FIRE DETECTION IN AIRPORT TERMINALS AND HANGERS

In this article, Kevin Botha, Vesda Regional Sales Manager for Xtralis Middle East explores the shortcomings of commonly used fire detection techniques in airport environments and offers a tried and tested solution. Kevin has extensive experience in the design & application of Aspirating Smoke Detection systems

The Changing Role of Airports

Airports are not what they used to be. Drop an infrequent flyer into a modern terminal and they could be forgiven for thinking they are in the newest neighbourhood shopping mall. The days of empty, soulless terminals are thankfully past and passengers are now delighted by ultra-modern buildings with amenities such as business lounges, restaurants and retail outlets.

Business Continuity

Disruption to airport activities is costly to operators, airlines and their customers alike and the on-time movement of passengers, baggage, freight and aircraft are crucial to the financial wellbeing of a modern airport. Possibly the most dangerous and expensive kind of disruption is caused by fire and a tragic example is the 1996 outbreak at Düsseldorf in Germany which caused the loss of 17 lives and injury to 62 people. Financial and consequential losses understandably pale into insignificance in such a tragedy but it is worth noting that estimated losses have been put at between US $200-600 million.

Fire Detection Shortcomings

Unfortunately because modern fire detection technologies do not necessarily provide immediate, obvious benefit to airport operators and owners, and because designers and consultants prefer to stick to what they regard as "safer", more traditional solutions, new technologies can be slow to be adopted and it is only when "things go wrong" that owners will perhaps search for technically advanced solutions which will help to prevent re-occurrence. The generally accepted view seems to be that the standard detection technology deployed in today's airports is adequate to protect airport operators and their customers against loss due to fire. The spot or beam smoke or heat detectors we see scattered throughout terminal and operations buildings are surely good enough at performing this task. If a fire occurs the detectors will sense the smoke or heat and the fire alarm will sound. Or will it?

Conventional Smoke Detection Technology

Unfortunately all is not what it seems. Modern airport design has changed significantly. As previously observed, airports are now more akin to shopping malls, often featuring very large open areas and atrias. It is not commonly understood that smoke from even a moderate sized fire in such large open areas is extremely difficult to detect. The conventional fire detection technology we are familiar with requires a certain concentration of smoke to be reached inside the detection chamber before it declares an alarm – typically around 2% to 4% obscuration as measured over one linear metre (expressed as 2-4% obs/m). These technologies rely on the standardised theory that if we install enough detectors at intervals governed by local or international standards, at least one of them should "see" sufficient smoke to declare an alarm. However, we know that smoke is almost always affected by incidental air movement, driving it away from detectors, or that it loses buoyancy as it cools or is affected by warmer thermal air layers at high level within the building. The result is that conventional detection systems generally only see enough smoke to declare an alarm once a fire is already well advanced, perhaps into its flaming stage and we could even conclude that airport customers are likely to detect the fire before the authorities, causing confusion and possible panic not to mention the cost of disruption to the airport and airlines. In fact, research shows that conventional detection sensitivity provides only a 20% certainty of

detection*. Similar shortcomings also exist in "behind the scenes" areas such as baggage handling, hangars, technical areas warehouses and electronic data processing areas. Smoke is difficult to detect in all these areas either because they feature large voids or because it is quickly diluted or removed by air conditioning systems. Clearly a better, earlier method of fire detection is needed.

Aspirating Smoke Detection

A technology widely accepted in many historic buildings, shopping malls, warehouses and computer rooms is VESDA (Very Early Smoke Detection Apparatus). VESDA is an active ASD (Aspirating Smoke Detection) system which works by continually drawing air from small orifices in a network of sampling pipes located throughout the building into a highly sensitive, flexible detector. The advantages of modern ASD systems, when applied in an airport environment are numerous and significant:

Advanced ASD systems allow operators to make intelligent decisions about how to react to potential fire situation. Advanced systems use laser technology to provide a very wide sensitivity band, typically ranging from 0.025% obs/m to 20% obs/m from a single detector. Advanced ASD systems continually report the density of smoke in the area, in obscuration per metre and are capable of detecting at the very earliest, incipient stage through the smouldering and flaming stages to the final heat stages of a fire. Advanced ASD systems provide multiple, staged alarms: For example, a 1st stage pre-alarm (Alert) accompanied by very slow growth observed smoke trend in an Electronic Data Processing area may only require investigation by a competent technician capable of changing a faulty, overheating power supply or printed circuit board. On the other hand a fast growing smoke trend accompanied by 3 stages of alarm (Alert, Action, Fire 1) in an airport terminal or baggage handling area would indicate that a serious danger exists and that firefighting measures should be deployed immediately.

