Congressional Testimony Transcript

Committee: House of Representatives, Science, Space, and Technology
Subcommittee: Space and Aeronautics
Hearing Title: Examining R&D Pathways to Sustainable Aviation
Date: 24 March 2021
Witness Name: Steven J. Csonka
Position: Executive Director, Commercial Aviation Alternative Fuels Initiative (CAAFI)
President, Csonka Aviation Consultancy, LLC

Start of Oral Testimony:
Esteemed members of the Committee and Subcommittee, thank you for your general interest in aviation sustainability, and your specific interest in sustainable aviation fuels (or SAF), with SAF being the sole focus of my remarks today. I'm going to dive right into 3 themes representative of questions extended to me by subcommittee staff.

- How do SAF fit into the larger landscape of approaches and pathways to enable more sustainable aviation?
    1. I believe SAF represents the only viable approach for achieving any near-term substantive in-sector net carbon reduction. Further out in time, we might see more radical tech incorporation at rates that offset traffic growth driven by the aviation value paradigm. In the meantime, SAF scaling and usage can deliver a direct and proportional reduction in net carbon. SAF incorporation has no impact on any other parallel approaches to enabling improved sustainability via advancements in technology, operations, or infrastructure.

- What are the opportunities and challenges of SAF for reducing the aviation sector's carbon emissions?
    1. Opportunities include:
        1. SAF are drop-in fuels, obviating the need for significant investments outside of the fuel production itself.
        2. SAF are not hypothetical. We started using them commercially 5 years ago.
        3. SAF are proven to lower net carbon emissions.
        4. SAF will be free of sulfur, and likely have lower levels of certain hydrocarbons responsible for tailpipe soot and criteria pollutants affecting air quality.
        5. SAF can be produced from a very wide range of processes and from feedstocks which recycle carbon from our biosphere, or feedstocks from 24x7 waste streams of various human and circular-economy industrial activities.

    2. On the other side of the spectrum, challenges include:
        1. SAF being a very nascent industry. We're just getting started and every new facility is high on the cost curve.
        2. Given its nascent state, SAF production generally cannot compete with the cost of petro-jet at the current range of oil prices. The carbon reduction afforded by SAF is not yet broadly monetizable, and as a result of the inability of free market economics to change this paradigm, policy is likely needed to affect change.
        3. Industrial system cost reductions are typically achieved through the continued introduction of new technology, utilization of lower-cost inputs, and via learning

curve improvements and tech and supply-chain scale-up. However, none of these can be achieved without initiating the first steps of expansion, again, likely only achievable through policy support or regulation.

- Third and finally, what research could be undertaken or accelerated by NASA and FAA to support SAF development and utilization to further reduce aviation environmental impacts.

  NASA has expertise in measurement, analysis, and characterization of the atmosphere and atmospheric impacts of aviation's emissions constituents. Questions associated with SAF in these areas include:

  1. Quantifying the impact of different hydrocarbon molecules in jet fuel, their resulting combustion constituents, and their contribution as green-house-gas agents;
  2. Further work can be done on physical emissions measurements, both on ground test and flying aloft, using different formulations of SAF with varying chemistry;
  3. Work can be done to address the impacts & benefits of elimination of certain hydrocarbon compounds known to have difficulty in achieving full combustion, and responsible for soot, PM, or HAPS production.

  FAA has been using several impactful programs to advance the modelling and understanding of ways to expedite SAF development and use, including ASCENT, CLEEN, and CAAFI. R&D associated with SAF in these areas include:

  1. Continuing to make progress on the use of modelling, referee test models, small-quantity fuel screening, and clearinghouse assistance to continue to reduce the cost and time associated with industry qualification of new SAF pathways. Using such models and knowledge development will help us move more quickly in the direction of higher allowable SAF blend levels or 100% SAF formulations;
  2. Removing supply chain barriers through analysis, tool development, and facilitating broader industry engagement and collaboration.

  All of these efforts by NASA and FAA should foster more interest on the part of commercialization entities to consider SAF production, by creating a better, realizable value proposition than exists today.

In summary, the opportunity for SAF is great, while the challenges for scaling remain abundant. The research capabilities of NASA and FAA, and other agency partners, are critical to enabling SAF maturation, and improving aviation sustainability. Thank you for your attention and I look forward to addressing your questions.

