

NASA Aeronautics Update

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Topics

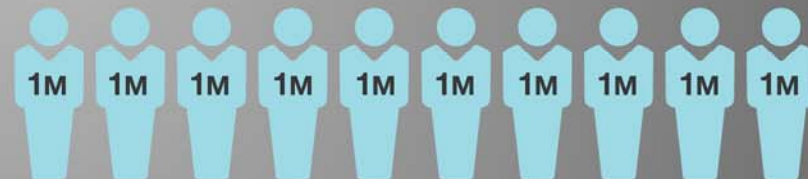


- **NASA Aeronautics Strategy**
- **FY 15 Budget Highlights**
- **New ARMD Structure**



Why is aviation so important?

The air transportation system is critical to U.S. economic vitality.





Why should I care?

Take the system view. You may not have flown today but something you needed did.



\$1.6 TRILLION
VALUE OF FREIGHT TRANSPORTED BY AIR
(exports, domestic, indirect spending, 2008)



\$636.1 BILLION
SPENT BY AIR TRAVELERS IN U.S. ECONOMY
(foreign and domestic travelers, 2008)



734 MILLION
PASSENGERS ON U.S. CARRIERS
(domestic and international, 2012)

Aeronautics Research Supports High Quality Manufacturing Jobs



Civil Aeronautics Manufacturing*

2008 1,096,000 jobs

2009 1,112,000 jobs



“Sales orders for all four versions of the GTF engine, which each have an estimated price of \$12 million, have prompted Pratt to add nearly 500 engineers at its East Hartford, Conn., headquarters. “We haven't done this in some time,” says Sue Gilbert, director of human resources.... Every business in the area, from real estate to dentists to pizzerias, could benefit.” – **Time Magazine**

* FAA 2011

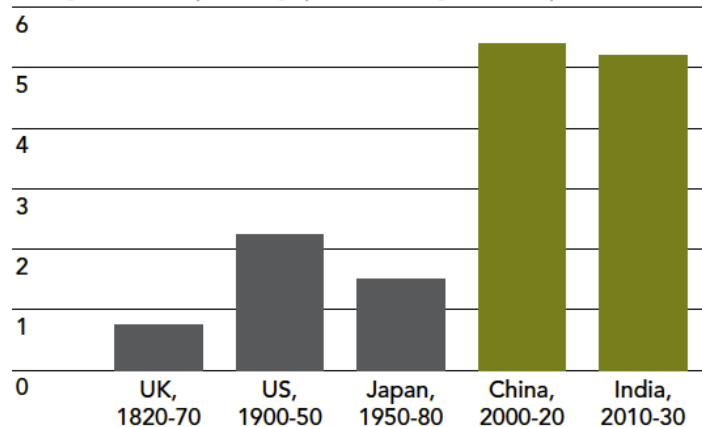


What do emerging global trends reveal?

New realities challenge traditional approaches to strategic planning.

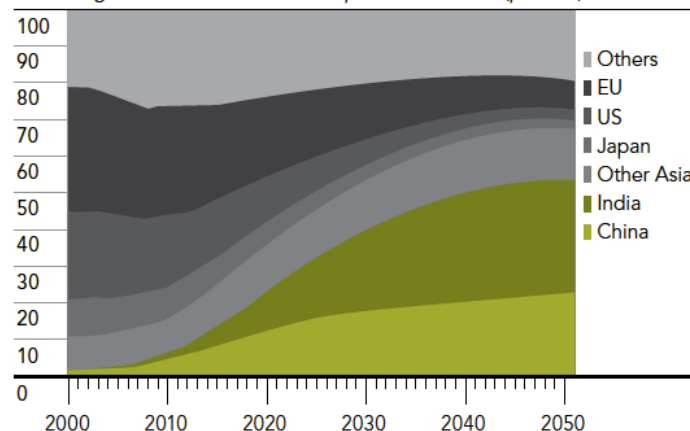
China and India growing economically at unprecedented rates

