The Next Generation of Explorers
GRC Update - Overview & Opportunities for Collaboration
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Outline

• GRC Overview
• Opportunities for Collaboration / Technologies for Advanced Concepts
• GRC Engagement Portfolio
• Public Outreach
• Spring’20 Internship Opportunities for Students
• Contact Information
• Useful Links
• Questions
Center Overview - Vision and Mission

- **NASA Vision:** To discover and expand knowledge for the benefit of humanity.

- **NASA Mission:** Lead innovative and sustainable program of exploration with commercial and international partners to enable human expansion across the solar system and bring new knowledge and opportunities back to Earth.
  
  - Support the growth of the Nation’s economy in space and aeronautics, increase understanding of the universe and our place in it, work with industry to improve America’s aerospace technologies, and advance American leadership.

- **Glenn Mission:** Drive research, technology, and systems to advance aviation, expand human presence across the solar system, enable exploration of the universe, and improve life on Earth.
GRC Overview - Glenn Campuses

Lewis Field (Cleveland)
- 350 acres
- 1486 civil servants and 1,528 contractors
- 75 Pathways Interns (not included above)

Plumbrook Station (Sandusky)
- 6500 acres
- 24 civil servants and 105 contractors
- 1 Pathways Intern (not included above)
Center Overview - Glenn Civil Service Workforce

- 68 percent of the workforce charge their time directly to technical missions

- 68 percent of scientists and engineers earned advanced degrees, 24 percent with Ph.D.’s

As of 6/2018

*Projected Workforce Level
Center Overview – Glenn Economic Impact

Employees Contribute $90M in State and Local Income Taxes

<table>
<thead>
<tr>
<th>Impact</th>
<th>Northeast Ohio</th>
<th>State of Ohio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>$1.4 B</td>
<td>$1.5 B</td>
</tr>
<tr>
<td>Value Added</td>
<td>$742 M</td>
<td>$776 M</td>
</tr>
<tr>
<td>Employment</td>
<td>$7,271 Jobs</td>
<td>7,603 Jobs</td>
</tr>
<tr>
<td>Labor Income</td>
<td>$485 M</td>
<td>$511 M</td>
</tr>
<tr>
<td>Taxes</td>
<td>$124 M</td>
<td>$129 M</td>
</tr>
</tbody>
</table>

NOTE: Data from an Economic Impact Study prepared by Cleveland State Univ., June 2018
Center Overview - Glenn Awards and Recognition

R&D 100 Awards
Total of 125 awards, highest in the Agency, in these disciplines
- Propulsion systems
- Materials and structures
- Aerospace communications
- Power and energy conversion

Collier Trophy
- Contributions to airline accident reduction (2008)
- Advance turboprop technology (1988)
- Thermal ice prevention systems (1946)

Patents
- Currently
  - 167 to Glenn
  - 175 to Glenn partners

Federal Laboratory Consortium
- 17 FLC National Awards
- 11 FLC Midwest Awards

Space Technology Hall Of Fame
- Software Defined Radio
- GATR ground antenna transmit and receiver
- ACTS communication satellite
- PMR-15 Polymide resin

Emmy
- Contributions to the Communications Technology Satellite (1987)

NASA Software of the Year
- 1 Winner 4 Co-winners
- 7 Runner-ups
- 2 Honorable Mentions

NASA Invention of the Year
- 2 Winners 2 Runner-ups
- 5 Honorable Mentions

Presidential Rank (2005 to 2018)
- 25 Meritorious
- 7 Distinguished
Opportunities for Collaboration - Areas of Expertise - Strong Foundation
Expertise helps to meet GRC commitments/Grow Center in areas for its future

Aircraft Propulsion
Space Propulsion and Cryogenic Fluids
Physical Sciences and Biomedical Technologies in Space
Communications Technology and Development
Power, Energy Storage and Conversion
Materials and Structures For Extreme Environments
Opportunities for Collaboration-NASA Aeronautics Programs

**Advanced Air Vehicle Program**
- Enable new aircraft to *fly safer, faster, cleaner, quieter*, and *use fuel efficiently*.
- Innovate *design concepts* developed for advanced vehicles *integrate multiple* simultaneous vehicle performance considerations that focus on fuel burn, noise, emissions and intrinsic safety.

