Fighting Fire with Fire

Air Force Research Laboratory personnel are starting fires and setting explosions at Tyndall Air Force Base — all in the name of providing innovative fire fighting technologies to the field.

by Jennifer Kiel
AFRL

FIRE

The countdown can be heard frequently on the test range at Tyndall Air Force Base, FL, where evaluating raging fires and explosions is all in a day's work for a small group of engineers, scientists and technicians whose mission is to find solutions to meet the needs of the wartime firefighter.

Air Force Research Laboratory's Fire Research Group conducts all aspects of fire research and development associated with aircraft and building fires, agent development, advanced fire detection and suppression, improved vehicle performance and individual firefighter capabilities.

These days, with the Air Force's transition to an expeditionary force and the current world situation driving new demands for fire fighting technology, they are busier than ever. The group's firefighters already extinguish more fires in one year on the test range than most would normally experience in a lifetime.

"Our goal," said Virgil Carr, team leader, "is to develop or identify improved suppression and mitigation agents and the specialized equipment and technologies required to counter new and evolving fire threats." This is no small task as developing weapons technology continues to increase in complexity, lethality and cost.

Innovative Fire Fighting Technology

Currently, efforts are underway to develop fire fighting apparatus that is light and air transportable, and more efficient than existing vehicles such as the P-19 or P-23. The result is the Combined Agent Fire Fighting System (CAFFS).

CAFFS is a lightweight, skid-mounted, dual-agent system for fighting hydrocarbon fuel fires. Transportable on any commercially available 1½-ton pickup truck, it delivers the same knockdown capability as a large crash rescue vehicle, but with significantly less weight, volume and cost.

"The secret to the effectiveness of the system is the use of dual-agent turret and handline nozzles that control and extinguish both pool and three-dimensional running fuel fires," said Jennifer Kalberer, fire protection engineer. The nozzle configuration allows the foam to triple the throw range of the dry chemical, enabling the dry chemical to provide exceptional knockdown. This allows the foam to quickly seal the surface area for complete extinguishment in a fraction of the time of a single agent nozzle.

Field evaluations of this unit are currently underway at forward operating locations in cooperation with Headquarters Pacific Air Forces. Other potential applications include tent city fire protection, hot pit refueling and chemical/biological decontamination. Eventually, the system will be demonstrated for remote robotic operation.

Another of the group's projects involves improving aircraft cargo container safety aboard military and civil aircraft, which is essential for safely transporting hazardous materials. Testing flame-resistant materials, installing fire suppression systems and constructing a new generation of cargo container are all part of the group's effort to find a solution to a potentially disastrous problem. The project shows such promise that AFRL has been approached by a major overnight shipping corporation to conduct mutually beneficial experiments to the military and private industry.

AFRL was also funded by the Defense Ammunition Logistics Agency to develop an Advanced Fire Protection Deluge System (AFPDS) designed to save lives at Army munitions production plants. The AFPDS controls deflagrations (intense, rapidly burning fires) occurring in munitions manufacturing accidents.

An AFRL firefighter tests equipment and agents in the fire pit (an outdoor live fire test facility) at Tyndall's Silver Flag Exercise Site. The Fire Research Group's firefighters extinguish more fires in one year on the test range than they would normally experience in a lifetime.

Firefighters test the Combined Agent Fire Fighting System, a lightweight, skid-mounted, dual-agent system for fighting hydrocarbon fuel fires. *(Photos courtesy AFRL)*

According to Steven Wells, project engineer, the AFPDS uses ultra-high speed detection and water suppression to detect and suppress a fire within 30 thousandths of a second. The system discharges cooling water at 180 feet per second, extinguishing the fire and leaving 98 percent of the munitions unburned while preventing human injury.

The success of this system has led to its installation in the commercial manufacturing world. Already, the AFPDS has saved personnel and equipment at a paint manufacturing plant when propane gas was ignited after leaking from an aerosol paint can. The facility was undamaged and able to continue normal operations.

Also under development is a new explosively driven extinguishing system for protection of large areas of munitions mixing operations and submunitions manufacturing. This system is designed to be more than twice as fast as the current AFPDS and represents a quantum leap forward in protection of munitions facilities.

Another recent innovation involved retrofitting some older generation fire trucks with an improved suspension system to decrease rollover potential. Loss of vehicle control and rollover has cost firefighters' lives, as well as lost time, injuries and hundreds of thousands of dollars in repair and replacement of vehicles. Working closely with industry leaders, Fire Research Group personnel designed, fabricated, installed and tested a compact, inexpensive suspension strut to augment current leaf spring suspension systems. This technical approach has proved successful and, in the future, may be specified in NFPA standards for installation on some new commercially available fire trucks.

Group personnel also perform fire fighting agent evaluations. Recently, the Environmental Protection Agency identified the key ingredient in one of DoD's most commonly used fire fighting agents, Aqueous Film Forming Foam (AFFF), as having a detrimental impact on the environment. The group's future efforts include a search for an extinguishing agent that is free of persistent, bioaccumulating and toxic chemicals, while maintaining the military specification for fire fighting performance.

Leading the Way

Many technologies developed at Tyndall are now used by firefighters not only at DoD installations but also at major airports across the United States. The group's personnel serve as consultants to the Air Force major commands, the Air Force Civil Engineer Support Agency, base civil engineers and non-Air Force agencies.

The ability to meet mission needs with the full array of unique fire research facilities and the flexibility to meet customers' needs enables AFRL to keep DoD in the lead of national and international aircraft crash/rescue fire research.

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Remote Location, Unique Facilities

Tyndall AFB is on Florida's Gulf Coast, an ideal location for conducting year-round outdoor research. Located on an 18-mile-long peninsula, the base provides remote space and ideal geography for outside hydrocarbon fuel fires and experiments requiring explosives.

The Department of Defense/Federal Aviation Administration large-scale fire test facility at Test Range I, on Silver Flag Exercise Site, boasts two outdoor 100-foot-diameter, Environmental Protection Agency-approved, closed-loop fire pits. This unique facility is the only one approved for *unrestricted* burning of hydrocarbon fuel. A 300-foot live fire burn pit is scheduled for installation next year.

Test Range II, known as Sky X (ten), hosts special facilities constructed for indoor fire and explosion testing. For example, the Energetic Materials Fire Building has a special hinged roof that allows explosive overpressure to escape outside, minimizing damage to inside equipment. This building also houses a 1,000-cubic-foot total flood facility for evaluation of highly toxic or potentially explosive fuels and oxidizers.

The Medium-Scale Fire Test Facility is an environmentally controlled hardened shelter for conducting up to 100-square-foot pool fire tests indoors, avoiding the effects of wind and rain. Tests conducted there include large-scale composite burn analysis of aircraft structural materials and evaluation of the Air Force C_2 CB (carbon dioxide chemical/biological) canister, which is part of the Joint Firefighter Integrated Response Ensemble (J-FIRE).