NASA GRC-Academia Collaborative Opportunities

M. David Kankam, Ph.D.
University Affairs Officer
NASA Glenn Research Center / Cleveland, OH

Presented at Southeastern Regional
Space Grant Directors Meeting, Lexington/KY

Sept. 28, 2016
Items Covered

- Introduction to GRC
- Representative Opportunities for Collaboration
- University/Higher Ed. Progs. – Pathways for Collaboration
- NASA Higher Education Pipeline Projects
- Key Calendar Dates for University/Higher Ed. Programs
- NASA Internship – Spring 2017 Opportunities @ Glenn
- Noteworthy Websites for Faculty / Students Engagements
- Team Opportunity: University Student Design Challenge
- Contact Information
Maple Brook Station Test Site
(Sandusky)
• 6500 acres
• 11 civil servants and 102 contractors

Lewis Field
(Cleveland)
• 350 acres
• 1626 civil servants and 1511 contractors

As of Jan., 2013
Representative Opportunities for Collaboration

• **Air-Breathing Propulsion**
  - Aeropropulsion Research & Technology
    - Ascent & Thermal Propulsion; Thermal Systems; Engine Combustion
    - Propulsion Systems; Combustion and Reaction Physics
    - Turbomachinery & Turboelectric Systems; Acoustics; Icing

  - Cross-Cutting Engineering Disciplines
    - Fluid & Cryogenics Systems; Thermal Systems

• **Multidisciplinary Research [Physical Sciences & Biomedical Technologies in Space]**
  - Fluid Physics & Transport, and Combustion Physics & Reacting Processes

• **Long-Term Collaboration Topics:**
  - Aviation safety improvements with advanced fuels / Green fuels for aviation

• **In-Space Propulsion Systems & Technologies**
  - Electric & Chemical Propulsion Systems
Representative Opportunities for Collaboration

• **Communications Technology and Development – Elements are:**

  ➢ **Space Comms. (SpaceComm) & Aeronautics Comms. (AeroComm)**
    - Networks, Architectures & Systems Integration; Information & Signal Processing; Advanced High Frequency; Optical Commns.

  ➢ **Intelligent Systems – Cross-Cutting Competencies**
    - Expertise in:
      - Optics & Photonics; Smart Sensors Systems; Instrumentation-Electronic;
      - Controls – Dynamic System Modeling & Controls

  ➢ **Areas for Potential Collaboration**
    - Advanced RF Antenna & Optical Technologies (Novel Optical Comm. Architectures – Increase data rate from Mars to Earth, 6Mbps to 250Mbps)
    - Cognitive Radio & Signal Processing Technologies
    - Smart Sensors and Electronic Systems Technologies
    - Control, Simulation & Embedded Hardware Technologies
Representative Opportunities for Collaboration

• **Power, Energy Storage and Conversion**
  - Power Architecture, Mgt. & Distribution;
  - Photovoltaic & Electrochemical Systems
  - Thermal Energy Conversion;

➢ **Topics for Potential Collaboration**
  - Photovoltaics for low intensity and low temperature operation
  - Concepts for removal of dust from Lunar or Mars surface solar arrays
  - Solid oxide fuel cells with on-cell reforming of methane
  - High Efficiency solid-state heat-to-electricity conversion
  - Autonomous control & fault management/recovery of space power systems
  - Radiation-tolerant, high-voltage (300-600V) SiC power electronics
Representative Areas of Engagement & Collaboration - cont’d

- **Materials and Structures for Extreme Environments**
  - High Temp. Materials (Ceramic Matrix Composite, Thermal Protection Seal)
  - Electric Propulsion Materials (High Pwr. Density Elec. Motors SiC Semiconductor)
  - Lightweight Concepts (Aerogel, Nanomaterials)
  - Mechanisms and Drive Systems (Shape Memory Alloy-Based Actuation)
  - Computational Modelling;
  - Flight Structures (Low Impact Docking Seal, Vibration Testing)

- **Potential Opportunities for Collaboration**
  - Multifunctional materials (For sensing, thermal mgt. and energy storage)
  - Big data analytics tools-based computational modeling of materials
  - Modeling of fabrication processes for composite materials
  - Advanced magnetic materials
  - Multiscale modeling of materials and structures
University/Higher Education Programs – Pathways for Collaboration

University / HE Programs
University Affairs Officer,
Dr. Mark (Dave) Kankam
216-433-6143

Vanessa Webbs, PM-Internships & Scholarships
Lynne Sammon, Ed. Progs. Specialist

Internships
- High School
- UG/Grad
- Externally & Internally Funded

Scholarships
- Aero Scholarship Program (ASP)

