# Transforming the National Airspace: A UAS Safety Perspective

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System-Wide Safety

Scenario: Autonomous passenger carrying vehicle transporting a passenger from downtown to the airport. In-flight emergency occurs for the passenger, requiring re-routing to a landing site near a hospital

Environment: Urban, dense population, small UAS VLOS operations, rogue drones sighted, reduced communications & GPS degradation, urban canyon

Question: What safety services/capabilities are needed to execute this scenario and return operations to normal?

# Agenda

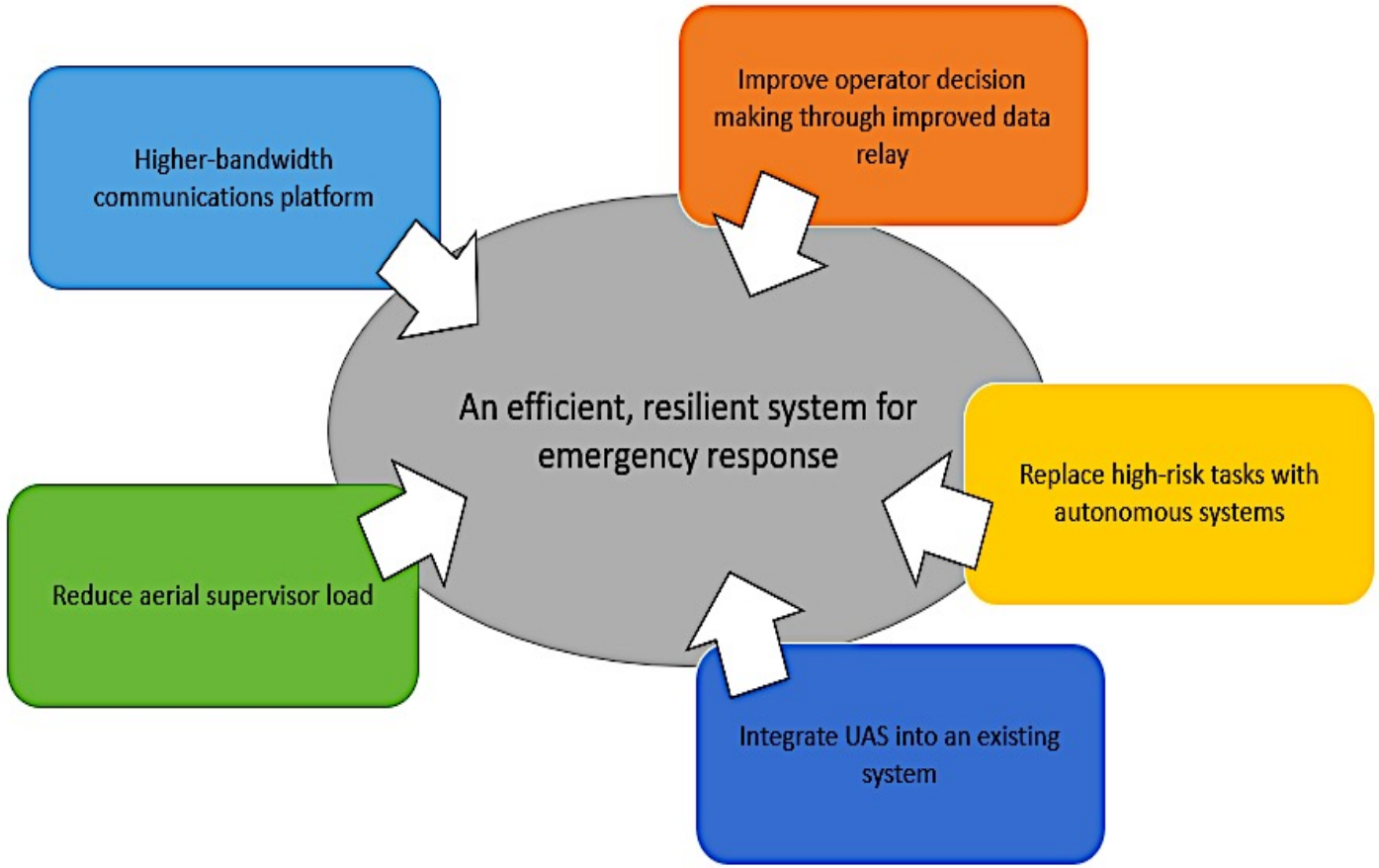
- UAS Benefits
- Aviation Safety
- System-Wide Safety
- Risk Mitigation
- Vision for NAS


