AAM National Campaign Developmental Testing (NC-DT) Virtual Dry Run

June 29, 2021
## Crosscutting Working Group: AAM NC-DT Virtual Dry Run - Agenda

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<tr>
<th>TIME (PT)</th>
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<tr>
<td>11:00AM – 11:15AM</td>
<td>NC Developmental Test Objectives</td>
<td>Starr Ginn National Campaign Lead</td>
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<tr>
<td>11:15AM – 11:30AM</td>
<td>NC Dry Run Overview</td>
<td>Jeff Leigh National Campaign Chief Engineer</td>
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<td>11:30AM – 11:50AM</td>
<td>Pre-recorded Live Feed with Narration</td>
<td>Starr Ginn National Campaign Lead David Zahn National Campaign Airspace PI Rick Simmons Rotorcraft Test Pilot</td>
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<tr>
<td>11:50AM – 12:00PM</td>
<td>Airspace Procedure Overview</td>
<td>David Zahn National Campaign Airspace PI</td>
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**Q&A (20 minutes)**

| 12:20PM – 12:35PM  | NC Flight Test Infrastructure Overview | Shivanjil Sharma National Campaign Deputy Lead |
| 12:35PM – 12:50PM  | Airspace Core Services for UAM        | Spencer Monheim ATM-X UAM Tech Lead |

**Q&A (10 minutes)**

| 1:00PM – 1:20PM    | Flight Test Plan Overview             | Dave Webber FAA Vehicle PI |
| 1:20PM – 1:35PM    | Data Products and Process with FAA    | Bryan Brown/Sarah Eggum FAA Data Coordinator Mohana Gurram NASA Data Manager |

**Q&A (20 minutes)**

| 1:55PM – 2:00PM    | Closing                               | Starr Ginn National Campaign Lead |

*This agenda may be subject to modification.*
NC Execution in FY21 – NC Developmental Test

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**NC Partnership Management**
- ACO Release
- Partner Selection
- NC-1 Vehicle Information Exchange Engagements
- NC-1 Partner Reviews & Prep
- NC-1 Flight Testing

**NASA Testing**
- Dry Run Flight Testing
- Flight Testing

**NC DT with Joby**
- DT Flight Testing

**Data Buys: Bell & FLE Flights**
- Scenario Development and Flight Test Objective Refinement
- Bell Flight Testing
- FLE Flight Testing

**Airspace Simulation (X3 & X4)**
- X3 Data Collection
- X4 Data Collection
Accelerate Certification and Approval: *Develop and assess an integrated approach to vehicle certification, pilot licensing, and operational approval.*

Develop Flight Procedure Guidelines: *Develop preliminary guidelines for flight procedures and related airspace design criteria.*

Evaluate the Communication, Navigation, and Surveillance (CNS) Trade Space: *Explore and evaluate CNS requirements, options, and trade-offs.*

Demonstrate an Airspace Management Architecture: *Demonstrate and document an airspace system architecture capable of safely managing scalable AAM operations without burdening the current air traffic management system.*

Identify Community Integration Needs: *Conduct initial characterization of the community noise of AAM vehicles through measurements of vehicle ground noise.*
NC Developmental Test Objectives

**NC-DT Goal:** Ensure that NASA is fully prepared to execute NC-1 event in a manner maximizing benefits to the AAM community

**DTO-1: Assess Maturity and Robustness of NASA Proving Ground**

*Full Success:* Collect data to support analysis of the flight test and simulation infrastructure for Scenarios 1-4.

**DTO-2: Assess Effectiveness of NC Testing Processes, Logistics, and Data Collection**

*Full Success:* Guide one partner organization through technology readiness, test readiness, flight and simulation execution, and data collection processes.

**DTO-3: Preliminary Assessment of Partner Capabilities and Systems Performance**

*Full Success:* Conduct flight test and simulation for at least one partner aircraft/airspace system to collect vehicle, airspace, and connectivity/communication performance data against the requirements for Scenarios 1-4.

