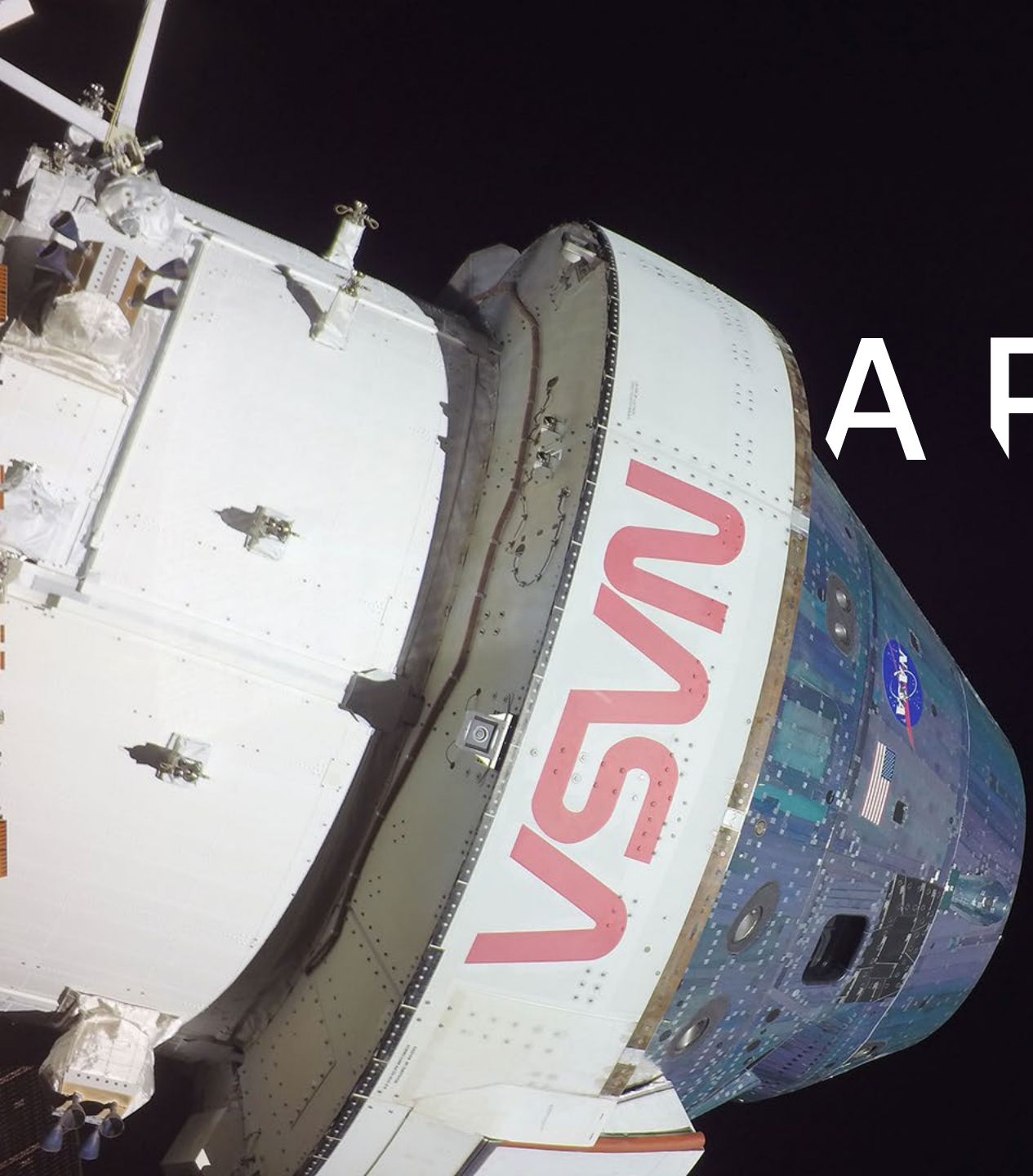
National Aeronautics and Space Administration

Langley Alumni Association ✦ February 10, 2026

Langley & Artemis II: Humanity's Return to the Moon

✦ **First Crewed Mission of the Artemis Program**

Presenter: Jeffrey Herath
Title: Deputy Director, Space Technology and Exploration Directorate
Langley Research Center



ARTEMIS II

- Is a Test Flight
- Is the first crewed flight under NASA's Artemis campaign
- Will help confirm systems and hardware needed for early human lunar exploration missions.
- Is an approximately 10-day mission
  - The Artemis II crew will travel roughly 4,700 miles beyond the far side of the Moon
  - Farther from Earth than any humans have ever traveled, before returning home.

Artemis II Overview

ARTEMIS FIRSTS:

- Crewed integrated flight test of the Space Launch System (SLS) rocket, Orion spacecraft, and Exploration Ground Systems (EGS) at KSC
- Active Orion Launch Abort System (LAS)
- Demonstration of Orion life support systems
- Proximity operations demonstrations
- Human data collection in transit to and from the Moon, in lunar orbit, and through reentry and splashdown
- Conducting new science and technology demonstrations in orbit

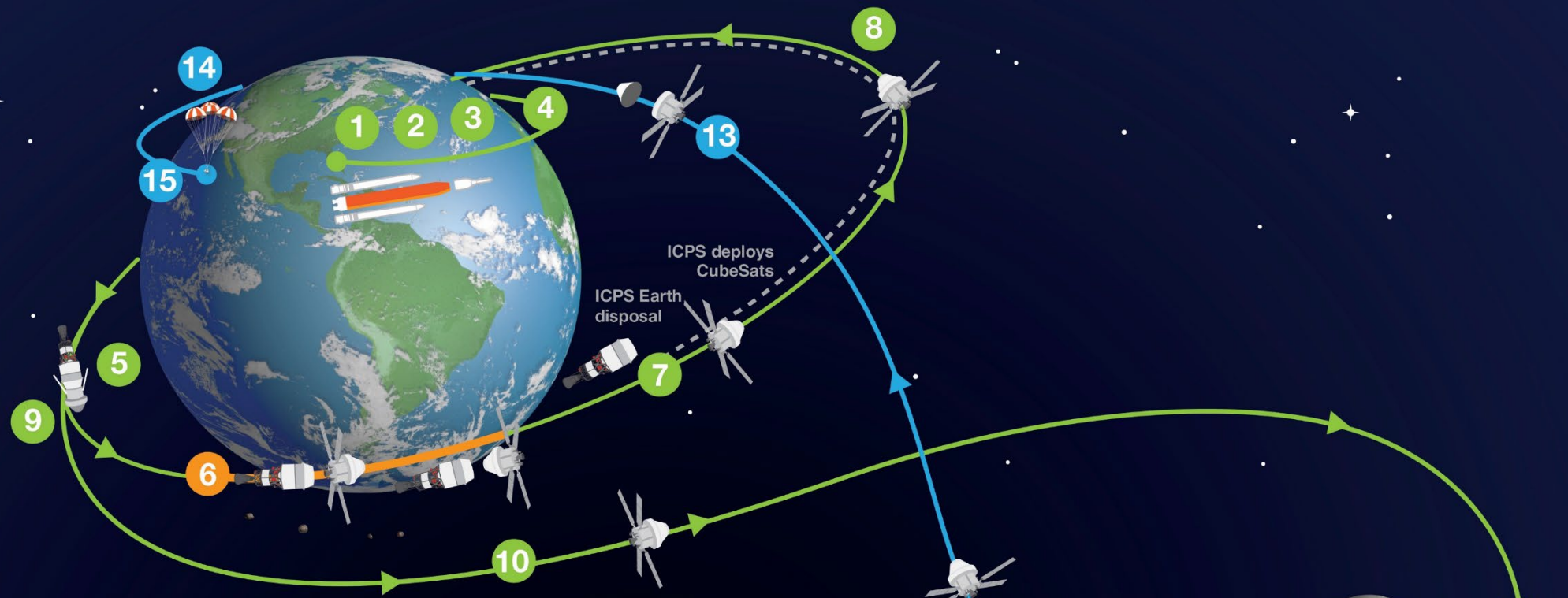
NEW ELEMENTS:

- Orion life support systems
- Launch Complex 39B emergency egress system for crew and new liquid hydrogen system

COMMON ELEMENTS:

- SLS rocket Block 1 configuration
- Orion crew spacecraft
- Mobile Launcher 1

ENSURING CREW SAFETY IS OUR TOP PRIORITY!



ARTEMIS II

First Crewed Test Flight to the Moon Since Apollo

1 LAUNCH
Astronauts lift off from Launch Pad 39B at Kennedy Space Center.

2 JETTISON SOLID ROCKET BOOSTERS, FAIRINGS, AND LAUNCH ABORT SYSTEM

3 CORE STAGE MAIN ENGINE CUT OFF
With separation.

4 PERIGEE RAISE MANEUVER

5 APOGEE RAISE BURN TO HIGH EARTH ORBIT
Begin 23.5-hour checkout of spacecraft.

6 ORION SEPARATION FROM INTERIM CRYOGENIC PROPULSION STAGE (ICPS) FOLLOWED BY PROX OPS DEMO
Plus manual handling qualities assessment for up to 2 hours.

7 ORION UPPER STAGE SEPARATION (USS) BURN
Begins high Earth orbit checkout. Life support, exercise, and habitation equipment evaluations.

8 PERIGEE RAISE BURN

9 TRANS-LUNAR INJECTION (TLI) BY ORION'S MAIN ENGINE
Lunar free return trajectory initiated with European service module.

10 OUTBOUND TRANSIT TO MOON
Outbound trajectory correction (OTC) burns as necessary for lunar free return trajectory; travel time approximately 4 days.

11 LUNAR FLYBY
4,047 mi/6,513 km (mean) lunar far side flyby altitude.

12 TRANS-EARTH RETURN
Return trajectory correction (RTC) burns as necessary to aim for Earth's atmosphere; travel time approximately 4 days.

13 CREW MODULE SEPARATION FROM SERVICE MODULE

14 ENTRY INTERFACE (EI)
Enter Earth's atmosphere.

15 SPLASHDOWN
Ship recovers astronauts and capsule.

AIIMM–09.10.25

Meet the Crew

Reid Wiseman
Commander

Victor Glover
Pilot

- **Commander:** Reid Wiseman (NASA).
- **Pilot:** Victor Glover (NASA)
  First person of color to leave Earth orbit.
- **Mission Specialist 1:** Christina Koch (NASA)
  First woman to leave Earth orbit.
- **Mission Specialist 2:** Jeremy Hansen (CSA)
  First non-American to leave Earth orbit.
- **Backups:** Jenni Gibbons (CSA)
  and Andre Douglas (NASA).

