

NASA GRC Overview and Engineering Discussion for Lake Superior State University

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National Aeronautics and Space Administration

What do you think of when you hear the name NASA?

Space Shuttle

National Aeronautics and Space Administration









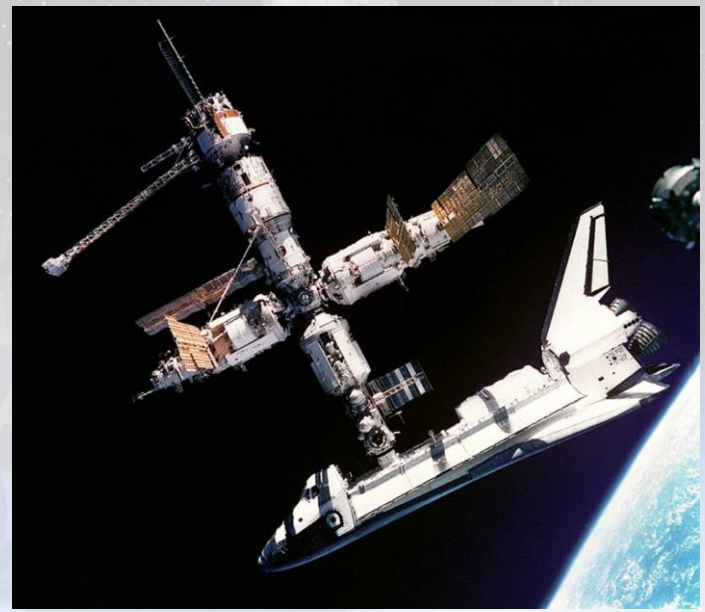


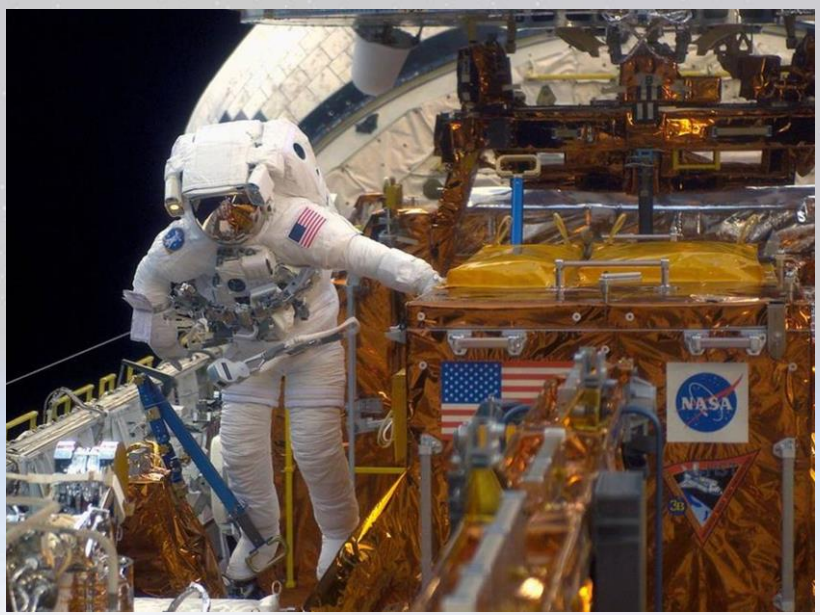




International Space Station

National Aeronautics and Space Administration













National Aeronautics and Space Administration

There is so much more to the work that we do at NASA and today we will talk specifically about NASA GRC.