**DTO-4: Assess the Suitability of NC-1 Scenarios**

*Full Success:* Assess the applicability of the scenarios through the execution of at least three of the NC-1 scenarios with at least one vehicle and one airspace partner.
National Campaign OV-1

NASA National Campaign OV-1

CNS Contingencies

Air-to-Air Conflict Management

Constrained Conflict Management

Noise Evaluation & Response

Trajectory Planning & Compliance

Airspace Management Facilities

Aircraft and Airspace System Interoperability

UAM Ports & Approaches

Distance: ~ 20 miles
6 AAM NC “UAM Heliports”
- 40x40ft TLOF
- Northern Heliports suitable for wind/controllability studies
- All Heliport design/placement IAW AC 150/5390-2C Heliport Design

1 AAM NC “UAM Vertiport”
- 1090ft length x 120ft width TLOF/FATO
- 01H + 02H + 03H = XEDW Research Airport
- 04H + 05H + 19/01 = XVPT Research Airport
- 06H = XX33 Research Airport
4833 Helipads

Asphalt Removed

FATO and Safety Area will not be marked on unpaved surfaces

148/328 Mag

020/200 Mag

290/110 Mag

195/335 Mag

North
ORION 3 Scenario 2 In-flight Re-route
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Approaches Used:
JEFF LEIGH
National Campaign Chief Engineer
Key activities to support Dry Run and DT Flight Objectives

• A series of Performance, Trim, Stability, and Control flight test maneuvers intended to support or validate vehicle flight manual performance, operating characteristics, or operational limitations (Vehicle Characteristics) these classical, proven, test techniques provide data that support compliance findings against current FAA minimum requirements for vertical flight aircraft dependent on the operational use case

• A set of ground and flight tasks that represent the “building blocks” that make up a UAM mission, including simulated IMC approaches to defined “UAM Heliports” and “UAM Vertiports” in controlled, but varied, conditions (UAM Task Elements) these “developmental” test techniques are intended to support FAA civil certification compliance findings for UAM aircraft that utilize highly-augmented flight control systems and/or “simplified vehicle operations.” NASA is a key collaborative partner with FAA for development of these so-called “Mission Task Elements.”

• Flyability evaluations of research UAM approaches, departures, and enroute procedures utilizing an FAA evaluation application which operates independently from the flight vehicles’ avionics (Approach, Departure, Route Flight Checks)

• Flights that are specifically designed to simulate a “real world” urban air taxi mission including pre-flight planning, ground operations, flight operations, air traffic management and contingencies expected in the UAM mission. (Scenarios Testing).
Build 2 Purpose and Scope

• Purpose
  – Facilitate the development of the data collection systems and mobile range infrastructure required for NC-1;
  – Refine the NC Scenarios, test techniques, and safety assurance processes; and
  – Capture foundational vehicle and operational data to support evolutions in vehicle, infrastructure, and airspace requirements that will enable the advent of UAM in the National Airspace System (NAS).

• Scope
  – Approximately 25 hours of flight activity using a helicopter within the Dry Run Flight Test Infrastructure
  – Meet Flight Test Plan (FTP) objectives
  – Build on the lessons learned during December’s Fam Flights.
  – Integrate and test additional infrastructure systems to include PLASI, differential GPS, and additional helipads at building 4833 and X-33
Key activities to support Dry Run and DT Flight Objectives

Being the first set of flight tests that support the greater AAM National Campaign (NC) project, the tests contained herein also support the following objectives:

- Provide airborne data to support air traffic management research
- Validate a representative UAM test range construct
- Capture baseline Infrastructure/Terminal environment data
- Determine suitability of current aeronautical procedure development and recommend changes for future AAM/UAM development.
- Determine suitability of current ARINC 424 coding requirements in support of AAM/UAM.
- Look at FAA Flight Inspection Approach Procedures that could be appropriate for UAM operations
- Validate/refine Airspace assumptions for UAM
- Validate GSE design, test site design, and GSE layout
- Exercise the NASA Airworthiness Process in order to prepare for subsequent UAM participant vehicles
- Collect time/space/position data and video data that will support communication of AAM goals, conclusions and concepts
Build 2 Flight Test Infrastructure Overview