Christina Koch
Mission Specialist

Jeremy Hansen
Mission Specialist

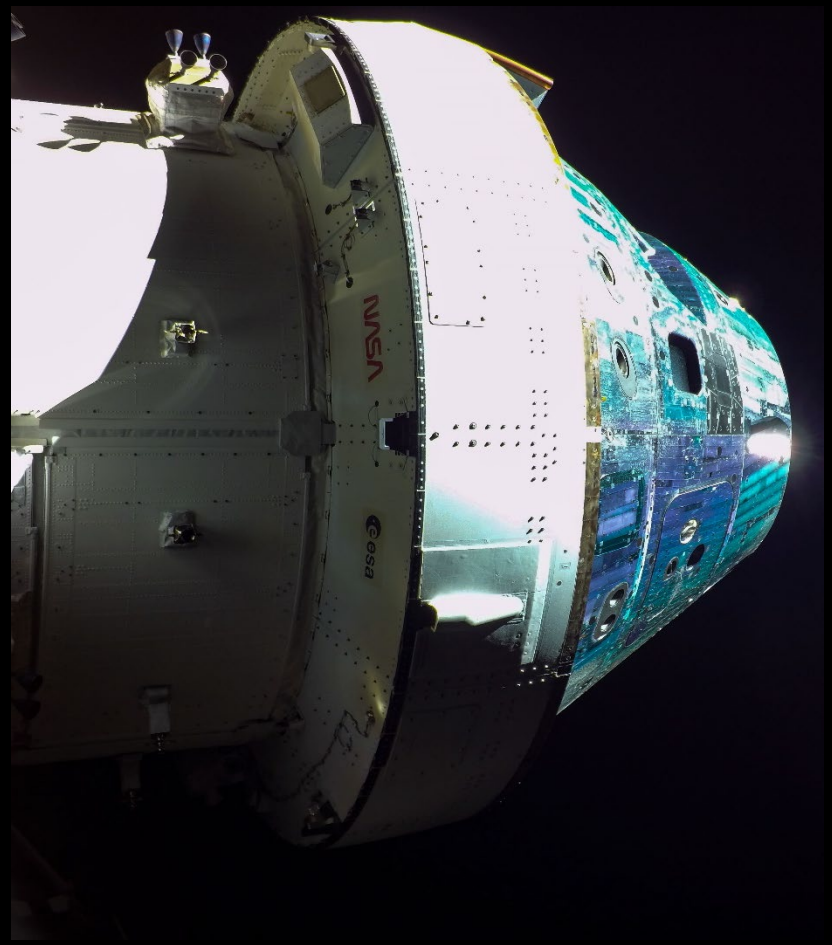
Mission Timeline & Launch Status

- **Target Launch Date:** No earlier than **March 6, 2026**.
- **Current Status: First Wet Dress Rehearsal (WDR)** completed (February 2, 2026), some issues with hydrogen leaks though fueling was completed, a second WDR will be planned before launch.
- **Launch Site:** Kennedy Space Center, Launch Complex 39B.
- **Next Major Milestone:** 2nd WDR.

NASA Langley's Support for Artemis II

The Foundational Elements for Artemis II

Space Launch System

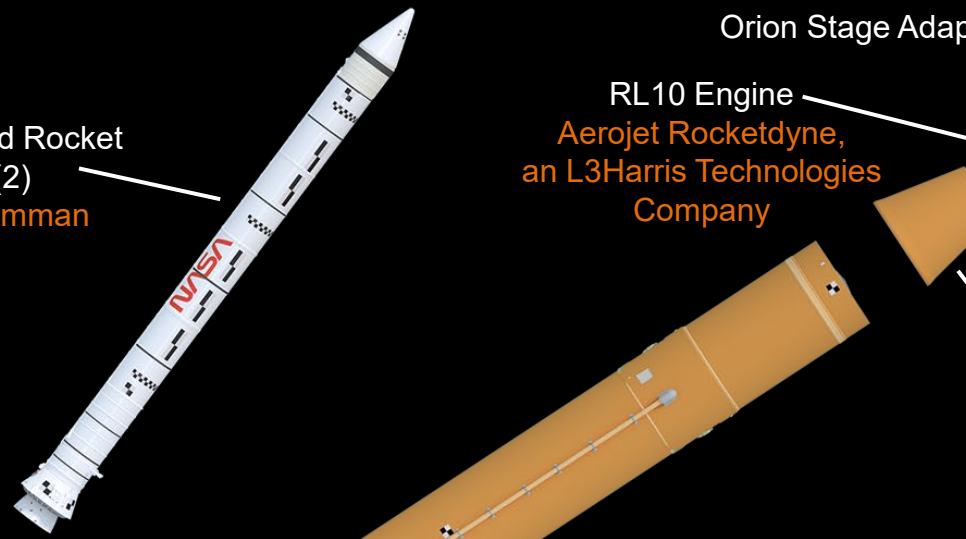


Orion

Exploration Ground Systems

NASA's Space Launch System

Block 1 Configuration



5 Segment Solid Rocket Booster (2)
Northrop Grumman

Core Stage & Avionics
Boeing

RS-25 Engine (4)
Aerojet Rocketdyne

Launch Abort System (LAS)
Crew Module (CM)
Service Module (SM)
Encapsulated Service Module (ESM) Panels
Spacecraft Adapter
Orion Stage Adapter

Orion Multi-Purpose Crew Vehicle
Lockheed Martin

RL10 Engine
Aerojet Rocketdyne, an L3Harris Technologies Company

Interim Cryogenic Propulsion Stage (ICPS)
Boeing/United Launch Alliance

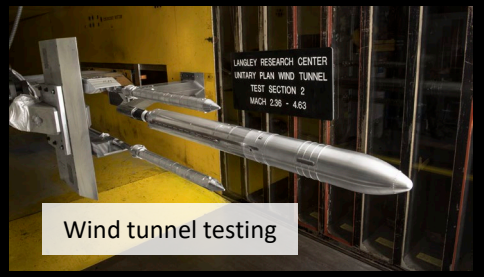
Launch Vehicle Stage Adapter
Teledyne Brown Engineering

SLS-4933

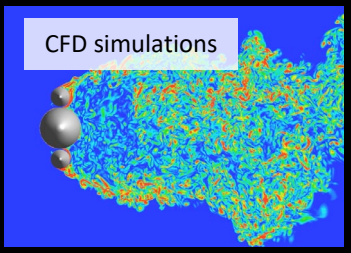
SLS Aerosciences at Langley

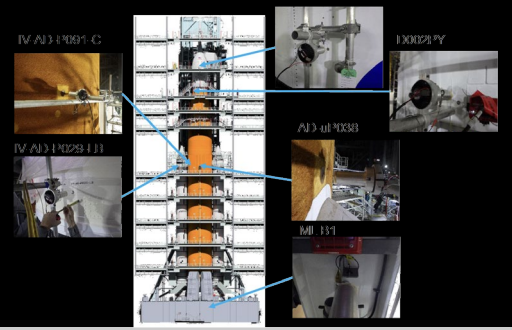
- **Goal:** Provide support to SLS Aerodynamics Task Team (ATT) at Marshall

- **Responsibilities:**
  - Conduct **Wind Tunnel Tests** for integrated aerodynamics, buffet loads and wind induced oscillations
  - Conduct **CFD** for distributed aerodynamic loads
  - Develop **Aerodynamic Databases**
    - Static Aerodynamic Integrated Loads with Uncertainty Quantification
    - Static Aerodynamic Distributed Loads
    - Unsteady Buffet Forcing Functions
  - Launch and flight support activities
    - Lead aerosciences Development Flight Instrumentation (DFI) coordination
    - Artemis II Day-of-Launch support
    - Flight Data Analysis (FDA)



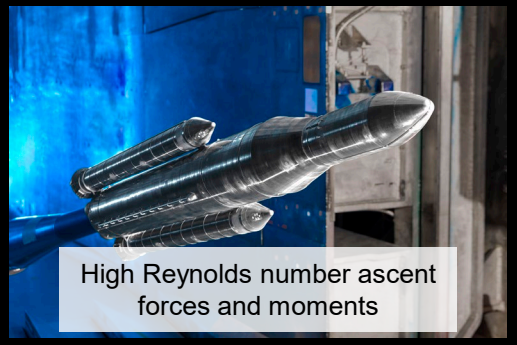
Wind tunnel testing


CFD simulations

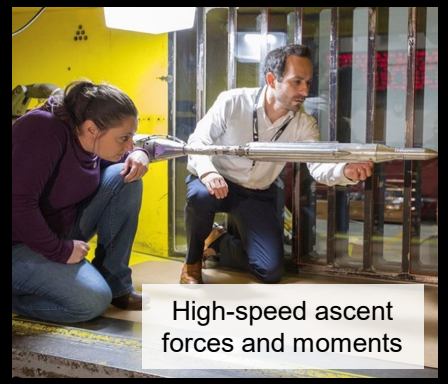

DFI verification testing and documentation

Wind Tunnel Test Capabilities

Ground wind loads and liftoff testing

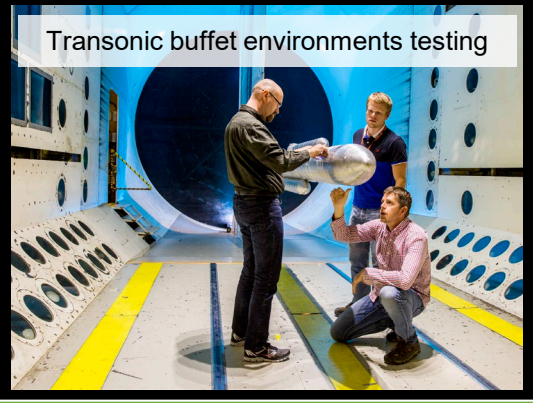


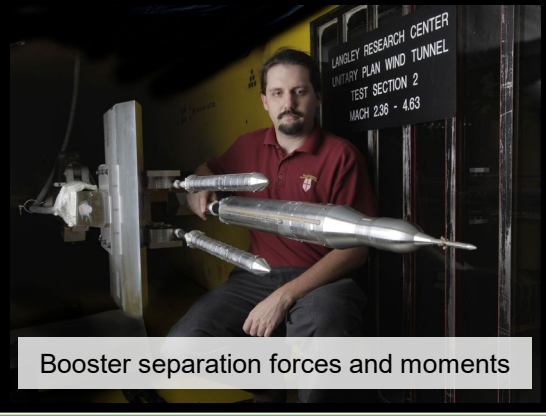
High Reynolds number ascent forces and moments