**Transformative Aeronautics Concepts Program**
- Cultivates *multi-disciplinary*, revolutionary concepts to *enable aviation transformation*.
- Sharply *focused research* provides *flexibility* for innovators to *explore technology feasibility* and provide the knowledge base for radical transformation.
Opportunities for Collaboration-NASA Aeronautics Programs

Airspace Operations and Safety Program (AOSP)

- **AOSP works** with the Federal Aviation Administration, industry and academic partners to conceive and develop Next Generation Air Transportation System (NextGen) technologies to further improve the safety of current and future aircraft.

Integrated Systems Research Program

- **Conducts** flight-oriented, integrated, system-level research & technology development that supports flight research needs across the ARMD strategic thrusts, the programs and their projects. IASP is focused on rigorous execution of complex flight tests & related experiments.
Technologies for Advanced Concepts

NASA Glenn - Aeronautics

- Supersonics
- Advanced Propulsion and Airframe Integration
- Electrified Aircraft
- Small Core
- Engine and Airframe Icing
- Propulsion Acoustics
- Hypersonics
- Urban Air Mobility
Space Science

Radioisotope Power Systems (RPS)
- RPS Program Management
- Dynamic Power Conversion Technology

Planetary Science
- NASA Evolutionary Xenon Thruster – Commercial (NEXT-C) for future science missions (DART, CAESER)
- Extreme environment testing facilities
  - Glenn Extreme Environments Rig (GEER)
    - World-class capability to simulate harsh environments, such as on Venus
- Venus missions and instruments

Earth Science
- Airborne hyperspectral monitoring of harmful algal blooms (Lake Erie)
Human Exploration

Orion Multi-Purpose Crew Vehicle (MPCV)
• Lead European Service Module (ESM) integration
• Conduct Orion/ESM testing at Plum Brook Station
• Support Vehicle Integration and Production Operations

Space Launch System (SLS)
• Lead Universal Stage Adapter (USA)
• Lead the fairing development for the cargo version of SLS

Commercial Crew/Cargo
• Reimbursable Space Act Agreements for engineering support and testing
  – SpaceX
  – Sierra Nevada
  – Boeing
  – Others
Space Operations

International Space Station (ISS)
- Develop and Operate ISS Microgravity Experiments
  - Fluid physics and combustion science research

- Human Research Program
  - Human health/exercise countermeasures
  - Exploration medical capability
  - Computational modeling

- ISS Electrical Power System
  - Sustaining engineering and analysis
  - Lithium-ion battery development/deployment

Space Communications and Navigation (SCaN)
- Advanced Communications Technology
  - Cognitive communications
  - RF propagation
  - RF/Optical hybrid technology
  - Beaconless pointing
  - Quantum communication and encryption

- Spectrum Management and Spectrum Analysis
GRC Engagement Portfolio

- **Space Grant**
  - GRC Specialist – M. David Kankam

- **Minority University Research and Educational Project (MUREP)**
  - MUREP Aerospace Academy – Priscilla Mobley
  - MUREP Institutional Research Opportunity (MIRO) – M. David Kankam

- **NextGen STEM** – Maria Arredondo

- **NASA Internship and Fellowships (Students)**
  - Internships – Vanessa Webbs
  - Fellowships – M. David Kankam

- **NASA Postdoctoral Fellowship** – M. David Kankam

- **NASA Glenn Faculty Fellowship** – M. David Kankam

- **Educator Professional Development Collaborative (EPDC)** – Susan Kohler
Public Outreach

- **University Student Design Challenge (USDC-4)**
  - Register at: [https://www.nasa.gov/content/university-student-design-challenge-2019-2020](https://www.nasa.gov/content/university-student-design-challenge-2019-2020)
  - Opens - , Closes – 10/18/'19

