NASA Aerosciences Evaluation and Test Capabilities Project

Dr. Ron Colantonio, Aerosciences Evaluation and Test Capabilities (AETC) Project Manager

2017 AIAA AVIATION Forum
Aerosciences Evaluation and Test Capabilities (AETC) Project

“...Improve access to our facilities, putting them back in the hands of our researchers and engineers to execute the NASA’s missions, programs, and projects...” NASA Aerosciences Capability Leadership Team

Vision

- Sustain and improve test capabilities and test technologies in support of NASA testing requirements - “The right facility at the right time”

Scope

- Aeroscience ground test facilities deemed critical to NASA
- Operations, maintenance, and new capability and test technology advancements
Facility Portfolio

LaRC 14 x 22 Foot Subsonic Tunnel
Subsonic, Alternate Uses

LaRC National Transonic Facility
High Reynolds Number Flow

ARC Unitary Plan Wind Tunnels
11'x11' Transonic Wind Tunnel
9'x7' Supersonic Wind Tunnel

LaRC Unitary Plan Wind Tunnel (FY17 Portfolio)
Supersonic Speed Range

LaRC Aerothermodynamics Complex
Exploration Workhorse

Subsonic

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Transonic

LaRC Transonic Dynamics Tunnel
Aeroelasticity & Flutter

GRC 9’x15’ Low Speed Wind Tunnel
Low-speed Propulsion Acoustic

GRC 8’x6’ Supersonic Wind Tunnel
Transonic-propulsion

GRC 10 x 10 Foot Supersonic Wind Tunnel
Large-scale Supersonics & Propulsion

LaRC 8-Ft High Temperature Tunnel
Large-scale Hypersonics & Propulsion

Supersonic

GRC Icing Research Tunnel
Aircraft Icing Condition Simulation

LaRC Transonic Dynamics Tunnel
Aeroelasticity & Flutter

GRC Propulsion Systems Laboratory
Engine (and icing) Simulation at Altitude

LaRC 20-Foot Vertical Spin Tunnel (FY17 Portfolio)
Spin Characteristics & Dynamic Stability

Hypersonic

GRC 9’x15’ Low Speed Wind Tunnel
Low-speed Propulsion Acoustic

GRC 8’x6’ Supersonic Wind Tunnel
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Specialty Tunnels:

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Large-scale Hypersonics & Propulsion
AETC Investment Areas

AETC will invest in **workforce** and **assets** (facilities and related systems and support tools) necessary to **meet technical needs** within NASA. The investments are broken down into four elements:

- **Operations**: Funds directed to key facilities to support labor and procurement needs so that the facilities continue to be available to NASA researchers and projects.

- **Maintenance**: Funds directed for the maintenance of key facilities to ensure current and future operations while minimizing risk to customer testing.

- **Capability Advancement**: Funds directed to create new capabilities needed by NASA in specific facilities. They include larger-scale investments in areas such as data systems, tunnel and model controls, new test environments, and facility systems.

- **Test Technology**: Funds directed to improve measurement capabilities (pressure, force, flow, and temperature), test techniques and processes, and develop technologies critical to meeting NASA research needs and applicable to a multitude of facilities.
AETC Project Structure

Aeronautics Research Mission Directorate (ARMD)
Dr. Jaiwon Shin, Associate Administrator

Advanced Air Vehicle Program (AAVP)
Jay Dryer, Director

Human Exploration and Operations Mission Directorate (HEOMD)
Science Mission Directorate (SMD)

Space Technologies Mission Directorate (STMD)

Ron Colantonio, AETC Project Manager (PM)
Chris Mouring, AETC Deputy PM

Business Unit
Lead Analyst
Ames Analyst
Glenn Analyst
Langley Analyst
Subproject Budget Support
Schedulers

Test Technology Subproject Manager
Capability Advancements Subproject Manager
Maintenance Subproject Manager

Aeroscience Testing Advisory Board
ARMD PM, DoD, Industry and Other Stakeholder Inputs
NASA is implementing a **Capability Management Model** for capabilities critical to addressing current and future mission needs.

The Capability Leadership Model enables *stewardship* of NASA’s critical capabilities, *awareness* by senior management of capability health, and *sustainment* of Center capabilities to meet mission needs. The model approach targets those capabilities that need: (a) a greater coordination and alignment across Mission Directorates and Centers; and, (b) an integrated strategy toward advancement for future Agency objectives.

The implementation is through:
- Increased oversight of capabilities
- Capability Leadership Teams
- Capability (Centralized) Management Programs

### Existing Capability Leadership Teams

#### Discipline & System Areas:
- **Aerosciences**
- Avionics
- Electrical Power
- Flight Mechanics
- Guidance Navigation & Control
- Human Factors
- Life Support/Active Thermal
- Loads and Dynamics
- Materials
- Mechanical Systems
- Non-Destructive Evaluation
- Passive Thermal
- Propulsion
- Software
- Structures
- Systems Engineering
- Space Environments
- Cryogenics
- Instruments and Sensors

#### System Areas:
- Entry, Descent, and Landing
- Rendezvous and Capture
- In-Situ Resource Utilization

#### Other Areas:
- Life Sciences
- Earth Science
- Heliophysics
- Planetary
- Astrophysics
- Aircraft Operations
- Mission Operations

![Rocket Image]
Vision for the NASA’s New Aerosciences Ground Test Funding Model

One of the first NASA Capability Management recommendations was a New Funding Model for Aerosciences ground test capabilities.

