Project 33

Alternative Jet Fuel Test Database Library

University of Illinois Urbana-Champaign

PI: Tonghun Lee

PM: Prem Lobo

Cost Share Partner: Ansys, Inc.

Objective:

This project's objective is to establish a comprehensive and foundational database of current and emerging alternative jet fuels by integrating relevant new and pre-existing jet fuel test data into a common archive that can support scientific research, enhance operational safety, and provide guidelines for the design and certification of new jet fuels. Currently, we are in the process of connecting our database with European projects ALIGHT and NewJET as well as setting up live, periodic fuel data sampling from domestic airports across the US. Additionally, we are looking to leverage existing data and machine learning techniques to support development of prescreening and kinetic analysis tools for new fuels undergoing the rigorous and resource intensive certification process.

Project Benefits:

Further development of a centralized alternative jet fuel test database with a broad range of data categories and extensive sampling under each data type would benefit fuel scientists and researchers investigating variability of new fuels, composition-property relationships, engine operability metrics, cost of production, production methods, fuel storage and transportation methodology and design, etc. This in turn will benefit policy makers and shareholders in making informed decisions in the integration of AJF into the commercial sector. At the high level, this database ultimately provides a critical foundation for the implementation of AJF and will assist in achieving new climate and sustainability targets in the sector as they become more demanding in future policy.

Research Approach:

Develop a Comprehensive SAF Database on Properties & Testing

- Assemble data into a centralized database for sustainable aviation fuels
- Apply advanced analysis technique: Machine-Learning based strategies
- Enhance website usability and analysis functionalities
- Connect database to international network: ALIGHT and NewJET
- Forge a new data pipeline with domestic US airports: fuel test data reports
- Incorporate a variety of testing data beyond composition-property test reports

In anticipation of 100% SAF efforts being realized and unprecedented politico-financial support supplied for the testing and scaling of new sustainable aviation fuels and blend stocks, two main actions become paramount: (1) Accurate and regionally specific tracking and monitoring of jet fuel composition, property, blending and usage trends, and (2) improved methodologies for rapidly assessing both chemical-property and engine operability indicators for newer fuels undergoing the certification process. With a rapidly diversifying landscape of alternative fuels and increased momentum in national integration efforts, the need for close monitoring and analysis of the state-of-the-art in Alternative Jet Fuel (AJF) becomes critical in proceeding with ultimate SAF adoption under high levels of certainty and control.

Major Accomplishments (to date):

Accomplishments in Current Year

- Improved online interface, data retrieval and analysis functionalities
- Established contact with United Airlines to pursue airport data collection
- Established contact with new international programs for data sharing
- Connected with Seattle SEA and established pipeline of new fuels data
- Developed machine learning based techniques for fuel data analysis: Data imputation, uncertainty quantification and characterization
- Utilize machine learning based optimization development of chemical kinetic mechanism for novel fuels

Future Work / Schedule:

- Continue data collection from pre-established fuel data sources
- Improve the online database usability and supporting features for analysis
- Detail data types and retrieval mechanisms from US airports
- Develop flexible program to convert fuels data of many formats to JSON
- Commence data sharing with ALIGHT and NewJET programs
- Expand test data scope to include contrail and emissions testing data
- Further investigate the potential for building rapid kinetic models using composition-property data and novel machine learning frameworks

This research was funded by the U.S. Federal Aviation Administration Office of Environment and Energy through ASCENT, the FAA Center of Excellence for Alternative Jet Fuels and the Environment, project 33 through FAA Award Number 13-C-AFJE-UI-026 under the supervision of Prem Lobo. Any opinions, findings, conclusions or recommendations expressed in this this material are those of the authors and do not necessarily reflect the views of the FAA.