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



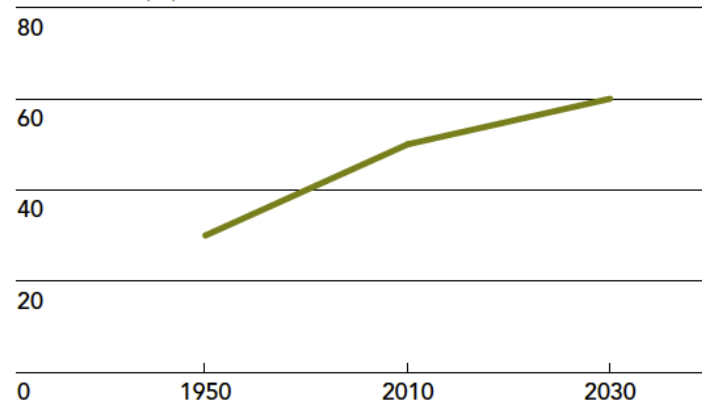
Asia-Pacific will have the largest middle class

Share of global middle-class consumption, 2000-2050 (percent)

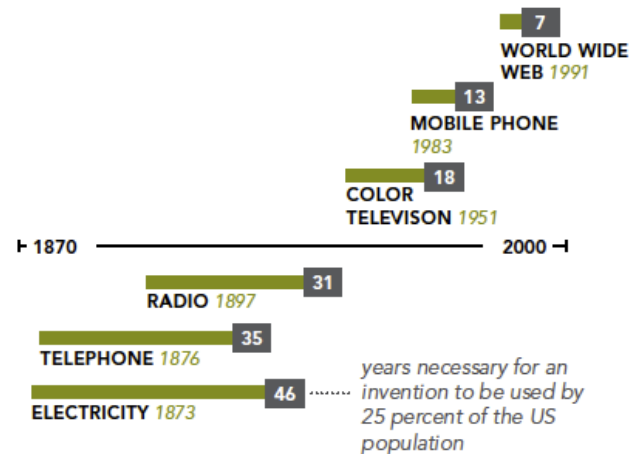


The world will be predominantly urban

Percent urban population



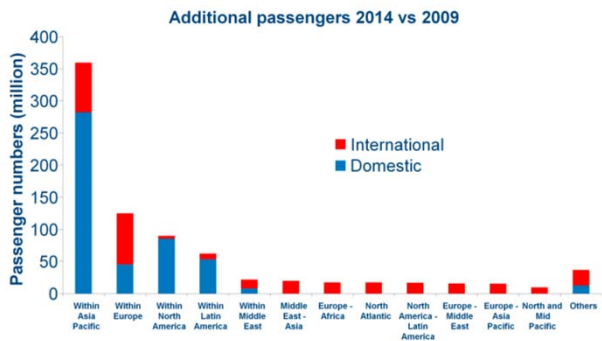
Revolutionary technology development and adoption are accelerating



Why are these trends important?

Challenges are multiplying and accelerating. Technology is a catalyst.

Adding 360 million passengers in Asia Pacific



Source: IATA

They drive global demand for air travel...

FLYING HIGH

The C919, slated to take off in 2014, will be a 150-seat single-aisle jetliner.



Compared to current airplanes of the same size, the C919 jet is expected to:

- ✓ Use up to 15 percent less fuel
- ✓ Cut direct operation cost by 10 percent
- ✓ Reduce carbon emission by 50 percent

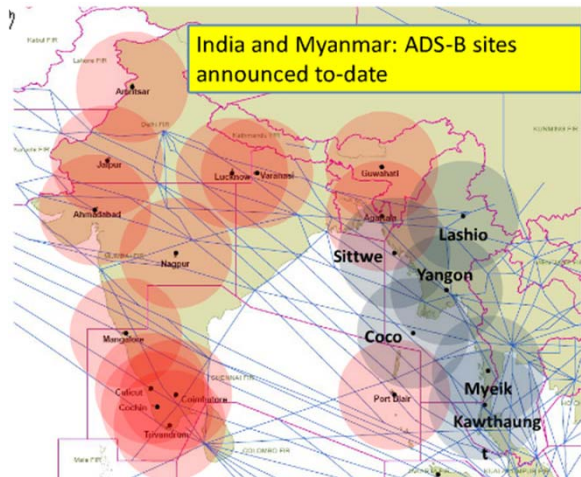
FLYING FOR THE SKIES

	C919 [®]	A320 [®]	737-800 [®]
Overall length	38.6m	37.6m	39.5m
Height	12.5m	11.8m	12.5m
Wing span	33.6m	34.1m	34.3m
Range (Max)	5,555km	5,700km	5,665km

