Aircraft Hangers – Safe and Sound Protection

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Hangers are getting larger, as are the aircraft they are designed and built to accommodate. Both the hanger structures and the aircraft are also becoming increasingly expensive to build, which is raising the stakes when it comes to hanger fire protection.

The Asia Pacific region is home to five of the world's busiest 20 airports; together, airports in Beijing, Hong Kong, Singapore, Sydney and Tokyo had just short of 270 million passenger movements in 2010. A number of airlines based in the region also operate the world's latest generation of "superjumbo" aircraft, including the largest passenger airliner in the world, the double-deck, wide-body, four-engine Airbus A380, which is operated in the region by Korean Air, Singapore Airlines and Quantas.

Many airports have had to modify and improve their facilities to accommodate aircraft of this gigantic size. The 525-seater Airbus A380 for example has a wing span of 79.75 metres, an overall length of 72.72 metres and a height of 24.09 metres. Compare this with the original giant of the skies, the Boeing 747-100B that has a wingspan a full 20 metres shorter. The result is that hangers have had to be built to house these giants at a growing number of international airports around the world. The largest is believed to be the Dubai Airwing Hangar at Dubai International Airport in the United Arab Emirates, which has eight sets of doors that are 26 metres high and span 570 metres – the length of almost six football pitches.

That being said, hangers vary greatly in size, construction and use, and these factors are important considerations when determining the fire protection requirements of the building and its contents. It is important to determine the type and number of aircraft that the hangar will accommodate, the mix of aircraft that are likely to be housed in the hangar at any one time, and how this might change as the airport develops and new aircraft come on stream.

It is particularly important to determine the type and scale of maintenance that will be performed on the aircraft in the hangar as this can vary from virtually no maintenance in hangers designed to solely protect aircraft from the elements, to complete overhaul of the aircraft. It is also worthwhile to bear in mind the timescale in which this maintenance takes place. From the airline's point of view it is essential that maintenance time is minimised to maximise the opportunity for the aircraft to fly with paying passengers or freight.

The Hanger Fire Risk

Due entirely to the nature of the contents of aircraft hangers they present very special and unique high-hazard fire protection challenges that require the maximum hazard mitigation. Aircraft such as the Airbus A380 cost in the region of US$ 375 million and have expensive electronics and large highly combustible fuel loads that demand fast and reliable suppression. Indeed, in the majority of cases, the aircraft are more valuable than the hangars in which they are accommodated.

It is though important to understand that the majority of hangers (other than those used solely for garaging aircraft) are sub-divided into a number of areas that may include some or all of the following:

- The hangar or aircraft storage area.
- Maintenance workshops.
- Warehouse and storage areas.
- Administration and supervision offices.
- Electrical and hydraulics utilities areas.

The generally held view is that the highest risk of a fire in a hangar occurs when an aircraft is undergoing either repair or maintenance, and when fuel is being stored or handled. While there are strict international protocols regarding fuel in an aircraft, it is impractical to remove all fuel before to moving it to a hangar, so the presence of flammable aviation fuel is a constant danger.

While hanger fires are, thankfully, rare they do nevertheless occur. In 2007 a fire in a maintenance hangar in Abu Dhabi completely destroyed a Qatar Airbus A300-600 aircraft. Two other aircraft were damaged, one being an Air Mauritius A319 that had been parked in the hangar next to the Qatar A300. A year earlier a fire at a Sabena Technics hangar at Brussels' national airport destroyed four aircraft including a Belgian armed forces Lockheed Martin C-130H Hercules and an Airbus A320. Temperatures in the hanger reached at least 100°C, buckling the all-metal structure and bringing down the roof.

Hanger Protection Foam

Foam has proven to be the most effective firefighting agent for hanger fires, and three key considerations need to be taken into account when devising the most effective and reliable solution. These are: the foam concentrate itself; the foam delivery system; and the siting of the delivery hardware.

Foam technology has developed apace in recent years and foam concentrates suitable for hanger protection are available from several companies, most notably the Swedish manufacturer, Skum, the Italian company, SaboFoam, Ansul and the Scandinavian supplier, Solberg, which was recently acquired by the USA-based Amerex Corporation. Well known and respected brand names include Towalex, Hydrex, and Ansulite.

Synthetic AFFF (Aqueous Film Forming Foam) concentrates have now been successfully installed in both civil and military aircraft hangars. These are water-based and have the ability to spread over the surface of hydrocarbon-based liquids. Alcohol-resistant aqueous film forming foams (AR-AFFF) are resistant to the action of alcohols and are able to form a protective film.