NASA Centers and Installations

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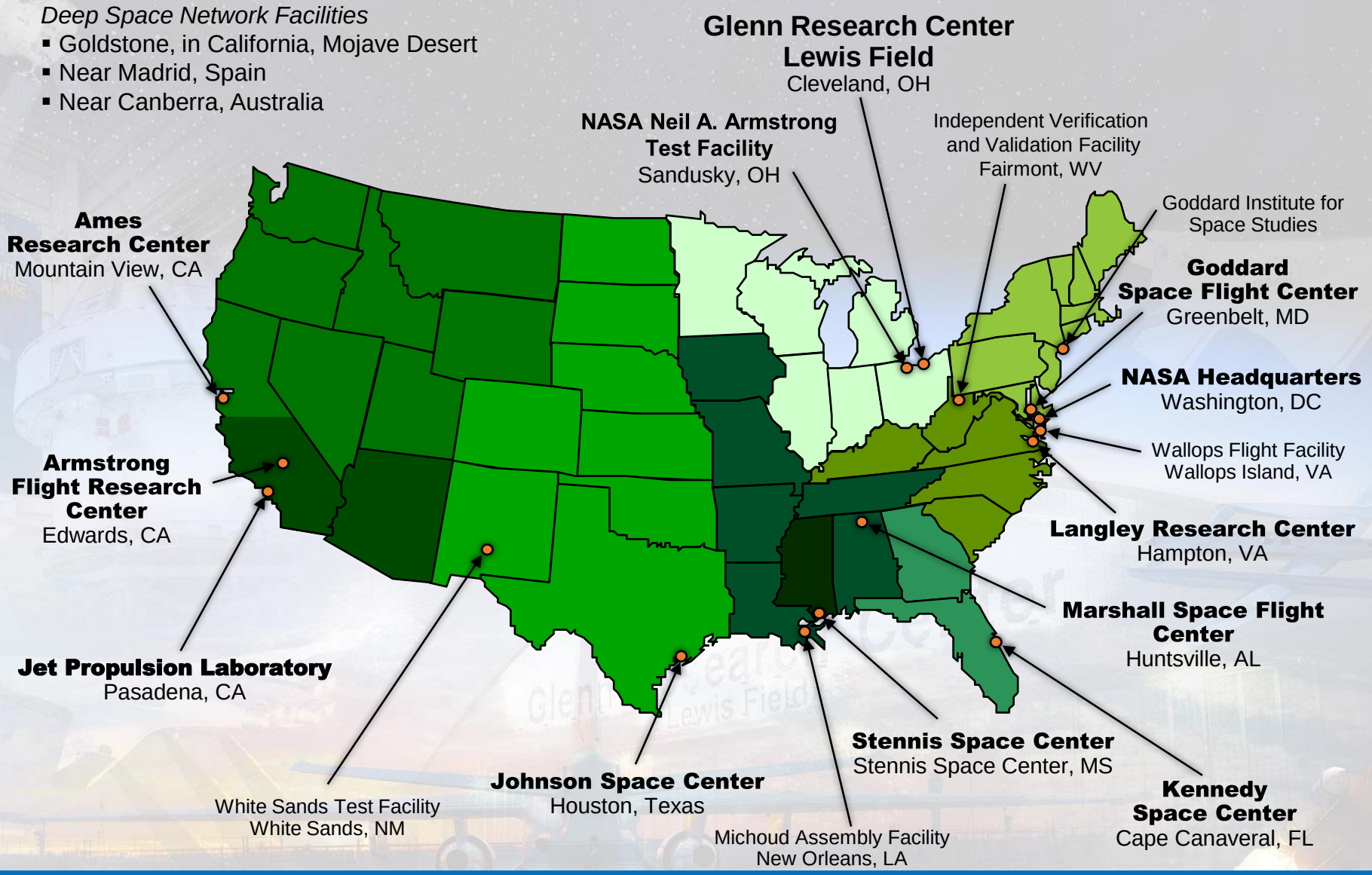
Deep Space Network Facilities
- Goldstone, in California, Mojave Desert
- Near Madrid, Spain
- Near Canberra, Australia



NASA Glenn - Campuses



GRC-Lewis Field
(Cleveland, OH)

- 307 acres
- 1,497 civil servants and 1,643 contractors
- 56 Pathways Interns (not included above)



GRC-Neil Armstrong Test Facility
(Sandusky, OH)

- 6,740 acres
- 21 civil servants and 100 contractors

NASA Glenn - Core Competencies



Air-Breathing Propulsion





In-Space Propulsion and Cryogenic Fluids Management





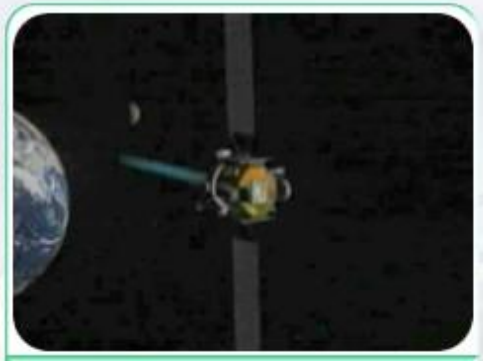
Physical Sciences and Biomedical Technologies in Space





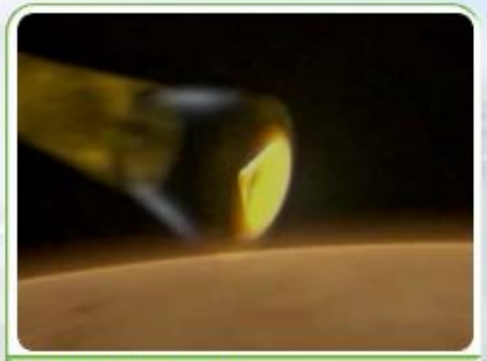
Communications Technology and Development





Power, Energy Storage and Conversion





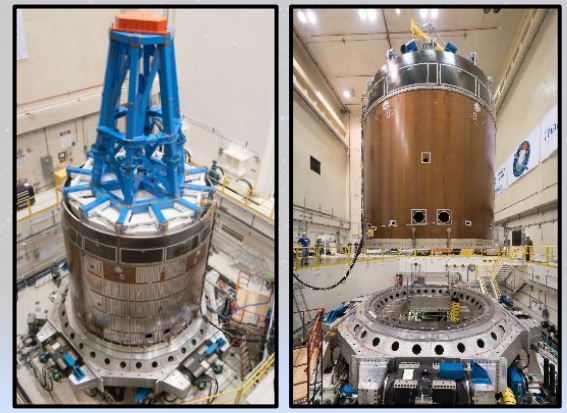
Materials and Structures for Extreme Environments



