Project 001(A) Alternative Jet Fuel Supply Chain Analysis

Washington State University

Project Lead Investigator

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University Participants

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- FAA Award Number: 13-C-AJFE-WaSU-023, 026
- Period of Performance: October 1, 2024, to September 30, 2025
- Tasks:
  1. Prepare and assess design cases
  2. Evaluate the most promising biorefinery concepts for alternative jet fuel (AJF) production
  3. Supplement and maintain the current inventory of biorefinery infrastructures that are useful for AJF production, as identified in the conversion design cases
  4. Update Community Asset and Attribute Model (CAAM) Measures and perform a community social asset assessments
  5. Refine and deploy facility siting tools to determine regional demand and potential conversion sites to be used in regional analyses
  6. Perform a refinery-to-wing stakeholder assessment.
  7. Conduct a supply chain analysis
  8. Provide analytical support for regional Commercial Aviation Alternative Fuels Initiative (CAAFI) and U.S. Department of Agriculture (USDA) jet fuel projects
  9. CAAFI collaboratively supports research, development, demonstration and deployment efforts on sustainable aviation fuel (SAF)/AJF

Project Funding Level

The ASCENT Project 001A has received $5,155,056 in Federal Aviation Administration (FAA) funding over its lifetime, $3,886490 in matching funds, and state-committed graduate school contributions for four doctoral students. Faculty time for Michael Wolcott, Manuel Garcia-Perez, and Xiao Zhang contributed to the cost share.

Investigation Team

Washington State University

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Project Overview

As part of an effort to realize an "aviation system in which air traffic will move safely, swiftly, efficiently, and seamlessly around the globe," the FAA set a series of goals and supporting outcomes, strategies, and performance metrics (Hileman et al., 2013). The goal entitled "Sustaining our Future" outlines several strategies collectively aimed at reducing the environmental and energy impacts of the aviation system. To achieve this goal, the FAA set an aspirational goal for the aviation industry to utilize one billion gallons of AJF by the year 2018. This goal was created according to economic, emission, and overall feasibility perspectives (Richard, 2010; Staples et al., 2014). Over the past several years, the goals for United States (U.S.) AJF use have been updated with the SAF Grand Challenge that the U.S. will produce three billion gallons of SAF by 2030, with an increase to 35 billion gallons in 2050 with a minimum reduction of 50% in lifecycle greenhouse gases.

Most approaches to supply chain analyses for AJF optimize feedstock-to-refinery and refinery-to-wing transportation logistics (Bond et al., 2014). One of the greatest barriers to large-scale AJF production is the high capital of greenfield facilities, which translates to risk in the investment community (Huber & Corma, 2007). The cost of cellulosic ethanol plants ranges from $10 to $13 per gallon capacity (Hileman & Stratton, 2014); moreover, the additional processing steps required to convert the intermediate to a drop-in AJF could increase this cost to more than $25 per gallon capacity (Hileman, 2013).

Motivated by the realities of converting these initial commercialization efforts into second-generation AJF, researchers have considered alternative conversion scenarios, including the transitioning of existing facilities (Brown, 2013). The conversion of existing refineries to produce renewable diesel and AJF has been completed on first phase conversions at the following refineries: World Energy®'s Paramount, California, refinery; Montana Renewables™, Great Falls, Montana, refinery; Marathon®'s Dickinson, North Dakota, refinery; Marathon's Martinez Renewables, Matinez, California, refinery; and Phillips 66®'s Rodeo Renewed, Rodeo, California, refinery. Research on approaches for achieving the SAF Grand Challenge goals

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for AJF consumption has relied on “switching” scenarios, in which existing and planned capacities are used to produce drop-in fuel (Malina, 2012). These approaches require the identification of existing industrial assets, similar to refinery conversions, which can be targeted for future AJF production. Thus, siting becomes not only an exercise for optimizing feedstock transportation but also a necessary task for aligning this critical factor with the existing infrastructure, markets within regions, and the appropriate social capital for developing this new industry (Henrich, 2007; Seber et al., 2014).

To date, all published AJF supply chain analyses have been limited to stand-alone jet fuel production technologies that do not generate bioproducts. Hence, future studies must consider the potential techno-economic and environmental benefits of using the existing industrial infrastructure and the production of co-products with respect to the development of jet fuel production scenarios.

Design cases of stand-alone AJF production facilities will be used in supply chain evaluations. Social asset modeling is not well developed, and efforts are likely to be hampered by difficulties in quantifying social assets when compared with improved environmental performance or reductions in AJF costs. However, the community characteristics of a potential site must be considered when determining preferred locations for a new biorefinery. Community resistance or enthusiasm for the AJF industry can strongly influence the success or failure of a facility (Martinkus et al., 2014; Rijkhoff et al., 2017). Thus, community social asset modeling efforts conducted within this project, such as those based on the CAAM, will inform disciplinary applications and advances. Social factors can have substantial effects, either positive or negative, on project adoption and implementation, particularly in high-technology or energy-related projects (Lewis et al., 2012; Martinkus et al., 2012; Mueller et al., 2020). The consideration of social factors in site selection and implementation decisions can maximize positive social support and minimize opposition and social negatives, thereby substantially promoting the success of a project. In this regard, the CAAM originally piloted in the Northwest Advanced Renewables Alliance (NARA) project was designed to provide a quantitative rating of select social factors at the county level (Martinkus et al., 2014).

Focusing on regional supply chains, this research aims to identify the key barriers that must be overcome to meet AJF targets. Our team will address this overall goal by developing tools to support the AJF supply chain assessment performed at Volpe. Our efforts will provide facility siting analyses that assess conversion design cases combined with regional supply chain assets and social capacity assessments for communities to act collectively toward development goals. Finally, a refinery-to-wing stakeholder assessment will support modeling and accounting of AJF distribution for downstream fuel logistics.

References

Bond, J. Q., Upadhye, A. A., Olcay, H., Tompsett, G. A., Jae, J., Xing, R., Alonso, D. M., Wang, D., Zhang, T., Kumar, R., Foster, A., Sen, S. M., Maravelias, C. T., Malina, R., Barrett, S. R. H., Lobo, R., Wyman, C. E., Dumesic, J. A., & Huber, G. W. (2014). Production of renewable jet fuel range alkanes and commodity chemicals from integrated catalytic processing of biomass. *Energy & Environmental Science*, *7*(4), 1500–1523. https://doi.org/10.1039/C3EE43846E

Brown, N. (2013, November 20). *FAA alternative jet fuel activities* [Conference presentation]. Continuous Lower Energy, Emissions & Noise (CLEEN) Consortium, Atlanta, Georgia.,

Henrich, E. (2007, August 29-31). *The status of FZK concept of biomass gasification* [Conference presentation]. 2nd European Summer School on Renewable Motor Fuels, Warsaw, Poland.

