



National Partnership for Aeronautical Ground Testing – Overview and NASA Perspective

AVTech 2017

James Bell
NASA
AETC Test Technology
Project Manager

October 26, 2017





Outline



- National Partnership for Aeronautical Testing (NPAT)
 - Scope
 - Origin
 - Organization
 - Activities
- Aeronautics Evaluation and Test Capability (AETC)
 - Function and Organization
 - Facilities covered by AETC



Scope of the NPAT

- The National Partnership for Aeronautical Testing is an agreement which provides a formal basis for cooperation between NASA and the Department of Defense in the area of aeronautical test facilities.
- Covers “facilities used for testing of vehicles (e.g., aircraft, missiles, or space vehicles) or for related scientific and engineering studies of the flow of gas around or through objects.”
- Includes wind tunnels, propulsion test facilities, simulation facilities, and open-air ranges.
- A Council is established to implement the agreement, but neither party otherwise commits or exchanges any funding or personnel.



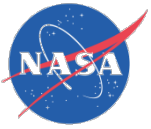
NPAT History

- Beginning in the late 1990's, the DoD and NASA have worked to define improved methods for cooperating in the management and operation of the major elements of their aeronautical test infrastructure.
- In 1998 NASA and the DoD established the National Wind Tunnel Alliance (NWTa) and the Air Breathing Propulsion Test Facilities Alliance (ABPTFA) to further these goals. (Other alliances were also established in the areas of rocket propulsion, space environment, arc-jet, and ballistic range testing.)
- In 2000 the NWTa and ABPTFA were combined and expanded into the National Aeronautical Test Alliance, which included all NASA and DoD aeronautical test facilities.
- The NATA was superseded in 2007 by the NPAT. Each department in the DoD is represented individually in the NPAT, as well as several distinct organizations within NASA.



NPAT Council

- The NPAT Council is the main organization implementing the NPAT and consists of representatives from:
 - NASA Advanced Air Vehicles, Integrated Aviation Systems, and Strategic Capabilities Assets Programs
 - NASA Aerospace Evaluation and Test Capability Portfolio
 - DoD Assistant Secretary for Research and Engineering
 - DoD Military Services (Army, Navy, Air Force)
- The Council is authorized to “conduct studies, address issues, and develop approaches and strategies to improve cooperation...”.
- The Council meets semi-annually or as agreed.



NPAT Activities

- Facility User Meetings: Semi-annual meetings to allow exchange of information with facility users from industry, NASA, and DoD. 'Mini-FUMs' held in conjunction with industry conferences.
- Working Groups: Associations of technical experts chartered to meet periodically and undertake joint work in specific areas.
 - NFMTC: National Force Measurement Technical Capability
 - WTCWG: Wind Tunnel Characterization Working Group
- Individual projects such as joint wind tunnel tests or research and development activities.
 - FAVOR test series
 - Pressure-sensitive paint development



National Force Measurement Technical Capability



- The NFMTC is a repository of technical capability for the maintenance and advancement of force and moment measurements in aeronautical test facilities.
 - Within the context of the NPAT, the NFMTC serves as a resource for exchanging information about force measurement, and engaging in joint projects.
 - Within the context of NASA, the NFMTC is the agency's organization for developing new force measurement technology and for maintaining existing force measurement capability.
- NFMTC activities within NASA
 - Design and procurement of force balances
 - Balance calibration
 - Balance research and development



NTF-107 identified as a good candidate balance for 3D printing.



Wind Tunnel Characterization Working Group



- The WTCWG serves as a mechanism for of information and coordination of activities for wind tunnel characterization.
- Members are representatives of large NASA and DoD (primarily Air Force) facilities.
- Monthly telecons and annual face-to-face meetings allow members to exchange information.
- Recent and on-going joint projects
 - Joint evaluation and status report on the condition of wind tunnel calibration and characterization equipment (rakes, static pipes, etc.) at major NASA and Air Force wind tunnels.
 - Development of consistent approach to wind tunnel characterization.





