

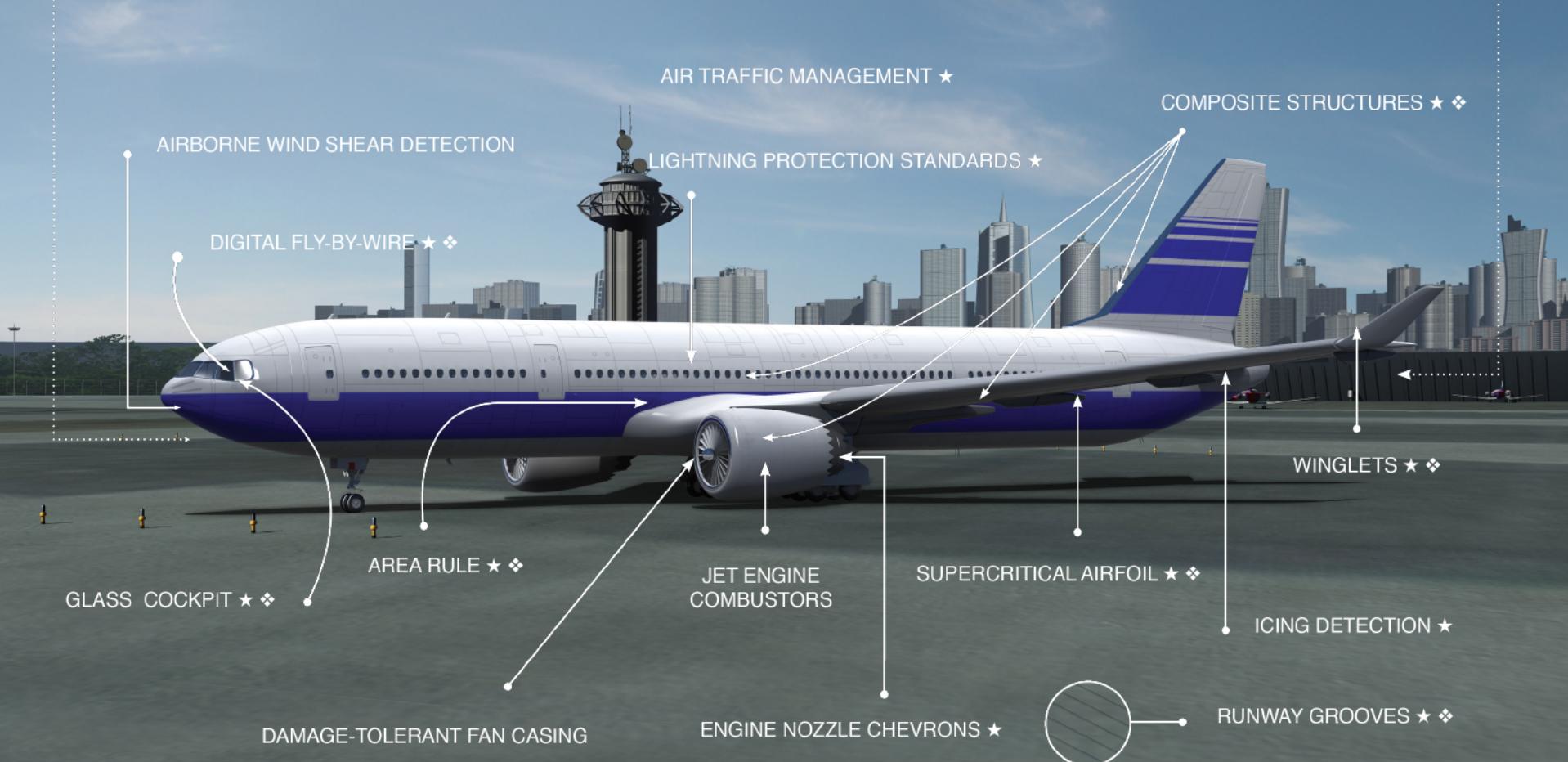


## Aeronautics and Space Engineering Board

Jaiwon Shin, Associate Administrator  
Aeronautics Research Mission Directorate  
October 12, 2017