System-Wide Safety

# Autonomous Vehicles in Action


*Safe, sustainable, affordable, and accessible aviation for transformational local and intraregional missions.*

# UAV Use Case: Detecting and Fighting Wildfires



# Aviation Safety: Where We Are

- Safety is priority
- Accidents trigger investigations & new rules
- Regulations can promote and hinder innovation

# Aviation Safety: What Must Change

## For a safe, transformed NAS:

- Identify barriers
- Leverage research
- Lead the emerging market community
- Engage and galvanize the community

# Aviation Safety: Where We Want To Be

**REACTIVE**
(Past)

Responds to events that have already happened

**PROACTIVE**
(Present)

Analyze and identify existing hazardous conditions

**PREDICTIVE**
(Future)

Analyze, identify, and mitigate potentially hazardous conditions


National Aeronautics and Space Administration
National Aeronautics & Space Administration (NASA)
Aeronautics Research Mission Directorate (ARMD)
Airspace Operations & Safety Program (AOSP)
System-Wide Safety Project
+ CENTURY MEDICAL CENTER +
www.nasa.gov

# System-Wide Safety (SWS) Project


Assure safe, rapid, and repeatable access to a transformed NAS

Use innovative technology to address risk

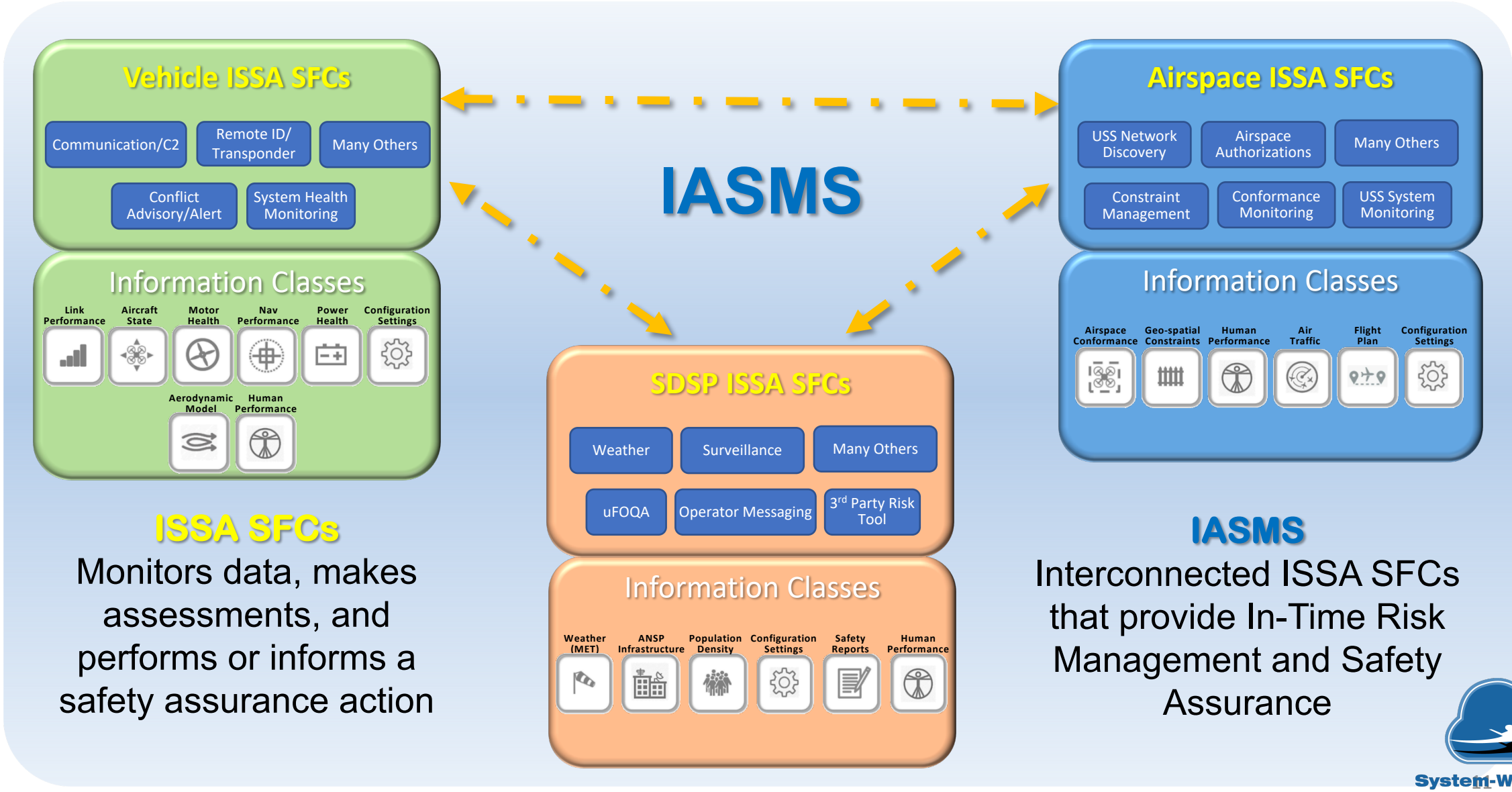
Integrate data that provides strategic insight

