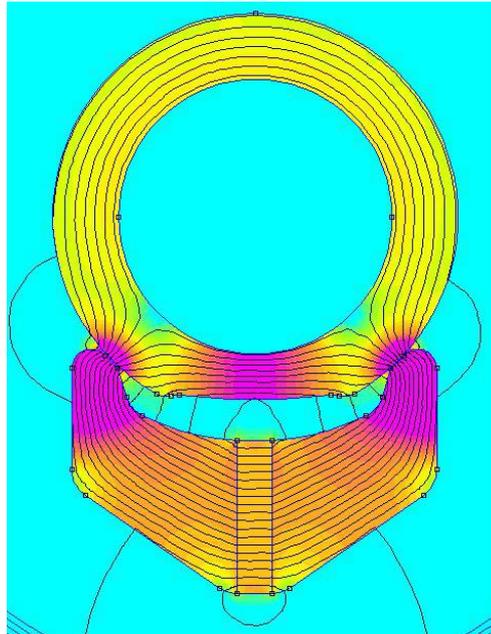
Principal engineer developing the Nucleus project from 2022 onward

Optical simulation + redesign for improved field number and stray light rejection

Method for creating a reflected-light confocal system for <\$100

X-MOR4-E

Product manager + developer for automated objective changer with novel magnetic shuttle mechanism designed for 24/7 operation. Accelerated lifetime test to **1 million cycles** showed minimal wear and a repeatability **better than $1.5\mu\text{m}$** .



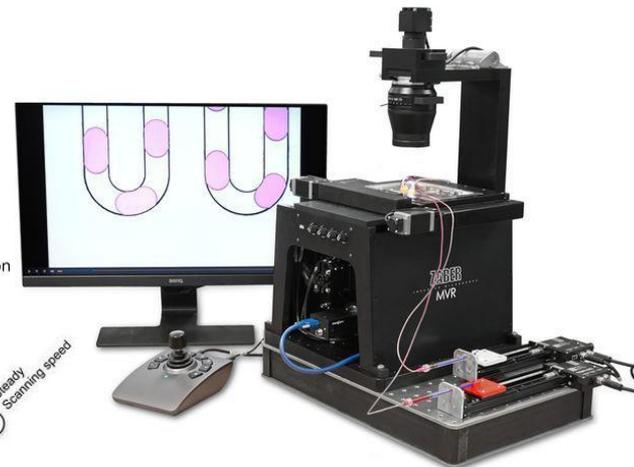
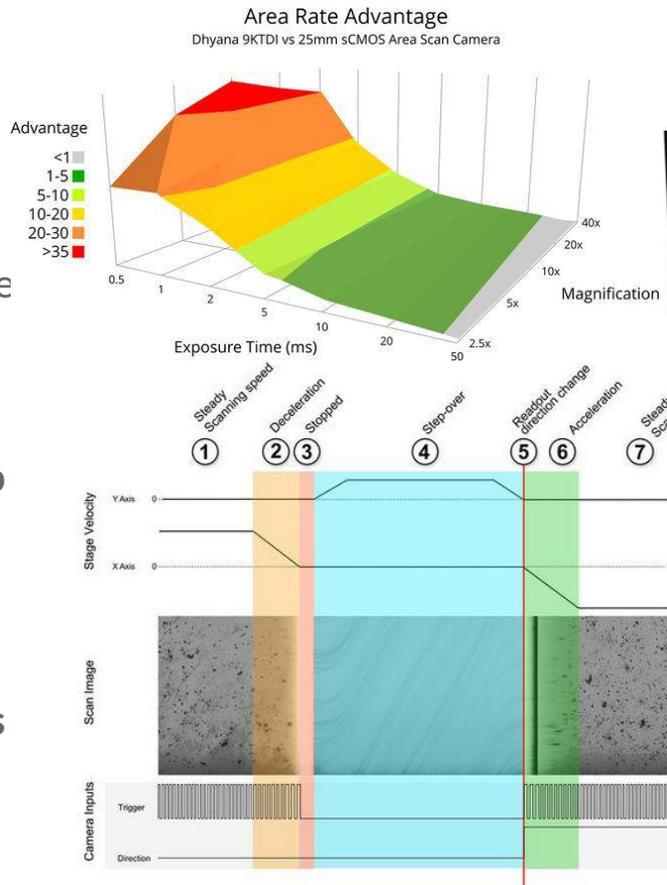
Whitepapers on TDI and Microfluidics

Tests and hardware to integrate TDI imaging and automated microfluidics.

