National Aeronautics and
Space Administration

Engineering Directorate Overview

Langley Contractor's Steering Council

September 17, 2020

Engineering Directorate

Directorate Office
D2

Dawn M. Schaible, Director
Steven W. Gayle, Deputy Director
Scott A. Hill, Senior Technical Advisor for Projects
Vacant, Chief Operations Officer
Craig D. Jones, Associate Director for Space Tech & Exploration
William C. Edwards, Associate Director for Science
Lisa O. Rippy, Associate Director for Aeronautics (SEEMB Detail)
Ray D. Rhew, Acting Associate Director for Aeronautics
Michael W. Brewer, Associate Director for Labs & Facilities

Chief Engineers Office
James E. Wells, Chief Engineer (CE)
Vacant, Deputy CE

Committee on Earth Observation Satellites Systems Engineering Ofc
Brian D. Killough, Lead

Business Office
Adam K. Altman
Lead Financial Mgmt. Specialist

Administrative Office
Cheryl C. Cannon
Lead Admin. Mgmt. Specialist

Aeronautics Systems Engineering Branch
D201

Ray D. Rhew, Head
Louis J. Glaab, Asst. Head

Mechanical Systems Branch
D202

Vacant, Head
Kenneth L. Hodges, Acting Head
Garfield A. Creary, Asst. Head

Electronic Systems Branch
D203

Arthur T. Bradley, Head
Kevin M. Somervill, Asst. Head (SEEMB Detail)
Yuan Chen, Asst. Head

Atmospheric Flight and Entry Systems Branch
D205

N. Ronald Merski, Head
Monica F. Hughes, Asst. Head
Glenn A. Hrinda, Asst. Head

Structural and Thermal Systems Branch
D206

Troy O. Mann, Head
Crystal J. Fenn, Asst. Head
Lance L. Proctor, Asst. Head

Flight Software Systems Branch
D207

David A. Haakenson, Head
Chris Thames, Asst. Head

Systems Engineering and Engineering Methods Branch
D209

Lisa O. Rippy, Acting Head
Kevin M. Somervill, Acting Asst. Head
Nipa Phojanamongkolkij, Asst. Head (SACD Detail)

Systems Integration and Test Branch
D210

Wade R. May, Head
Spencer L. Johnston, Asst. Head

Remote Sensing Branch
D211

Alan Little, Head
Larry B. Petway, Asst. Head

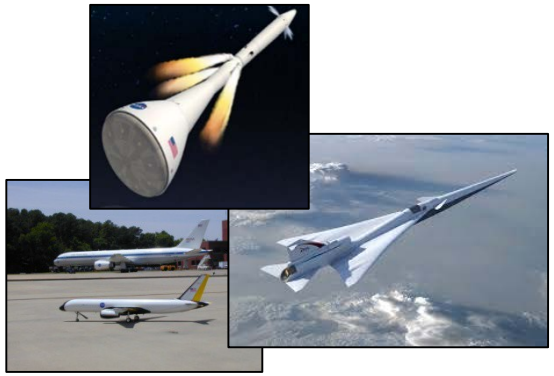
Fabrication Technology Development Branch
D212

Nancy M. H. Holloway, Head
Kenneth A. Deyerle, Asst. Head

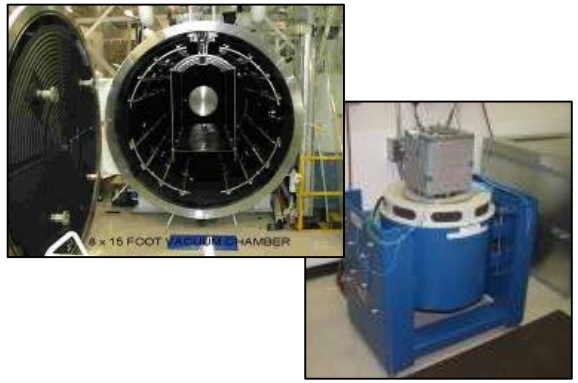
Metals Applications Technology Branch
D213

