



**Aeronautics Committee Report
to the
NASA Advisory Council**

Ms. Marion Blakey (Chair)

May 6, 2011

Committee Information



- Members:
 - Ms. Marion Blakey (Chair)*
 - Dr. Ilan Kroo*
 - Dr. Mark Lewis*
 - Mr. Preston Henne
 - Dr. R. John Hansman*
 - Mr. Mark Anderson*
 - Dr. Harry McDonald
 - Mr. Paul Adams*
 - Dr. John Langford**
 - Mr. John Borghese**
 - Dr. Ray Colladay (ex-officio)
- Plans for next meeting: Face-to-face Committee Meeting at Ames Research Center, August 2-3, 2011.

*In attendance at meeting

** New Members





Areas of Interest Explored at Current Meeting

Topics covered at the Aeronautics Committee meeting held on April 14-15 at NASA Dryden Flight Research Center:

Aeronautics Budget Update

Unmanned Aircraft Systems (UAS) in the National Airspace System (NAS) Project Planning*

UAS in the NAS Subcommittee

Green Aviation Research: Drag Reduction via Laminar Flow

Air Traffic Management Technology Demonstration*

* This topic has a related recommendation or observation provided by the Aeronautics Committee

Dryden Flight Research Center: Aeronautics & Aviation



- Atmospheric Flight Research and Test
- Experimental and testbed aircraft – piloted and unpiloted
- Unmanned Aircraft Systems
 - Extensive experience in securing Certificates of Authorization (COA) for UAS flights
- Range and Aircraft Test Facilities
 - Western Aeronautical Test Range
 - Research Aircraft Integration Facility
 - Flight Loads Laboratory
 - Dryden Aircraft Operations Facility

Dryden Flight Research Center: Aeronautics & Aviation Success Story



X-48 Blended Wing Body (BWB)

- Research partnership of Boeing, NASA, and AFRL
 - Design and fabrication contracted to Cranfield Aerospace
- Purpose
 - Evaluate low speed stability and control of blended wing body configuration in free-flight
 - Evaluate flight control algorithms
 - Evaluate prediction and test methods for blended wing body class vehicles
- Potential benefits of a hybrid aircraft configuration
 - Reduced noise profile
 - Reduced emissions
 - Reduced fuel consumption
- Status
 - Phase 1 covered 80 flights at DFRC from July 2007 to March 2010 and proved that the tailless flying-wing aircraft can be controlled at low speed.
 - The aircraft is currently being modified to support the next phase of flight testing starting later in CY2011.



Areas of Increased Research



Beginning in FY 2012 ARMD will increase research in the following areas

- The effects of high altitude ice crystals on aircraft
- Efficient and safe airport surface operations
- Composite structures and materials
- Utilization and understanding of alternative fuels for fuel-flexible aircraft engine development
- Flight research that focuses on low-cost, simple, short-term flight demos aimed at enhancing aviation safety and airspace efficiency

Hypersonics Research



Refocus of Hypersonics Research



ARMD's hypersonics research has been reduced to focus on goals outlined in the National Aeronautics Research and Development Plan

- The research will be in areas where NASA possesses unique competencies relied upon by other agencies
- The research will be foundational in nature and focused on knowledge development and tool creation , in the areas of:
 - *Aerothermal heating and boundary layer transition*
 - *Advanced air breathing propulsion systems*
 - *Materials technologies*
- Reduced or eliminated areas include entry, descent and landing (EDL) materials development, new vehicle concepts, turbine-based combined cycle engines, and flight and propulsion system controls.

Unmanned Aircraft Systems (UAS)

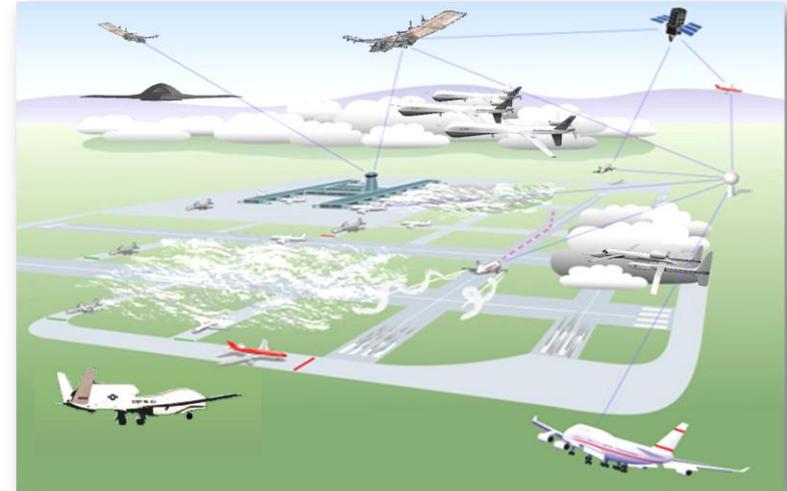


UAS in the NAS Update

The goal of the Unmanned Aircraft Systems (UAS) Integration in the National Airspace System (NAS) Project is to contribute capabilities that reduce technical barriers related to the safety and operational challenges associated with enabling routine UAS access to the NAS.

