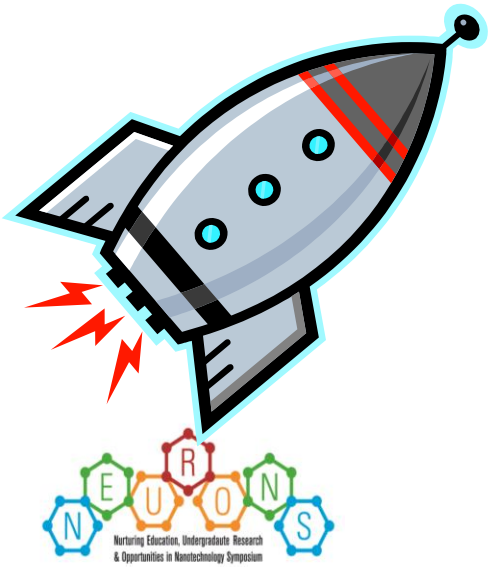
FROM UTPA TO NASA GLENN RESEARCH CENTER, A JOURNEY TO THE COOLEST JOB ON THE PLANET!



Dr. Maricela Lizcano
Research Materials Engineer
Ceramics Branch
Structures and Materials Division
NASA Glenn Research Center
Cleveland, OH

April 5, 2013

Educational Background

2004 B.S. Mechanical Engineering
Research: Nano Reinforced Polymeric Materials - UTPA

2006 M.S. Mechanical Engineering
Research: Electrorheology of C_{60} Suspension Fluids-UTPA

2011 Ph.D. Mechanical Engineering
Research: Low-Temperature Processing of Inorganic Polymers TAMU

NEURONS
Nurturing Education, Undergraduate Research & Opportunities in Nanotechnology Symposium

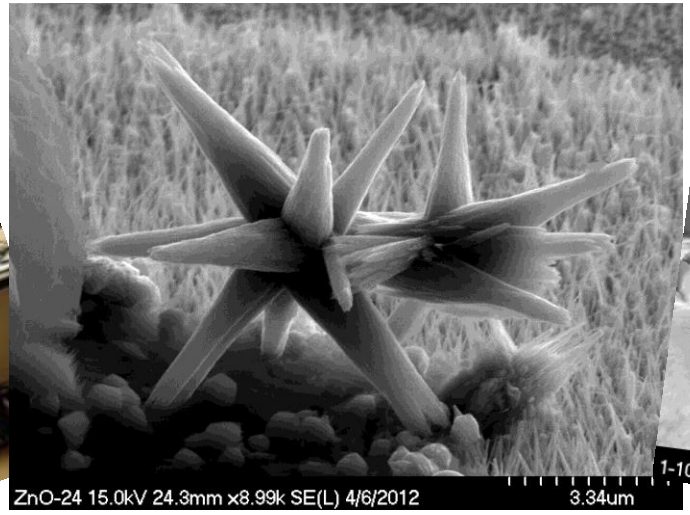
Growing Up…An Engineer in the Making

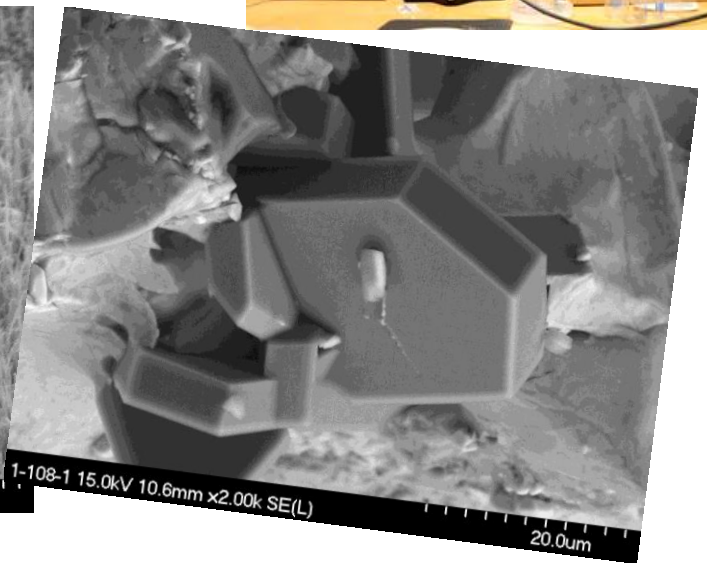
Dr. Lizcano grew up in Edinburg, TX. Her parents were born in Monterrey , Mexico. She has 7 siblings!

Ever since she was a child, she was fascinated by how things worked and was always trying to fix broken things around the house!

First Stop, UTPA College of Engineering and Computer Science A Smart Academic Investment

- AFFORDABLE
- Faculty with High Standard of Excellence
- State-of-the-Art Facilities



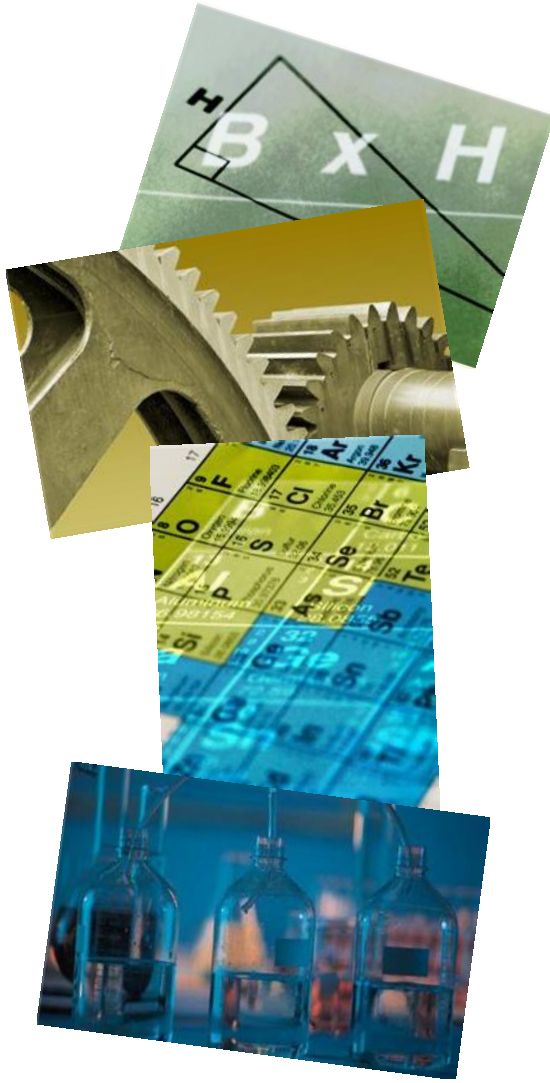


Zinc Oxide and Zintl Compound $Ca_5Al_2Sb_6$

SEM images taken by Jonathan Mackey PhD Student at University of Akron.

Pathways to Success
UTPA Undergraduate Opportunities

- Research Work Opportunities
  - Mechanical Engineering-Research with Faculty
  - Physics- Research with Faculty ,Instrumentation and Lab Instructor
  - Mathematics- Research with Faculty
  - Internships-NREL Internship and REU at UTPA and Vanderbilt University
  - HESTEC 2004 and 2005 Competition Coordinator
  - Scholarships-Lockheed Martin, LSAMP, Bridge to a Doctorate
- Faculty
  - Student/Teacher ratio
  - Dedication and Commitment
  - High Standard of Excellence
- Results
  - A STRONG COMPETITIVE RESUME Highlighting Academic Achievements, Work Skills such as Knowledge of Research Instrumentation, Data Processing and Analysis.



