



# NASA Glenn Research Center

Dr. Janet L. Kavandi, Center Director

## CENTER OVERVIEW

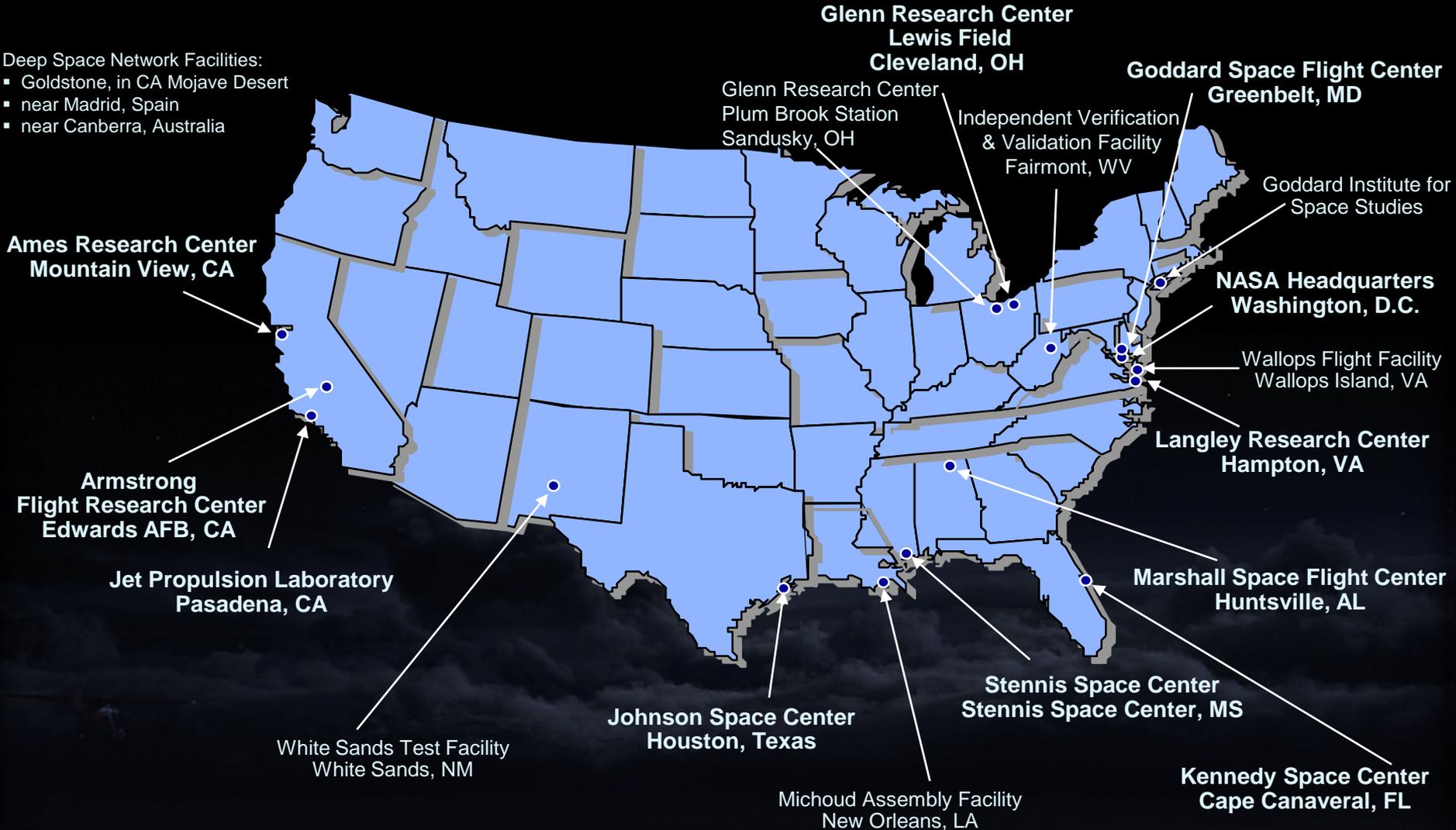
Dr. John M. Sankovic  
Director, Office Technology Incubation and Innovation  
Center Chief Technologist





# NASA Centers and Installations

- Deep Space Network Facilities:
- Goldstone, in CA Mojave Desert
  - near Madrid, Spain
  - near Canberra, Australia





