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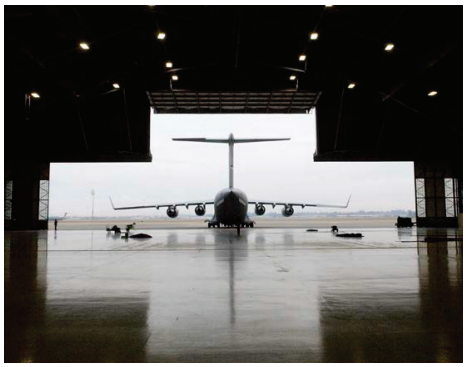
WHITE PAPER

Protecting aircraft in hangars: Five keys to successful fire detection and mitigation



High-performance systems that detect heat or flames and actuate fire suppression systems are essential to safeguard assets, hangar structures and human life.

Aircraft hangar fire detection and protection systems are critical to protect the contents of the hangar and the facility itself. A regional FBO hangar might price out at $150,000 and a commercial jet airliner hangar might be worth a few million dollars, while commercial or military aircraft can easily cost hundreds of millions of dollars.

Protecting these assets requires addressing a hangar's unique site challenges:

Large detection expanse and obstacles. Hangars are spacious rectangular buildings, and aircraft bodies and wings stretch out to create sizable obstructions.

Large hangar doors. Tall doors create variable conditions. When they're open, a detector's field of view (FOV) may include the runway and detect non-threatening flames that can potentially trigger false alarms—from sources like the afterburners of jets or auxiliary power units (APUs) in parked aircraft.

Radio-frequency interference (RFI). Hangars are also subject to RFI from avionics, ground-seeking airport radar and various communication devices, all of which can cause false fire alarm conditions to occur.

Hangars vary in size, type and number of aircraft they hold, and how they are equipped. Each hangar can be classified as belonging to one of four hangar group types, in compliance with NFPA 409 and the International Building Code, depending on construction, door height, building dimensions and the types of hazardous materials stored. This means that when it comes to fire detection and mitigation systems, one size does not fit all. Each system must take a facility's unique characteristics and requirements into account.

Following are five considerations essential to the planning, design and implementation of any aircraft hangar fire protection system:

1. Locating flame detectors

Big areas like hangars require comprehensive fire coverage, so a flame detector's range and FOV are critical. Generally speaking, the greater the detector range and FOV, the fewer devices you will need to achieve full coverage. However, there may be situations where the detector's area of coverage needs to be controlled to prevent it from picking up signals outside of hangar doors, such as the afterburners of jets that are taking flight or APUs from parked aircraft.



Optical flame detectors must be positioned so they have a view beneath the aircraft's wings and fuselage. Therefore, detector mounting heights are often dictated by the smallest aircraft stored in the hangar. It is equally

important, however, to consider possible movable obstructions such as toolboxes and ladders.

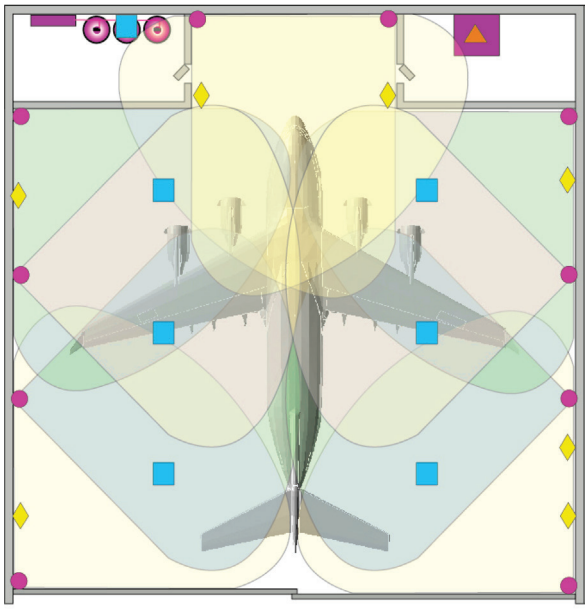
For this reason, wall-mounting flame detectors at a height of 8 to 12 feet (2.44 to 3.66 meters) is preferred over ceiling-mounting detectors. Areas where flammable solvents are used and stored are also typically monitored by gas, flame and smoke detectors.

