



# 2008 ESMD Space Grant Faculty Project



# Faculty Assignments

Dr. James Conrad, Univ. of North Carolina - Charlotte (JSC)  
Dr. Jiang Guo, California State University Los Angeles (ARC)  
Dr. Ellen Lackey, University of Mississippi (KSC)  
Dr. Jonathan Lambright, Savannah State University (SSC)  
Dr. Prabhakar Misra, Howard University (GSFC)  
Dr. Nadipuram Prasad, New Mexico State University (JPL)  
Dr. Roger Radcliff, Ohio University (GRC)  
Dr. Gregory Selby, Old Dominion University (LaRC)  
Dr. Jean-Marie Wersinger, Auburn University (MSFC)  
Dr. Stephen Whitmore, Utah State University (DFRC)

## Project Implementation

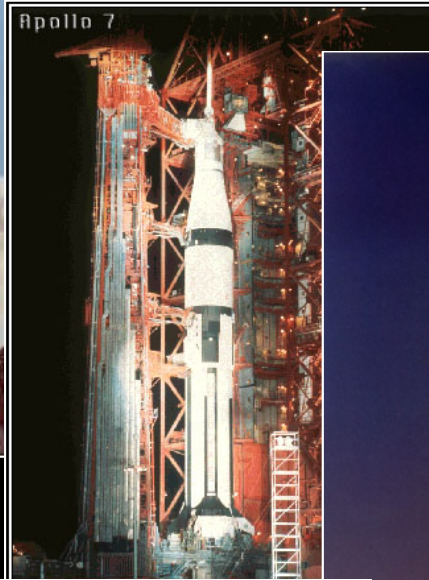
Gloria Murphy, ESMD SG Faculty Project Manager (KSC)

# Objectives

- Gather senior design project ideas and internship opportunities:
    - Relative to space exploration
    - In support of the ESMD Space Grant Student Project
  - Support NASA's Educational Framework
    - Outcome 1: Contribute to the development of the STEM workforce
- 



# *Ares I, Ares V*



# Ares I Crew Launch Vehicle

- ◆ ~25-mT payload capacity
- ◆ 2-Mlb gross liftoff weight
- ◆ 309 ft in length

## First Stage

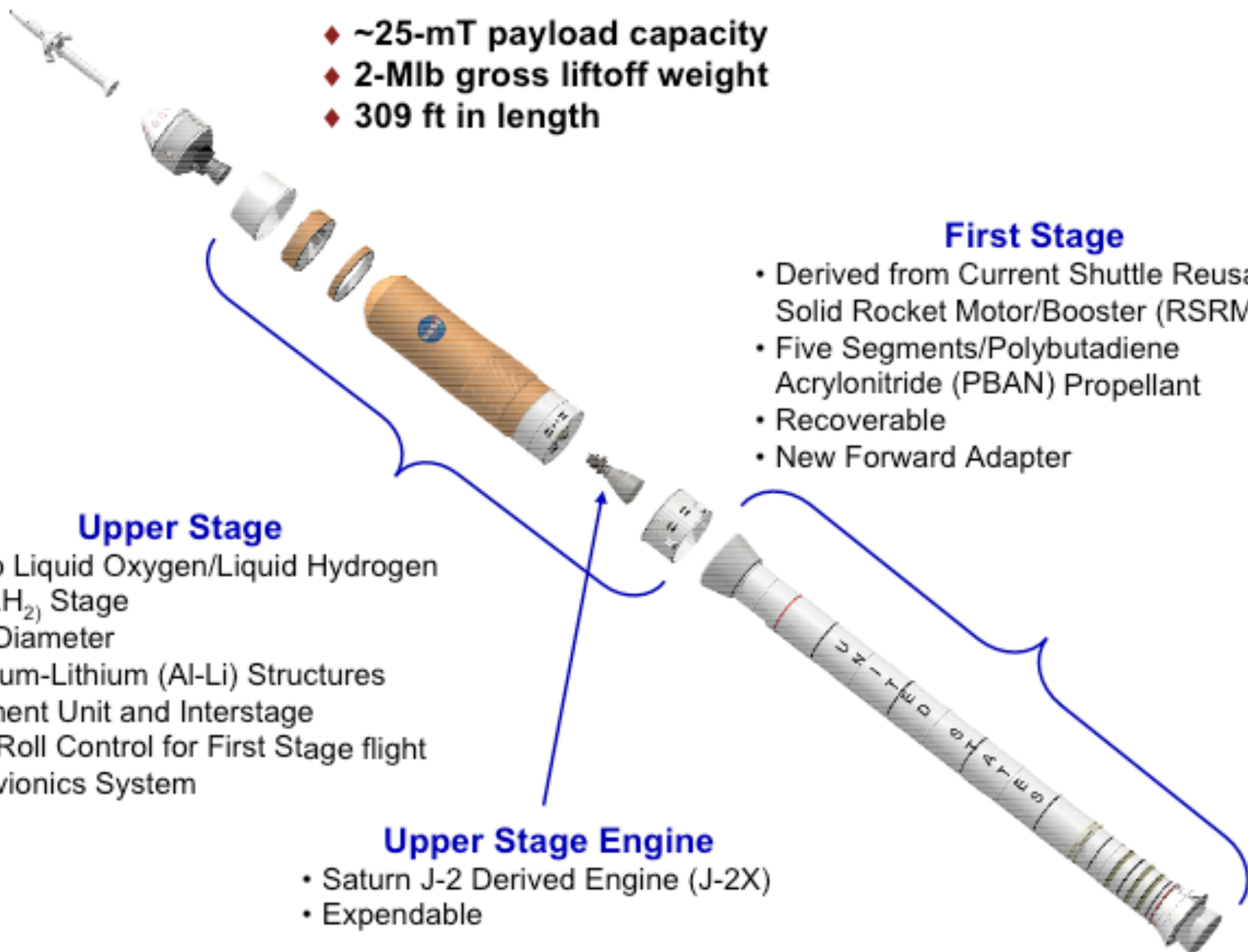
- Derived from Current Shuttle Reusable Solid Rocket Motor/Booster (RSRM/B)
- Five Segments/Polybutadiene Acrylonitrile (PBAN) Propellant
- Recoverable
- New Forward Adapter