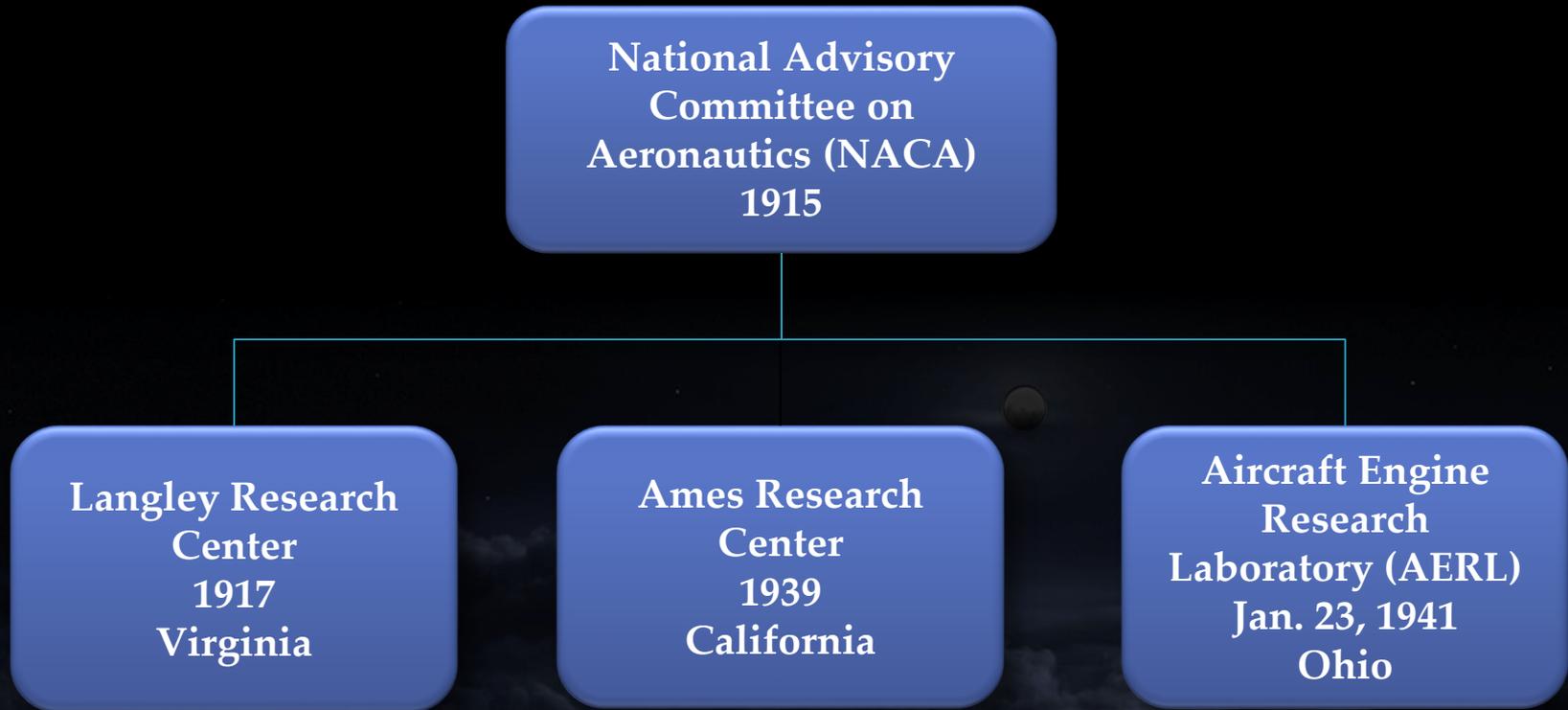
*A century ago...*

*...it shall be the duty of the Advisory  
Committee for Aeronautics to supervise and  
direct the scientific study of the problems of  
flight with a view to their practical  
solution...*

Act of Congress, approved March 3, 1915



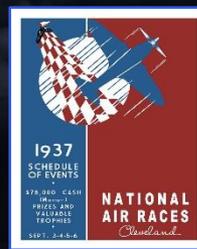
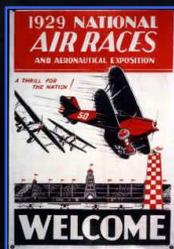
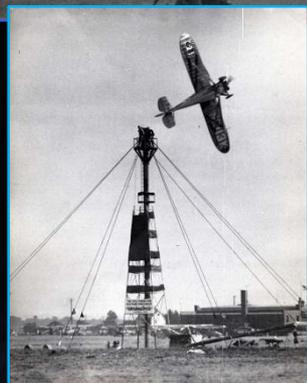
# Birth of U.S. Aeronautics Research