Thomas J. Burns, Head
Mark A. Simonton, Asst. Head

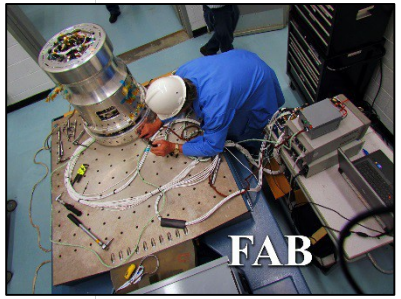
Engineering Capabilities & Expertise



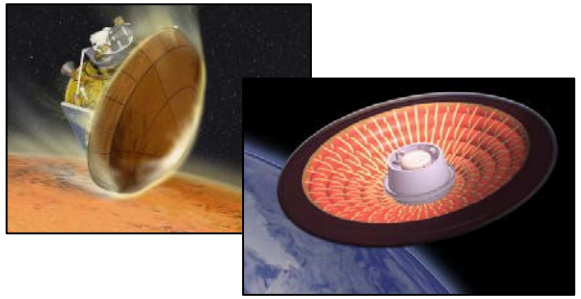
Flight Systems



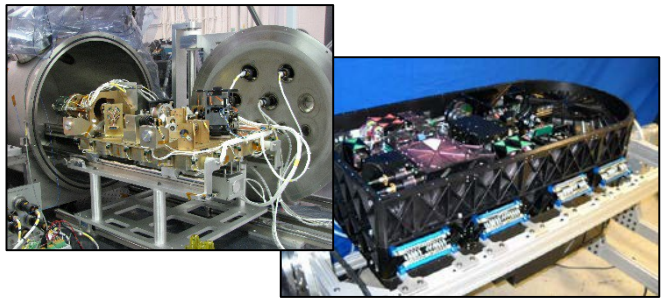
Environmental Testing



Fabrication & Manufacturing



Entry, Descent & Landing

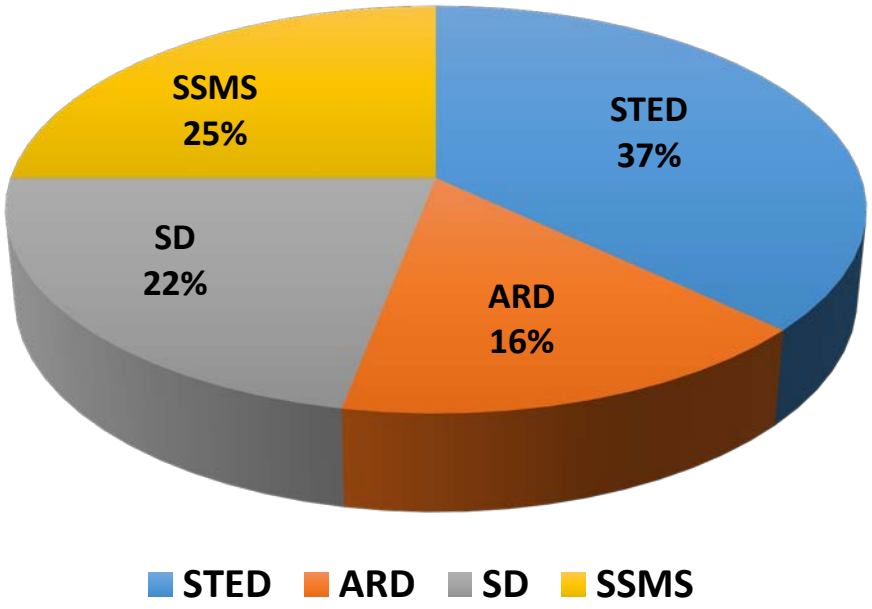


Sensor/Sensing Technology

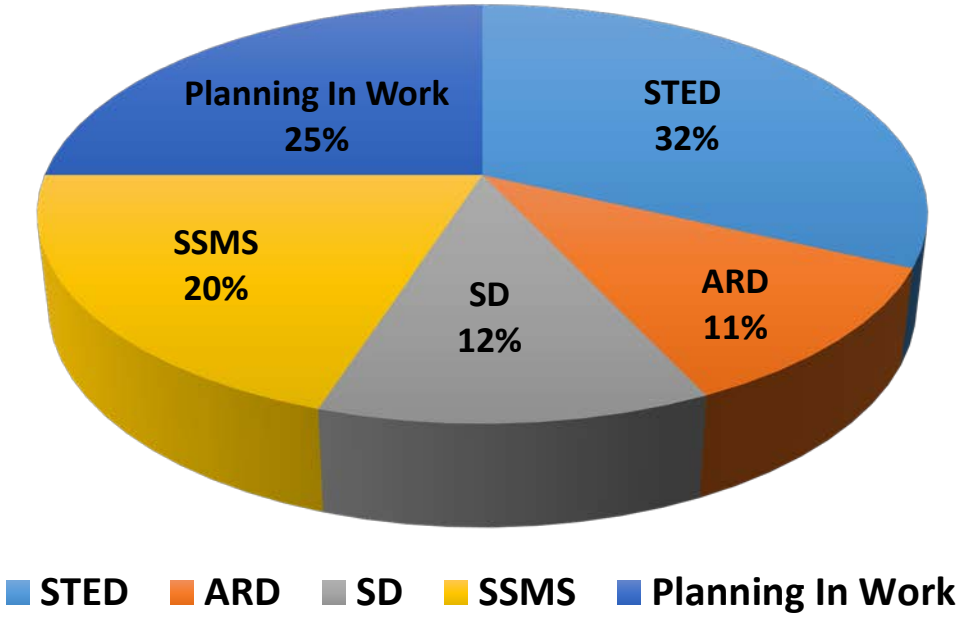
Lidar/Laser Technology

Engineering Workforce Support of Mission Directorates

FY 20 ED CS Workforce Distribution



FY 21 ED CS Workforce Distribution*



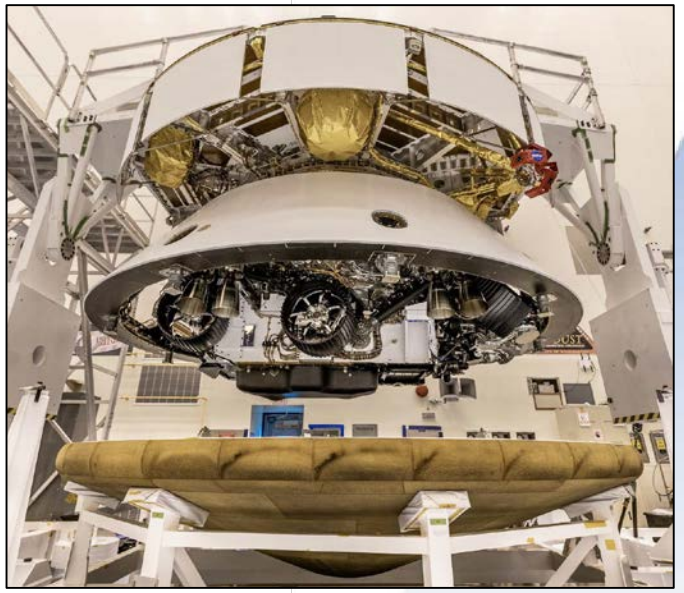
* Per 9/11/20 WPS Report

Engineering Project Portfolio Highlights

Mars 2020/MEDLI 2

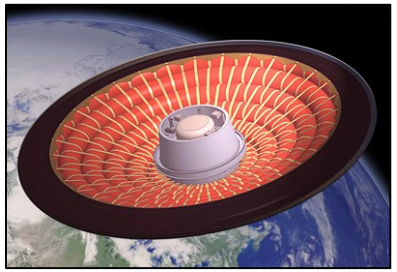
- **MEDLI2 Goals:**
  - Collect data during Mars 2020 mission's atmospheric entry enabling improved designs of future Mars entry systems for robotic and crewed mission
  - Understanding aerothermal environments, thermal protection system performance, and aerodynamic performance characteristics of the Mars 2020 entry vehicle. Also extends to designing entry systems for other destinations, such as Venus, Titan, and the gas giants

- **Major Accomplishment in FY20:**
  - System integration and launch on July 30, 2020
- **Next Milestone (FY21):**
  - Landing at Jezero Crater on Feb. 18, 2021



The image taken on May 28, 2020, at Kennedy Space Center in Florida.