## Upper Stage

- 280-klb Liquid Oxygen/Liquid Hydrogen (LOX/LH<sub>2</sub>) Stage
- 5.5-m Diameter
- Aluminum-Lithium (Al-Li) Structures
- Instrument Unit and Interstage
- RCS / Roll Control for First Stage flight
- CLV Avionics System

## Upper Stage Engine

- Saturn J-2 Derived Engine (J-2X)
- Expendable



# ESMD Centers

## Ames Research Center

- Lead Orion Thermal Protection System development
- Program and Project analysis support



## Dryden Flight Research Center

- Lead Orion Launch Abort System Flight Test development



## Jet Propulsion Lab

- Program and Project analysis support



## White Sands Test Facility/White Sands Missile Range

- Orion Launch Abort System flight testing
- Orion and Ares propulsion



## Glenn Research Center

- Orion Service Module and Spacecraft Adapter integration
- Ares Upper Stage subsystem development
- Integrated Orion qualification testing
- Manufacture Ares I Upper Stage simulator



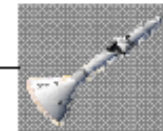
## Goddard Space Flight Center

- Communications support



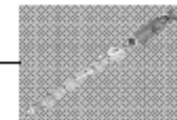
## Langley Research Center

- Orion Launch Abort System integration and landing system development and testing
- Test vehicle integration for initial Ares I flight tests



## Marshall Space Flight Center

- Ares Project
- Lead Earth Departure Stage
- Ares I Upper Stage propulsion testing



## Michoud Ass'y Facility

- Orion component fabrication and assembly
- Possible Ares I Upper Stage, Ares V Core Stage, and Earth Departure Stage assembly and manufacture



