Project 097 FAST-Tech System Level Assessment

Georgia Institute of Technology

Project Lead Investigator

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University Participants

Georgia Institute of Technology (Georgia Tech)

- P.I.(s): Dr. Dimitri N. Mavris
- FAA Award Number: 13-C-AJFE-GIT-155
- Period of Performance: October 1, 2024, to December 31, 2025
- Tasks:
  1. Fueling Aviation's Sustainable Transition (FAST)-Tech Fleet Benefit Assessment Problem Formulation
  2. Initializing Modeling of FAST-Tech Aircraft Technologies and Advanced Configurations

Project Funding Level

The Federal Aviation Administration (FAA) provided $250,000 in funding to Georgia Tech. Georgia Tech has agreed to a total of $250,000 in matching funds. This total includes salaries for the project director and research engineers, as well as funding for computing, financial, and administrative support, including meeting arrangements. Georgia Tech has also agreed to provide tuition remission for students, paid from state funds.

Investigation Team

P.I.: Prof. Dimitri Mavris
Co-P.I.: Dr. Jimmy Tai
Program Manager: Brennan Stewart
Supporting Engineers: Srujal Patel and Dr. Zhimin Liu
Students: Joao De Azevedo, Kavya Krishnan, Alexandre Masset, Clementin Leron, Benjamin Bashtovoi, Byron Chang, Saisruthi Bandla, Paul Dumont, and Naomi Michael

Project Overview

The objective of this research project is to support the FAA by independently modeling and assessing the technologies that are being developed under the FAST Program. This will involve direct coordination and data sharing with FAST-funded companies to accurately model the environmental benefits of these technologies at the vehicle and fleet levels.

Georgia Tech was previously selected to perform all system-level assessments for the Continuous Lower Energy, Emissions and Noise (CLEEN) program under Partnership for Air Transportation Noise and Emission Reduction (PARTNER) Project 036, ASCENT Project 010, and ASCENT Project 037. As a result, Georgia Tech is in a unique position from both the technical and programmatic standpoints to perform system level assessments for the FAST Program. From a technical perspective, Georgia Tech has significantly enhanced the Environmental Design Space (EDS) over the past 5 years to incorporate advanced, adaptive, and operational technologies targeting fuel burn and emissions.

The goal of this work is to conduct fleet-level assessments for aircraft representative of future "in-service" systems. To accomplish this goal, Georgia Tech requires system-level EDS models using a combination of both FAST Technologies and other public domain technologies and defining assumptions for future fleet scenarios. To expedite this study, Georgia Tech will leverage previously created EDS models, public technologies sets, and future fleet scenarios from Georgia Tech's work on ASCENT Project 037, in combination with the technology models created for the FAST technologies funded under ASCENT Project 097. This approach will allow Georgia Tech to complete the FAST fleet assessment quicker and for less cost than if Georgia Tech were to redevelop these assumptions using ASCENT Project 097 funds.

Work conducted during this period of performance focused on reviewing which assumptions ASCENT Project 097 would utilize from Georgia Tech's ASCENT Project 037 program and assessing Georgia Tech's capabilities of modeling FAST technologies and performing background research on the technology concept. In the previous year of performance, Georgia Tech had selected a fleet assessment methodology and a base year case from Georgia Tech's ASCENT Project 037. However, as Georgia Tech has become more familiar with technology set which is to be evaluated for the FAST Tech program, Georgia Tech recognized that significant edits will be required to the framework used in ASCENT Project 037. This is due FAST technologies being developed to support multiple fuel types and the introduction of novel vehicle architecture, while ASCENT 037 is focused around traditional tube and wing aircraft fueled by Jet A. Georgia Tech does have experience with these concepts in other programs such as our support of National Aeronautics and Space Administration (NASA) Electrified Powertrain Flight Demonstration, some work will be required to implement these changes. However, Georgia Tech's working effort for this year primarily focuses on Modeling of FAST-Tech Aircraft Technologies and Advanced Configurations. Georgia Tech was able to initiate Non-Disclosure Agreements (NDA) with the majority of FAST contractors whose technologies will be models as part of the Fleet assessment, and thus heavy emphasis for this year was place on the initial modeling work based on FAA FAST Tech contractor inputs.