## THE NACA RESEARCH FACILITIES

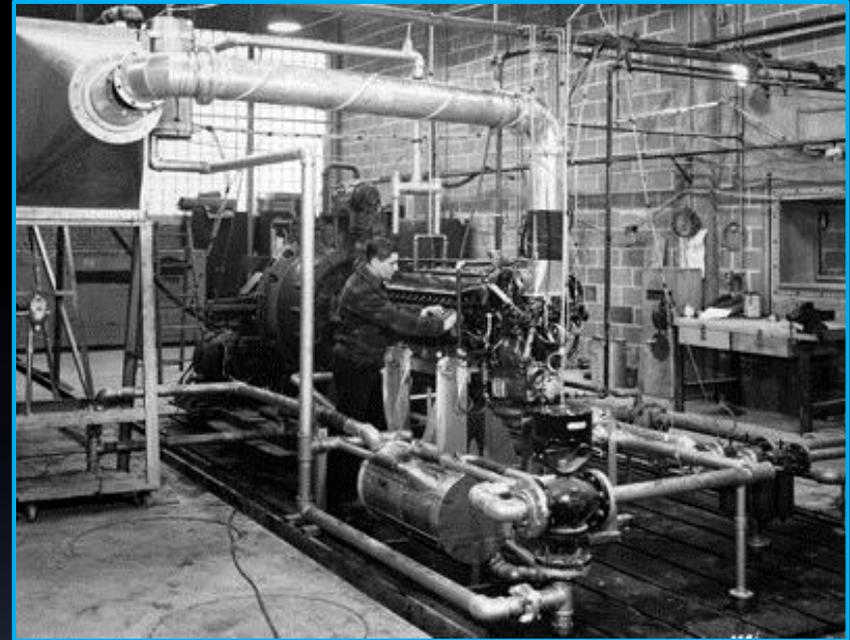


# The Roots of NASA Glenn





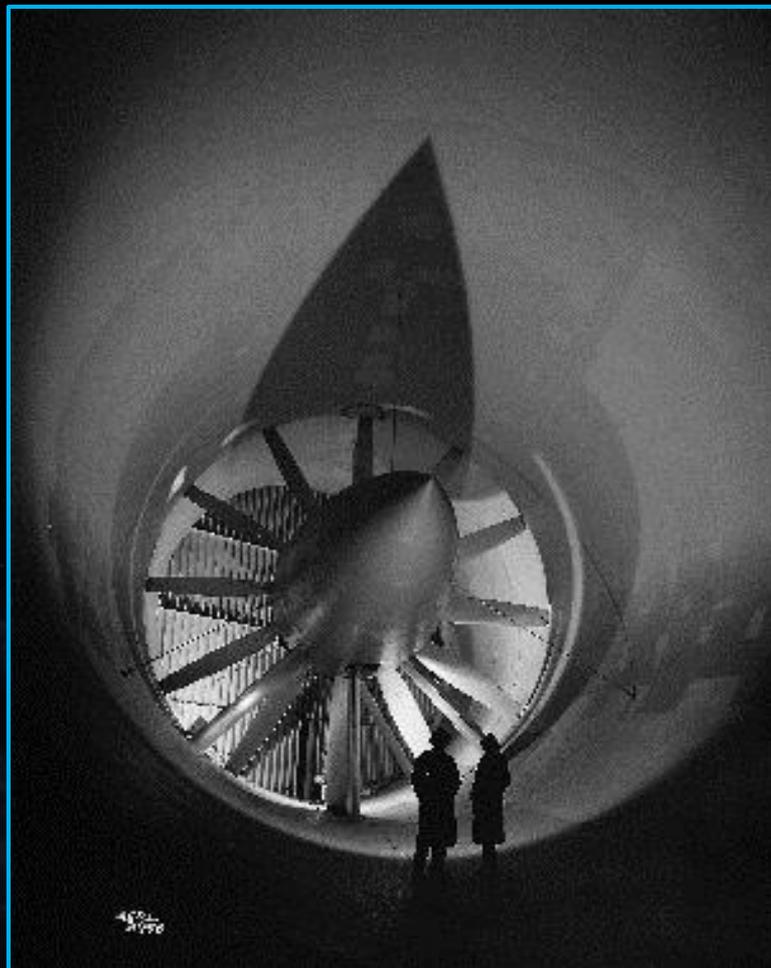
# NASA Glenn Goes to War



## AERL OPEN FOR THE BUSINESS



# NASA Glenn Goes to War



**ALTITUDE WIND TUNNEL, ONE OF A KIND**



# NASA Glenn Goes to War



## ALTITUDE WIND TUNNEL, FIRST PROJECT



# NASA Glenn Goes to War

## FLYING LABORATORY



THE NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS ESTABLISHED BY THE U. S. GOVERNMENT IN 1915, IS OFFERING EMPLOYMENT TO MEN AND WOMEN COLLEGE STUDENTS IN ALL FIELDS OF ENGINEERING, MATHEMATICS AND PHYSICS WHO WILL GRADUATE WITHIN THE NEXT 8 MONTHS

It offers

A Career in Aeronautical Research  
Permanent Activity  
Freedom from Monotony

YOU ARE INVITED TO ARRANGE WITH YOUR PLACEMENT DIRECTOR FOR A PERSONAL INTERVIEW WITH OUR REPRESENTATIVE ON \_\_\_\_\_ 1944, AT \_\_\_\_\_ M. IN \_\_\_\_\_

AMES AERONAUTICAL  
LABORATORY  
MOFFETT FIELD, CAL.

