Composites for Space Applications

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Remarks

- Welcome to Composite Conference 2012
- Special thanks and welcome to participants in the NASA Composite Summit that started this collaboration.
- Special Thank You!
  - Joshua Jackson (MKF), Harold Beeson (NASA), James Fekte (NIST) and Antonio Ruiz (DOE) for chairing the conference
  - Session chairs and all NASA and NIST staff who worked hard to organize the conference with MKF
  - New Mexico State DACC’s president Dr. Margie Huerta for hosting us in the East Mesa Facility
  - Angelique Lasseigne (G2M2) Crystal Lay (NMSU Mechanical and Aerospace Engineering) and Charles Nichols (NASA) for making STEM student sponsorship possible.
Why are we here?

- Need high strength materials in mass and cost constrained applications
  - Additional knowledge needed to use composites in our applications more efficiently
  - Non-homogenous material
  - Anisotropic structures
  - Viscoelastic response to loading
  - Multiple material interfaces

- Composite use in space systems requires
  - Advanced structural models
  - Life and failure mode prediction
  - Harmonized codes and standards
  - Materials and processes that address composite component variability
  - Reliable nondestructive evaluation
## NASA’s Use of Composites

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<th>Period</th>
<th>Vehicles/Programs</th>
<th>Applications</th>
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<td>Future</td>
<td>NASA Space Technology Roadmaps</td>
<td>Composite is Cross cutting technology, TA12, TA7</td>
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<td>Today</td>
<td>NASA’s COTS &amp; CCDEV Vehicles</td>
<td>Composite Pressure Vessels, Composite Structure</td>
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<td>Today</td>
<td>Space Launch System</td>
<td>Composite Pressure Vessels, Composite Structure</td>
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<td>Today</td>
<td>Orion</td>
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<td>1990s</td>
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<td>1970s</td>
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<td>Composite Pressure Vessels, Composite Wing Leading Edge</td>
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<td>1960s</td>
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Crosscutting for Space Technology Roadmaps

- Composites are a crosscutting technology for NASA’s future missions.
  - Mars Precursor Missions & Heavy Lift Vehicle (2020)
  - Advanced In-space Propulsion (2025)
  - Space Platforms (2030)

- Information on technology roadmaps can be found at:
  [http://www.nasa.gov/offices/oct/home/roadmaps/index.html](http://www.nasa.gov/offices/oct/home/roadmaps/index.html)
## Composites Need: Space Technology Roadmap

### 2.1 Materials
- **2.1.1 Lightweight Structure**
- **2.1.2 Computational Design**
- **2.1.3 Flexible Material Systems**
- **2.1.4 Environment**
- **2.1.5 Special Materials**

### 2.2 Structures
- **2.2.1 Lightweight Concepts**
- **2.2.2 Design and Certification Methods**
- **2.2.3 Reliability and Sustainment**
- **2.2.4 Test Tools and Methods**
- **2.2.5 Innovative, Multifunctional Concepts**

### 2.3 Mechanical Systems
- **2.3.1 Deployables, Docking and Interfaces**
- **2.3.2 Mechanism Life Extension Systems**
- **2.3.3 Electro-mechanical, Mechanical and Micromechanisms**
- **2.3.4 Design and Analysis Tools and Methods**
- **2.3.5 Reliability / Life Assessment / Health Monitoring**
- **2.3.6 Certification Methods**

### 2.4 Manufacturing
- **2.4.1 Manufacturing Processes**

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Cont'd
Accelerated Growth in Composites

- Barriers to Growth
  - Funding limitations
  - Cross disciplinary technological challenges
  - Maturity required to meet roadmap dates

- Steps to Accelerate Growth
  - U.S. intra-government collaboration
  - Government-industry partnerships
  - International communication and collaboration
  - Globally harmonized roadmaps for key technologies

NASA-Commercial Collaboration
Charlie Bolden (NASA) and Elon Musk: (Space X)
Let’s Go!

• Address the global challenge of using composites in our applications by addressing common issues
• Excited to meet with leaders who are advancing composites in their applications
• Keep up with a paradigm shift from metals to composites occurring in aerospace, automotive, marine, and pipelines

www.compositeconference.com