Explore safety impacts from technical advancements

Maintain aviation industry safety record

System-Wide Safety

# SWS Alphabet Soup—SFC, ISSA, IASMS




**ISSA SFCs**

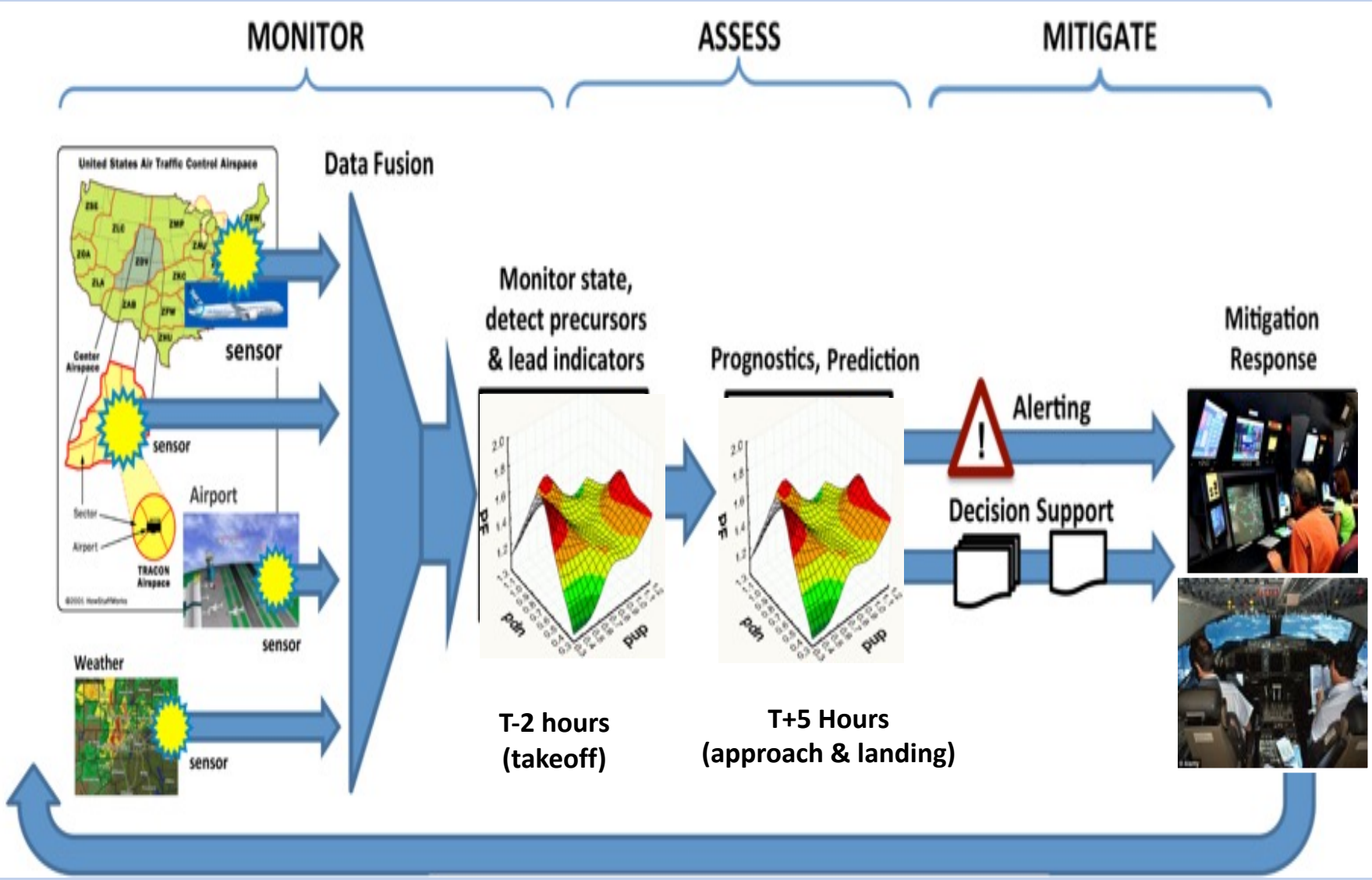
Monitors data, makes assessments, and performs or informs a safety assurance action