Next year's work will focus on continuation of modeling of FAST-Tech Technologies, construction of vehicle models for Advanced Configurations, and adapting the Fleet Analysis assumptions for the set of architecture developed to access FAST Technologies.

Milestones

The major milestones and their planned due dates are listed below:

Task No.	Milestone	Planned Due Date
1	FAST-Tech Fleet Benefit Assessment Problem Formulation	December 31, 2025
2	Initialize Modeling of FAST-Tech Aircraft Technologies and Advanced Configurations	December 31, 2025

Major Accomplishments

- Established NDAs and held kickoffs held with nearly all FAST Tech contractors.
- Initiated modeling work for over half of the contractors.
- Completed preliminary models for select contractors.

Task 1 - FAST-Tech Fleet Benefit Assessment Problem Formulation

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Objective

The objective of this task is to align the assumptions used in this FAST fleet benefit assessment with the most relevant assumptions used across similar recent assessments performed by Georgia Tech.

Research Approach

Georgia Tech has provided fleet benefit assessments regarding fuel burn, nitrogen oxides (NO_x) emissions, and noise in a number of previous research efforts. Learnings from these previous fleet benefit assessments will set the starting point for this assessment. The FAA is interested not only in the effects of individual FAST technologies, but also the impact of combining various FAST and other public domain technologies across vehicle size classes. The fleet benefit assessment will be updated to match the most relevant assumptions constraining the FAST program in conjunction with the FAA.

Georgia Tech and the FAA have agreed that methodology used in ASCENT Project 037 will serve as a useful starting point for the methodology for the FAST fleet benefit assessment (Mavris et al., 2023). Figure 1 shows an overview of the methodology for the FAST-Tech fleet benefits assessment based on the fleet assessment methodology used in ASCENT Project 037. The public set of technologies used in ASCENT Project 037 will also serve as the basis for the non-FAST technologies which will be infused into the mid- and far-term generations of aircraft analyzed in the FAST fleet benefits assessment.

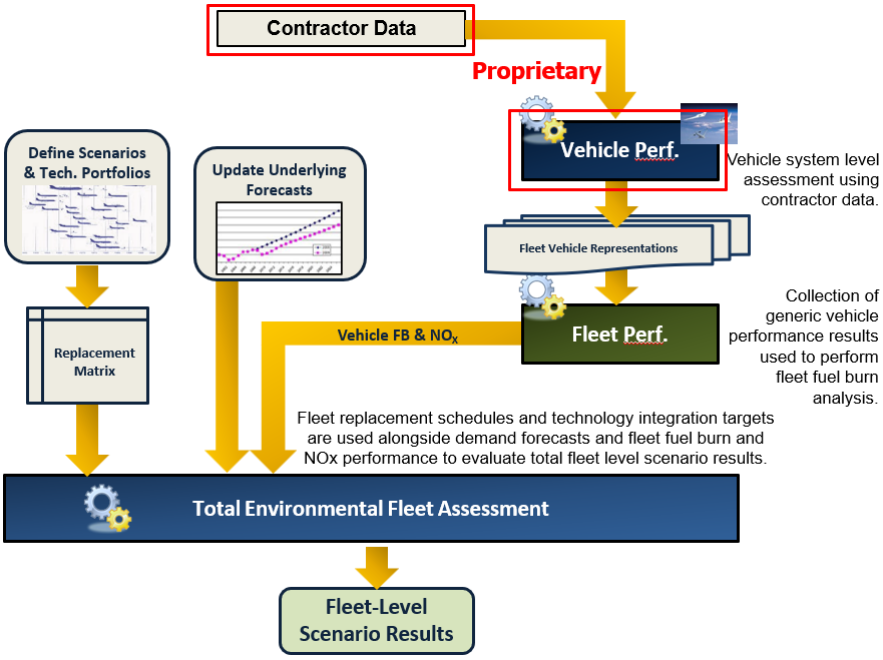

Figure 1. FAST Fleet Assessment Initial Methodology Overview. FB: Fuel Burn, NO_x: nitrogen oxides.

However, this methodology does not currently account for comparisons between multiple fuel types, (as necessitated by the list of technologies funded by the FAST program), nor does it currently consider the introduction of novel vehicle architectures. These are problems which Georgia Tech research teams have addressed in the past, such as work in support of NASA's Electrified Powertrain Flight Demonstration program, but it will take effort to adapt out fleet assessment methodology to those changes. However, Task 2 has been prioritized over this task during the performance period of this report.