High-speed ascent forces and moments

Transonic buffet environments testing





Booster separation forces and moments

Subsonic (Low Speed) — Transonic — Supersonic

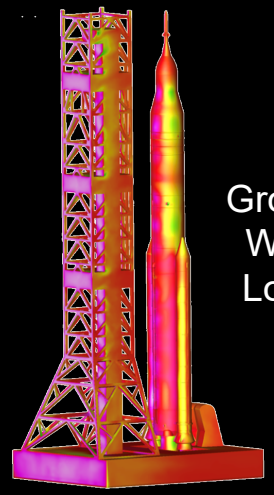
14- by 22-Foot Subsonic Tunnel

National Transonic Facility

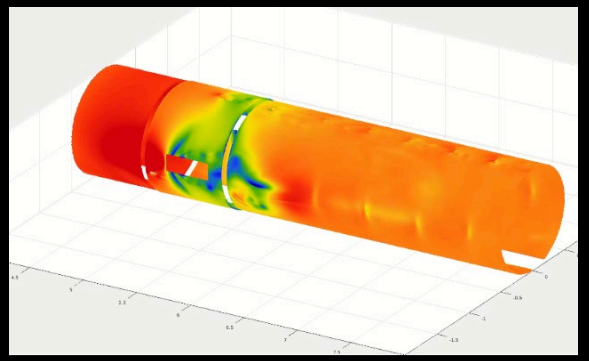
Transonic Dynamics Tunnel

Unitary Plan Wind Tunnel

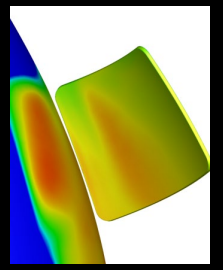
Computational Expertise



Ground Wind Loads

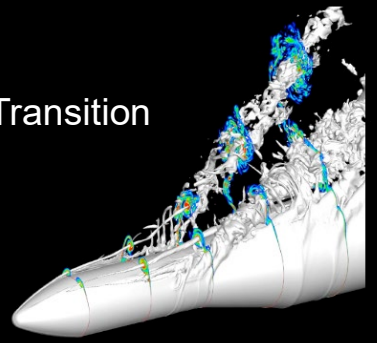


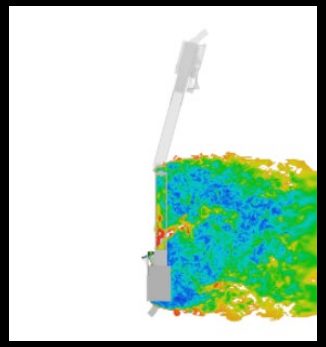
Transonic buffet environment due to booster forward attachment protuberance



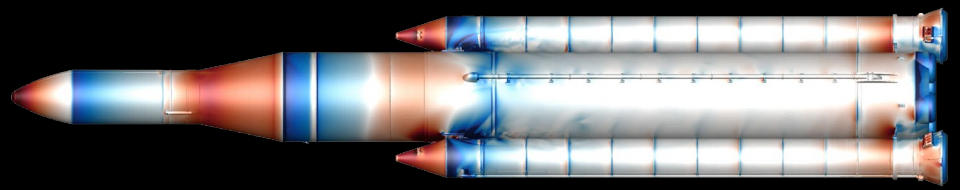
Launch Abort System escape hatch

Transition





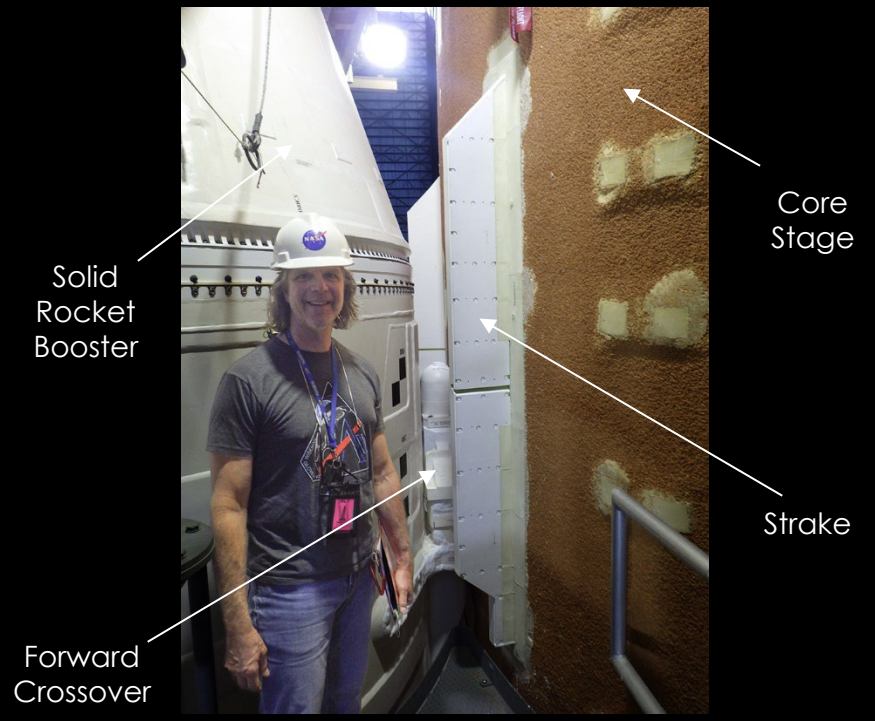
Crew Access Arm



Surface pressures of the Space Launch System vehicle at supersonic ascent conditions.

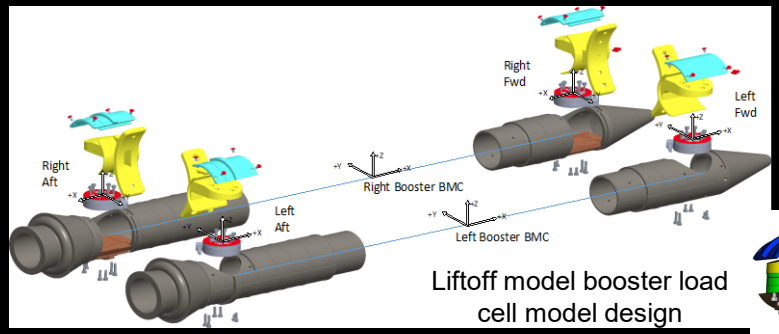
Artemis Vortex Issue Resolution Team (AVIRT)

- AVIRT Tasks
  - VADIR derived forcing functions for Vibration, Shock, and Acoustics (VS&A)
    - VADIR: Vortex Aligned Densely Instrumented aRray wind tunnel test at NASA Ames
  - Liquid Oxygen Feedline environments (FUN3D based)
  - Centerline Buffet Forcing Functions (BFF)
    - Strake assessment using data from LaRC TDT Test data
  - VADIR forcing function uncertainty
  - Strake flutter assessment (NASA and Boeing Designs)
  - Strake forced response
  - Shedding frequency dwell time
  - Ground Wind Loads, Low-speed, Off-nominal, and Transonic (LOT) Lineloads, and LOT Forces and Moments
    - Strake sensitivity study using CFD
- Closed out at SLS Engineering Review Board (SERB) on December 15, 2025

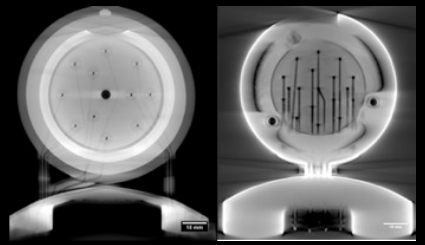


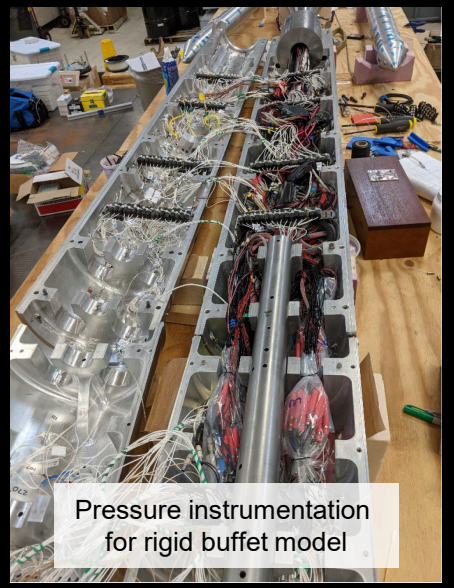
Langley Model and Test Support

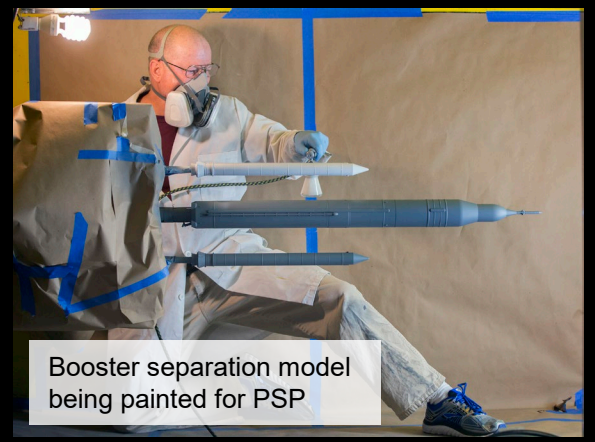
- Test planning and development
- Model design and fabrication
  - Model and support hardware design
  - Traditional machining
  - Additive manufacturing
- Instrumentation specialists
  - Balance capability development
  - Unsteady pressure installation
- Optical measurements branch
  - Particle Image Velocimetry (PIV)
  - Pressure Sensitive Paint (PSP)
  - Shadowgraph
  - Development of new capabilities
- Structural testing and non-destructive evaluation (NDE)



