Aircraft fires are unlike most fires. Often occurring in tough-to-access areas such as aircraft engines and cargo holds, these fires typically involve spilled jet fuel and a variety of other material hazards.

The FAA prepares our nation’s airports for such events under ATR’s Aircraft Rescue and Fire Fighting (ARFF) program. This program focuses on industry standards and procedures for advanced tactics, innovative equipment, and effective fire fighting agents that increase post-crash fire survivability. Fire studies conducted here complement in-flight survival research performed nearby at the FAA’s Fire Safety Branch.

In order to test the performance characteristics of equipment and fire agents, scenarios including interior fires, exterior fires, and cargo fires are constructed using specialized vehicles and test apparatus at the ARFF Research Facility in Atlantic City, NJ.

Quickly identifying and safely accessing a fire’s source are crucial when it comes to defusing these emergency situations. Therefore, ATR works to investigate and inform on the ways in which today’s aircraft passenger loads, fuel stores, composite materials, and unique space configurations affect incident preparedness. Contemporary ARFF tools are also assessed for industry best practices. An evaluation of thermal imaging cameras and techniques, for example, offers improved heat source and passenger location in low-visibility conditions.

Proper use of the tactics and tools vetted under this program promotes a safer national aerospace system by literally saving the lives of passengers and crew and protecting their rescuers. ARFF operations across the U.S. and around the world look to guidance developed here as they strive to continually reduce the risks associated with fire rescue events.
A fleet of versatile test vehicles and an evolving Aircraft Rescue and Fire Fighting (ARFF) Research Facility give ATR the leading edge in discovering and testing new methodologies.

The FAA’s four fire trucks are utilized on and offsite in a variety of test scenarios. They hold 100 to 3,000 gallons of water, and those equipped use high reach extendable turrets to discharge water and foam at up to 1,200 gpm. The two larger vehicles attack interior fires directly by piercing aircraft with skin penetrating nozzles. The newest, a 6x6 Rosenbauer Panther, was acquired in 2016 specifically to test compressed air foam system (CAFS) functionality and performance.

Other program capabilities include an outdoor open burn area, as well as a fire-hardened L1011 aircraft which has been configured with three chambers for fire testing. Soon, a custom-built lab will house critical testing on alternatives to fluorinated aqueous film-forming foam (see side panel).

Currently under construction, the laboratory will provide a controlled environment to ensure tests are repeatable and provide containment for any potential hazardous waste. Throughout the structure, data acquisition systems will collect information using multi-gas analyzers, thermal cameras, and other instrumentation. Fires tested will be 6 ft. and 10 ft. in diameter, matching those cited under rigorous MILSPEC and International Civil Aviation Organization protocol for ARFF.

Large-scale fire tests take place offsite at Tyndall Air Force Base near Panama City, FL, through the FAA and U.S. Air Force’s long-standing interagency agreement. Tyndall is home to two 100-ft.-diameter fire pits and is one of the only large open-air fire burn facilities in the nation that can perform test fires involving up to 1,000 gallons of fuel.

Visit the ATR Website at www.airporttech.tc.faa.gov

Are FFFs the new AFFF?

Each airport must retain a certain amount of fire extinguishing agent at any given time. That agent, aqueous film-forming foam (AFFF), is a highly effective combatant to liquid pool fires.

AFFF are called “film-forming” because, even after the foam has dissolved, a watery layer remains, coating the liquid pool surface and creating a barrier that suppresses and extinguishes a fire. Fluorine and hydrogen-based substances reduce water surface tension to allow for formation of this aqueous foam.

In recent years, though, concern has grown around potential health and environmental impacts of certain fluorinated chemicals found in AFFF, PFAS. Two specific PFAS, PFOS and PFOA, are under study for their bio-accumulative, persistent, and toxic nature. A desire to phase out these chemicals led the FAA Reauthorization Act of 2018 to direct that, in three years, the FAA cease requiring fluorinated chemicals in AFFF in order to meet fire performance standards. This order begs the integration of sound alternatives so that ARFF operations can continue to effectively serve airports. Fluorine-free foam (FFF) formulas show potential to replace current AFFFS but are not yet proven to possess equal capabilities.

To that end, the FAA Office of Airport Safety and Standards has asked ATR to help evaluate FFFs and develop standards for their use at airports. First, ATR will identify commercially available FFFs and FFFs used in military and airport applications around the world by conducting a literature review. Next, chemical analysis will test compatibility among FFF candidates. Since ARFF departments may currently mix AFFF concentrates from different foam vendors with no adverse effect, incompatibility could mean strict adherence to a single manufacturer or risk of cross contamination. Finally, select concentrates will undergo fire extinguishment performance testing for comparison against fluorinated AFFF. Integration processes will be developed for FFF(s) that meet all performance requirements.