NASA Space Academy at Glenn
GRC Mentors

NASA MARTI at Glenn
GRC Mentors

Fellowships
- Advanced STEM Training and Research
- Jenkins Graduate Fellowship
- Graduate Aeronautics

Interns/Research Associates (Undergraduates and Graduates)

MARTI – Multidisciplinary Aero Research Team Initiative
Important Calendar Dates of Higher Ed. Progs. - by Session

• **Internship Application Period** (Apply at- [https://intern.nasa.gov](https://intern.nasa.gov))
  - Spring Appln.: Early June– Mid Oct.; Session- Early Jan.-End Apr. (16 wks)
  - Summer Appln.: Early Nov.– Early Mar.; Session– Early June – Mid Aug. (10)
  - Fall Appln: Early March- End May; Session – End Aug.-Mid Dec. (16 wks)
  - Year-Long Appln: Any time; Session -16 wks + (Single or multiple terms)

• **Scholarship Application Period for Academic Year 2016-2017**
  - Opening Date – Nov’/16 target;   Profile & Update at - [https://intern.nasa.gov](https://intern.nasa.gov)

• **Student Fellowship Application Period for Academic Year 2016-2017**
  - Opening Date – Nov’/16 target;   Profile & Update at - [https://intern.nasa.gov](https://intern.nasa.gov)
  - Apply at - [https://nspires.nasaprs.com/external/solicitations/summary](https://nspires.nasaprs.com/external/solicitations/summary)

• **Glenn Faculty Fellowship Prog.-** [http://www.nasa.gov/centers/glenn/education](http://www.nasa.gov/centers/glenn/education)
  - Applns. Date: Mid Oct. thru end Jan./’17;   Session: Early June-Mid Aug

• **NASA Space Academy at Glenn**
  - [https://academy.grc.nasa.gov](https://academy.grc.nasa.gov) (Apply at- [https://intern.nasa.gov](https://intern.nasa.gov), by 1/30)

• **NASA Multidisciplinary Aeronautics Research Team Initiative (MARTI)**
  - [https://academy.grc.nasa.gov](https://academy.grc.nasa.gov) (Apply at- [https://MARTIapp.com](https://MARTIapp.com), by 1/30)
### NASA Internship – Spring 2017 Opportunities @ Glenn: 1/9-4/28

<table>
<thead>
<tr>
<th>Opportunity Title</th>
<th>Core Competency</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Temperature Metallics for Hypersonic Vehicle Applications</td>
<td>Air Breathing Propulsion and Materials Structures for Extreme Environments</td>
</tr>
<tr>
<td>Exploring the Depths of Kraken Mare - Thermal Analysis for the Saturn Titan Submarine</td>
<td>Air Breathing Propulsion; Communications Technology and Development; and In-Space Propulsion and Cryogenic Fluids Management</td>
</tr>
<tr>
<td>Cryogenic Propellant Transfer Models for Space Propulsion Systems</td>
<td>Air Breathing Propulsion; Communications Technology and Development; and In-Space Propulsion and Cryogenic Fluids Management</td>
</tr>
<tr>
<td>Modeling and Testing of Novel Cryogenically Cooled Hybrid Electric Aircraft System</td>
<td>Air Breathing Propulsion; Communications Technology and Development; In-Space Propulsion and Cryogenic Fluids Management; and Power, Energy Storage and Conversion</td>
</tr>
<tr>
<td>Testing of Additively Manufactured Hall Thruster</td>
<td>In-Space Propulsion and Cryogenic Fluids Management</td>
</tr>
<tr>
<td>Permeability Characterization of Aerogel Composites</td>
<td>Materials and Structures for Extreme Environments</td>
</tr>
<tr>
<td>Gear Research for Aerospace Applications</td>
<td>Materials and Structures for Extreme Environments</td>
</tr>
<tr>
<td>Aerogels for Conformal Antennas</td>
<td>Materials and Structures for Extreme Environments</td>
</tr>
<tr>
<td>Opportunity Title</td>
<td>Core Competency</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------</td>
</tr>
<tr>
<td>Polymer Matrix Composite Fabrication and Testing</td>
<td>Materials and Structures for Extreme Environments</td>
</tr>
<tr>
<td>Lumped Parameter Models of the Cardiovascular and Central Nervous System for VIIP</td>
<td>Physical Sciences and Biomedical Technologies in Space</td>
</tr>
<tr>
<td>Development of a High Power, High Efficiency, Class-F Type, Ka-Band, Gallium Nitride (GaN), Solid-State Power Amplifier (SSPA)</td>
<td>Communications Technology and Development</td>
</tr>
<tr>
<td>Development of a Ka-Band Offset fed Parabolic Reflector Antenna with a Planar Array Feed System</td>
<td>Communications Technology and Development</td>
</tr>
<tr>
<td>Turbomachinery Simulations using High-Order Discontinuous Galerkin Methods</td>
<td>Air-Breathing Propulsion</td>
</tr>
<tr>
<td>Air temperature probe characterization for icing applications</td>
<td>Air-Breathing Propulsion</td>
</tr>
<tr>
<td>Lithium-Air Batteries for Electric Aircraft</td>
<td>Power, Energy Storage and Conversion</td>
</tr>
<tr>
<td>Polymer Aerogel Synthesis</td>
<td>Materials and Structures for Extreme Environments</td>
</tr>
</tbody>
</table>
**Noteworthy Websites for Faculty/Student Engagements**