LANGLEY MEMORIAL  
AERONAUTICAL LABORATORY  
HAMPTON, VA.

AIRCRAFT ENGINE  
RESEARCH LABORATORY  
CLEVELAND, O.

AERL  
211C

# RESEARCH EMPLOYMENT OPPORTUNITIES



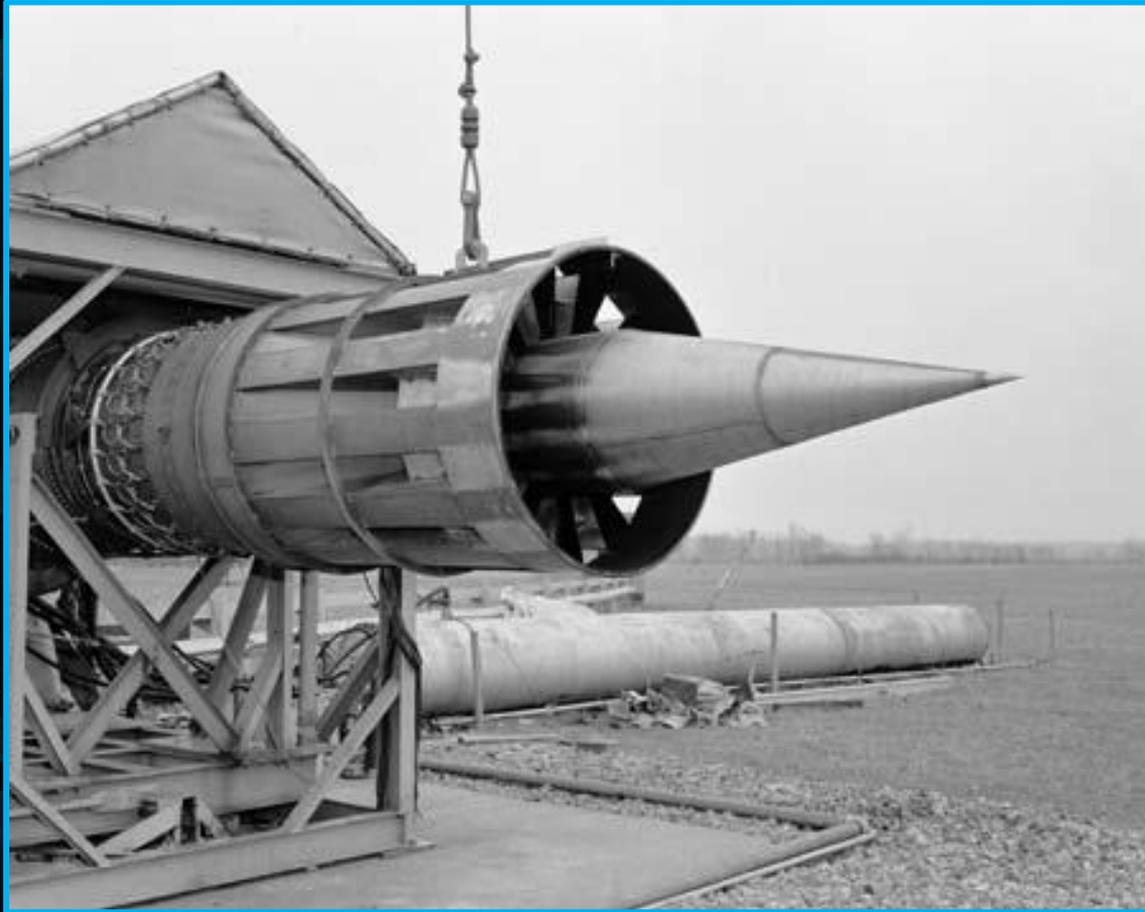
# NASA Glenn Goes to War



## B-29 IN-FLIGHT & GROUND RESEARCH



# NASA Glenn: Enters The Jet Age



## LEWIS FLIGHT PROPULSION LABORATORY



# NASA Glenn: On The Path to Space



## LEWIS RESEARCH CENTER MULTIPLE-AXIS SPACE TEST INERTIA FACILITY



# NASA Glenn: On The Path to Space



## LEWIS RESEARCH CENTER MERCURY TO CENTAUR



# Who Is NASA Glenn Today?



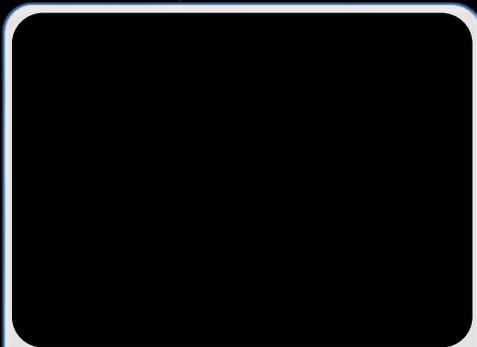
## Lewis Field (Cleveland)

- 350 acres
- 1626 civil servants and 1511 contractors
- 66% of workforce are scientists and engineers



## Plum Brook Station (Sandusky)

- 6500 acres
- 11 civil servants and 102 contractors



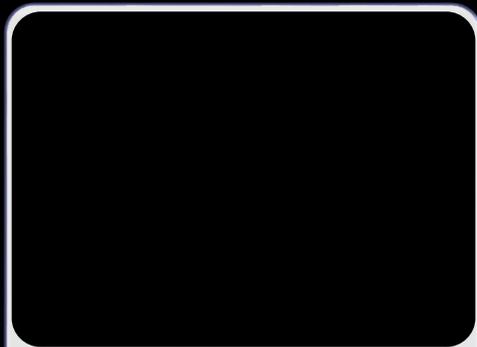
Air-Breathing Propulsion



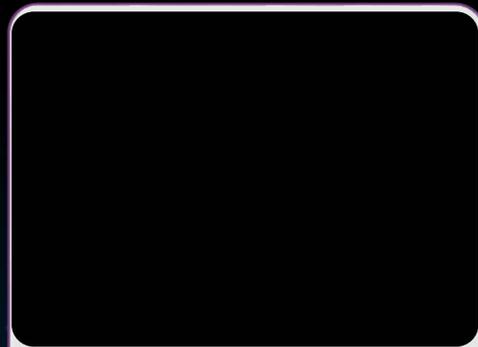
In-Space Propulsion and Cryogenic Fluids Management



