

# Phase I Project Summary

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**Firm: Intelligent Automation, Inc.**

**Contract Number: NNX10CC21P**

**Project Title: Integrated Testbed for Environmental Analysis of NextGen Concepts Using ACES**

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**Identification and Significance of Innovation:** (Limit 200 words or 2,000 characters whichever is less)

In this Phase I research project we developed an integration tool that aids an analyst in producing combined performance/environmental benefits computations for advanced aviation concepts. The advantage of providing this “360-degree” view of a concept is that the experimental plan, model assumptions, and database sources are identical for both the performance and environmental components of the analysis, facilitating results comparison and benefits computation. The traditional challenge for producing such an assessment was the difficulty of integrating performance models with environmental models, as the two types of models are built by experts with different domain skills, and are typically developed by separate groups in isolation. This innovation allows analysts and program managers to conduct combined performance/environmental studies of new concepts faster, and therefore less expensively, than the previous state of the art.

**Technical Objectives and Work Plan:** (Limit 200 words or 2,000 characters whichever is less)

Objective 1. Define a modeling framework for ACES/environmental model connectivity and identify data conversion/interface issues.

Objective 2. Develop a strategy for improving the process of generating meaningful environmental results for future concept of operations.

Objective 3. Demonstrate the utility of the modeling framework and improved environmental modeling results by using an example future concept (i.e. time-based airborne merging and spacing).

Objective 4. Document the results for both the example study and the use of the modeling framework itself.

Task 1. Conduct a trade study to evaluate NAS existing environmental tools.

Task 2. Define the modeling framework and associated environmental and performance tools, specifically targeting the integration of ACES and AEDT.

Task 3. Develop modeling strategies for improving the performance/environmental assessment state of the practice in several key areas:

- Deterministic trajectory generation—change to stochastic trajectory computation so that variances in intended/actual trajectories can be accounted.
- Runway-to-runway trajectory generation—ensure that performance models can compute high precision trajectories from runway-to-runway.
- Mixed equipage analysis—develop a strategy so that evaluation of a transition period where mixed-equipage issues dominate can be performed.

**Technical Accomplishments:** (Limit 200 words or 2,000 characters whichever is less)

In this Phase I research project we developed an integration tool that aids an analyst in producing combined performance/environmental benefits computations for advanced aviation concepts. The traditional challenge for producing such an assessment was the difficulty of integrating performance models with environmental models, as the two types of models are built by experts with different domain skills, and are typically developed by separate groups in isolation. This project produced an integrated testbed for both performance and environmental analysis, by developing an integrator tool whose application is the integration of the NASA-developed Airspace Concepts Evaluation System (ACES) with the FAA-developed Aviation Environmental Design Toolkit (AEDT). In demonstrating the utility of the tool, the Phase I project undertook a sample analysis of historical and future projected flights into the Chicago O’Hare airport, investigating the resulting delay as well as noise and emissions. The conclusion is that integrating the two models, although filled with challenges, can be done with a properly-developed software tool.

**NASA Application(s):** (Limit 100 words or 1,000 characters whichever is less)

1. Enabling the NASA Aeronautical Directorate to base future research investment decisions not only on the performance of proposed new aviation concepts, but on their environmental impact as well.
2. Enabling the NASA Centers currently involved in aviation research (currently, Langley, Glenn, and Ames) to fine-tune their concepts to keep them within environmental limits while simultaneously meeting performance targets

**Non-NASA Commercial Application(s):** (Limit 200 words or 2,000 characters whichever is less)

1. In the Federal Aviation Administration, aiding the benefits analysis of their airport expansion plans.
2. At the fourteen Metroplexes within the United States, helping them assess the performance and environmental impact of their expansion plans.
3. Potentially down the road, real-time assessment of the performance and environmental impact of the National Airspace System.

**Name and Address of Principal Investigator:** (Name, Organization, Street, City, State, Zip)

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