FAVOR Test Series

- In 2008-2009, NASA and the Air Force conducted a cooperative series of test of the same model in multiple different wind tunnels.
 - Facilities: 11x11, 8x6, NTF, and 16T
 - FAVOR (Facility Aerodynamics Validation and Operations Research) model chosen for its compatibility with all facilities.
- The test objectives were to compare test procedures and resulting data
 - Test teams from each facility participated in test preparation and execution at other facilities to gain insight into each others methods.
 - Joint evaluation of data.





Other Activities

- Pressure-Sensitive Paint System Development
 - NASA and AEDC adopted joint hardware, software, and procedures for PSP in late 2000s.
 - Cross-training allowed support of NASA tests by AEDC personnel and vice versa.
- Joint meeting at AFRL in 2016 to present new developments in test technologies.



Potential Future Areas of Cooperation



- New Test Technologies
 - IR thermography
 - Model deformation measurements
 - Additive manufacturing of balances
- Further joint test campaigns to compare wind tunnel test procedures. (Review changes made since FAVOR tests.)

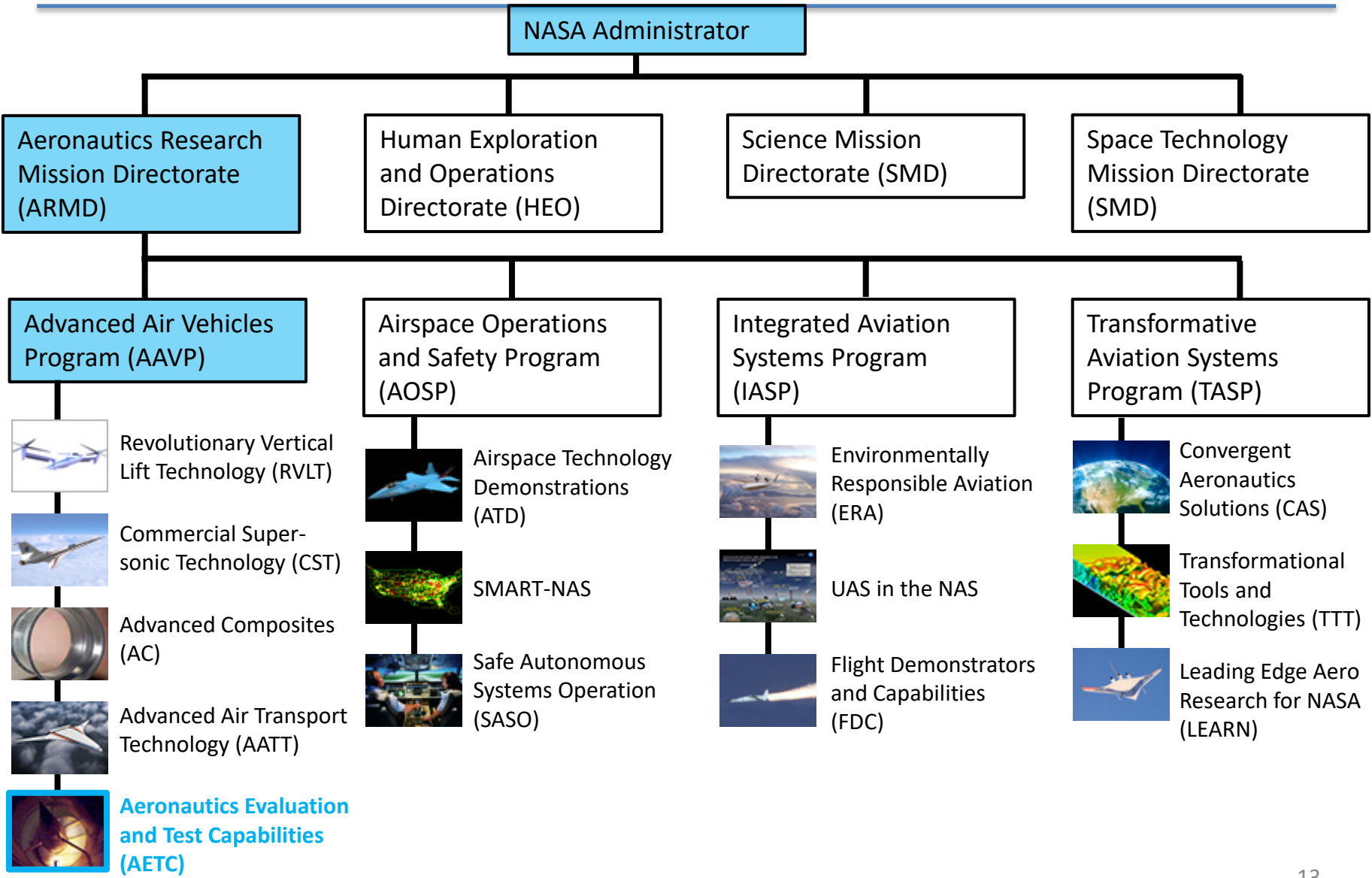


Introduction to AETC

- AETC's role is to preserve and enhance the ground test capabilities needed to achieve ARMD's missions.
- AETC invests in workforce and assets needed to help the facilities support ARMD, while the facilities themselves are owned and operated by their respective centers.
- AETC is divided into four elements:
 - Operations: Direct funding to support key labor and procurement needs while maintaining stable and competitive rates to customers.
 - Maintenance: Funds directed to maintain physical plant to ensure current operations and minimize risk for the future.
 - Capability Advancement: Handles large scale investments in facility physical plant, controls, and data systems.
 - Test Technology: Funds small-scale “pilot” projects to bring new test capabilities, especially measurement systems, into the facilities.