**IASMS**

Interconnected ISSA SFCs that provide In-Time Risk Management and Safety Assurance

System-Wide Safety


Operations Safety
TC-1
Predictive Terminal Area Risk Assessment
TC-2
IASMS SFC Development for Emerging Operations
TC-5
Safety Demonstrator Series for Operational IASMS
TC-3
Time to Certification
TC-4
Complex Autonomous Systems Assurance
Design Safety
VERTIPORT CLOSURE
GPS DEGRADATION: 35%
NASA
System-Wide Safety

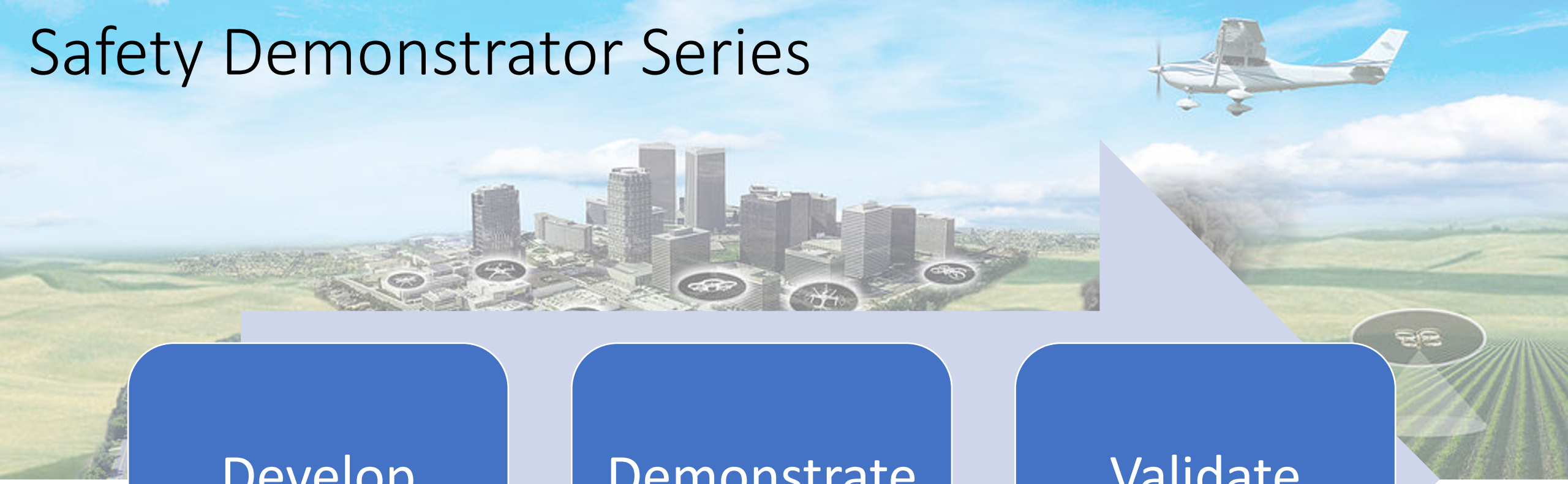



## Risks

- **Flight outside of approved airspace**
- **Unsafe proximity** to air traffic, people on the ground, terrain or property
- **Critical system failures** (including loss of link, loss or degraded positioning system performance, loss of power, flight control failure and engine failure
- **Loss-of-Control** (i.e., envelope excursions)
- **Physical/Environment Related Risks**
  - Weather encounters (including wind gusts)
  - Threat by person—malicious
- **Cyber-security** related risks
- Those our predictive and prognostic SFCs have **not identified yet…**