Expanded our knowledgebase and the reach of our microscopes.

My setup achieved a **speedup of 30x** compared to a high-end sCMOS camera

Both articles, once published, directly lead to **\$50,000 sales** within 6 months.



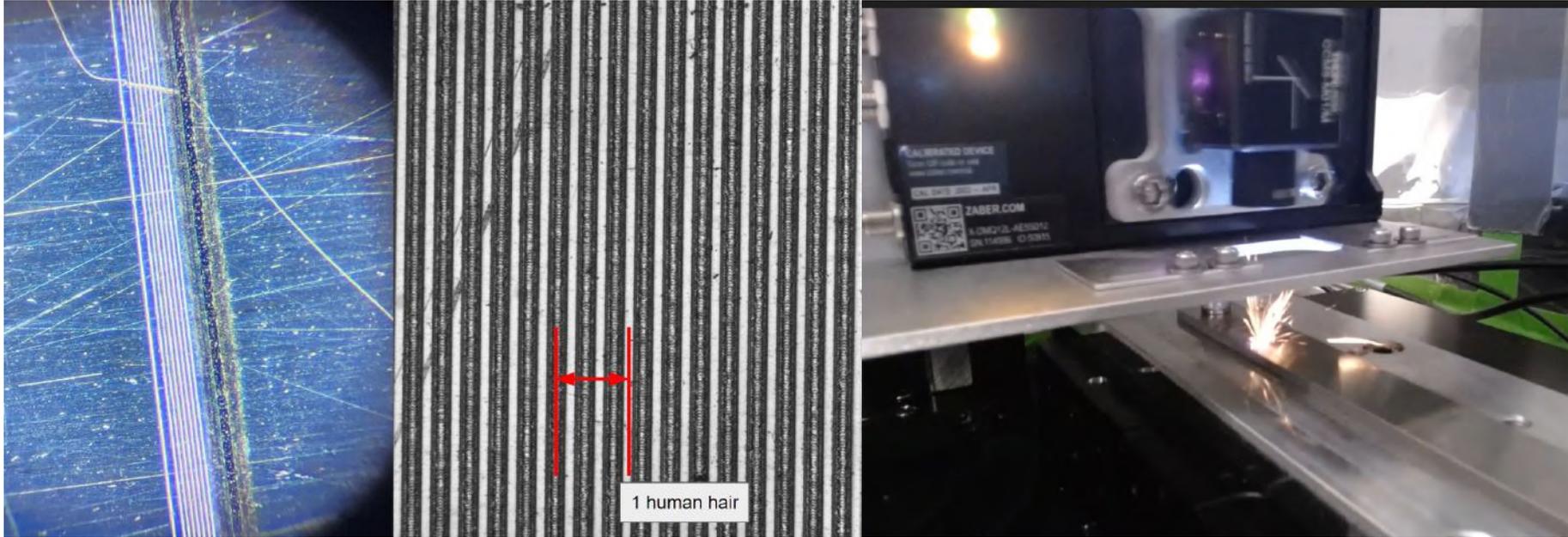
zaber.com/articles/tdi-imaging

zaber.com/articles/automated-microfluidics

Figure 14. Stage velocity, camera inputs and resulting scan image as the scanning stage progresses through the scan and step-over sequence.