To ensure compliance with NFPA 409, it is critical to use a performance-based design that adheres to the standards.

2. Rejecting false alarms

In order to reduce the probability of false alarms and unintended activations, it is imperative to use detectors that are highly resistant to false alarm sources, and also proven to be unaffected by electromagnetic interference (EMI) / RFI energy.

False alarms can result in the unwarranted deployment of a fire suppression material, such as aqueous film forming foam (AFFF). Foam deluge systems are designed to coat large aircraft very quickly and even fill an entire hangar. Under normal conditions, sensing an actual fire and extinguishing it are very good things. If a deluge is triggered by a false signal, it comes at a price. Significant costs are incurred to clean up and remove discharged foam, recharge the AFFF system and, in some cases, repair damages to the aircraft. For example, the cost to clean and repair an engine that has been doused with foam has been shown to be about one-half the cost of replacing it. (*Aircraft Hangar Fire Suppression System Design Study*, Naval Research Laboratory, Washington, DC, June 16, 2000).



A fire protection system with Det-Tronics X3301 Multispectrum Infrared Flame Detectors, notification appliances, and a Det-Tronics Eagle Quantum Premier® (EQP) Fire and Gas Safety Controller can, upon detection of a fire, automatically generate a signal to activate a fire suppression system.

3. Building in redundancy

Using multiple detectors to monitor the same area, in order to validate the detection of heat or flame, is a proven way to build in fire detection system redundancy.

Fail-safe plans should also include scrutiny of the cable runs that carry detector signals back to the point of control, and determine which of those should be redundant. Of course the system has to support redundancy as well. It must contain algorithms capable of handling voting circuits and making correct decisions given duplicate detectors and transmission paths.

4. Speeding detection and decision making

Automatic activation once heat or flame thresholds have been reached is a very effective way to speed detection and decision making. An aircraft fuselage skin can be damaged in as little as 45 seconds after initial contact with fire, so automatic activation can be critical for protection.

The time that it takes an activated suppression system to extinguish a fire depends on a number of factors and is quite variable, ranging from a few seconds to minutes. What does this mean for the accurate detection and activation sequence, and how quickly does it have to be carried out? The best answer is as quickly as possible, and obviously the less time spent here means more time available for suppression. A system that can receive and analyze data from multiple detectors, make error-free decisions and dispatch activation and alarm messages—in no more than 12 seconds—leaves over 30 seconds for the system to deluge the flame.

5. Integrating fire and gas detection and suppression

Any effective fire and gas detection and suppression system must be capable of interfacing with and integrating flame, gas and smoke detectors, fire suppression devices and notification appliances. The detection range of any given device that triggers the system to take notice should be configurable.

The system must be able to initiate audible and visual alarms and dispatch signals to start pumps, open deluge valves, close heating, ventilating and air conditioning dampers and notify authorities.

Conclusion

The five steps above cover the fundamentals for planning aircraft hangar fire protection. Determining the specific detector types, locations and mounting options for your site and building them into an effective fire protection system is a task for the experts. This is why it makes sense to work with professionals who have the experience and knowledge to deal with code requirements. Expect detection and/or suppression systems providers to step up with this kind of support.

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About Det-Tronics

Det-Tronics is a global leader in fire and gas safety systems, providing premium flame and gas detection and hazard mitigation systems for high-risk processes and industrial operations. The company designs, builds, tests and commissions SIL 2 Capable flame and gas safety products ranging from conventional panels to fault-tolerant, addressable systems that are globally certified. Det-Tronics is a part of Carrier, a leading global provider of innovative HVAC, refrigeration, fire, security and building automation technologies.

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