Hileman, J. I., De la Rosa Blanco, E., Bonnefoy, P. A., & Carter, N. A. (2013). The carbon dioxide challenge facing aviation. *Progress in Aerospace Sciences*, *63*, 84–95. https://doi.org/10.1016/j.paerosci.2013.07.003

Hileman, J. I., & Stratton, R. W. (2014). Alternative jet fuel feasibility. *Transport Policy*, *34*, 52–62. https://doi.org/10.1016/j.tranpol.2014.02.018

Hileman, J. (2013). *Overview of FAA alternative jet fuel activities* [Meeting presentation]. Biomass R&D Technical Advisory Committee, Washington DC.

Huber, G. W., & Corma, A. (2007). Synergies between bio- and oil refineries for the production of fuels from biomass. *Angewandte Chemie International Edition*, *46*(38), 7184–7201. https://doi.org/10.1002/anie.200604504

Lewis, K., Mitra, S., Xu, S., Tripp, L., Lau, M., Epstein, A., Fleming, G., & Roof, C. (2012). *Alternative jet fuel scenario analysis report* (Publication No. DOT/FAA/AEE/2011-05). U.S. Department of Transportation, Bureau of Transportation Statistics. http://ntl.bts.gov/lib/46000/46500/46597/DOT-VNTSC-FAA-12-01.pdf

Malina, R. (2012, November 27). *HEFA and F-T jet fuel cost analyses* [Presentation]. Massachusetts Institute of Technology, Laboratory for Aviation and the Environment.

Martinkus, N., Kulkarni, A., Lovrich, N., Smith, P., Shi, W., Pierce, J., & Brown, S. (2012, August 27-31). *An innovative approach to identify regional bioenergy infrastructure sites* [Conference presentation]. 55th International

Convention of Society of Wood Science and Technology, Beijing, China. https://www.swst.org/wp/meetings/AM12/ppts/smith_paul.pdf
Martinkus, N., Shi, W., Lovrich, N., Pierce, J., Smith, P., & Wolcott, M. (2014). Integrating biogeophysical and social assets into biomass-to-alternative jet fuel supply chain siting decisions. *Biomass and Bioenergy*, *66*, 410-418. https://doi.org/10.1016/j.biombioe.2014.04.014
Mueller, D., Hoard, S., Roemer, K., Sanders, C., & Rijkhoff, S. (2020). *Quantifying the Community Capitals Framework: strategic application of the Community Assets and Attributes Model*. *Community Development*, *51*(5), 535–555. https://doi.org/10.1080/15575330.2020.1801785
Richard, T. L. (2010). Challenges in scaling up alternative jet fuels infrastructure. *Science, 329*(5993):793-796. http://dx.doi.org/10.1126/science.1189139
Rijkhoff, S. A. M., Hoard, S. A., Gaffney, M. J., & Smith, P. M. (2017). Communities ready for takeoff Integrating social assets for biofuel site-selection modeling. *Politics and the Life Sciences: The Journal of the Association for Politics and the Life Sciences*, *36*(1), 14–26.
Seber, G., Malina, R., Pearlson, M. N., Olcay, H., Hileman, J. I., & Barrett, S. R. H. (2014). Environmental and economic assessment of producing hydroprocessed jet and diesel fuel from waste oils and tallow. *Biomass and Bioenergy*, *67*, 108–118. https://doi.org/10.1016/j.biombioe.2014.04.024
Staples, M. D., Malina, R., Olcay, H., Pearlson, M. N., Hileman, J. I., Boies, A., & Barrett, S. R. H. (2014). Lifecycle greenhouse gas footprint and minimum selling price of renewable diesel and jet fuel from fermentation and advanced fermentation production technologies. *Energy & Environmental Science*, *7*(5), 1545–1554. https://doi.org/10.1039/C3EE43655A

Task 1 – Prepare and Assess Design Cases

Washington State University

Objectives

In previous years, our team has worked toward completing reviews and final reports of design cases for six stand-alone AJF technologies (Table 1) and four relevant industries (i.e., sugarcane, pulp and paper, corn ethanol, and petroleum refineries). The status of each stand-alone AJF techno-economic analysis (TEA) and report is shown in Table 1. Results on pyrolysis and alcohol-to-jet (ATJ) pathways have been published in the referenced peer-reviewed journals. The work conducted from October 1, 2024, to September 30, 2025, focused on the following objectives:

1. Conduct a detailed analysis of a new AJF pathway for hydrothermal liquefaction (HTL) processing.
2. Conduct TEA on the integration of lignin co-product technologies in the ATJ pathway to determine the potential for reducing fuel costs.
3. Develop a new case report focusing on a technology review, an evaluation of lipid conversion processes (hydroprocessed esters and fatty acids [HEFA], catalytic hydrothermolysis [CH], SBI BioEnergy,® FORGE Hydrocarbons,™ Tyton Bioenergy Solutions,™ and decarboxylation), and new technologies for the production of alternative lipids (HTL and sugar-to-lipid).
4. Prepare manuscripts for publication.

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Table 1. Evaluated stand-alone alternative jet fuel technologies. TEA: techno-economic analysis.

Fuel Type	Literature Review/Design Report Date	Publications	Techno-Economic Analysis (TEA) Model
Pyrolysis	Literature review based on a design report, 138 pages (2017)	*Energy Fuel*, *33*(6), 4683–4720, 2019. https://doi.org/10.1021/acs.energyfuels.9b00039; *Fuel Process Technology*, *195*:106140, 2019. https://doi.org/10.1016/j.fuproc.2019.106140	A standardized TEA is complete and has been posted on the Washington State University repository.
Alcohol-to-jet (ATJ)	Literature review based on a design report, 28 pages (2015)	*ChemSusChem*, *11*(21), 3728-3741, 2018. https://doi.org/10.1002/cssc.201801690	A standardized TEA is complete and has been posted on the Washington State University repository.
Synthetic kerosene and synthetic aromatic kerosene (SK-SAK)	Literature review based on a design report, 36 pages (2015)	Manuscript based on the case design report in preparation	This work was based on a Sasol® process, for which we have not found any significant development since 2016. Because of a lack of adequate process information/data on SK-SKA production from renewable feedstock, we are not able to build a reliable TEA.
Direct sugar-to-hydrocarbon	Literature review based on a design report, 88 pages (2017)	*Biomass and Bioenergy*, *145:105942*, 2021. https://doi.org/10.1016/j.biombioe.2020.105942	A standardized TEA is complete and available for use by partners.
Virent® BioForming process	Literature review based on a design report, 46 pages (2015)	*Biomass and Bioenergy*, *145:105942*, 202. https://doi.org/10.1016/j.biombioe.2020.1059421	A standardized TEA is complete and available for use by partners.
Catalytic hydrothermolysis (CH)	Literature review based on a design report, 35 pages (2018)	*Renewable and Sustainable Energy Reviews*, *115:111516*, 2021. https://doi.org/10.1016/j.rser.2021.111516; *Data in Brief*, *39:107514*, 2021. https://doi.org/10.1016/j.rser.2021.111516	A standardized TEA is complete and has been posted on the Washington State University repository.
Gasification Fischer Tropsch (GFT)	No literature review conducted	*Biomass and Bioenergy*, *145:105942*, 2021. https://doi.org/10.1016/j.biombioe.2020.105942	A standardized TEA is complete and has been posted on the Washington State University repository.