- **Aeronautics Projects:**
  - Hierarchical Control of Propulsion, Power, and Thermal Management for Electrified Aircraft Propulsion System
  - Automatic Dependence Surveillance Broadcast (ADSB) for Situational Awareness of Autonomous Unmanned Aerial Vehicles (UAV's)

- **Space Projects:**
  - Enabling the Next Generation of Space Travel
  - Exploring and Utilizing the Lava Tubes of the Moon

- Kick-off -11/6/'19; Winners Announcement - 4/13/'20
Public Outreach

• GRC-Academia Snr.-Yr. Capstone Collaboration
  ➢ Registration **closed** on Sept. 12/’19

• University Day – Internship Awareness (Oct/Nov)
  ➢ Opportunity to increase- (a) Students’ awareness of GRC facilities & hosted Internships
    (b) Minority applicant pool through knowledge sharing

• NASA Glenn Faculty Fellowship Program (NGFFP)
  ➢ Application for 2020 Enrolment -
  ➢ Opened – Aug. 12/’19;  **Closes** – Oct. 18/’19 at 11:59 PM

• NASA Postdoctoral Program (NPP) - [https://npp.usra.edu](https://npp.usra.edu)
  ➢ Application Acceptance: July 2 - Nov. 1;  Next Cycle: Nov. 2 - Mar. 1
## GRC: Spring 2020 Internship Opportunities for Students

<table>
<thead>
<tr>
<th>Opportunity</th>
<th>Areas of Expertise</th>
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<tbody>
<tr>
<td>Condensing Heat Exchanger for Space Systems - Lab Work Internship</td>
<td>6</td>
</tr>
<tr>
<td>Converting Applets to Javascript for Web-based Simulations in Aeronautics</td>
<td>6</td>
</tr>
<tr>
<td>Development and Evaluation of Electrified Aircraft Propulsion Control Systems</td>
<td>1, 4</td>
</tr>
<tr>
<td>Synthesis and Characterization Ceramic Aerogels and their Composites</td>
<td>5</td>
</tr>
<tr>
<td>Materials Development for High Temperature Environments</td>
<td>1, 5</td>
</tr>
<tr>
<td>Metallurgical Laboratory Assistant</td>
<td>1, 4, 5</td>
</tr>
<tr>
<td>Office of STEM Engagement (OSTEM) Customer Service Intern</td>
<td>Center Operations</td>
</tr>
<tr>
<td>Photovoltaic Device Testing for Space and Lunar Surface Missions</td>
<td>4</td>
</tr>
<tr>
<td>Polymer Aerogels for Energy Absorption, Filtration, and Acoustic Impedance</td>
<td>5</td>
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1. Aircraft Propulsion  
2. Communications Technology and Development  
3. Space Propulsion and Cryogenic Fluids Management  
4. Power, Energy Storage, and Conversion  
5. Materials and Structures for Extreme Environments  
6. Physical Sciences and Biomedical Technologies in Space
### GRC: Spring 2020 Internship Opportunities for Students - contd

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<tr>
<td>Power for Interstellar Fly-By Mission</td>
<td>4</td>
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<tr>
<td>Propellant Gauging Algorithms and Analysis</td>
<td>3</td>
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<tr>
<td>Reduced Gravity Cryogenic Transfer Project</td>
<td>3</td>
</tr>
<tr>
<td>Robotic Arm Antenna Near Field Scanning System</td>
<td>2</td>
</tr>
<tr>
<td>Shape Memory Material Database- Data extraction for the &quot;Alloys&quot; category</td>
<td>5</td>
</tr>
<tr>
<td>Superconducting Coil Testing and Modeling for Future Electric Aircraft</td>
<td>1, 3, 4</td>
</tr>
<tr>
<td>Ultra Sound Measurement Techniques for Turbomachinery Applications</td>
<td>1</td>
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Contact Information

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E-mail: Mark.D.Kankam@nasa.gov
Useful Links

• GRC Website:
  ➢ https://www.nasa.gov/centers/glenn/home/index.html

• NASA GRC Office of Education
  ➢ https://www.nasa.gov/centers/glenn/education/index.html
Questions?