Next Stop, Graduate School!

Picking A School-My Choices

- University of Texas Austin
- New Mexico State University
- **Texas A&M University**
- University of Colorado at Boulder

Making A Choice

- Education Standard/Location/ **Cost of Living**
  - In-state Tuition
  - Available Scholarships
  - Best Opportunity

Applied to 1 school Texas A&M

- School Visit
- Accepted

There is NO DOUBT in my mind, I was very well prepared for the challenges of a PhD program due to my experience at UTPA.

The Day It All PAID OFF!

Monday, April 25, 2011 11:51 AM

NASA Glenn Ceramics Branch Monday, April 25, 2011 11:51 AM
From:"Grady, Joseph E. (GRC-RXC0)"
To: "marcilizcano@[redacted]

Maricela – I recently received your [illegible] k in the Ceramics Branch at N[illegible] ceramic compo[illegible] cells. P[illegible] to talk [illegible] give a brief s[illegible]

Thanks
Joe Grad[illegible]
Chief, Cer[illegible]
NASA Gle[illegible]

NASA!?!

Final Destination, NASA Glenn Research Center Cleveland, OH

"Oh Yeah! That's what I'm talking about right there!"

NEURONS
Nurturing Education, Undergraduate Research & Opportunities in Nanotechnology Symposium

http://pixtale.net/2011/11/nasa-prepares-to-launch-curiosity/#

http://www.grc.nasa.gov/WWW/k-12/WindTunnel/windlist.html

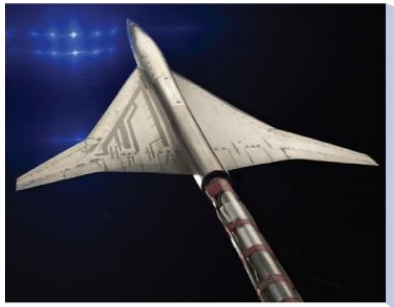
http://www.hivelocitymedia.com/features/QALugo7_29_10.aspx

Technology Areas of Expertise at NASA-GRC

- Materials
- Human Health
- Electronics
- Environmental Emissions
- Sensors, Instrumentation and Communication
- Energy and Power
- Industrial Processes
- Software Applications
- Physical Sciences

