Aeronautics Research and Technology Roundtable

George Donohue

April 5, 2012

Statement of Task

The Aeronautics Research and Technology Roundtable (ARTR) convenes senior-most representatives from industry, universities and NASA to define and explore critical issues related to NASA's aeronautics research agenda that are of shared interest; to frame systems-level research issues; and to explore options for public-private partnerships that could support rapid, high confidence knowledge transfer. This forum will be designed to facilitate candid dialogue among participants, to foster greater partnership among the NASA-related aeronautics community, and, where appropriate, to carry awareness of consequences to the wider public.

Rules of the Roundtable

- **Convening activity: discussion-driven**
- **Does not produce reports or written products**
- **No consensus opinions or recommendations provided**

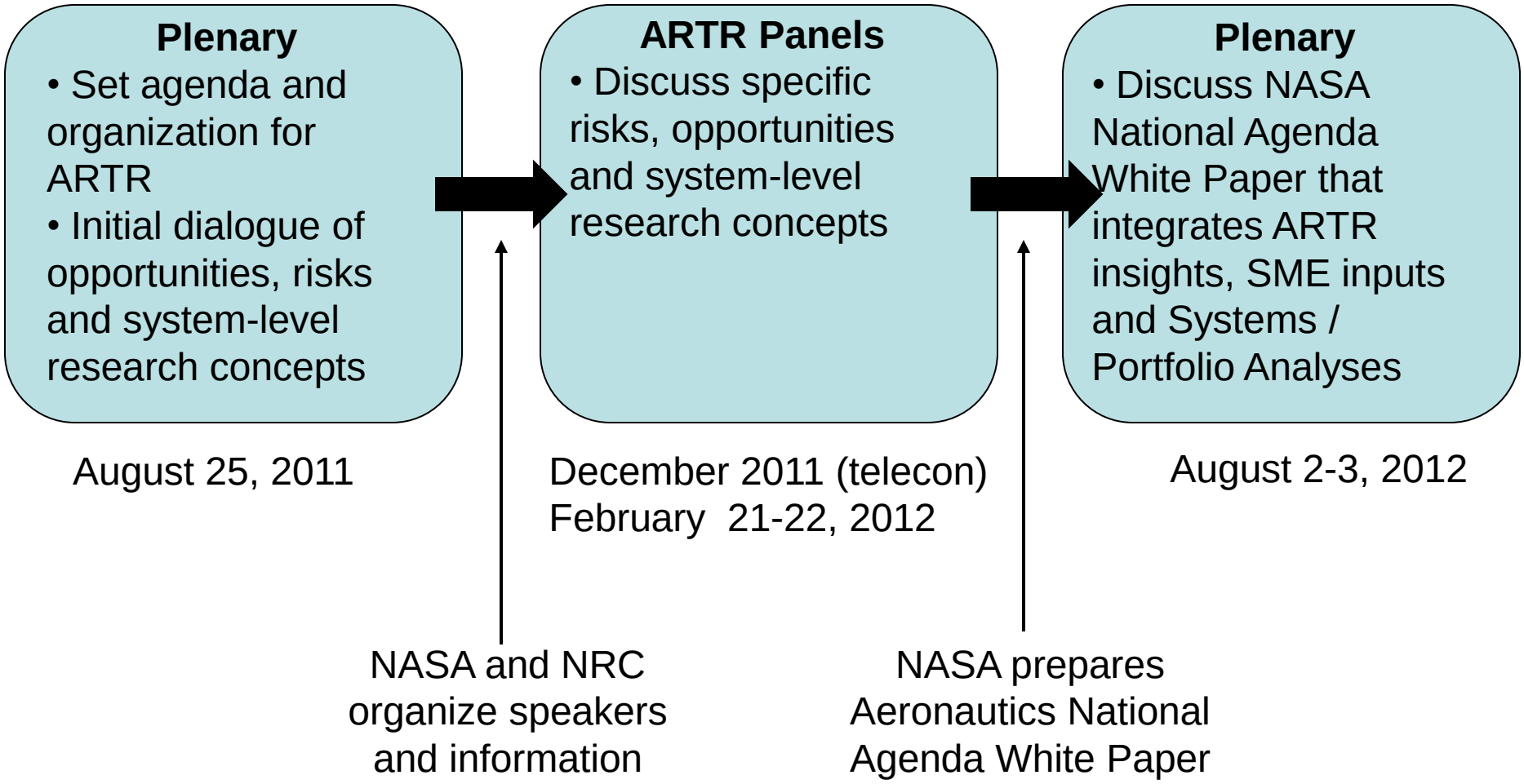
Key Questions Identified by NASA

1. What are the technical competencies for sustained leadership?
2. What are the most important aviation risks and opportunities for research focus?
3. What research is most effectively accomplished by public-private partnerships?