**Redlined differences to final configuration**

**Flight Crew**

Paul Davidovich FRI Pilot  
(Flight Research Inc)

Jon Jordan FAA Cert Pilot  
(Flight Test Engineer)

Dave Webber FAA FTE  
(Flight Test Engineer)

Jay Sandwell FAA FIAPA  
(Flight Inspection Airborne Processor Application)
SHIVANJLI SHARMA
National Campaign Deputy Lead
National Campaign – Data and Information Exchange

Data Needs and Requirements

FAA
Industry Partners
NASA Research Projects
National Campaign Flight Test Infrastructure

Gap Analysis for Current Standards

- FAA access to shared database and collaborative analysis to inform gaps in policy and standards
- Sharing key outcomes with standards bodies
- Using data to inform NASA/FAA Working Groups including development of concept of operations
- Leveraging ULIs to ensure consistent development with research institutions
- Community engagement through AAM Ecosystem Working Groups

National Campaign Operational Demos Data Collection & Analysis

MBSE Approach for CC
Dry Run - Lessons Learned

Assessment of Flight Test Infrastructure
- Determined maturity and performance requirements of flight test infrastructure components
- Understood integration needs as well as power and connectivity requirements

Development of NC Flight Test Plan
- Established flight test points comprised of flight maneuvers and vehicle characteristics expected by UAM vehicles
- Providing Cooper Harper ratings on control margin with FAA Test Pilots and Flight Test Engineers
- Evaluating FAA Subpart B regulatory airworthiness standards

Development of Infrastructure and UAM Approach and Departure Procedures
- UAM approach and departure procedure design including iteration on angles and descent rates that incorporate vehicle dynamics as well as passenger ride quality
- Developed infrastructure requirements by establishing vertiport and heliport dimensions and markings

Assessed Data Collection Equipment and Procedures
- Exercised data collection systems including a differential GPS system, instrumentation on board the vehicle, as well as instrumentation provided by the FAA (FIAPA - Flight Inspection Airborne Processor Application)
- Developed data models, database schemas, and access controls to facilitate data analysis

Assessment of Integrated Operations and Scenarios
- Simulated future UAM missions including pre-flight planning, ground operations, flight operations, and contingencies
- Real time ADS-B inputs to inform an airspace component (provided by ATM-X UAM) to represent a future third party airspace provider
AIRSPACE COMPONENTS

Spencer Monheim
ATM-X UAM Sub-project Airspace Integration Testing & Demonstration Tech Lead
Airspace Components – UAM Subproject

- PSU – Provider of Services to UAM:
  - Communication Airspace Component between Operators
  - Discovery – Informs a PSU of other PSUs operating in an airspace
  - Authorization – ANSP-actor component, verifies the authenticity of a PSU/Operator
• Communication standard was collaboratively developed and tested by Industry and Public Stakeholders

• Functionality of PSU is derived from FAA Conops
NPSU Operation Diagram Example (scenario 1)

Flight Demonstration provides opportunity to test data/information flow in a future UAM Airspace System

Propose Operation

Future Information Flow
Next Steps

• X3 Simulation and NC Dry Run set foundation through executing operations in single operator baseline

• X4 Simulation increases complexity and interconnectivity through interactions between two simultaneous operators, one NASA operator and one Industry operator

• X4 Simulation enables testing concepts and software prior to flight test as preparation and risk reduction for NC-1
FLIGHT TEST PLAN OVERVIEW

Dave Webber
FAA Vehicle Cert Principal Investigator
Advanced Air Mobility (AAM) encompasses several nascent “operational use cases” in addition to innovative evolutions in existing aerial mobility/technologies. These new operational use cases need to be understood in order to develop appropriate regulatory (minimum airworthiness) requirements for vehicles.
FAA Perspective

FAA recognizes that standards, across lines of business, must evolve to support UAM.

FAA Vehicle Certification recognizes the “holistic” inter-dependence of standards.

Assumption:
If Vehicle Characteristics standards are Raised/Lowered – Terminal Ops volumes are Increased/Decreased.

Vehicle technology itself will pace the introduction of new forms of transportation.