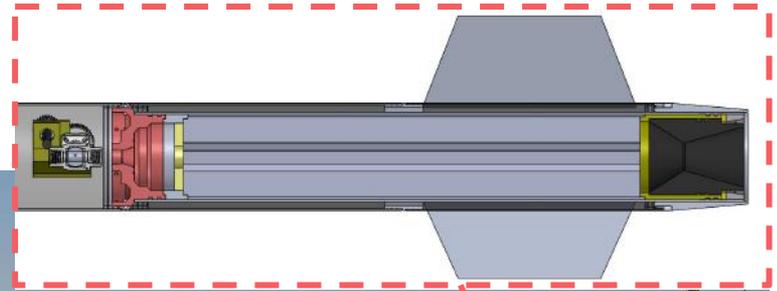
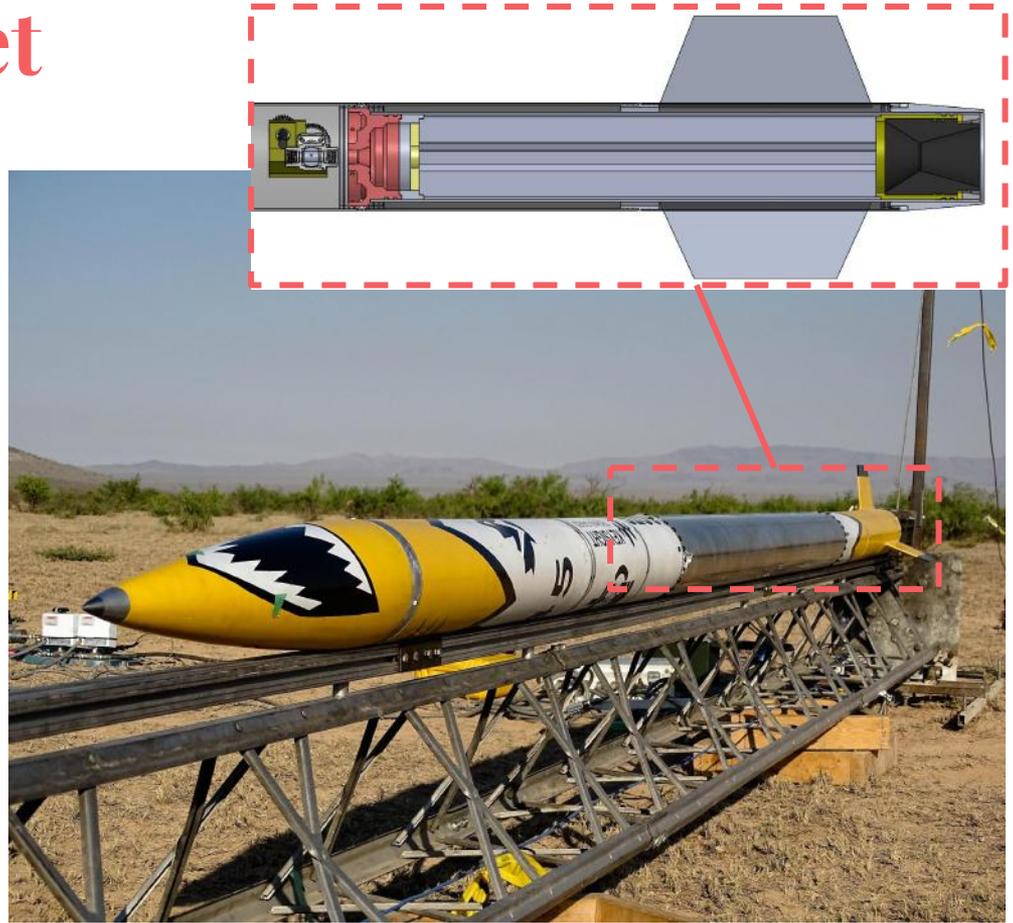
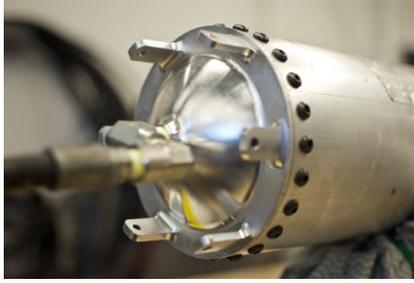
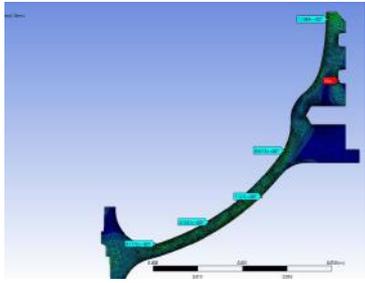
Laser encoder marking system

Flying optics and multidimensional parameter optimization for fiber laser direct marking of encoder lines. 40 hours from inception to readable encoder scales with high contrast!



