

Aviation and Climate Change- Managing the Challenge of Growth

Meeting: ICAS Aviation and Environment Workshop

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Federal Aviation
Administration

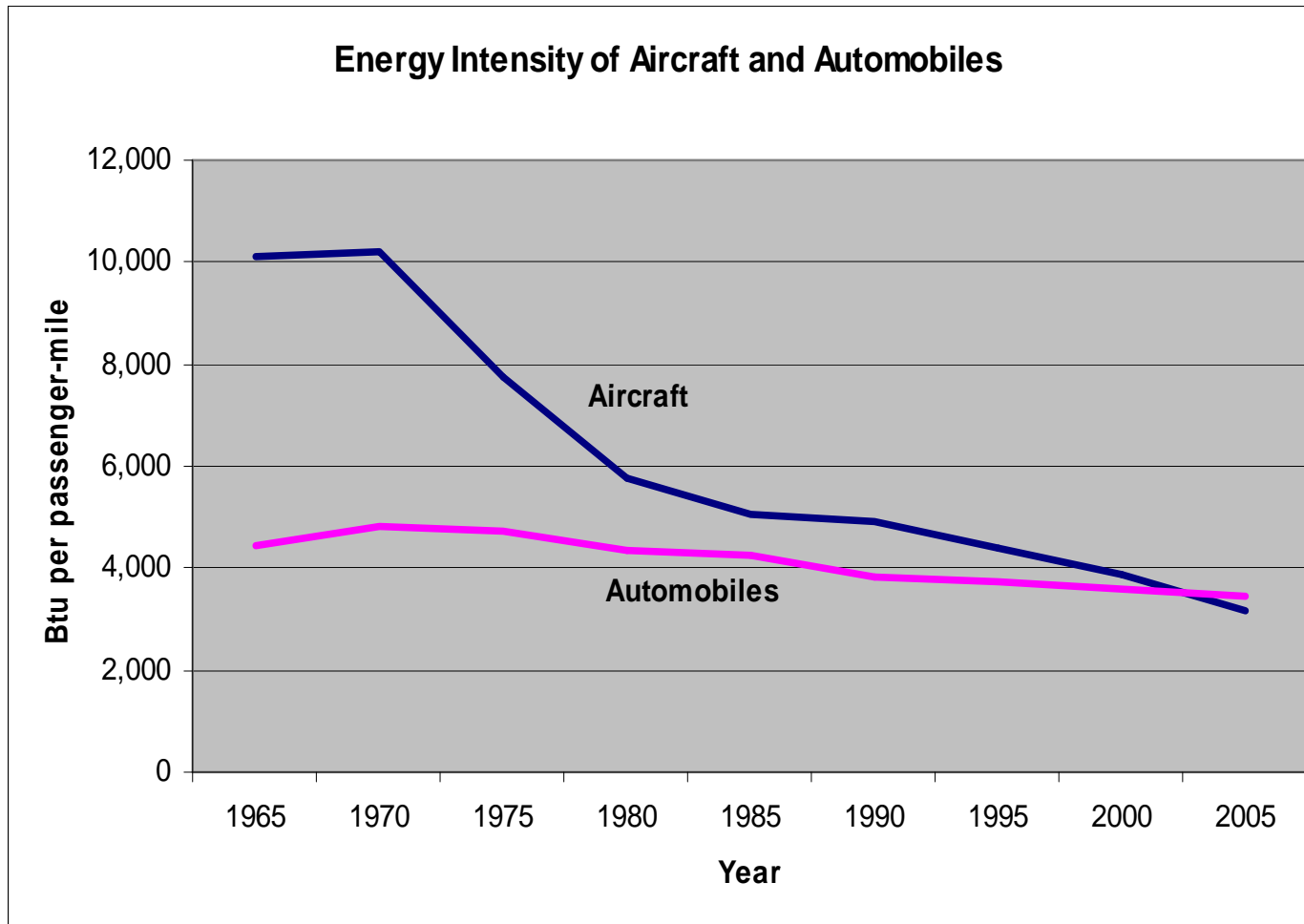


Outline

- U.S. Aviation Performance
- The Evolving Challenges
- A Way Forward: The NextGen Plan
- The Year Ahead
- Some Closing Observations

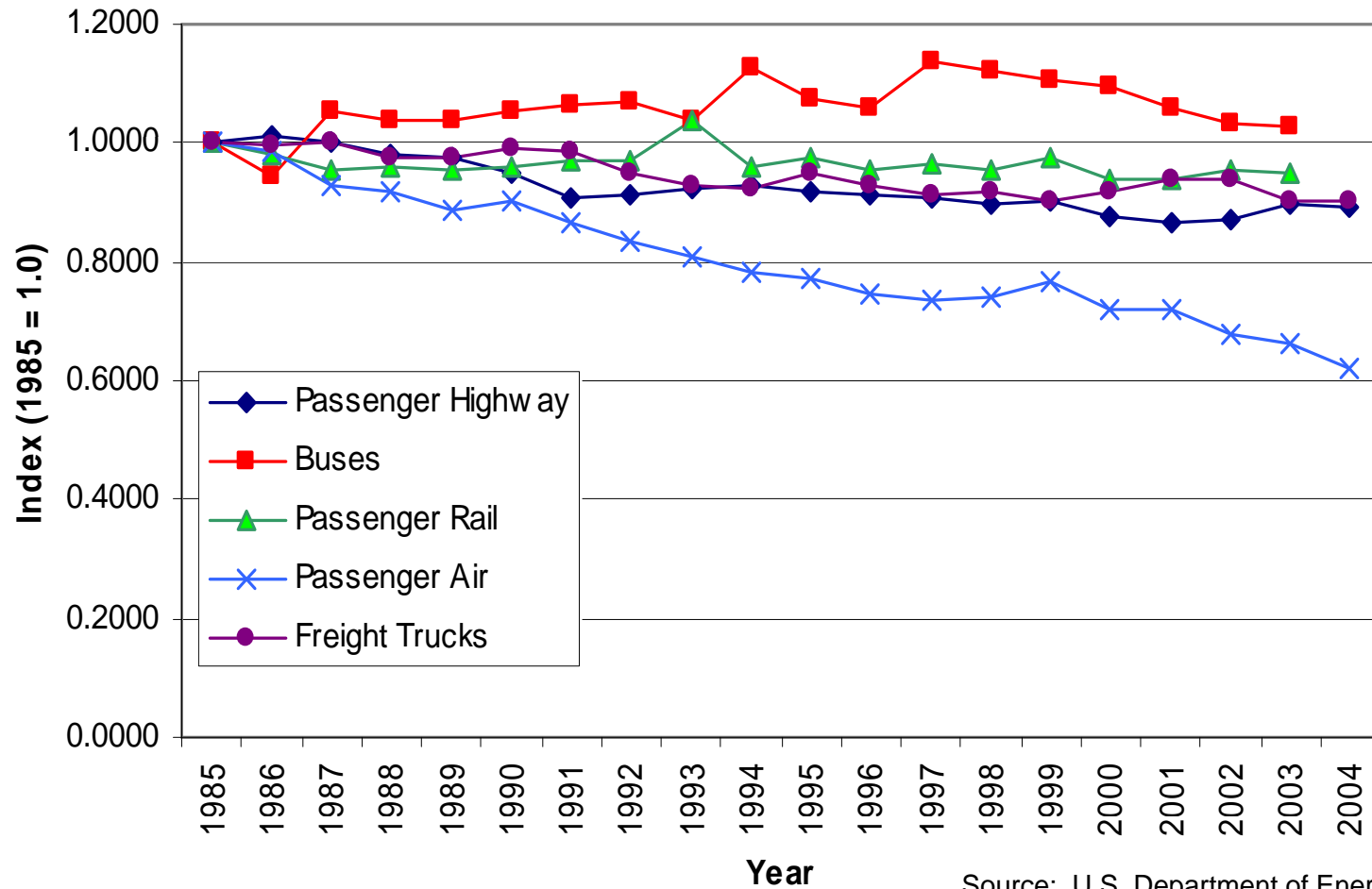


U.S. Experience: Aircraft and Automobiles



Source: U.S. Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics 2007*, Table 4-20: Energy Intensity of Passenger Modes (Btu per passenger-mile)

