National Aeronautics and Space Administration

NASA Update for FAA REDAC

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Four Transformations for Sustainability, Greater Mobility, and Economic Growth

ARMD PROGRAMS

Airspace Operations and Safety Program

Advanced Air Vehicles Program

Integrated Aviation Systems Program

Transformative Aeronautics Concepts Program

Aerosciences Evaluation and Test Capabilities Portfolio

Aeronautics FY 2025 Budget Request

$ Millions	FY 2024 Enacted	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029
Aeronautics	**$935.0**	**$965.8**	**$985.1**	**$1,004.8**	**$1,024.9**	**$1,045.4**
Airspace Operations and Safety		151.2	164.3	174.1	177.7	180.9
Advanced Air Vehicles		278.8	269.6	262.4	248.8	218.7
Integrated Aviation Systems		264.4	277.0	277.6	300.9	342.0
Transformative Aeronautics Concepts		155.3	157.6	171.1	175.2	179.0
Aerosciences Evaluation and Test Capabilities		116.2	116.5	119.5	122.3	124.7

ARMD's FY 2025 budget request changes relative to FY 2024

- NASA adjusted funding for elements of the Sustainable Flight National Partnership.
  - Increased Sustainable Flight Demonstrator (SFD) project as the X-66 aircraft moves into the design/build phase.
  - Decreased Electrified Powertrain Flight Demonstration (EPFD) project in near term, with rephasing to address extended flight demonstration schedule and preserve overall lifecycle cost.
  - Increased the Hi-Rate Composite Aircraft Manufacturing (HiCAM) project to support two major ground tests, wing and fuselage.
  - Decreased Hybrid Thermally Efficient Core (HyTEC) project to reflect the latest contract payment schedule.

- NASA increased funding for the Low Boom Flight Demonstrator (LBFD) project to cover rebaselined commitments for cost and schedule. The project was rebaselined due to poor contractor performance and, to a lesser extent, COVID impacts from 2020 through 2022 that caused delays to X-59 aircraft delivery.

- NASA increased the Advanced Air Transport Technology (AATT) project for research and studies on non-CO_2 greenhouse gas emissions such as contrails.

Sustainable Flight National Partnership Benefits

Small Core Gas Turbine for 5% 10% fuel burn benefit

Electrified Aircraft Propulsion for ~5% fuel burn and maintenance benefit

Sustainable Aviation Fuels for reduced lifecycle carbon emissions

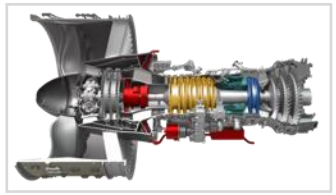
Transonic Truss Braced Wing for 5% 10% fuel burn benefit

High Rate Composites for 4 6x manufacturing rate increase

Integrated Trajectory Optimization for 1% 2% reduction in fuel required and minimization of contrail formation

Next-generation transports using up to 30% less fuel, current and future fleets flying optimal trajectories, engines burning sustainable aviation fuels for net-zero lifecycle greenhouse gas emissions

Ultra-Efficient Airliners: Sustainable Flight National Partnership



FY20 | FY21 | FY22 | FY23 | FY24 | FY25 | FY26 | FY27 | FY28 | FY29

Technology Readiness Target

"Digital Flight Test"

Model Based Systems Analysis & Engineering

X-66 Sustainable Flight Demonstrator (SFD)

Flight Test

Transonic Truss Braced Wing (AATT)

TC Completion

Hi-Rate Composite Aircraft Manufacturing (HiCAM)

Mfg & Structural Demonstrations

Hybrid Thermally Efficient Core (HyTEC)

Core Demonstration

Electrified Powertrain Flight Demonstration (EPFD)

Flight Tests

Electrified Aircraft Propulsion Technologies (AATT)

TC Completion

Achieve TRL 6 in time for industry product decision-making

Test Duration

Planned

Notional

NASA and Boeing ecoDemonstrator Test SAF Impact on Contrails

BOEING
ecoDemonstrator PROGRAM
GE Aerospace
Transport Canada
Transports Canada
FEDERAL AVIATION ADMINISTRATION
AERODYNE RESEARCH, Inc.
UNITED
MIT
DLR Deutsches Zentrum für Luft- und Raumfahrt German Aerospace Center
MISSOURI S&T

Progress

- Contrail-cirrus clouds are net climate warming and form on engine-emitted particles
- Ground tests in 2021-22 lay groundwork for joint flight test in FY24
- Initial data reveals substantial cruise altitude soot particle reductions from burning 100% SAF in advanced GE lean-burn aircraft engine combustors
- Discovered the role of engine oil

- Small businesses developed and tested novel water vapor sensors through the NASA Small Business Innovation Research program
- Partnered with manufacturers, airlines, universities, and government agencies to design and execute the tests and to gather the data needed by national stakeholders
- Initiated National Academy of Sciences study to develop a national research agenda on potential mitigations for the impacts of persistent contrails (aviation-induced cloudiness)

A Look Ahead

- Test results guide and motivate industry investment in SAF and engine technology R&D and jobs
- Unique in-flight data will be publicly available in Nov 2024 for use in climate and aviation model assessments, university research, industry model validation
- Beginning to develop future contrails research plans

FY 2025 request includes funds to continue research in aviation contrail formation modeling and mitigation.