NASA Glenn - Unique Space Environmental Test Facilities



Vacuum Chambers



Mechanical Vibration Facility



Reverberant Acoustic Test Facility



Glenn's Extreme Environment Rig



Zero Gravity Research Facility

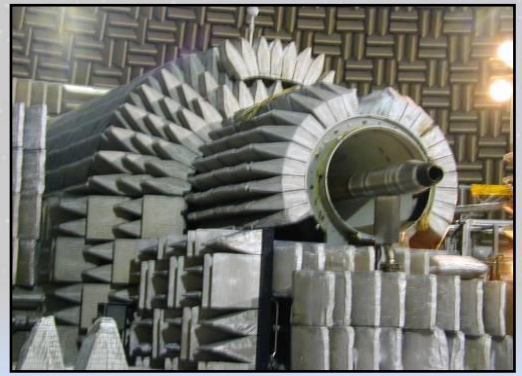


Simulated Lunar OPErations (SLOPE) Facility

NASA Glenn - Unique Aeronautics Test Facilities



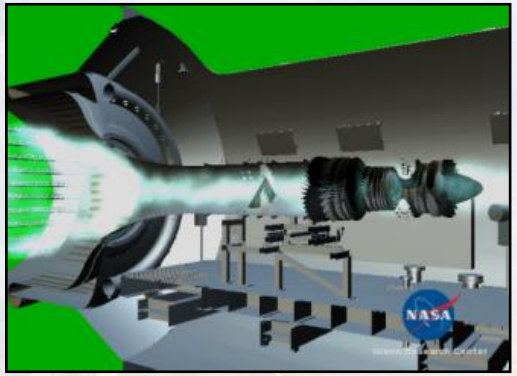
Transonic, Supersonic, and Subsonic Propulsion Wind Tunnels



Aero-Acoustic Propulsion Lab



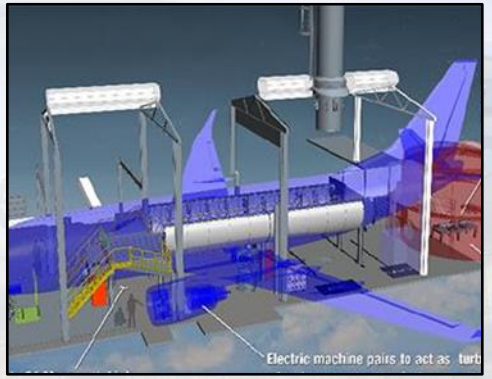
Icing Research Tunnel



Propulsion Systems Laboratory



Engine Component Facilities



NASA Electrified Aircraft Technology (NEAT)

Space Flight Systems at NASA GRC

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Space Operations

- International Space Station (ISS)
- Space Communications

Space Science

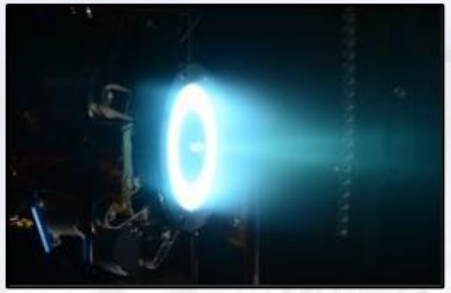
- Radioisotope Power Systems (RPS)
- Planetary Science
- Biological and Physical Sciences
- Earth Science

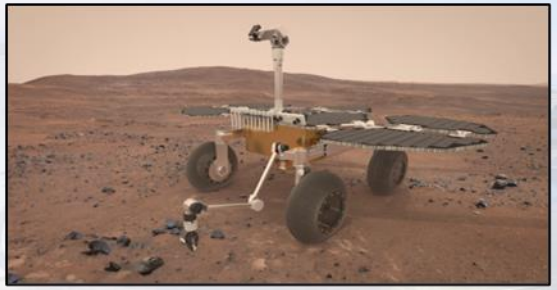
Human Exploration

- Orion Multi-Purpose Crew Vehicle
- Space Launch System (SLS)
- Commercial Crew/Cargo

Lunar and Mars Technology

- Integrated Electric Power Production and Distribution
- Cryogenic Fluids Storage and Transfer
- Payloads for Commercial Lunar Landers
- Electric Propulsion
- In Situ Resource Utilization: “Living off the Land”
- Surface technologies: Landers, Rovers, and Habitats
- Advanced Communications Systems and Architectures