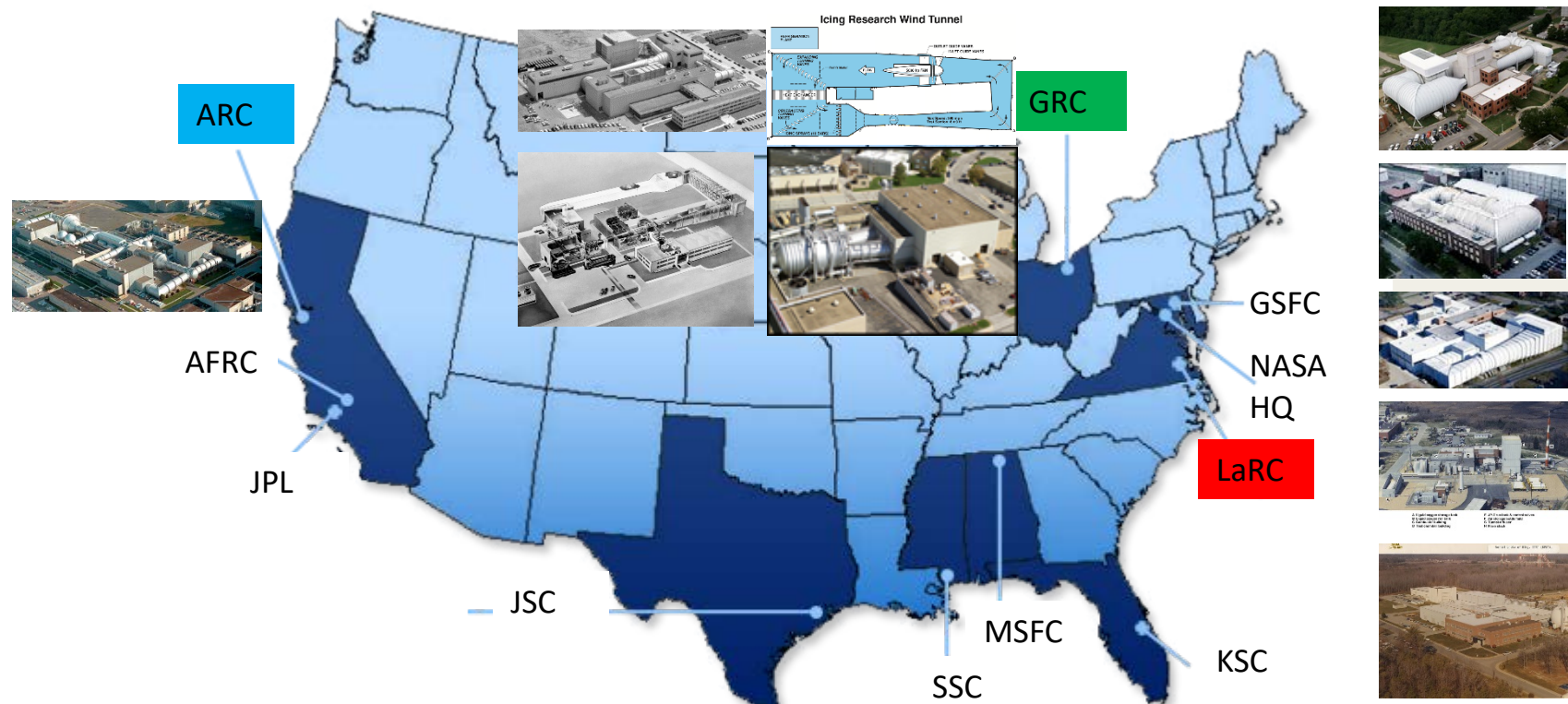


AETC Position within NASA





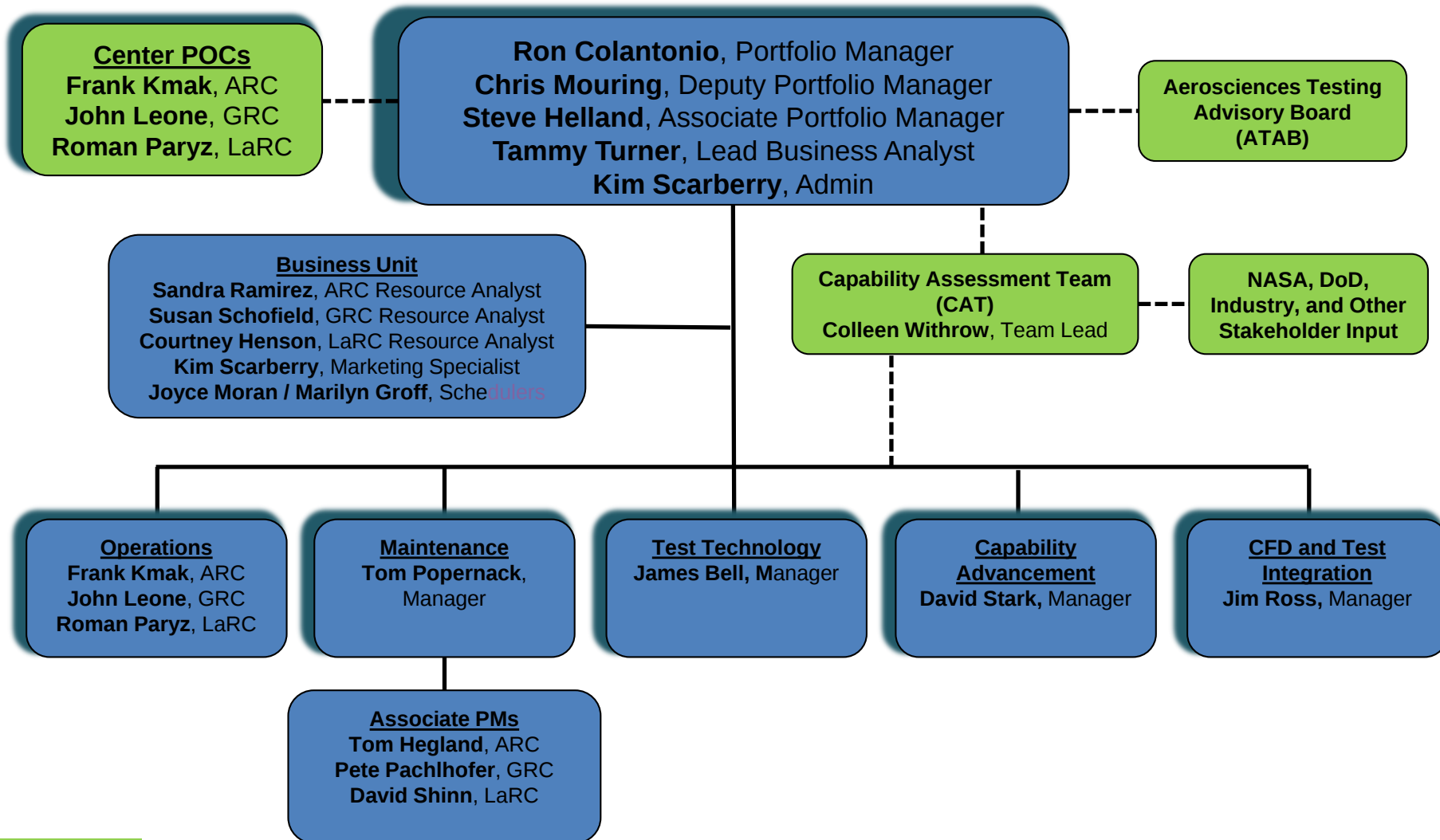
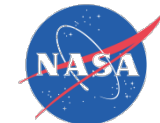
AETC Facility Locations and Summary