Liftoff model booster load cell model design

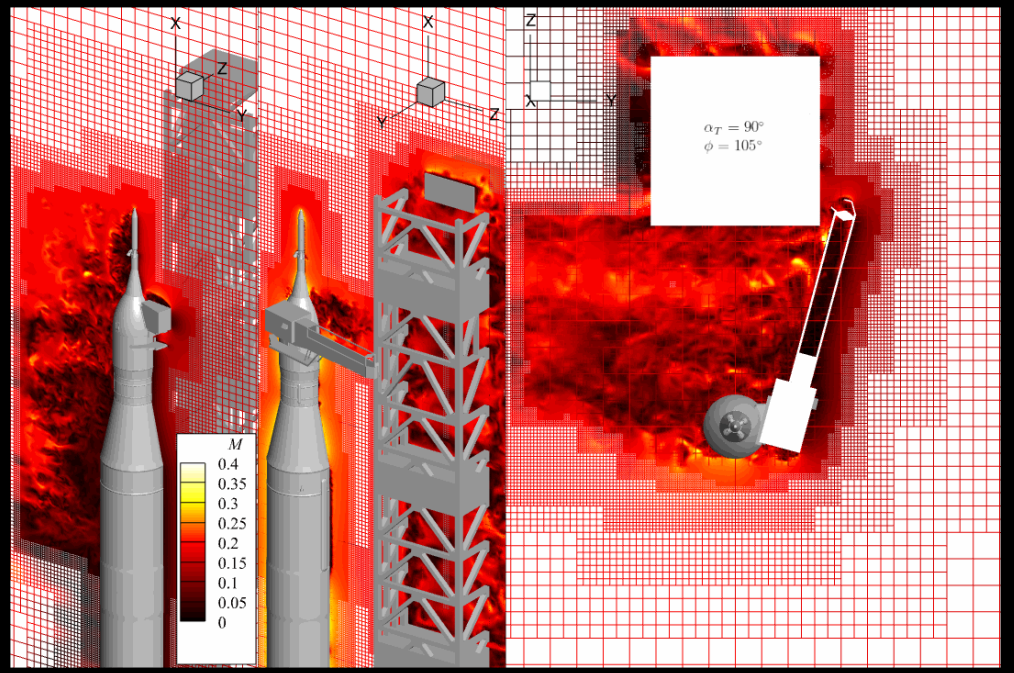

CT scans of additively manufactured model hardware


Pressure instrumentation for rigid buffet model


Booster separation model being painted for PSP

SLS Aerosciences Artemis II Launch Support

- Pre-Launch Activities
  - 6 cryogenic loading and terminal count simulations
  - Development Flight Instrumentation (DFI) inspections
  - DFI health monitoring
  - Flight Readiness Analysis Cycle (FRAC)
    - Review and verification of aerodynamic databases
    - Rolling Launch Period assessments
  - Wet Dress Rehearsal (WDR) support
  - “911 calls” for the Liftoff and Transition CFD Team
    - Interim Cryogenic Propulsion Stage Venting
    - Crew Access Arm Venting
- Day-of-Launch support
  - DFI health monitoring
  - Assessment of launch constraints due to aerodynamics
  - Cryogenic loading and terminal count
- Post-flight
  - Detailed review, assessment, and delivery of DFI data
  - Review and assessment of flight data against aerodynamic databases



Example Crew Access Arm Venting Simulation (LaRC-D301)

Orion

Spacecraft Adapter

Spacecraft Adapter Jettison Panels

Crew Module (CM)

Launch Abort System

Jettison Motor

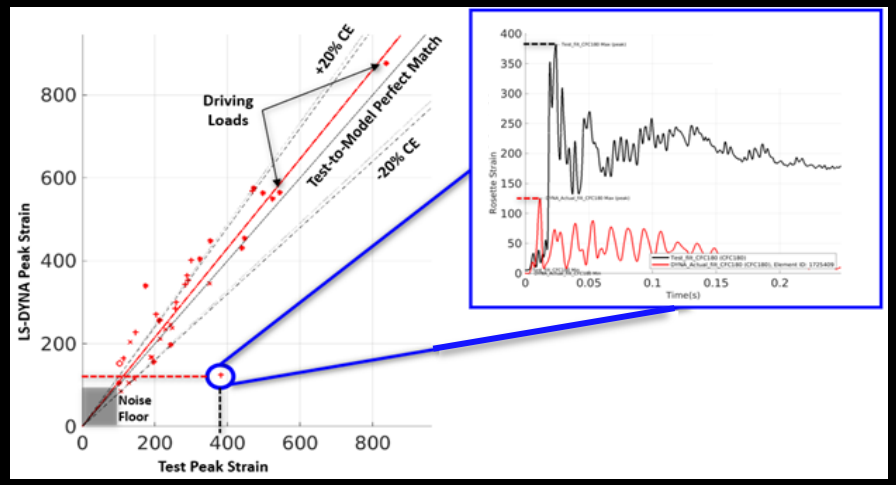
Abort Motor

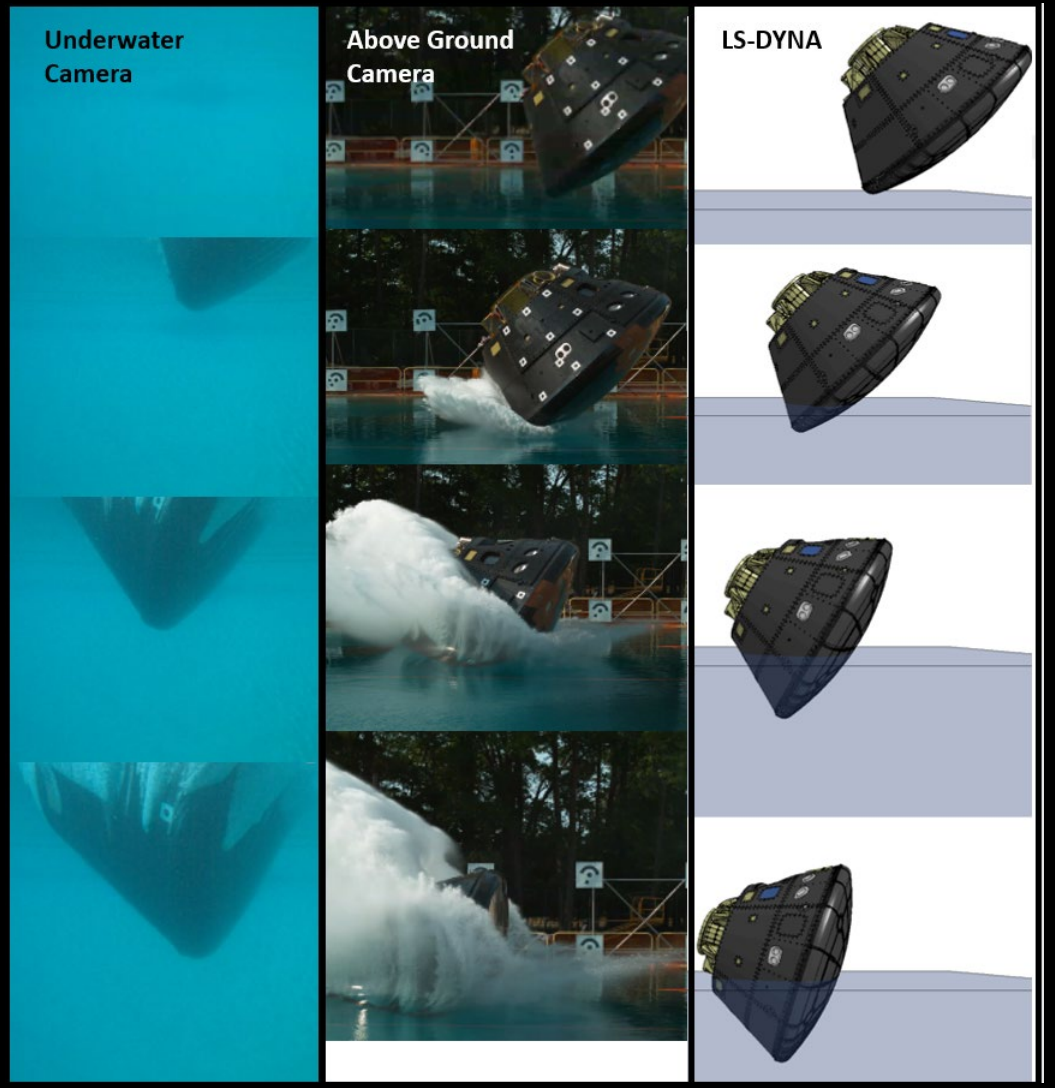
Attitude Control Motor

Service Module (SM)
Includes the European Service Module and the NASA Crew Module Adapter

Orion Splashdown Testing

- Performed extensive water-impact testing at the Hydro Impact Basin using an 18,000-pound Orion mockup.
- Simulated various entry angles and sea states to ensure the capsule—and its four crew members—can safely withstand the impact of a Pacific Ocean splashdown.
- Above and below water surface high speed imagery analyzed for comparison to LS-DYNA model.
- Strain Gauge, Accelerometer, and Rate sensor test data correlated to LS-DYNA calculations.





Open Water Recovery Hardware

Hydro Impact Basin provided the opportunity for the Orion Open Water Recovery team to perform final fit checks of recovery hardware.

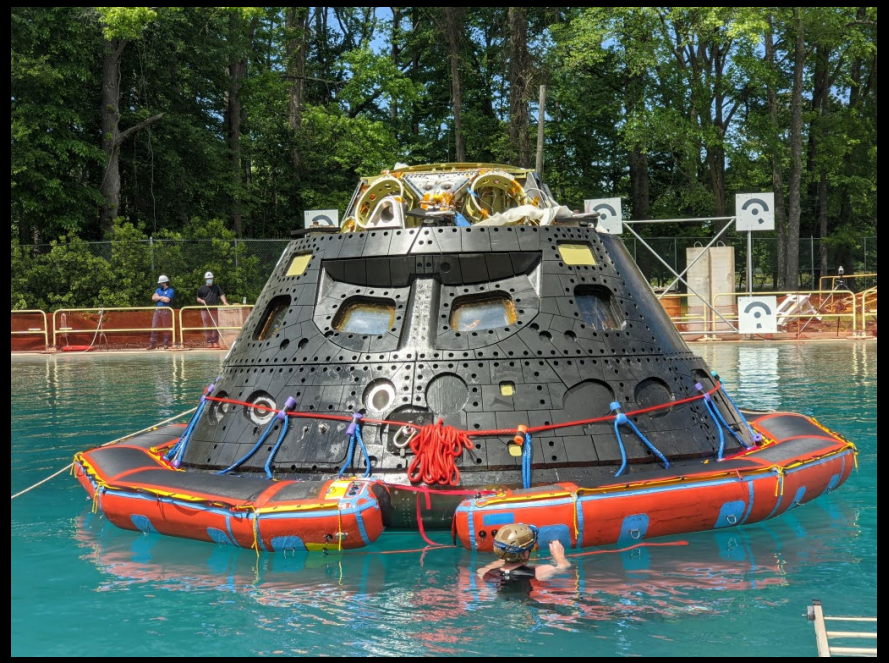
The activity supported the recovery of the CM after water landing and providing egress for the astronauts.