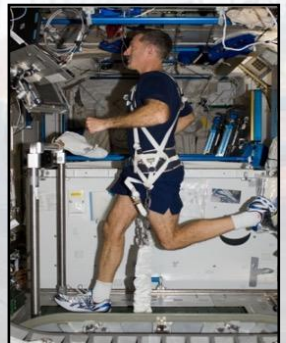






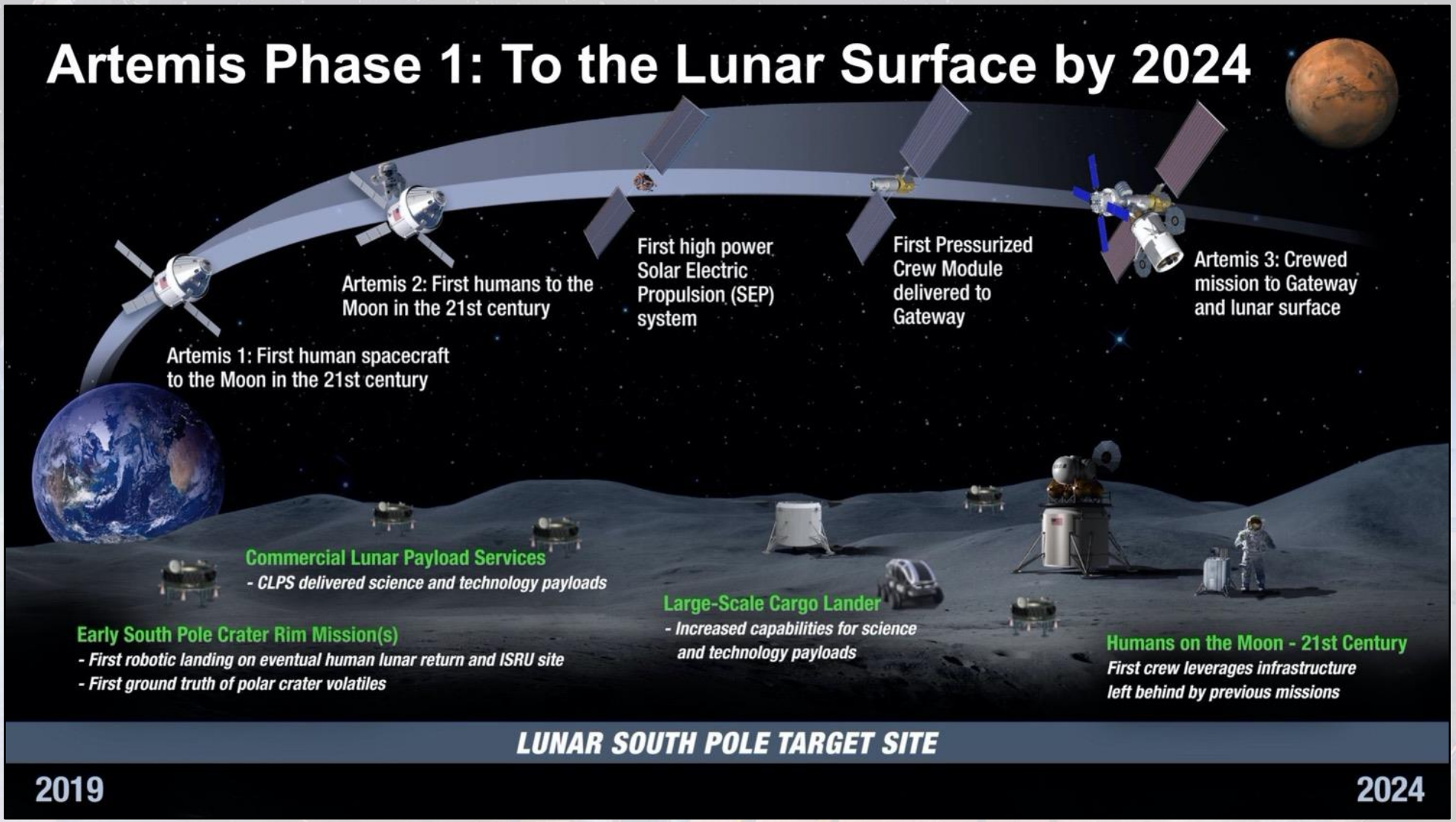








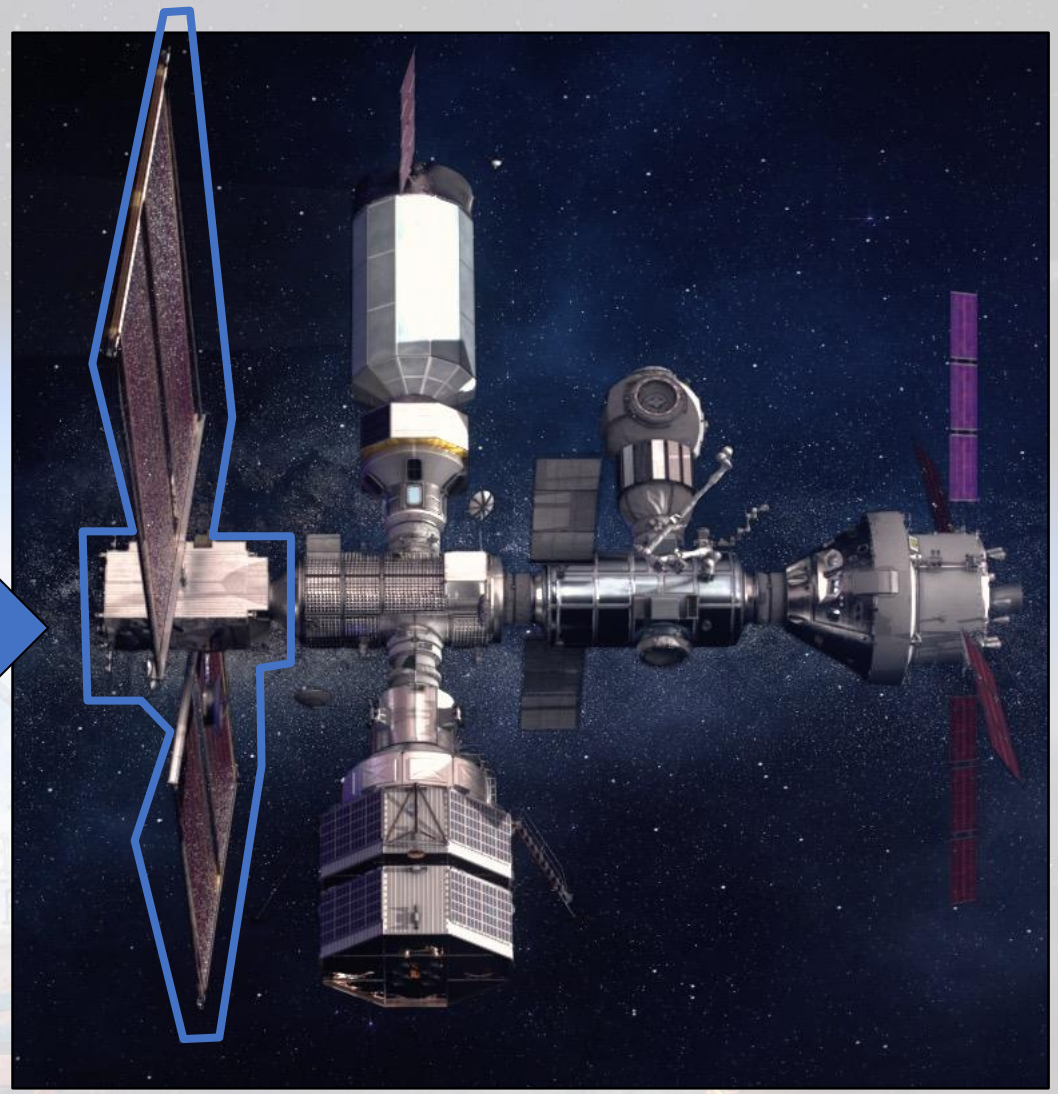



Artemis Phase 1: To the Lunar Surface by 2024
Artemis 1: First human spacecraft to the Moon in the 21st century
Artemis 2: First humans to the Moon in the 21st century
First high power Solar Electric Propulsion (SEP) system
First Pressurized Crew Module delivered to Gateway
Artemis 3: Crewed mission to Gateway and lunar surface
Commercial Lunar Payload Services
- CLPS delivered science and technology payloads
Early South Pole Crater Rim Mission(s)
- First robotic landing on eventual human lunar return and ISRU site
- First ground truth of polar crater volatiles
Large-Scale Cargo Lander
- Increased capabilities for science and technology payloads
Humans on the Moon - 21st Century