U.S. Experience: Transportation Mode Performance

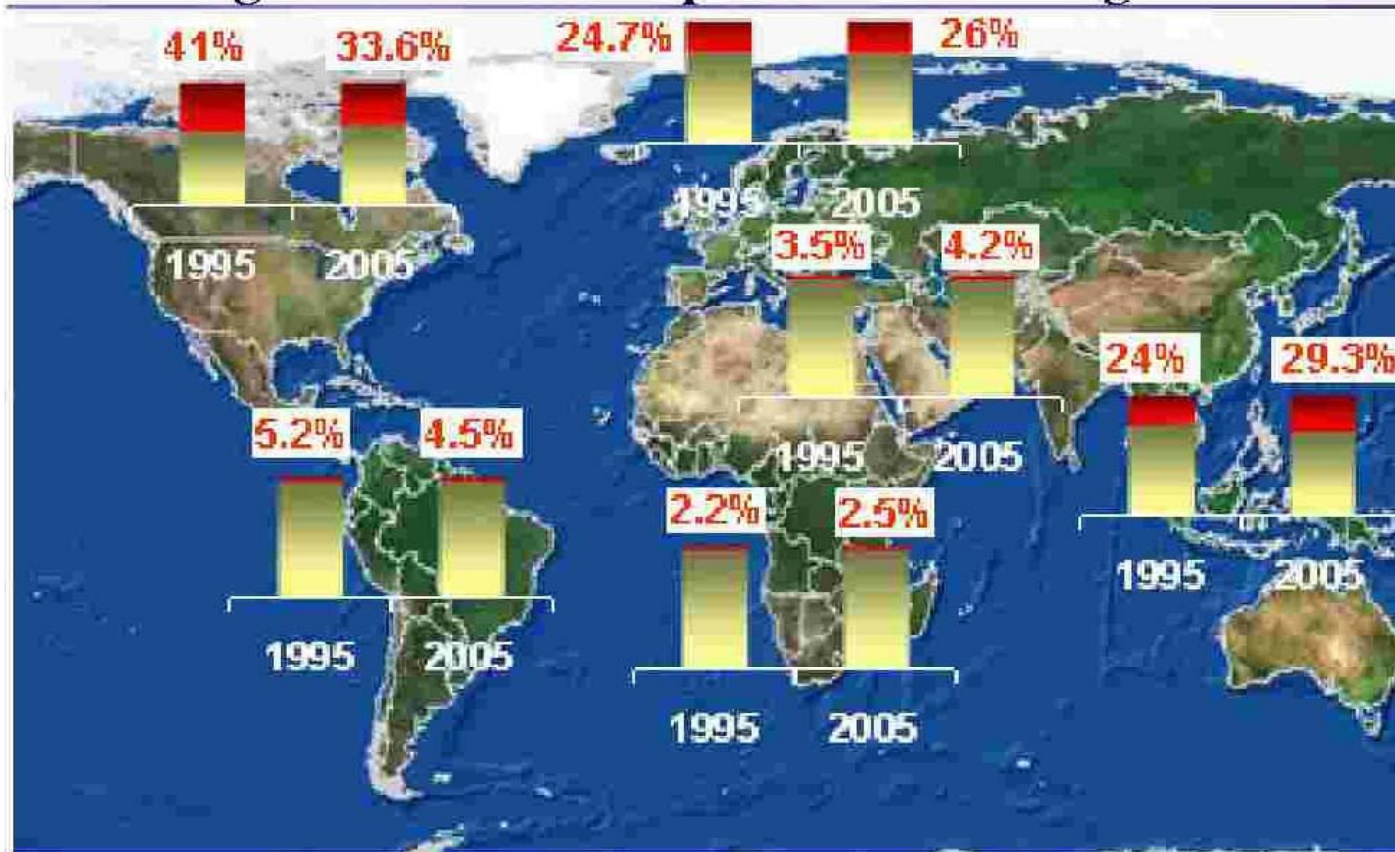


Source: U.S. Department of Energy, U.S. Energy Intensity indicators. (intensityindicators.pnl.gov)



U.S. Experience: Declining Contribution to Global Fuel Use

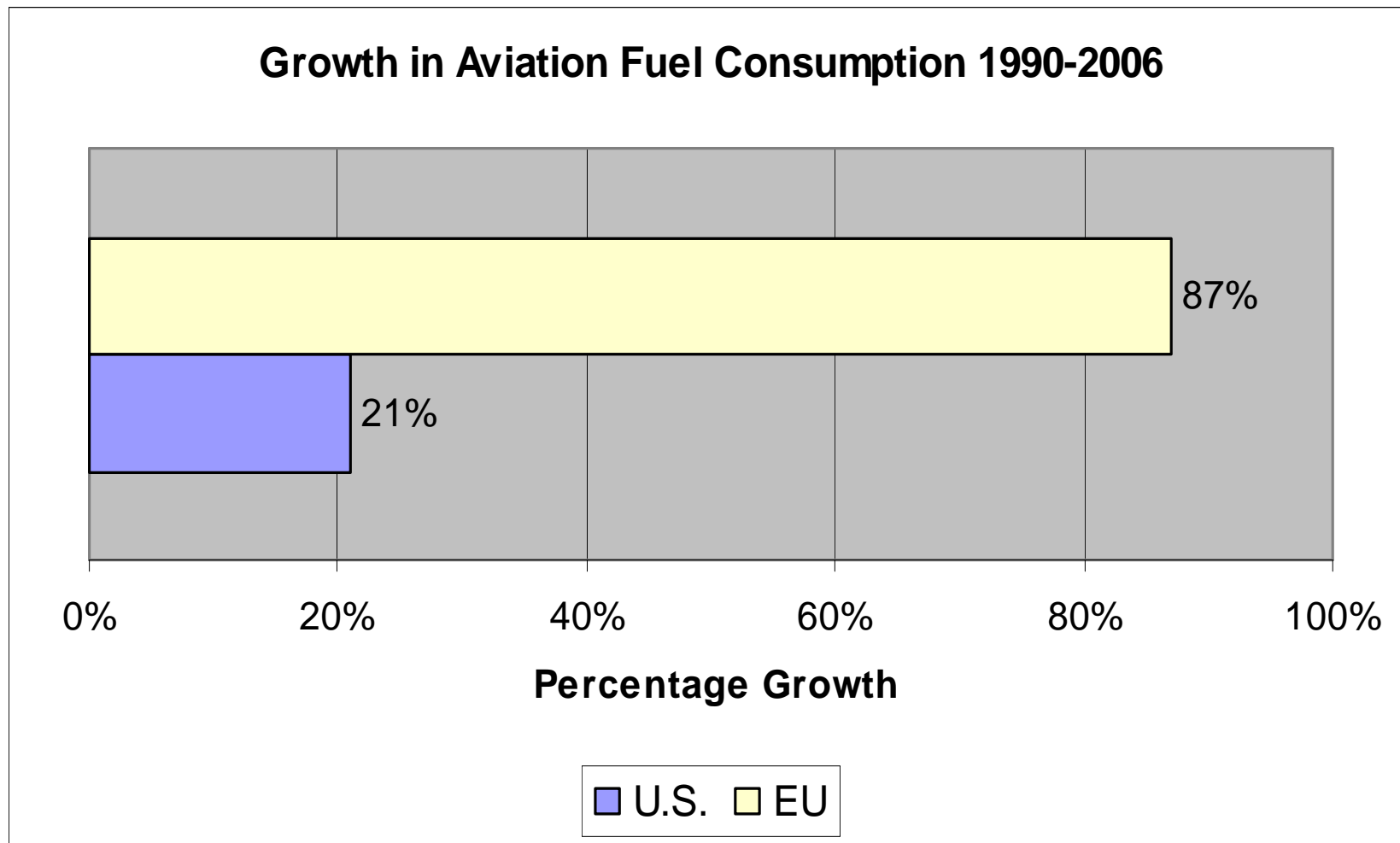
Regional fuel consumption as % of the global



