Uncrewed Aerial Systems at NASA Langley Research Center

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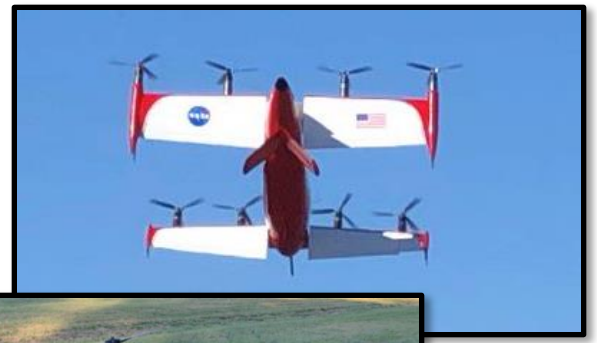
UAS Research at Langley

- ***Vehicle Centric***
  - Autonomous Operations
  - Health Monitoring and Prognostics
  - Mission (Capability) Driven Airframe Design
  - Flight Dynamics and Controls
- ***Airspace Integration***
  - Advanced Air Mobility
  - UAS in the NAS
  - UAS Traffic Management
  - Sense and Avoid
  - Contingency Operations
  - Certification
- ***Research Payload Platform***
  - Atmospheric Science
  - Space Systems
  - Wildfire Detection
  - Acoustic Signatures
  - Exploration simulation



CERTAIN

City **E**nvironment for **R**ange **T**esting of **A**utonomous **I**ntegrated **N**avigation

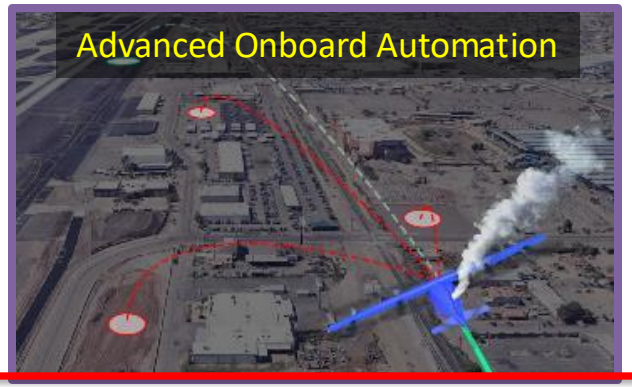
Langley uses its people, buildings, and landscape to study the challenges of autonomous flight

HDV Project Overview

- Two primary thrusts in HDV
  - Prototype and assess representative UAM Ecosystem UML-4
    - Focus on Vertiport Automation System
  - Perform testing and safety risk assessments to expand operations and achieve operational credit for NASA techs
    - sUAS BVLOS Operations
    - Provides off-ramp to sUAS Part-135 operators
- Prototyping representative UAM Ecosystem includes:
  - Vertiport automation systems (primary focus)
  - On-board autonomous systems
  - Airspace management systems
  - Ground control
  - Fleet management systems
- Perform coordinated spiral development and test series
  - Each schedule work package is a spiral (~14 months)
    - Includes HHITL Sim
    - Subsequent flight test
  - Acquire essential results to inform future research investments
  - Perform comprehensive safety risk assessments
  - To both support the UAM Ecosystem prototyping/assessment
  - And to generate essential data and results to achieve meaningful operational credit