NASA GRC Work Profile

Aeronautics Research



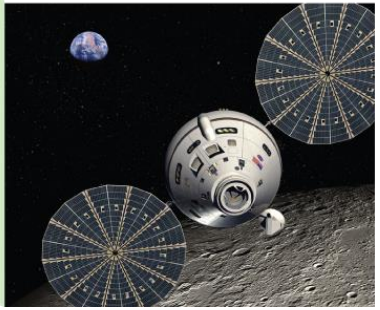
Science

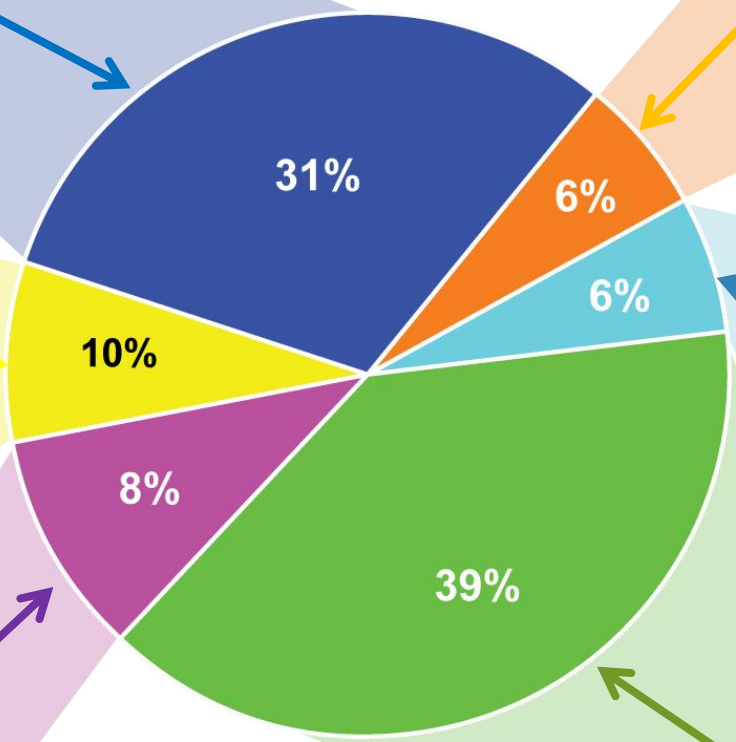
Mission Support

Space Operations

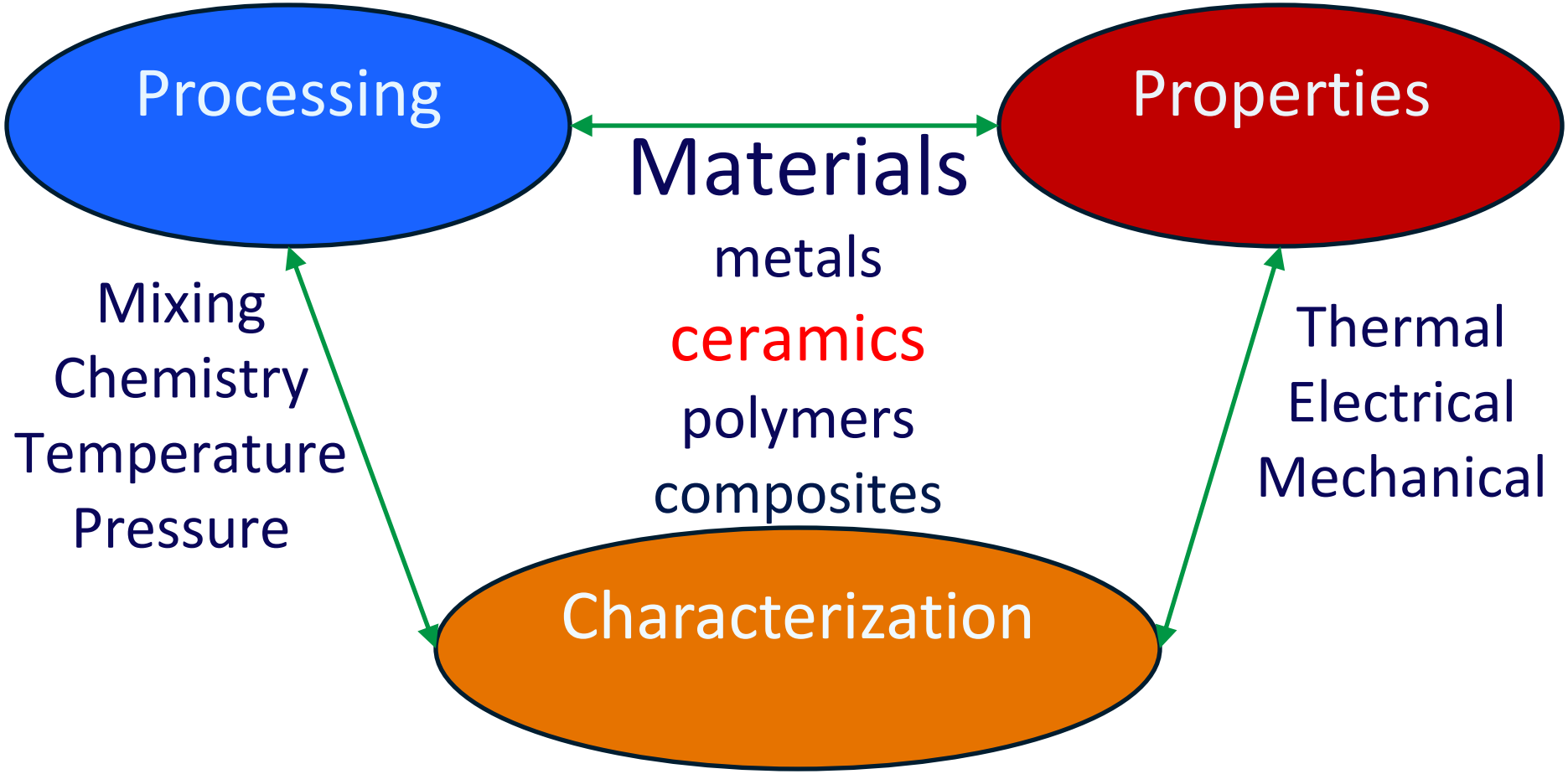
Cross Agency Support

Exploration Systems



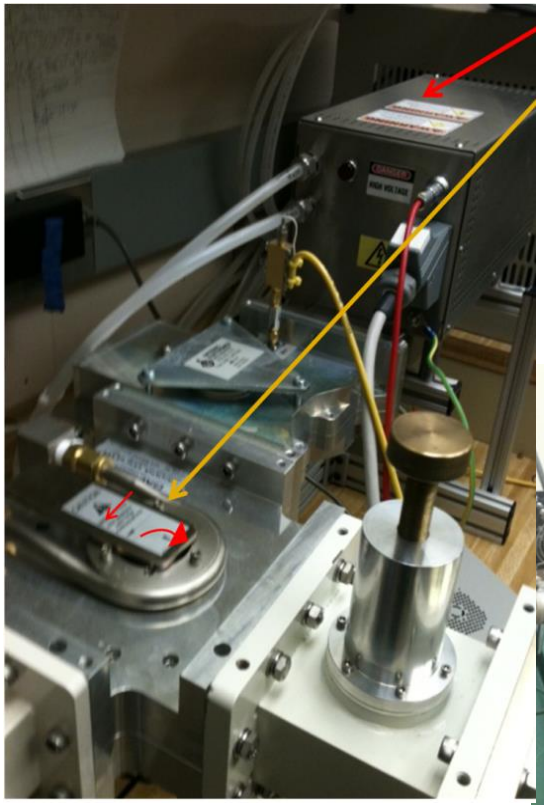


Job Title: Research Materials Engineer



Material Processing

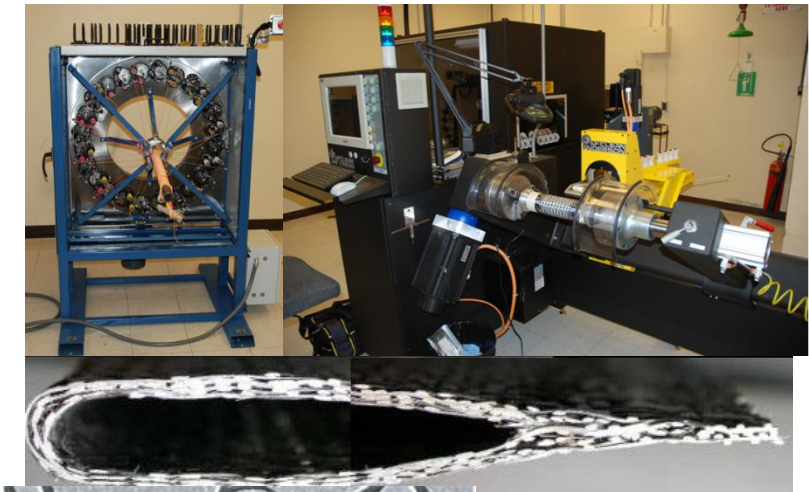
Microwave Furnace

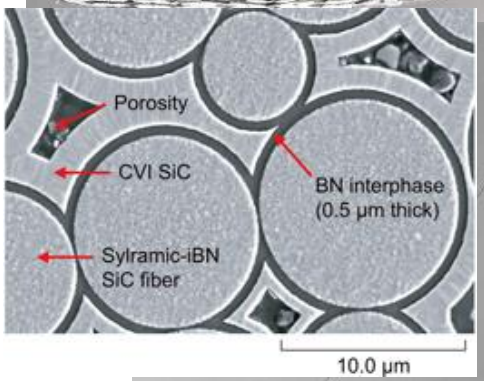


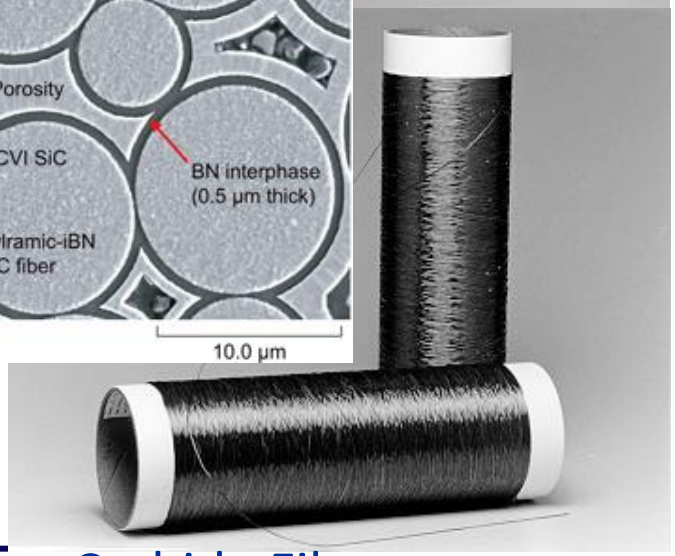
Magnetron
Circulator

Electric Tube furnace

Fiber Weaving



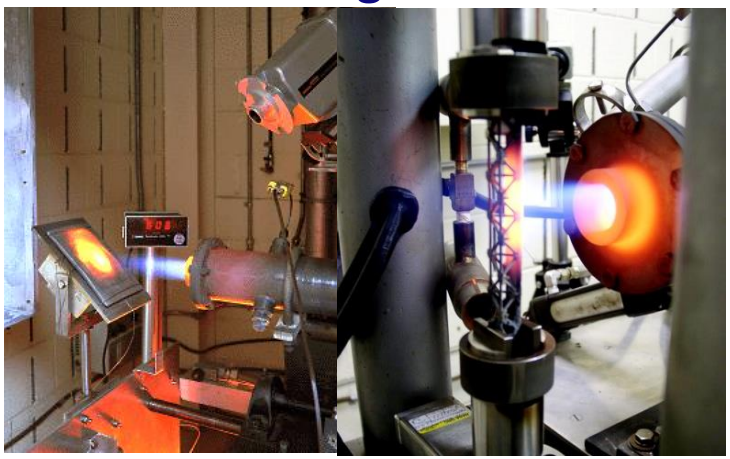




Silicon Carbide Fibers

Material Property Testing

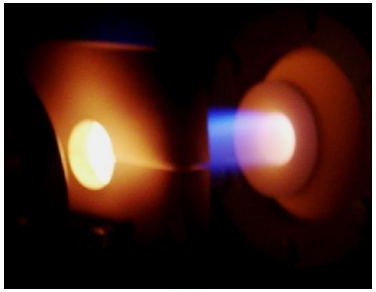
Hot Section Engine Environment



Mechanical Testing for long term durability testing to 3000°F in air with strain measurement