FAA seeks the proper balance of standards that will enable social acceptance of perhaps the most challenging new operational use case: Urban Air Mobility.

Anchoring to today’s rotorcraft capabilities/heliport design – The UAM Helicopter Dry Run, captures foundational data to support evolutionary UAM concepts.
Urban Air Mobility operational assumptions

Small urban footprint – *public-use* UAM terminals
- Defined Approach/Departure “surfaces” coincident with obstacle clearance surface (OCS)
- Limited approach/departure paths
- Condensed surface operations
- Little control over urban landscape evolution

**UAM “air taxi” must compete with ground-based transportation options**
- Instrument Meteorological Conditions
- Limited icing capability
- 9 degree nominal approach angles – steeper less disruptive to urban planning
- Lower Altitude final approach fix (FAF) increases efficiency
- Aircraft must be capable of safe operations in urban wind environment
- UAM corridors above cargo delivery drones, but below general aviation traffic

**UAM Vertiports can take advantage of urban rivers or other larger urban spaces**
Nominal Approach Profile – NC UAM Heliport

Altitude AGL (ft)

-700
-600
-500
-400
-300
-200
-100
0
100
200
300
400
500
600
700

Horizontal Distance (ft)

-1000
-500
0
500
1000
1500
2000
2500
3000
3500

Nominal 9° GPA

HCH 10ft

V_{AT}=10kts

TLOF ELEV 2500

Approach/Departure Surface = Obstacle Clearance gradient 10:1

V_{FAF}

H_{FAF}

TLOF = Touchdown/Liftoff Area (≈LDA); FATO = Final Approach/Takeoff Area (≈RPZ) — ref: Heli/Verti/Airport AC

TLOF=Landing Surface available; FATO defines origin of Approach/Departure/Obstacle Clearance
Urban Air Mobility (UAM) configurations

- **Lift + Cruise** Completely independent thrusters used for cruise vs. for lift without any thrust vectoring

- **Electric Rotorcraft** An eVTOL aircraft that utilizes a rotor, such as an electric helicopter or electric autogyro

- **Wingless (Multicopter)** No thruster for cruise/only for lift

- **Vectored Thrust** An eVTOL aircraft that uses any of its thrusters for lift and cruise.

“UAM” is a subset of Advanced Air Mobility (AAM) – intended for paid passenger-carrying operations (aka: on-demand mobility)
Urban Air Mobility (UAM)

• The UAM economic/operations model (\$\$’s per seat-mile) demands an aviation version of “mass production” and operation that is new to small aircraft
  – 10’s of thousands of aircraft operated by a single part 135 operator (in some cases this operator will be the manufacturer) vs-
  – 100’s of aircraft purchased by private parties and operated by several operators running a mixed fleet operation
• UAM are expected to exhibit engine and system isolation features similar to transport category rotorcraft (Cat A flyaway capability)
• UAM are expected to utilize “Simplified Vehicle Operations”
• UAM operational safety and efficiency will benefit from standardized takeoff and landing operations that:
  – utilize a critical engine/system failure concept, and;
  – assure adequate designated surface area and adequate performance capability for continued safe flight in the event of critical (propulsion or systems) failures.
Urban Air Mobility (UAM)

• Low speed controllability must account for constraints of the urban landscape
  – Urban “pinnacle” takeoffs and landings
  – Constrained approach and departure paths
  – Unpredictable winds associated with “urban canyons” coupled with urban development

• UAM economic model will demand flight characteristics that enable condensed IMC ops in the urban environment
  – Minimum Trim, Stability and Control, and maneuverability characteristics/limitations must be established for all UAM entrants ($V_{MIN-I}$, $V_{Y-I}$, $V_{NE-I}$, etc)
  – Many UAM entrants have highly-augmented, feedback-control, FBW FCS, that will provide 4-axis Stability Augmentation (a key enabler for low-speed Helicopter instrument operations)

• UAM Terminal Procedures (TERPS), Infrastructure and Airspace standards will need to align with UAM Category/Class Vehicle Minimum Airworthiness Requirements*

