

ACERO

Advanced Capabilities for Emergency Response Operations

24-HOUR REMOTE SUPPRESSION OPERATIONS

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Deputy Lead for Second Shift Capabilities

12 MAR 2024

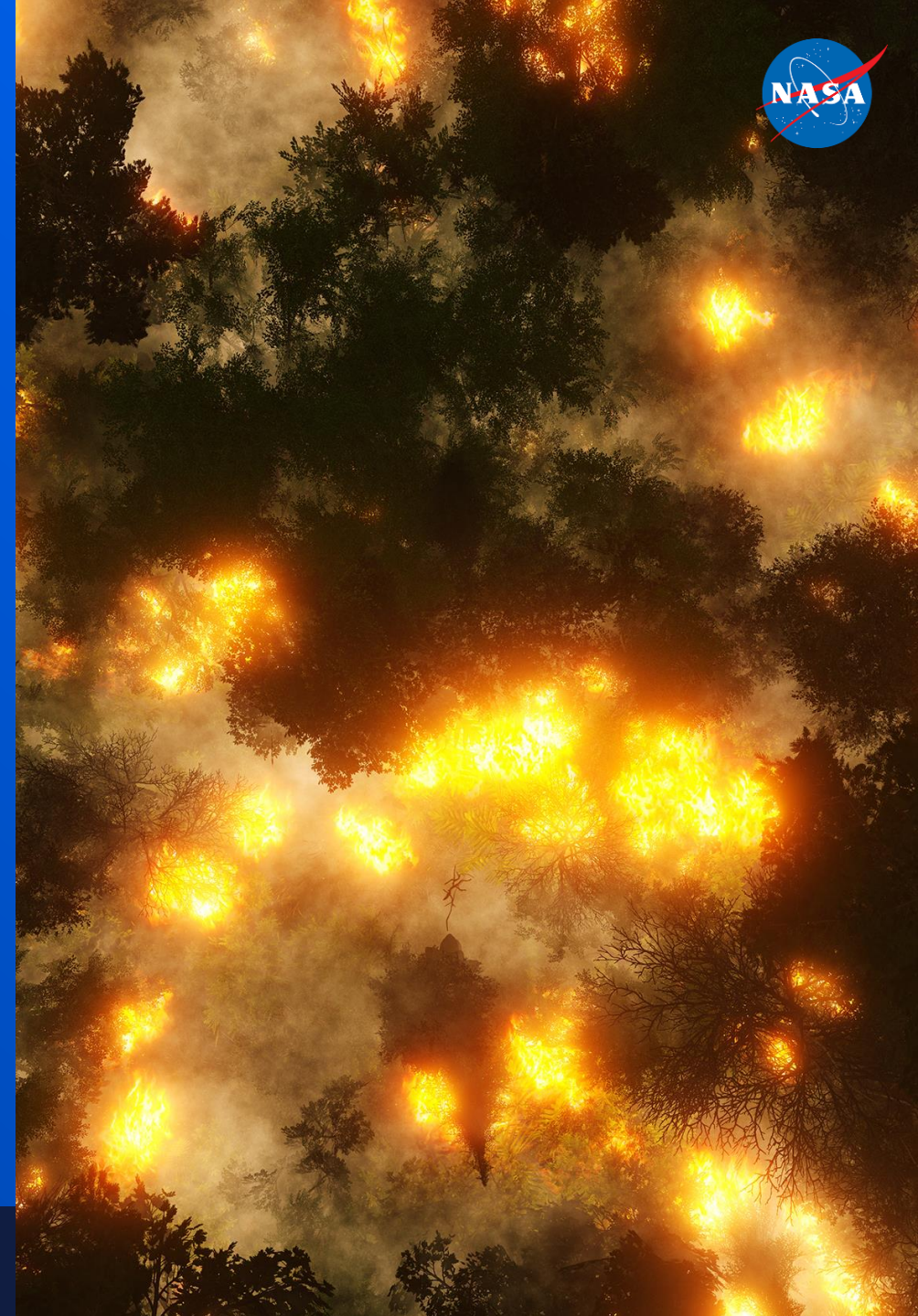
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ACERO Project Overview