First crew leverages infrastructure left behind by previous missions
LUNAR SOUTH POLE TARGET SITE
2019
2024

Gateway Enables Lunar and Mars Exploration

- Strategic presence around the Moon
- Resilience, sustainability, and robustness in the lunar architecture
- Open architecture and interoperability standards are building blocks for partnerships and expansion

GRC leads the Power and Propulsion Element (PPE) for Agency



Aeronautics at NASA GRC

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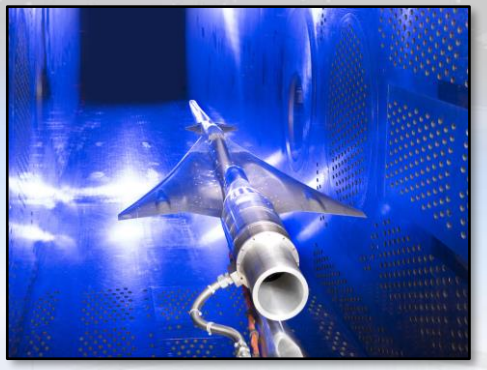
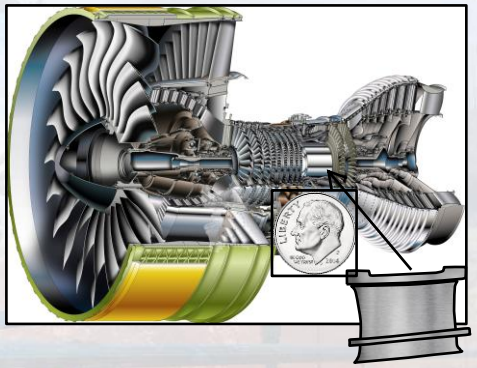
NASA GRC is conducting ground-breaking research in Aero-propulsion and technology development in power, propulsion, communications, and materials for extreme environments that will be utilized by current and future aircraft.