In FY17 the New Funding Model will fully cover the operational cost for NASA users of a key set of critical aeroscience ground test facilities. In addition, limited funds are available for capability advancements, new test technologies, and maintenance.

Starting in FY19 consumables (e.g. power, fuel, etc.) will also be covered.

The primary objective of the New Funding Model is to improve access to our facilities, putting them back in the hands of our NASA researchers and engineers to execute NASA’s missions, programs, and projects. The New Funding Model will:

– Enable technology innovation and risk reduction by providing easier access and remove cost bias that favors computation over test
– Reinforce the role of facilities as a NASA centrally managed resource
– Improve facility utilization
– Enable capability and discipline sustainability
– Provide an improved measure for facility decisions involving capability partnering, investment, and divestment

The NASA Aerosciences Evaluation and Test Capability (AETC) Project will manage the aeroscience ground test capability portfolio for the Agency under this New Funding Model.
Operations Cost Recovery Model
Previously (FY16 and prior)

- Fixed Costs
  - Partial Fixed Costs
  - AETC Resource Allocation
- Variable Cost (Test Specific & CMO)
  - Testing Customer Funds
  - AETC Allocation Typically Covers ~50% of Fixed Cost

Customer Revenue Covers ~50% of Fixed Cost via Facility Rates (Occupancy Hour x Rate) and 100% of Variable Costs
FY17 New Funding Model

NASA Customers (including Ones with Key External Partners)

- AETC Resource Allocation
- Variable Cost (Test Specific & CMO)
- NASA and/or Key Partner Funds*
- AETC Allocation Will Cover 100% of Fixed Costs

*This will change in FY19 when consumables become part of the New Funding Model.
# What’s Covered and What’s Not in FY17 from a NASA Customer Perspective

## What's Covered

<table>
<thead>
<tr>
<th>WHAT'S COVERED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operations labor for planned capacity (civil servant &amp; contractor workforce)</td>
</tr>
<tr>
<td>Capability-related procurements such as:</td>
</tr>
<tr>
<td>Inventory/Supplies</td>
</tr>
<tr>
<td>Fabrication &amp; fabrication quality checks</td>
</tr>
<tr>
<td>Facility Operation Consumables</td>
</tr>
<tr>
<td>Base Load Consumables (e.g., electricity for shop areas, service air, limited hp air)</td>
</tr>
<tr>
<td>Instrumentation and measurement uncertainty</td>
</tr>
<tr>
<td>Re-certifications (e.g., pressure systems, lifting systems)</td>
</tr>
<tr>
<td>Calibrations (metrology)</td>
</tr>
<tr>
<td>Configuration management</td>
</tr>
<tr>
<td>Software licenses</td>
</tr>
<tr>
<td>IT security</td>
</tr>
<tr>
<td>Maintenance of Vehicles and forklifts</td>
</tr>
<tr>
<td>Capability-related travel</td>
</tr>
<tr>
<td>Workforce development &amp; reshaping (mentoring, training, interns, knowledge capture)</td>
</tr>
</tbody>
</table>

## What's Not Covered

<table>
<thead>
<tr>
<th>WHAT'S NOT COVERED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Specific and capability-related consumables in FY17 &amp; FY18 (e.g., electricity, hp air, LN2, R-134a, etc.)</td>
</tr>
<tr>
<td>Test-specific modifications to capability</td>
</tr>
<tr>
<td>Test-specific fabrication (e.g., models and test-specific hardware)</td>
</tr>
<tr>
<td>Test-specific instrumentation, engineering support, and DAS</td>
</tr>
<tr>
<td>Select Dynamic data systems</td>
</tr>
<tr>
<td>Test-specific test techniques:</td>
</tr>
<tr>
<td>Sublimation</td>
</tr>
<tr>
<td>Oil Flow</td>
</tr>
<tr>
<td>IR Thermography</td>
</tr>
<tr>
<td>Pressure Sensitive Paint</td>
</tr>
<tr>
<td>Particle Image Velocimetry</td>
</tr>
<tr>
<td>Schlieren</td>
</tr>
<tr>
<td>Background Oriented Schlieren</td>
</tr>
<tr>
<td>Computation Fluid Dynamics Services</td>
</tr>
<tr>
<td>Test-specific Staffing/Expertise (i.e., beyond capability Ops staff; e.g., Acoustics Engineer)</td>
</tr>
<tr>
<td>Non-occupancy overtime</td>
</tr>
<tr>
<td>Contract administration</td>
</tr>
<tr>
<td>Test-specific travel</td>
</tr>
</tbody>
</table>

Facility test operations require both a skilled civil servant and contractor workforce.