Mach 0.3 Burner Rigs

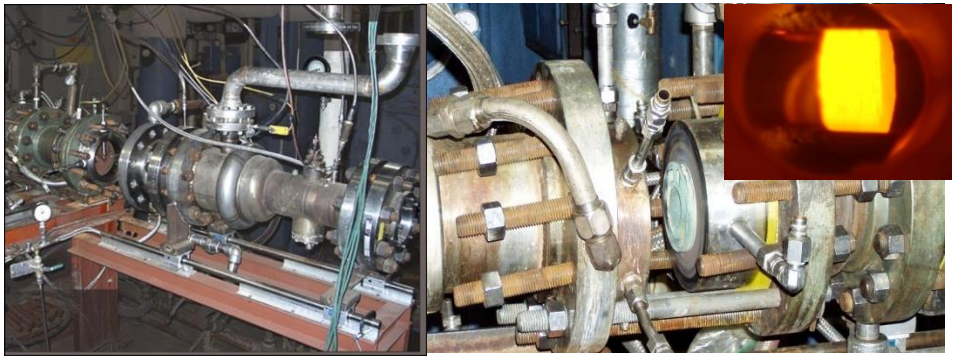
Jet fuel combustors: 700° to 2500°F exposure in oxidative or corrosive environments



Erosion Burner Rig

Jet fuel combustor

Particle impingement



High Pressure Burner Rig

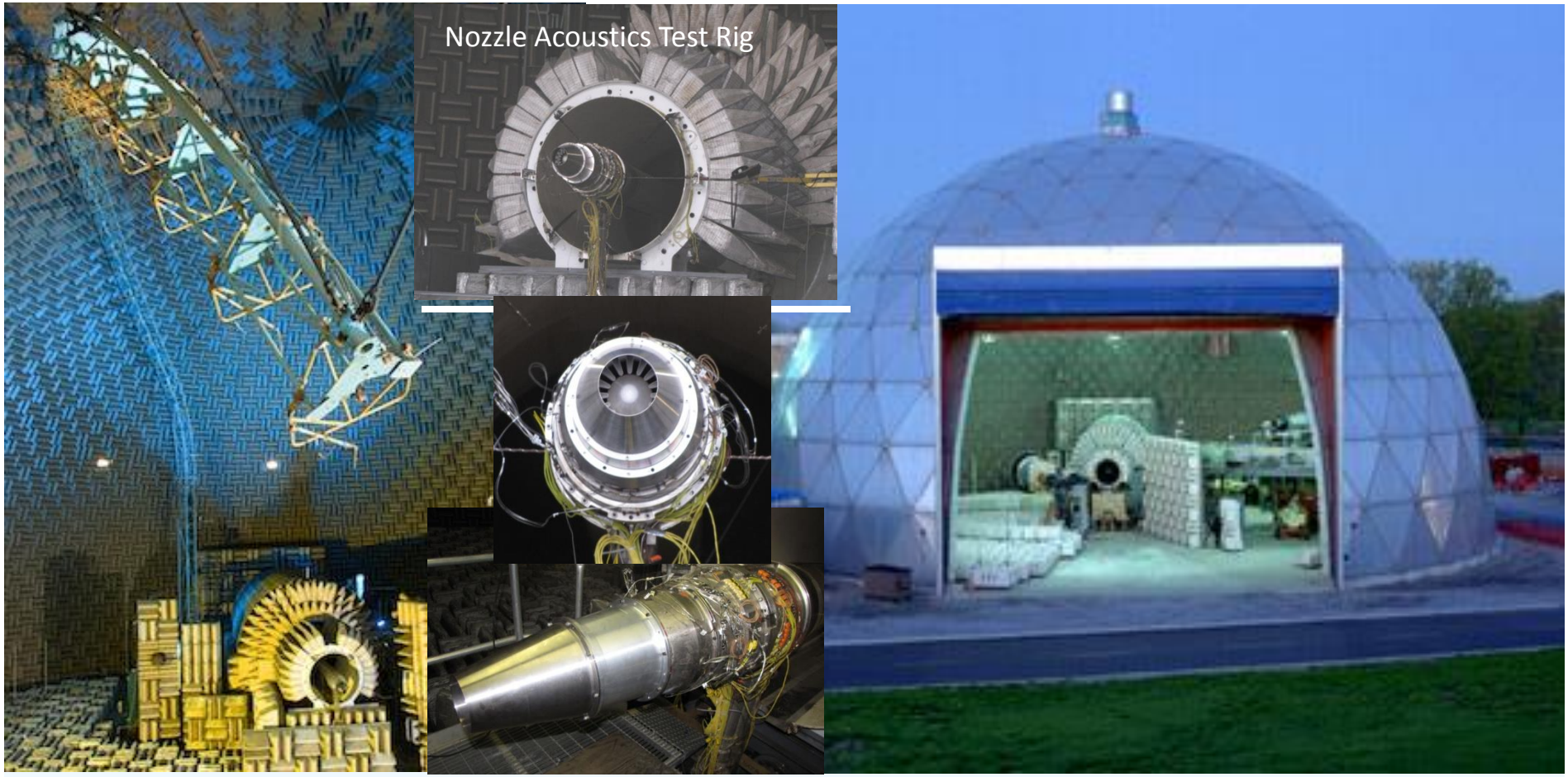
Jet fuel combustor

Gas temperatures of 1500 ° F - 3000 ° F

Test pressures between 5 - 10 atm.

Gas flow velocities 30 - 100 ft/sec.

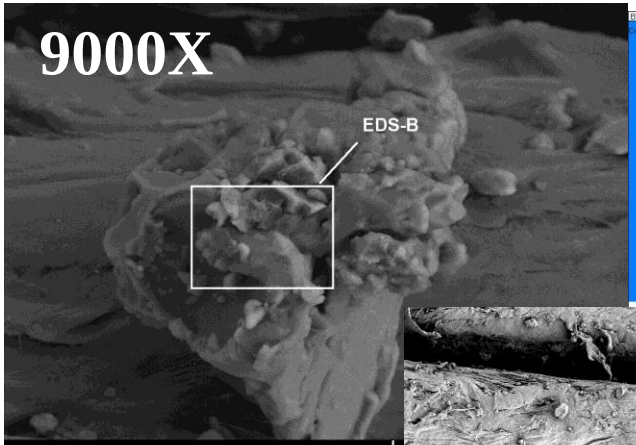
Acoustic Testing of the CMC Mixer Nozzle

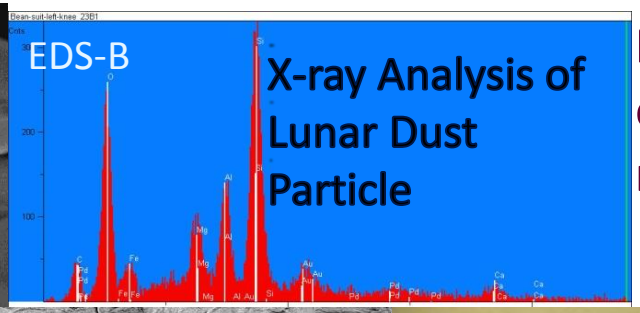


Aero-Acoustic Propulsion Laboratory (AAPL)
Anechoic wedges are on all surfaces inside the 65 foot radius geodesic dome prevent community noise or reflective noise from contaminating data.