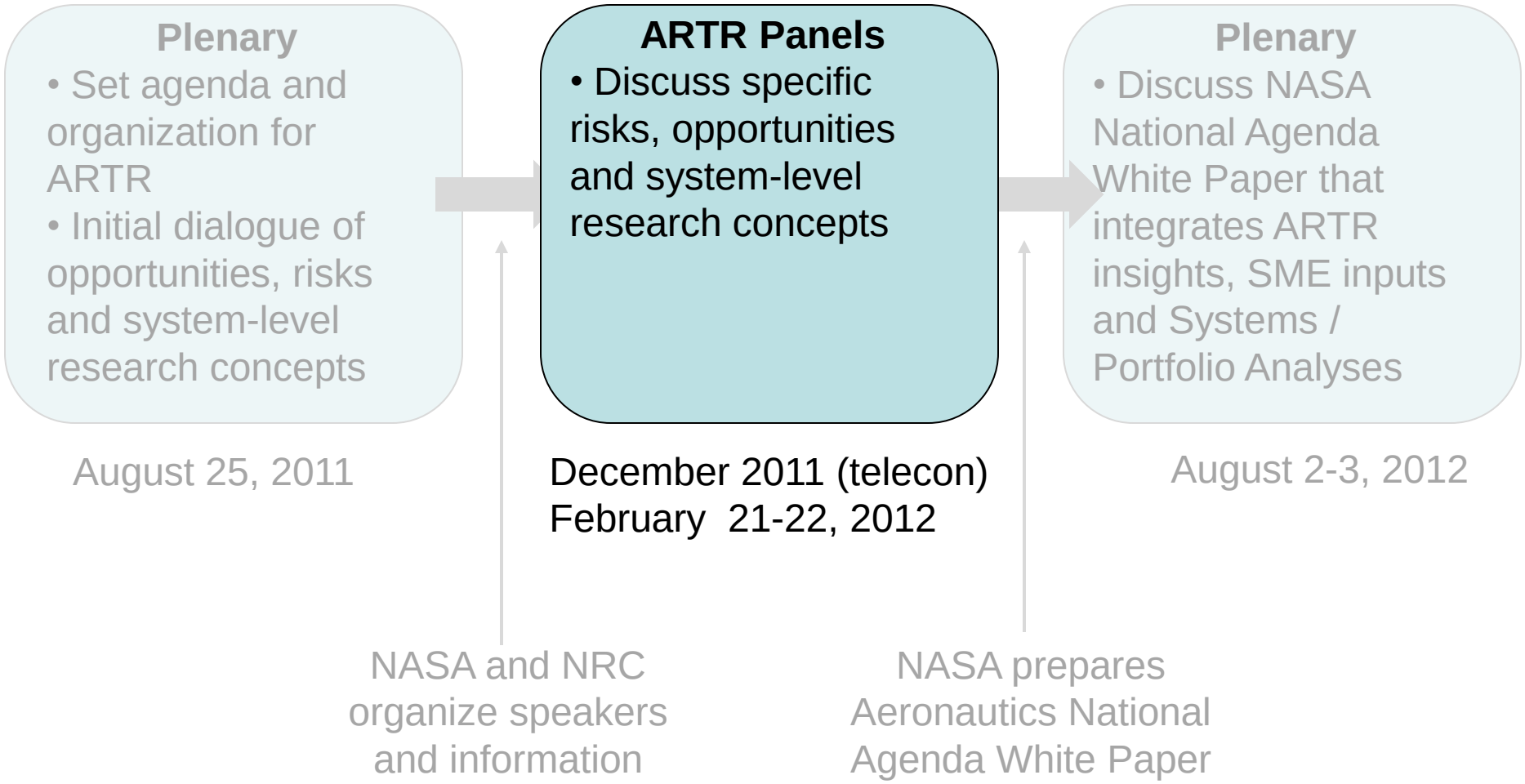
Roundtable Membership

- **John J. Tracy**, (Chair) The Boeing Company
- **Ella M. Atkin**s, University of Michigan
- **Inderjit Chopra**, University of Maryland, College Park
- **R. Scott Dann**, General Atomics Aeronautical Systems, Inc.
- **George L. Donohue**, George Mason University
- **Alan H. Epstein**, NAE, Pratt & Whitney
- **Catherine Ferrie**, Bell Helicopter TEXTRON Inc.
- **M.E. Rhett Flater**, American Helicopter Society
- **Bruce J. Holmes**, NextGen AeroSciences, LLC
- **Margaret T. Jenny**, RTCA, Inc.
- **Ray O. Johnson**, Lockheed Martin Corporation
- **Charles E. Keegan**, Raytheon Company
- **Dale Klapmeier**, Cirrus Aircraft
- **Andrew Lacher**, MITRE Corporation
- **Robert G. Loewy**, NAE, Georgia Institute of Technology
- **Lourdes Quintana Maurice**, Federal Aviation Administration
- **Mark F. Miller**, Sikorsky Aircraft Corporation
- **M. Granger Morgan**, NAS, Carnegie Mellon University
- **David E. Parekh**, United Technologies Corporation
- **Steven Pennington**, U.S. Air Force
- **Eli Reshotko**, NAE, Case Western Reserve University
- **Thomas E. Romesser**, NAE, Northrop Grumman Aerospace Systems
- **Jeanne M. Rosario**, General Electric Company
- **Jaiwon Shin**, National Aeronautics and Space Administration
- **Edward Yarbrough**, Honeywell International

ARTR 2012 Process/Timeline



Recent ARTR Activity



Vertical Lift Panel Sessions

Discussion topics included:

- **Noise**
- **Embedded electronic systems and reliability**
- **Tilt rotors**
- **Engines of variable RPMs**
- **Electric and hybrid propulsion**