Source: ICAO based on OAG timetable

*By region of registration

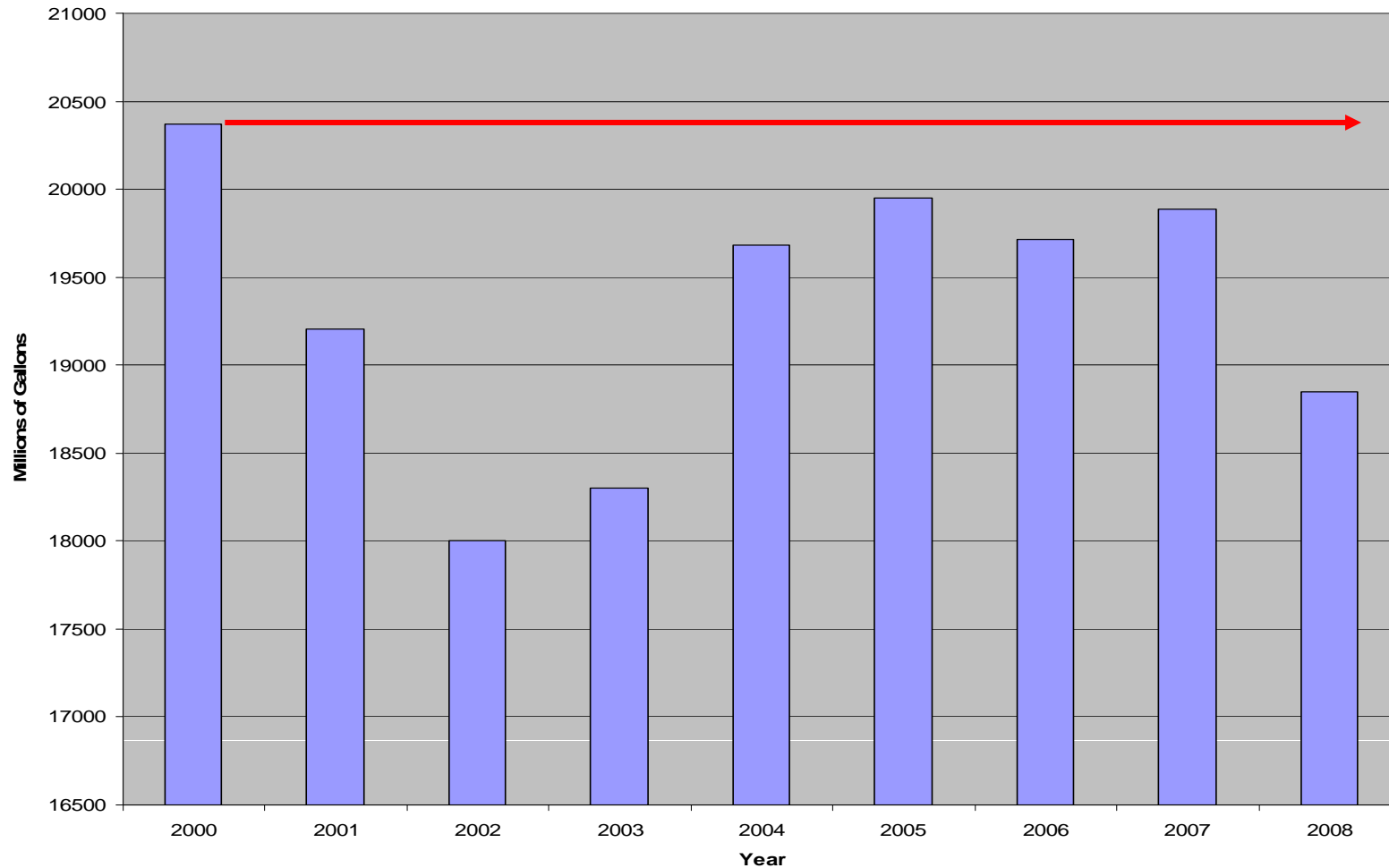
U.S. Experience: Much Slower Growth than Europe



Source: BTS, EEA

U.S. Experience: Absolute Decline in Fuel Consumption

U.S. Commercial Aviation Fuel Consumption



Source: BTS



The Challenge: Multiple Environmental Drivers

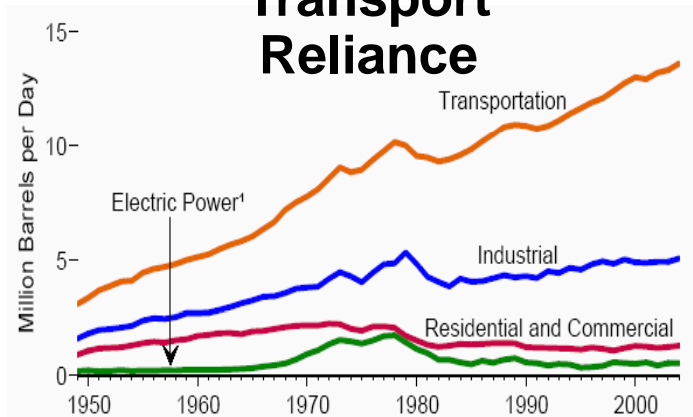
- Aviation impacts community noise footprints, air quality, water quality, energy usage and availability, and the global climate.
- Trends show environmental impacts from aircraft noise and aviation emissions will be a critical constraint on capacity growth.
- Fundamental changes ongoing from economic downturn, fuel costs, and financial turmoil.



➤ ***The challenge is to ensure energy availability and affordability and reducing aviation's environmental footprint, even with projected aviation growth***