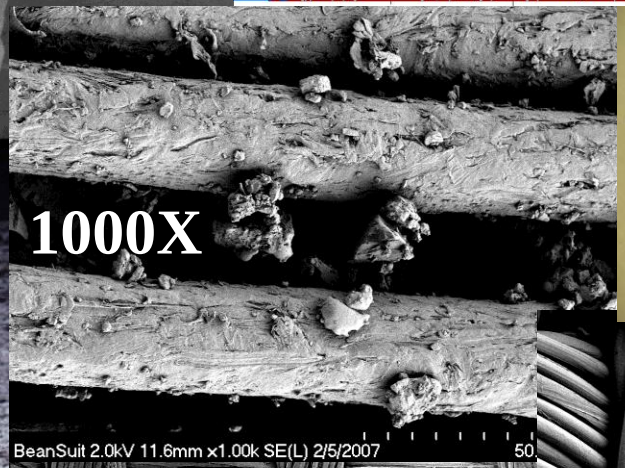
Material Characterization

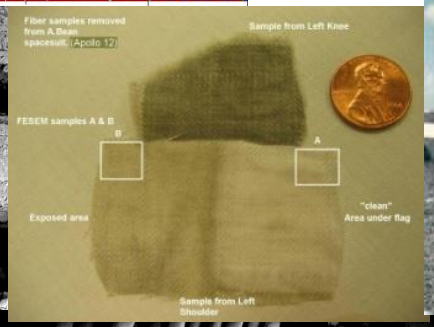
Microstructure Apollo Era Space Suit and Lunar Dust

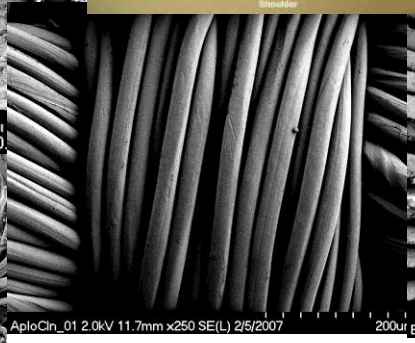


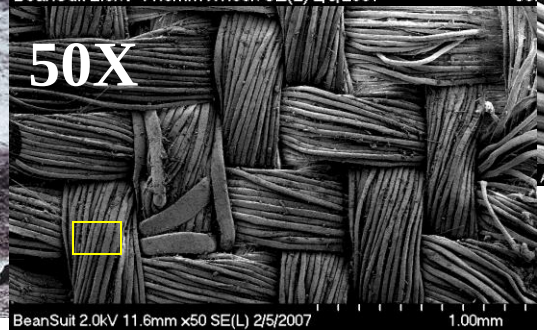


Purpose: Preparation for extended stay on the moon.





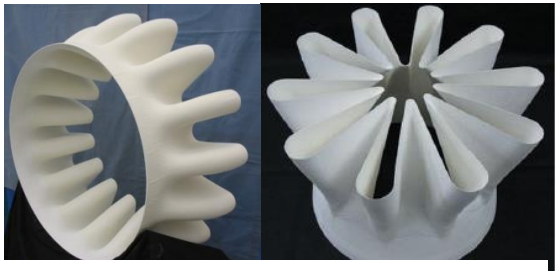


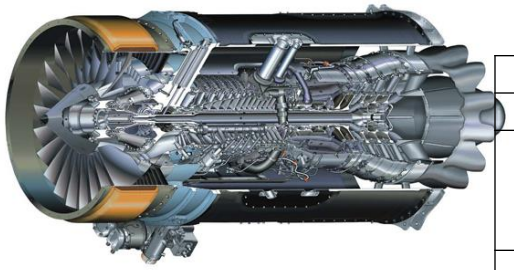


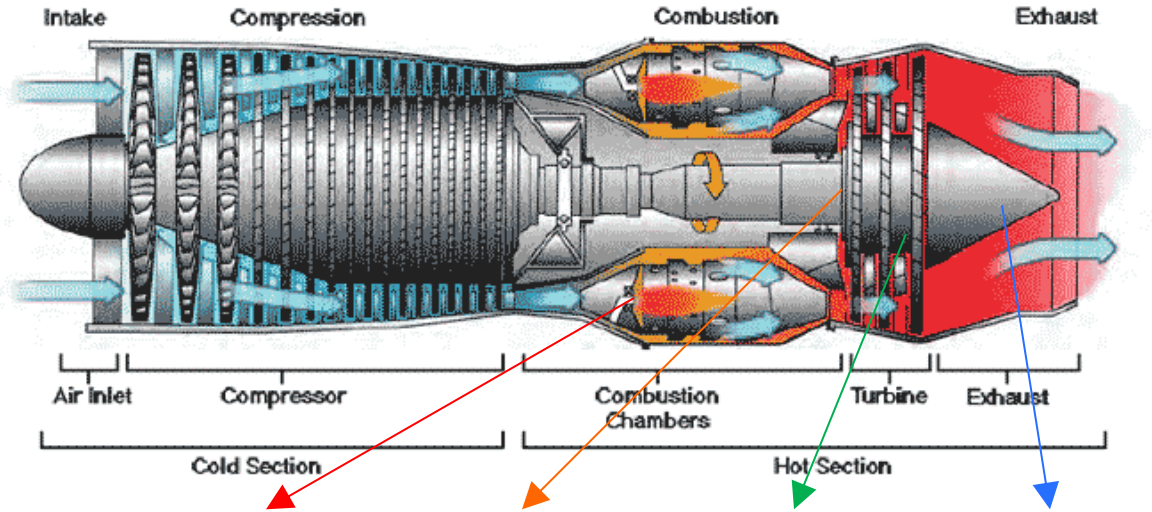
Teflon coated fiber glass

Ceramic Matrix Composites (CMC) ERA Goals: Reduced Aircraft Noise, Emissions and Fuel Burn