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Fuel Type	Literature Review/Design Report Date	Publications	Techno-Economic Analysis (TEA) Model
Microchannel GFT (microGFT)	No exhaustive literature review written, capital costs found in the open literature for microchannel FT deemed unreliable	Capital cost results deemed unreliable	A standardized microGFT TEA was completed; however, the cost information is considered unreliable.
Hydroprocessed esters and fatty acids (HEFA)	No literature review conducted	*Biomass and Bioenergy, 145:105942,* 2021. https://doi.org/10.1016/j.biombioe.2020.105942	A standardized TEA is complete and has been posted on the Washington State University repository.

Research Approach

Background

A detailed literature review was conducted and prepared design case reports on six AJF pathways were prepared, including pyrolysis, ATJ, synthetic kerosene, direct sugar-to-hydrocarbon, Virent BioForming (now owned by Marathon Petroleum Corporation), and CH. Our team has also collected data from the literature to conduct TEAs for these pathways. The results from these design cases were applied in the development of supply chains and the identification of synergies that may eventually lead to the construction of integrated AJF production systems that take advantage of the infrastructure in a given region. An analysis of the locations of existing infrastructure demonstrated that the U.S. can be divided into regions according to the dominant biomass. Thus, we believe that the generation of advanced biorefinery concepts focused on petroleum refineries, pulp and paper mills, sugarcane mills, and corn ethanol mills is a viable approach for evaluating the synergy among AJF pathways, existing infrastructure, and co-products. Thus, our team can then compare the biorefinery concepts developed for each technology to identify the most promising approach, which can subsequently be used in supply chain analyses.

Stand-alone design case reports were generated by reviewing relevant research in the academic literature and public information provided by commercial entities developing the corresponding technology. The published manuscripts were subjected to an industrial expert review. The reports provide details regarding the processes involved in each conversion pathway and outline the technology readiness and particular barriers to implementation. Publicly available information regarding the commercial processes and research literature will provide a foundation of information to be used in modeling efforts. In cases lacking detailed process engineering information, as possible new models were built to estimate the parameters needed to complete assessments such as techno-economic modeling and supply chain modeling. Aspen Plus primarily generates process models and details, including mass balances, energy balances, energy requirements, and equipment size and cost. These results will also provide the basis for a comparative analysis of design cases, which identify the key advantages and markets for each technology.

Each design case has the following components:

- Feedstock requirements
- Companies developing/commercializing the technology
- Current locations of units in the U.S. and worldwide
- Block and flow diagram of the technology
- Unit operations and process conditions (e.g., reactor type, separation unit type, catalysts, product yield, and jet fuel yield)
- Properties of the produced jet fuel
- Identification of potential intermediates
- Current and potential uses of wastes and effluents
- Developed co-products

- Potential methods for coprocessing intermediates, wastes, and co-products by using existing infrastructure (e.g., petroleum refineries or pulp and paper mills)
- Preliminary TEA
- Technological challenges and gaps

The ASCENT Project 001A team has submitted technical reports and supplementary Microsoft® Excel® files with mass and energy balances and TEAs for the pathways listed. Furthermore, we have conducted a strategic analysis to identify the overall weaknesses of the technologies under study. All files are available for Project 001 team members.

- Pyrolysis-bio-oil hydro-treatment concept (hydro-treated depolymerized cellulosic jet): The TEA is complete.
- ATJ: A manuscript with information on the mass and energy balances and the TEA has been published.
- Fischer Tropsch (FT): Two design cases have been prepared for biomass gasification. The first case focuses on microreactors, and the second design case is applicable to technology based on larger standard reactors (reviews on the TEAs for gasification FT (GFT) and microchannel GFT have been completed. However, the limited reliability of the microreactor capital costs hinders the value of the practical impact of our microreactor TEA study. The TEAs are available for use by partners. In addition to gasification, the harmonized TEA was updated to include power-to-liquids with assistance from collaborators at MIT.
- HEFA: A stochastic TEA was created in MATLAB® and was confirmed to match the completed, deterministic TEA when the assumptions and costs match (the deterministic TEA review is complete). The TEA is now available for use.
- CH: The TEA is complete.
- A stochastic Excel-based spreadsheet version of the HEFA, ATJ, and FT TEAs were developed and shared for internal review.
- All TEAs were updated to include (1) 2021 cost year, (2) updated operating expense (OPEX) costs, (3) up-to-date feedstock costs, and (4) the addition of a second economic analysis perspective.

Milestones

- Updated all open-source TEAs to 2021 cost year.
- Updated the five SAF technology TEAs to include policies defined in the 2022 Inflation Reduction Act and revised in the 2025 One Big Beautiful Bill Act. Users can now model a variety of policy time horizons, values, and company structure scenarios. Specifically, the clean fuel production credit termed 45Z.

Major Accomplishments

A manuscript entitled “Comparison of techno-economic and environmental performance of alternative jet fuel production technologies” has been prepared, reviewed, and updated in preparation for FAA review. The ASCENT Project 001A team intends to submit these manuscripts to the FAA for review within the next four months. The team is working on the construction of a TEA for lignin extraction and utilization in a biorefinery process.

Our team has assisted the International Civil Aviation Organization (ICAO), and the Committee on Aviation Environmental Protection (CAEP) through participation in the previous Fuels Task Group (FTG), now Working Group 5 (WG5) and the Long-Term Aspirational Goal Task Group. An Excel spreadsheet of publicly announced global AJF producers has been updated, and the work with ICAO WG5 for integrating the historical portion of these data with their database is ongoing. Revised fuel projections were requested by and provided to the Modelling and Databases Group (MDG)-and Forecast and Economic Analysis Support Ground (FESG) at the FTG8 meeting on September 23-27, 2024, in Montreal, Canada. The methodology of projecting potential AJF production is under review, and a new methodology is under development. In addition, a separate U.S. database that does not include ICAO-specific assumptions and data is being maintained to assist in tracking progress toward meeting the SAF Grand Challenge goals.

Six Excel spreadsheet-based TEAs have been published on the WSU repository site to make these tools publicly available for analysis. These TEAs include HEFA, ATJ, FT with both solid and gaseous feedstocks, FT feedstock preparation, pyrolysis, and CH. The TEAs are being used by other ASCENT member universities and interested industry and government parties. These spreadsheet TEAs were updated and reposted in the 2025.

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We continued to generate data from the design cases and make these data available to ASCENT Project 001A partners to assist with supply chain analysis and techno-economic modeling by improving the conversion and cost figure database values.

Publications

Brandt, K., Martinez-Valencia, L., Camenzind, D., Martulli, A., Malina, R., Allroggen, F., & Wolcott, M. (2025). Pragmatic assessment of meeting the 2030 U.S. sustainable aviation fuel goal. *Biomass and Bioenergy, 206.* https://10.1016/j.biombioe.2025.108516

Outreach Efforts

Our results have been presented to the FAA, USDA Office of the Chief Economist (OCE), U.S. Department of Energy, ICAO, and CAAFI. Six harmonized TEAs have been posted on the WSU Research Repository for public use. The team has also made several presentations for graduate and undergraduate students.

Awards

None.