Partnering Approach for AAM Technology Demonstrations

TCL-1: eVTOL pilot on board operations for multiple operators

- Live Virtual Construct with NASA and FAA, including crewed eVTOL aircraft
- Cooperative operating practices
- Airspace automation
- System actor roles & responsibilities

Industry partner engagement

AFWERX
Joby

Focus: Integration of eVTOL aircraft into UAM airspace infrastructure

SKYGRID
wisk

Focus: Uncrewed operations and UAM service provision

AURA

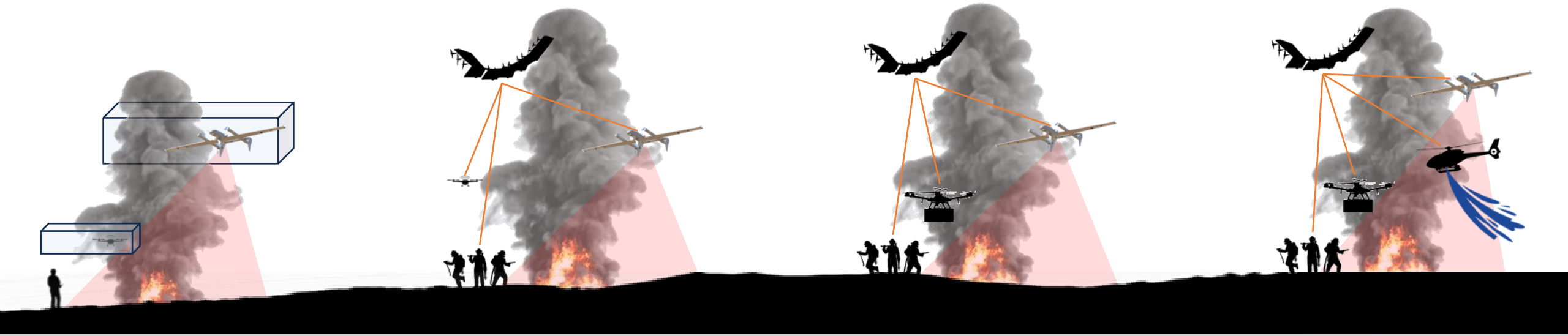
Focus Area: UAM communication digitization needs including command & control

TCL-2 [FY28]: Initial remotely piloted operations

TCL-3 [FY29]: Degraded weather operation

TCL = Technical Capability Level

Wildland Fire Demonstration Series



TCL 1 FY25

- **Use Case:** Monitoring
- **Technology:** UTM-in-a-box
- **Impact:** Locally shared situation awareness

TCL 2 FY26

- **Use Case:** Communications
- **Technology**: Communications Architecture and Aerial Comms Solution for UTM-in-a-box
- **Impact:** Reliable and interoperable mobile communications

TCL 3 FY27

- **Use Case:** Logistics
- **Technology:** Hazard Detection & Avoidance, Mission Planning, & xTM interoperability
- **Impact:** UAS mission that can transition to and from an incident

TCL 4 & 5 FY28 & FY29

- **Use Case:** Suppression
- **Technology:** Suppression Mission Autonomy
- **Impact**: End-to-End Suppression Operation with remotely piloted aircraft

Demonstrations test increasingly complex missions needed to suppress fire in degraded visual environments.

TCL = Technical Capability Level

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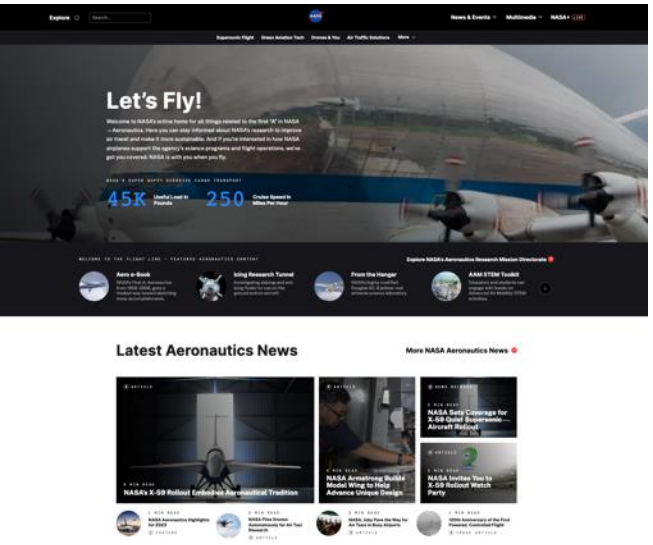

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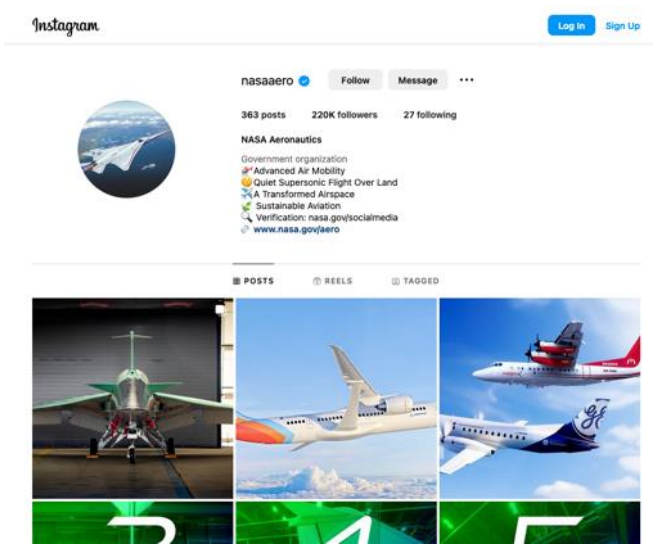

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