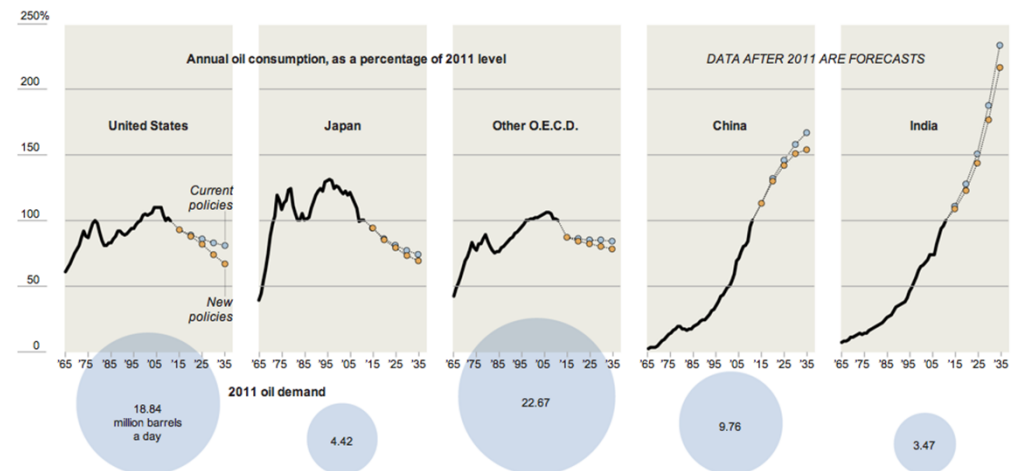
Source: COMAC[®], Airbus[®], Boeing[®]

TIAN CHI / CHINA DAILY

They drive expanding competition for high-tech manufacturing...



They drive "leapfrog" adoption of new technology/infrastructure...



They drive resource use, costs, constraints and impacts...

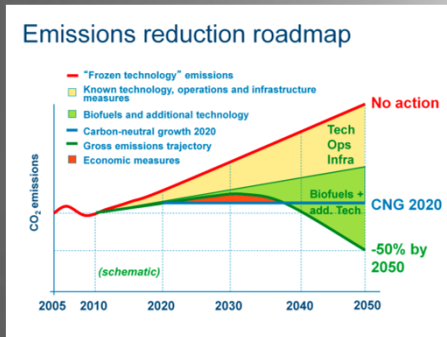


How do these trends affect aviation?

Three mega-drivers emerge.



Traditional measures of global demand for mobility – economic development, urbanization -- are growing rapidly



Severe energy and climate issues create enormous affordability and sustainability challenges



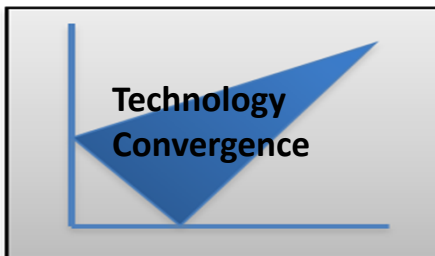
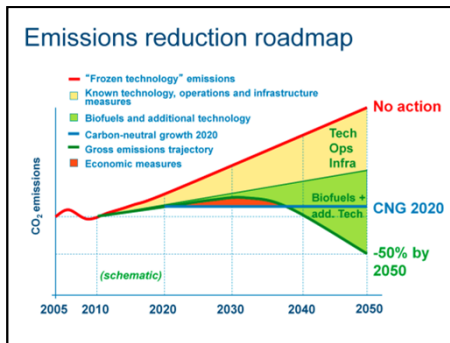
Revolutions in automation, information and communication technologies enable opportunity for safety critical autonomous systems



How is NASA Aeronautics responding?

Research is organized into six relevant themes.

3 Mega-Drivers



6 Strategic Research & 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 Transports

- 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 tools for use in a prototype of an integrated safety monitoring and assurance system

Assured Autonomy for Aviation Transformation

- Develop high-impact aviation autonomy applications



What vision has NASA set for aviation?