Physical Sciences and Biomedical Technologies in Space



Communications Technology and Development

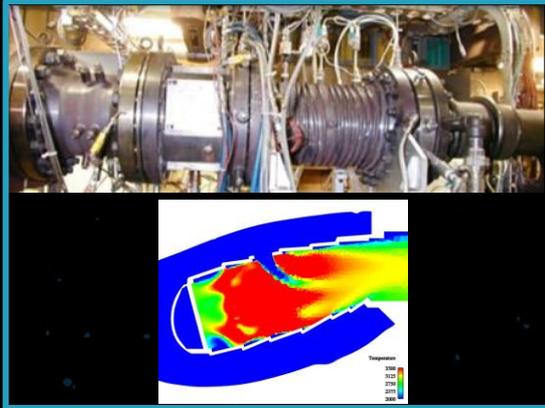


Power, Energy Storage and Conversion

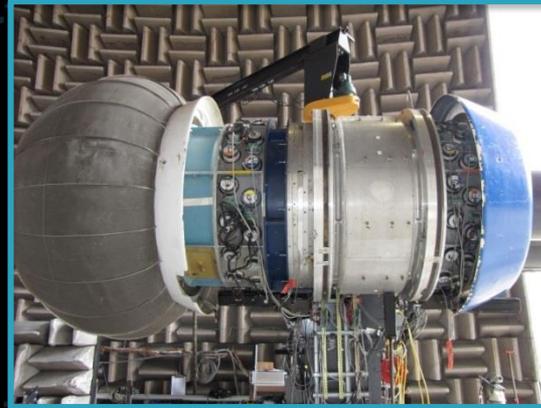


Materials and Structures for Extreme Environments

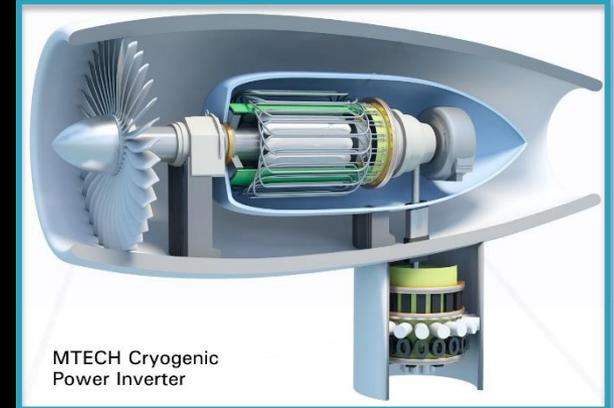




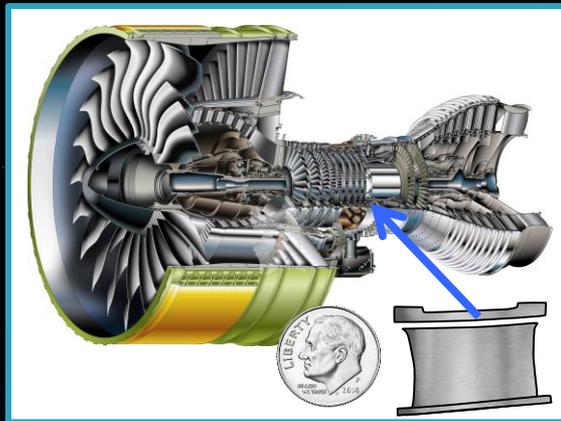
Low Emissions Combustion



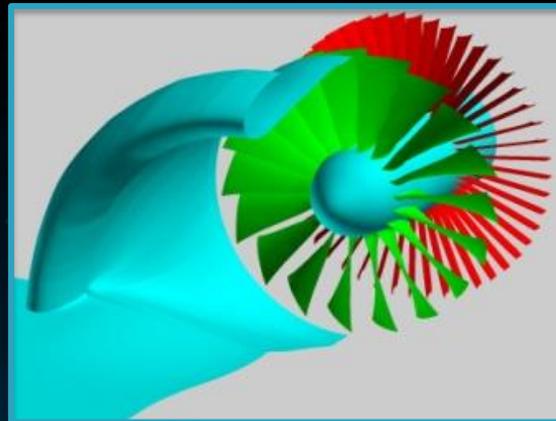
Noise Reduction Technologies



Hybrid Gas Electric Propulsion



Compact Higher Bypass Propulsion



Propulsion Airframe Integration



