



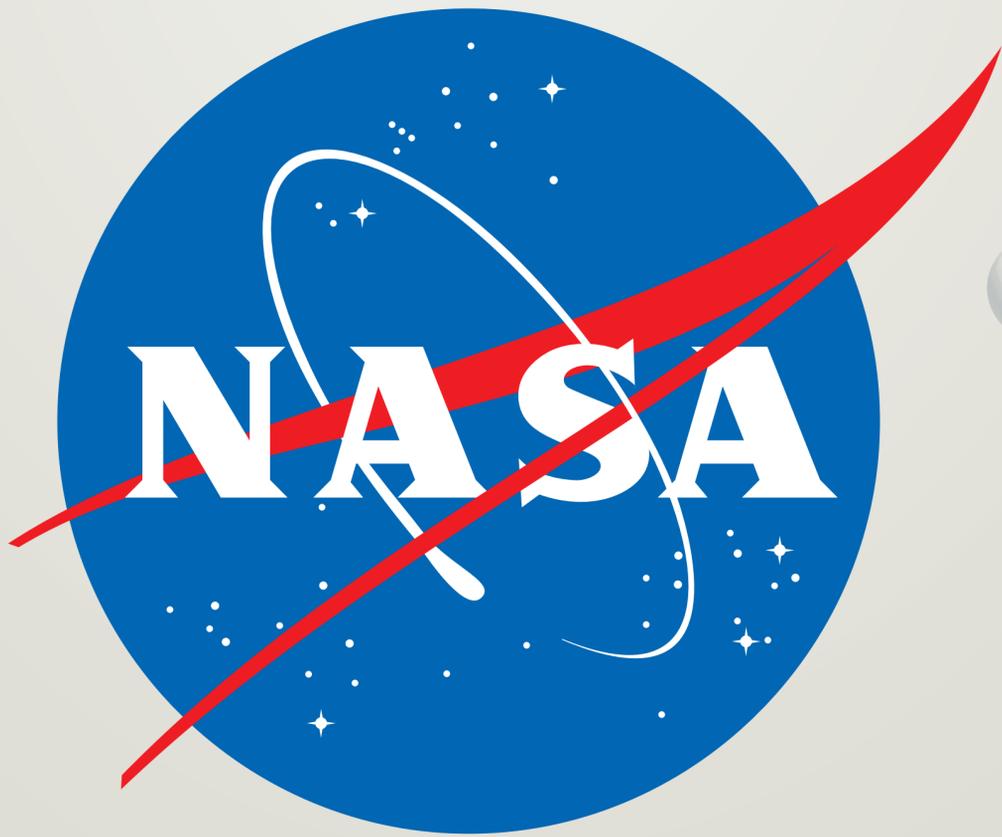
NASA IS

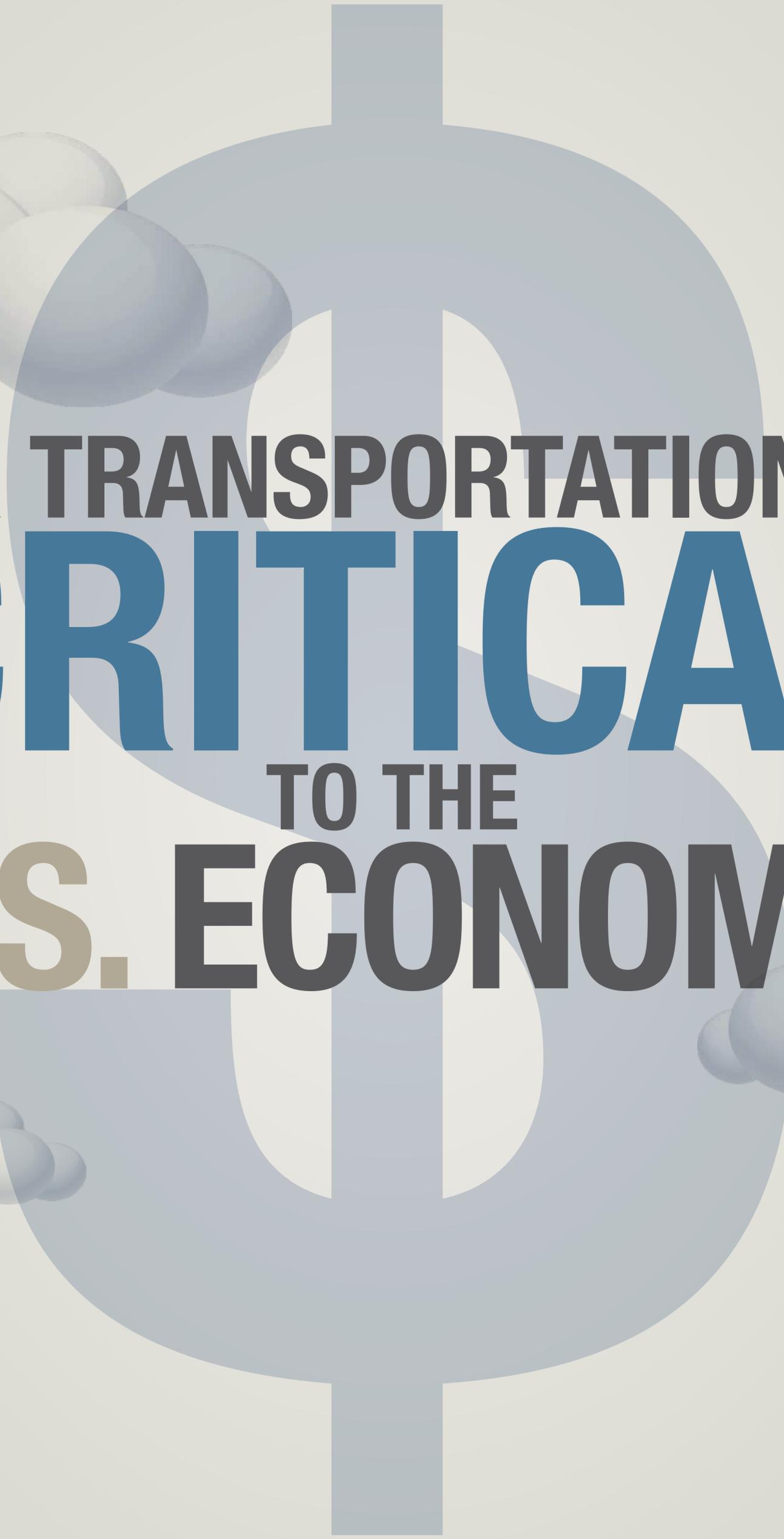
WITH YOU

WHEN

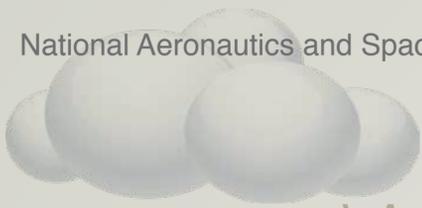


YOU FLY.





**AIR TRANSPORTATION IS
CRITICAL
TO THE
U.S. ECONOMY.**



Why is aviation so important?

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

\$1.5 TRILLION

TOTAL U.S. ECONOMIC ACTIVITY

(Civil and general aviation, 2012)



\$78.3 BILLION

POSITIVE TRADE BALANCE

(Civil aviation, 2012)



11.8 MILLION

DIRECT AND INDIRECT JOBS

(Civil and general aviation, 2012)

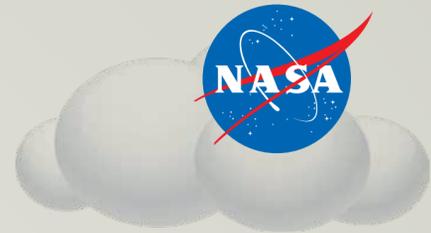


5.4 PERCENT

OF TOTAL U.S. GROSS DOMESTIC PRODUCT

(Civil and general aviation, 2012)





Why should I care?

Aviation drives many different parts of the economy.



\$18.1 BILLION

VALUE OF FREIGHT TRANSPORTED BY AIR

(all U.S. carriers, 2014)



\$670.8 BILLION

**SPENT BY AIR TRAVELERS
IN U.S. ECONOMY**

(domestic and foreign travelers, 2012)



761 MILLION

PASSENGERS ON U.S. CARRIERS

(domestic and foreign, 2014)





YOU
MAY NOT
HAVE

**FLOWN
TODAY,**



BUT
SOMETHING
YOU NEEDED



DID.