• COMPUTATIONAL FLUID DYNAMICS (CFD) ★❖

NASA STRUCTURAL ANALYSIS (NASTRAN) ★❖



★ Applies also to general aviation aircraft

❖ Applies also to military aircraft

# DECadal Survey of Civil Aeronautics

*Foundation for the Future*



NATIONAL RESEARCH COUNCIL  
OF THE NATIONAL ACADEMIES

2006

# GLOBAL GROWTH IN AVIATION

## 2016 GLOBAL AVIATION INDUSTRY

3.8 B Passenger Trips

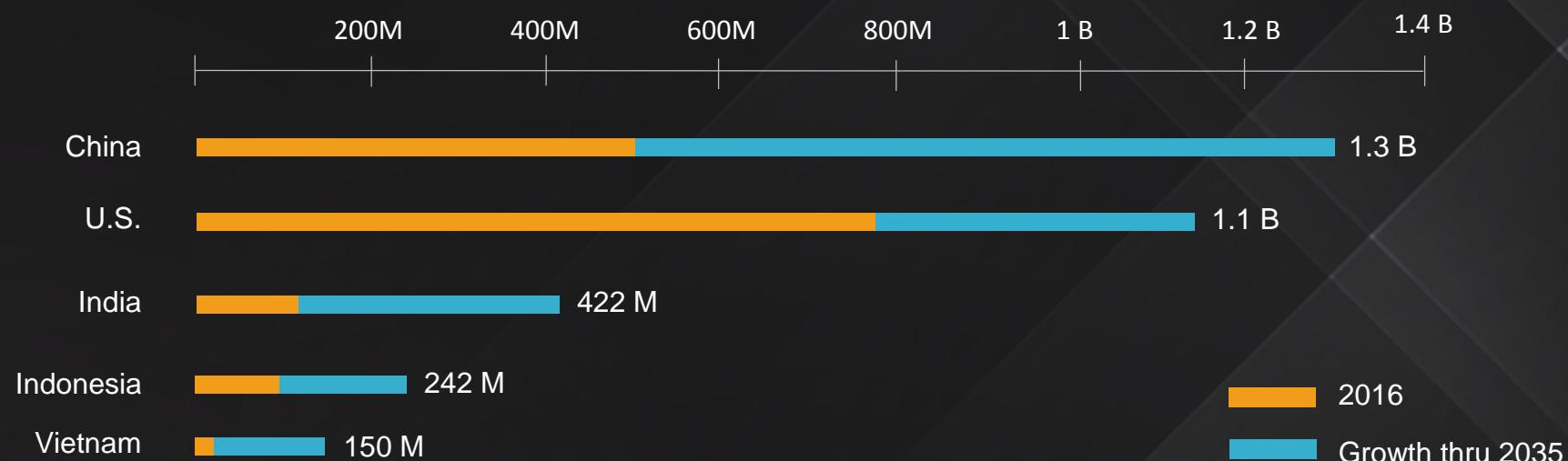
North America & Europe combined  
is half of all passenger trips

## 2035 GLOBAL AVIATION INDUSTRY

7.2 B Passenger Trips

Asia-Pacific passenger trips equal to  
North America & Europe combined

### Top Five Fastest-Growing Markets



Over 36,000 new aircraft required  
(replacement and growth) over the 20 year period (\$4-\$5 T value)

# AERONAUTICS RESEARCH & TECHNOLOGY ROUNDTABLE



National Aeronautics and Space Administration 



**NASA AERONAUTICS**

Strategic Implementation Plan  
2017 Update

[www.nasa.gov](http://www.nasa.gov)

6 Strategic Thrusts

-  Safe, Efficient Growth in Global Operations
-  Transition to Alternative Propulsion and Energy
-  Innovation in Commercial Supersonic Aircraft
-  Real-Time System-Wide Safety Assurance
-  Ultra-Efficient Commercial Vehicles
-  Assured Autonomy for Aviation Transformation