*which have not yet been established – here’s where NASA’s AAM National Campaign comes in...
UAM key enablers

Minimum Flight Characteristics required for Urban Operations
- All Azimuth Capability
- Windward/Leeward effects on controllability
- Tailored UAM civil certification HQ tasks

Condensed UAM Approaches/Airspace
- Viable UAM IMC approaches
- Heliport and Vertiport operations

**AIRSPACE constraints**

**VEHICLE minimum requirements**

Required evolutions to existing standards to enable UAM
- Terminal/Instrument Procedures (TERPS)
- Urban Planning

**INFRASTRUCTURE needs**
Using a “Surrogate UAM” vehicle, the initial flight test plan endeavors to answer several UAM research questions:

- Are existing Airplane and/or Rotorcraft FAA Subpart B (stability, control, trim, and performance) airworthiness requirements appropriate for the UAM operational use case (aka, mission)?

- Can UAM vehicle designs deliver an aircraft that exhibits stability, control and performance that enables condensed, steep (nominal 9°), approaches, in Instrument Meteorological Conditions, into the expected UAM terminal environments?

- Are existing Heliport Design Criteria (dimensions, proximity to structures, and approach/Departure surfaces) appropriate for the UAM mission? Can this criteria be reduced to further enable UAM goals?
UAM Helicopter Flight Test Plan

**FAA “Subpart B” Vehicle Characteristics**

**Performance**
- Hover Power Margin (IGE/OGE) – free flight method
- Level Flight
- Climb/Descent/Glide

**Flight Characteristics**
- Trimmed Flight Control Positions – Forward Flight
- Critical All Azimuth Controllability
- Maneuverability
- Static Longitudinal Stability
- Static Lateral/Directional Stability
- Dynamic Stability

**Approach/Departure Routes FIAPA**
*(Flight Inspection Airborne Procedure Automation)*

**Integrated Scenarios Testing**
*(Ops evaluation of an assumed UAM operation)*

**Other**
- PLASI Checkout
- VIP sortie

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**UAM Task Elements**

**Ground and Hover Tasks**
- Ground Handling/Taxi
- Precision Hover
- Lateral Reposition and Hold
- Hover Turn and Hold
- Pirouette
- Vertical Reposition and Hold

**Takeoff and Landing Tasks**
- Takeoff
- Heliport and Vertiport Approach
- Terminal Hover
- Landing
- Urban Landscape/Dynamic Interface
- Decelerating Turn (RESERVED)

**Transition Tasks**
- Deceleration IGE (Varied $V_{AT}$)
- Acceleration IGE/OGE (RESERVED)
- Depart and Abort (RESERVED)
- Simulated Failure (Approach/Departure) (RESERVED)
- Balked Landing to Go-around

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*OH-58C acts as an “experiment control”
- known flying qualities deficiencies can help “tune” developmental UAM (Handling Qualities) Task Elements

~25 hours – assuming ~1 hr sortie length
Flight Research OH-58C instrumentation

- Aircraft provides all the necessary parameters for basic Flight Characteristics (S&C&P) evaluations

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VFTE IADS Display
DATA PRODUCTS AND PROCESS WITH FAA

Sarah Eggum – FAA Data Manager
Mohana Gurram– NASA Data Manager
Data Products & Processes with FAA

NASA | FAA Collaboration

FAA UAM Focals
- AVS – Aviation Safety
- AJO – Air Traffic Organization
- APL – Policy, International Affairs, and Environment
- ASH – Security & Hazardous Materials Safety
- ARP – Airports
- ANG – NextGen
- AGC – Office of the Chief Counsel
- TSI – Transportation Safety Institute

Data Element Card

Title: Critical Airworthiness Control Summary (CACSS)

Data Elements:
- Overall Safety
- System
- Design
- Operations
- Maintenance

Data Requirements:
- Critical Design
- System
- Safety
- Operations
- Maintenance

Collaborative gap analysis for existing standards & policies across all FAA lines of business to enable UAM operations