HDV Schedule Work Packages

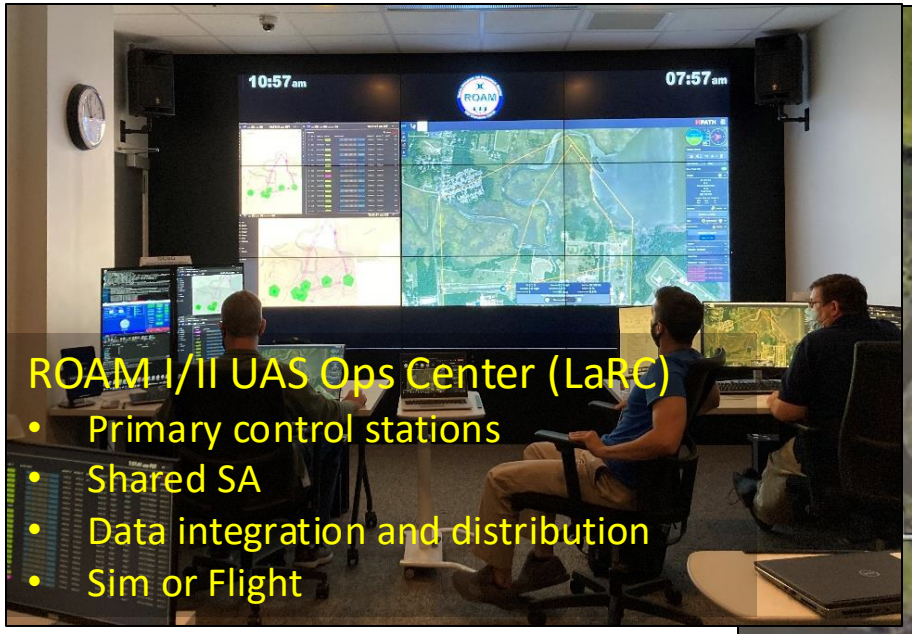
FY 21 to 22



FY 22 to 23

FY 24 to 25

HDV Simulation and Flight Testing (Coast to Coast)



ROAM I/II UAS Ops Center (LaRC)

- Primary control stations
- Shared SA
- Data integration and distribution
- Sim or Flight

CERTAIN (LaRC)

- sUAS multi-vehicle
- Extended Visual Line of Sight ops
- BVLOS operations

Image Landsat / Copernicus

AOL (ARC)

- Fleet manager
- ATM-X Provider of Services UAM interface
- Multi Aircraft Control System Sim

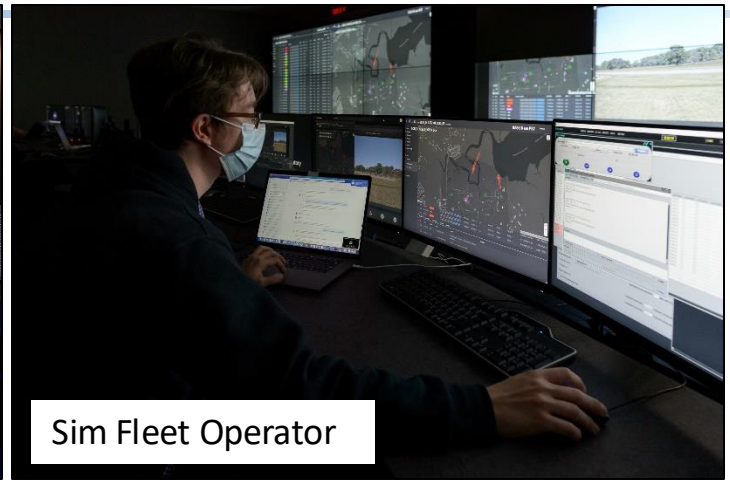
SIVL Lab (LaRC)

- 6 DOF Hardware-in-the-Loop sim
- Autonomous system integration

AVAL (ARC)

