Airport Cities article
Fire Detection in Airports

This article explores the shortcomings of commonly used fire detection techniques in airport environments and offers a tried and tested solution.

Preamble:
Airports are not what they used to be. Drop an infrequent flyer into the centre of 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.

Caption: “Shopping Mall or Airport?”
Business continuity:
Disruption to airport activities cannot be tolerated 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 sad example is Düsseldorf airport when 17 people lost their lives and 62 were injured in 1996. 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 conventional 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?

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 atria’s. It is not commonly understood that smoke from even a moderate sized fire in such a large open area 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 passengers are more 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. 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.

![An Aspirating Smoke Detector (ASD)](image)

*Caption: “An Aspirating Smoke Detector (ASD)”*

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 1\textsuperscript{st} stage 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 would indicate that a serious danger exists and that fire fighting measures should be deployed immediately.
ASD systems are inherently good at detecting smoke in large open areas, diluted by air movement, volume and thermal layering. Because a single ASD detector typically covers a large area up to 2000 m², highly diluted smoke can enter many sample holes and is effectively “gathered” by the sampling network into the central, highly sensitive detector.

Caption: “Smoke dilution in an aircraft hangar”
• Advanced ASD systems feature very low cost of ownership. Maintenance is be conducted at the 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 of 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. Installed systems are 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 smoke 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. In the airport industry they are for example installed in Heathrow Terminal 4 and the new Terminal 5 baggage handling areas, Chep Lap Kok airport passenger terminal Hong Kong, Emirates Hangars Technical galleries Dubai and Amiri flight hangars Qatar to name just a few.

However, a word of caution... Not all ASD systems feature the technology required to provide the benefits listed in this article. In fact 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.

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 technology will achieve them. Without these needs being clearly specified, the result could easily be a well designed system with good intent but poor lifetime performance due to poor choice of product.

Further verification via 3rd party approvals such as LPCB, UL or FM 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.

Notes about the author
Kevin Botha is VESDA Regional Sales Manager for Vision Fire & Security Middle East and has extensive experience in the design and application of Aspirating Smoke Detection systems.
Vision Fire & Security is represented in the UAE by Tyco Fire & Security.