What are the challenges?

Innovation improves efficiency, but challenges remain.

16 BILLION GALLONS BURNED IN 2013

JET FUEL

(U.S. airlines)



DELAYS



COST \$8.1 BILLION FOR U.S. AIRLINES IN 2013

\$9.5 BILLION SPENT ON
NOISE
ABATEMENT

BY AIRPORTS SINCE 1982





Where do we see NASA's benefits today?

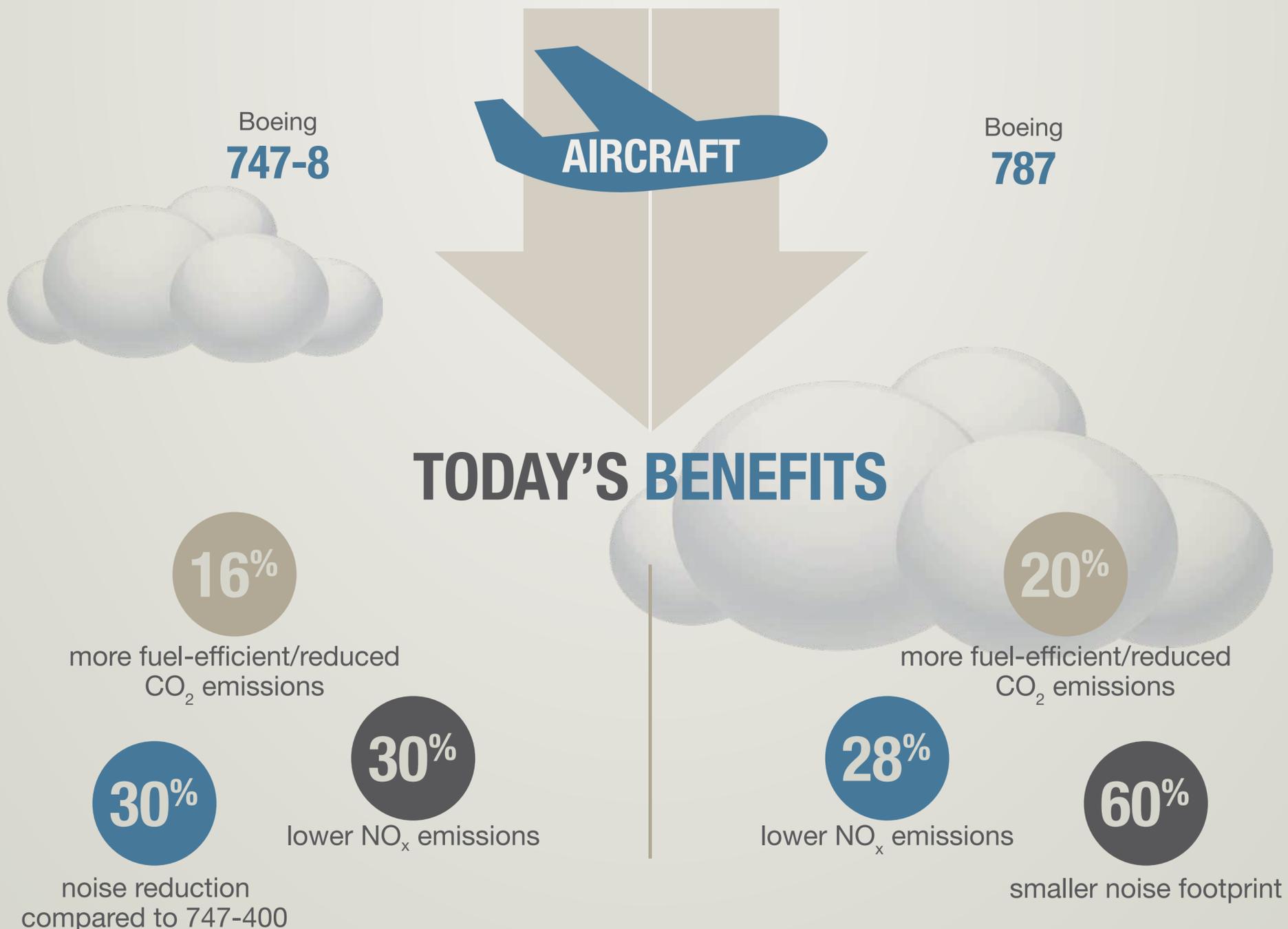
NASA's fundamental research can be traced to ongoing innovation.