**Pre-flight & In-flight**

# Safety Demonstrator Series



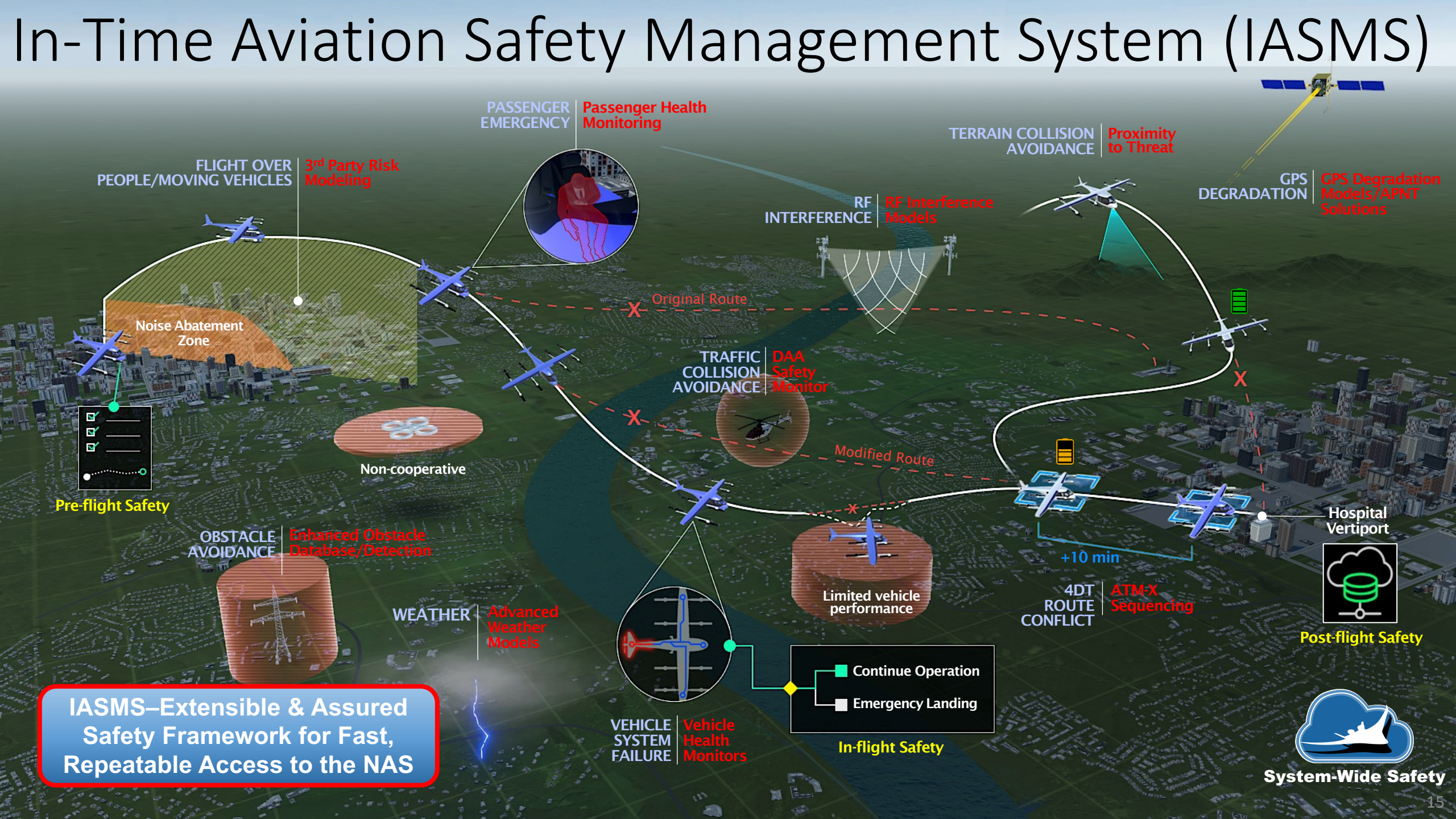
Develop

Demonstrate

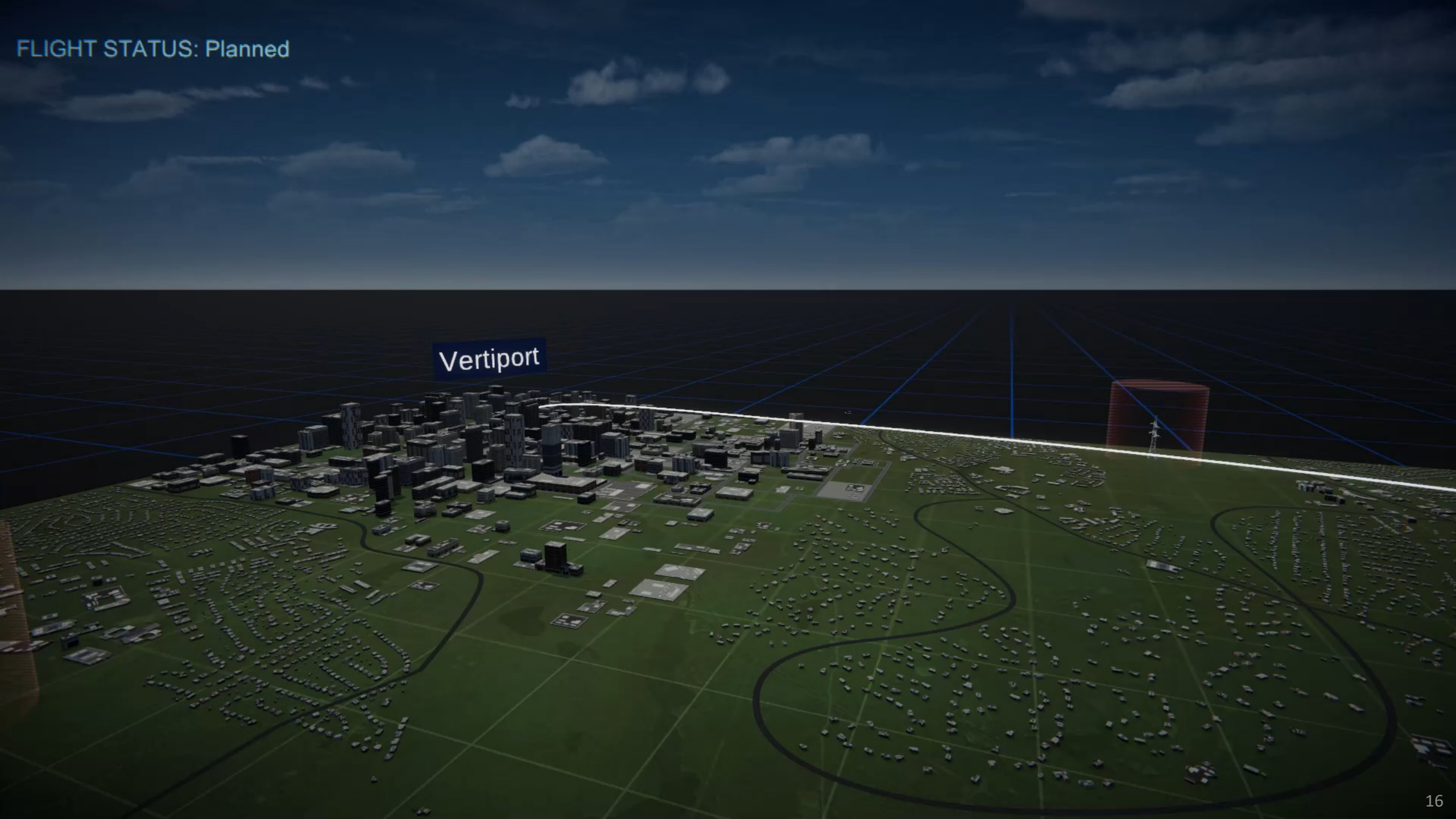
Validate

Develop increasingly capable
*In-Time Aviation Safety Management System (IASMS)*
through demonstrations of increasingly complex
series of use cases

# In-Time Aviation Safety Management System (IASMS)




**IASMS–Extensible & Assured Safety Framework for Fast, Repeatable Access to the NAS**


FLIGHT STATUS: Planned
Vertiport

# Community Engagement: Aviation Safety Reporting System (ASRS)

Collects and analyzes events from a more diverse and growing community

Enables investigation of new IASMS SFCs


https://asrs.arc.nasa.gov/

# ASRS Reporting Form


https://asrs.arc.nasa.gov/

## UAS FORM

**For immediate action of UNSAFE or UNAUTHORIZED drone operations contact local authorities.**

*DO NOT REPORT UAS ACCIDENTS AND CRIMINAL ACTIVITIES ON THIS FORM.*