ARC	11x11	General purpose transonic	GRC	PSL	High altitude engine test cell with icing
ARC	9x7	General purpose supersonic	LaRC	NTF	Transonic full-scale Reynolds number
GRC	10x10	Supersonic propulsion/aerodynamic	LaRC	TDT	Transonic aeroelastic
GRC	8x6	Supersonic propulsion/aerodynamic	LaRC	14x22	Subsonic general purpose
GRC	9x15	Subsonic propulsion & acoustics	LaRC	8' HTT	Hypersonic general purpose/ propulsion
GRC	IRT	Subsonic icing	LaRC	4x4	Supersonic general purpose



AETC Organization Chart



Advisory Role



Changes to AETC in FY18

- Conversion from a Project to a Portfolio
 - Changes reporting requirements and management structure.
 - Recognizes that the function of the organization is stewardship of assets as opposed to achievement of specific goals.
- Cognizance of Outside Facilities
 - AETC is now required to maintain awareness of NASA and non-NASA facilities which are outside of the AETC portfolio
 - AETC shall be able to advise NASA HQ about issues concerning aero ground test facilities in general
- CFD and Test Integration Subproject
 - New subproject to help determine under what circumstances CFD can be used to substitute for ground test capability.
 - First target is Mach number range of $M = 2.5 - 6$ (i.e. Mach range of LaRC Unitary).



Concluding Remarks

- The NPAT is a high-payoff enabler of cooperation between NASA and DoD.
 - The NPAT gives provides 'cover' and 'ground rules' for cases where DoD and NASA personnel find R&D areas they want to explore jointly.
 - The NPAT is a lightweight entity. Between meetings, most organizational responsibilities are carried out by two co-executive secretaries.
 - The NPAT is a useful avenue for resolving conflicts because individual NPAT members are fairly highly placed within their organizations.
- Within NASA, the AETC provides the central mechanism for funding, maintaining, and enhancing the large aeronautical test facilities.



Backup