Consumables such as liquid nitrogen, fuel, and power needed for testing are not covered in FY17 and 18 but proposed to be covered in FY19.
**Generic Example of Price Change to NASA Customer**

**Nature of Test:**
- 2 weeks of model installation, 4 weeks of large tunnel testing, and 2 weeks of model removal
- Project/Customer supplies the model for testing and research personnel during the test

### FY16 Testing Cost ($K) Charged to NASA Customer

<table>
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<tr>
<th>Item</th>
<th>Cost ($K)</th>
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</thead>
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<tr>
<td>Facility Workforce Cost</td>
<td>$1,245</td>
</tr>
<tr>
<td>Capability Related Procurements</td>
<td>$376</td>
</tr>
<tr>
<td>Jet Fuel and Nitrogen</td>
<td>$35</td>
</tr>
<tr>
<td>Electrical Power</td>
<td>$528</td>
</tr>
<tr>
<td>Test Model High Pressure Air</td>
<td>$160</td>
</tr>
<tr>
<td>Advanced Schlieren</td>
<td>$25</td>
</tr>
<tr>
<td>IR Thermography</td>
<td>$85</td>
</tr>
<tr>
<td>Contract Administration</td>
<td>$24</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$2,478</strong></td>
</tr>
</tbody>
</table>

### FY17/18 Testing Cost ($K-no inflation adjustment) Charged to NASA Customer

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<tr>
<td>Contract Administration</td>
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</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$857</strong></td>
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### FY19 and Beyond Testing Cost ($K-no inflation adjustment) Charged to NASA Customer

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<td>Contract Administration</td>
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<td><strong>Total</strong></td>
<td><strong>$294</strong></td>
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Partnerships and External Testing

- **NASA partners can qualify for sponsored testing** in the aerosciences ground test facilities if the following apply:
  - Mutually beneficial interests only, and
  - Partner testing is sponsored by a NASA project or program, and
  - Testing is documented with a NASA Space Act or Interagency Agreement or NASA Research Announcements (NRA), and
  - One or more of the following apply to required data sharing:
    - Enables and/or increases NASA technology readiness
    - Supports Small Business Innovation Research (SBIR)
    - Lowers NASA research and/or development risks
    - Accelerates NASA technology transfer
    - Reduces risks of NASA contracted deliverables
    - Enables and/or accelerates delivery of NASA contracted deliverable

- The relevant NASA program or project is responsible for substantiating sponsored operations testing costs.

- Issues with sponsored partnerships will be addressed by a NASA advisory board.

- **External customers (non-partners) will continue to pay hourly utilization rates plus consumables plus test-specific costs**

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All partnerships must still abide by the Space Act or other agreement or Federal regulations, constraints, and processes (e.g., non-exclusivity). The New Funding Model will not change how we mechanically generate partnership agreements.
AETC will invest in **workforce** and **assets** (facilities and related systems and support tools) necessary to meet **technical needs** within NASA. The investments are broken down into four elements:

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New Model Provides Investments in New Capabilities and Maintenance

FACILITY CAPABILITY ADVANCEMENTS
1. CC-CA-01 Reduce Background Noise Levels for Engine System Noise Measurements (GRC 9- X 15- Foot Low Speed Wind Tunnel) [FY15-18]
2. CC-CA-02 Optical Improvements for Diagnostic Techniques for Aerodynamic Performance (ARC 11- X 11 And 9- X 7- Foot Wind Tunnels) known as “Optical Test Section of Tomorrow” [FY15-17]
3. CC-CA-03 Methods to Create a Viable and Affordable Freezing Drizzle/Rain Experimental Simulation Capability [FY15-21]
5. NEW- CC-CA-05 Full Life Cycle Mach 6 Testing at Long Duration for NASA Langley 8-Foot High Temperature Tunnel [FY17-21]

TEST TECHNOLOGIES
1. CC-TT-01 Optical Instrumentation for Advanced Flowfield Measurements Needed for Next Generation Computational Simulation Development and Validation [FY15-19]
2. CC-TT-02 Force Balance Repeatability and Accuracy to Accommodate Needs of Advanced Aircraft Design Wind Tunnel Models [FY15-19]

IMPROVED OPERATIONS
1. NEW- CC-OPS-01 Propulsion Simulator Test and Calibration Capability to Enable Next Generation Aircraft and Spacecraft Wind Tunnel Testing [FY17-18]
2. NEW- CC-OPS-02 Shape Memory Alloy Remote Control Actuation [FY17-19]
Summary

• AETC Project is meeting the needs of NASA and external customers—"The right facility at the right time”

• NASA’s New Funding Model started in FY17 and will improve access to our facilities to better execute NASA’s missions, programs, and projects.
  – Enable technology innovation and risk reduction by providing easier access and remove cost bias that favors computation over test
  – Reinforce the role of facilities as a NASA centrally managed resource
  – Improve facility utilization
  – Enable capability and discipline sustainability
  – Increase opportunities with partners from commercial and outside agencies where mutually beneficial interests and data sharing are present.

• Additional information on the new model, testing at NASA and/or partnership opportunities can be directed to:

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  Ron.Colantonio@nasa.gov  
  216-433-6370