CMC engine component reduce cooling air requirements

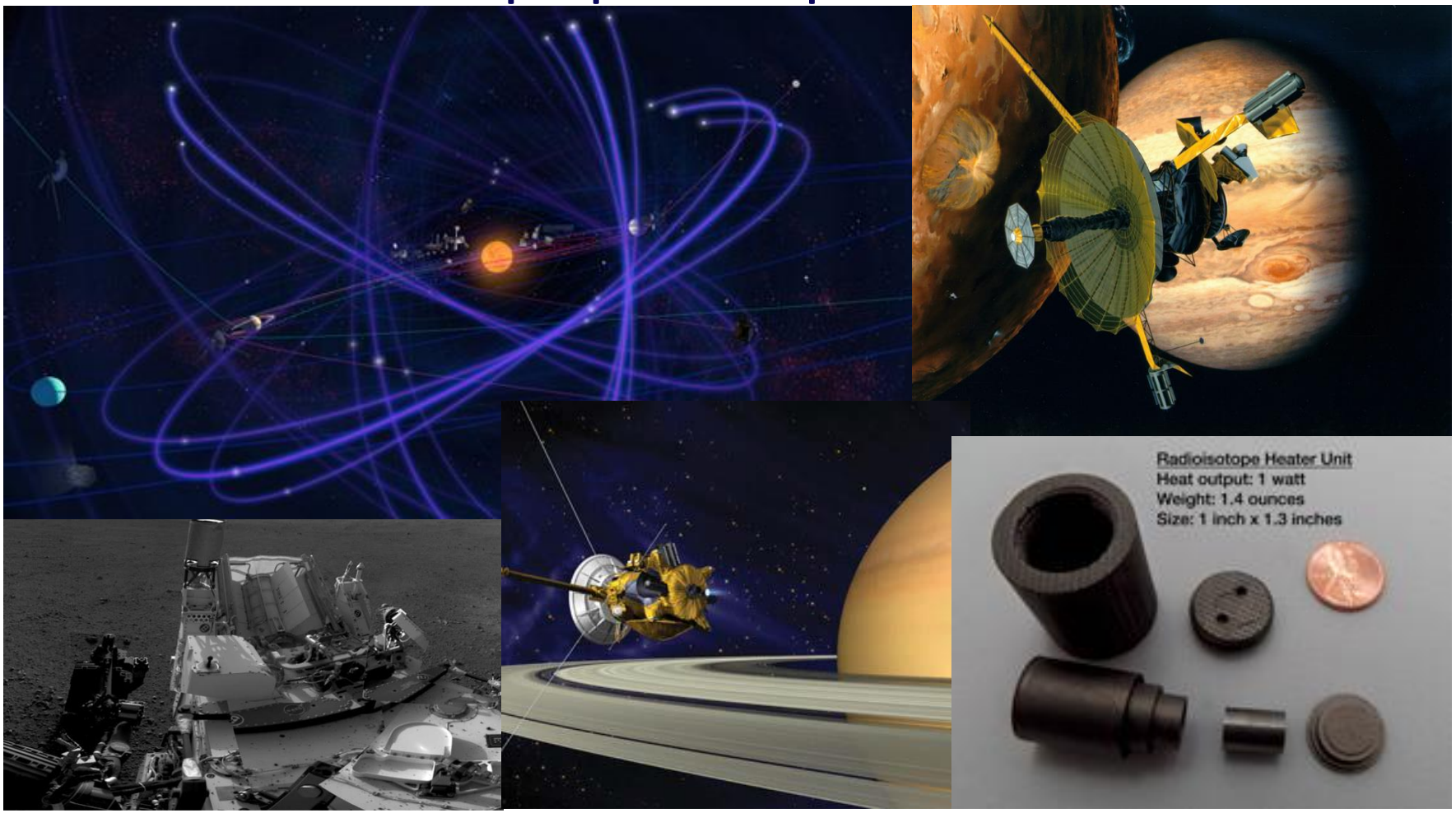






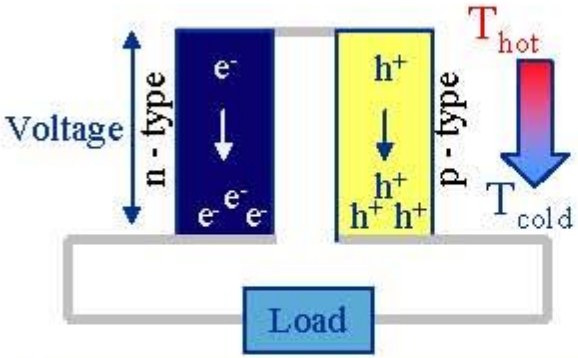
	Combustor	High Pressure Turbine	Low Pressure Turbine	Exhaust Nozzle
Temperature	2200-2700°F	2400-2700°F	2200-2300°F	1500-1800°F
CMC System	SiC / SiC	SiC / SiC	SiC / SiC	Oxide / Oxide
Engine Benefit	• Reduced cooling • Reduced NOx • Pattern Factor	• Reduced cooling • Reduced SFC	• Reduced cooling • Strength / weight	• Light weight • Noise reduction • Higher use temp
Challenges	• Durability • Attachment & Integration	• Manufacturing • Durability • Attachment & Integration	• Manufacturing • Durability • Attachment & Integration	• Manufacturing • Durability

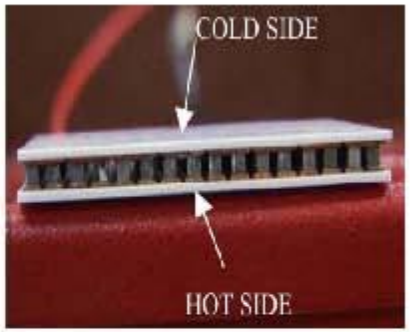
Radioisotope Power Systems (RPS) For Deep Space Exploration