Challenge: Changing Oil & Energy Dynamics

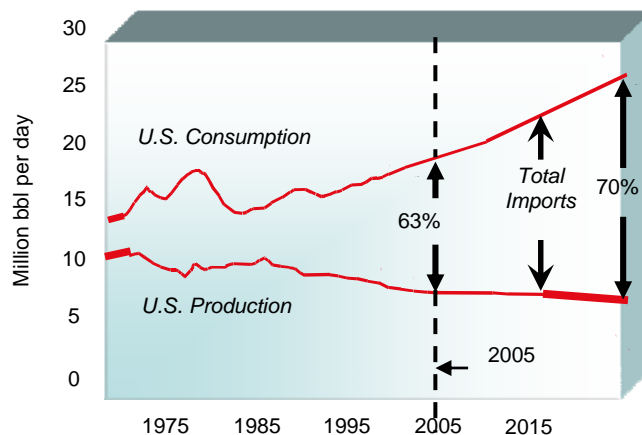
Transport Reliance



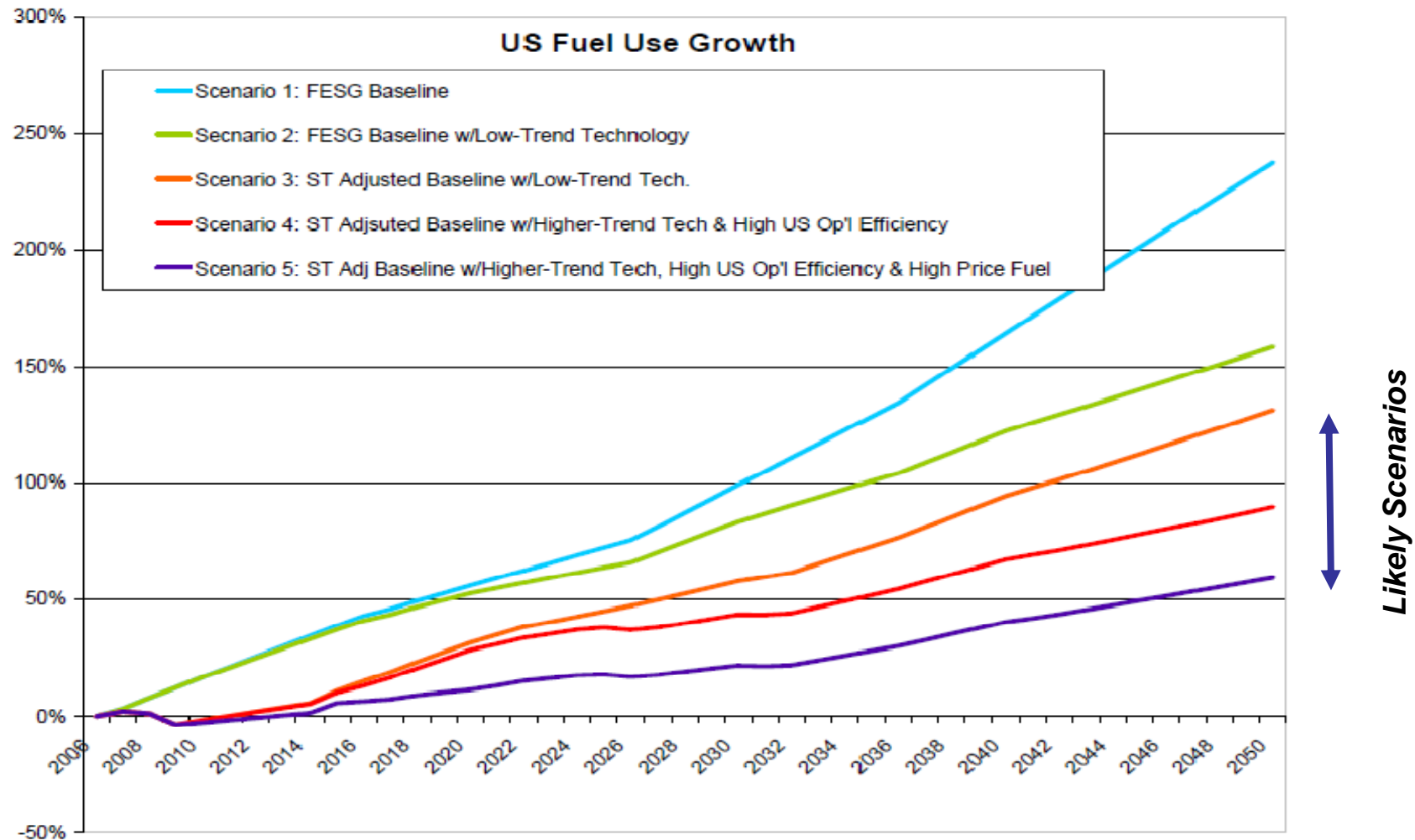
Price Volatility



Energy Security



The Challenge: Some U.S. Fuel Scenarios

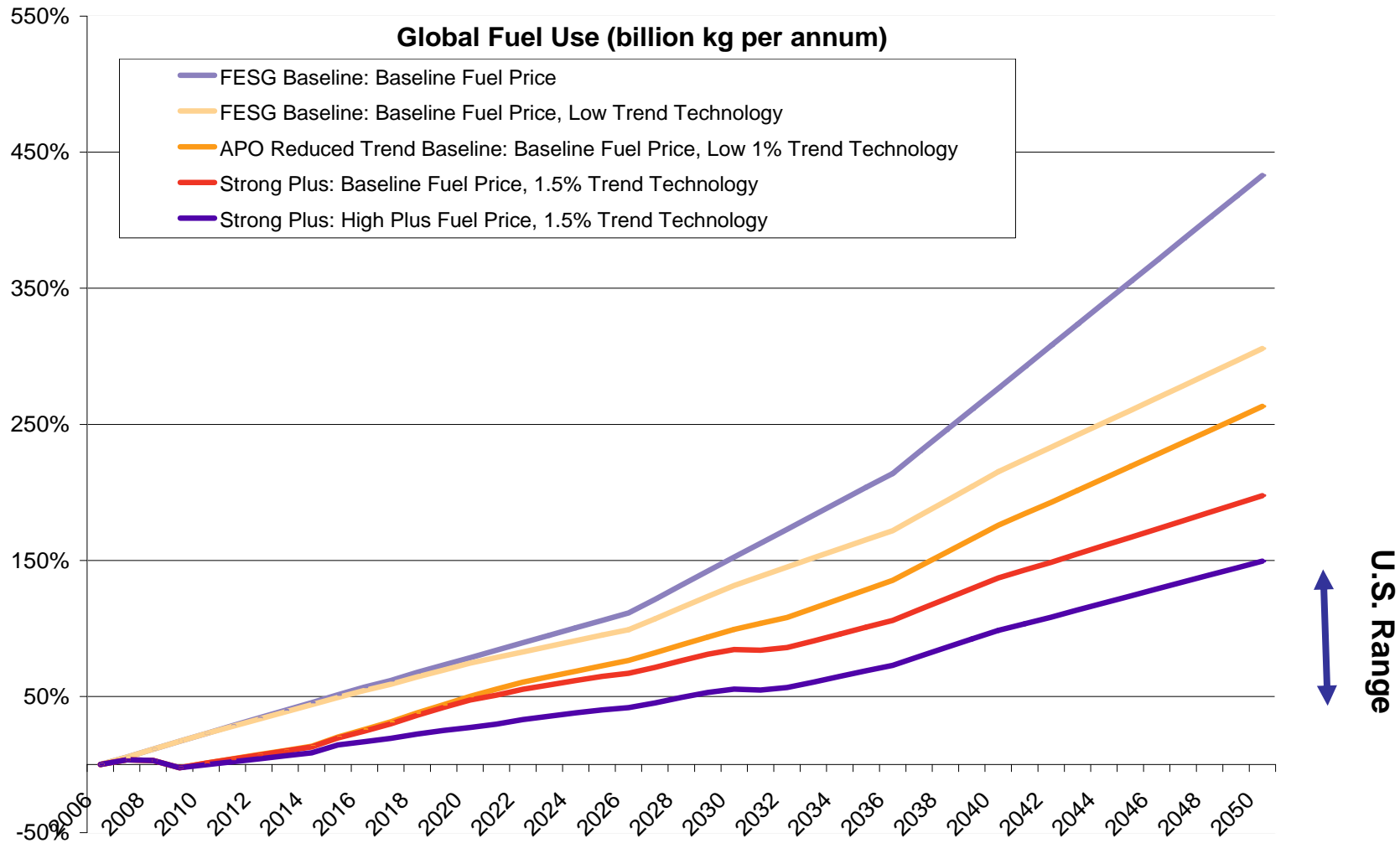


Source: FAA Preliminary Analysis

The Challenge: Growing Role of Developing Countries

Rank	Country	RPKs	% RPKs	Cum %
1	UNITED STATES	1244694456	33.43%	
2	EU	909917091	24.44%	57.9%
3	CHINA	272563311	7.32%	65.2%
4	JAPAN	153288868	4.12%	69.3%
5	AUSTRALIA	99614166	2.68%	72.0%
6	CANADA	94680009	2.54%	74.5%
7	SINGAPORE	82904045	2.23%	76.7%
8	REPUBLIC OF KOREA	69292450	1.86%	78.6%
9	UNITED ARAB EMIRATES	65121483	1.75%	80.3%
10	RUSSIAN FEDERATION	63192258	1.70%	82.0%
11	THAILAND	50809492	1.36%	83.4%
12	BRAZIL	50688932	1.36%	84.8%
13	MALAYSIA	49578130	1.33%	86.1%
14	INDIA	46150555	1.24%	87.3%
15	MEXICO	34122966	0.92%	88.3%
16	SOUTH AFRICA	29191380	0.78%	89.0%
17	INDONESIA	28243288	0.76%	89.8%
18	NEW ZEALAND	26092980	0.70%	90.5%
19	TURKEY	24297389	0.65%	91.2%
20	SAUDI ARABIA	23793457	0.64%	91.8%

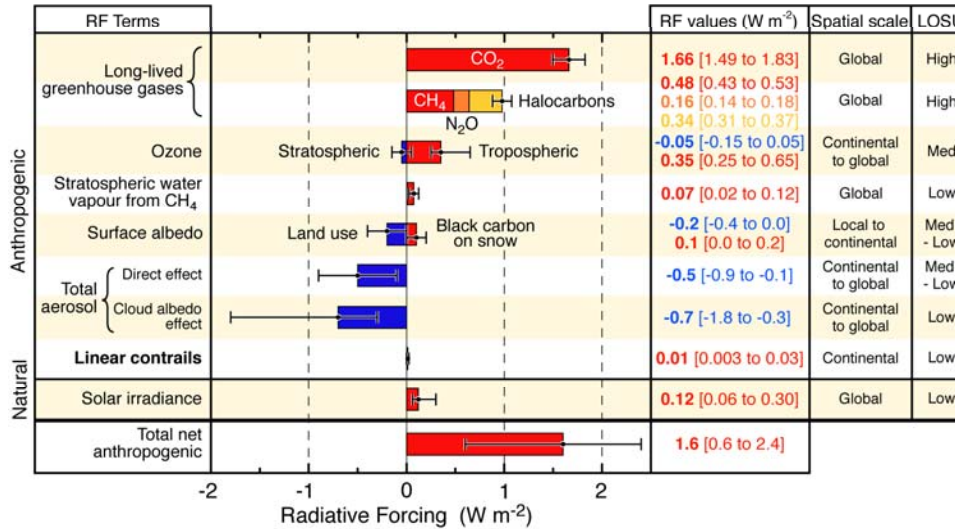
The Challenge: Global Growth Much Higher than U.S.