Task 2 - Initialize Modeling of FAST-Tech Aircraft Technologies and Advanced Configurations

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Objectives

The objective of this task is to estimate the impact of FAST relevant technologies at the vehicle-system level, each of these technologies must be modeled regarding their impacts to aircraft fuel burn and emissions using EDS.

Research Approach

To complete the FAST fleet benefit assessment outlined in Task 1, Georgia Tech must develop aircraft representative of future "in-service" systems, utilizing the technologies funded by FAST. Two necessary steps to accomplish the modeling of these future "in-service" systems are modeling all FAST technology in EDS and ensuring that new vehicle architectures are included in EDS modeling space. Once these tasks are completed, Georgia Tech will be able to develop the representative models of the future "in-service" systems and perform the fleet-level benefit assessment outlined in Task 1.

Table 1 shows the status of the modeling effort regarding each of the FAST relevant technologies. The FAA announced the awards for the FAST contracts in August 2024, (FAA, 2024), and Georgia Tech was authorized to begin initiating NDA discussions with each of the contractors in December 2024. As the initial FAA announcement of the awards of the FAST contracts is currently unavailable online, additional references for each award have been provided, (Businesswire, 2024, Heart Aerospace, 2024, Marquand, 2024, SAF Path, 2024, USASpending, 2025, Warwick, 2024, and ZeroAvia, 2024).

Throughout the period of performance, Georgia Tech was able to complete NDA discussions with nearly all FAST contractors. Georgia Tech was able to begin the technology modeling process with select contractors (Georgia Tech did not have resources to work with all contractors simultaneously) and finished preliminary modeling with some of the contractors. Table 1 provides a brief overview of the contractors Georgia Tech plans to work with and a description of their technologies.

Table 1. FAST Technologies and Their Modeling Status. CO_2: carbon dioxide, NAS: National Airspace System.

Contractor	Technology
Green Taxi, Inc.	Green Taxi Electric Taxi (eTaxi) system for Embraer E-175 Aircraft
JetZero, Inc.	Blended Wing body Lightweight Composite Structures
Honeywell International Inc.	Sustainable Electrified Aircraft Power
APiJET, LLC	Optimizing Flight Routes using Real-Time Operating Constraints for Maximum Reduction of CO_2 Emissions via Scalable Ground-Based Software
Heart Aerospace Inc.	Total Hybrid Electric Management and Integration System
University of Michigan	Expanding Flight Operations-based Low Emissions Technologies: Fleet-wide and NAS-wide Arrival Flow Optimizer
ZeroAvia Federal, Inc.	Project Hydrogen Aircraft Engine Zero Emission Leap
Otto Aviation Group, LLC	Wind-Tunnel Testing of a Transonic Aircraft with a Fully Integrated Slotted, Natural Laminar-Flow Wing
Wright Electric Inc.	Ultra-High Energy Battery

In the previous annual report, Georgia Tech provided insight into how each of the technologies might be modeled under Georgia Tech's current modeling capabilities based on publicly available information on each of these technologies. This insight was provided before Georgia Tech initiated discussions with each contractor under an NDA. Now that discussions have taken on a proprietary nature, Georgia Tech will not be able to publicly disclose the details of any of these modeling efforts.

Publications

Conference Presentation

Stewart, B., Tai, J., Mavris, D. (2025, October 16). *FAST-Tech System Level Assessment* [Conference presentation]. ASCENT Fall Meeting 2025, Alexandria, Virginia.

Outreach Efforts

Georgia Tech presented the current status of Fleet Assessment plans for the FAST Program as part of the ASCENT Fall Meeting in Alexandria, Virginia on October 16, 2025, to a mixed audience of industry, academia, and government representatives.

Awards

None.

Student Involvement

Nine graduate students have been funded by the effort: Joao De Azevedo, Kavya Krishnan, Byron Chang, Benjamin Bashtovoi, and Saisruthi Bandla are PhD students, and the remaining four students, Alexandre Masset, Clementin Leron, Paul Dumont, and Naomi Michael, are master's students.

Plans for Next Period

- Continue modeling of FAST-Tech Technologies.
- Construct vehicle models for Advanced Configurations, which are needed to access each technology.
- Adapt the Fleet Analysis assumptions for the set of architecture developed to access FAST Technologies.

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