Alternative Fuels Characterization

# Human Exploration

## Orion Multi-Purpose Crew Vehicle (MPCV)

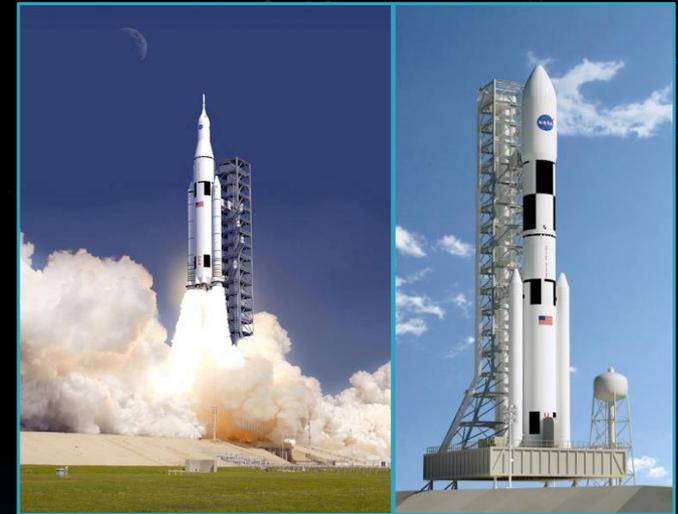
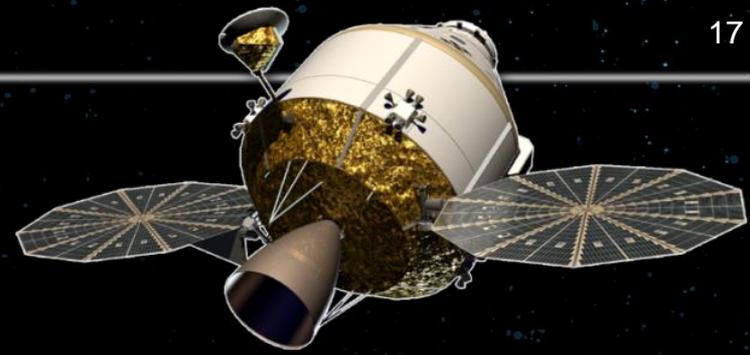
- Co-Lead Crew & Service Module with JSC
- Lead European Service Module (ESM) Integration
- Orion/ESM testing at Plum Brook
- Vehicle integration and power systems support

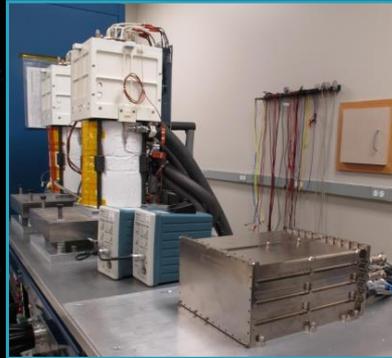
## Space Launch System (SLS)

- Lead payload shroud/fairing development
- Lead Universal Stage Adapter
- Subsystem support (power, TVC, DFI, ...)