- Overall test quality monitoring
- Trial planning tool testing and development

SAO Integrated Architecture Elements

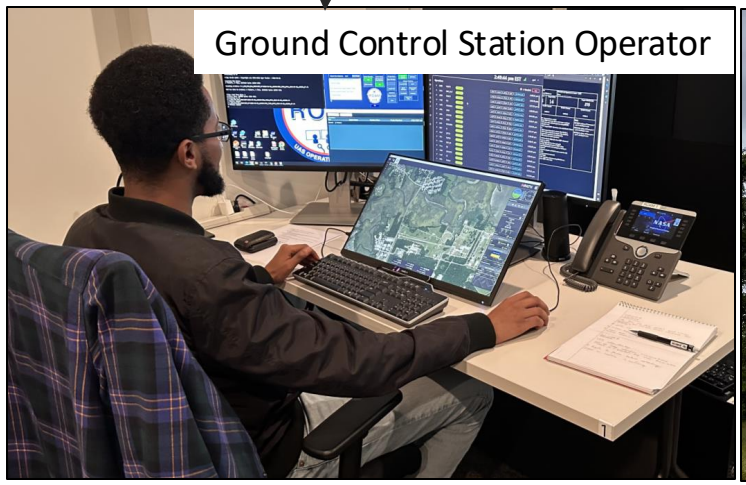


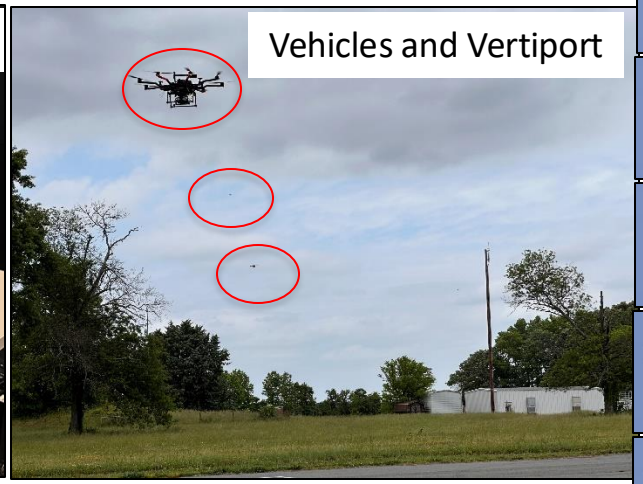
Airspace Services (PSU)

Vertiport Automation System

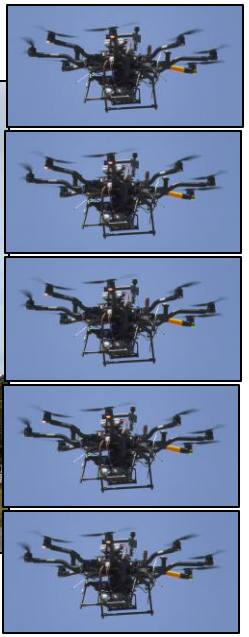
Fleet Management Service

Fleet Operations (sim)