Technologies for Advanced Concepts

- Electrified Aircraft Propulsion
- High-Power Density Core
- Advanced Air Mobility and Aero Communications
- Aero Cybersecurity
- Supersonics and Hypersonics
- Propulsion Acoustics
- Airframe and Engine Icing









National Aeronautics and Space Administration

NASA GRC and Technologies of the Future: Research and Engineering

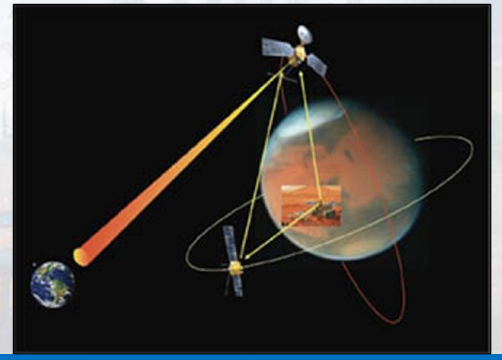
NASA GRC is conducting ground-breaking research in Space and Aeronautics, developing technologies in power, propulsion, communications, and materials for extreme environments that will be utilized in our future space missions and aircraft.

Technologies for Advanced Concepts

- Solar Electric Propulsion Evolution
- Power System Development for Space Exploration
- Space Communications Technology
- Technologies for Electrified Aircraft Propulsion
- Gas Turbine Engine Improvements
- Advanced Materials Research
- Artificial Intelligence-Based Airspace Communications
- Research Opportunities in Hydrogen-Powered Aircraft





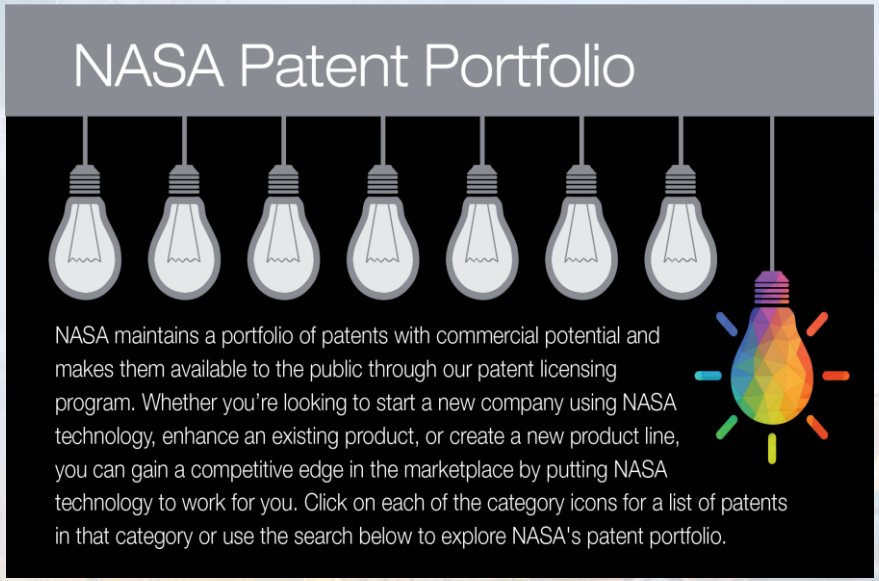




GRC Office of Technology Incubation and Innovation

NASA has programs for small businesses and university to engage in

- Technology Transfer Program, https://technology.grc.nasa.gov/
  - Technology Transfer University (T2U): Student entrepreneurs at universities build case studies with NASA's patent portfolio while learning about commercialization and licensing opportunities as part of an entrepreneurship course at the university
- Small Business Innovation Research (SBIR)/ Small Business Technology Transfer (STTR) Programs, https://sbir.nasa.gov/
- Space Technology Research Grant (STRG) Program, http://nasa.gov/strg
- NASA Software available for free use, http://software.nasa.gov





