UAH Payload Processing Capabilities Overview

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• Research performed by Faculty, Staff, Students across **8 Colleges** and **12 Research Centers**.

• **13th Nationally** by NASA-funded research expenditures and **19th in the Nation** by DOD-funded research expenditures (FY14 NSF Survey Data).
<table>
<thead>
<tr>
<th>Market</th>
<th>NASA</th>
<th>Interagency</th>
<th>International</th>
<th>Commercial</th>
<th>Academia</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ISS Crew, Cargo, Tourism</td>
<td>✓</td>
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<td>✓</td>
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<td>2 Free-Flight Missions</td>
<td>✓</td>
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<td>✓</td>
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<tr>
<td>3 Technology Testbed</td>
<td>✓</td>
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<td>✓</td>
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<tr>
<td>4 On-Orbit Servicing, Assembly, Repair</td>
<td>✓</td>
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<td>✓</td>
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<tr>
<td>5 Commercial Platforms/Services</td>
<td>✓</td>
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<td>✓</td>
<td>✓</td>
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<tr>
<td>6 National Security</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>7 Remote Sensing and Science</td>
<td>✓</td>
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<td>✓</td>
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<tr>
<td>8 LEO Support for Space Exploration</td>
<td>✓</td>
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**Proven Markets**

1. ISS Crew, Cargo, Tourism

**Enabled Markets**

2. Free Flight Missions
3. Technology Testbed
4. On-Orbit Servicing, Assembly, Repair
5. Commercial Platforms/Services
6. National Security
7. Remote Sensing & Science
8. LEO Support for Space Exploration

**NASA CCP Vision: Commercial Economy in LEO**

- Commercial satellite launches
- Government satellites
- ISS cargo
- ISS space tourism
- Industrial research
- Commercial crew
- Technical demonstration launches
- Expanded Spaceport tourism
- Fuel launch to depot
- Sovereign clients
- Private orbital facilities
- Expanded space tourism
- Earth observation and monitoring
- Supporting missions of exploration
- Pharmaceutical and advanced manufacturing

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UAH Relevance to On-orbit Payload Efforts

• Substantial **Past Performance** with Flight-qualified Science Experiments.

• **Technical Expertise** within the UAH Faculty and Staff (>1,500 full-time) across 8 Colleges and 12 Research Centers.

• Access to Innovative Graduate and Undergraduate **Students** (>7,800).

• Extensive **Facilities/Instrumentation**, including clean rooms, across the UAH Campus.

• Close **Proximity** to the Huntsville Airport, allowing for “just-in-time” UAH personnel presence at HSV landing site, and rapid access to campus facilities via I-65.

• Strong existing **Partnerships** with NASA/Marshall, DOD-Team Redstone, Hudson Alpha Institute for Biotechnology – facilitated by very close geographic proximity.

• UAH as a non-profit with **substantial student involvement**.

• Being a public PhD-granting Research University, industry partners can include UAH as a **stable asset** in their long-term business planning.
UAH Space Flight Hardware Heritage

Space Shuttle Flight Payloads

- EIOM-2, STS-8 (Atomic Oxygen Interactions with Materials)
- Spacelab 1, STS-9 (Active Radiation Dosimeter)
- LDEF Experiment, STS-11 (Atomic Oxygen Interactions)
- Spacelab 2, STS-20 (Nuclear Radiation Monitor)
- GAS 007 – STS-61-C (4 Student Experiments)
- GAS 105 – STS- (NLO, Nuclear Track Detectors, immiscible polymers, electrodeposition)
- USML–1 (polymer foam, immiscible polymers, electrodeposition)
- Imaging Spectrometric Observatory, ATLAS-1, STS-45
- Concap II - STS-46, (Atomic Oxygen, electrodeposition, AMS)
- Concap III – (Sintered Metals)
- CMIX – 1 - STS-52 (MDA)
- CMIX-2- STS-56, (MDA)
- Concap IV – STS-57, (NLO)
- Spacehab – 1, STS-57 (Sintered metals, organic separations, 3DMA)
- Concap IV – 2, STS-59, (NLO)
- Spacehab – 2, STS-60, (NLO, Sintered metals, organic separations, ORSEP 3DMA)
- OAST-2, STS-62 (Nuclear Emulsion Technology Experiment)
- Spacehab – 3, STS-63 (ECLIPSE)
- CMIX-3, STS-67, (MDA, Biodyn)
- CMIX-4, STS-69, (MDA, Biodyn)
- Concap IV – 3, STS-69, (NLO)
- USML-2, STS-73, (3DMA)
- Spacehab – 4, STS-77, (Sintered metals, Vapor Transport, Organic Separation)
- Optozone – Mir, (Sintered metals)
- Spacehab – 5, STS-79, (Sintered Metals, 3DMA)
- Optozone – Mir, (Sintered metals)
- Spacehab – 5, STS-79, (Sintered Metals, 3DMA)
- PEP/WCI Mid-Deck Glove box (STS-87)
- Biodyne (STS-95)
- JUSTSAP/3DMA (STS-95)
- Protein Crystal Growth Education Program, STS-106, went to ISS
- PFMI, MSG experiment on ISS
- SUBSA, MSG experiment on ISS
“Don't tell me that man doesn't belong out there. Man belongs wherever he wants to go—and he'll do plenty well when he gets there.”  Wernher von Braun
Research Facilities and Equipment
University of Alabama in Huntsville - Colleges