Project activities currently underway include:

- Gap analysis of consolidated concept of operations (Con Ops) against today's NAS
- UAS in the NAS state of the art assessment to identify currently implemented and ongoing efforts
- NextGen UAS ConOps
- Roadmap work with the Joint Planning and Development Office (JPDO) and the Federal Aviation Administration (FAA)





UAS Roadmap Work

- **JPDO**

- Working with JPDO to develop a research, development and demonstration (RD&D) roadmap for UAS access to the NAS due to OMB by the end of FY11. The RD&D roadmap will provide the foundation for a technology roadmap necessary for the overall National Roadmap for UAS access into the NAS and NextGen.

- **FAA**

- Working with FAA and key stakeholders to define success and to ensure that a National Roadmap is created which includes (at a minimum) policy, procedures, and technology. These areas of concentration need to be integrated to show all activities required for UAS to be safely integrated into the NAS and NextGen.

Committee Recommendation



Short Title of the Proposed Recommendation:

UAS Integration in the NAS Interagency Roadmap

Short Description of the Proposed Recommendation:

In response to a request from the Office of Management and Budget, NASA is working with other Joint Planning and Development Office (JPDO) agencies to develop a research, development and demonstration (RD&D) roadmap to provide the foundation for a technology roadmap necessary for the overall National Plan for UAS access to the NAS. The Committee supports and encourages the ongoing work being conducted by NASA to support the JPDO and the Federal Aviation Administration in the development of an interagency RD&D roadmap. NASA is also working with FAA and key stakeholders to define success and to ensure that a National Plan is created which includes (at a minimum) policy, procedures, and technology.

The Committee recommends that NASA, as a member agency of the JPDO, ensure that the RD&D interagency roadmap activity include clear documentation of on-going and future activities currently funded across the governmental departments and agencies relating to UAS RD&D. In addition to supporting the deliverable to OMB, the committee also recommends that NASA includes data about international research programs on UASs in its own planning to augment its own research considerations, even if not submitted in the report to OMB.

Committee Recommendation



Major Reasons for Proposing the Recommendation:

Awareness of UAS integration and research efforts being pursued across the federal government and internationally will allow NASA, in conjunction with other federal agencies, to make better informed investment decisions about their UAS research and technology development efforts. Such an interagency effort will also provide stakeholders and users an understanding of duplications and gaps across government investment. NASA should also take into consideration global technology development efforts to inform its planning and to eventually support full global UAS interoperability.

Consequences of No Action on the Proposed Recommendation:

Failure to do so could lead to inefficient use of U.S. government resources as NASA invests in technologies and operational solutions that are redundant in light of other federal government efforts or that are incompatible with global harmonization of UAS airspace access.

UAS Subcommittee Terms of Ref.



- The Aeronautics Committee, in conjunction with the ARMD Associate Administrator, discussed and approved the draft terms of reference (TOR) establishing a UAS Subcommittee to provide advice and recommendations on a wide range of UAS issues
- The ARMD AA and the NAC Aeronautics Committee Chair have agreed that Dr. John Langford be appointed to lead the subcommittee.
- Objectives will include:
 - Provide advice and recommendations on the overall objectives, approach, content, and structure of the UAS Integration in the NAS Project to ensure that the Project addresses relevant and compelling research needs of the community to enable safe and efficient integration of UAS within NAS.
 - Review and evaluate effectiveness of implementation for all critical technical challenges in the project plan, and provide advice and recommendations for improvement.
 - Provide advice and recommendations on the types and procedures of information and data transfer to and on strategic cooperation with stakeholders performing UAS related development work in government and industry.

