

# FEDERALLY FUNDED SCIENCE SUPPORTS AMERICAN AVIATION

## IMPACTS AT A GLANCE



### AVIATION IS A MASSIVE ENTERPRISE

The U.S. aviation industry is a cornerstone of American mobility, commerce, and national competitiveness. The Federal Aviation Administration handles more than 16 million flights each year - over 44,000 flights and more than 3 million passengers every day, across more than 19,400 airports. In 2024 alone, more than 859 million passengers flew domestically in the United States. U.S. airports support 12.8 million jobs, generate \$619 billion in annual payroll, and produce \$1.8 trillion in annual economic output. This vast system depends on accurate, timely, and trusted scientific information. Federally funded weather, climate, and Earth observation science helps keep passengers safe, supports pilots and ground crews, improves operational efficiency, and gives airlines, airports, and aerospace operators the information they need to manage risk in real time and plan for the future.

### PROTECTING AVIATION PROTECTS AMERICA

Federal science support for aviation goes far beyond the daily forecast. NOAA, NSF, NASA, and related federal programs provide the underlying observations, models, and decision-support tools that help the aviation sector respond to turbulence, icing, wildfire smoke, severe storms, flooding, hurricanes, and shifting temperature and wind conditions. NOAA's High Resolution Rapid Refresh model (HRRR) and related tools support short-term operational planning around airports and flight routes. NOAA research also feeds products that warn of icing hazards, improve turbulence forecasting, and strengthen wildfire smoke and hurricane predictions. These capabilities matter because weather already causes 74% of U.S. flight delays, with weather-related delays and cancellations costing more than \$1 billion annually; the FAA has estimated that all delays can impose tens of billions in economic losses.



**3 million** daily passengers



**65,000** air turbulence incidents reported each year resulting in **\$2.6 billion in costs**



**\$1.8 trillion** in annual economic output generated by U.S. airports

**AMERICANS ARE MORE SECURE, COMPETITIVE, AND PROSPEROUS BECAUSE OF REASONABLE AND MEANINGFUL INVESTMENTS IN FEDERAL EARTH SCIENCE AND WEATHER INTELLIGENCE**

# WHAT FEDERAL SCIENCE DELIVERS FOR AVIATION

## NOAA

NOAA provides much of the operational science backbone the aviation industry uses every day. Its satellites, weather models, research labs, and data systems support real-time and short-term decision-making for pilots, dispatchers, airports, and air traffic managers. GOES satellites provide near-real-time imagery for severe weather and hurricane tracking; HRRR supports short-term aviation forecasting; and NOAA research improves warnings for turbulence, icing, wildfire smoke, flooding, and severe storms. NOAA's Forecast Icing Product, Current Icing Product, and Ground-based Remote Icing Detection System identify icing hazards near airports and on flight paths. Environmental data archives help aviation planners prepare for seasonal shifts, flooding risks, and changing operating conditions.

## WHAT THE INDUSTRY GETS FROM FEDERAL SCIENCE

- Real-time weather awareness for storms, smoke, hurricanes, and visibility threats
- Short-term operational forecasts for routing, deicing, ground operations, and traffic flow
- Hazard-specific tools for icing, turbulence, flooding, and wildfire smoke
- Seasonal and historical data for maintenance, equipment deployment, and risk analysis
- Long-range planning tools for airport resilience, infrastructure investment, and future operating conditions

## NASA

NASA supplies critical Earth observation, modeling, and open data that strengthen aviation planning and risk awareness. Through Goddard Space Flight Center and other Earth science activities, NASA collects satellite data on precipitation, aerosols, clouds, land conditions, and surface change. The Global Precipitation Measurement (GPM) mission improves understanding of rain and snow, while the Plankton, Aerosol, Cloud, and ocean Ecosystem (PACE) mission helps scientists better understand aerosols and air quality. NASA also develops and runs climate models and maintains major public data platforms, including the Earth Observing System Data and Information System (EOSDIS) which make vast Earth system datasets available to researchers, planners, and commercial users. For aviation, these capabilities help inform long-range planning on issues like flooding, dust, air quality, and future operating conditions at airports and along key corridors.

## NSF NCAR

The National Science Foundation supports NCAR, which provides advanced research, modeling, and data resources that improve understanding of aviation-relevant weather hazards. NCAR's models help researchers better understand extreme weather, turbulence, and the interaction of local and global atmospheric processes. NCAR also maintains large public data archives and tools that support both scientific analysis and applied forecasting. Its research matters to aviation because turbulence alone is associated with tens of thousands of incidents annually and billions in costs. NCAR helps provide the foundational science that improves forecasts, route planning, hazard awareness, and operational resilience across the aviation system.



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[info@usacompetes.org](mailto:info@usacompetes.org)



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