Credits: David Dunning, FAA NC Lead

AAM Implementation Plan

Credits: NC STWG
Data Products & Processes with FAA

Approach to Data

Data Needs and Requirements

Influencers

FAA
Industry Partners
NASA Research Projects
NC Scenarios
ASTM Specifications

Spreadsheet

Airspace Test Infrastructure

Data Ingestion
Data Storage
Data Models
Data Flows
Test Plans
MOF
Range
Vehicle

Flight Test Infrastructure

Credits: NASA Ames ATI
Data Products & Processes with FAA

Collections of Data

Performance Graphs | Conformance Graphs | Flight Track | Signal Validation | Atmospheric Graphs | Deviations | Messaging | ARINC Coding

Credits: NC Data Team
QUESTIONS & WRAP UP
BACKUP
DAVID ZAHN
National Campaign Scalable UAM Operations Principal Investigator
6 AAM NC “UAM Heliports”
- 40x40ft TLOF
- Northern Heliports suitable for wind/controllability studies
- All Heliport design/placement IAW AC 150/ 5390-2C Heliport Design

1 AAM NC “UAM Vertiport”
- 1090ft length x 120ft width TLOF/FATO

- 01H + 02H + 03H = XEDW \[\text{Research Airport}\]
- 04H + 05H + 19/01 = XVPT \[\text{Research Airport}\]
- 06H = XX33 \[\text{Research Airport}\]
# XEDW - 01H

## Facility Search

<table>
<thead>
<tr>
<th>Identifier</th>
<th>XEDW</th>
</tr>
</thead>
</table>

## AIRNAV Data

### Airport
- AIRPORT ID: XEDW
- STATE: CA
- COUNTRY: US
- MVAR: E12
- STATUS: Active

### Runway
- Runway: 01H (A)

<table>
<thead>
<tr>
<th>General</th>
<th>Helipad</th>
</tr>
</thead>
<tbody>
<tr>
<td>LANDING LENGTH</td>
<td>LATITUDE</td>
</tr>
<tr>
<td>96 FT</td>
<td>N34° 57' 32.8320&quot;</td>
</tr>
<tr>
<td>TRUE BEARING</td>
<td>LONGITUDE</td>
</tr>
<tr>
<td>250.35°</td>
<td>W117° 52' 54.1200&quot;</td>
</tr>
<tr>
<td>PUB DATE</td>
<td>ELEVATION</td>
</tr>
<tr>
<td>09/28/2020</td>
<td>2276.0 FT</td>
</tr>
<tr>
<td>FL RWY LENGTH</td>
<td>ELLIPSOID ELEV.</td>
</tr>
<tr>
<td>2170.7 FT</td>
<td>2170.8 FT</td>
</tr>
<tr>
<td>FL RWY HEIGHT</td>
<td>MODEL / SOURCE</td>
</tr>
<tr>
<td></td>
<td>WGS84 / E</td>
</tr>
<tr>
<td></td>
<td>HORIZ. DATUM</td>
</tr>
<tr>
<td></td>
<td>WGS84</td>
</tr>
<tr>
<td></td>
<td>VERT. DATUM</td>
</tr>
<tr>
<td></td>
<td>EGM_96</td>
</tr>
<tr>
<td></td>
<td>CALC ELLIP HT</td>
</tr>
<tr>
<td></td>
<td>2170.8 FT</td>
</tr>
<tr>
<td></td>
<td>IS DISPLACED</td>
</tr>
</tbody>
</table>

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[Image of a map with a highlighted area labeled 01H]
### RNAN - XVPT (19)

#### Facility Search
- Identifier: XVPT

#### AIRNAV Data
- **Airport**
  - AIRPORT ID: XVPT
  - STATE: CA
  - COUNTRY: US
  - MVAR: E12
  - STATUS: Active

- **Runway**
  - Runway ID: 19 (A)
  - **General**
    - LANDING LENGTH: 1094 FT
    - TRUE BEARING: 21.0°
    - PUB DATE: 09/18/2020
    - FI RWY LENGTH: 1124.0 FT
    - FI RWY HEIGHT: 2302.8 FT
  - **Threshold**
    - LATITUDE: N34° 57' 03.8880"
    - LONGITUDE: W117° 53' 02.4000"
    - ELEVATION: 2276.0 FT
  - **End**
    - LATITUDE: N34° 57' 13.6440"
    - LONGITUDE: W117° 53' 57.7200"
    - ELEVATION: 2279.0 FT