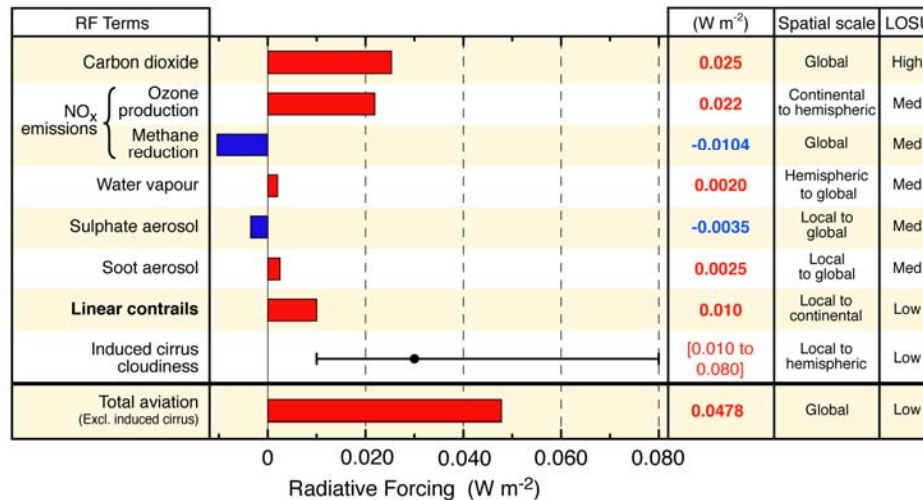
Source: FAA Preliminary Analysis

The Challenge: Aviation Associated Uncertainties in Climate

Global Radiative Forcing Components in 2005



Aviation Radiative Forcing Components in 2005



Aircraft emissions account for ~3% of total human induced global integrated climate change

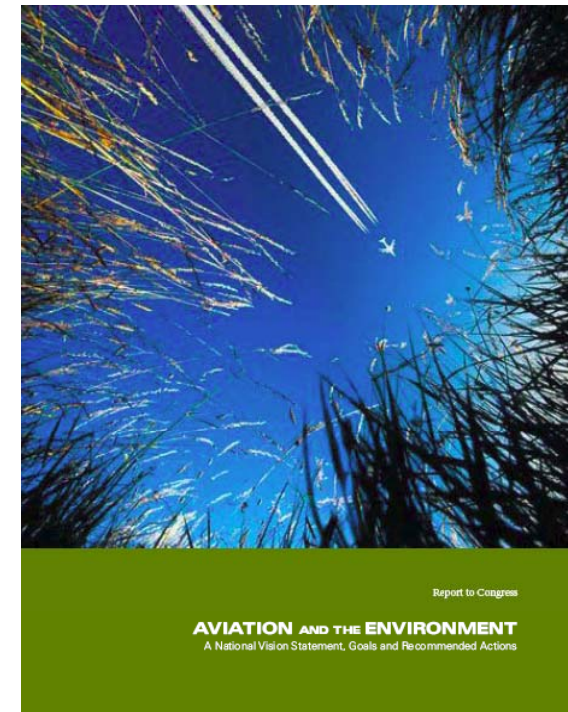
Measures to Tackle the Challenge

NextGen Vision

Provide environmental protection that allows sustained aviation growth

Key Initiatives:

- Continued Local Mitigation
- Better Scientific Understanding
- Enhanced Policy Tools
- Leveraging Research Resources
- Accelerate Operational Changes
- Mature New Aircraft Technology
- Develop Sustainable Alternative Fuels
- Policy Options



A Way Forward: Continuing Mitigation Efforts



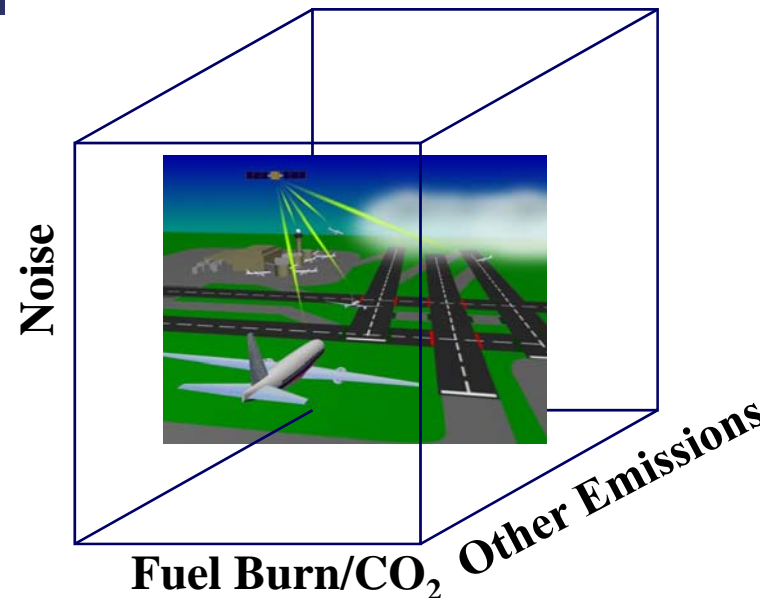
- **Airport Configuration and Operation for Better Efficiency**
 - New runways, extensions, taxiways, preferential runway use
- **Airport Ground Measures**
 - Run-up areas, aircraft taxiing, noise shielding
- **Aircraft Flight Procedures**
 - Optimized profile descent, departure profiles
- **Program Support Measures**
 - Noise monitoring, complaint response, pilot education, noise advisory committees, noise abatement officer, property advisory services, periodic program review
- **Voluntary Airport Low Emissions (VALE) Program**
 - Financing low emission vehicles, refueling and recharging stations, gate electrification, and other airport air quality improvements for airports in clean air non-attainment and maintenance regions

The Way Forward: Better Science & Integrated Analysis

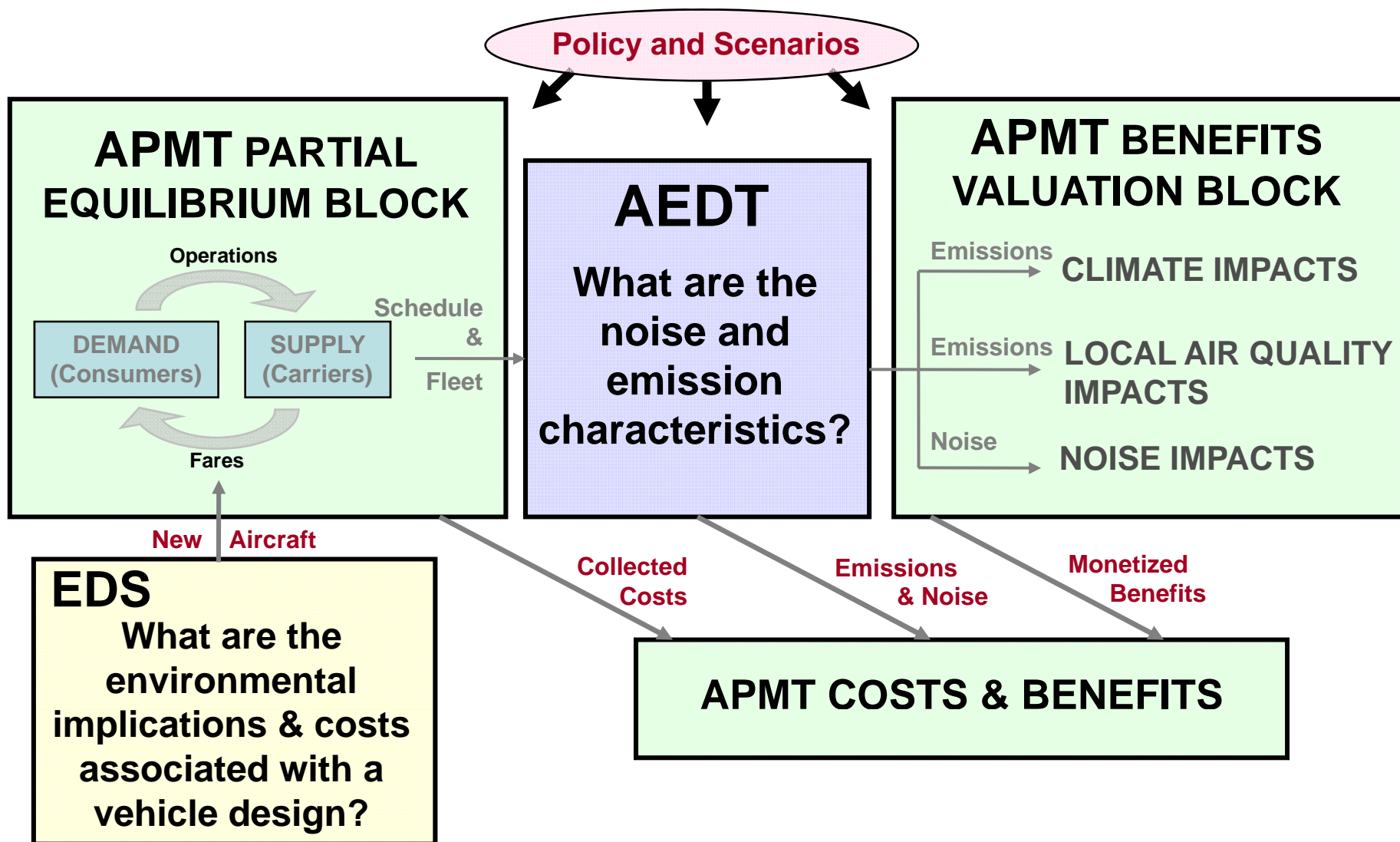


Improved metrics, measurement techniques, and modeling capability to quantify and predict impacts and to understand inter-relationships of aviation environmental factors