End of Oral Testimony

Start of Additional Written Testimony

The entire jet-powered aviation enterprise has identified a basket of measure as the means to achieve carbon-neutral growth and long-term aspirational reductions in net carbon emissions[1]. These include technological advancements (which include the development of sustainable aviation fuels, or SAF), improvements in operations and infrastructure, and the use of market-based mechanisms. Commensurate with the goals, the industry also requested the assistance from world-wide governments to remove system inefficiencies and to help accelerate new technology development and incorporation (which is typically already being done with aircraft, engine, and systems technologies), but had not yet been done with SAF. Such support has primarily come from only the U.S. and E.U., but only at amounts that have served to initiate SAF deployment, not scale it broadly.

SAF in general is a low-net-carbon replacement for petroleum derived jet fuel. It is jet fuel produced synthetically from carbon and hydrogen sources that originate from biomass and other circular economy sources initially (waste streams), and then perhaps in the longer term from electrolyzed hydrogen and reformed carbon dioxide generated using renewable energy. The reuse or recycling of carbon from our biosphere, instead of continuing to pull it out of the earth in the form of petrochemical fuels, enables us to stop increasing the level of net CO2 emissions growth, and then perhaps enable future reductions, depending on level of incorporation.

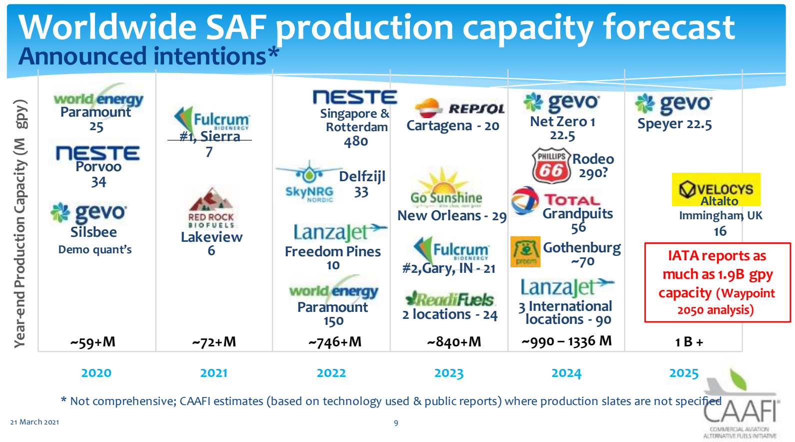
SAF represents the only viable approach for achieving any level of deep net carbon reduction in-sector. This is reinforced by the fact that ~93% of carbon emissions come from aircraft flights of >80 seats and flying more than >500km. Even if we were able to double the rate of historical efficiency improvement offered by the incorporation of engine and aircraft technologies in new design introductions, and completely removed the system inefficiencies driven by operations and infrastructure shortfalls, we would still have an increasing footprint of carbon emissions based on historical traffic growth levels. This growth is driven by the continued burgeoning demand for safe, efficient, long-range, high-speed transport of goods and people offered by aviation. Only the reductions in net carbon affiliated with SAF usage allow us to cap physical emissions and move in the direction of annual reductions. Further, while progress is being made with hybrid aircraft, electrified aircraft, and use of hydrogen as a primary fuel source for aircraft, such technology pursuits are today primarily targeted at vehicles with <80 seat and <500km range whose carbon emissions comprise a small fraction of aviation's impact. These radically new technologies remain far from being technically feasible (let alone cost feasible) for use in commercial fleets, likely for several more decades. Such systems cannot achieve levels of sufficient energy per unit volume or per unit mass to even be considered in conceptual aircraft design studies, let alone for system demonstration in test vehicles and rigs, often missing the targets of today's technologies by 1 to 2 orders of magnitude. This is not to say that such technologies are not eventually critical, and should continue to be researched, but for near term reductions that enable longer-term significant reductions, SAF will be key.

The opportunities and challenges of SAFs for reducing the aviation sector's carbon emissions are many. The opportunities include:

---

[1] Climate change (atag.org)

- SAF are not hypothetical. We started using them commercially 5 years ago, and have many pathways and opportunities to increase their production.
- Three facilities continuously produce SAF today. Several facilities are being built, and many others are being engineered or are in various stages of planning. The industry will perhaps achieve the first 1% of jet fuel worldwide usage coming from SAF within 5 years.