# RECAPTURING NASA'S AERONAUTICS FLIGHT RESEARCH CAPABILITIES

NATIONAL RESEARCH COUNCIL  
OF THE NATIONAL ACADEMIES

2012



# NEW AVIATION HORIZONS

CLEANER, FASTER, QUIETER



AUTONOMY  
RESEARCH  
FOR CIVIL  
AVIATION  
TOWARD A NEW ERA OF FLIGHT

NATIONAL RESEARCH COUNCIL  
OF THE NATIONAL ACADEMIES

2014



AERODYNAMICS

VERTICAL LIFT

GPS

BATTERIES

COMMUNICATION

SOFTWARE

COMPUTER

IMAGING

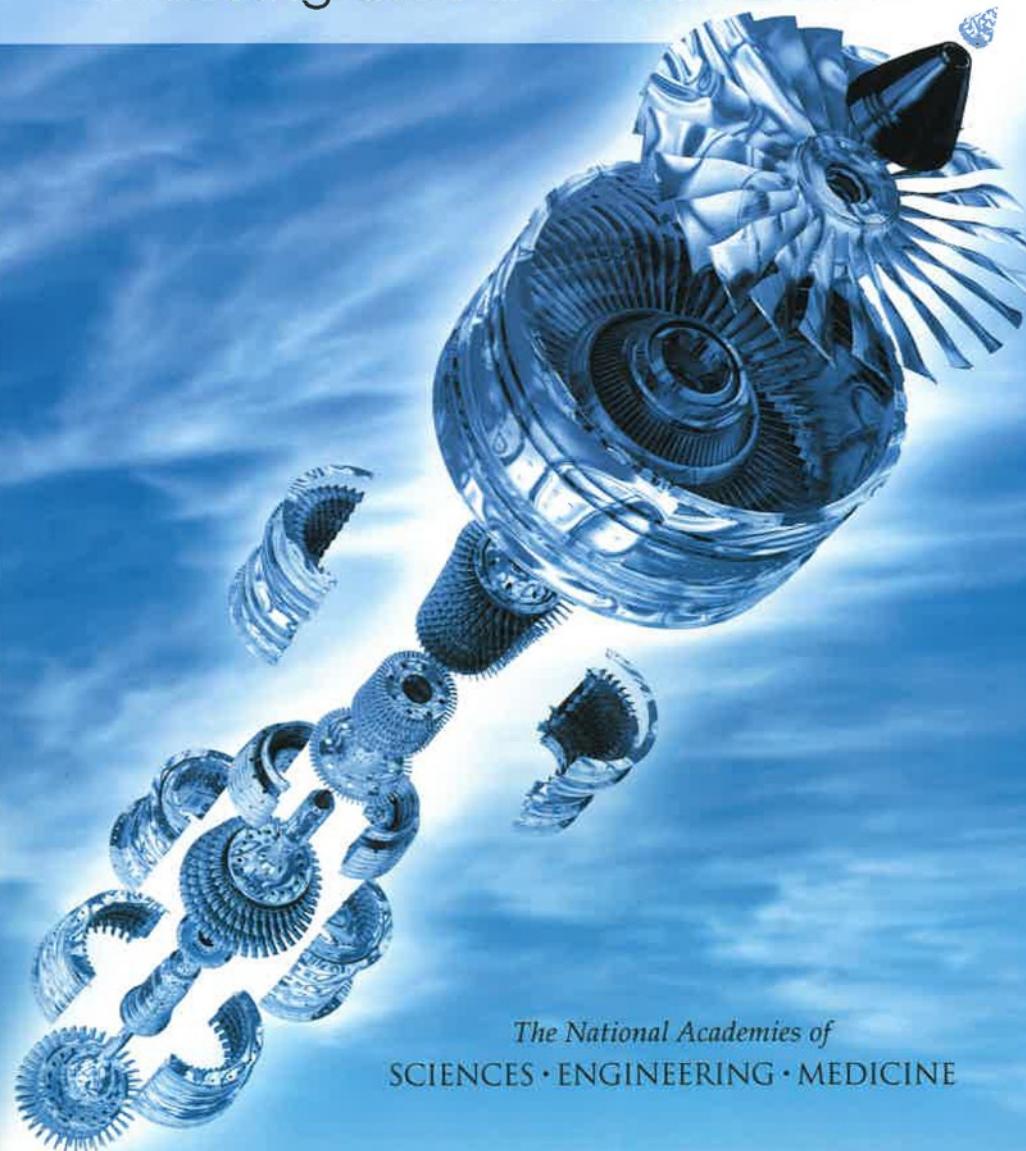
CONVERGENCE  