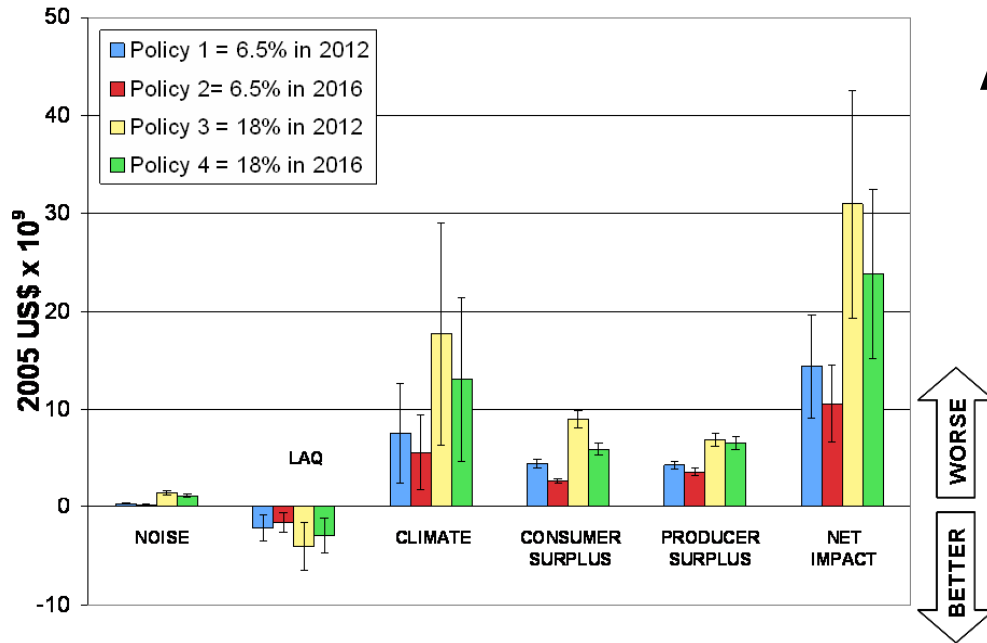
**Aviation Emissions
Characterization (AEC) Roadmap**
**Aviation Climate Change Research
Initiative (ACCRI)**
**Evolving Noise Metrics and Health
Impacts Plan**



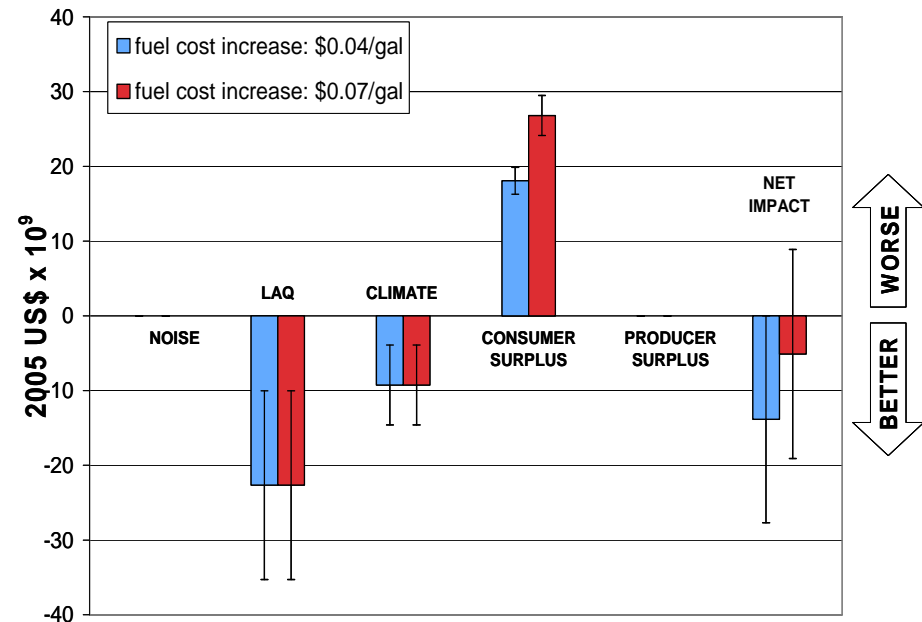
A Way Forward: New Integrated Tools & Approach



A Way Forward: Integrated Assessment



Traditional Increased Stringency Approach to reduce NOx....



Versus consideration of an ultra low sulfur fuel (alternative or conventional)...

Note: All numbers in both charts are not for citation. They are very provisional data used in sample problems for models

A Way Forward: Leveraging Research Resources



Partnership for Air
Transportation Noise and
Emission Reduction
www://partner.aero

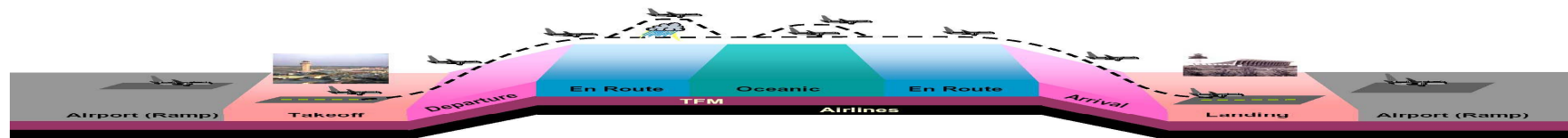
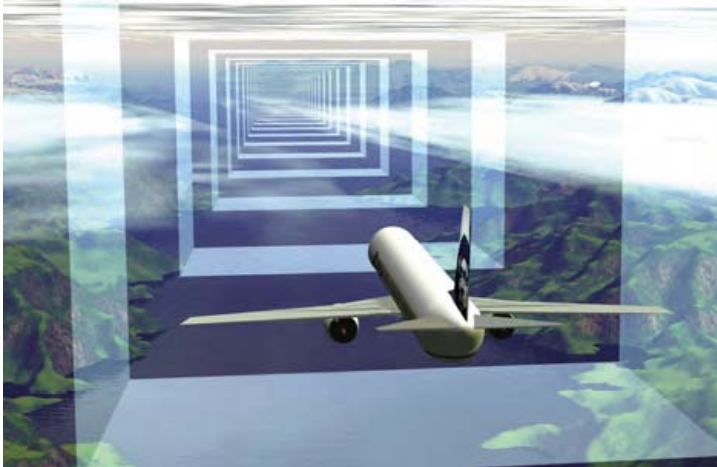


A world-class research organization...

- ...closely aligned with national and international needs
- ...leveraging a broad range of stakeholder capabilities
- ...fostering breakthrough technological, operational, policy and workforce advances

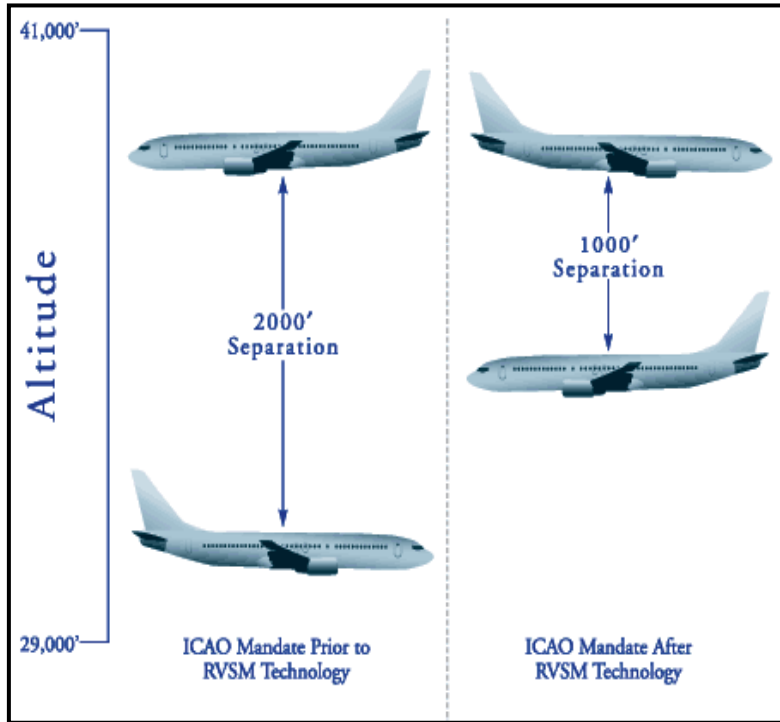
- Georgia Institute of Technology
- Harvard University
- Massachusetts Institute of Technology
- Pennsylvania State University
- Purdue University
- Stanford University
- Missouri University of Science and Technology
- University of North Carolina
- York University