## Commercial Crew/Cargo

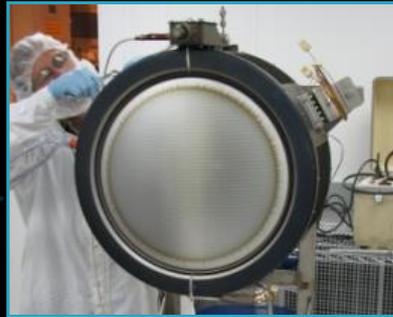
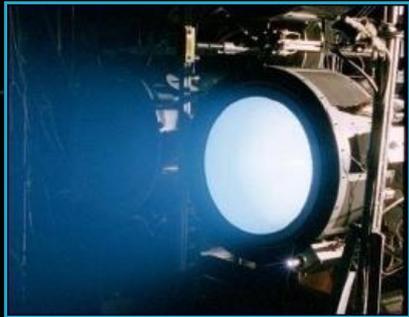
- Reimbursable Space Act Agreements for engineering support and facilities for testing





## Radioisotope Power Systems

- Stirling Radioisotope Generator (SRG)



## In-Space Propulsion

- Solar Electric Propulsion (SEP) capabilities
- NASA Evolutionary Xenon Thruster (NEXT)
- Hall effect thrusters



## Planetary Science

- Extreme environment instruments and testing facilities
- Balloon platforms
- Mission planning (Mars/other)

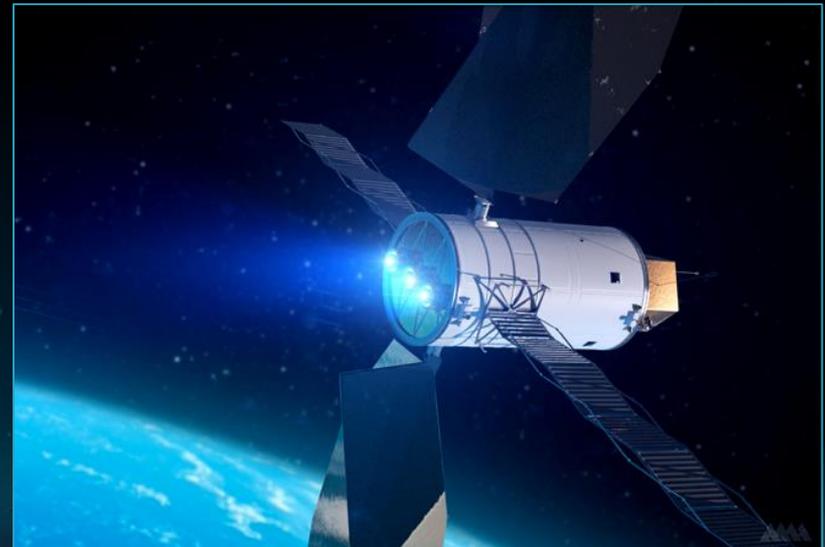
## Advanced Exploration Systems (AES)