SOTS Hybrid Rocket

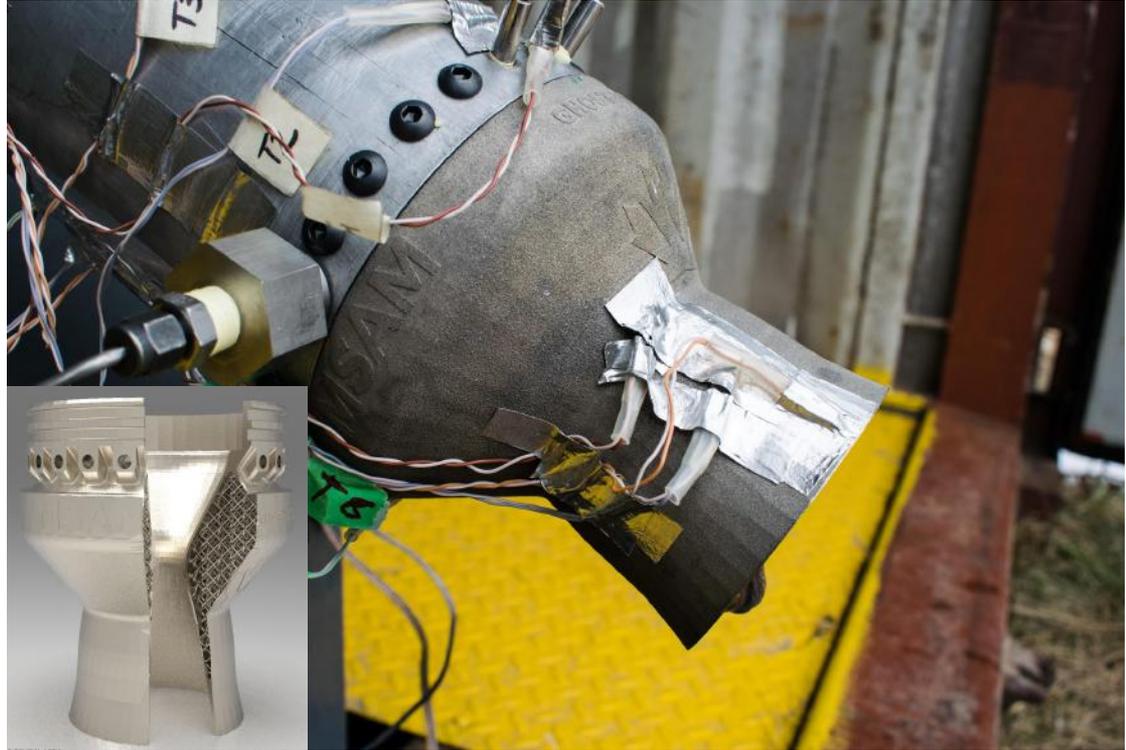
I re-developed the oxidizer system for a Nitrous-oxide HTPB engine delivering 6kN of thrust for a launch to 15,500ft



3D Printed Inconel Rocket Nozzle

Thrust-optimized parabolic nozzle geometry printed out of Inconel 625 gains 3% performance over previous conical design while weighing 30% less.

Water **phase-change cooling** system designed using ANSYS transient thermal. Used **lattice topology optimization** to minimize weight of the internal structure.