*NIFS Application ➔ OSSI (One Stop Shopping Initiative)*
- [http://intern.nasa.gov/](http://intern.nasa.gov/)

*NASA Space Academy at Glenn*
- [https://academy.grc.nasa.gov](https://academy.grc.nasa.gov) (Application at OSSI)

*NASA Multidisciplinary Aeronautics Research Team Initiative (MARTI)*
- [https://MARTIapp.com](https://MARTIapp.com)

*NASA Postdoctoral Program (NPP)*
- [http://nasa.orau.org/postdoc/](http://nasa.orau.org/postdoc/) (Transitions to USRA after 1/16/'16)

*NASA Glenn Faculty Fellowship Program (NGFFP)*
- [http://www.nasa.gov/centers/glenn/education/index.html](http://www.nasa.gov/centers/glenn/education/index.html)

*NASA Space Technology Research Fellowships / Grants*
*National Space Grant College & Fellowship Program /EPSCoR  
  •  http://www.nasa.gov/offices/education/programs/national/spacegrant/home/index.html

*NASA Solicitation & Proposal Integrated Review & Evaluation System (NSPIRES)  
  ➢ Includes information on: 
    o NASA MUREP Institutional Research Opportunity (MIRO)  
      •  https://npires.nasaprs.com/external/solicitations/summary

* NASA Research Announcements (NRAs)  
  ➢ Includes Education Opportunities in NASA STEM (EONS)  
Future Air Vehicles

How would a community look if aeronautical vehicles were used as a means to travel within city limits?

Gather a multidisciplinary team with a minimum of three students

- Full-time, sophomore through senior undergrads
- Universities may allow Capstone credit to senior students
- Science, Technology, Engineering, Arts, and Mathematics

CONSIDERATIONS

ENERGY CONSUMPTION
NOISE
EMISSIONS
COST
ALTERNATIVE ENERGY
SAFETY

Register by November 23, 2016
http://www.nasa.gov/feature/university-student-design-challenge

For questions, email grc-university-design-challenge@mail.nasa.gov
Team Opportunity: University Student Design Challenge-GRC

- **Goals/Objectives:** Engage teams of STEAM students to **conceptually design** air vehicles to transport passengers from nodes at urban cities
  - Alleviate traffic congestion; Gain seamless commute

- **Purpose:** Reduce U.S. & global urbanization travel congestion & noise; improve safety & health
  - Efficiently connect travelers to, & within nodes

- **Approach:** Consider aviation-based “multimodal outer-belt” concept – Vehicles move commuters between nodes connecting hwys, regional a’ports, rail & bus stns.

- **Consider:** Range, air speed, payload); Hybrid or Fully Electric vehicle; Propulsion system architecture; VTOL & STOL; Piloted or UAV

- **Academic Majors:** Aerospace/Elec./Mech. Engg, Physics, Economics, Sociology Economics, Transportation/Energy Systems

- **Milestones:** Challenge Begins -Spring 2017; Registration Deadline – 11/23/’16; Culmination Event – 4/21/2017 (Cleveland)

- **Additional Info, E-mail:** grc-university-design-challenge@mail.nasa.gov

- **Register at:** [http://www.nasa.gov/feature/university-student-design-challenge](http://www.nasa.gov/feature/university-student-design-challenge)
Contact Information

* University Affairs Officer – GRC
Director of Space Academy & MARTI @ Glenn
NASA Glenn Research Center,
21000 Brookpark Rd., MS 7-4
Cleveland, OH 44135

Phone: Voice ➔ (216) 433-6143; Fax ➔ -3678

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

• Glenn Office of Education Website (For Program Details):
  http://www.nasa.gov/centers/glenn/education