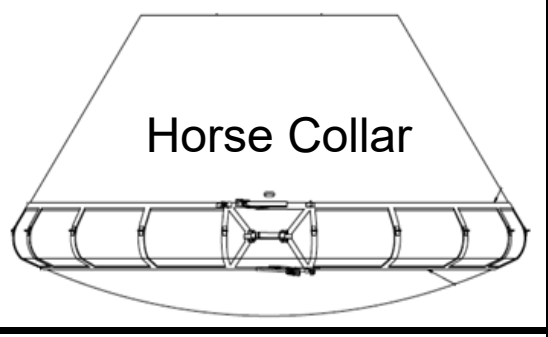
Out of Water Fit Checks:

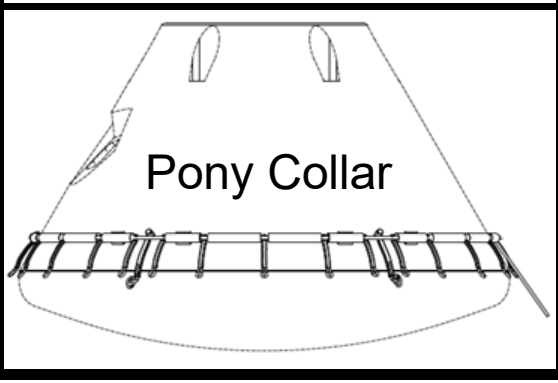
- Horse Collar
- Pony Collar

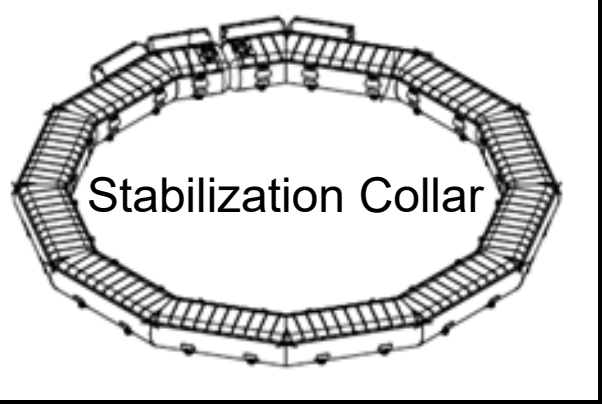
In Water Fit Check:

- Horse and Pony Collars
- Stabilization Collar
- Conducted in the HIB
- 5 divers in water to conduct fit check





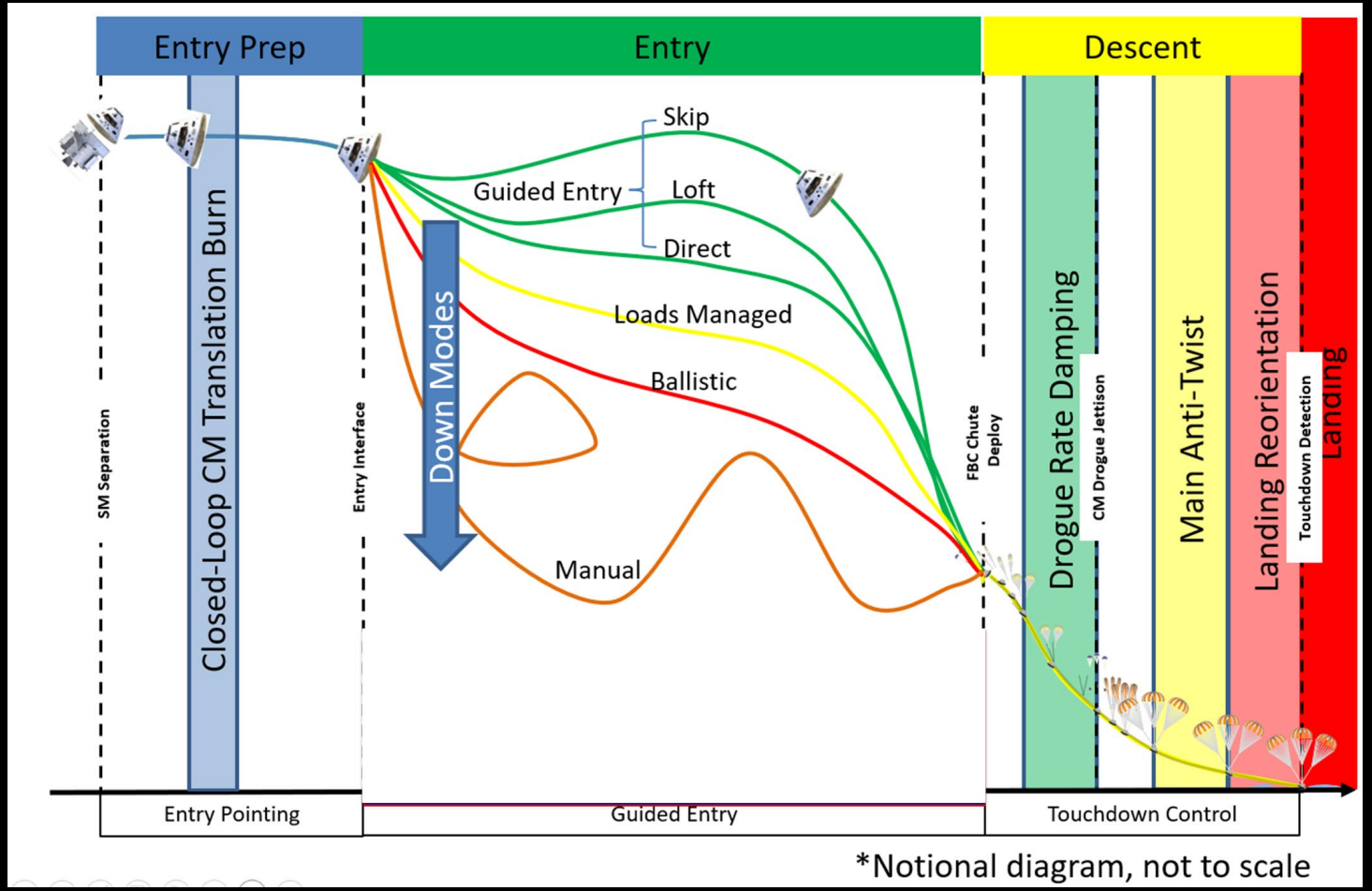




Orion MPCV: Entry Flight Dynamics

Orion Crew Module Entry, Descent, and Landing (EDL)

- Small team of 8 people
- Start control at separation of Crew Module (CM) from Service Module (SM)
- Ends after splashdown
- Responsible for:
  - Exo-atmospheric maneuvers
  - Atmospheric Bank Reversals
  - Control Under the Chutes
    - Drogue Rate Damping
    - Main Anti-Twist
    - Landing Reorientation
  - Contingency Modes of Operation
    - 2 Ballistic Modes
    - Direct Entry
    - Load Managed
    - Manual Piloting



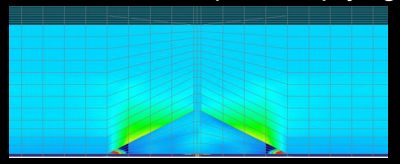
Langley and Orion's Heatshield History

- Langley has been involved since 2007 with the Advanced Development Program (ADP).
- Langley had a major role in the structural analysis support for TPS material down select.
- Langley adopted an Insight/Oversight role that was/is invaluable to the agency.
  - Working daily with prime contractor throughout the entire Orion Heatshields' design, analysis, testing, and flights.
- Langley is currently maintaining this oversight integrity through its Subsystem Management team.

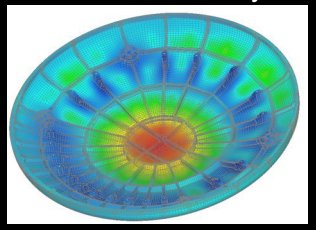
Early TPS MDU Builds

Water Impact Testing

Avcoat Block cross-section showing RTV thermal expansion/prying



Displacement plot f the Headshield Carrier System



Assembled Orion Heatshield ready for installation

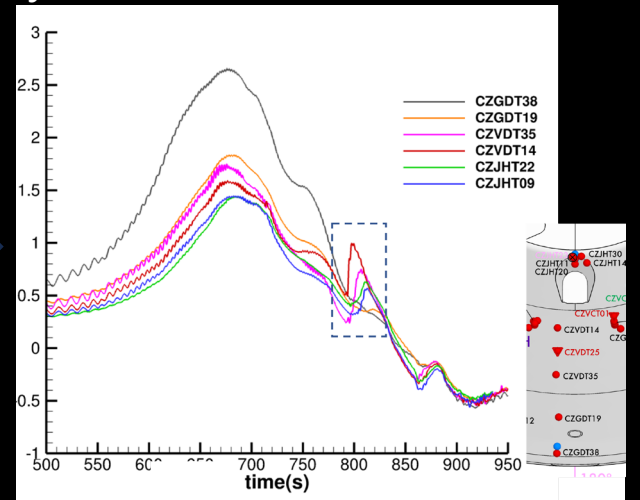
Heat Shield Validation

- Led complex **thermal-mechanical analyses** to validate the structural design and manufacturing of the Orion heat shield.
- Provided critical expert analysis during the investigation into the **Artemis I heat shield char loss**, helping to approve the modified reentry profile for Artemis II to ensure crew safety.

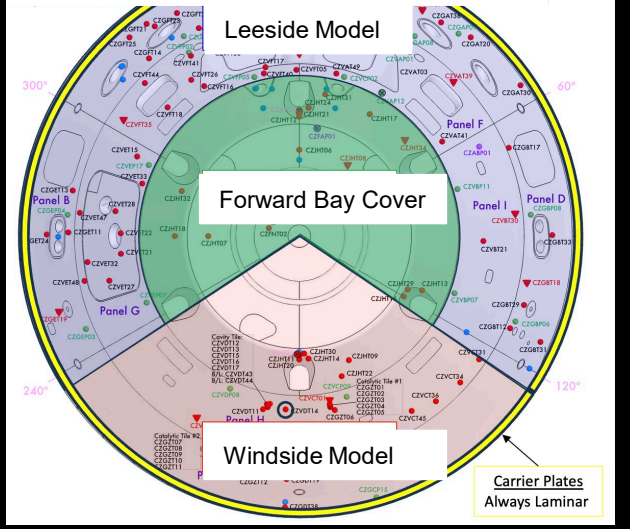
Artemis I Postflight Backshell

Artemis I Postflight Heatshield

Early Transition Increased Heating



New flow transition model developed for Artemis II backshell panels.