- Arts, Humanities and Social Sciences
- Business Administration
- Education
- Nursing
- Engineering
  - Chemical and Materials
  - Mechanical and Aerospace
  - Civil and Environmental
  - Electrical and Computer
  - Industrial and Systems

- Science
  - Biological Sciences
  - Chemistry
  - Physics
  - Mathematics
  - Computer Science
  - Space Science
  - Atmospheric Science

- Honors
- Graduate Studies
UAH-Research Centers and Institutes

- Center for Applied Optics (CAO)
  - Nano and Micro Devices Center (NMDC)
- Center for Management and Economics Research (CMER)
- Center for the Management of Science and Technology (CMOST)
- Center for Space Plasma and Aeronomic Research (CSPAR)
- Earth System Sciences Center (ESSC)
- Humanities Center (HC)
- Information Technology Systems Center (ITSC)
  - Center for Modeling, Simulation, and Analysis (CMSA)
- Propulsion Research Center (PRC)
- Research Institute (RI)
  - Aerophysics Research Center
  - Reliability and Failure Analysis Laboratory
- Rotorcraft Systems Engineering and Simulation Center (RSESC)
- Small Business Development Center (SBDC)
- Systems Management and Production Center (SMAP)
Structure-based Drug Design Process
- macromolecular neutron crystallography

Clinical Trials

Chemoinformatics

Drug

Lead Structure

Structure
Two GCF units (GCF-1 and GCF-2) launched on SpaceX-3 on April 18, 2014 and one (GCF-2) returned on SpaceX-3 on May 18, 2014. GCF-1 returned on SpaceX-4 on October 25, 2014.
### Terrestrial vs. Low-Gravity

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<th>Ground</th>
<th>Microgravity</th>
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Length of capillary = 70mm; Inner diameter = 2mm
50% of the atoms in a protein are hydrogen: *The role of hydrogen atoms in protein structures is severely understudied.*

The only technique to-date to definitively identify and locate hydrogen atoms is MNC. *Large volume crystals are required.*

Structure-based drug design process requires the knowledge of **ALL** atom placements in the targeted molecule. *The cost of downstream drug testing is affected by the accuracy of the initial target structure.*
Oak Ridge National Laboratory (ORNL)
Spallation Neutron Source (SNS)
MaNDi, TOPAZ, IMAGINE

Forschungszentrum (FRM-II)
Juelich
BIODIFF

Japan Proton Accelerator Research Complex (J-PARC)
IBIX

3-4 hour drive to ORNL

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Marshall Space Flight Center

Electrostatic Levitator

Corporate Sponsor: Dow Corning
RSESC-NASA Projects

- RSESC staff has built, developed, supported MSFC on over 60 payload projects.
- Payloads vehicles include:
  - Space Shuttle
    - Internal Payloads
    - Satellites
    - Shuttle Bay Payloads
  - Space Station
    - FRAM
    - EXPRESS Lockers
    - Glovebox
  - KC-135
  - NASA Drop Tube and Drop Tower
  - Satellites
  - Long Duration Balloons
  - CONUS Balloons
  - WB-57, ER2, DC-8
  - Global Hawk
ISS Glovebox Experiments

Pore Formation & Mobility Investigation (PFMI)
Solidification Using a Baffle in Sealed Ampoules (SUBSA)

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Center for Applied Optics: WAVE : Response to Columbia Accident Investigation Board

A Collaboration with NASA MSFC to design and build a telescope on a mobile platform to observe the Shuttle launch as never seen before.
NMDC Cleanroom

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Reliability and Failure Analysis Lab

This multi-disciplinary organization provides customers with the latest developments in the field of reliability. Our students have hands on experience with tools that support research efforts, developing experienced candidates for the engineering workforce.

Government and commercial clients.

Commercial customer focus on verifying that products meet or exceed the stated standards for reliability and maintainability. Our analysis impacts their designs resulting in cost effective design changes and optimization of vendor selection.

- Halt Chamber
- Dynamic Vibration System
- Thermal Shock
- Autoclave
- Industrial Oven
- Cyclic Corrosion Test Chamber
- Altitude Chamber
- Environmental Chambers

- Drop Tester
- Tensile Fatigue Testing System
- Accelerometer Calibration System
- Modal Exciter
- Thermogravimetry (TGA)
- Dynamic Mechanical Thermal Analysis (DMTA)
- Differential Scanning Calorimetry (DSC)
- Thermal Conductivity Tester

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Thank You!
Questions - Comments