5 total

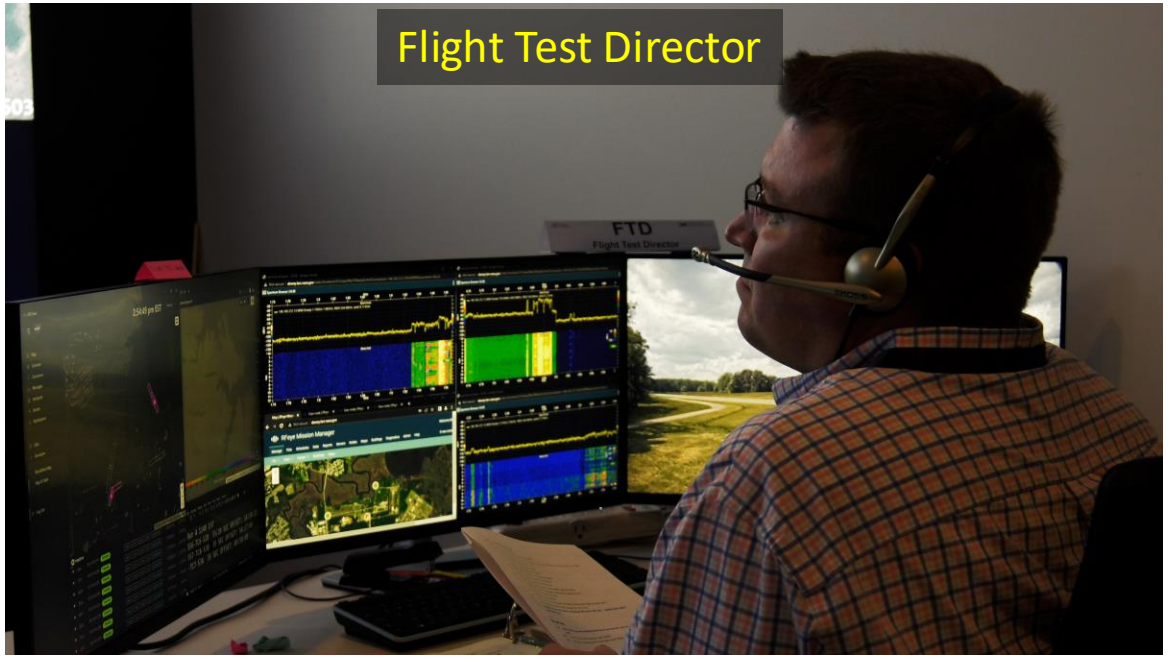


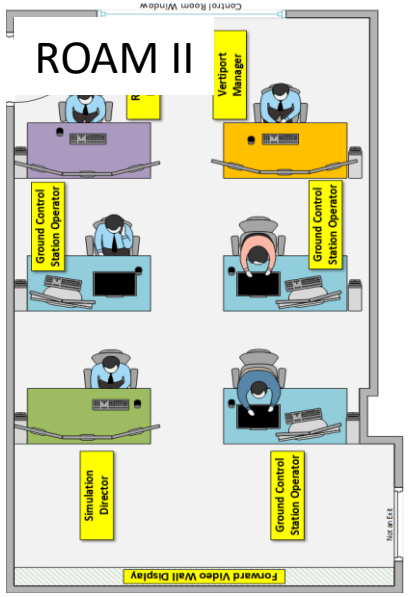
Vehicles and Onboard Automation

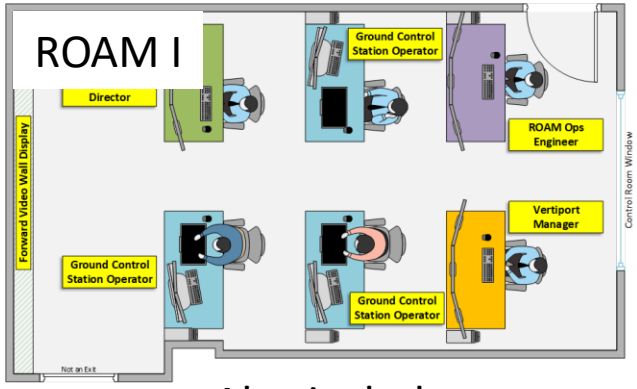
ARC

LaRC

ROAM I/II Control Stations







Also includes

- Range Safety Officer
- Airspace Monitor
- Radar Operator

Information Being Displayed – Front Walls

ROAM I – Front Wall

GCS MPATH

IAD

UMAT/Test Cards

Video of ROAM II

Vertiport Cams

ROAM II – Front Wall

Test Card / Routing Info

Vertiport Cams

IAD

UMAT

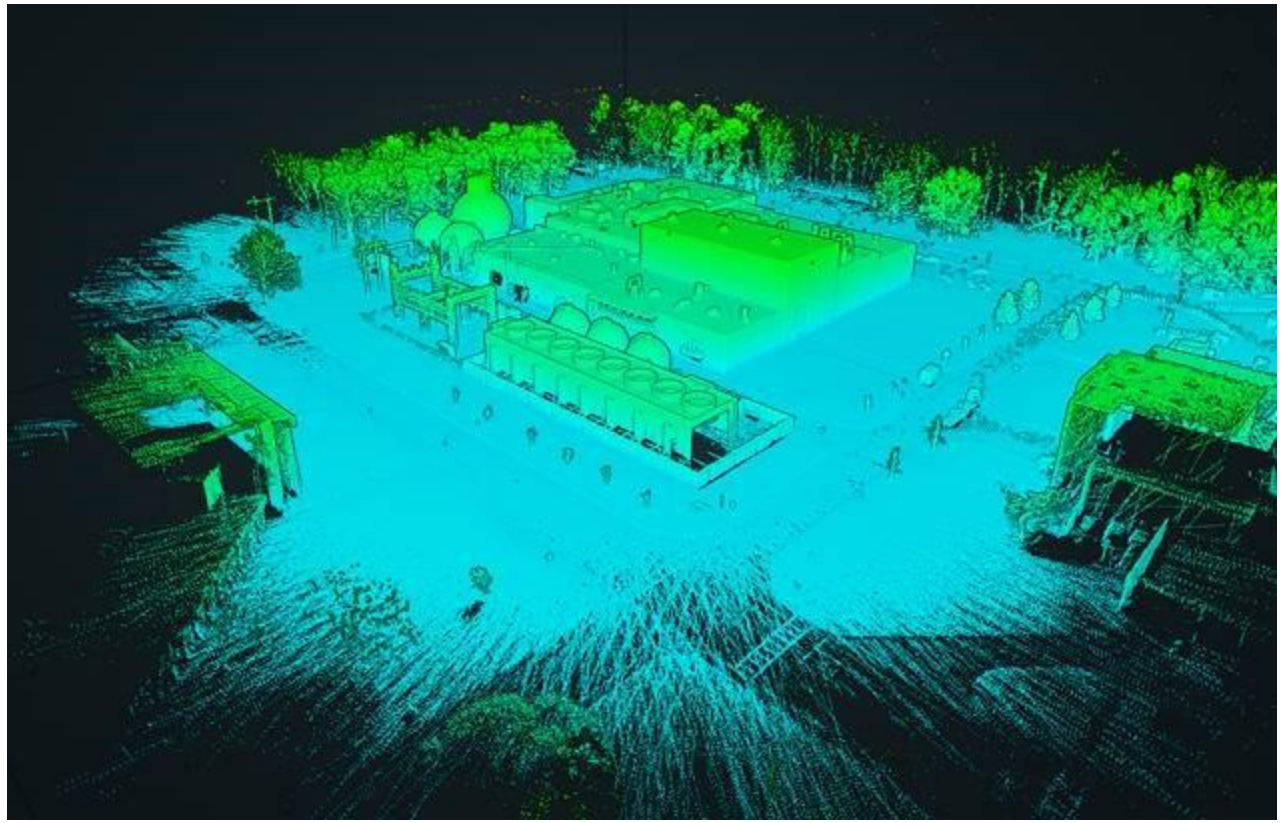
Vertiport Manager Traffic Monitoring (UAS Mission Assessment Tool)