- SAF are drop-in fuels. No investments are required for replacing aircraft, retrofitting airports, retrofitting or adding fuel transport infrastructure, or requiring completely new and significant power infrastructure. Based on this view, it would appear that the development of SAF is likely to represent the lowest societal cost to deep decarbonization of aviation. Any incremental cost comes in the form of the new SAF production facilities themselves, as well as some infrastructure required to enable fuel blending and integration with existing distribution systems (e.g. fuel tanks, blending systems, transfer racks, and terminal stations). Further, the industry is currently moving in the direction of defining 100% SAF formulations which will reduce and perhaps eliminate the need that currently exists for blending neat SAF with conventional jet fuels.
- SAF are proven to lower net carbon emissions. Most of the pathways being pursued achieve greater than 50% lifecycle reductions in net carbon. Today, fuels are being delivered for use with 70+% reductions, and approaches have been identified to continue moving in the direction of 100% reductions (net zero carbon fuels), and even beyond, to net carbon negative fuels.
- SAF will be free of sulfur, and likely to have significantly reduced polycyclic aromatics, resulting in significant reductions in tailpipe criteria pollutants (particulate matter, CO, UHC, and HAPS) which affect air quality, as well as contribute to contrail production[2].
- SAF can be produced from a very wide range of biochemical and thermochemical processes, with a wide range of feedstocks, including fats, oils, greases, sugars and starches, lignocellulose, a wide range of 24x7 waste streams from various human activity and circular-economy production concepts.

The challenges include:

- SAF is a nascent industry, arguably 12 years old, competing against a petroleum baseline initiated in 1859 and enjoying 162 years of optimization and tremendous scale.

---

[2] IPCC and other academic studies suggest aviation also produces other exhaust constituents responsible for radiative forcing responsible for planetary warming, beyond just CO_2, including: PM, NOx, water vapor, contrails, and persistence contrails which can form cirrus, all of which combined may have twice the radiative forcing impact as CO_2 alone.

- SAF production generally cannot compete with the cost of petro-jet at today's oil price. The carbon reduction afforded by SAF is not yet fully monetized, and as a result of the failure of free market economics to change this paradigm, policy is needed to affect change.
- Given appropriate policy support, either through incentive or regulation, SAF will still need to pursue significant supply chain development and cost reductions. Such cost reductions are typically achieved through the continued introduction of technology, utilization of low-cost feedstocks, and via learning curve improvements and tech and supply-chain scale-up. These reductions cannot commence without an initial push of commercialization, again, likely needing to come from policy support.

I have often referred to aviation's intent to use SAF as simply requiring the establishment of an entirely "new industrial sector," replete with its own technology development, supply chain development, demonstration and deployment activities, building of new refineries, enabling distribution infrastructure, and key commercial players. Although we passed the 5-year anniversary of continuous production of SAF from the first facility[3] on 10Mar'21, this sector should not be viewed as anything but a nascent sector. There is no doubt that foundational progress has been made to enable this sector to reach its initial penetration of 1% of jet fuel utilization by 2025, but the industry is clearly thinking more holistically than that. Initially, to a program that represents a major fraction of aviation's 2050 aspirational reduction goal (-50% from 2005 levels), to even more aggressive goals that are now being announced by airlines on a continuing basis. These more aggressive goals are in line with societal consensus goals of achieving net-zero carbon in 2050 or earlier, or in line with Paris commitments, with some advocating for net-zero carbon in 2030.

What is needed to accelerate and achieve these broad goals for SAF development and commercialization, specifically from the perspective of Agency assistance? … A full range of R&D and demonstration and deployment efforts across the full set of various supply chain models that have demonstrated technical feasibility, and economical promise.

- Interagency collaboration has been shown to be effective in such cases, as the concept of a "new industrial sector" include the remits of USDA, DOE, DOI, DOC (NSF), and DOT/FAA, with DOD's branches being both SAF consumers as well as active researchers in pathway development and certification.
- Several years ago, these agencies, including OS&TP, worked with aviation and fuel industry focals to develop a Federal Alternative Jet Fuel R&D strategy[4] (FAJFRDS). The strategy outlines essential R&D needed to enable this sector to flourish. Since then, some of the work elements have been completed or are ongoing, but many remain, or today would be expanded to areas of discovery since then. The Strategy outlines goals in 4 general areas:
  - Feedstock Development Production and Logistics
  - Fuel Conversion and Scale-up
  - Fuel Testing and Evaluation
  - Integrated Challenges

  The Strategy included 82 specific work elements, in near, mid, and long term efforts, assigned to the above identified Agencies, either individually or collectively. It also included

---

[3] World Energy's Paramount, CA plant (previously AltAir) delivering continuous quantities of SAF to Los Angeles International Airport via contracting with United Airlines.

[4] Federal_Alternative_Jet_Fuels_Research_and_Development_Strategy.pdf (caafi.org)

a focus on multi-agency collaboration for more optimal coordinated research. A recent report on SAF from the DOE's Offices of Energy Efficiency & Renewable Energy, and Bioenergy Technologies Office[5] both outlines similar R&D needs, as well as the value of interagency and industry collaboration. The recently formed SAF Interagency Work Group, operating under the auspices of the USDA/DOE Biomass Research and Development Board is currently undertaking an update and refresh of the FAJFRDS.