A Way Forward: Transforming Air Traffic Management



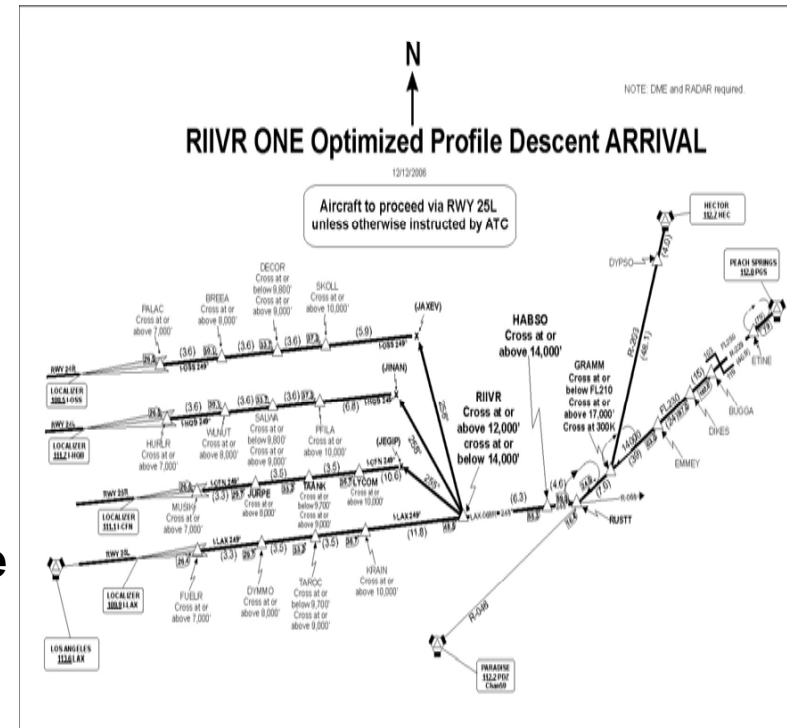
New air traffic management capabilities and procedures will allow us to further reduce aviation's environmental footprint

A Way Forward: Benefits of New Procedures Arriving Now

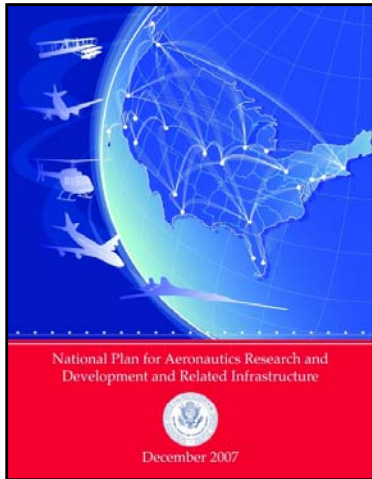


- Instituted in US in Jan 2005
- Enhances capacity in preferred altitudes
- Estimated 300 million gallons saved yearly

- Continuous Descent Approach at LAX
- Saves fuel usage, emissions, and noise



A Way Forward: U.S. Aeronautics Environmental Goals



N + 1 (2015 EIS)

- 33% Fuel burn
- 60% LTO NOx ref CAEP/6
- 32 dB noise ref Stage 4

N + 2 (2020 IOC)

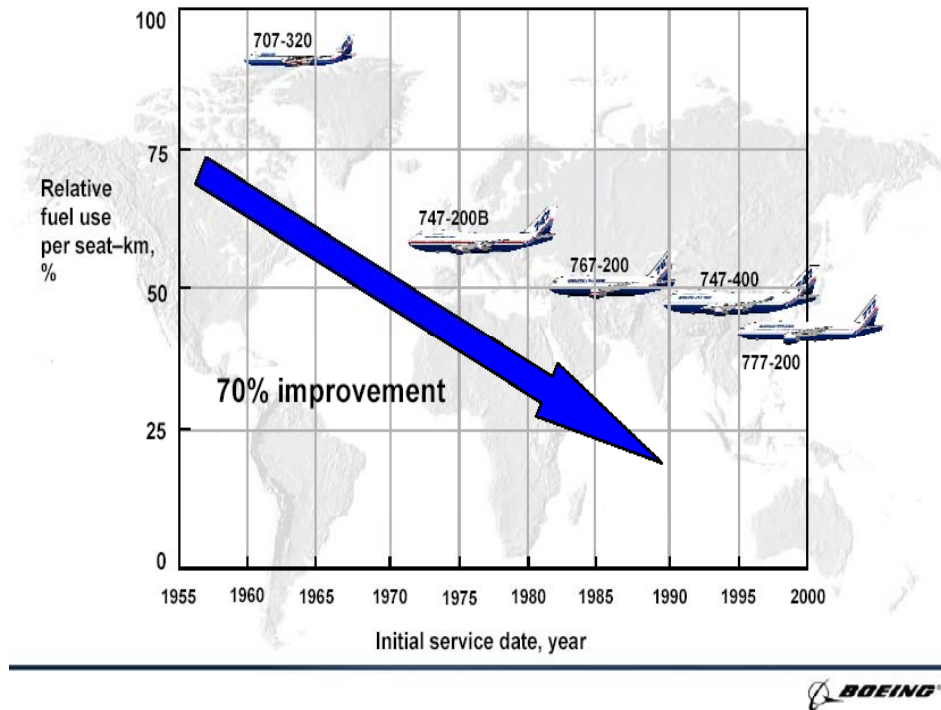
- 40% Fuel burn
- 70% LTO NOx ref CAEP/6
- 42 dB noise ref Stage 4

N + 3 (2030-35 EIS)

- 70% Fuel burn
- Better than - 75% LTO NOx ref CAEP/6
- 55 LDN (dB) at airport boundary



A Way Forward: Fostering New Aircraft Technology

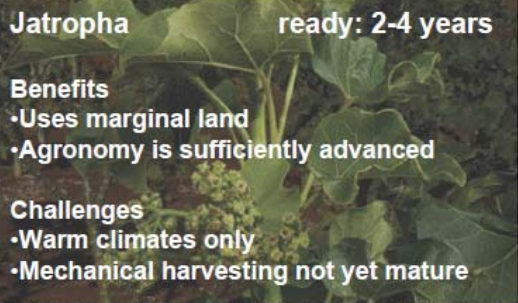


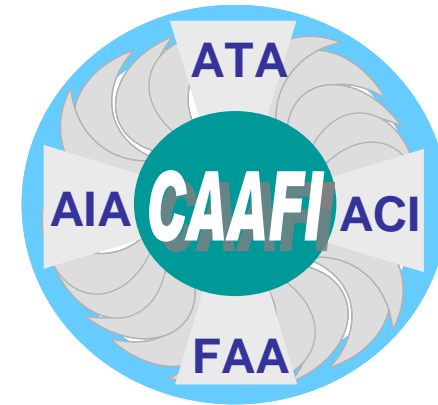
FAA Continuous Low Energy, Emissions and Noise (CLEEN)

Establishing a consortium to accelerate development of aircraft and engine technologies – to reduce noise, air quality, and greenhouse gas emissions.

http://www.faa.gov/news/conferences_events/2008_market_research_conference/

A Way Forward: Accelerating Use of Sustainable Energy

 <p>Jatropha ready: 2-4 years</p> <p>Benefits</p> <ul style="list-style-type: none">•Uses marginal land•Agronomy is sufficiently advanced <p>Challenges</p> <ul style="list-style-type: none">•Warm climates only•Mechanical harvesting not yet mature	 <p>Algae ready: 8-10 years</p> <p>Benefits</p> <ul style="list-style-type: none">•High productivity•Potential for scale <p>Challenges</p> <ul style="list-style-type: none">•Major process tech. innovation needed•GMO risks
 <p>Halophytes ready: 2-4 years</p> <p>Benefits</p> <ul style="list-style-type: none">•Uses desert land and salt water•Part of system designed for GHG reduction <p>Challenges</p> <ul style="list-style-type: none">•Proven at pilot scale to-date•Improve agronomy for cost reduction	 <p>Camelina ready: now</p> <p>Benefits</p> <ul style="list-style-type: none">•Ready-to-go•Can integrate with traditional agriculture <p>Challenges</p> <ul style="list-style-type: none">•Limited total potential owing to yield•Somewhat tied to grain market swings