- **Terminal operations and VTOL**
- **Cost**
- **Safety**

Vertical Lift Panel Members

Robert Loewy, *Panel Lead*

Inderjit Chopra

Catherine Ferrie

M.E. Rhett Flater

Mark F. Miller

David E. Parekh

Vertical Lift

- **NASA focus on a 90 PAX, 20,000 GTW, 300 nm commercial transport vehicle mission may be misplaced:**
  - **High Cost of Operations (a crosscutting issue)**
  - **Low Reliability**
- **Noise is a major environmental issue**
  - **a crosscutting issue**
- **Embedded digital electronic control system certification an increasing civil problem**
  - **A crosscutting safety issue**

General Aviation Panel Sessions

Discussion topics included:

- **Safety**
- **Fuels**
- **Noise**
- **Acquisition costs**
- **Avionics**
- **Electric/hybrid propulsion**
- **Training**
- **Ease of use**

General Aviation Panel Members

Dale Klapmeier, *Panel Lead*
Ella M. Atkins
George L. Donohue
Bruce J. Holmes
Andrew Lacher
M. Granger Morgan
David E. Parekh
Edward Yarbrough

General Aviation

- **Technically Advanced Aircraft (TAA) have not increased GA safety record over the last Decade!**
  - **Complexity of flying greatly reduced but fatal accident rate worse (crosscutting issue: human - robotics system interactions – roles and missions not well understood)**
- **Potential Loss of US Technical Design and Mfg. Competency to China, Brazil, India ??**
- **Fuel consumption rate, Noise, Airspace Access, Cost of Operations, pilot training and flight control interactions**
  - **Crosscutting issues**

Commercial Aviation Panel Sessions

Discussion topics included:

- **Economic policy**
- **Export control**
- **WTO restrictions**
- **Certification**
- **Fuel efficiency**
- **Noise**
- **Flight demonstrations**
- **Systems integration**
- **Safety and security**
- **Propulsion systems**

Commercial Aviation Panel Members

Alan Epstein, *Panel Lead*
George L. Donohue
Bruce J. Holmes
Margaret T. Jenny
Charles E. Keegan
M. Granger Morgan
Steven Pennington
Eli Reshotko, NAE
Jeanne M. Rosario
John J. Tracy

Commercial Aviation

- Largest US Trade Balance of ANY US Industry
- EU/ICAO starting to charge for Emissions
  - Not yet generally recognized as a US issue
- General Perception that Aeronautics is a Mature field
  - Place Drawing of B767 over B707; similar profiles!
  - Crosscutting issue
- Boeing sees no high profit Business Model for 90-120 PAX aircraft that US Air Transportation Network relies on to feed Hub operations
  - Canada and Brazil dominate but use US engines
  - US has a thin array of feeder markets (very price sensitive)
  - Other countries use HS rail to feed air hubs
- Total Cost of Operations increase (esp. fuel) leading to a stagnation (shrinkage?) in US ASM/GDP capacity
  - Crosscutting issue

Unmanned Aircraft Systems Panel Sessions

Discussion topics included:

- **Automation (Robotics!)**
- **Adaptive software systems**
- **Certification**
- **Flight demonstrations**
- **ATC Architecture**
- **Safety**

UAS Panel Members

George Donohue, *Panel Lead*
Ella M. Atkins
R. Scott Dann
Margaret T. Jenny
Ray O. Johnson
Dale Klapmeier
Andrew Lacher
M. Granger Morgan
David E. Parekh
Steven Pennington
Thomas E. Romesser
Edward Yarbrough

Unmanned Air Systems

- Many see UAS in Civil Airspace as a Paradigm breaker for a 60 yr. old (WW II) ATC system Architecture
  - Crosscutting issue
- Military draw-down will put Thousands of operational UAS into US Civil Airspace by 2015
- FAA Authorization language requires 30 Sept. 2015 compliance
- NASA program too modest to help meet this goal
- SAFE Operation in combined Airspace a Major Issue for FAA & DoD
  - Roles and Missions of pilot, ATC, UAS operators, digital communications systems, bandwidth, security, feed-back control time constants, software certification, procedures certification, etc. – all crosscutting issues