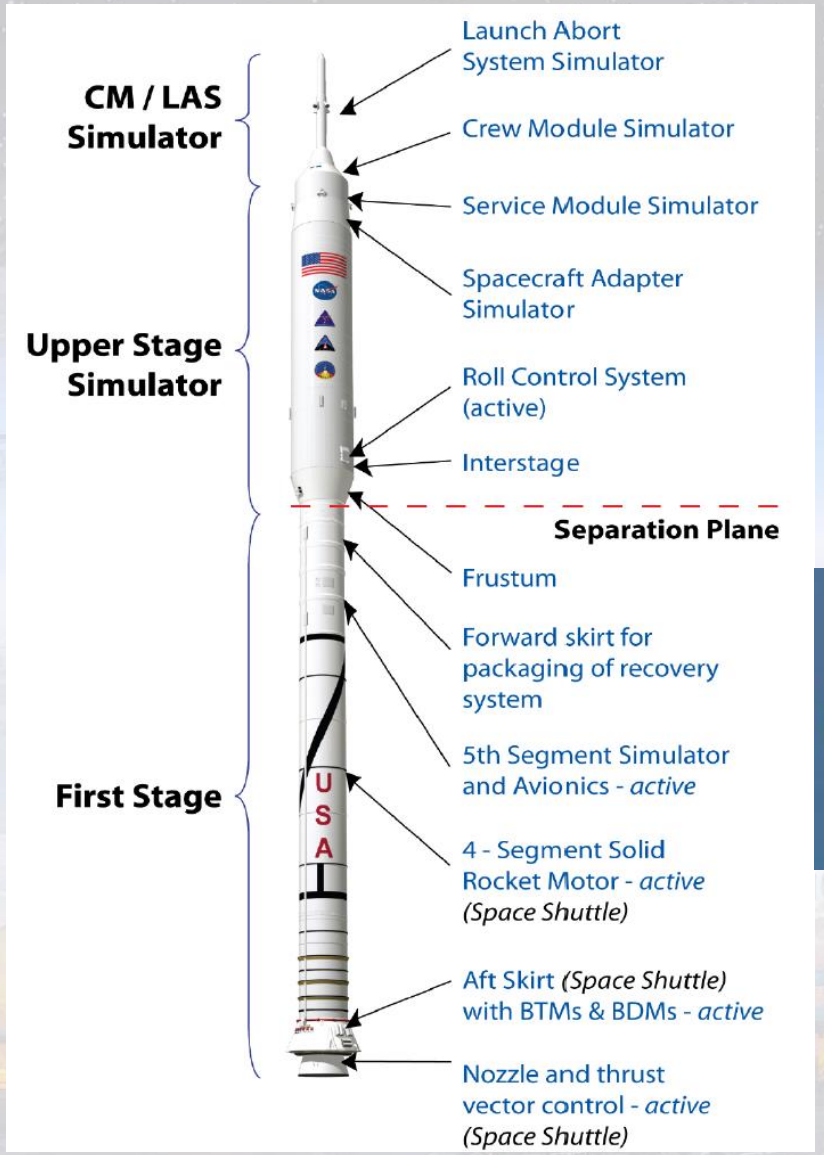
Employment Opportunities

- NASA Career Opportunities - https://www.nasa.gov/careers
  - NASA uses USAJOBS to advertise any job opportunities - https://www.usajobs.gov/
- NASA Pathway Internship Program - https://www.nasa.gov/careers/students-and-recent-graduates
  - Offers a direct pipeline to full-time employment at NASA upon graduation
  - Types of Internships
    - Engineering, Science, and Technology
      - GS-899: Engineering
      - GS-1399: Physical Sciences
    - Business
      - GS-0099: Safety & Occupational Health
      - GS-299: Human Resources
      - GS-399: Administration and Program Management & Analysis
      - GS-599: Accounting & Budget
      - GS-1099: Communication & Public Relations
      - GS-1199: Procurement and Contracts
      - GS-1599: Math & Statistics
      - GS-2299: Information Technology


National Aeronautics and
Space Administration
NASA
Engineering Discussion
TO THE MOON AND BEYOND
EXPLORE MOON to MARS
Glenn Research Center
Lewis Field
X-59 QueSST
N268VA
www.nasa.gov