*ACCIDENTS AND CRIMINAL ACTIVITIES ARE NOT INCLUDED IN THE ASRS PROGRAM AND SHOULD NOT BE SUBMITTED TO NASA.*
*ALL IDENTITIES CONTAINED IN THIS REPORT WILL BE REMOVED TO ASSURE COMPLETE REPORTER ANONYMITY.*

IDENTIFICATION STRIP: *Please fill in all blanks to ensure return of strip.*
*NO RECORD WILL BE KEPT OF YOUR IDENTITY. This section will be returned to you.*

TELEPHONE NUMBERS where we may reach you for further details of this occurrence.

HOME ____ HOURS ____

OTHER ____ HOURS ____

NAME (required)

ADDRESS/PO BOX (required)

ADDRESS LINE 2

CITY (required) STATE ____ ZIP (required)

TYPE OF EVENT / SITUATION (select all that apply)

- Airspace Incursion / Excursion
- Collision (aircraft, person, object)
- Deviation (altitude, procedure)
- Equipment Issue

(Use Command/Ctrl to multi-select)

Other: Event / Situation

DATE OF OCCURRENCE (MM/DD/YYYY)

MM/DD/YYYY

LOCAL TIME (24 HR. CLOCK) [HH:MM]

HH:MM

PLEASE FILL IN APPROPRIATE SPACES AND CHECK ALL ITEMS WHICH APPLY TO THIS EVENT OR SITUATION.

**REPORTER** Reset

**How were you involved in the UAS operation?** ○ Single Person Crew ○ Multi-Person Crew ○ Not Involved (e.g. eyewitness)

**If part of a Multi-Person crew tell us:**

Crew Size: ____ (total including reporter)

Role at time of event: (select all that apply)

- ☐ Person Manipulating Controls (ground control station / remote control transmitter)
- ☐ Remote Pilot in Command (RPIC)
- ☐ Visual Observer
- ☐ Other Crew Member: ____

**Reporter Location** ○ Outdoor / Field Station ○ Repair Facility

# Vision for a Future National Airspace System

# Questions?


IASMS ACTIVE
[ ALERT ]
[ SYSTEM HEALTH: 83% ]
RF INTERFERENCE
GPS DEGRADATION: 35%
VERTIPORT CLOSURE
System-Wide Safety

# Backup