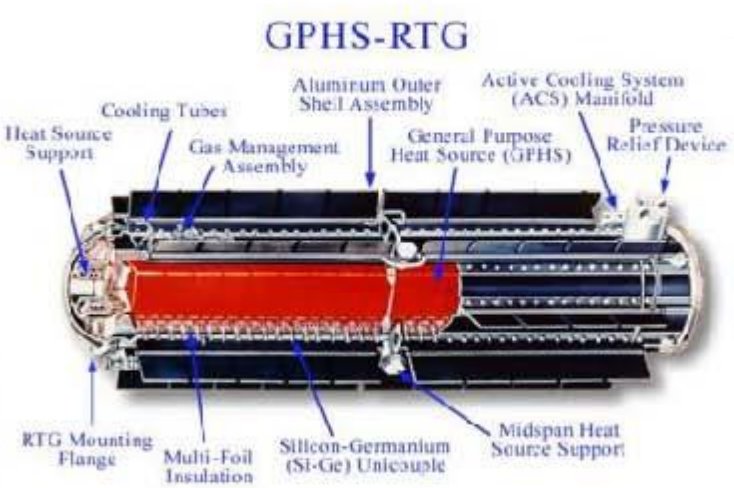


http://solarsystem.nasa.gov/rps/galileo.cfm

Heat to Electric Power Generation



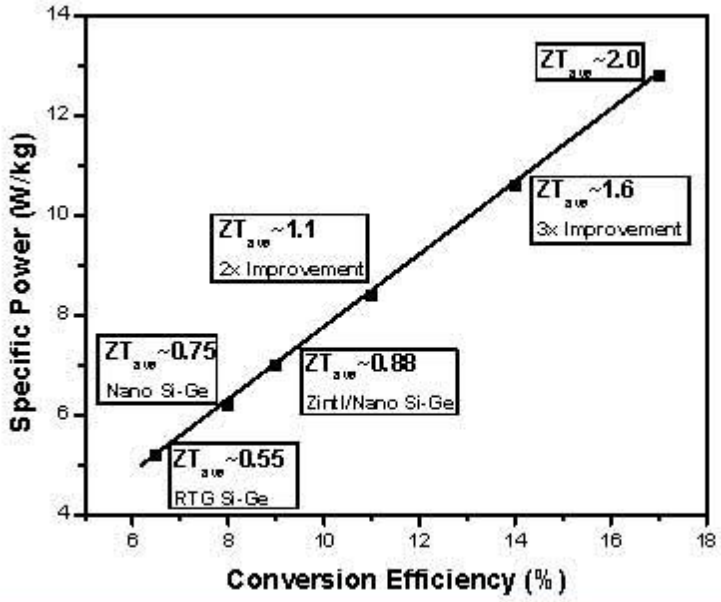




Objective: High Conversion Efficiency

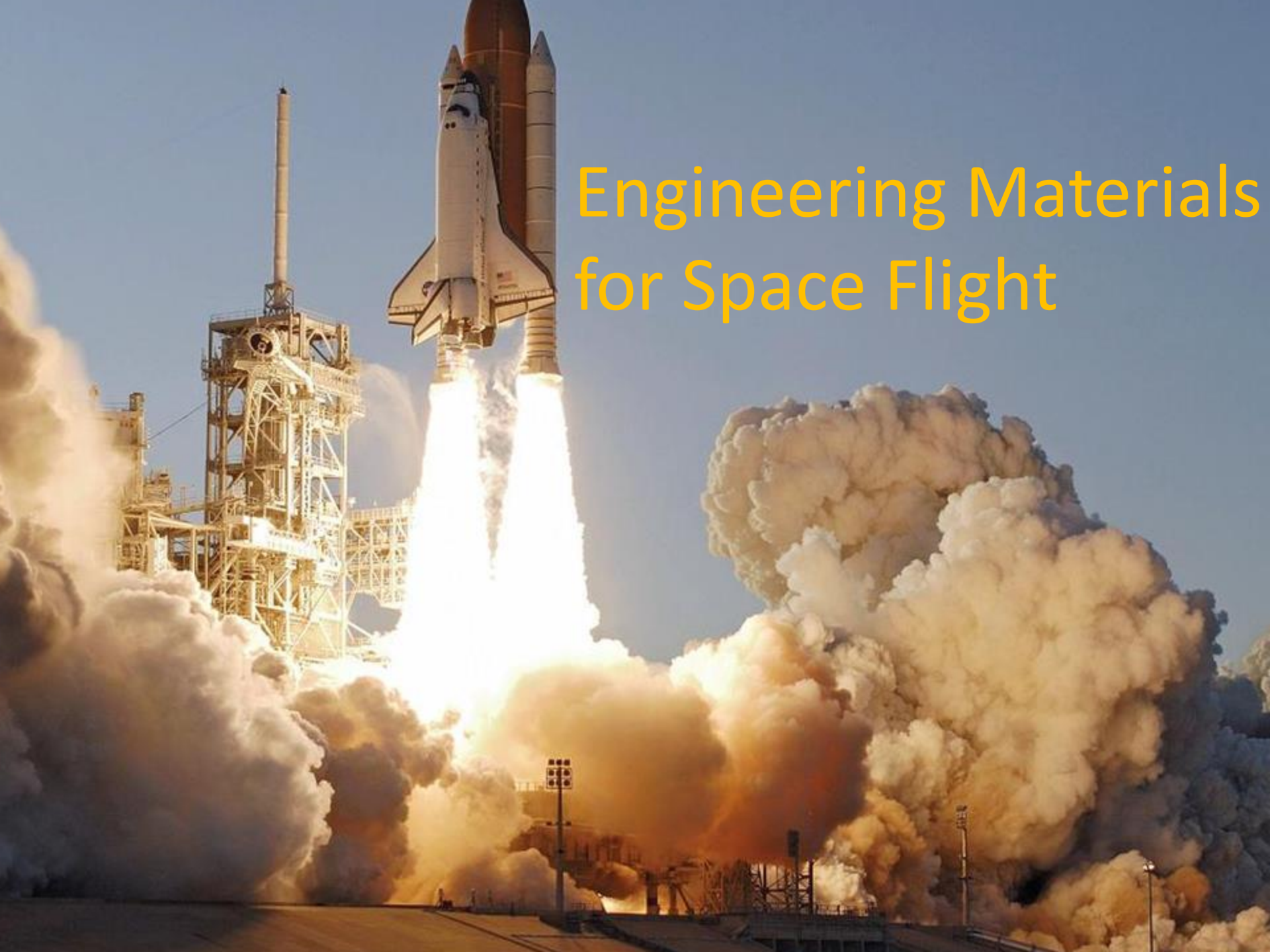
- Reduces Mass, Volume & Cost

Space Power Generation



Waste Heat to Power

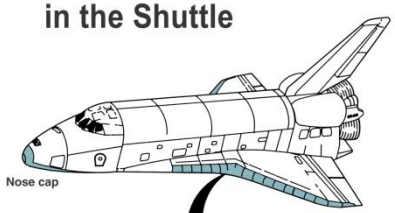
- Waste Heat is one of our most under utilized energy resources
- U.S.-energy consumption ~29 tera-kWh (10^{12})
  Barrels of Oil – 170 giga-barrels (10^{9})
- World-energy consumption ~120 tera- kWh (10^{12})
- 20-65 percent is lost in the form of heat
- Maximizes efficiency
- Reduces CO_2 emission



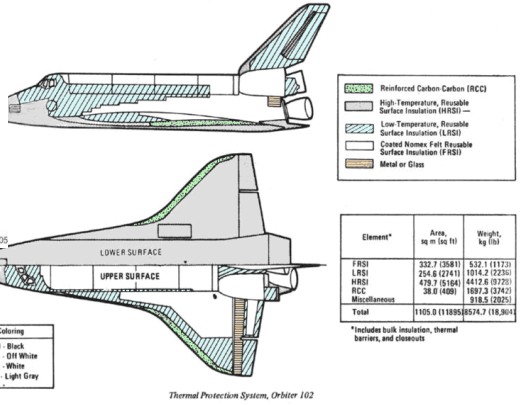
Engineering Materials for Space Flight

Thermal Protection Systems

Reinforced Carbon/Carbon (RCC) in the Shuttle

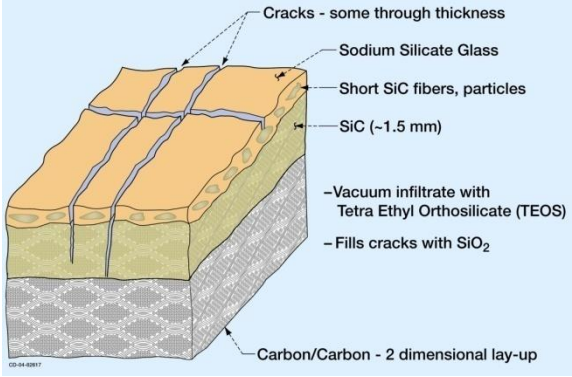


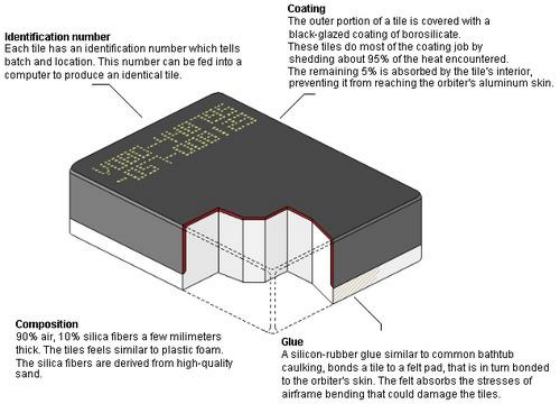
High Temperature Reusable Surface Insulation (HTRSI)



Thermal Protection System, Orbiter 102

Coated Reinforced Carbon/Carbon Composite





Re-entry Environment

- Temperature to 2000 K
- Reduced pressure--0.005 to 0.010 atm
- Gases--O_2, N_2, CO_2
  - Shock leads to O, N and ions
- Short times ~15 minutes/re-entry
- Best simulated with arc-jet

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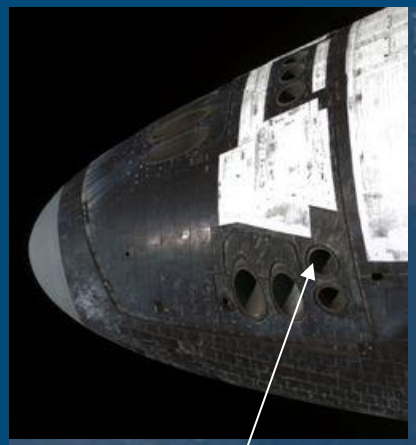
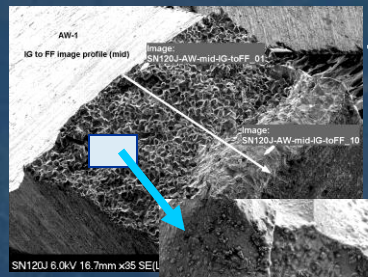