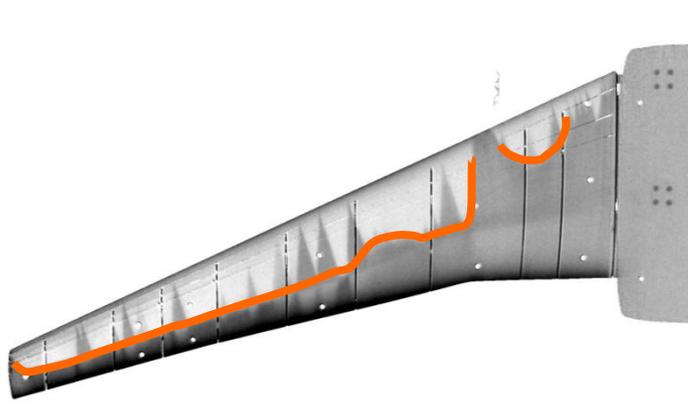
Green Aviation Research: Laminar Flow Technology Maturation



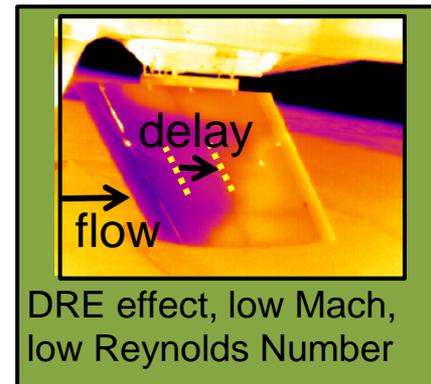
Systems analysis identify laminar flow as critical technology to meet fuel burn reduction goals

"No other single technology, with a demonstrated physical basis, can provide as large a performance benefit"
– Northrop Grumman Roadmap for Laminar Flow

- Undertaking system studies to mature technologies to address critical barriers to laminar flow



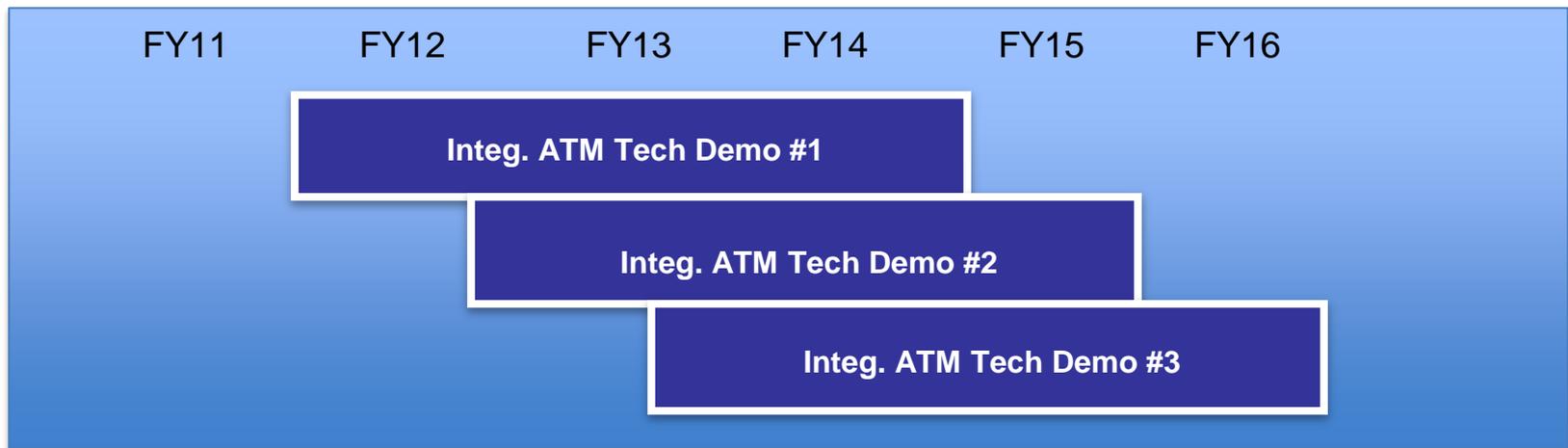
Analysis compared to wind tunnel transition measurements at $Re = 22 \text{ M/ft}$



Air Traffic Management Integrated Technology Demonstrations



- In 2011, OMB and Congress have requested NASA to:
 - Accelerate air traffic management (ATM) technology transition, including Automatic Dependent Surveillance - Broadcast (ADS-B)
 - Conduct more relevant flight research emphasizing enhancing aviation safety and airspace efficiency
- NASA is pursuing partnerships with the ATM community to define a series of partnered integrated technology demonstrations to:
 - Operationally demonstrate integrated scheduling and spacing capabilities (tech demo #1)
 - Motivate the acceleration of ADS-B equipage
 - Sustain environmentally efficient operations at peak throughput



