



COMMERCIAL AVIATION ALTERNATIVE FUELS INITIATIVE® (CAAFI)

Research & Development Team Advances Alternative Fuel Technical and Feedstock Evaluation Tools for Aviation

What? A path forward for the development of R&D communication tools was agreed to at the Research & Development (R&D) Team meeting of the Commercial Aviation Alternative Fuels Initiative (CAAFI). The meeting was hosted by the Federal Aviation Administration (FAA) and the Volpe National Transportation Systems Center (Volpe/RITA) on February 16th and 17th, 2011 in Cambridge, MA. The following provides meeting outcomes as reported by CAAFI sponsors who lead or are key participants on the team.

Why? Gaining agreement on how to assess and communicate the status of alternative fuels as they are produced and used is critical to their deployment. The CAAFI R&D team has existing tools (the Fuel Readiness Level, or FRL, and the CAAFI Roadmaps) that provide much-needed communication among various stakeholders. The team has undertaken the modification and expansion of these tools to facilitate more effective communication. In addition, the team has committed to providing a guidance document explaining the path of a novel fuel from development through qualification to certification (approval) to assist new producers in understanding the process.

Who? The CAAFI R&D Team includes stakeholders from the commercial aviation and alternative fuels communities, including airlines, equipment manufacturers, fuel producers, government agencies, the military, environmental groups and academia.

Meeting Highlights

The R&D committee meeting was attended by a wide cross section of participants from industry, agriculture, academia, and government, allowing significant discussion and interaction among aviation fuels community stakeholders. The R&D Team reviewed and discussed the latest work in aviation alternative fuel development and communication tools for evaluating alternative fuels. The team evaluated the ongoing usefulness of the CAAFI R&D Team roadmaps, which indicate significant milestones in the development of feedstocks and conversion processes. The CAAFI R&D Team also heard a talk on the expansion of CAAFI's well-accepted tool, the Fuel Readiness Level, to encompass pass/fail criteria for each level, feedstock availability, and environmental due diligence. Collaborators from the U.S. Department of Agriculture (USDA) presented on the development of a Feedstock Readiness Level (FSRL) tool, a joint effort between CAAFI, FAA and USDA. The team also heard about relevant alternative fuels programs and funding opportunities at USDA, the Advanced Research Projects Agency – Energy (ARPA-E), The Defense Advanced Research Projects Agency (DARPA), and the Department of Energy (DOE). A summary of developments in the Department of Defense (DOD) was also provided by a representative of the Air Force Research Laboratory. The FAA provided a briefing on the Continuous Lower Energy, Emissions and Noise (CLEEN) program. In addition, the team received updates from the other CAAFI teams (environment, certification, and business). The group also heard about the communication needs and certification efforts of a variety of groups through panel

sessions and discussions. A poster session provided background on a number of companies' processes and projects.

The primary goal of the meeting was to identify key issues in the implementation of the FRL using the newly drafted pass/fail criteria, and to get feedback on the team's roadmapping efforts and their utility as well as the new FRL-related FSRL and environmental progressions.

Presentations

The CAAFI R&D Team would especially like to thank the following contributors and their organizations for their presentations during the meeting:

| Presenter | Organization | Topic |
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| Marty Bradley Mike Epstein Stephen Kramer | Boeing General Electric Pratt & Whitney | Opening and Closing Remarks, Goal Setting |
| Marty Bradley | Boeing | Roadmap Discussion |
| Kristin Lewis | Volpe National Transportation Systems Center (USDOT) | Fuel Readiness Level Expansion and Recent Developments |
| Harry Baumes Jeff Steiner | USDA Office of Chief Economist USDA Agricultural Research Service | Feedstock Readiness Level (FSRL) tool development |
| Chris Cassidy | USDA Rural Development | Programs and Funding Opportunities |
| Joanne Morello | USDOE | Biomass programs, goals, and funding opportunities. |
| Tim Edwards | Air Force Research Lab | Dept. of Defense Alternative Fuels Activities |
| Robert Mantz | DARPA | Current DARPA Projects and Activities |
| Eric Toone | ARPA-E | Current ARPA-E Projects and Activities |
| Mark Rumizen | FAA | Certification/Qualification Team update |
| Nancy Young (and Kristin Lewis) | Air Transport Association (and USDOT) | Environmental Team update |
| Hortencia Barton Richard Altman | Air Transport Association CAAFI Executive Director | Business Team Update and State Level CAAFI Efforts |
| Nathan Brown | FAA | CLEEN Update |
| Panel Presenters: Tim Edwards Joanne Morello John Gardner R.C. Knight Dan Robertson Kevin Weiss Amy Lyons Joanna Bauldreay Jack Lewnard Josh Taylor Marty Bradley Mike Epstein Stephen Kramer | Affiliation Air Force Research Laboratory Dept. Of Energy Washington State Univ. ISFuel Joule Unlimited Byogy Fla. Feedstock Growers Assoc. Shell Gas Technology Institute GEVO Boeing GE Pratt & Whitney | Panel Government Government University/Smaller Producer University/Smaller Producer University/Smaller Producer University/Smaller Producer Feedstock Producer Larger Producers Larger Producers Larger Producers OEMs OEMs OEMs |
| Poster Presenters: Fernando Garcia R.C. Knight Jeff McDaniel David L. Stanley Jap Kapat | Affiliation Amyris Integrated Synthetic Fuel Inc. Velocys Purdue University University of Central Florida | |

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| Deepak Dugar Felicia Spagnoli Edward N. Coppola Thomas M. Maloney Joanna Bauldreay Rochelle Bosy Michael Wright Shane Fleming Bill Vasden Kevin Weiss (2 posters) Josh Taylor | MIT Joule Unlimited Applied Research Assoc., Inc. Conn. Center for Advanced Tech. Shell Research Ltd. Gas Technology Institute US Navy-NAWCWD/Cobalt Tech. LanzaTech NZ, Ltd. Fla. Feedstock Growers Assoc. Byogy Renewables / ATJ Task Force GEVO | |
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Actions

- 1) The Team and CAAFI leadership will develop a briefing package that describes the path to certification/qualification of a new fuel for aviation use.
- 2) Investigate possibility of CRC involvement and support of roadmaps or other mechanism to fund dedicated person-hours.
- 3) In order to facilitate use of FRL and utility of CAAFI R&D team roadmaps, the CAAFI Team Leads will improve roadmap structure and make it more explicitly aligned with the FRL, as well as provide a standard set of milestones companies/organizations can use for their own milestone submission / FRL designation
- 4) FSRL will be incorporated into the Roadmaps.
- 5) Team feedback on FSRL and pass/fail criteria will be solicited again and incorporated.

About CAAFI

CAAFI's mission is to enhance energy security and environmental sustainability for aviation through alternative fuels. CAAFI is a forum that focuses the efforts of the U.S. commercial aviation supply chain to engage the emerging alternative fuels industry. It enables its diverse participants — representing all the leading stakeholders in the field of aviation — to build relationships, share and collect needed data, and motivate and focus research on aviation alternative fuels. See CAAFI Fact Sheet:

<http://www.caafi.org/about/brochure.html>