Low-Earth Orbit Flight Test of an Inflatable Decelerator (LOFTID)



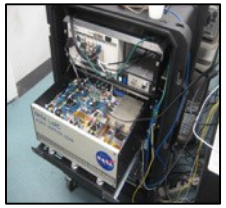
Deployed Reentry Vehicle

- **LOFTID Goals:**
  - Demonstrate inflatable decelerator technology entry from low-Earth orbit
  - Technology benefits include:
    - Landing heavier payloads (mass)
    - Landing at higher altitude locations (elevation)
    - Enabling better utilization of the full volume of a launch vehicle fairing
  - Inflatable decelerator technology is scalable to both crewed and large robotic missions to Mars
- **Next milestones (FY21):**
  - Critical Design Review and System Integration Review – Oct 6-8
  - JPSS current launch date 2022

Navigation Doppler LIDAR (NDL)

- **NDL Goals:**
  - Elevate space-based lidar instrument to Technology Readiness Level (TRL) 6 and higher
  - Provide precise vehicle velocity vector and altitude measurement for precision navigation and well-controlled descent, landing, and ascent maneuvers
- **Major Accomplishments in FY20:**
  - ETU 1 and 2 both characterized and delivered as part of the Safe and Precise Landing Integrated Capabilities Evolution (SPLICE) Project
- **Next Milestones (FY 20 and 21):**
  - ETU 2 launching on Blue Origin New Shepard Sept 23, 2020
  - ETU 4 (Astrobotic) need date Dec 2020

Measures velocity and range along three different laser beams



Technology previously tests on helicopters and rocket-powered free-flyer vehicles

Orion/Launch Abort System (LAS)

- **Orion Goal:**
  - Serve as the exploration vehicle carrying crew to space, provide emergency abort capability, sustain crew during space travel, and provide safe re-entry from deep space return velocities
- **Significant Accomplishment in FY20:**
  - Delivered LAS for Artemis 1
- **Next Milestones (FY21):**
  - LAS Office transition to JSC for sustaining operations/production
  - Water impact testing planned for early next year (1 swing and 3 vertical tests)