Air Traffic Management

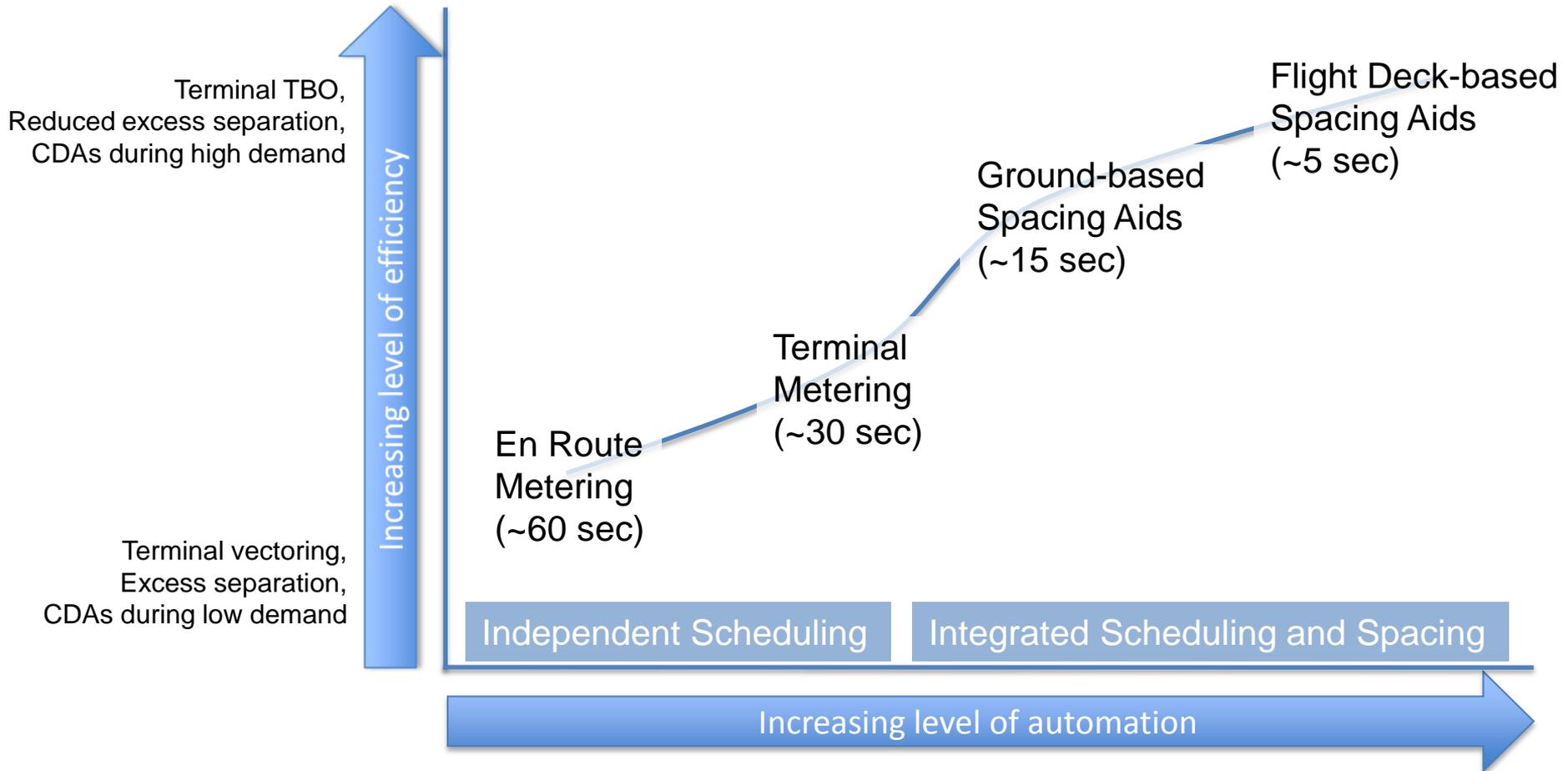
Integrated Technology Demonstrations (cont.)



