All Part 139 airports retain fire fighting personnel, equipment, and importantly, fire-extinguishing agents to put out aircraft fires safely and effectively. While airports’ most utilized agent, aqueous film-forming foam (AFFF), is a highly effective combatant to fuel fires, it has garnered increasing concern over potential environmental and health impacts of perfluoroalkyl and polyfluoroalkyl substances (PFAS), a group of chemicals found in AFFF concentrates used at airports (see reverse). FAA’s Reauthorization Act of 2018 called for the FAA to discontinue requirements for fluorinated AFFF use at Part 139 airports by October of 2021. To ensure alternatives are available for airport operators discontinuing use of AFFF after that date, the FAA is researching and testing eco-friendly formulas for potential airport use.

Recently, new foam formulas known as fluorine-free foams (FFFs) have shown potential to replace current AFFFs, but they have not yet been proven to possess equivalent fire-extinguishing capabilities—a disadvantage which could require additional capacity for foam and/or additional trucks and delay fire extinguishment, when every moment is precious. For these reasons, the FAA plans to evaluate FFFs and assess performance standards for FFFs use at airports.

In order to accomplish this research effort, ATR broke ground on a new research facility in November 2018 that will focus on live fire-testing for AFFF alternatives, as well as other aircraft rescue and fire fighting (ARFF) technologies. Construction of the ARFF Research Facility (ARFFRF) was completed in October 2019. This facility provides the capabilities to perform both military (FAA required) and International Civil Aviation Organization foam testing standards in an enclosed area. (See additional details about the ARFFRF on reverse.)
ATR’s custom-built Aircraft Rescue and Fire Fighting Research Facility (ARFFRF) will enable critical fire performance testing on alternatives to fluorinated aqueous film-forming foam (AFFF).

The laboratory will provide a controlled environment to ensure tests are repeatable and provide containment for any potential hazardous waste. Over 150 feet of 90 inch ductwork and a 180,000 cfm fan will ventilate the 50-feet wide x 50-feet long x 65-feet high building, which will sustain fires of two expected sizes, in alignment with MILSPEC and International Civil Aviation Organization (ICAO) protocol:

- ICAO Level C Fire – 78.8 ft.$^2$, 22.3 ft. flame height, 11.9 megawatt
- MIL-F-24385 Fire – 28.2 ft.$^2$, 24.3 ft. flame height, 10.2 megawatt

The enclosed fire-test facility will contain and collect the byproducts of fire-testing and prevent any release of such byproducts to the surrounding environment, allowing for more frequent and efficient testing. The ARFFRF is outfitted with a 15-megawatt hood calorimeter and numerous sensors to help researchers assess fire behavior during extinguishment. Sensors include color/thermal video, heat flux sensors, and weight platforms for measuring fuel burn rate and fire fighting agent use.

This ARFFRF is expected to become the heart of ATR’s Aircraft Rescue and Fire Fighting Facility, which houses other capabilities at the same location, including an outdoor open-burn area and a fire-hardened L1011 aircraft configured with three fire-testing chambers.

Visit the ATR Website at [www.airporttech.tc.faa.gov](http://www.airporttech.tc.faa.gov)

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**The trouble with fluorine**

Even after an aqueous film-forming foam (AFFF) has dissolved, it leaves behind a liquid layer or film. That layer coats the liquid pool surface and creates a barrier that suppresses and extinguishes a fire. It even prevents jet fuel from reigniting once a fire is out.

How does it work? The fluorine and hydrogen-based substances in AFFF reduce water-surface tension to allow for formation of its distinctive aqueous film. Unfortunately, the same chemicals that contribute to AFFF’s fire extinguishing performance also cause the agent to persist in the environment.

Perfluoroalkyl and polyfluoroalkyl substances, or PFAS, are the fluorinated substances found in AFFF. Two specific chemicals in this group, perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA), are of heightened concern because they are considered persistent and bio-accumulative by United States Environmental Protection Agency standards. Their high resistance to degradation is of concern for airports and their surrounding communities, where AFFFs are currently the only agents that meet federal fire-performance standards.