Orion Crew Module TPS

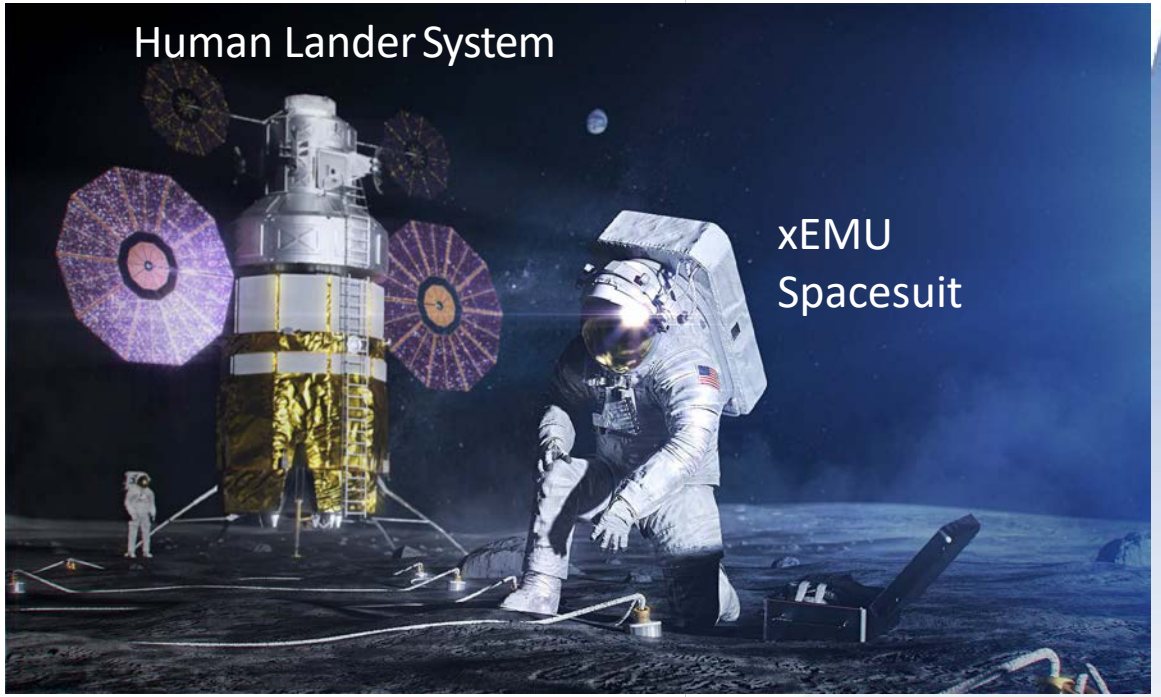
Orion Launch Abort System

Orion Crew Module Water Impact Testing

Artemis

- **Artemis Goals:**
  - Land first woman and next man on the Moon by 2024
  - Collaborate with partners for sustainable exploration by the end of the decade
  - Use what is learned on and near Moon to take next giant leap – sending astronauts to Mars

- **Current engineering roles in HLS:**
  - Deputy Manager for Structures
  - Lead for all Mission Segments
  - Abort Mission Segment Lead
  - Lead for Landing Legs risk mitigation
  - SE&I leadership roles
  - Discipline Support: Structures; Mechanical Systems; Mechanisms; Deorbit, Descent and Landing
  - NDL technology infusion
  - xEMU prototype development

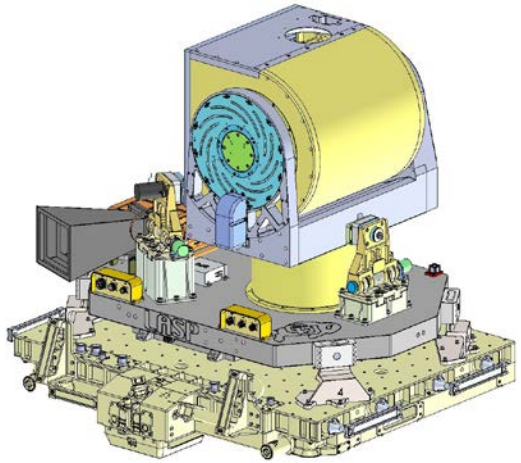


Commercial Lunar Payload Services (CLPS)

- **LaRC Payloads**
  - Stereo Cameras for Lunar Plume-Surface Studies (SCALPSS) will capture video and still image data of lander's plume as it starts to impact the lunar surface through engine shut off -- critical information for future lunar and Mars vehicle designs
  - NDL will provide extremely precise velocity and range sensing for increased navigation precision during descent and landing for a soft and controlled touchdown on the Moon. NDL is being collaboratively developed with JSC

CLARREO Pathfinder Mission

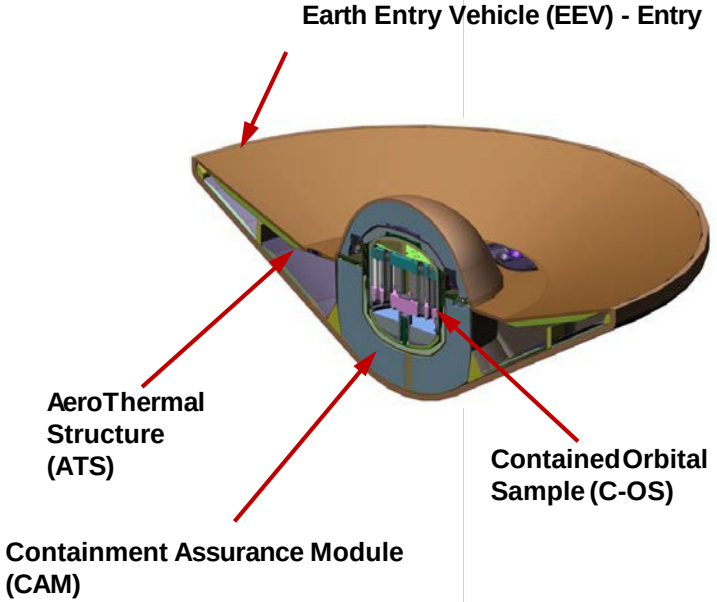
- **CLARREO Pathfinder Goal:**
  - Substantially improve accuracy of Earth radiation measurements -- advances ability to detect climate change and identify its causes
- **Significant Accomplishments in FY21:**
  - Successful CDR in March 2020
- **Next Milestones (FY21):**
  - Flight PCU delivery to LASP planned for April, 2021
  - System-level Pre-Environmental Review in 2022