A revolution in sustainable global air mobility.

Transformative

Sustainable

Global

**Safety
NextGen
Efficiency
Environment**



On-Demand



Fast



Intelligent



Low-Carbon



Summary



Why a New Aeronautics Research Strategy?



- ▶ ARMD has solid partnerships, high relevancy and is delivering high impact results
- ▶ Now is the time to recognize the challenges and opportunities of the future and build off the solid track record that has been established
 - ▶ Rising competition in international R&D
 - ▶ Relentless challenges in mobility, energy and climate
 - ▶ Accelerating opportunities to infuse non-aerospace sector technologies to create “convergent” solutions
- ▶ Therefore, ARMD’s new strategy builds on the current leadership and focuses on enabling revolutionary advances in the 21st Century aviation

“Civil aviation [is] blessed with growing demand, record orders and increasing deliveries, but facing global competitors, affordability and sustainability challenges, and an industry-shaking technological revolution.”
Graham Warwick, AvWeek, September 2013

The Time Bomb of Complacency – AvWeek Editorial, September 2, 2013

“An alarm needs to be sounded. A vital and vigorous aeronautics research program is essential... NASA’s unveiling of a new strategy for aeronautics research is a bold and welcome move.”

Budget Overview



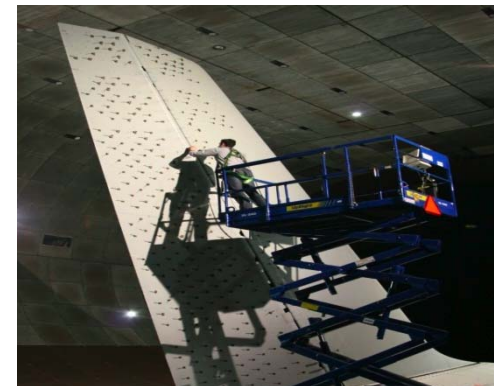
Outyears are notional

(\$M)	2015	2016	2017	2018	2019
Aeronautics	\$551	\$557	\$562	\$568	\$573

- NASA has developed a compelling strategic vision for aeronautics research. This vision led to six strategic thrust areas for research to enable NASA to be responsive to a growing demand for mobility, severe challenges to sustainability of energy and the environment, and technology advances in information, communications, and automation technologies.

- The strategic thrust areas are:

- Safe, efficient growth in global operations
- Innovation in commercial supersonic aircraft
- Ultra-efficient commercial vehicles
- Transition to low-carbon propulsion
- Real-time system safety assurance
- Assured autonomy for aviation transformation.



- This research will continue to support economic growth and high quality jobs, and advances in mobility and long-term sustainability within the aviation industry.
- NASA will continue to develop methods and technologies to support implementation of NextGen.
- As NASA completes the Environmentally Responsible Aviation Project the technologies that have been developed to simultaneously reduce fuel burn, community noise and emissions will be transferred for use by the aviation industry.

ARMD Budget Request



Outyears are Notional

	(\$ Millions)	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Aeronautics		\$551.1	\$556.6	\$562.2	\$567.8	\$573.5
Airspace Operations and Safety		131.0	132.7	134.6	135.9	137.3
Advanced Air Vehicles		213.6	211.4	205.8	203.3	205.3
Integrated Aviation Systems		127.0	125.8	128.0	133.4	134.8
Transformative Aeronautics Concepts		79.5	86.8	93.8	95.2	96.2

ARMD Programs with Strategic Thrusts



Mission Programs

Airspace Operations and Safety Program

- Safe, Efficient Growth in Global Operations
- Real-Time System-Wide Safety Assurance
- Assured Autonomy for Aviation Transformation

Advanced Air Vehicles Program

- Ultra-Efficient Commercial Vehicles
- Innovation in Commercial Supersonic Aircraft
- Transition to Low-Carbon Propulsion
- Assured Autonomy for Aviation Transformation

Integrated Aviation Systems Program

- Flight Research-Oriented Integrated, System-Level R&T supporting all six thrusts
- X-Planes/Test Environment

Seedling Program

Transformative Aeronautics Concepts Program

- High-risk, leap-frog ideas supporting all six thrusts
- Critical cross-cutting tool development