- Modular power systems
- Spacecraft fire safety
- EVA flight technologies



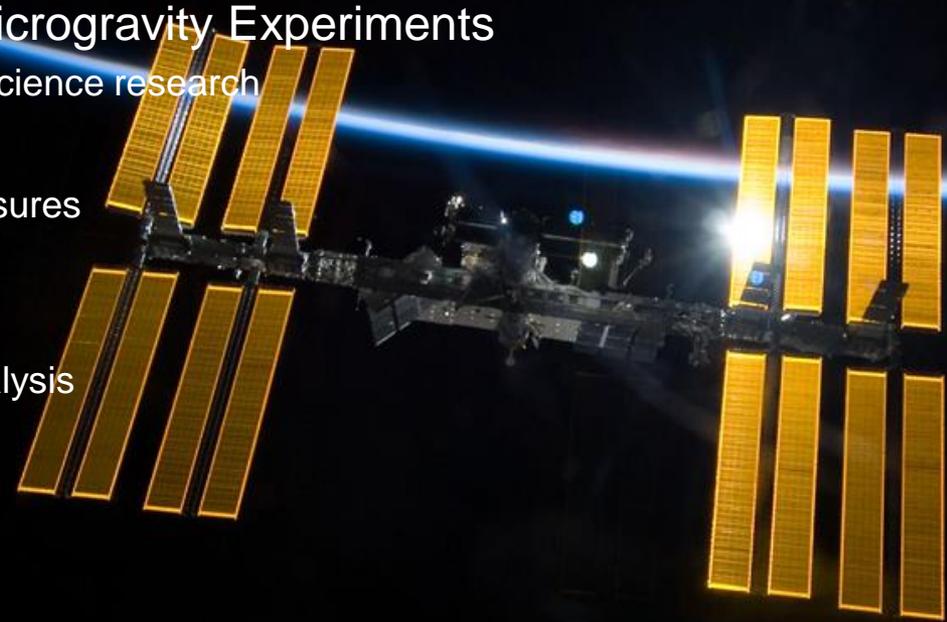
## Space Technology Program

- Evolvable Cryogenics (eCryo) technology project
- Solar Electric Propulsion (SEP)
- Space power generation and storage
- Nuclear systems
- Nanotechnology
- Manufacturing innovation



## International Space Station (ISS)

- Develop and Operate ISS Microgravity Experiments
  - Fluid physics and combustion science research
- Human Research Program
  - Human health and countermeasures
  - Exploration medical capability
- ISS Electrical Power System
  - Sustaining engineering and analysis



## Space Communications and Navigation (SCaN)

- Software-defined radios (SCaN testbed)
- RF propagation and RF/optical hybrid technology
- Network Services Compatibility Test Sets
- Program Systems Engineering
- Spectrum Management



# NASA Glenn: Looking to The Future



# Hybrid Electric Propulsion

Prove Out Transformational Potential



Environmental Benefit

Explore and demonstrate vehicle integration synergies enabled by hybrid electric propulsion

Work toward full PAI and HEP

Increasingly electric aircraft propulsion with minimal change to aircraft outer mold lines

Modeling  
Explore Architectures  
Test Beds  
Component Improvements

Single Aisle Transport



Certify, Operate

2040

Build, learn, demonstrate

2030

Small Aircraft



2020

Gain experience through integration and demonstration on progressively larger platforms

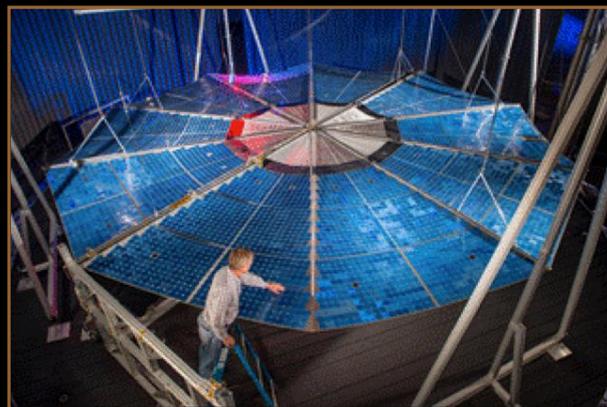
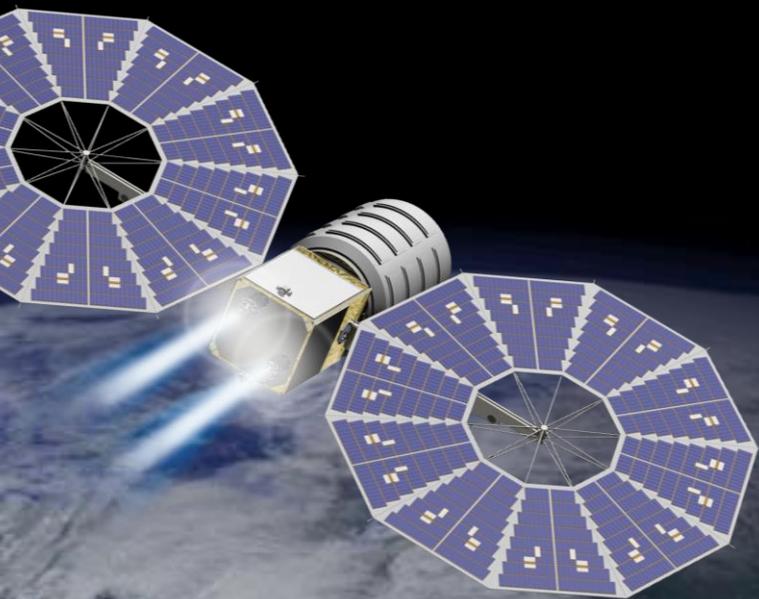
Knowledge through Integration & Demonstration



# 30 to 50 kW-Class Solar Electric Propulsion (SEP)

GRC is developing high performance SEP capability to enable future in-space exploration missions.

- High propellant efficiency
- Reduced launch mass
- Lower mission cost





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[overview.grc.nasa.gov](https://overview.grc.nasa.gov)