Student Involvement

Santheeb Velmurugan participated in the creation, editing, and updating of design cases for methanol-to-jet (MTJ).

Plans for Next Period

- Submit MTJ review paper for journal publication.
- Submit "Lipid and bio-processing technologies: process intensification and continuous flow-through reaction (PICFTR), lipid-to-hydrocarbon (LTH), Tyton, decarboxylation, and coprocessing" for journal publication (or as a report).
- Complete MTJ Aspen process model and subsequent harmonized TEA.
- Updated harmonized TEAs to 2024 cost year for use in ICAO WG5 "Rules of Thumb" update.
- Continue to support ICAO work through participation in the WG5. This includes the regularly scheduled SAF database updates and volume projections, additional work on chain of custody documents and potentially guidance, and the requested to update the SAF "Rules of Thumb" including evaluation of adding co-processing.

References

National Renewable Energy Laboratory. (2018). *Process design and economics for the conversion of lignocellulosic biomass to hydrocarbon fuels and coproducts: 2018 biochemical design case update* (Publication No. NREL/TP-5100-71949). https://www.nrel.gov/docs/fy19osti/71949.pdf

Task 2 – Evaluate the Most Promising Biorefinery Concepts for AJF Production

Washington State University

Objective

In continuation of work completed from previous years, the ASCENT Project 001A team completed our evaluation of biorefinery scenarios for AJF production using corn ethanol, sugarcane, and pulp and paper mills and petroleum refineries. The objective of this task is to conduct detailed TEAs on the integration of lignin co-product technologies and the ATJ pathway to determine the potential for reducing fuel costs.

Research Approach

Background

In this task, our team used design cases for existing infrastructure, AJF production technology, and identified co-products to generate new biorefinery concepts for petroleum refineries, pulp and paper mills, sugarcane mills, and corn ethanol mills. The results from this effort will allow us to identify and select the most commercially feasible biorefinery concepts.

Major technical gaps or barriers to the commercialization of each biorefinery concept will also be determined from the results of this study.

The integration of process technologies was assessed via an approach similar to that for the stand-alone design cases. The integration concepts were developed by pairing stand-alone cases with these concepts to evaluate the economic and environmental advantages of the integration approaches. Over this period, our team has conducted detailed analyses of ATJ conversion and integration with pulp mill operations. Our team has also investigated the potential contribution of lignin co-products to the overall process economy.

A dry-grind corn ethanol mill with a capacity of 80 million gallons of ethanol per year was studied to evaluate potential biorefinery scenarios for AJF production. Similarly, a sugarcane mill with a sugarcane processing capacity of 12,444 tons per day that produces raw sugar, molasses, surplus bagasse, and surplus electricity, was studied. The petroleum refinery used as the base case processes 120,000 barrels of crude oil per day. Five AJF technologies were studied: (1) Virent BioForming, (2) ATJ, (3) direct sugar-to-hydrocarbon, (4) fast pyrolysis, and (5) GFT. A standardized methodology was adopted to compare the biorefinery concepts for a dry-grind corn ethanol mill, sugarcane mill, and petroleum refinery in several integration scenarios with six jet fuel production scenarios. For all cases, our team estimated the fuel minimum selling price (MSP) and greenhouse gas emissions.

A manuscript on the integration of ATJ technologies with pulp mill infrastructure was published. Three additional manuscripts were published with results for corn ethanol mills (2021), sugarcane mills (2022), and petroleum refineries (2021).

P-graph is a tool to identify combinatorially feasible technological structures from basic unit operations. Biochemical technologies - Virent's BioForming, Alcohol to Jet, and gasification were the focus of p-graph analysis. These studies suggested that acetic acid co-production could increase the economic viability of these technologies. The p-graph work has been completed. We are currently working on the final report of this task.

In this year, the ASCENT Project 001A team has begun the process of refining the Aspen process model (Figure 1) to analyze MTJ production. There are three units in the MTJ process: (1) olefination of methanol (MTO), (2) hydrogenation of oligomers, and (3) fractionation of aviation fuel base stock. The Honeywell® UOP Renewable Jet Fuel Process™/hydro MTO process was referenced to generate C2 and C3 olefins as input feedstocks for oligomerization reaction, and the oligomerized products are hydrotreated to be used as the precursors for SAF. In addition to the Aspen model development, we drafting a paper titled "Methanol to sustainable aviation fuel" in collaboration with Pacific Northwest National Laboratory based on comments from an internal review.

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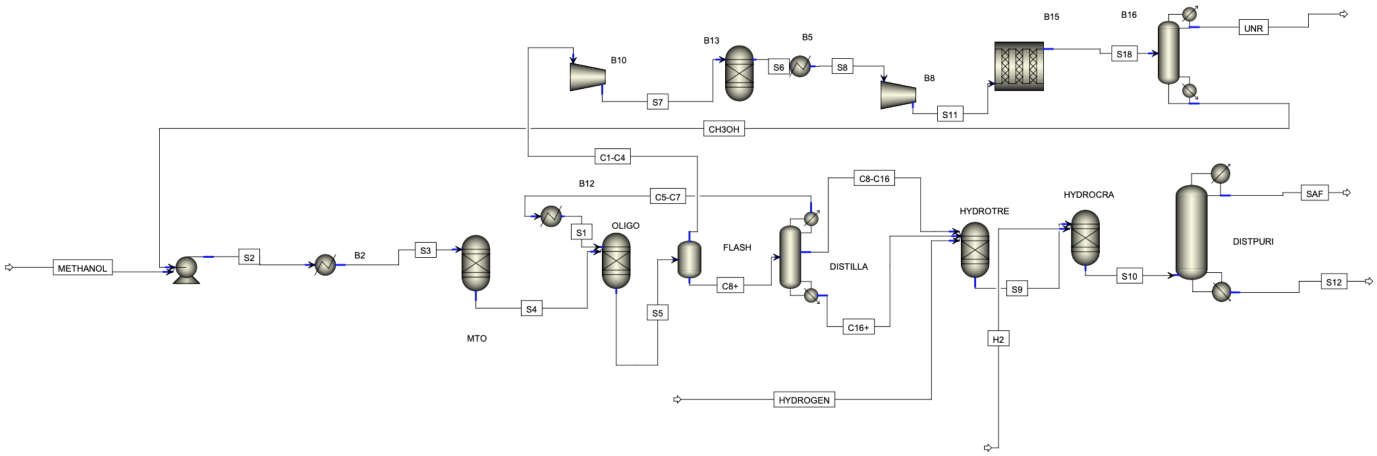

Figure 1. Aspen Plus flow sheet for methanol to aviation fuel base stocks.

Major Accomplishments
None.

Publications
None.

Outreach Efforts
None.

Awards
None.

Student Involvement
Graduate students, Claudia Marcela Valderrama and Santheeb Velmurugan, have received training in this project.

Plans for Next Period
- Complete a preliminary TEA analysis of MTJ conversion and the internal review of the review paper and submit it to the FAA internal review and then submit it for peer-reviewed journal publication.
- Pending completion of the initial Aspen model, begin work on a TEA to model the economics of MTJ and the impacts of technical and policy options.
- Complete a report or peer-reviewed manuscript titled “Lipid and bio-processing technologies: an insight into bioconversion potential of process intensification and continuous flow-through reaction (PICFTR), lipid to hydrocarbon (LTH) and TYTON bioenergy.”