Questions


NASA LANGLEY RESEARCH CENTER
UAS
OPERATIONS OFFICE
UNINHABITED AERIAL SYSTEMS OPERATIONS OFFICE


CITY ENVIRONMENT RANGE TESTING FOR AUTONOMOUS INTEGRATED NAVIGATION
CERTAIN
UAS OPERATIONS OFFICE

Center Modeling



GIS LiDAR

Photogrammetric Modeling

Space Hardware Testing – Dragonfly Parachute Tests For Landing on Titan
https://www.nasaspaceflight.com/2023/01/dragonfly-edl-overview/

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sUAS Facility Inspections

National Transonic Facility Wind Tunnel Inspection (https://www.nasa.gov/feature/nasa-vertiport-research-takes-flight)

Atmospheric Instrumentation Testing To Detect Wind Flow Around Buildings for UAM (https://www.nasa.gov/uam-overview/)

Current CERTAIN Capabilities

- Airspace
  - 800 Acres of Urban and Rural Airspace
  - FAA COA and LAFB Letter of Procedure
  - Part 107 Operations
  - 400’ altitude, 125 lbs vehicle weight
  - Class D airspace, reverting to Class G
- Technology
  - NextNav Local Positioning System
  - Safeguard Range Containment System
  - ClearCom voice communication system
  - Radar and RF detection systems
  - GPS Predictive Quality Services
- Data Collection
  - Telemetry
  - Local Weather Stations
  - Data networking
- Infrastructure
  - Spectrum Management Office
  - Rooftop Access and Operations
  - Indoor/Netted flight testing capability
  - Improved surface for fixed wing operations and multiple Vertiports
  - UAV test vehicles
  - Safety Process and Procedures
  - Simulation capabilities
  - Remote Command and Control Facilities

NEXTNAV

NASA Langley Review Process

- Strategic Involvement
  - Initial Risk Assessment which guides:
    - Tailoring of the Engineering Review Process
    - Documentation requirements
    - Engineering rigor
    - Configuration Control Process
    - Component, Sub-system and System level testing requirements
  - CONOPS Development
  - Design guidance for Airworthiness Certification
  - Assistance with development of Hazard Analysis
  - Assistance with Airworthiness Review Board
  - Development and review of the Operational Readiness Review (ORR)
  - Coordination with FAA for Airspace Authorizations
- Tactical Involvement
  - Scheduling of airspace and ranges
  - Airworthiness Inspection
  - Pilots, Visual Observers, Range Safety Officers
  - Ground Support Equipment