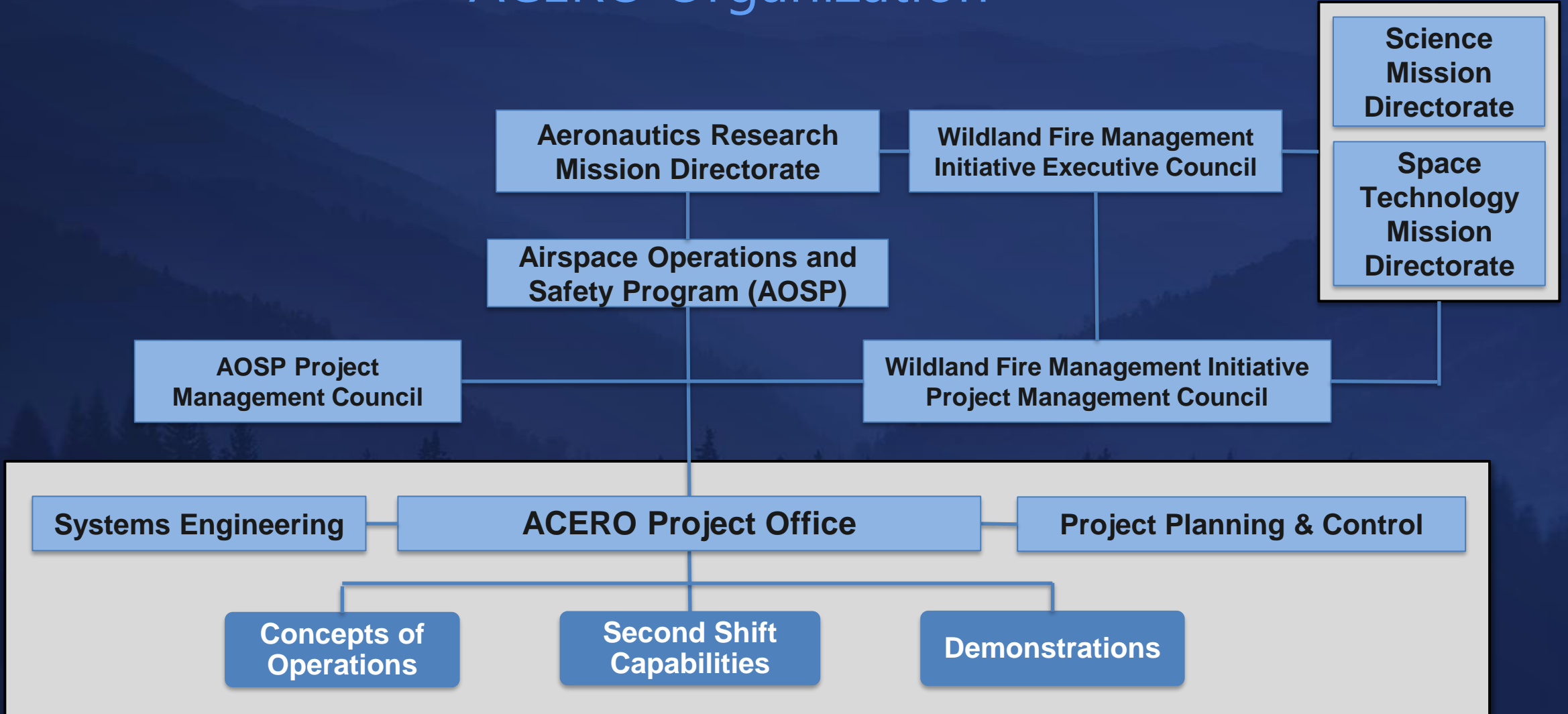
NASA Project Reference: <https://www.nasa.gov/aeroresearch/programs/aosp/acero-project-description>

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ACERO Organization



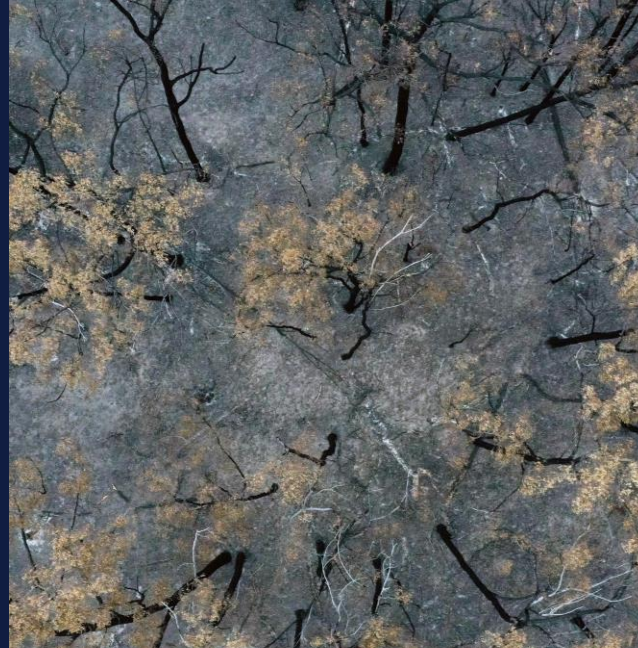


Wildfires

Wildfires release large amounts of carbon dioxide.