Task 3 – Supplement and Maintain the Current Inventory of Biorefinery Infrastructures that are Useful for AJF Production, as Identified in the Conversion Design Cases

Washington State University

Objective

The objective of this task is to provide the required periodic evaluation of the databases to add new facilities or update the status of closed facilities in each category to ensure that the geospatially specific assets are current.

Research Approach

The use of existing infrastructure assets is a key component of retrofit approaches for advances in this industry. To differentiate between the relative values of various options, the specific assets must be valued with respect to their potential use within a conversion pathway. Regional databases of industrial assets that might be utilized by a developing AJF industry have been assessed on the national level. These baseline databases have been compiled from a variety of sources, including industry associations, universities, and news outlets. These databases will be expanded, refined, and validated as the conversion design cases indicate additional needs for regional analyses.

Milestones

- Evaluated the databases as necessary to add new facilities or to change the status of closed facilities in each category, to ensure that the geospatially specific assets are current.
- Converted the geospatial infrastructure data for use in supply chain resiliency models.

Major Accomplishments

- Compiled, validated, and shared National databases with the ASCENT Project 001A teams upon request. All metadata are available for use in regional analyses.
- Updated the count, scale and location of wood pellet mills.
- Geolocated the soybean and canola crushers in the U.S. with facility scale information.
- Geolocated large-capacity animal slaughter facilities in the U.S. For facilities in the Western U.S., capacities of facilities were found using public sources.

Publications

None.

Outreach Efforts

None.

Awards

None.

Student Involvement

None.

Plans for Next Period

This task will be closed out with a final infrastructure write-up and the most recent version of each database posted on the WSU repository next year.

Task 4 – Update CAAM Measures

Washington State University

Objective

The objective of this task is to update the CAAM with the latest available data.

Research Approach

Based on a community capitals framework, the ASCENT Project 001A team created the CAAM, which provides quantitative indicators of four social assets: social, cultural, human, and political capital. The CAAM provides quantitative proxy measures of qualitative concepts for initial site-selection assessments. Variations of the model have been applied to the Pacific Northwest, Idaho, Montana, Colorado, and Wyoming. Manuscripts on applications of the CAAM have been published in *Community Development*, *Politics and Life Sciences*, *Biomass & Bioenergy*, and *Frontiers in Energy Research*. The CAAM is currently being updated with the latest available data, with plans to make the CAAM more publicly accessible for use. As the social capital data have not been updated for several years, the research team is updating the data or creating our own measures to be validated in future use.

Milestones

- Conducted an investigation of alternative social capital data sources and measures.
- Met with another research team regarding additional data for potential cultural capital use, the Cultural Vitality Index (CVI) data from Creative West (formerly WESTAF).
- Validated the CAAM by using a private company.

Major Accomplishments

None.

Publications

None.

Outreach Efforts

None.

Awards

None.

Student Involvement

None.

Plans for Next Period

None. This task is complete.

Task 5 – Refine and Deploy Facility Siting Tools to Determine Regional Demand and Potential Conversion Sites to be Used in Regional Analyses

Washington State University

Objective

The objective of this task is to develop tools to site potential conversion facilities. Two primary tools are needed for this task: (1) a generalized tool to site initial locations that meet the needs of a specific conversion facility type and (2) a tool to select optimal conversion facility sites from the initial set of locations.

Research Approach

The ASCENT Project 001A team began developing a geospatial siting pre-selection (GSP) tool in early 2019. This tool is a Python®-based script that automates ArcGIS® to produce points representing locations that suit the needs of a conversion facility. The GSP tool uses a combination of buffer and cost datasets. Buffer datasets ensure that a candidate is sited in proximity to the necessary infrastructure, such as roads, rails, and natural gas pipelines. Because the candidate set generated by using only buffers will be very large, cost datasets have been added to distinguish candidates from each

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other. Cost datasets represent geospatially variable costs, including electricity, natural gas, and transportation. In early 2020, a graphic user interface was added to the GSP tool to make it more user-friendly. An additional script was developed in 2022 to model the transportation cost inputs for the GSP tool based on the local density of feedstock, the maximum feasible travel distance from the facility for feedstock collection, and regional road characteristics. This script also includes a rudimentary user interface. In 2023, our team performed a retrospective analysis of corn ethanol plants using the GSP, with the objective of performing a pseudo-validation. This study showed that the facility locations of the mature ethanol supply chain were in areas that the GSP would have prioritized for siting, indicating that the tool is likely a good fit for other similar supply chains, such as SAF supply chains. The team also performed an extensive study in 2023 to show how the number of candidates and locations of candidates affect the optimization model solution time. The results of this study showed that a small number of candidates generated by the GSP performed significantly better than the same number of points laid out in a square grid.

The Many-Step Transshipment Solver (MASTRS) is a Python-based script that models large supply chains across multiple levels by building and solving mixed-integer linear programming problems. The model starts with feedstock spread across many locations and then models the distribution and conversion of feedstock into biofuels and other co-products through multiple levels of intermediate facilities that may include temporary storage, pre-treatment, and fuel production, before new products are sent to their destinations. Intermediate facilities may include existing facilities or new candidate facilities that are generated by the GSP tool. The MASTRS output shows the flow of materials throughout the supply chain and the most cost-efficient capacities and locations for new facilities.

The modeling combination of GSP and MASTRS scripts has been implemented for several regional supply chains. MASTRS was first implemented for the Pacific Northwest oilseed-to-jet-fuel supply chain in 2018. Since 2019, the GSP and MASTRS scripts have been used together for two supply chain models for both the production of jet fuel from forest residuals and lumber production byproducts in the Pacific Northwest. The first supply chain model uses single-stage conversion at integrated biorefineries, and the second supply chain model is a multi-stage model with distributed preprocessing facilities.

Milestones

- Updated the GSP tool to Python 3 so that it can function with ArcGIS Pro.
- Made substantial improvements have been made regarding tool accessibility for new potential users along with the expansion of tool capabilities.

Major Accomplishments

None.

Publications

None.

Outreach Efforts

None.

Awards

None.

Student Involvement

None.

Plans for Next Period

- Continue the process for publishing manuscripts that define the GSP and MASTRS tools.
- Continue implementing the GSP and MASTRS tools in regional supply chain analyses upon request.

Task 6 – Perform a Refinery-to-Wing Stakeholder Assessment

Washington State University

Objective

The objective of this task is to extend the stakeholder assessment to a limited sample of informed stakeholders in the remaining sections of the country to provide insight into market and industry dynamics, with the aim of optimizing successful outcomes.

Research Approach

Conduct online surveys of key stakeholders to inform market and industry dynamics.

Milestones

None.

Major Accomplishments

None.

Publications

None.

Outreach Efforts

None.

Awards

None.

Student Involvement

None.

Plans for Next Period

None. This task is complete.