## Stennis Space Center

- Ares propulsion testing



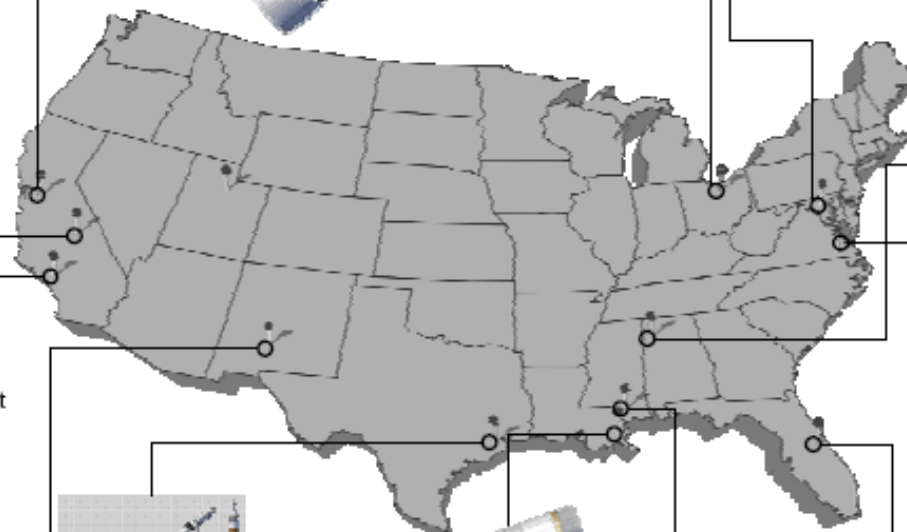
## Kennedy Space Center

- Ground Operations Project
- Ground processing, launch and landing/recovery



## Johnson Space Center

- Constellation Program
- Project Orion, Mission Operations Project, Lunar Lander Project, and EVA Systems Project



# ESMD Project Areas

## Spacecraft

Guidance, navigation, and control;  
Thermal; Electrical; Avionics; Power  
systems; High-speed reentry;  
Interoperability/Commonality; Advanced  
spacecraft materials; Crew/Vehicle health  
monitoring; Life-support systems;  
Command/Communication software;  
Modeling and simulation

## Ground Operations

Pre-launch; Launch; Mission  
operations; Command, control,  
and communications; Landing and  
recovery operations

## Propulsion

Methods that utilize materials found on  
the Moon and Mars; On-orbit  
propellant storage; Methods for soft-  
landing

## Lunar & Planetary Surface Systems

Precision landing software; In-situ  
resource utilization; Navigation  
systems; Extended surface  
operations; Robotics; Environmental  
sensors and analysis; Radiation  
protection; Life-support systems;  
Electrical power and efficient power  
management systems



# Senior Design Projects for ESMD

Allow students the practical design experience of developing technologies and systems for space exploration under the advice, guidance, and mentorship of university faculty, and NASA engineers and scientists.



The projects are aligned with a clear vision for exploration and serve to stretch one's imagination for developing revolutionary technologies needed to explore our solar system and beyond.



# Example of a Senior Design Project

One problem with enclosed living spaces is that sometimes surfaces will collect condensation due to a cold surface behind the wall. This water could promote the growth of plant or animal life (mold and bugs!).



Investigate how you can design a “wall system” that will trap any condensation that forms, then evaporate it periodically (e.g. every six hours) actively using very little energy or passively when the adjacent air warms above dewpoint.

# ESMD Senior Design Project Example



Students insulating their senior design prototype of a loop heat pipe.



Students preparing sounding rockets for launch at competition.

# Internships

- Space Grant Consortia fund the interns to work with their mentors for ten weeks.
- Highly qualified students are placed in the mentors' preferred areas.
- Mentors gain a sense of pride that they have contributed to the next generation workforce of NASA and the space industry.
- Students receive unique and invaluable experiences.





# Intern Enrichment Activities



- NASA speakers
- Tours and demonstrations
- Picnic with mentors

Interns receiving a motivational welcome from Joe Dowdy, Special Operations Manager in the Office of the Director at KSC



Group activities included viewing the STS-124 landing



# Internship Project Examples



Project Description - Building test bed for lunar simulant and developing a percussive lunar excavator bucket

Samuel – “My mentor emphasizes that what we are working on this summer is useful in a variety of areas in NASA.”

David – “This project has been perfect ...people should apply.”



# Internship Project Examples



One student is designing and producing a MATLAB® program that seamlessly meshes three different static aerodynamic databases for the Ares I.

One project goal was to improve existing composite materials mechanically and electrically by adding carbon nanotubes to them.



# Senior Design Project and Internship Opportunities 2008-09

[http://education.ksc.nasa.gov/esmdspacegrant/Sr\\_Design.htm](http://education.ksc.nasa.gov/esmdspacegrant/Sr_Design.htm)

[http://education.ksc.nasa.gov/esmdspacegrant/ESMD\\_Exploration\\_Internships.htm](http://education.ksc.nasa.gov/esmdspacegrant/ESMD_Exploration_Internships.htm)

## Langley Research Center (LaRC)

14 Senior Design Projects

12 Internships

## Goddard Space Flight Center (GSFC)

9 Senior Design Projects

14 Internships

# Conclusions

## The ESMD Space Grant Faculty Project

- Bridges the gap between academia and the NASA vision and mission. Students connect to real world space-related work.
- Exposes students to new and novel approaches to space exploration that better prepare them for future space-related careers.
- Creates greater awareness of current NASA research to new faculty who have never been previously associated with or exposed to the NASA vision and mission.
- Motivates incorporation of space-related curriculum into higher education institutions to increase the education and knowledge base of graduating students.