Suppression Costs Average 2.9 Billion Over 5yr Period

Containing and responding to these fires also requires collaboration among firefighters and ground crews, and the coordination of dozens of aircraft operated by multiple government agencies.



1.5 Million

The amount of acres of forests and grasslands that burn each year.

Using Drones and Advanced Aviation Technologies

NASA's Advanced Capabilities for Emergency Response Operations (ACERO) project - led by the agency's Ames Research Center in Silicon Valley, California - is using drones and advanced aviation technologies to improve wildland fire coordination and operations.



Current Operations

Current aerial firefighting operations are limited to times when aircraft have clear visibility.

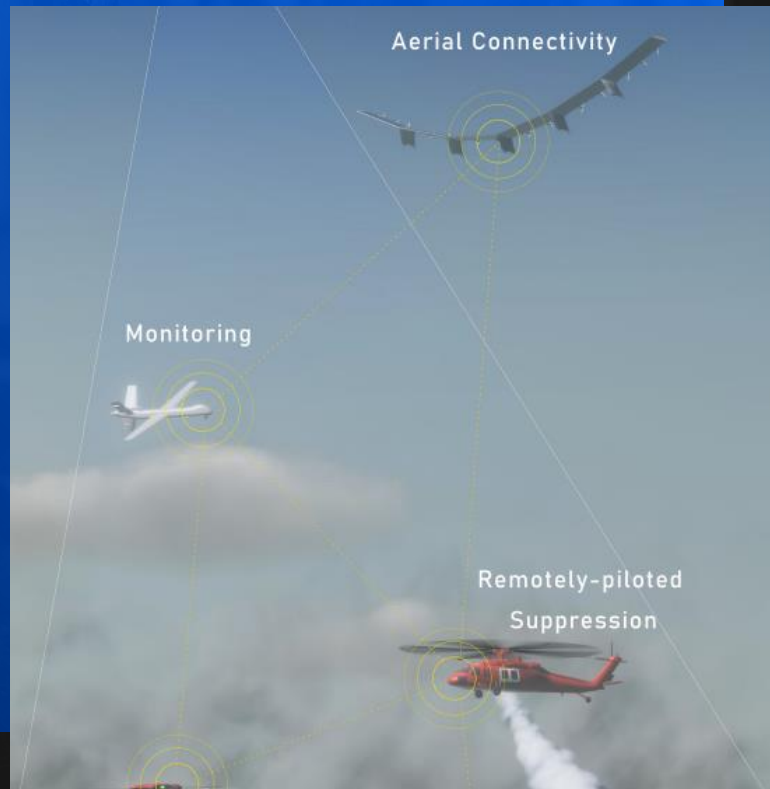
Drones Can Help

Drones can help expand the window of time available for aerial suppression because they can be safely operated by pilots on the ground.

Reduce Safety Risks

Using drones for aerial suppression operations would reduce safety risks to pilots and make aerial wildfire operations more effective.

ACERO's Project Objectives



Example ACERO Use Cases

Develop interagency Concept of Operations to ensure consistency of operational priorities, technology adoption, and programmatic alignment for national needs

Develop and demonstrate emerging airspace management technology to improve emergency responders' efficiency and safety during a disaster

Develop and demonstrate new mission capabilities using emerging aviation technologies that support 24-hour operations

Leverage public, private, and philanthropic partnerships and cross-mission directorate technologies to develop and demonstrate prototype capabilities