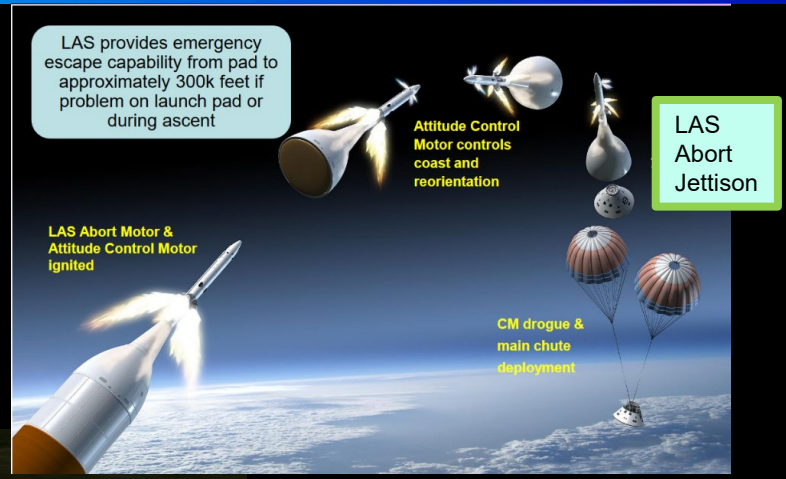
Orion MPCV: Guidance, Navigation, and Control

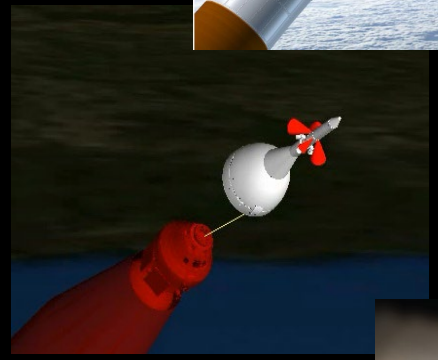
Langley G&C team part of three Orion teams

- Ascent Abort G&C Team
- Launch Abort System P&O Team
- Entry G&C Team

Primary Tasks

- Orion Launch Abort System (LAS) G&C Design & Con-ops Trade Studies and Performance Assessments
- LAS Abort and Entry, Descent, and Landing G&C Analysis and Risk Reduction
- Support Orion G&C Program Reviews, Verification Analysis, and Generation of Trajectory Data Products
- LAS Jettison Separation Clearance IV&V Analysis

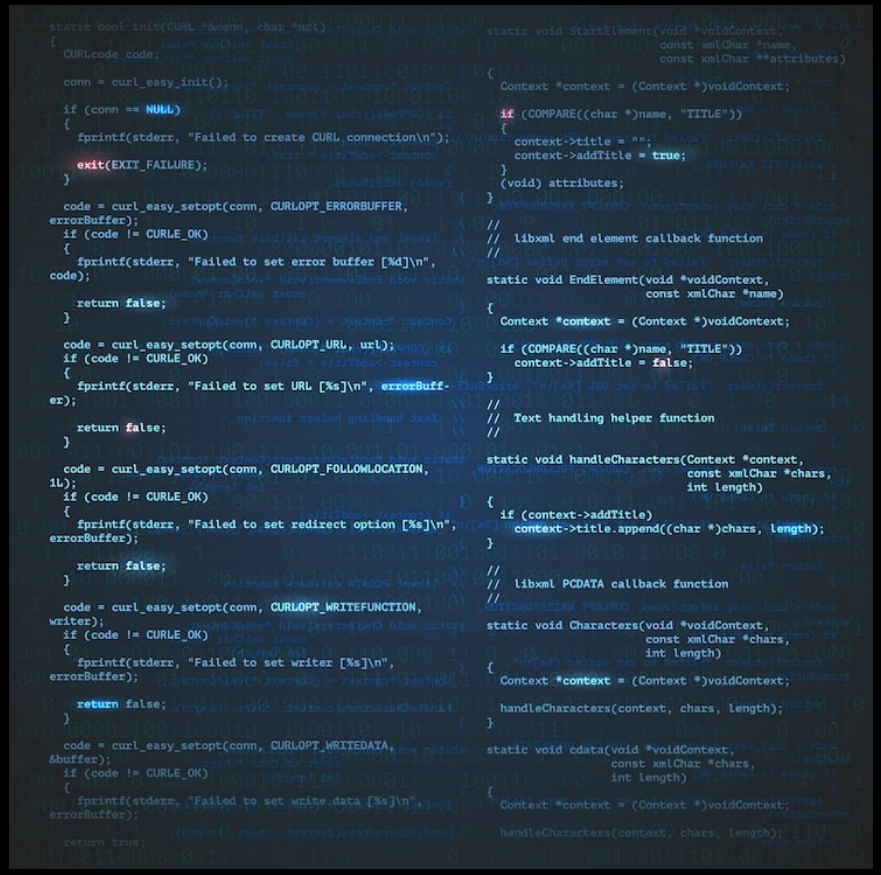




Verified GNC success criteria for complete set of LAS abort performance scenarios & metrics

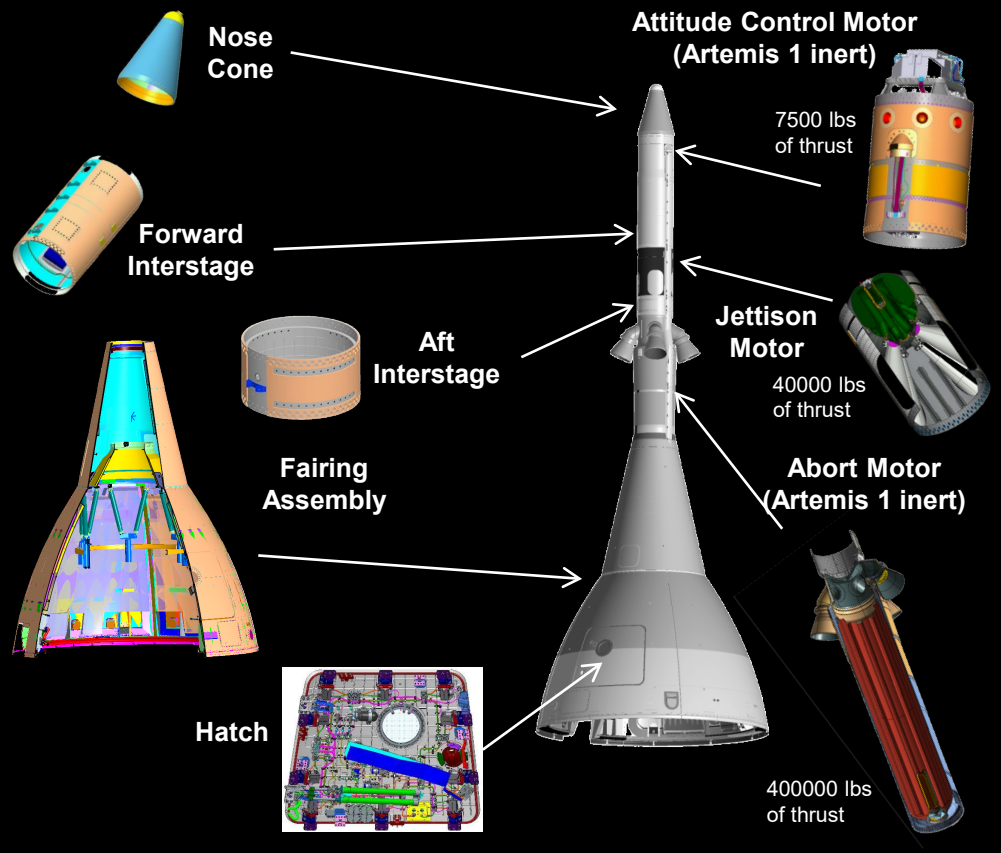
Orion MPCV: Flight Software

- Langley is fully integrated into the JSC Orion Flight Software (FSW) team. We provide expertise in the following areas:
  - **Data Integration Systems Manager**: providing Certification of Flight Readiness (CoFR)
  - **Software Functional Manager** (SFM) (Elisa and Rafia): domain experts in the Environmental Control and Life Support (ECLS), Communication and Tracking (CMT), Radio Management and Tracking (RMT), Core and Common Flight Software (CSFW) areas monitoring Lockheed's progress and process compliance for quality and completeness.
  - **Mission Engineering Room** (MER): on-console FSW support at JSC during flight.
  - **Software Reliability Engineering** (SRE): domain expert leading the effort to quantify software risk and reliability based on software defect data
- We partner with not only JSC but Lockheed Martin (LM), KSC, SLS, HLS, FOD, Gateway, Moon to Mars (M2M), Honeywell teams across our Artemis work

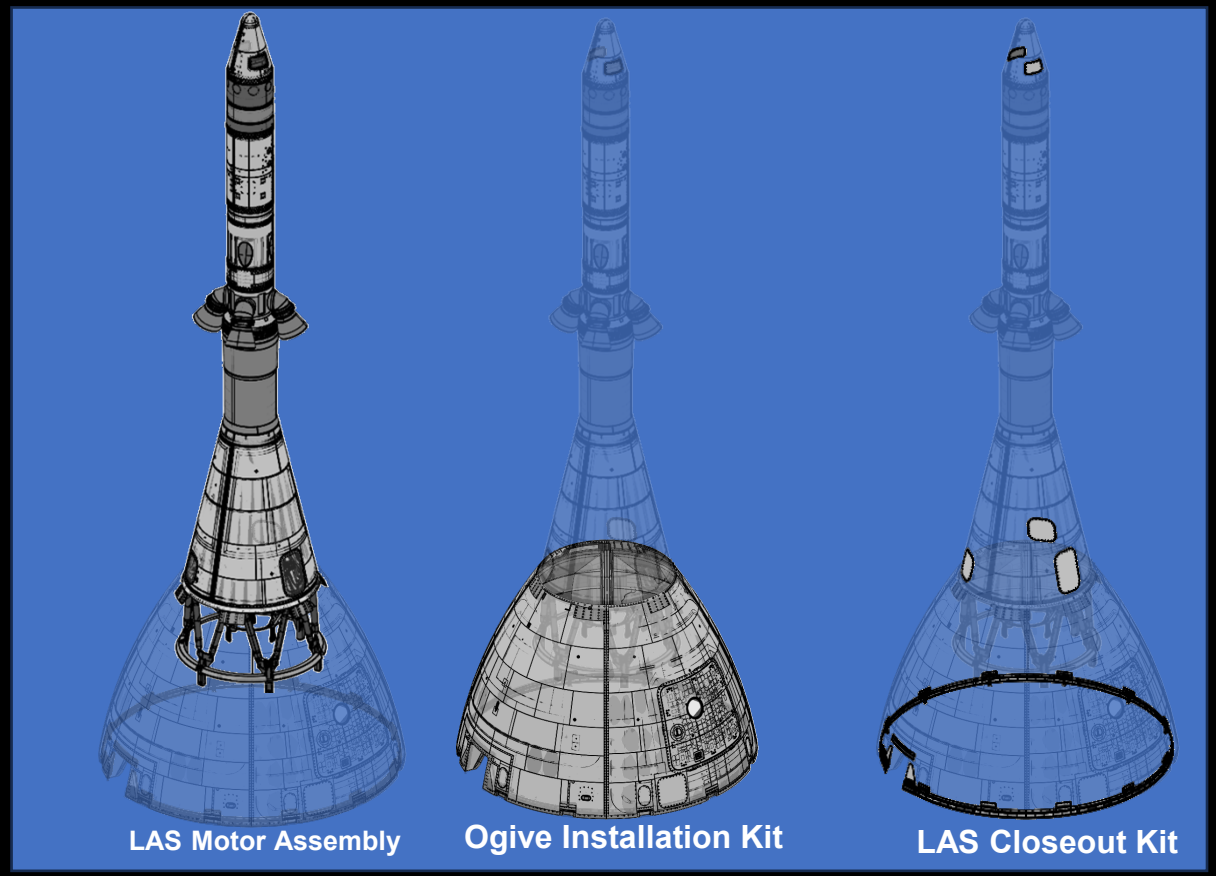


Launch Abort System (LAS) Management

- Managed the development of the **Orion LAS**, the critical safety "escape" system designed to pull the crew module away from the rocket in the event of a launch emergency.