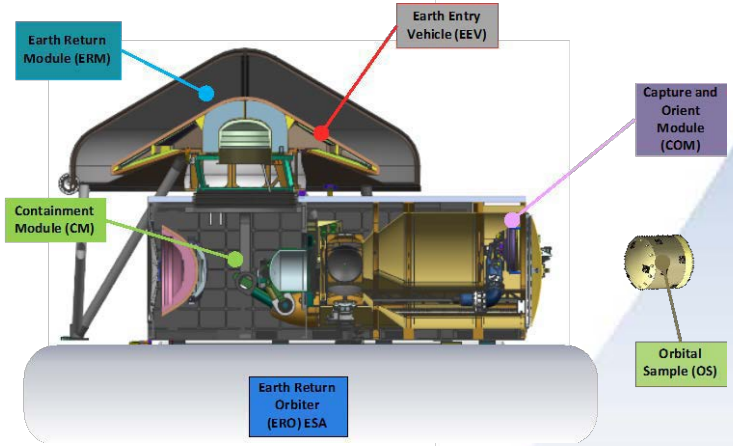


CLARREO Pathfinder Mission will be launched to, and deployed on, the International Space Station

Mars Sample Return Earth Entry Vehicle

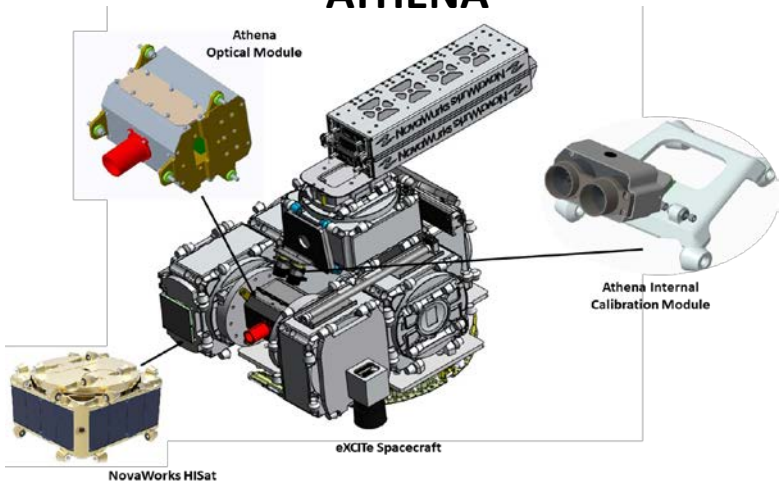
- **Earth Entry Vehicle (EEV) Goal:**
  - Return samples collected on Mars surface (by the Mars Perseverance Rover) to Earth, landing on US soil
- **Significant Accomplishments in FY20:**
  - Trade studies conducted included:
    - Hot structure vs. cold structure
    - Aeroshell structural design
- **Next Milestones (FY21):**
  - Testing to validate analysis of hard surface landing
  - Campaign Concept Review (CCR) – Oct 2020