- **Ellipsoid Elevation**
  - FI RWY LENGTH: 2170.7 FT
  - MODEL / SOURCE: WGS84 / E
  - HORZ. DATUM: WGS84
  - VERT. DATUM: EGM_96
  - CALC ELLIP HT: 2170.8 FT
  - IS DISPLACED: 

- **Ellipsoid Elevation**
  - END: 2173.7 FT
  - MODEL / SOURCE: WGS84 / E
  - HORZ. DATUM: WGS84
  - VERT. DATUM: EGM_96
  - CALC ELLIP HT: 2173.8 FT
  - IS DISPLACED: 

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[Map Image: XVPT RWY 19]
Flight Inspection Airborne Processor Application

• Ingests FAA AIRNAV data
• Ingests ARINC 424 for RNAV procedures
• Performs data quality checks
• Collects detailed data over runway threshold and runway end (e.g. HP Lat/Long, Rad Alt, IRU, air data, GNSS)
• Estimates the North, East, Up errors of the spatial data used for the procedure
• Logs all data for replay and/or analysis
Example UTE Test Sheet : Static

Research areas Airspace, Flight, and Infrastructure

Assign POC’s from NASA and FAA for Data Exchange

FAA POC’s delegated in areas of responsibility
  - Technical
  - Policy

Identify gaps in current criteria, standards, and regulations

Summarize suggestions for change
## Spatial Data Position Errors  
**Area A – XEDW – 01H**

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Location</th>
<th>Elevation</th>
<th>Vertical Error (from Garmin)</th>
<th>Lateral Error (from Garmin)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Garmin Handheld Survey</td>
<td>(34 57 32.88 N, 117 52 54.07 W)</td>
<td>2274 ft.</td>
<td>Most Accurate</td>
<td>Most Accurate</td>
</tr>
<tr>
<td>Google Earth</td>
<td>(34 57 32.84 N, 117 52 54.20 W)</td>
<td>2276 ft.</td>
<td>+2 ft.</td>
<td>(-0.04 degrees, +0.13 degrees)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11.55 ft. 249.50 True Bearing</td>
</tr>
<tr>
<td>TARGETS</td>
<td>(34 57 32.69 N, 117 52 53.29 W)</td>
<td>2241 ft.</td>
<td>-33 ft.</td>
<td>(-0.19 degrees, -0.78 degrees)</td>
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<tr>
<td></td>
<td></td>
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<td></td>
<td>67.71 ft. 106.48 degrees True Bearing</td>
</tr>
<tr>
<td>Surveillance Broadcast Services Monitor</td>
<td>(34 57 33.01 N, 117 52 53.97 W)</td>
<td>2280 ft.</td>
<td>+6 ft.</td>
<td>(+0.13 degrees, -0.10 degrees)</td>
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<tr>
<td></td>
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<td></td>
<td>15.56 ft. 32.34 True Bearing</td>
</tr>
<tr>
<td>FIAPA</td>
<td>Pending Flight Data</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Quad Zero Approach

Altitude AGL (ft)

GPA 9°

HCH 10ft

PinS

Baro Glidepath distance: 3156 ft

TLOF ELEV ~3000

V_{\text{threshold}} = \sim 0

Horizontal Distance (ft)

TDP

50kts

70kts

789 ft

789 ft

750 m/s

Time Speed Altitude

HMAS

HMAS

HMAS

FAF 70 KIAS

0kts

30kts

50kts

700

600

500

400

300

200

100

0

-1000

-500

0

500

1000

1500

2000

2500

3000

3500
Work Underway: Fusing data to apply to approach
NASA/FAA Flight following collaboration:

- Real time (1 sec refresh rate)
- Pilot deviations
- Route tracking and conformance
- Enforcement/Contingency Management
- Post flight data analysis
FAA's Surveillance Broadcast Service Monitor Tool