ASD systems are inherently good at detecting smoke in large open areas which has been diluted by air movement, volume and thermal layering. Because a single ASD detector typically covers a large area up to 2000 sq. metres, highly diluted smoke can enter many sample holes and is effectively "gathered" by the sampling network into the central, highly sensitive laser detector.

Advanced ASD systems provide low cost of ownership. Maintenance is conducted at a convenient detector location and there is no need for workers to enter the protected area. Further, advanced ASD systems require no cleaning or maintenance of the laser detection element itself but feature advanced air handling and methods and filtration to protect the detector against contamination.

Solutions based on advanced ASD technology provide verifiable fire detection performance further enhanced by using a performance based design approach. Sample pipe and orifices are installed in locations where smoke is likely to travel but at the same time provide compliance with international codes and standards such as BS 5839, 6266 or NFPA72 or 76. Installed systems can and should be tested and documented using recognised fire simulation tests to prove their performance. The tests set a benchmark for the facility, are repeatable and can be conducted annually to ensure a minimum level of continued protection.

Advanced ASD systems provide repeatable, reliable detection, achieved by ensuring that electrical and optical components inside the detector are not exposed to airborne contaminants which could in turn result in the detector altering its sensitivity and performance over the medium or even short term.

Installed ASD systems are aesthetically pleasing and sample pipes can be concealed in voids or installed in such a way that the detection is almost invisible to the human eye.

Tried and Tested Technology - But Choose Carefully

Advanced ASD systems feature a wide, adjustable sensitivity range and are widely used by major blue chip clients. For example, in the airport industry they are installed in the new Dubai Terminal 3 baggage handling facilities, London Heathrow Terminal 4 and the new London Heathrow Terminal 5 baggage handling areas, Chep Lap Kok airport passenger terminal Hong Kong, Emirates hangars technical galleries Dubai, and Amiri flight hangars in Qatar, to name just a few.

A Word of Caution....

Not all ASD systems have the technology or ability to provide the benefits highlighted in this article. Most ASD systems are sensitive to smoke within a very limited range (either very sensitive or very insensitive or somewhere in between) and are unable to be easily set up to meet a clients particular requirements. Other systems do not maintain their sensitivity to smoke (repeatability) over the longer term due to contamination of optical and electrical components.

Detector sensitivity and performance claims should be verified by reviewing testing and certification to European Norm EN54-20 – a standard written specifically for ASD systems. Application limits should be carefully understood: how many sample holes can be installed on the selected product but still maintain Very Early Warning (Class A), Early Warning (Class B) or Standard Warning (Class C) approval to EN54-20? Manufacturers should clearly and openly state these limitations. Any designs and calculations should clearly show the level of compliance achieved with respect to sensitivity classes, preferably by using approved modelling software such as ASPIRE2

Conclusion

While the potential benefits are clear and desirable, the user or consultant should specify very clearly their need to achieve these benefits and vendors should be asked to demonstrate and verify how their proposed product and design will achieve them. Without these needs being clearly specified and complied with, the result could easily be a well designed system with good intent but poor lifetime performance due to poor choice of product. Verification via third party approvals such as UL, BS and preferably EN54-20 on all products on offer, careful review and understanding of the operating methodology of the detector and follow up with careful specification will ensure that these life and revenue saving benefits are readily achievable with Aspirating Smoke Detection systems. ■

**Geiman J.A., and Gottuk D.T., "Alarm Thresholds for Smoke Detector Modelling", Fire Safety Science Proceedings of the Seventh International Symposium, 2002, pp197-208*

XTRALIS VESDA HELPS PROTECT DUBAI AIRPORT'S TERMINAL 3 BAGGAGE HALLS

Dubai International Airport operated by the Department of Civil Aviation, is the busiest airport in the Middle East serving 40 million passengers per year and 120 airlines to over 205 destinations. Dubai's new Terminal 3 houses one of the most advanced baggage handling systems in the world, containing over 50 kilometres of baggage conveyer spread over a 160,000 square metre terminal with several levels 40 metres in height.

The effective handling of baggage is critical to the continued operation of the terminal and DCA needed an early warning smoke detection system to protect people, luggage as well as the building and its inventory.