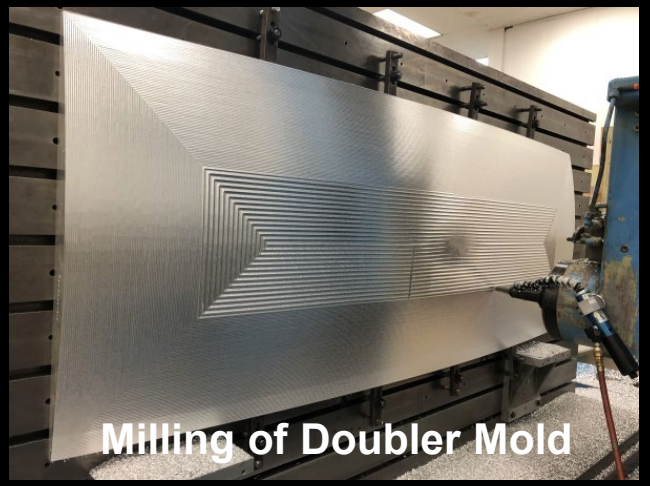


ORION LAS End Items



LAS Ogive Doubler Panel Fabrication

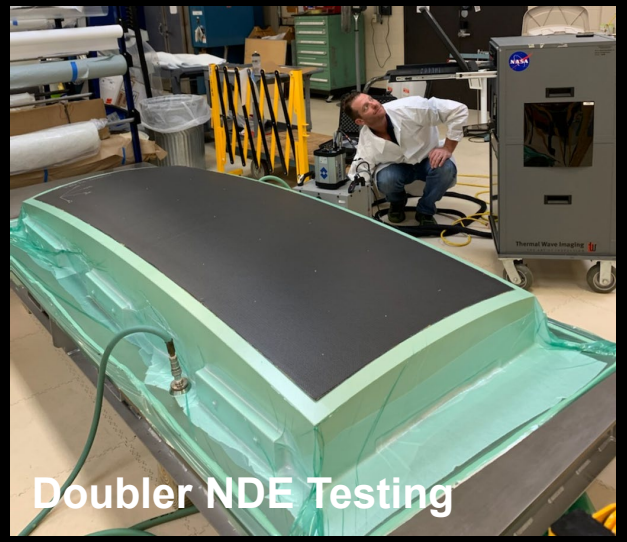
NEEDS	• **Repair damage on Artemis-2 LAS Ogive panels** that occurred during protoqual testing.
GOALS	• Fabricate doubler panels to adhere to Ogive panels where repairs are required. • Ensure repairs meet Lockheed composite flight hardware fabrication requirements.
OBJECTIVES	• Develop and implement composite layup processes at LaRC in collaboration with Lockheed engineers. • Design and fabricate layup mold tooling for doubler panels and witness samples • Produce composite doubler panels and witness samples for Artemis-2 to be used for repair efforts. • (Later) Fabricate additional contingency composite doubler panels to be available for Artemis-3+. • **Deliver fabricated doubler panels to Michoud Assembly Facility in Louisiana where the were cut to size and applied to repair of the Artemis-2 LAS Ogive panels.**

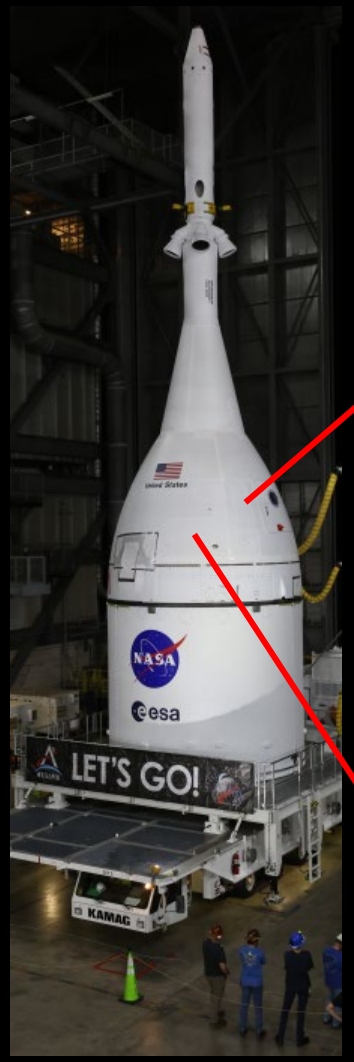

Milling of Doubler Mold

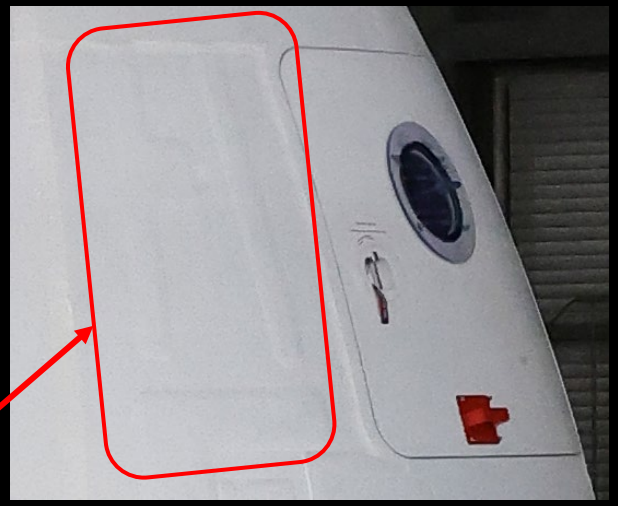
Finished/Polished Mold

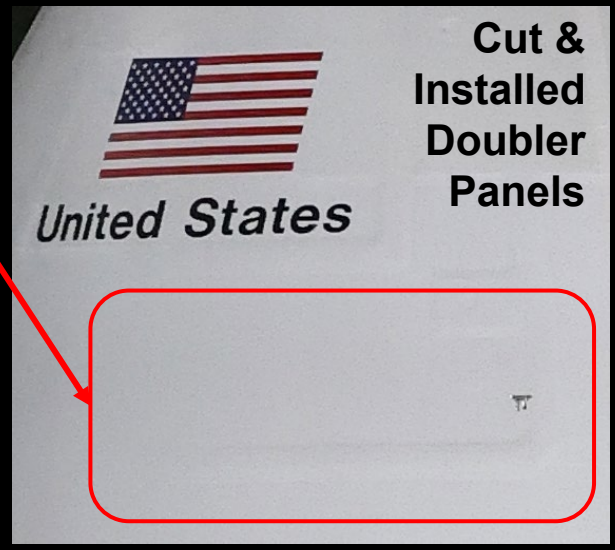

Panel Layup

Completed Ogive Doubler Panels









Orion LAS – The Results

Built 6

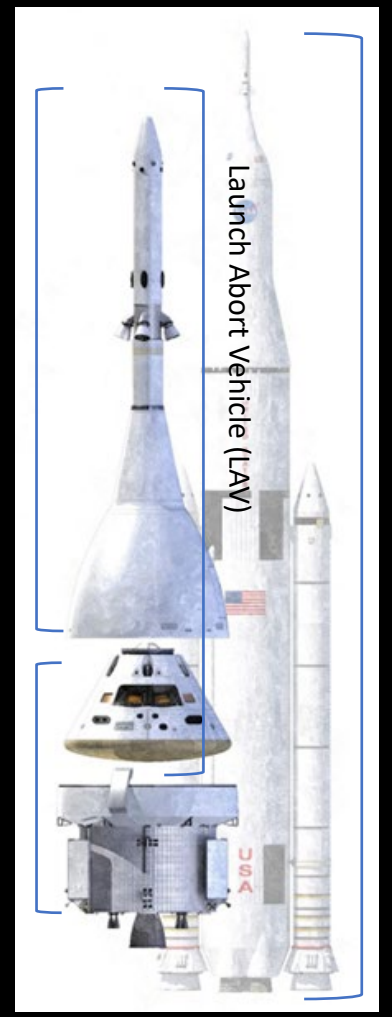
Flew 3

Performed 2 Successful Aborts

Delivered First Artemis Flight Hardware

Orion MPCV: LAS Structures

- Orion LAS Structures Subsystem Manager
  - Support Spacecraft Structures System Manager as deputy lead
  - Support certification of Orion LAS Structures for flight
    - Oversight of Lockheed Martin (LM) design, analysis, test
      - Review of test plans, test reports, analysis methods, stress analysis reports (SARs)
    - Verification of requirements
      - Ensure evidence of requirements fulfillment is accurate, complete, and documented
      - Track open liens against schedule milestones
      - Provide technical and administrative guidance for waivers against requirements
    - Configuration management of paperwork supporting Flight Readiness



SCIFLI Imaging

- The Scientifically Calibrated In-Flight Imagery (SCIFLI) team will use ground-based and aircraft platforms to capture high-resolution thermal and spectral images of the spacecraft during launch and its 25,000 mph reentry.
- SCIFLI goes beyond the photo documentation, obtaining data sets (in the form of imagery or spectral observations) that are converted to engineering units.
- For Artemis II, the SCIFLI team will deploy a network of sensors, including six ground-based platforms for launch and four specialized aircraft for reentry.
- **Critical Data:**
  - As Orion enters the atmosphere, aircraft will use multiple instruments to track it.
  - **Thermal Mapping:** By using calibrated infrared and spectral data, SCIFLI converts light intensity into precise **surface temperature maps** of the heat shield.
  - **Model Validation:** This "flight truth" data is compared against **Computational Fluid Dynamics (CFD)** models. If the real-world heating differs from the prediction, engineers refine the models to increase safety for future Mars missions.

