Project 037 CLEEN II Technology Modeling and Assessment

Georgia Institute of Technology

Project Lead Investigator

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University Participants

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- P.I.(s): Dr. Dimitri Mavris (PI), Mr. Christopher Perullo, Dr. Jimmy Tai (Co-PI)
- FAA Award Number: 13-C-AJFE-GIT-013
- Period of Performance: September 1, 2015 – February 25, 2017

Project Funding Level

The project is funded at the following levels: Georgia Institute of Technology ($200,000).
The Georgia Institute of Technology has agreed to a total of $200,000 in matching funds. This total includes salaries for the project director, research engineers, graduate research assistants and computing, financial and administrative support, including meeting arrangements. The institute has also agreed to provide tuition remission for the students paid for by state funds.

Investigation Team

Georgia Institute of Technology
Principal Investigator: Dimitri Mavris
Co-Investigators: Christopher Perullo, Jimmy Tai
Fleet Modeling Technical Lead: Holger Pfaender

Project Overview

Georgia Tech (GT) was previously selected to perform all of the system level assessments for the CLEEN program under PARTNER project 36 and ASCENT project 10. As a result, Georgia Tech has a unique position from both a technical and programmatic standpoint to continue the system level assessments for CLEEN II. From a technical perspective, GT has significantly enhanced the Environmental Design Space (EDS) over the last 5 years to incorporate advanced, adaptive, and operational technologies targeting fuel burn, noise, and emissions. EDS was successfully applied to all CLEEN I contractor technologies including: GE open rotor, TAPS II combustor, FMS-Engine and FMS-Airframe; Pratt & Whitney geared fan; Boeing adaptive trailing edge and CMC nozzle; Honeywell hot section cooling and materials; and Rolls-Royce turbine cooling technologies. GT also gained significant experience in communicating system level modeling requirements to industry engineers and translating the impacts to fleet level fuel burn, noise, and emissions assessments. This broad technical knowledge base covering both detailed aircraft and engine design and high level benefits assessments puts GT in a unique position to assess CLEEN II technologies.

As the ultimate goal of this work is to conduct fleet level assessments for aircraft representative of future ‘in-service’ systems, GT will create system level EDS models using a combination of both CLEEN II and other public domain N+1 and N+2 technologies. The technology and fleet assumptions setting workshops conducted under ASCENT project 10 will be heavily leveraged for this effort. Non-CLEEN II technologies for consideration along with potential future fleet scenarios will help to bound the impact of CLEEN II on future fleet fuel burn, emissions, and noise.

Long term goals of this project include the vehicle and fleet level assessments of fuel burn, emissions, and noise benefits for the aircraft and engine technologies funded for development under CLEEN II. More specifically, the first period of performance for this work seeks to establish working relationships with each of the chosen CLEEN II contractors (yet to be awarded at this time) and to identify system level modeling needs within EDS for each contractor. At the conclusion of the first period of performance, GT expects to have system level modeling roadmaps in place for each contractor along with non-disclosure agreements (NDA) and working timelines to conduct the assessments for each contractor.

Major Accomplishments

As the project has just started, there are no major accomplishments to report. Georgia Tech has begun the process of signing non-disclosure agreements with the CLEEN II contractors and will host the CLEEN Consortium in November of 2015 at Georgia Tech.

Publications

None.

Outreach Efforts

None.

Awards

None

Student Involvement

None yet; students will be involved later in the period of performance once modeling work begins.

Plans for Next Period

In the first year of CLEEN II, it is unlikely that detailed technology modeling data will be available. Therefore, GT will focus on attending contractor kickoff meetings and working with awarded contractors to discuss proposed modeling approaches and initial timelines for assessment (pending successful negotiations of NDAs). Once GT knows what technologies are being considered under CLEEN II, work can begin to incorporate additional technology modeling capabilities into EDS. Georgia Tech will also work with FAA over the course of the project to incorporate any modeling structure enhancements in EDS performed under this project into the version of EDS that will be installed under ASCENT Project 10 in the FAA Environmental Modeling Lab.

GT will also work with the FAA to choose baseline vehicles for the assessment process. The FAA is interested not only in the effects of individual CLEEN II technologies, but also the impact of combining various CLEEN II and other public domain technologies across vehicle size classes. GT has extensive experience is in this field as the system assessment contractor for FAA CLEEN I, NASA ERA, and the NASA FW projects. Translating the technology impacts across the fleet (aircraft size classes) requires both vehicles for assessment, and the ability to communicate modeling needs to the CLEEN II contractors. Modeling and roadmap work from ASCENT project 10 will also be leveraged in this effort.

Once GT understands the breadth and number of technologies to be assessed under CLEEN II, modeling and assessment rodamaps will be constructed for each CLEEN II contractor. These roadmaps will include working schedules for data exchange between GT and the contractor and expected system assessment modeling start and end dates. Roadmaps will be broken out by technology and will be used to plan out resources and modeling efforts for the remainder of the CLEEN II program. The roadmaps will also include descriptions of the technology modeling approaches for each CLEEN II technology and whether or not the underlying assessment models (independent of CLEEN II data) are leveraged from prior FAA work, must be newly developed under this work, or are from another effort such as a NASA funded project.

References

None