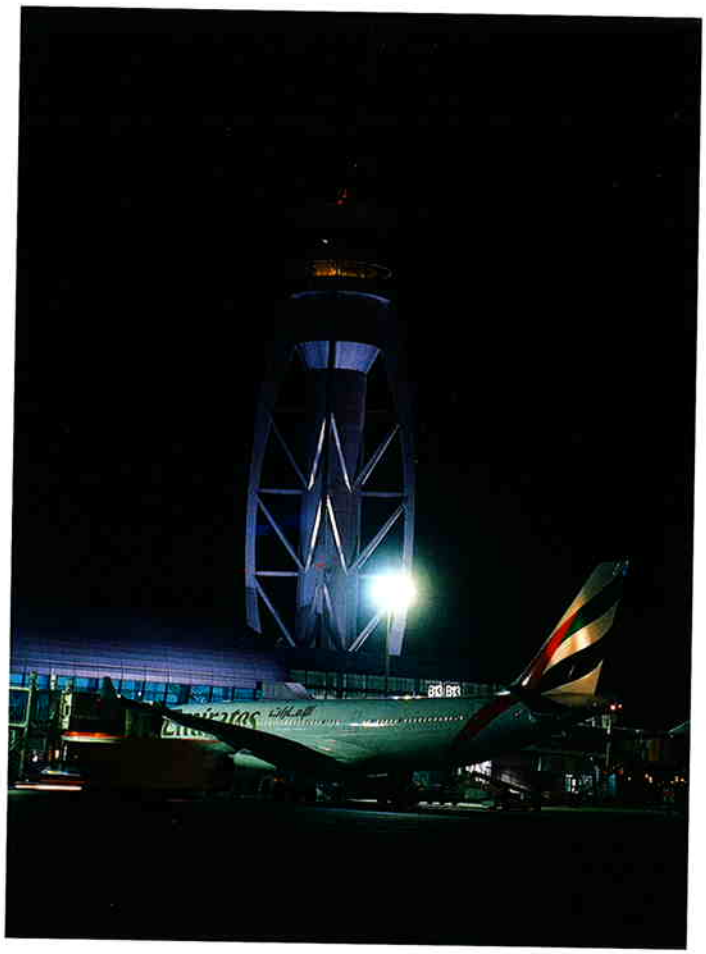
DCA worked with Juma Al Majid, Project Managers, to conduct a detailed study through Tyco Fire & Security UAE, to determine that the EN54-20 and FIA approved Xtralis VESDA Aspirating Smoke Detection (ASD) system was the best fit for the job.

Craig Nixon, Business Development Manager, Tyco LLC commented: "Smoke generated from a small fire in the baggage handling area would be difficult to detect by more conventional methods such as point or beam detection systems, further complicated by the fact that the area is densely packed with equipment which impedes smoke migration and makes maintenance of more conventional detection systems complicated and costly.

Xtralis VESDA is capable of detecting low levels of highly diluted smoke in the space by constantly sampling air for smoke particles via a network of sample pipes distributed in the area. VESDA's proven early detection capability means a small fire can be easily detected before it develops into a potentially major incident which could cause downtime and costly disruption to the running of the terminal and its passengers."

Another key advantage of using an Early Warning ASD system like Xtralis VESDA is its use of flexible, multiple alarm levels ensuring time to investigate alarms and make decisions, minimising false alarms. This feature reduces the risk of unwanted release of sprinkler or suppression systems, or indeed the unwanted evacuation of the terminal.

Mr Nizar Ebrahim, Project Manager at Juma Al Majid comments: "Xtralis VESDA is an ideal solution to protect this critical area, as the VESDA pipework can be placed where the smoke is most likely to travel. VESDA has the great advantage in that the detectors can be installed at an easily accessible location, making it possible to conduct maintenance without the need to disrupt the running of the airport."



DCA has the peace of mind knowing that VESDA will provide the earliest warning of a potential fire, minimise risk of disruption, reduce false alarms and allow easy maintenance access.

Mr Nizar Ebrahim adds: "We are proud to have installed a VESDA ASD system in full compliance with NFPA 72. The successful Class C/B smoke tests conducted on site prove that Xtralis Vesda is a natural choice for the protection of Dubai Airport Terminal 3."

Khaleel Rehman, Regional Sales Executive for Xtralis VESDA comments: "We are happy that VESDA is providing Dubai Airport Terminal 3 with superior smoke detection helping to ensure smooth transit of both travellers and baggage through the terminal. We hope that this installation will set an example for other building owners and fire installers looking to protect large open public spaces such as airports and train terminals. ■