SCIFLI: End to End Airborne Imagery

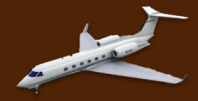
L-3 to L-1 Days	L-4 hrs. through Launch	Mach 39-30/Peak Heating (Entry)	Mach 25 (CLE1)	Mach 15 (CLE2)	Mach 1 to Splashdown	Recovery

SCIFLI Aircraft

TBD Aircraft
(L-1hr to L)

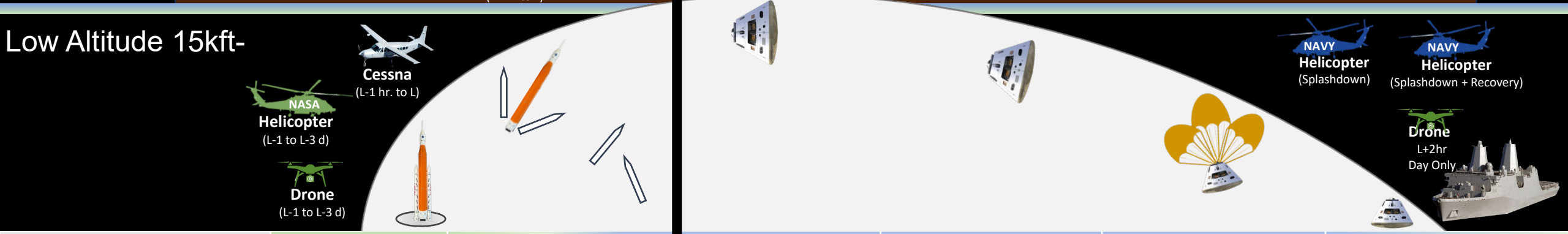
Gulfstream V
(Entry – Peak Heating)

Navy P-3
(Descent – CLE1)



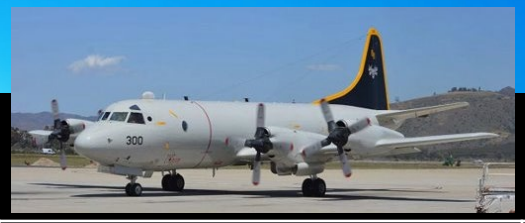
Gulfstream III
(Descent – CLE2)

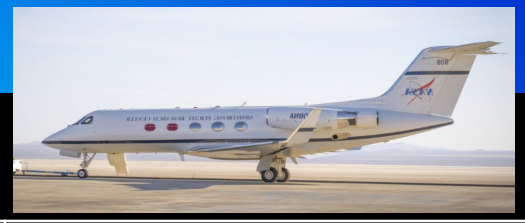
WB-57
Mach 2 - Splashdown

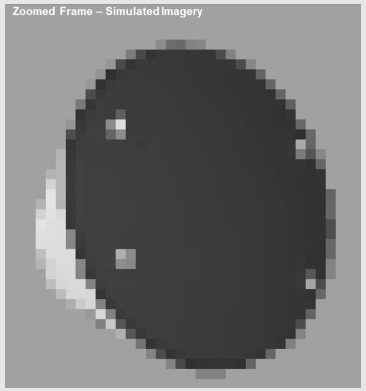
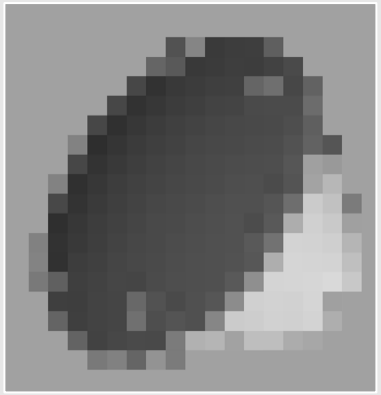
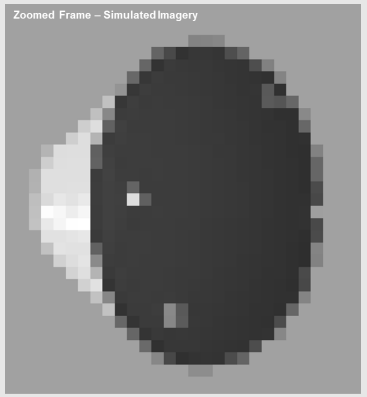
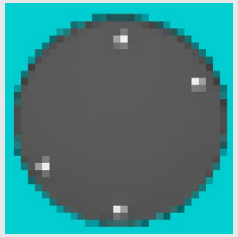
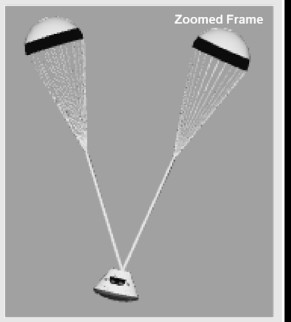


Airborne Asset	Pre-Launch	Launch + Ascent	Entry	Descent	Landing	Recovery
Low Altitude (Provided by EGS)						
NASA KSC Drones (Daylight only)	✓ Recorded (8K)					✓ Recorded (8K)
NASA Cessna 208B Caravan		✓ Live (HD)/Recorded (8K)				
Navy Helicopters (2)					✓ Live (HD)/Recorded (8K)	✓ Live (HD)/Recorded (8K)
NASA Helicopter (1)	✓ Recorded (8K)					
High Altitude (Provided by SCIFLI)						
NASA JSC Gulfstream V (G-V)		✓ Live Streamed (4K)	✓ Live (4K)/Recorded (6K)	✓ Live (4K)/Recorded (6K)		
Navy P-3 (Cast Glance)			✓ Recorded (HD)	✓ Recorded (HD)		
NASA AFRC Gulfstream III (G-III)				✓ Recorded (6K)		
NASA JSC WB-57				✓ Live (HD)/Recorded (HD)	✓ Live (HD)/Recorded (HD)	✓ Live (HD)/Recorded (HD)

SCIFLI: Imaging Aircraft for Artemis II





Target Aircraft	**JSC G-V** (N95NA)	**VX-30 Cast Glance P-3 (BH300)**	**AFRC G-III** (N808NA)	**JSC WB-57** (N926NA)
Primary Imaging Objective	Orion Peak Heating	Peak Char Loss (Char-1)	Late Char Loss (Char-2)	Parachute Deploy, Mach 1 TPS
Basing Location	NAS Pt. Mugu, California	NAS Pt. Mugu, California	NAS Pt. Mugu, California	March ARB, California
Onboard Personnel	2 Pilots, 1 Flight Safety Officer, 7 SCIFLI QNCs	3 Pilots, 2 Flight Engineers, 1 Radar Operator, 2 Naval Flight Officers, 6 Gimbal/Sensor Operators	2 Pilots, 1 Flight Safety Tech, 7 SCIFLI QNCs	1 Pilot, 1 Sensor Equipment Operator
Live-Streaming	Yes, via Starlink	No	No	Yes, via Starlink
Payloads	UHD NIR, Spectrometer VIS-NIR, Multi-band Sensor (VIS, NIR, SWIR, MWIR)	NIR, SWIR, High Speed Video, MWIR	UHD NIR, High speed Mutli-band (VIS-NIR-SWIR), Dynamic vision sensor (VIS-NIR)	Gimbaled VIS-MWIR
Sample Imagery				 

A Couple Items for Future Artemis Flights

Artemis Spacecraft Handling Qualities (ASHaQ)

- ASHaQ software is used for data-driven design decisions aimed at manual control and human involvement in the **lunar landing task under the Human Landing System (HLS) program within the Artemis campaign**.
- **Enables human-in-the-loop simulation** studies to assess handling qualities criteria for manual control during lunar approach and landing phases.
  - Astronauts regularly come to Langley to train and use these systems
- Allows evaluations of concepts for trajectory design, displays, sensors, enhanced vision, vehicle designs, and guidance navigation and control laws for manual and automatic control of human lunar landing vehicles.

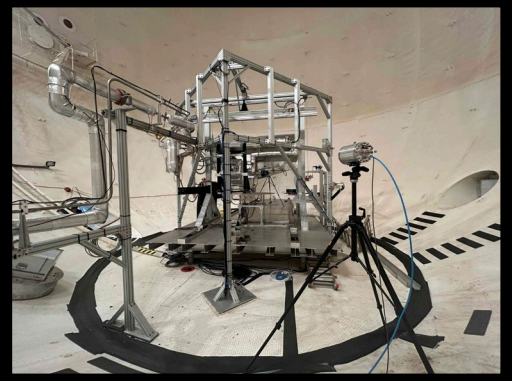
Exploration Flight Deck Simulator (EFD)

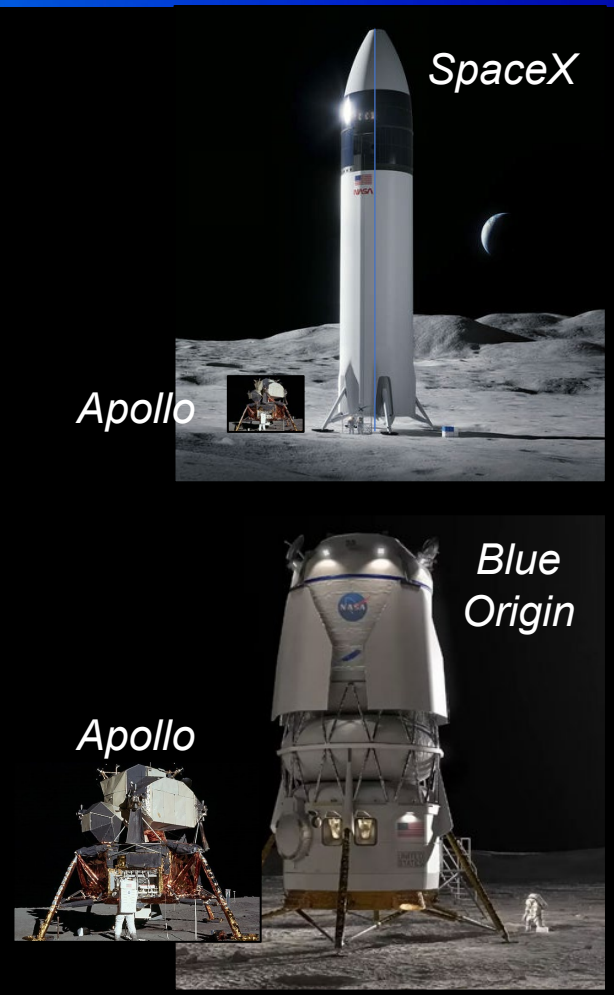
- EFD is currently being developed in 2026
- Enables dual crew motion evaluations (i.e., motion effects, crew experience) during critical flight phases (initial ground contact and settling, divert, redesignation, contingencies & aborts) with HLS flight deck.
- Assessing mission risks, risk mitigation, and insight for both Provider systems going forward
  - Crew resource management, crew monitoring/interaction with automation, time critical decision making
  - Two crew configuration swappable between seated & standing with seating for one instructor and two observers

Artemis and Plume-Surface Interaction (PSI)

- Artemis will land vehicles much more powerful than Apollo
- New data are needed to understand the environments produced during landing on and ascent from the lunar surface → critical risk reduction
- 2026 Testing in the NASA Langley 60ft vacuum sphere will obtain data on cratering and ejecta produced at simulated descent and landing conditions relevant to Artemis
- Risks posed to Artemis landers from PSI:
  - Visual and sensor obscuration / degraded performance
  - Vehicle stability and tilt
  - Localized augmentation of heating, pressure
  - Abrasion damage, debris/ejecta
- Additional risks to surface operations and nearby surface assets and payloads

This is a new NASA test capability to explore cratering/erosion and ejecta from landing – Moon and Mars relevant





HLS Lander Concepts

Let’s Go Artemis II

QUESTIONS?