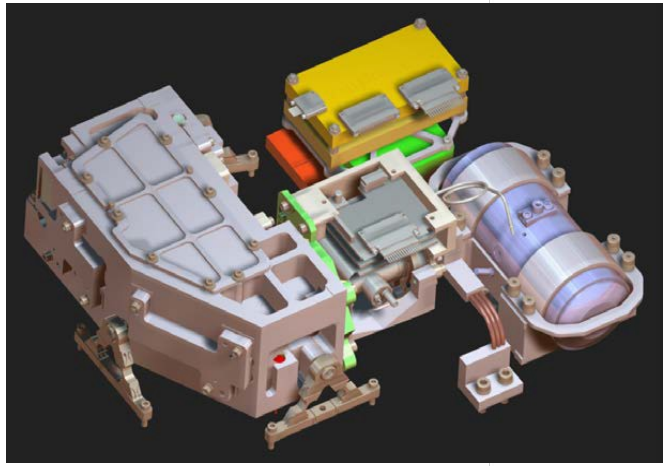
Small Satellite Development

ATHENA



Strengthen capabilities to quickly develop and demonstrate advances in science and technology, and characterize ability of HISats to support future SI

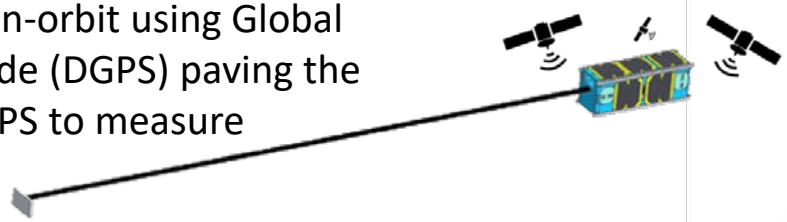
ARCSTONE



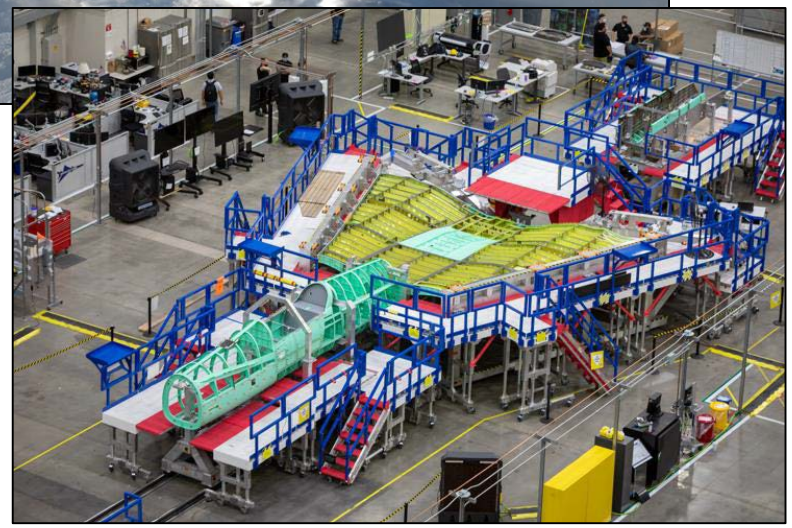
Lunar spectral reflectance measurements to provide SI-traceable calibration source (Moon) for on-orbit sensors

GPX2

Demonstrate measurement of a known baseline on-orbit using Global Position System (GPS) operating in differential mode (DGPS) paving the way for on-orbit assembly using high-accuracy DGPS to measure relative proximity and orientation



Low Boom Flight Demonstrator (LBFD)



- **LBFD goals:**
  - Design and build a piloted, large-scale supersonic X-plane with technology to reduce sound levels of a sonic boom to that of a gentle thump
  - Fly X-plane over select U.S. communities to gather data on human responses to low-boom flights and deliver that data set to U.S. and international regulators
- **Significant Accomplishment FY20:**
  - KDP-D completed
  - XVS acceptance testing complete
- **Next Milestones (FY21):**
  - Complete XVS testing, install and checkout
  - Ground Proof Loads Test Readiness Review (TRR)
  - Aerodynamics, Boom & Mission Performance Assessment Technical Reviews (Pre-FRR)

Questions?