In collaboration with



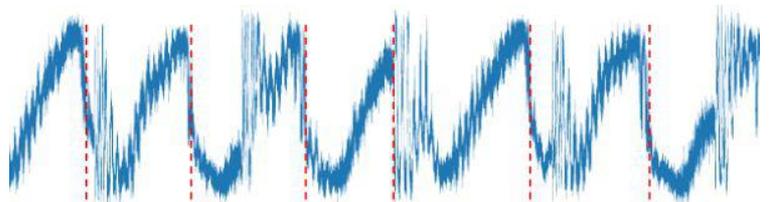
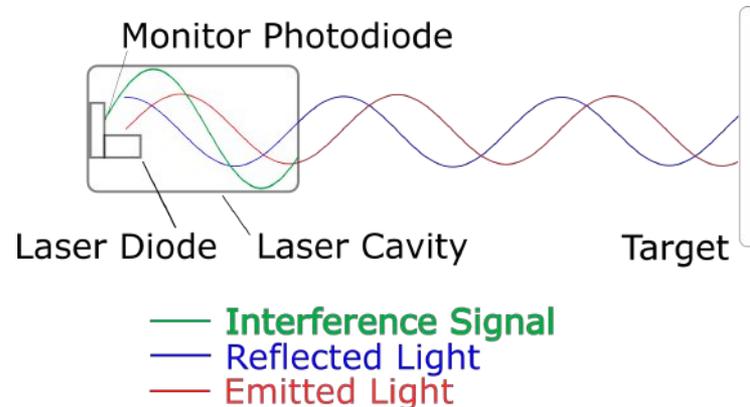
Capstone: Self-Mixing Laser Interferometer



Quantum sensing on a classical budget

Optical feedback configuration for an inexpensive interferometer to do precision displacement measurements.

Achieved 50nm resolution ($\lambda/12$) at a BOM cost of only \$400 including the necessary environmental calibrations.



$$\phi_{nom} - \phi_{feedback} = C \sin(\phi_{feedback} + \tan^{-1} \alpha)$$

Interference Fringe Signal

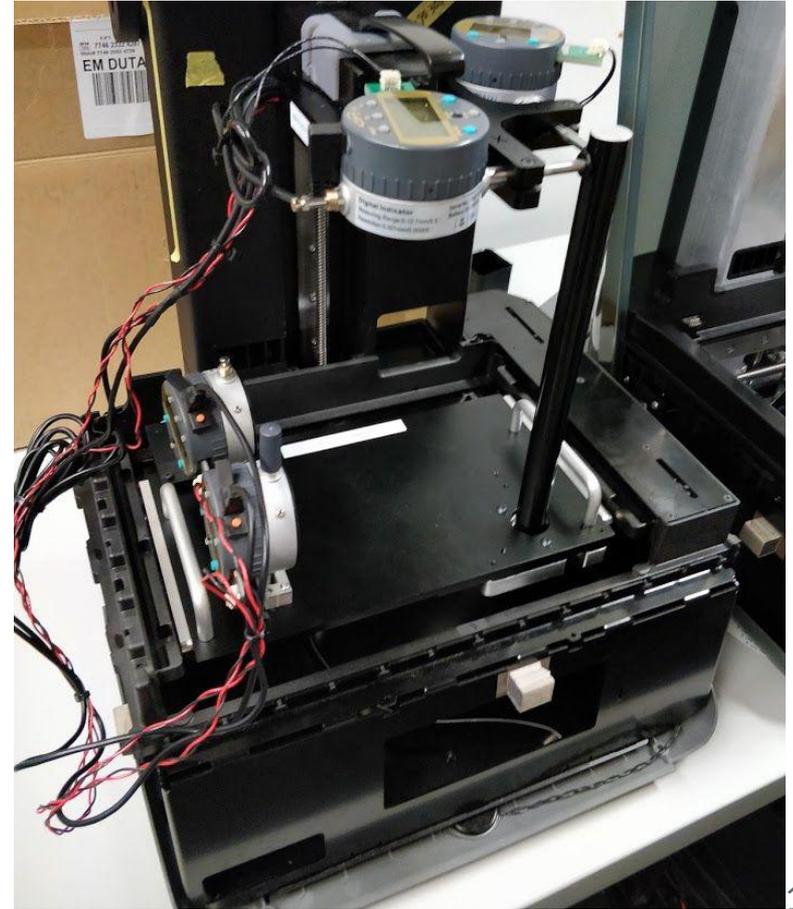
Form 3: 3d printer calibration system

Automated in-process metrology for perpendicularity of the Z axis with respect to the print plane.

This will detect poorly installed Z rails and prevent prints from coming out slanted.



Successive layers printing with poor Z perpendicularity



Flight Control Ground Station

Software and electrical implementation for data visualization, manual override commands and physical user interface.

Implements custom packets over a LoRa radio link to communicate with the flight computer.

