

Helping Protect Critical Military Assets through Sustainable Fire Protection Technology

In 1986, halon suppression agents – once familiar and trusted products used in clean agent fire suppression applications – were identified as contributing to ozone depletion, resulting in a swift and decisive firestorm of activity to protect the fragile ozone layer. The Montreal Protocol (1987) prompted stringent controls over halon discharges and eventually mandated the discontinuation of halon production.

However, the continued use of halon was not immediately banned or restricted. Instead, different countries addressed the situation independently, from planning for imminent bans to reserving the use of halon for critical applications. Such was the case with the United States Air Force (USAF), which retained the use of halons to protect critical military applications, but with the careful intention of eventually identifying a suitable agent to replace the use of halon.

For example, large and mobile USAF Jet Engine Noise Suppressor Test Facilities (known as hush houses) have been protected with Halon 1301 for decades. A hush house is a piece of military support equipment, resembling an aircraft hanger, that is designed for the purpose of testing aircraft engines in an enclosed environment. Hush houses are very large, mobile enclosures, typically 81 feet × 65 feet × 24 feet high (24.7 meters × 19.8 meters × 7.3 meters high) Quonset-style structures. These test facilities are strategic to maintaining peak operational efficiency of military aircraft.

In the mid-1990s, Halon 1301 was targeted for removal from all USAF hush houses, retained by the U.S. Department of Defense halon bank, and replaced by another agent if a suitable replacement could be found. This was mandated because of the environmental impacts associated with halon and the fact that hush houses were not considered as “mission critical” as compared with other Air Force operations.

In an effort to address this mandate, the USAF secured the services of Vital Link, Inc. (VLI) of Sealy, TX. In operation since 1990, VLI is an OEM specialty designer and supplier of aero engine test facilities, including hush houses and test cells. Members of VLI’s staff had been involved with the USAF hush house program since its inception in the early 1980s.

As such, VLI was well aware of both the USAF’s need to replace its halon systems and its attempts to identify a suitable replacement gaseous agent. VLI was also cognizant of the drawbacks of alternative systems such as high expansion foam, sprinklers or water mist.

Over a decade ago, VLI teamed with its long time subcontractor Hiller Systems, Inc. (Mobile, AL) to continuously survey the marketplace in search of a suitable halon replacement that would address the requirements of the USAF.

VLI and Hiller studied the clean extinguishing agent FK-5-1-12, commercially known as 3M™ Novec™ 1230 Fire Protection Fluid, when it first entered the market and determined that it was an ideal solution based on the following attributes and criteria:

- Novec 1230 fluid is a fast acting agent that can be effectively and uniformly deployed at all hush house locations. Essentially, it is an operational equivalent to halon in all critical areas.
- Novec 1230 fluid supports human life with a high NOAEL factor (No Observed Adverse Effect Level), does not contribute to ozone depletion and, unlike HFCs, is sustainable with regard to climate impact.
- Novec 1230 fluid is supplied in non-regulated, non-pressurized containers that can be stored and shipped globally in a liquid form, which makes its resupply more economical than high pressure clean agent alternatives which may have shipping restrictions.
- The cost of the system based on Novec 1230 fluid is cost-effective considering the value of the equipment, aircraft and engines.

In order to reach a consensus to accept Novec 1230 fluid as a suitable alternative to Halon 1301, stringent “live” discharge testing was required by the USAF to ensure that the system would operate as expected. It was also critical that the total area inside each hush house would be protected by the system.

The Support Equipment & Vehicles Division of the Agile Combat Support Directory at Robins AFB Georgia oversaw successful collaborative testing of the system manufactured by Siemens (Florham Park, NJ) using Novec 1230 fluid. This system was integrated



Jet Engine Noise Suppressor Test Facility (“hush house”) at the Air National Guard’s Dannelly Field in Montgomery, AL.



Concentration Test: 3M™ Novec™ 1230 Fire Protection Fluid is discharged in the Dannelly Field hush house.



Fire Performance Engine Test: Fuel flows from a jet engine nacelle mock-up and feeds a pool fire.

into the facility by Vital Link, Inc. in partnership with installer Hiller Systems. Witnessed approval testing was conducted in the spring of 2012 at two Alabama locations: 3M Decatur Fire Test Facility and the Air National Guard's Dannelly Field in Montgomery, AL.

Test Criteria

The test program was developed to evaluate the performance of a clean agent fire extinguishing system installed in a hush house enclosure with the most likely fire hazards. Due to the high asset value of the hush house and associated equipment within, it was not advisable to conduct full-scale fire tests. Therefore, the test program was split into two parts: fire performance testing to evaluate the agent performance, and concentration tests to evaluate the system within the hush house.

Fire Performance Test

The fire test work was conducted at 3M's Decatur AL fire test facility in an 18 feet × 18 feet × 18 feet high (5.5 meters × 5.5 meters × 5.5 meters high), clean agent total flood test enclosure. Defining the fire hazard fuel load and geometry was a critical first step in developing two fire scenarios: a fixed size jet fuel pool fire located under a simulated aircraft wing (pan test), and a dynamic flowing fuel configuration incorporating the geometry and elevation of a jet engine nacelle mock-up with a fuel spray and cascading fuel feeding a pool fire below (engine test).

Fire Test Results

Each fire test was successful and was replicated with similar results. All fires were extinguished completely

within the required 30 seconds of the end of discharge. Temperatures were monitored for 10 minutes following the tests confirming no re-flash occurred.

Concentration Test

Conducted in the hush house, the second portion of the test program was designed to evaluate the ability of the clean agent system to deliver the correct concentration within 10 seconds.

As a result, the full system discharge with concentration monitoring was successful with a system discharge time of 9.9 seconds; minimum design concentration was met and held for over 10 minutes.

Summary and Conclusions

After reviewing many possible Halon 1301 replacement solutions to protect the strategic USAF Jet Engine Noise Suppressor Test Facilities (hush houses) around the world, engineers at the USAF Support Equipment & Vehicles Division of the Aerospace Sustainment Directorate at Robins AFB Georgia selected an integrated system solution using 3M™ Novec™ 1230 Fire Protection Fluid. The selected system met the sustainable, long-term technology requirements of a highly-effective fire extinguishant – zero ozone depletion potential, a GWP of <1, the largest margin of safety among chemical clean agents for use in occupied spaces, and a reliable USA manufactured and supplied, commercial component that is available globally: 3M™ Novec™ 1230 Fire Protection Fluid.

The 3M™ Novec™ Brand Family

The Novec brand is the hallmark for a variety of proprietary 3M products. Although each has its own unique formula and performance properties, all Novec products are designed in common to address the need for safe, effective, sustainable solutions in industry-specific applications. These include precision and electronics cleaning, heat transfer, fire protection, protective coatings, immersion cooling, advanced insulation media replacement solutions and several specialty chemical applications.

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Electronics Materials Solutions Division

3M Center, Building 224-3N-11
St. Paul, MN 55144-1000
www.3M.com/novec1230fluid
1-800-251-8634

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