UAS Integration in the NAS Project

Project Overview

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IT&E Integrated Test Flow

- Level 1 Milestone
- Reviews
- Annual Performance Goal/Indicator
- Development Milestones
### IHITL Description

**Purpose**
- Evaluates and measures the acceptability of algorithms and pilot guidance displays with ATC operations with increased simulation fidelity by adding CNPC time delay, a proof of concept GCS, and VFR cooperative and non-cooperative traffic.

**Approach**
- 2 LVC configurations to be tested (Config1 & Config2)
  - Config1: Ames/Armstrong connectivity (ATC and Pilot test set-ups)
  - Config2: LaRC/Ames connectivity (SAA-CA interoperability)
- Scenarios - Class E airspace operations near major TRACONs

**Test Duration**
- Jun – Jul 2014
  - Config1 Test Set-up 1: ATC – 3 weeks (15 Controllers)
  - Config1 Test Set-up 2: UAS pilots – 2 weeks (10 pilots)
  - Config2 Test Set-up: ATC – 3 weeks (6 Controllers)

**Tech Transfer**
- Validated SAA, C2, HSI performance requirements and guidelines
- Community insight into LVC Infrastructure capabilities

**Project Benefit**
- Validates Project models
- Risk reduction for SAA Initial Tests and Flight Test Series 3
- Foundational infrastructure integrated test supports SAA Initial Flight Tests, FT3, & FT4

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**IT&E Integrated Test Flow**

**IHITL**

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<th>FY14</th>
<th>FY15</th>
<th>FY16</th>
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<td>Preliminary MOPS Development</td>
<td>MOPS Verification &amp; Validation</td>
<td>Preliminary MOPS July 2015</td>
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**IHITL Development**

- Level 1 Milestone
- Reviews
- Annual Performance Goal
- Development Milestones

- FY13 APG LVC Charac. Report (5/30/13)
- FY14 APG IHITL Report
- FY14 APG IHITL Sim Complete (8/8)
- Preliminary MOPS Inputs Aug 2014
- FY14 APG IHITL Report

**Technologies**

- ZFW (Dallas-Ft Worth)
- ZOA (Oakland Center)
Flight Test Series 3 Description

Purpose

• Flight test prototype SAA & C2 systems utilizing RGCS; conduct integrated flight test series to verify Preliminary DAA & C2 MOPS and validate sensor models
• Demonstrate system integration of surrogate UAS with CNPC, RGCS, and SS Algorithms

Approach

• Increase complexity from IHITL through live aircraft incorporation and increased definition from MOPS
• Focus scenarios on testing of SAA (sensitivity, pilot workload, and maneuver negotiation), C2 (CNPC Mixed Traffic Flight Tests including Integrated SAA), and human factors (RGCS utilized to evaluate pilot information requirements)

Test Duration

Jun – Aug 2015
• 36 flights/2 backups (3.5 hr flights)

Tech Transfer

• First fully integrated flight test including both prototype systems for both DAA and C2 MOPS
• Initiates verifications of the preliminary MOPS

Project Benefit

• Baseline FT4 System Architectures implemented
• Baseline flight test scenarios developed and validated
Flight Test Series 4 Description

Purpose
- Contribute to validation of Final MOPS; flight test SAA, CNPC, and RGCS in more stressed environments
- Demonstrates systems integration and evaluation of the state of UAS concepts and supporting technologies
- Demonstrate final LVC-DE configuration

Approach
Increased complexity from FT3
- Challenging encounter geometries
- UAS pilot and ATC negotiation in complex/busy airspace
- Two aircraft with CNPC to assess link performance within the same spectrum
- Demonstrate CA/SS Interoperability, well clear compliance

Test Duration
Feb - Apr 2016
- 34 flights/2 backups (3.5 hr flights)

Tech Transfer
- DAA and C2 system refinements flight tested
- Contributing to validation of final MOPS

Project Benefit
- Baseline technologies for Capstone demonstration