Industry Partnerships and International Standards for Certification Efficiency

John Tomblin
WSU/NIAR
LOCATIONS

NIAR Headquarters
Wichita State University
1845 Fairmount St, Wichita

Aircraft Structural Test & Evaluation Center
Kansas Coliseum
1229 E. 85th St N, Park City

National Center for Aviation Training
4004 N Webb Rd, Wichita

Electromagnetic Effects & Environmental Test Labs
Air Capital Flight Line
3501 S Oliver St, Wichita
NIAR LABORATORIES

- Advanced Coatings
- Aging Aircraft
- Ballistics/Impact
- CAD/CAM
- CIBOR
- Composites
- Computational Mechanics

- Crash Dynamics
- Electromagnetic Effects
- Environmental Test
- Full-scale Structural Test
- Human Factors
- Mechanical Test
- Metrology

- NDT
- Oil Analysis
- Research Machine Shop
- Reverse Engineering
- Virtual Reality
- Beech Wind Tunnel

- Computational Mechanics
**NSF AERO R&D RANKINGS**

**AERO R&D EXPENDITURES**

<table>
<thead>
<tr>
<th>Rank</th>
<th>University</th>
<th>Expenditures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>UTAH STATE UNIVERSITY *</td>
<td>67 million</td>
</tr>
<tr>
<td>2</td>
<td>GEORGIA INSTITUTE OF TECHNOLOGY</td>
<td>54 million</td>
</tr>
<tr>
<td>3</td>
<td>WICHITA STATE UNIVERSITY</td>
<td>40 million</td>
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<tr>
<td>4</td>
<td>UNIVERSITY OF COLORADO BOULDER</td>
<td>37 million</td>
</tr>
<tr>
<td>5</td>
<td>UNIVERSITY OF ALABAMA - HUNTSVILLE</td>
<td>34 million</td>
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**INDUSTRY FINANCED AERO R&D**

<table>
<thead>
<tr>
<th>Rank</th>
<th>University</th>
<th>Expenditures</th>
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</thead>
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<tr>
<td>1</td>
<td>WICHITA STATE UNIVERSITY</td>
<td>29 million</td>
</tr>
<tr>
<td>2</td>
<td>GEORGIA INSTITUTE OF TECHNOLOGY</td>
<td>6 million</td>
</tr>
<tr>
<td>3</td>
<td>UNIVERSITY OF NOTRE DAME</td>
<td>5 million</td>
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<tr>
<td>4</td>
<td>MASSACHUSETTS INSTITUTE OF TECHNOLOGY</td>
<td>3 million</td>
</tr>
<tr>
<td>5</td>
<td>UNIVERSITY OF COLORADO BOULDER</td>
<td>2 million</td>
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</table>

* The Johns Hopkins University is listed as #1 with $300 million, but this includes Applied Physics Laboratory expenditures.
FAA Centers of Excellence

Airworthiness Assurance Center of Excellence
1997-2007

Center of Excellence for Composites and Advanced Materials
2004-present

Center of Excellence for General Aviation Research
2001-2011

Center of Excellence for Unmanned Aircraft Systems
2015-present
Accelerated Insertion of Advanced Materials

focused on increasing the efficiency of advanced material implementation into new aircraft models while at the same time decreasing the cost of these materials.
Qualify Matured Materials Only

GOAL: Material qualification and property data acquisition independent of aircraft certification program
Both the FAA and EASA accept composite specification and design values developed using the NCAMP process.

NCAMP works with the FAA, DoD and industry partners to qualify material systems and populate a shared materials database that can be viewed publicly.
DEVELOPING STANDARDS FOR CERTIFICATION EFFICIENCIES

Coupon – Component – Full Scale
Certification Cost & Time → Certification Efficiency

~ Certification Cost

- Full-Scale
- Sub-component
- Details
- Elements
- Laminate
- Lamina

Full-scale test is a significant portion of the overall budget. Improvements to full-scale test duration → Reduction to overall test timeline.
Jan. 24, 2013: Completion
Full-Scale Structural Test

Mechanical Test

Aging Aircraft

Ballistic & Impact Dynamics
Commercial Space
Unmanned Aerial Systems
Bombardier/Learjet 85
F-18 Life Extension
Other Teardown Programs

- C-5A Structural Teardown
- F-16C Static Test Article Teardown
- C-130 Center Wing Box Teardown
- B-52 Wing and System Component Teardown
KC-135 Aft Wing Terminal Fitting Test Program
Lower Level Building
Block Efforts

- Allowables
- Design Values
- Advanced Fiber Reinforced Composites
- Repair Materials
- Adhesives
- Polymer Based Additive Manufactured Materials
- Ceramic Matrix Composites
Higher Level Building
Block Efforts

Composite / Metallic Hybrid Structures

Structural Bonding

Environmental Compensation Factors

Load Enhancement Factors

Damage Growth in Fluid-Ingressed Sandwich Structures

Viscoelastic Behavior of Thermal Residual Stresses

Damage Tolerance of Composite Structures