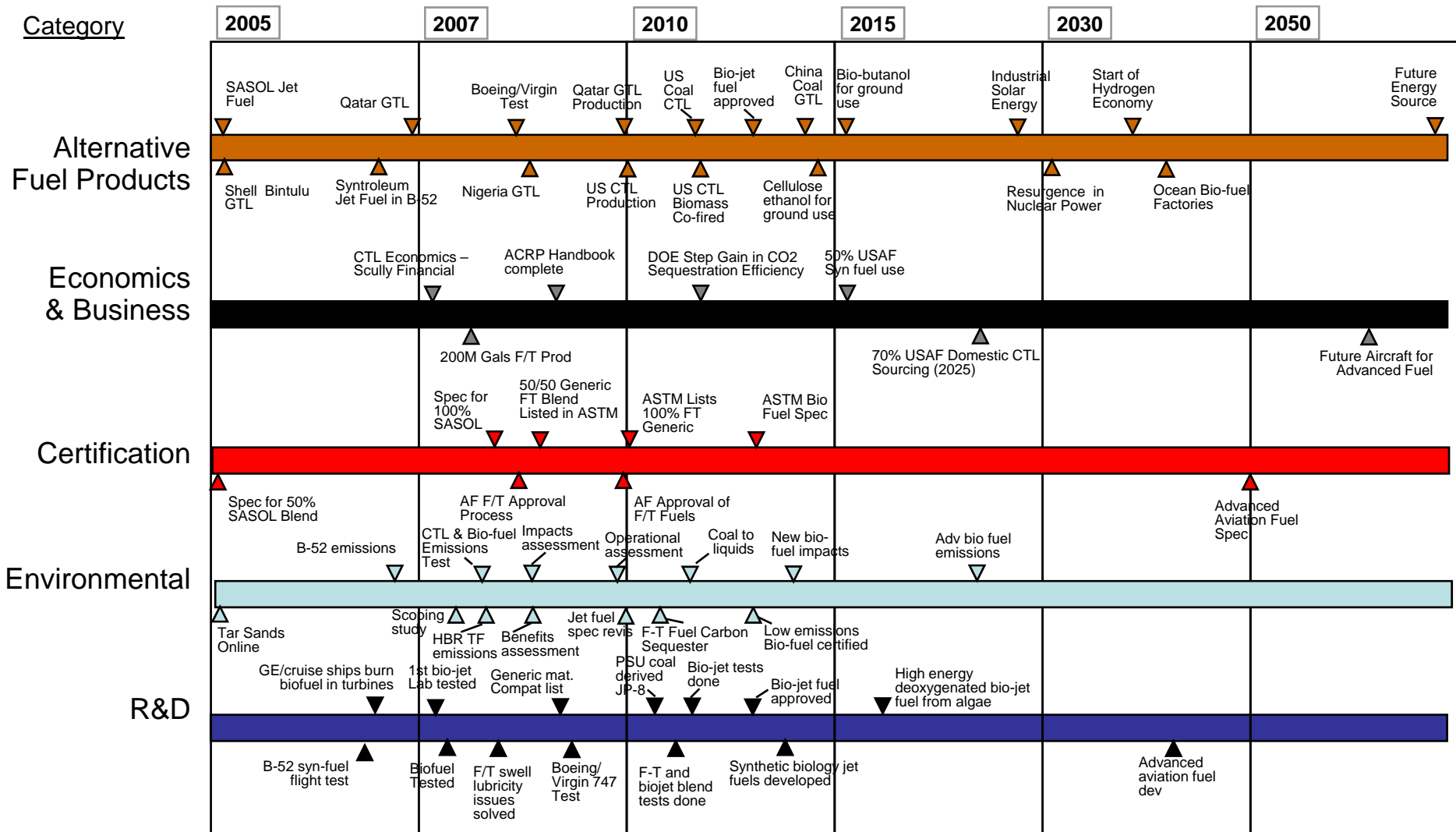


Commercial Aviation Alternative Fuel Initiative

<http://caafi.org>

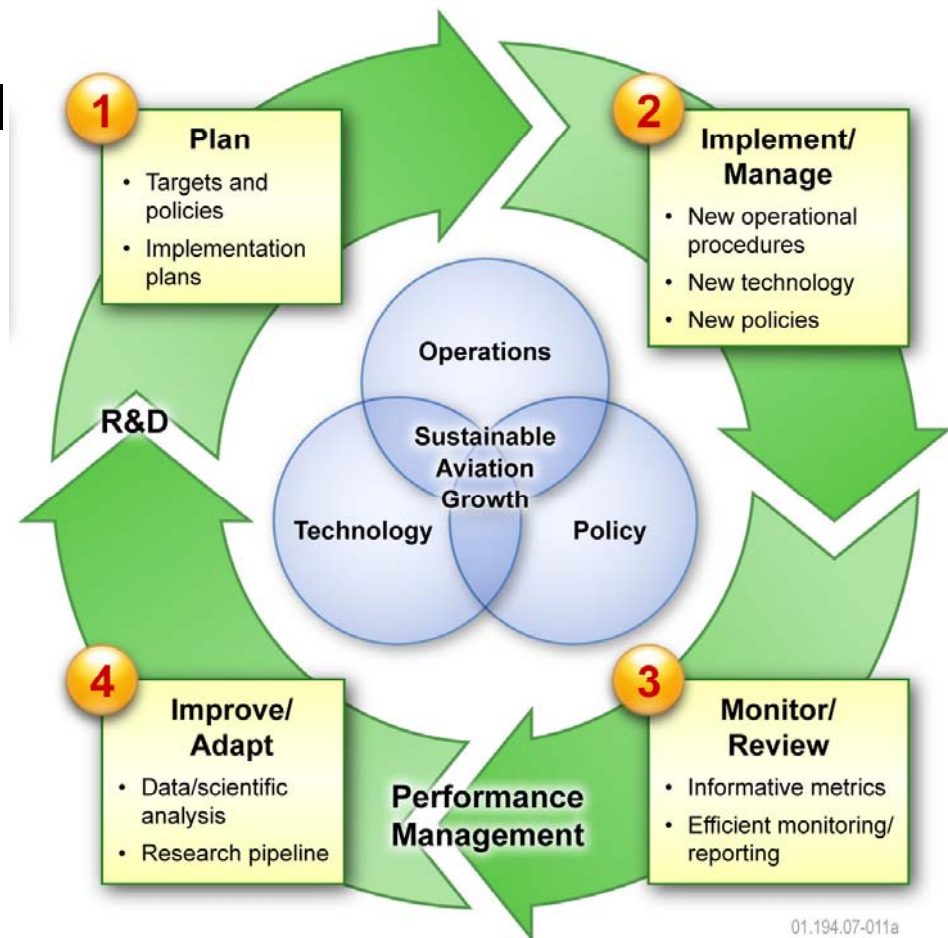
- Looking at a range of fuels
- Potential to enhance energy security and environmental performance
- Assessing business, safety, and environmental aspects
- Aggressive certification targets
- Operational use in 3-5 years

The Way Forward: CAAFI Roadmaps



A Way Forward: Some Policy Options

- Developing an “Environmental Management Systems (EMS) Approach” for NextGen
- New decision support tools
- Developing initial metrics and targets for NextGen
- Possible Market-Based Measures



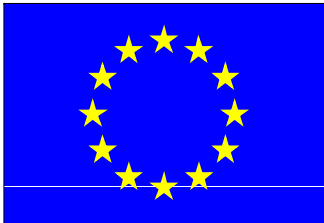
The Year Ahead: Political Developments



December 2009 Copenhagen meeting could shape future decisions on international bunker fuels.



ICAO's Group on International Aviation and Climate Change. Recommendations going to ICAO Council in late June. High Level Meeting in October 2009.



EU steps to include international aviation continue. The current design of their system is likely to produce legal conflict with multiple countries around the world.



U.S. Congress considering a number of climate and energy bills. Unclear what and when legislation will pass.

Some Closing Observations

- U.S. aviation has exceptional environmental record.
- Despite past progress, more complex environmental challenges to aviation growth ahead
- Climate change and energy issues could prove the most significant challenge.
- NextGen plan offers an integrated approach of technology, operational and policy innovation to address environmental constraints.
- A number of international and domestic decisions this year will shape the future of aviation.
- International partnership and collaboration is essential for success in meeting the challenges.