OF DISPARATE TECHNOLOGIES

# AIR TAXI IN DUBAI



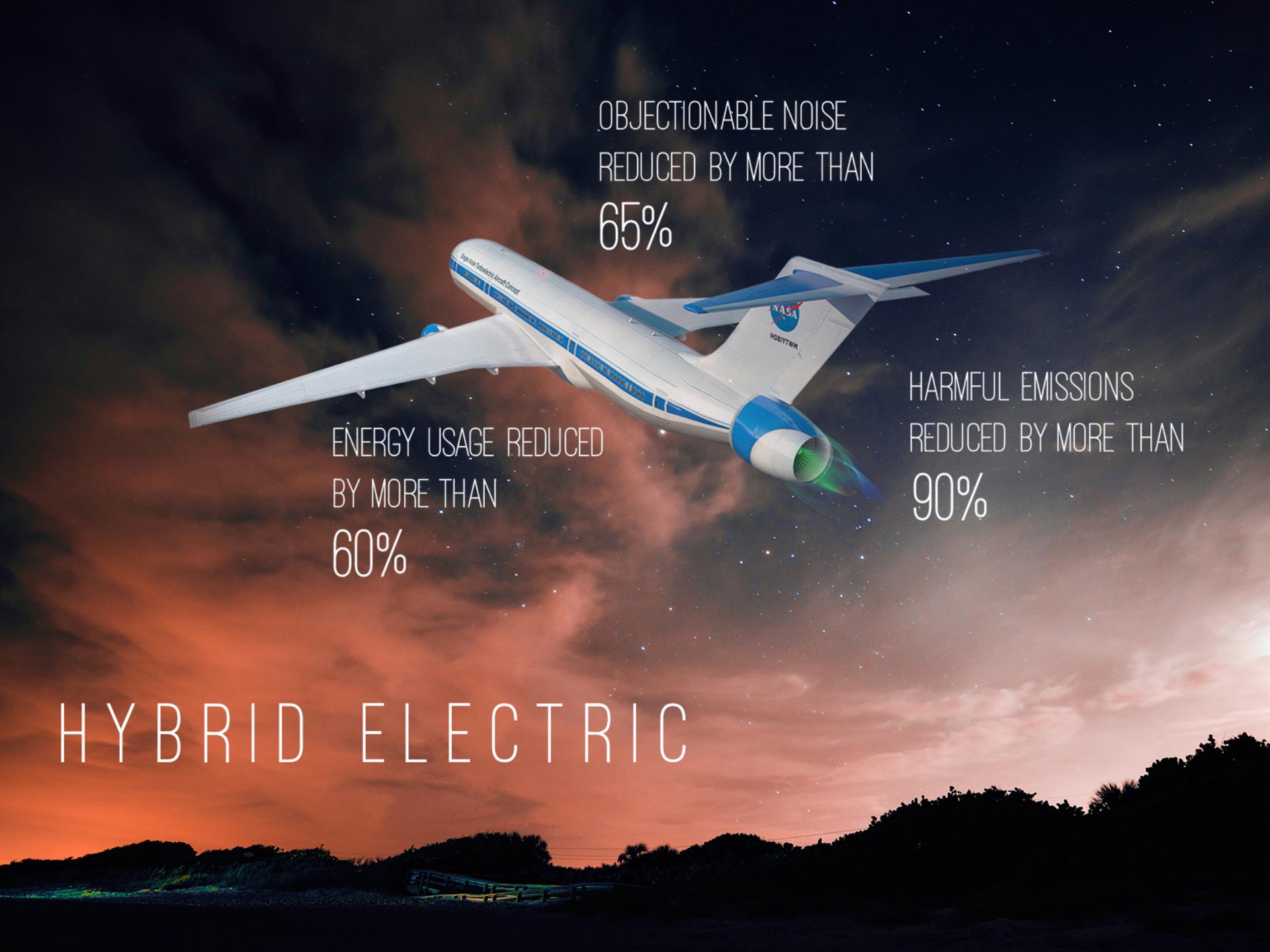
# Commercial Aircraft Propulsion and Energy Systems Research

Reducing Global Carbon Emissions



*The National Academies of*  
SCIENCES • ENGINEERING • MEDICINE

2016



OBJECTIONABLE NOISE  
REDUCED BY MORE THAN  
65%

ENERGY USAGE REDUCED  
BY MORE THAN  
60%

HARMFUL EMISSIONS  
REDUCED BY MORE THAN  
90%

HYBRID ELECTRIC



FROM SONIC BOOM TO  
SONIC "THUMP" OVER LAND