Second Shift Capabilities

Technical Overview



Second Shift Capabilities Technology Taxonomy

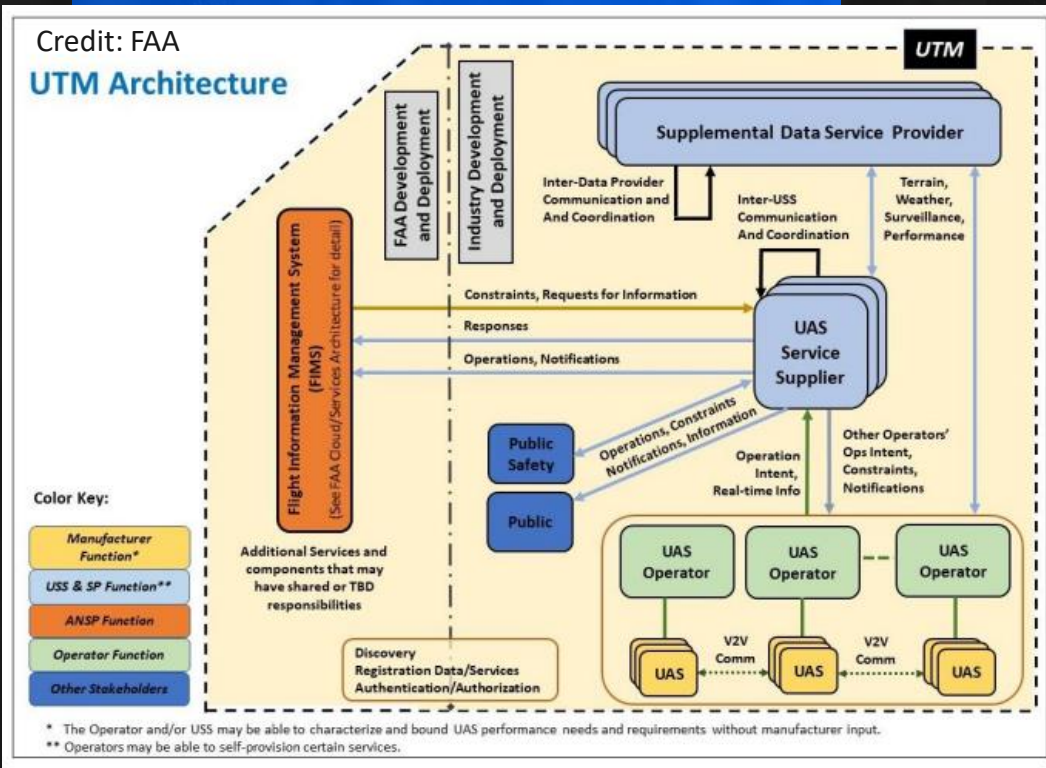


Example UAS Flight Capabilities

- Air Traffic Management – TX16
- Communications – TX05
- Human Systems Integration – TX06
- Autonomous Systems – TX10

NASA Taxonomy Reference: <https://techport.nasa.gov/>

Air Traffic Management



- Leverage Uncrewed Aircraft System (UAS) Traffic Management concepts and technologies for supporting emergency response air operations in austere environments.
- Develop and demonstrate technical capabilities for UAS operators to scale and integrate multi-aircraft flight operations in the National Airspace System (NAS).
- Support and integrate advanced airspace management technologies interoperability with current emergency air traffic public operations.

FAA UTM CONOPS 2.0 Architecture

Communications



- Leverage mobile ad hoc network (MANET) and Vehicle-to-everything (V2X) concepts and technologies for supporting emergency response air operations in disconnected environments.
- Develop and demonstrate technical capabilities for air and ground crews to exchange dynamic digital operationally relevant data.
- Support and integrate advanced communications technologies and capabilities with existing aviation operational communication architectures.

ACERO SSC Communications Overview Diagram

Human Systems Integration



Example UAS and Wildfire COP

- Leverage human factors and user interface concepts and aviation standards for supporting remotely piloted UAS operations.
- Develop and demonstrate human interface capabilities for air and ground crews to conduct coordinated flight operations within a dynamic operational environment.
- Support and integrate advanced human centric user interface capabilities with existing aviation and UAS common operational picture community/industry standards.

Autonomous Systems



- Leverage autonomy and decision support technologies to enable advanced remotely piloted UAS missions within VFR and UAS shared airspace.
- Develop and/or demonstrate integrated UAS flight operations in public low altitude aircraft operations and low altitude integrated multi-aircraft UAS operations in low vision environments.
- Support and integrate advanced algorithms to enable complex low altitude remotely piloted air operations.

Example UAS Package Delivery Flight Capability

Autonomous Systems

Aircraft Autonomy

Technical Overview



UAS Hazard Perception and Avoidance



- Leverage and integrate air traffic, ground and weather hazards into flight management technologies.
- Support industry standards groups for hazard perception and avoidance capabilities. (RTCA, ASTM)
- Advance low altitude remotely piloted operational capabilities within the National Air Space system.

Example Autonomy Technologies Flight Capabilities

Suppression Delivery Autonomy

Credit: National Guard



- Advance the identification and evaluation of fires within a designated operational area.
- Develop and execute the flight trajectories to conduct suppression maneuvering and execution.
- Establish airborne suppression evaluation to support air attack decision making and strategy.

Current operational aircraft suppression capabilities

Suppression Reload Autonomy



- Establish remotely piloted approach and departure maneuvers to authorized water sources.
- Advance and develop flight system capabilities to support remotely piloted hover hold capabilities during reloading of water suppression systems.

Current operational aircraft reload capabilities



Advanced Capabilities for Emergency Response Operations

The Future of Wildland Fire Response

The project's team leads an interagency working group to assess and identify the concepts and technologies needed to address the challenges ahead.

Partnering with Industry

NASA will partner with industry and wildfire response agencies to perform joint field demonstrations of newly developed ACERO-led aviation technologies.

For more information, please visit
our website:

[ACERO Program](#)

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