Finally, Subcommittee staff have also discussed the potential need for a more formalized SAF Interagency Agreement, including development of a Strategic Plan that coordinates the involvement with industry and academia, across Federal Agencies, resources, and programs, including workshops, execution of aligned and integrated R&D and demonstration and deployment efforts. It also suggested the development and funding of appropriate budgets, and reporting of such needs and progress to Congress. Many of the elements of that proposed Interagency Agreement align with the needs and approach of the previously derived FAJFRDS, and are viewed by this author as being pertinent to making significant and optimized progress with SAF development and commercialization.

The aviation industry remains extremely interested in the development of SAF. At present, there are greater than 350 M gallons per year committed to offtake agreements with airlines, representing greater than $6.5 B in commitments, and such commitments are continuing to expand. However, in order to see the expansion of SAF commensurate with the societal demands for sector-wide carbon reductions, much work remains to get to the point of having SAF be competitive with petroleum-derived jet fuel. CAAFI will continue to work on the foundational elements that allow for future progress, and stands ready to collaborate with policy makers on effective approaches for governmental support, should they choose to do so.

Steve Csonka
Executive Director of CAAFI
steve.csonka@caafi.org
www.caafi.org

End of Additional Written Testimony

[5] https://www.energy.gov/sites/prod/files/2020/09/f78/beto-sust-aviation-fuel-sep-2020.pdf

External Biography

Steve Csonka

President, Csonka Aviation Consultancy, LLC
Currently contracted through Booz Allen Hamilton to support the development and execution of the Commercial Aviation Alternative Fuels Initiative through the FAA SEMRS Contract
Executive Director, CAAFI (Commercial Aviation Alternative Fuels Initiative)
+1-513-800-7980
steve.csonka@caafi.org
Csonka.CAAFI.ED@gmail.com

BIO – short

Steve is a commercial aviation professional with broad, strategic airline, aviation OEM, and SAF experience since 1985. Over his career, Steve has been a strong industry advocate who has worked in roles of developing pragmatic solutions to the challenges of aviation growth, and that interest led him to accepting the current CAAFI Executive Director role in 2012. CAAFI (the Commercial Aviation Alternative Fuels Initiative, www.caafi.org) is industry partnership fostering the development and commercialization of sustainable aviation fuels (SAF). CAAFI engages in public-private-partnership activities designed to assist in bringing together the group of participants needed to stand up an entirely new industrial sector.

Steve also continues to serve in leadership, steering committee, consultancy, and BOD roles with multiple aviation industry organizations in areas of applying technology and business concepts to enable commercial progression with SAF, both through the work of CAAFI, as well as independent activities through his consultancy.

BIO – Long

Steve Csonka is an ardent advocate for the aviation industry who seeks pragmatic solutions to the challenges of aviation growth. Built upon strong technical experience that spanned the breadth of the commercial aircraft/engine life-cycle, Steve's capabilities and initiative have led to his various engagements in business development and long-term, strategic planning for the aviation enterprise over the past fifteen years. Such work has focused on the nexus of future product requirements, technology progression, and industry value propositions, including aspects of policy, advocacy, regulatory affairs, and environmental impact.

Steve's overall industry engagement led to his current role as Executive Director of CAAFI (the Commercial Aviation Alternative Fuels Initiative, www.caafi.org) where he leads this Public-Private Partnership working toward the development and commercialization of sustainable alternative jet fuels (SAJF). He has been in this role since 2012, directing the CAAFI efforts of its 1200+ members and 500+ organizations who share the industry vision of enabling the decoupling of net carbon growth from expected sectoral growth. CAAFI engagement occurs through several work teams and public-private initiatives, and it seeks to be a force multiplier for a wide range of efforts required to achieve significant uptake of low net-carbon SAJF.

Steve is a commercial aviation professional with 35 years of broad, strategic airline and aviation OEM experience (GE Aircraft Engines, American Airlines, GE Aviation, and CAAFI). He holds BS and MS degrees in Aerospace Engineering. He has served in leadership, steering committee, and BOD roles with multiple aviation industry organizations (AIA, ICCAIA, IATA, GAMA, ICAO/CAEP, ATAG, Carbon War Room) in areas of technology and environmental progression. His CAAFI role has also led to appointments to advisory/leadership roles with the USDA/DOE BRDB TAC, the USDA/DOT/DOE/Industry *Farm-to-Fly 2.0* initiative, USDA/NIFA/AFRI CAP projects, and study committee work of the National Research Council.