NASA'S WORK ON THESE TECHNOLOGIES

- Advanced composite structures
- Chevrons
- Laminar flow aerodynamics
- Advanced computational fluid dynamics (CFD) and numeric simulation tools

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- Chevrons
- Laminar flow aerodynamics
- Advanced computational fluid dynamics (CFD) and numeric simulation tools
- Advanced ice protection system

WAS TRANSFERRED FOR USE HERE





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NASA'S WORK ON THESE TECHNOLOGIES

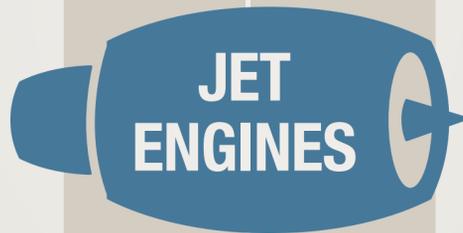
- Compression system aerodynamic performance advances
- Low-NO_x TAPS II combustor
- Low-pressure turbine blade materials
- High-pressure turbine shroud material
- Nickel-aluminide bond coat for the high-pressure turbine thermal barrier coating

- Low-NO_x Talon combustor
- Fan aerodynamic and acoustic measurements
- Low-noise, high-efficiency fan design
- Ultra-high-bypass technology
- Acoustics modeling and simulation tools

WAS TRANSFERRED FOR USE HERE



CFM
LEAP-1B



Pratt & Whitney
**PUREPOWER 1000G
GEARED TURBOFAN**

TODAY'S BENEFITS

15%

reduction in fuel burn/reduced
CO₂ emissions

50%

less NO_x

15^{dB}

noise reduction

16%

reduction in fuel burn/reduced
CO₂ emissions

50%

reduction in NO_x

20^{dB}

noise reduction



Where do we see NASA's benefits today?

NASA's fundamental research can be traced to ongoing innovation.

NASA'S TECHNOLOGIES

**EFFICIENT
DESCENT ADVISOR**

**SYNTHETIC/ENHANCED
VISION SYSTEMS**

**DATA-MINING
ALGORITHMS**

WERE TRANSFERRED FOR USE HERE

**FEDERAL AVIATION
ADMINISTRATION
(FAA)**

**AVIONICS
MANUFACTURERS**
(Honeywell, Rockwell Collins,
GE Aviation)

**FEDERAL AVIATION
ADMINISTRATION
AND AIRLINES**

Phased deployment by the FAA will start by 2014; full deployment will be in place by 2020.

There are more than 1,000 enhanced vision systems and more than 3,000 synthetic vision systems flying today.

The FAA's Aviation Safety Information and Analysis Sharing system uses NASA algorithms, in common with airline partners like Southwest Airlines.

TODAY'S BENEFITS

- Fuel-efficient continuous descents
- Potential \$300 million jet fuel savings per year (savings vary per spot fuel costs)
- Reduced delays in congested airspace
- Reduced noise and emissions around airports
- Retained safety
- Reduced controller workload through increased automation

- Improved ability to "see" in poor conditions
- Improved ground hazard avoidance
- Useful for civilian, military, and robotic flight
- Reduced landing ceiling and threshold minimums
- Safe, intuitive training environment for newer pilots

- Improved discovery by individual airlines of relevant operational events
- Increased identification of safety-related incidents
- Increased sharing of safety-related trends across airlines
- Reduced rate of incidents systemwide

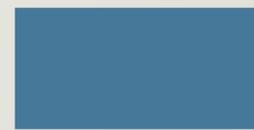


Did you know that NASA is
with you when you fly?



EVERY U.S.
COMMERCIAL
AIRCRAFT

AND EVERY U.S. AIR
TRAFFIC
CONTROL
TOWER



HAS NASA-SUPPORTED
TECHNOLOGY ON BOARD.