Task 7 – Conduct a Supply Chain Analysis

Washington State University
U.S. Department of Transportation Volpe Center

Objective

The objective of this task is to design and implement a dynamic fuel mapping tool, which significantly advances our methodology for wildfire risk assessment across a supply chain network. WSU and Volpe have each developed modeling tools that apply transshipment optimization to model the geospatial layout of developing supply chains. A comparison of these tools would be useful to identify the strengths and weaknesses of each tool.

Research Approach

Focusing on the use of woody-biomass-to-jet-fuel conversion via fast pyrolysis and the upgrading of a supply chain centered in the northern Rocky Mountains, a series of comparison studies was conducted by using optimization tools from Volpe and WSU. Each modeling approach was required to determine sites for new pyrolysis depots and upgrades to refineries. Forest production data were provided by the land use and resource allocation (LURA) model from the University of Idaho. Pyrolysis depot locations were selected by candidate generation tools included in each approach, and existing petroleum refineries were used as candidates for upgrading refineries. Cities, ports, and airport hubs throughout the U.S. West Coast and Rocky Mountain regions were used as markets for road transportation fuel, bunker fuel, and jet fuel.

In this task, we propose a novel hybrid dynamic fuel mapping methodology that combines a deep learning architecture and traditional classification algorithms. More specifically, the approach integrates a binary U-Net-based semantic segmentation model with a pixel-wise K-Nearest Neighbors (KNN) classifier to leverage the complementary strengths of both methods. The U-Net model first generates a binary mask distinguishing non-burnable and vegetated areas, effectively capturing large-scale spatial patterns and linear features critical for fire behavior modeling. The KNN classifier then performs detailed pixel-level classification of vegetation areas into fuel categories based on the Scott and Burgan fuel models. The methodology is implemented using free and publicly available Harmonized Landsat Sentinel-2 (HLS) imagery with a 30-m resolution, enabling near-real-time monitoring with a revisit interval of 2 to 3 days. The results demonstrate that the hybrid approach significantly improves spatial coherence of the fuel maps generated compared to using KNN or U-Net alone. Moreover, the model effectively captures dynamic vegetation changes. The resulting tool can be used to dynamically monitor the availability and distribution of burnable biomass feedstock while simultaneously leveraging live environmental data to conduct a comprehensive, near real-time assessment of immediate and projected wildfire risk to key supply chain network assets.

Milestones
None.

Major Accomplishments
- Studied five feedstock types for producing AJF: (1) agricultural residues and grasses, (2) forest residues, (3) urban wood waste, (4) oilseeds, and (5) fats, oils, and greases (FOG).
- Submitted a journal manuscript titled “Satellite imagery-based dynamic fuel mapping for wildfire risk assessment” for FAA review.

Publications
None.

Outreach Efforts
None.

Awards
None.

Student Involvement
Nasimeh Rashidi, a PhD student in Civil & Environmental Engineering at WSU, has worked on this task.

Plans for Next Period
- Utilize regional supply chain tools to assess forest residuals for SAF using pyrolysis methods.
- Submit a journal paper, “Satellite imagery-based dynamic fuel mapping for wildfire risk assessment.”

Task 8 – Provide Analytical Support for Regional CAAFI and USDA Jet Fuel Projects
Washington State University

Objectives
The objectives of this task are to (1) develop a readiness-level tools to assess the status of regional SAF production projects and to use supply chain and stand-alone design cases to support TEA and supply chain analysis, (2) assess the regional feedstock, conversion pathways, and MSP for SAF manufactured in U.S. regions, (3) support CAAFI requested analyses, and (4) deploy and enhance ASCENT tools for use in ICAO/CAEP/WG5.

Research Approach
The ASCENT Project 001A team assisted the regional USDA Bioenergy Alliance Network of the Rockies (BANR) team by deploying TEA and supply chain analysis for their project. This effort focused on the use of softwood forest salvage

feedstock in a thermochemical conversion process to produce fuels and co-products. The facility siting tools discussed in Task 5 (i.e., GSP and MASTRS) were implemented for the BANR supply chain and Port of Seattle project. For BANR, optimal locations for facility siting, supply chain configurations, and fuel production at different price points were calculated.

The Port of Seattle project required a detailed feedstock survey for forest residuals, municipal solid waste, and lipids. Each feedstock was quantified and then paired with a compatible SAF conversion pathway to determine the SAF MSP by using ASCENT-developed TEAs.

Federal (Renewable Fuel Standard, Inflation Reduction Act) and state (California, Oregon, Washington, Illinois) policies in the U.S. that incentivize the production of AJF, its co-products, or feedstock (i.e., green dihydrogen [H_2], carbon dioxide [CO_2] capture and utilization) were mapped in a series of flow charts. An initial decision support tool was programmed using Python and converted to an Excel spreadsheet to facilitate its sharing among stakeholders. This tool enables a user to identify applicable policies for specific scenarios and returns generalized values per volume of fuel or mass of feedstock. Values can be selected for different time ranges, confidence interval values, and multiple summary statistics. Graphics were added to the tool in addition to options to export the data. The decision tool underwent ASCENT and external stakeholder review. The output from this tool is a direct input into the harmonized TEAs to more accurately determine the economic viability of an AJF production pathway in the U.S. This was published in 2025 with a peer-reviewed paper.

Information about facilities and infrastructure has been supplemented with information about the current consumption of feedstocks. Using information from the U.S. Census Bureau, U.S. Energy Information Administration, California Air Resources Board, and annual company reports, our team has compiled data that show how lipid feedstocks have been consumed for fuels in the U.S. since HEFA fuels were first produced in the U.S. in 2014.

A financial model that uses a system dynamics approach was conceptualized and developed. This model analyzes the effects of federal and state policies on the financial performance of projects to produce SAF. This model can perform both deterministic and stochastic analyses. Three conversion technologies (i.e., HEFA, ATJ, FT) and nine feedstocks (including FOGs; vegetable oil; municipal solid waste; forest and agricultural residues; first- and second-generation ethanol; direct air capture; and flue gas) have been analyzed. The team assessed the influence of green hydrogen, renewable electricity and gas, and carbon capture utilization and storage on the financial metrics, based on calculations performed by MIT colleagues. A draft manuscript of this work is under internal review.

As continuation of the technical support to the ICAO/CAEP/WG5 on fuel accounting and reporting systems, a review paper titled "A dual sustainable aviation strategy: voluntary markets and regulatory frameworks" is being drafted and submitted to Renewable and Sustainable Energy Reviews. The paper aims to be a critical review on the impacts of regulatory and voluntary frameworks on the industry, examining their correlation to the development of sustainable supply chains, and the scaling up of the renewable energy. The collaboration with the Fuel Accounting Systems ad hoc group of the Technology Production and Policy subgroup continues on a Study of Fuel Accounting Systems for International Aviation as part of the CAEP/14 Cycle Tasks S.12.01 and S.12.02. An initial report outline was presented at the CAEP/14 WG5 Second meeting, and a preliminary report has been prepared and is under discussion. The report presents a review of fundamental concepts, updated information on regulatory and voluntary frameworks, and a survey of existing fuel accounting systems.

