Importance of International Collaboration

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Global Trends
Growing and Moving East

- Estimated additional passenger volume in 2016 vs 2011:
  - Million: 831
  - Million: 380
  - Million: 193

- New airplanes by region:
  - Asia Pacific: 13,460
  - Europe: 7,450
  - North America: 7,550
  - Latin America: 2,950
  - Middle East: 2,950
  - CIS: 1,330
  - Africa: 1,080
  - Total: 36,770

Source: Boeing
China & India Growing Economically at Historically Unprecedented Rates

Average increase in percentage point share of global GDP, per decade

<table>
<thead>
<tr>
<th>Country</th>
<th>Period</th>
<th>Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK, 1820-70</td>
<td>1900-50</td>
<td>2</td>
</tr>
<tr>
<td>US, 1900-50</td>
<td>1950-80</td>
<td>3</td>
</tr>
<tr>
<td>Japan, 1950-80</td>
<td>2000-20</td>
<td>5</td>
</tr>
<tr>
<td>China, 2000-20</td>
<td>2010-30</td>
<td>6</td>
</tr>
</tbody>
</table>

Global Trends

Rapid Urbanization

Percent urban population

- 80
- 60
- 40
- 20
- 0

1950 2010 2030

Source: National Intelligence Council
Technology Development and Adoption is Accelerating

Source: National Intelligence Council

<table>
<thead>
<tr>
<th>Invention</th>
<th>Year</th>
<th>Years for 25% Adoption</th>
</tr>
</thead>
<tbody>
<tr>
<td>World Wide Web</td>
<td>1991</td>
<td>7</td>
</tr>
<tr>
<td>Mobile Phone</td>
<td>1983</td>
<td>13</td>
</tr>
<tr>
<td>Color Television</td>
<td>1951</td>
<td>18</td>
</tr>
<tr>
<td>Radio</td>
<td>1897</td>
<td>31</td>
</tr>
<tr>
<td>Telephone</td>
<td>1876</td>
<td>35</td>
</tr>
<tr>
<td>Electricity</td>
<td>1873</td>
<td>46</td>
</tr>
</tbody>
</table>

Years necessary for an invention to be used by 25 percent of the US population

Source: National Intelligence Council
NASA’s 6 Strategic Research and Technology Thrusts

- Safe, Efficient Growth in Global Operations
  - Enable full NextGen and develop technologies to substantially reduce aircraft safety risks

- Innovation in Commercial Supersonic Aircraft
  - Achieve a low-boom standard

- Ultra-Efficient Commercial Vehicles
  - Pioneer technologies for big leaps in efficiency and environmental performance

- Transition to Low-Carbon Propulsion
  - Characterize drop-in alternative fuels and pioneer low-carbon propulsion technology

- Real-Time System-Wide Safety Assurance
  - Develop an integrated prototype of a real-time safety monitoring and assurance system

- Assured Autonomy for Aviation Transformation
  - Develop high impact aviation autonomy applications
International Forum for Aviation Research

26 Member Nations
Objectives of IFAR

- **Networking**: Network among government sponsored R&D organizations
- **Cooperation**: Improve our research outcomes through collaborative activities
- **Information Exchange**: Identify priority global research challenges for common action
- **Communication**: Inform aviation-related policies through research
- **Education**: Foster the next generation of global aeronautics researchers
Young Researcher Network Opportunities
for researchers in their 20’s and 30’s

Virtual Conference
3rd International Conference on Buckling and Postbuckling Behavior of Composite Laminated Shell Structures with DESICS Workshop
For Young Aerospace Researchers

IFARlink
• Network with colleagues
• Collaborate on research
• Find or post job, funding, and award opportunities

Virtual Conferences
• Give international presentations
• Join a discussion group
• Meet the presenters

Young Researcher Conference
• Meet other young researchers, senior researchers, and executives at the IFAR Summit.
• Present your research
• Address challenges in aviation research
• Participate virtually through IFARlink

www.ifarlink.aero
www.nasa.gov
IFAR’s Five Focus Themes

- **Air Transport Efficiency**: Increase air transport system performance for growth and safety.
- **Alternative Fuels**: Research new fuels and enable the use of alternative aviation fuels.
- **Climate Change**: Reduce emissions and improve efficiency.
- **Weather and ATM**: Reduce the adverse impacts of weather on air traffic management decisions and operations.
- **Noise**: Improve management of operations at and around airports to minimize noise.
Leading International Collaboration in Pre-competitive R&D

- Design better tests/experiments
- Expand data generated through R&D
- Enhance scope and quality of analysis of results
- Inform global standards and regulations

Total value is greater than the sum of the parts
Leading International Collaboration in Pre-competitive R&D continued

Alternative aviation fuels (9 countries)

- ACCESS-II flight demonstration

Air Traffic Management (12 countries)

- Integrated Arrival/Departure/Surface
- Global R&D roadmap development
- Inform international standards

Source Aircraft:
- NASA DC-8
- NRC CT-133
- DLR Falcon 20
- NASA HU-25 Falcon

Instrumented NASA, NRC (Canada), and DLR (Germany) aircraft sampled exhaust close behind the NASA DC-8 as it burned Jet A or a Jet A/biofuel blend