Some Cross-Cutting Themes Discussed by the Roundtable

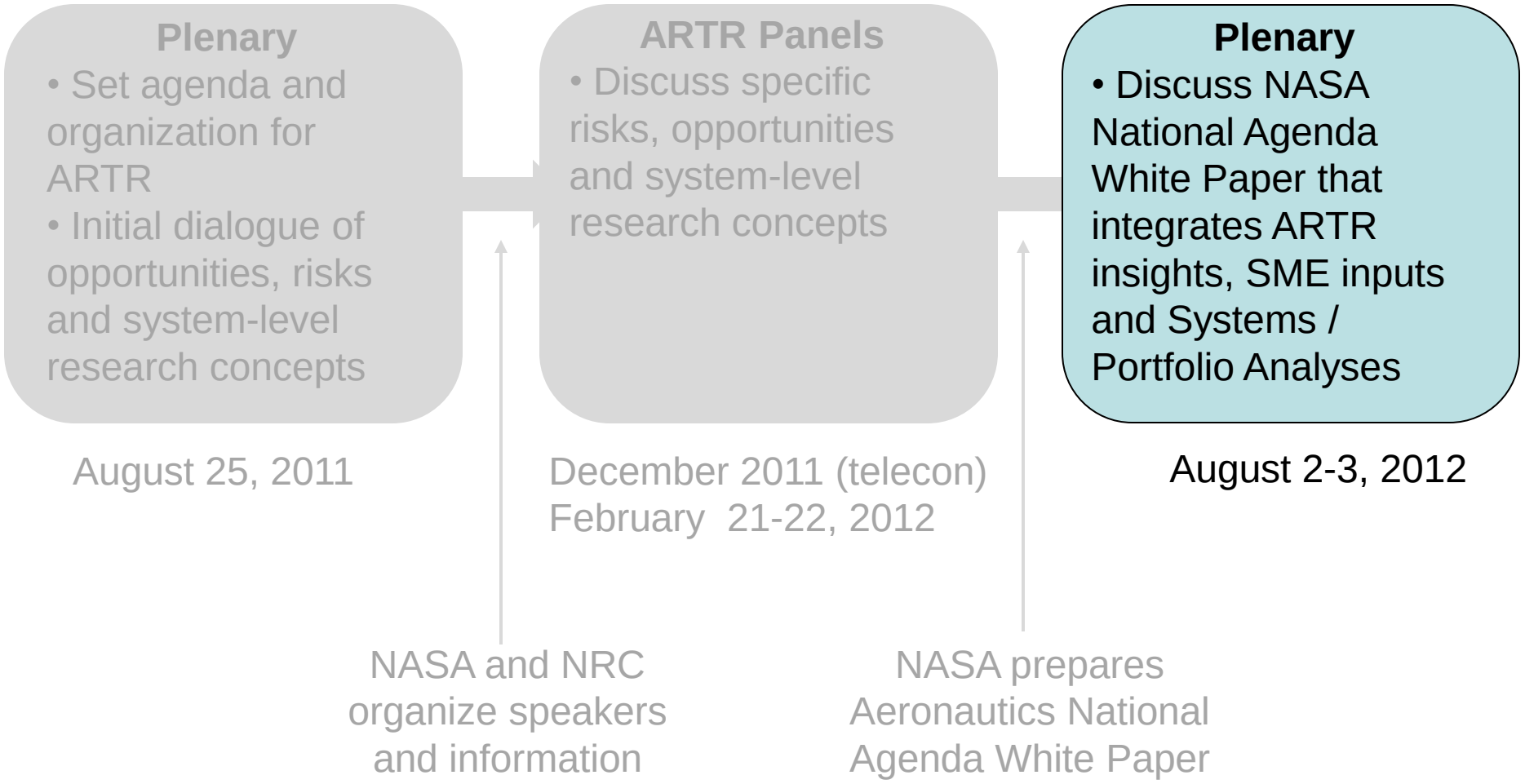
- **NASA ARMD funding situation**
- **Air traffic management system and how UAS, GA fit in – Human/Robotics interactions, roles & missions**
- **Safety**
- **Efficiency**
- **Environmental issues – noise in particular**
- **Electric propulsion**
- **Roadmaps**
- **Software certification**
- **Automation and software control systems**
- **Cybersecurity**
- **Demonstrations**

Roundtable Discussion Topics

Donohue's Observations

- **What are the Technical Competencies for Sustained Leadership?**
  - More emphasis on Aviation Systems Engineering and less on Aeronautics?
  - Software Architecture/T&E for Safety Certifications for 1:10E-9 fatal accident design criteria without extensive data available
- **What are the Most Important Aviation Risks and Opportunities for Research Focus?**
  - **Risk**: Lose International Leadership in UAS, ATC, Fuel Efficient Operations, (LOSS of a MAJOR US INDUSTRY)
  - **Opportunities:**
    - Single Pilot commercial operations (drawing on UAS technology and proper systems integration)
    - New Very Efficient 100 PAX aircraft design to feed Hubs at sustained high fuel costs;
    - Eliminate need for FAA VHF/UHF spectrum and FCC Auction to wide area broadband ISPs [Donohue's observation – not discussed]
      - FAA uses Very Valuable Spectrum Very Inefficiently, Voice Synthesis/Data Link applications under-utilized
- **What Research is Most Effectively Accomplished by Public-Private Partnerships?**
  - Every issue has a public-private dimension

Upcoming ARTR Activity



August 2-3, 2012 Roundtable Meeting

- **Provide feedback to NASA on Aeronautics national agenda white paper**
- **Obtain and discuss additional stakeholder viewpoints (such as airlines, airports, FAA, NTSB)**
- **Plan 2013 role for the Roundtable with NASA**