Technical support to the ICAO/CAEP/WG5 was provided. This support included (1) maintenance of the global database of SAF fuel production announcements, (2) revision of the potential AJF fuel production projections, and (3) preparation for the requested third version to the ICAO SAF "Rules of Thumb."

An assessment of the practical pathway to meet the U.S. AJF goals was completed and a journal article was written, reviewed and was in the final stages of the publication process at the end of the period of performance. This paper used harmonized assumptions as a companion paper from the National Renewable Energy Laboratory that is in process. Our team also completed a maximum feedstock price analysis for the USDA OCE for SAF manufactured using the HEFA pathway. The maximum price of each analyzed feedstock was determined for a variety of policy scenarios. This work has been extended and revised following the One Big Beautiful Bill Act to be written into a paper with University of Tennessee, Knoxville (UTK) as the lead authors using policy to determine volumes of soybean oil and second crop oils for different price and policy support scenarios.

An inventory of domestic and imported lipid feedstocks was created to support potential AJF production. The inventory includes production quantities, prices and locations of various lipids used in fuels including canola oil, soybean oil, corn oil, beef tallow, hog fats, and used cooking oil. Additionally, information about supply elasticity, competition from other markets and recent trends in international trade are also included.

Milestones

- Submitted manuscript "A Dual Sustainable Aviation Strategy: Voluntary Markets and Regulatory Frameworks" to *Renewable and Sustainable Energy Reviews.*
- Supported ICAO/CAEP/WG5 AJF global database and fuel production projections.

Major Accomplishments

None.

Publications

None.

Outreach Efforts

- Participated (Wolcott, M.) in the MassPort New England Regional SAF Workshop at Volpe National Transportation Laboratory held June 5, 2025, in Cambridge, Massachusetts.
- Participated (Wolcott, M.) on the review team for the new University of Maine project, "USDA Sustainable Wood to Fuel and Fish Feed," on September 30, 2025.

Presentations

Brandt, K.; Wolcott, M. (2025, August 21). *Sustainable Aviation Fuels: Supply Chains and Policy*. Eastern Washington Sustainable Aviation Fuel Tour. Pullman, Washington. Group included county legislators, regional port personnel, Alaska Airlines, Boeing and regional non-governmental organizations.

Brandt, K.; Echeverria Paredes, P.; Camenzind, D.; Wolcott, M. (2025, October 15). *ICAO WG5 Work Update* [Meeting presentation]. Fall 2025 ASCENT Meeting, Alexandria, Virginia.

Awards

None.

Student Involvement

None.

Plans for Next Period

- Complete publication of "A dual sustainable aviation strategy: voluntary markets and regulatory frameworks" (review paper) that was submitted.
- Submit "Spurring Technological Innovation, Industry Development and Decarbonization Through Sustainable Aviation Fuel Policy in Canada and the U.S.," a paper that is under internal review.
- Publish joint paper with UTK that covers the volume of oilseed lipids that match the maximum price biorefineries can pay given different policy scenarios.

Task 9 – CAAFI Collaborative Support of Research, Development, Demonstration and Deployment Efforts on SAF/AJF

CAAFI's Office of the Executive Director

Objectives

The objective of this task includes the responsibilities for the CAAFI's Office of the Executive Director to:

- Maintain familiarity with U.S. government, academic and industry SAF activities, and provide expertise in fostering the development and commercialization of SAF as enabled by the various pursuits or interests of these parties.

- Provide technical support to the FAA Office of Environment and Energy (AEE) and other agencies associated with the SAF Grand Challenge, as well as to other academic and commercial contributors.
- Lead or assist in facilitating public and private stakeholder engagement with SAF development, ASTM International fuel qualification, and related activities.
- Be responsible for executing an annually updated set of goals and priorities via a work plan approved by FAA AEE as well as the CAAFI Steering Group.

Research Approach

The CAAFI reinforces the value proposition of synthetic aviation turbine fuels (SATF), including SAF, through use of communications, outreach, and direct stakeholder engagement. CAAFI enhances the SATF Fuel Qualification approach through participation, advisement, and facilitation of producer and original equipment manufacturer (OEM) engagement in the ASTM qualification process, as well as internal coordination discussions with CAAFI research and development (R&D) and certification teams. CAAFI works to seek alignment of efforts to enable commercial SAF deployment, via leveraging research, partnering across U.S. government agencies, facilitating partnerships among supply chain stakeholders (typically both directly with individual companies and through various trade associations), and supporting innovative fuel acquisition processes. CAAFI implements and shares best practices across the SAF enterprise, including by providing tools and integrating information to support communication and understanding among diverse stakeholders. Finally, CAAFI will support the implementation of the SAF Grand Challenge roadmap by leveraging the above activities to facilitate the execution of the work streams and activities in the roadmap (https://www.energy.gov/sites/default/files/2022-09/beto-saf-gc-roadmap-report-sept-2022.pdf).

All of the above activities are supported through broad exchange of information among SAF stakeholders at our regularly occurring discussions, CAAFI webinars, and via pertinent conferences, workshops, and ad hoc meetings. Pertinent observations from more formal public activities are published on the CAAFI website: http://www.caafi.org.

CAAFI provides information resources and credible expert technical support to the SAF community through:

- An updated and cohesive communications strategy to leverage a range of outlets for technical information and information exchange.
- A continuously updated CAAFI website with greater functionality, usability across devices, and expanded content.
- Continued and expanded direct interaction with supply chain participants who seek out CAAFI leadership for information, advice, and coordination with other entities.
- Continued and expanded dissemination of information through events, conferences, interviews, written articles, and journal publications.

CAAFI coordinates and aligns with U.S. government agencies' activities in support of the SAF Grand Challenge (biweekly meetings throughout the execution period):

- Regularly coordinating with the Federal SAF Interagency Working Group on needs, goals, and priorities. Providing input on SAF Grand Challenge execution and performance tracking and supporting SAF Grand Challenge work team efforts and tasks.
- Communicating federal funding and program developments to the broader SAF community.
- Communicating the need for long-term, sustained policy support to meet the SAF Grand Challenge goals.
- Collaborating with stakeholders to develop key SAF communications and informational materials (e.g., infographics) that (1) reference the best available data and (2) highlight the potential economic benefits (employment, etc.), environmental, and social benefits of SAF.
- Promote consistency for coherent and clear messaging.

CAAFI facilitates ongoing efforts by jet fuel industry practitioners in committees such as ASTM D02, hosted by ASTM International:

- Development of a specification for SATF that can be used at higher blend levels up to 100% (complete) synthesized fuels.
- Assessment of options for a more generalized specification for SATF based on composition and other characteristics.
- Evaluation and approval of new SATF pathways.
- Establishment of additional specifications leveraging existing refining infrastructure to produce SAF.

- Support for clearinghouse, prescreening, and other SATF testing for fuel analysis and qualification in collaboration with the FAA-funded ASCENT Center of Excellence.

