Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2016-776

Topic # N14A-T005
COupled Multi-physics ANalysis and Design Optimization of nozzles (COMANDO)
Intelligent Automation, Inc.

WHO

SYSCOM: NAVAIR

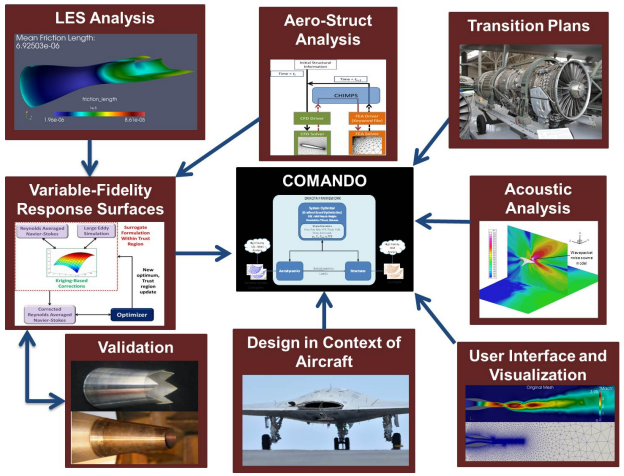
Sponsoring Program: NAVAIR

Transition Target: AIR 4.4.7.1 for use on multiple NAVAIR programs.

TPOC:
(301)757-0489

Other transition opportunities: Government, airframe OEMs and engine OEMs who are interested in the design and evaluation of complex conceptual and preliminary propulsion exhaust systems which have a high probability of successful, failure free development/flight programs and in reducing weight, noise, cost, improving design life, and improving performance of engine exhaust systems.

Notes: LES: Large Eddy Simmulation



WHAT

Operational Need and Improvement: Develop a design and analysis tool that:
- predicts both steady and unsteady stresses in propulsion system exhaust components
- minimizes component weight
- maximizes propulsion system performance
- links to analyses of gas turbine engine exhaust duct and nozzle
- pairs with aerothermostructural analyses of air vehicle aft deck and engine plume

Specifications Required: develop prototype software analysis tools that perform design optimization:
- performs aerodynamic and structural evaluation of conceptual/preliminary exhaust system designs
- verify analysis tool against experimental test data
- demonstrate methodology to optimize advanced exhaust ducts with advanced exhaust nozzles

Technology Developed:
Phase I: proved the feasibility of developing a multi-disciplinary analysis tool for aerodynamics and structures

Phase II: develop a multi-disciplinary optimization tool that couples aerodynamics, thermodynamics, and structural analyses with propulsion and acoustic analysis to design and analyze advanced engine exhaust systems efficiently.

Warfighter Value: Using IAI's pre-eminent design tool, COMANDO, aircraft manufacturers will be able to develop advanced engine exhaust systems to minimize component weight and maiximize system performance.

COMMANDO allows steady and unsteady aerothermostructural analysis of engine exhaust components in the design process

WHEN

Contract Number: N68335-16-C-0059 **Ending on:** November 19, 2017

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Develop Phase I prototype	N/A	Prototype tool successfully developed	3	November 2015
Develop multi-fidelity aerodynamic analysis	Med	Method to combine multi-fidelity information determined	4	November 2016
Implement tightly coupled aerostructural analysis	Low	Fluid structure interface capability developed	5	April 2017
Validate LES analysis	Low	Independent validation study results	5	August 2017
Develop COMANDO prototype	Low	Successful completion of beta tests	5	October 2017

HOW

Projected Business Model: IAI will involve OEMs, such as Pratt and Whitney (who is currently part of the team), to oversee the development of the tool. A beta version of the tool will be made available for in-house testing, and future licensing options could be explored with Pratt and other engine manufacturers and airframe OEMs.

Company Objectives: IAI is constantly striving to maintain and further its competitive edge in aerospace computing capabilities. It continues to provide advanced technology solutions and R&D services, as well as expand the intellectual property portfolio. IAI continues to persevere to transitioning its technology to the customer and commercial sector, as evidenced through our recent products in software, web-based services, and sensor systems.

Potential Commercial Applications: The direct use of COMANDO tool is in design of exhaust systems by engine manufacturers and also airframe manufacturers (for aero-propulsion integration). In addition, the design optimization capabilities developed here are applicable to other aircraft internal flow systems and ECS components (with appropriate analysis). The computational capabilities being developed at IAI as part of this effort and similar other efforts, would enable end users to design complex aerospace configurations using personnel with limited experience.

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