For these "enclosed" hanger applications, high-expansion foam is the ideal choice, owing to its use of the minimum amount of water. A characteristic of a high-expansion system is that the total amount of water required to extinguish a fire is, in relative terms, small, and so the total quantity of extinguishing media to be cleaned up after the fire has been extinguished is also minimised. The foam will, within minutes of its release, completely fill and engulf the area in which the fire has occurred, and so extinguish the blaze.

High-expansion foam can be put into two very broad categories: Class A foams and Class B foams. This is an important distinction, as a Class A foam is not designed to put out Class B fires. Class A foam is suitable for freely burning materials

such as wood, paper, textiles and other carbonaceous materials and, while it might extinguish a Class B flammable liquids fire, its use might lead to catastrophic results because of its inability to secure the liquid's explosive vapours. Class B fuels can be subdivided into two more subclasses: non-polar solvents such as aviation fuel that will not mix with water, and polar solvents that will mix with water.

In such applications as aircraft hangers, high-expansion foam has what is often called a "mass effect", isolating the entire fire area and extinguishing a fire in several ways. The water within the foam is turned into steam and contributes towards a rapid cooling of the fire; the steam also acts as an inerting agent and reduces the oxygen content of the air; the isolating characteristic of high-expansion foam prevents heat from spreading and setting other objects alight; and the foam also prevents flammable gases from spreading and igniting.

Foam Delivery

The majority of aircraft hangers are best protected using fixed foam firefighting monitors of either the oscillating type or fixed-nozzle type.

In brief, oscillating monitors, as the term implies, automatically oscillate from side to side when discharging foam onto the hangar floor. They are normally preset to swing back and forth over a given arc – typically at set sweeps of 30 degrees, 50 degrees, 70 degrees and 100 degrees – to provide a flow rate over a particular area, delivering a uniform foam blanket across the aircraft's fuselage, wings and the hangar floor area in the first sweep.

Fixed-nozzle monitors have nozzles that are, typically, mounted on a manifold or as single units approximately one-metre above the hangar floor. They have a preset angle of elevation and discharge pattern calculated to deliver the most effective stream pattern and range while ensuring that the stream is kept low enough to flow under the wings of any aircraft. This type of monitor system is frequently installed in hangers where aircraft or maintenance equipment in the hangar could interfere in the normal operation of the oscillating type monitor.

In essence, both of these types of monitors stand guard over a specific fire risk, hence the importance of ascertaining what type and size of aircraft are to be accommodated, where they will be positioned, and where maintenance fire risks are most likely to be located.

Monitors need to be robust, unerringly reliable and deliver their promised performance at a moment's notice. There are numerous manufactures of fire monitors with Skum and the Korean manufacturer, Shilla Fire, being among the most popular throughout the Asia Pacific region. Depending on the specification of the particular model, flow rates are available between 10,000 litres-a-minute and 20,000 litres-a-minute with maximum "throws" of more than 120 metres. Each system has its particular benefits and, in addition to the facility to preset the monitor's discharge, the leading equipment manufacturers' monitors incorporate either or both manual and remotely-controlled override. This enables the stream of foam to be re-directed with a manual rotation of 360 degrees and vertical elevation between minus 60 degrees and plus 90 degrees to enable it to be focused on a particular hot-spot.

Positioning Matters

Positioning of the fire monitors is absolutely critical and is something that may need to be under constant review. This need for persistent re-assessment is possibly less so in the case of purpose-built hangers for aircraft such as the Airbus A380, where there is unlikely to be a significant change to the position of the aircraft in the hanger or the location of particular fire risks.

However, if the hanger is used for a variety of different types and sizes of aircraft and if it is used for both fixed-wing aircraft and helicopters, maintenance work may be carried out in any number of different areas of the hanger, and the location of potential fuel leeks may vary greatly from one aircraft to another. There may also be a wide variation in fuselage and wing height with which to contend. Structural alterations to the hanger also have the potential to jeopardise the effectiveness of the firefighting if, for example, workshop or storage areas are enlarged or relocated.

So, all in all, hanger fire protection is not a simple matter, and the stakes are very high. It is certainly not a time to cut corners or take chances. As the fire in Abu Dhabi showed, if a fire is not tackled quickly and decisively, disaster is the inevitable outcome. APF

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