OBJECTIVES

The overall objective of this work is to create a AeroPropulsoServoElastic (APSE) framework using the MultiDisciplinary Integrated Computing Environment (MDICE) to accurately model multiphysics interactions between fluid, structural dynamics and engine dynamics in order to support the design of the next generation commercial supersonic transport aircraft. Specific objectives of Phase I included the following: 1) Implementation of a non-intrusive fluid structure interface within NASA’s FUN3D CFD code and validation using AGARD simulation benchmark. 2) Integration of an engine modeling code into the APSE framework. 3) Demonstration of the capabilities of the APSE simulation framework on a representative N+2 supersonic transport model.

ACCOMPLISHMENTS

NOTABLE DELIVERABLES PROVIDED

In Phase I, CFDRC enhanced and extended MDICE capabilities for APSE modeling and simulation of supersonic aircraft. This included the integration of the open source MATLAB/Simulink based TMATS toolbox for propulsion loads, and creating a non-intrusive interface with NASA’s FUN3D code for the external aerodynamic loads predictions. An existing interface to the non-linear structural dynamics solver (CFDRC-FEM) for the vehicle structural deformations was also leveraged for this effort. The coupling was demonstrated on a representative N+2 supersonic transport configuration. A midterm report, monthly briefing charts and a final report documenting all the technical activities were delivered.

KEY MILESTONES MET

The major achievements include 1) A non-intrusive interface to MDICE was implemented in NASA’s FUN3D flow solver for aeroelastic & APSE simulations. 2) The interface was validated against AGARD wing experimental data. 3) An interface to a Simulink based engine modeling toolkit (TMATS) was implemented to allow for a quick setup and redesign of the Engine model. 4) The framework was demonstrated on a simplified low boom N+2 supersonic aircraft configuration.

FUTURE PLANNED DEVELOPMENTS

PLANNED POST-PHASE II PARTNERS

CFDRC has received interest in utilizing the unique capabilities of this APSE technology from Lockheed Martin Aero. CFDRC has initiated contact with Raytheon to utilize the technology for hypersonic vehicle aerothromelastic applications. The technology will also be of great interest to the Air Force (AFRL-WPAFB in particular to those who have been funding CFDRC in this area).

PLANNED/POSSIBLE MISSION INFUSION

Opportunities include NASA Advanced Air Transport Technology (AATT), Commercial Supersonic Technology (CST), Revolutionary Vertical Lift Technology (RVLT), Orion crew exploration vehicle, Commercial Orbital Transportation Services (COTS), Transformational Tools and Technologies (TTT), HIAD (Hypersonic Inflatable Aerodynamic Decelerator) & SIAD (Supersonic Inflatable aerodynamic

PLANNED/POSSIBLE COMMERCIALIZATION

NASA Phase II-E and II-X funds will be pursued by seeking matching funds from NASA projects (CST, AATT and others) & primes (such as Lockheed Martin) to further mature, validate, and demonstrate the technology. Immediate commercialization and transition opportunities exist in supporting NASA CST as well as hypersonic programs such as Navy CPGS and DARPA TBG and HAWC programs.

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SUBTOPIC A1.07 Efficient Propulsion & Power TA N/A

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