RCS Thrusters

Cracks in flange near bolt holes

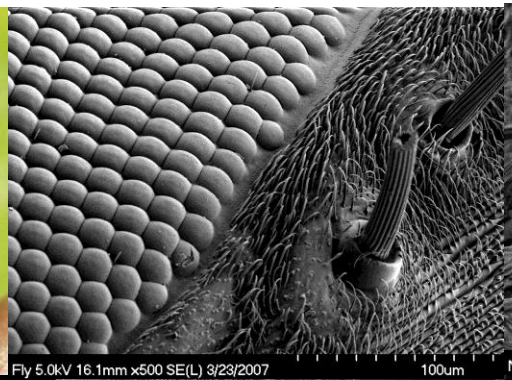


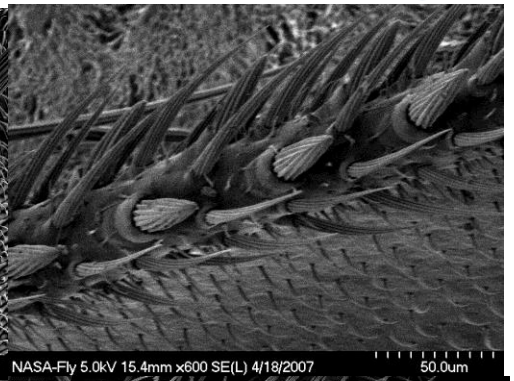
35X

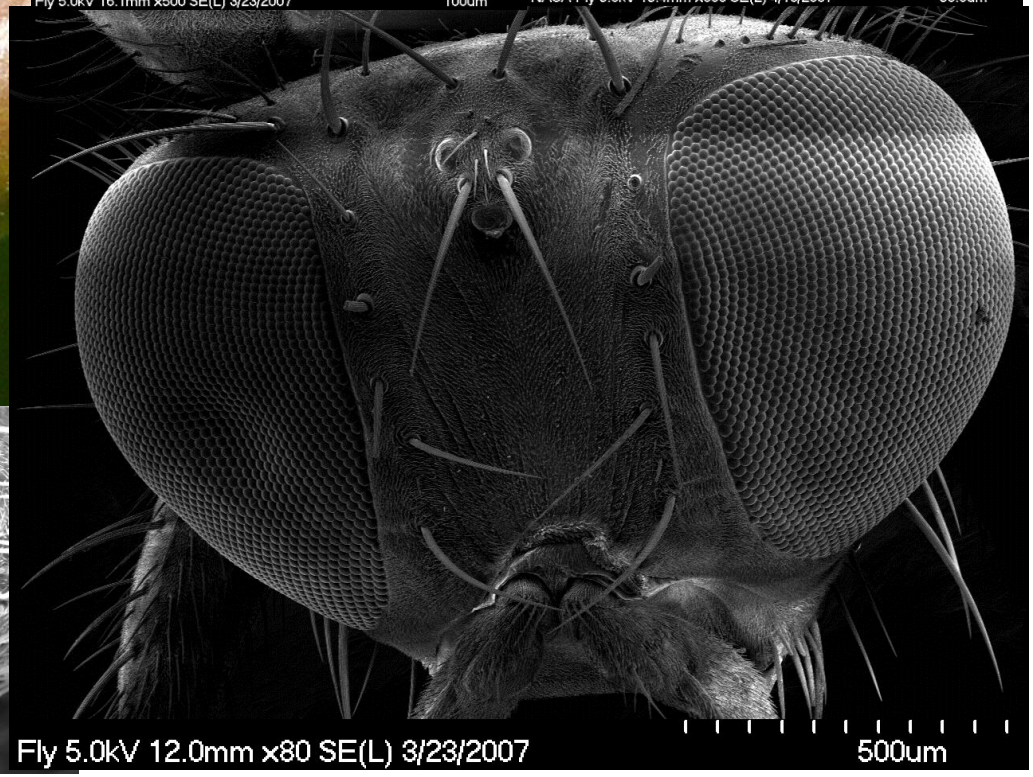
1500 X

REACTION CONTROL THRUSTERS

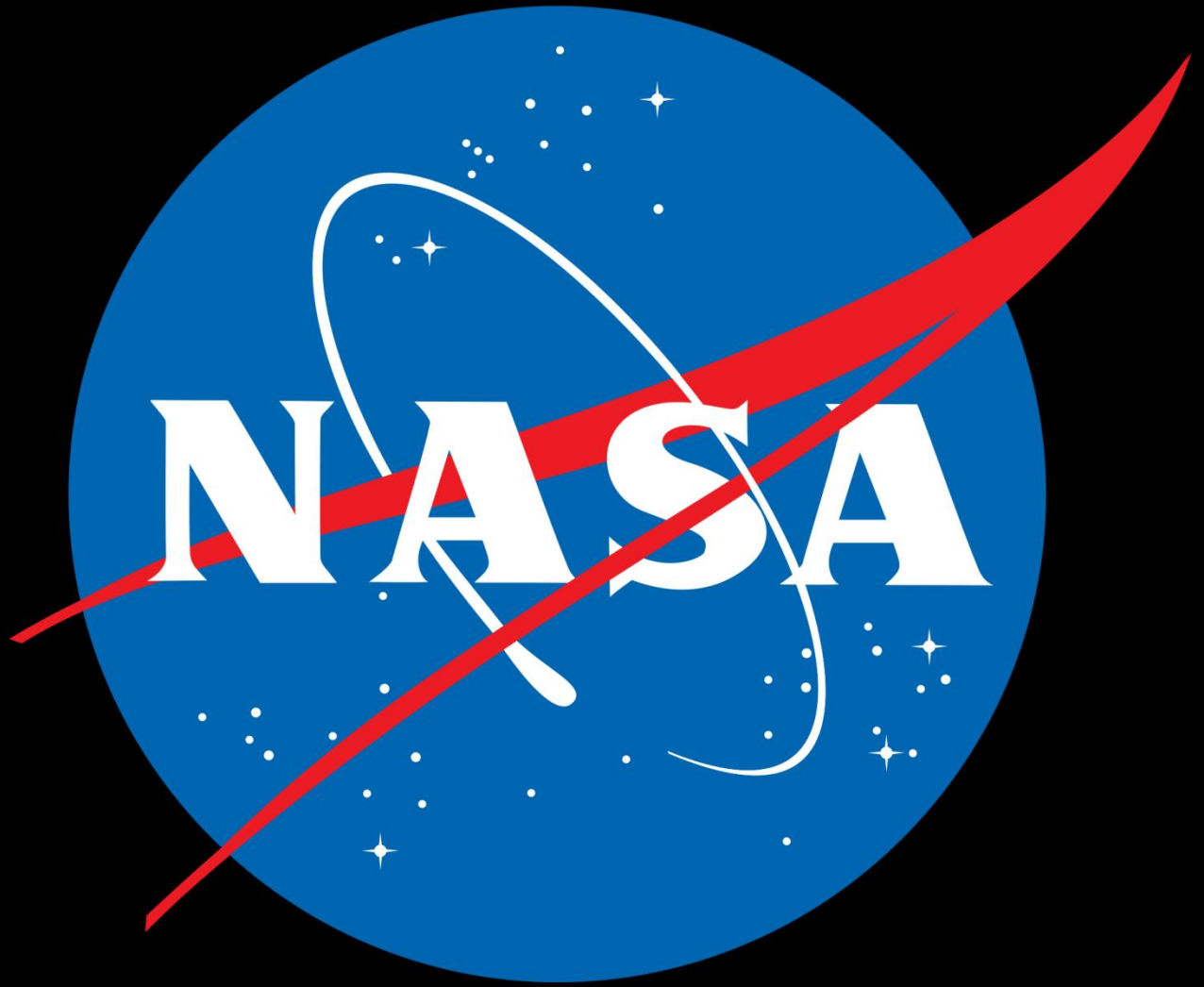
Just for fun…Your Next Picnic!







THANK YOU!!!



QUESTIONS?