ARES I-X Demonstration Test Flight





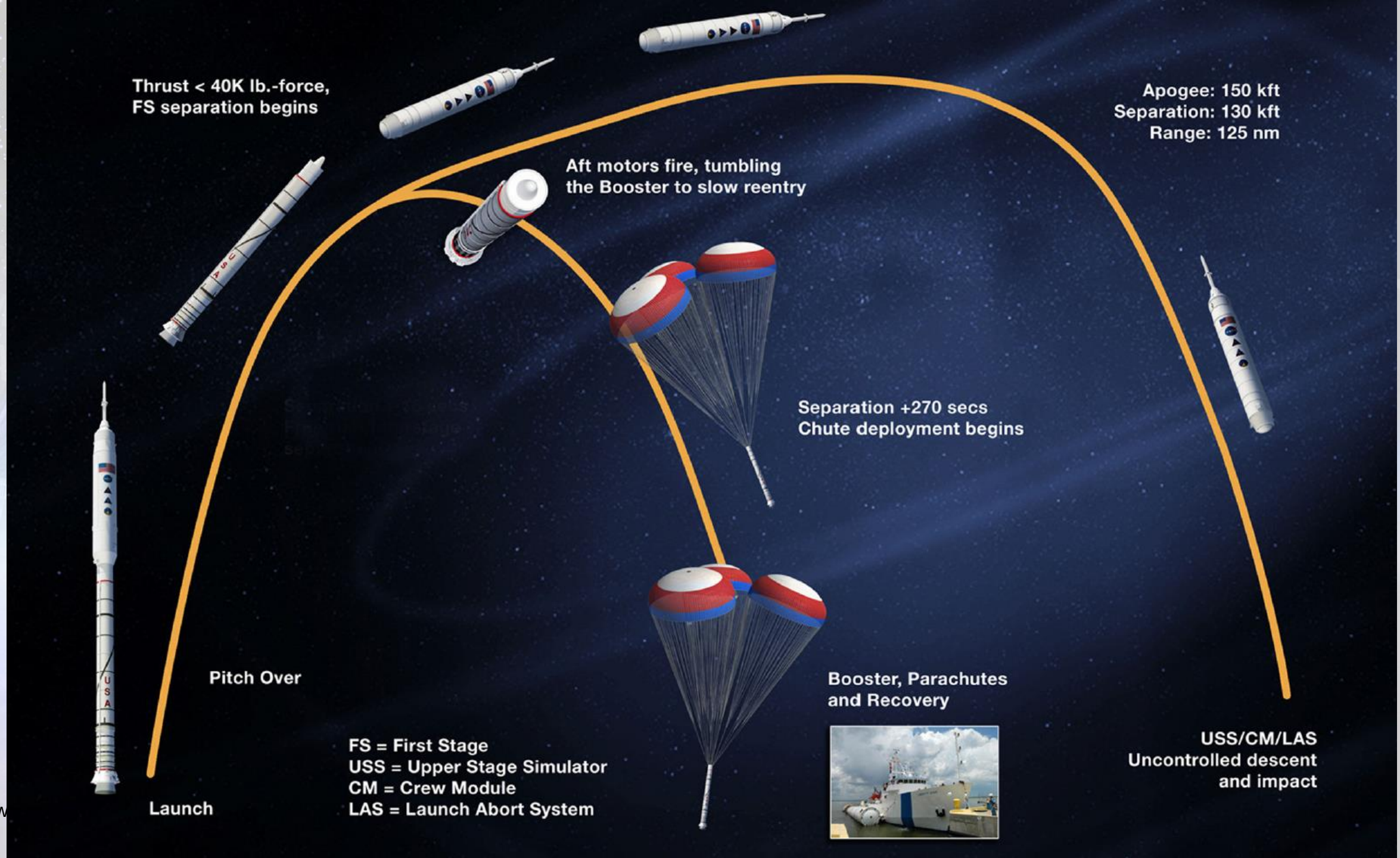











Thrust < 40K lb.-force,
FS separation begins
Aft motors fire, tumbling
the Booster to slow reentry
Apogee: 150 kft
Separation: 130 kft
Range: 125 nm
Separation +270 secs
Chute deployment begins
Pitch Over
Launch
FS = First Stage
USS = Upper Stage Simulator
CM = Crew Module
LAS = Launch Abort System
Booster, Parachutes
and Recovery
USS/CM/LAS
Uncontrolled descent
and impact

ARES I-X Demonstration Test Flight

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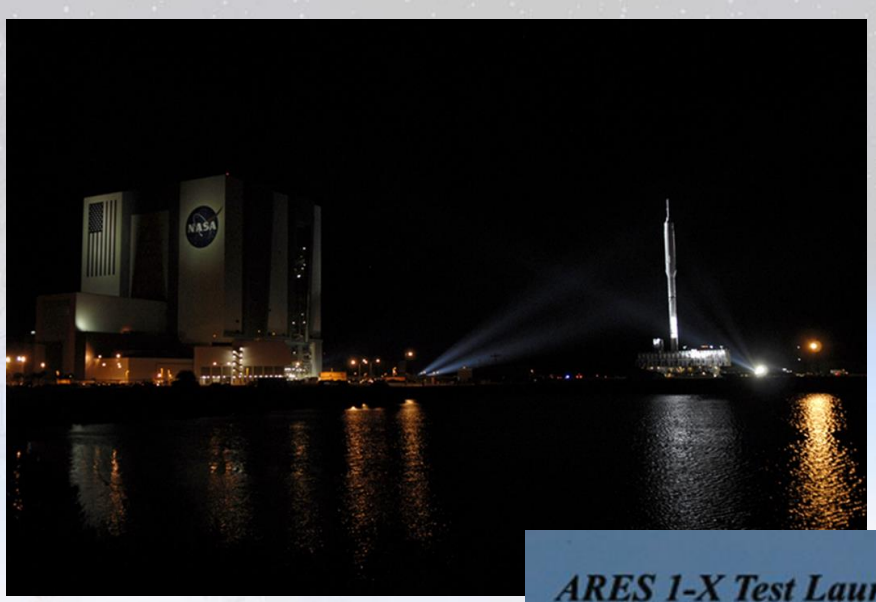



DEVELOPMENT FLIGHT TEST
ARES I-X



ARES 1-X Test Launch
October 28, 2009








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