CAAFI promotes harmonization of sustainability evaluation approaches and tools by:

- Facilitating broader acceptance of methodologies to assess the environmental, social, and economic performance of SAF.
- Facilitating research, demonstration, and commercial scale projects relating to regenerative agriculture/soil organic carbon sequestration.
- Fostering integration with developments in carbon capture and sequestration.
- Identifying concerns about carbon management and permanence with supply chain partners.

CAAFI enables continuing and expanding international engagement through:

- Input to the ICAO through events and direct engagement with working group participants.
- Coordination with other CAAFI-like organizations around the globe to align and complement work efforts.
    - Specific engagement with aireg in this period, including participation in their SAF Conference 2025 in June in Berlin.
- Collaboration with global SAF stakeholders on messaging.

Leveraging the above efforts to advance the use and commercial production of SAF by fostering strategic partnerships, identifying opportunities and aligning deployment efforts:

- Facilitating team development to respond to funding opportunities to develop novel feedstocks, SAF commercialization projects, and supply chains.
- Supporting the development of commercial agreements across the SAF supply chain to enable SAF production and use.
- Fostering other supply chain development and deployment partnerships.
- Developing an approach to collaboration with the established biofuel and energy industry and the agricultural sector.

Milestones

- Continued progress on CAAFI via each of the above listed support approaches.
- Released a new CAAFI Website.
- Progressed the concept of a Commercial Engagement Readiness Level Framework (release dependent of resource allocation for the coming year).
- Released a revised Feedstock Readiness Level Framework (along with an informational webinar).
- Executed the next North American SAF Conference & Expo in Minneapolis, Minnesota, on September 22-24, 2025.

Major Accomplishments

- Worked collaboratively with BBI International and SAF Magazine, CAAFI co-produced and executed the North American SAF Conference and Expo in Minneapolis, Minnesota on September 22-24, 2025.
    - The event showcased many updates for SAF value chain development, as well as providing a forum for major messaging from industry and government.
    - The event also addressed challenging issues currently facing the SAF industry, as well as highlighting opportunities across the value chain.
    - Approximately 300 attendees were able to connect with exhibitors showcasing the latest technologies and services in the industry, as well as with their peers in discussing how to move the SAF community forward.

Outreach Efforts

Outreach effort for this task included workshop participation, presentations, general discussions, panel moderation, interviews, and student seminars. The following is a list of outreach efforts participated in during this reporting period:

Tim Hughes

- Canola meeting, Bardwell, Kentucky, December 18, 2024
- Kentucky Commodity Conference, Bowling Green, Kentucky, January 15-16, 2025
- KY Ag Expo, Owensboro, Kentucky, January 29, 2025
- West KY Ag Conference, Water Valley, Kentucky, January 31, 2025
- Iowa Renewable Fuels Summit, Altoona, Iowa, February 03-04, 2025

- National Farm Machinery Show, Louisville, Kentucky, February 12-13, 2025
- Renewable Fuels Association Conference, Nashville, Tennessee, February 18, 2025
- Covercress Engagement, Livermore, Kentucky, February 19, 2025
- USDA Outlook Forum, Crystal City, Virginia, February 26-28, 2025
- Commodity Classic, Denver, Colorado, March 02-05, 2025
- Illinois Sustainable Fuels Conference, Chicago, Illinois, March 12-13, 2025
- BBI International Biomass Conference, Atlanta, Georgia, March 18-20, 2025
- IL focus collaboration: University of Illinois, National Corn Ethanol Research Center, Crysalis, Illinois, April 14-18, 2025
- Fastmarkets Biofuels & Feedstocks Americas 2025, Chicago, Illinois, May 05-07, 2025
- Pennycres Field Day, Macomb, Illinois, May 21-22, 2025
- Sustainable Fuels Summit, Omaha, Nebraska, June 08-11, 2025
- CA SAF Research Assets, San Francisco, California, September 01-03, 2025
- BBI/CAAFI NA SAF Conference & Expo, Minneapolis, Minnesota, September 21-24, 2025

Steve Csonka

- SEATAC SAF Workshop, Seattle, Washington, October 07-09, 2024
- SE Regional SAF Workshop, Atlanta, Georgia, October 14-15, 2024
- DOE Co-processing Workshop, Long Beach, California, October 16-18, 2024
- NBAA BACE Aviation Sustainability workshops, Las Vega, Nevada, October 22-24, 2024
- ASCENT Fall Meeting Advisory Committee, Washington DC, October 29-31, 2024
- SAE-SMC-CRC Annual, Columbus, Ohio, November 12, 2024
- Airbus Sustainability Forum, Washington DC, November 13-14, 2024
- AFCC Conference, Washington DC, November 19-22, 2024
- DOE Deploy, Washington DC, December 04-05, 2024
- ASTM D02 Biennial, Anaheim, California, December 09-12, 2024
- IL IMA Conference, Chicago, Illinois, March 12-13, 2025
- Marquis Collaboration, Hennepin, Illinois, March 14, 2025
- ABLC, Washington DC, March 17-21, 2025
- ASTM Meeting, Brussels, Belgium, April 07-11, 2025
- IL focus collaboration: University of Illinois, National Corn Ethanol Research Center, Crysalis, Illinois, April 14-18, 2025
- ASCENT Spring Meeting SAF, Knoxville, Tennessee, April 21-23, 2025
- CRC Meeting, UDRI, Dayton, Ohio, April 29-May 01, 2025
- IN HPLC Summit, Indianapolis, Indiana, May 06-07, 2025
- SPARC Conclusion Meeting, Tampa, Florida, May 11-14, 2025
- GLBRC Annual & SAIB Meeting, Milwaukee, Wisconsin, Mary 19-22, 2025
- MASSPORT Workshop, Cambridge, Massachusetts, June 04-06, 2025
- HYCO1 Visit, and EPC Conference, Houston, Texas, June 10-12, 2025
- CBI Annual & SAIB Meeting, Asheville, North Carolina, June 16-19, 2025
- AIREG Annual, Berlin, Germany, June 23-24, 2025
- SAF Summit Brussels, Belgium, June 25-26, 2025
- MN SAF Hub Session, Minneapolis, Minnesota, July 22, 2025
- AAIC & IOCC, Fairbanks, Alaska, August 31-September 04, 2025
- Cascadia Meeting, Seattle, Washington, September 05-06, 2025
- ARGUS NAm RFS LCFS, Monterey, California, September 15-18, 2025
- BBI NAm SAF C&E, Minneapolis, Minnesota, September 21-24, 2025

Awards

None.

Student Involvement

Student involvement activities occur on a continuing basis via engagement with the universities associated with the Bioenergy Research Centers (i.e., Great Lakes Bioenergy Research Center, Center for Bioenergy Innovation, and their partner institutions), ASCENT Advisory Board Meetings, and USDA National Institute of Food and Agriculture/Agriculture and Food Research Initiative Coordinated Agricultural Projects Sustainable Agricultural Systems efforts (i.e., the Sustainability Programming for Ag Retailers & Certified Crop Consultants [SPARC] and IPREFER). Members of the CAAFI Office of the Executive Director also participate annually in various University forums that promote student engagement in SAF activities (e.g., Fairbanks, Alaska activities highlighted above).

Plans for Next Period

None. CAAFI is no longer funded through ASCENT.