- NASA has developed several foundational technologies that are ready to be demonstrated operationally
- NASA 's technical challenge is to provide an integrated set of decision support tools and automation
 - To create efficient arrival sequences and schedules for all flights
 - To develop conflict-free trajectories that meet the schedule and merge the aircraft, as necessary
 - To provide real-time advisories for fuel-efficient trajectories that meet the schedule, and
 - To use ADS-B-based flight deck merging and spacing capabilities to allow aircraft to maintain precise spacing
- These tools highly leverage the FAA's investment in Next Generation Air Transportation System (NextGen) infrastructure
 - Automatic Dependent Surveillance-Broadcast (ADS-B)
 - Area Navigation (RNAV)
 - Optimized Profile Descent (OPD) Procedures

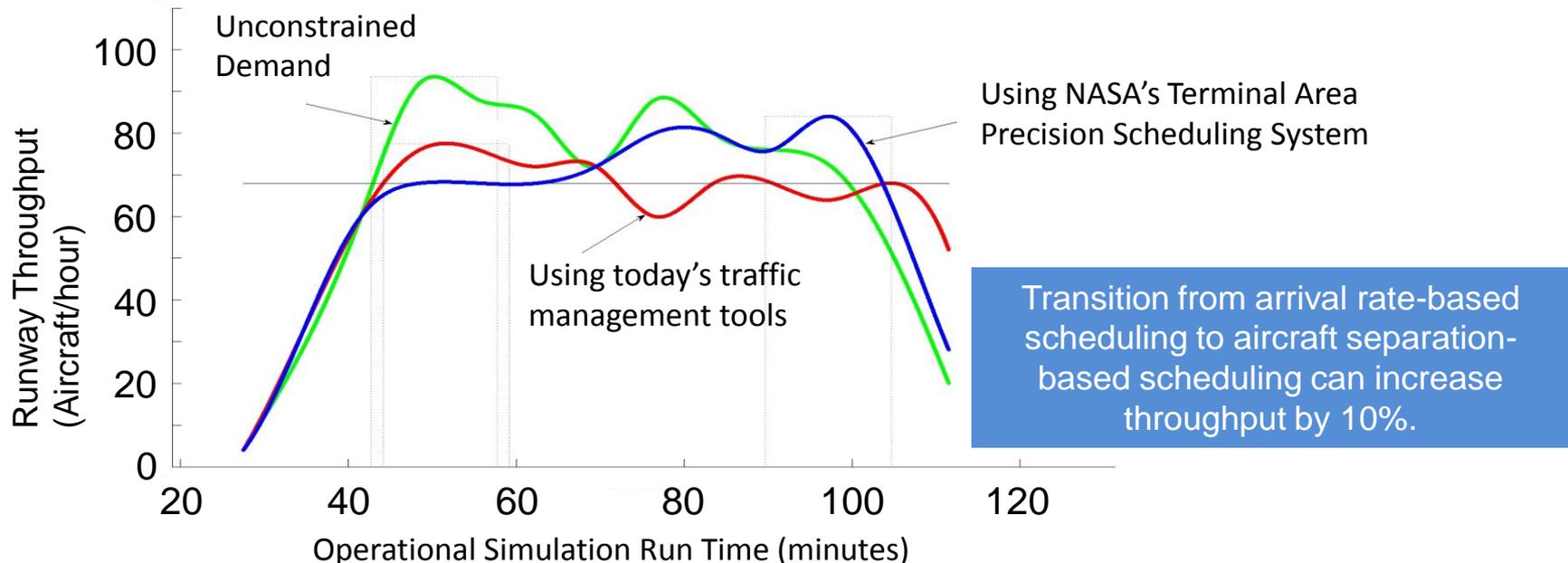


Operational Context



Benefits

- Higher throughput and more efficient flight paths
- Accelerated technology demonstration of a major integrated NextGen capability for terminal operations
- Promotes accelerated ADS-B equipage and enables other advanced capabilities
- Fuel savings





Committee Observation

The Committee strongly endorses the air traffic management integrated technology demonstrations currently planned within the Airspace Systems Program. These activities will demonstrate the full potential of the ADS-B functionality in the dense terminal area by integrating a critical set of technologies that NASA has developed and that are sufficiently mature for operational use. These activities expect to demonstrate significant savings in fuel consumption, flight time and reduced noise that would provide a strong financial incentive for operators to equip with ADS-B. This presents a major potential for NASA developed technologies to make a critical contribution to the accelerated implementation of ADS-B that is the backbone of the NextGen operating concept. The expected fuel savings would be achieved through more efficient flight paths and integrated NextGen capability for terminal operations, which will in turn increase throughput with ensured safety.

The committee wants to underscore the importance of these activities and NASA's approach in engaging both air- and ground-based communities in the effort. In addition, the committee hopes that NASA will calculate in some detail the fuel savings associated with the successful implementation of these technologies into the national airspace system.