Engine Room Fires: Intelligent fire detection

Interview with Rick Jeffress, Business Development Director at Fike Corporation.

Lube oil or fuel oil mist spraying on to hot surfaces and then igniting – it's one of the main causes of engine room fires, and the costs can be enormous.

The Swedish Club's analysis has shown that the frequency of engine room fires may be lower than other H&M claims, but the average cost of such fires is among the highest. According to recent analysis, the cost of an engine room fire averages out at USD 1.8 million per occurrence, compared with USD 320,000 for H&M claims in general.

And who can forget the headlines seven years ago when the Carnival Triumph lost power because of an engine room fire caused by a leak in a fuel oil line, leaving the ship and thousands of passengers drifting in the Gulf of Mexico for five days?

Classification societies and the International Maritime Organization (IMO) are responding to the issues. Last year DNV GL added a new class notation to its Rules on Equipment and Design Features – Fire Prevention in Machinery Spaces.

"This notation requires CCTV cameras covering critical oil leakage points and recommends a proven technology for rapid atmospheric oil mist detection using video analytics," says Rick Jeffress, Business Development Director at Fike Corporation.

As The Swedish Club frequently points out and Jeffress repeats: engine rooms have all the ingredients for a fire, in terms of oxygen, heat and flammable liquids under pressure.

"Oil mist leaks can take place on fuel or hydraulic flexible lines, piping or equipment connections, creating a spray or mist. They can also occur inside engines and release into the space as a fine mist or fog," he says. "Detecting oil mist in machinery spaces using fixed-point gas detectors is difficult due to the numerous locations where leaks can occur and airflow direction can vary depending on engines running, ventilation

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Oil mist is formed in one of two ways, – minute leaks in oil lines which under pressure give off very fine atomised spray, or when oil hits a hot surface and boils, creating a mist.

He says that their own monitoring shows that engine room fires or potential incidents are a common occurrence. Owners are taking measures to identify hotspots and this helps to avoid explosion and fire in the event of an oil leak. "We are seeing proactive companies covering hot equipment and working to reduce areas where there could be a leak, by doubling the walls of piping and using different types of connectors, for example. We are not seeing any increase in incidents but we are not seeing a decrease either – perhaps reflecting the increase in older ships, with older equipment."

Detecting oil mist

Following costly high-profile oil mist fires such as that on board the Carnival Triumph, major cruise lines began to evaluate video analytics oil mist detection technology in 2013, he says. "Extensive onboard assessment and testing, on several ships, was conducted over two years – resulting in software modifications and upgrades to meet the demands of the shipboard engine room environment and consistently recognise the specific oil mist visual signatures," says Jeffress.

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Machinery spaces and low ceilings make engine room monitoring extremely challenging. "Also, there are people walking close to the cameras, so there is a high potential for false alarms," he says. "We have addressed this issue by adding human recognition to the oil mist and a smoke algorithm as well as other setting options for this environment."

Reduced manning is an issue as personnel will likely not be in the space to notice the event and mist can be light or near invisible to the eye. Unmanned engine rooms on many ships will have cameras and conventional smoke and fire detectors, but what happens if there is an event? Without analytics software, the crew must take the extra time to find the correct camera based on the location of the event.

Video analytics software automatically annunciates an alarm, with location information, and live video of the detection, allowing shipboard personnel to quickly and easily evaluate the incident. Live video of the event, accessed quickly, can increase response time and decrease potential fire damage and/or personnel injuries.

Specialist video analytics

The company has responded to the challenge with a solution that combines

shipboard camera networks with its video analytics. This, says the company, creates a highly efficient means for rapidly detecting oil mist. The system can be linked to automation and safety management systems that automatically alert shipboard personnel with alarm and pop-up video of the event as it is happening. This allows critical time to take action before disaster occurs.

The system is designed to provide early detection of oil mist, smoke, flame as well as reflected flame – the latter being particularly important to supplement existing flame detectors around fuel systems.

Artificial intelligence

The video analytics software, installed in onboard servers that are connected to the CCTV camera network, was developed with artificial intelligence and sophisticated machine learning algorithms; it monitors the light level, colour changes and other signatures across all pixels in the field of view of the cameras.

The video is analysed at a rate of 15 frames per second by the software for signatures of smoke and oil mist, flame and reflected flame. If, after very brief tracking, a detection is confirmed, a signal is sent to

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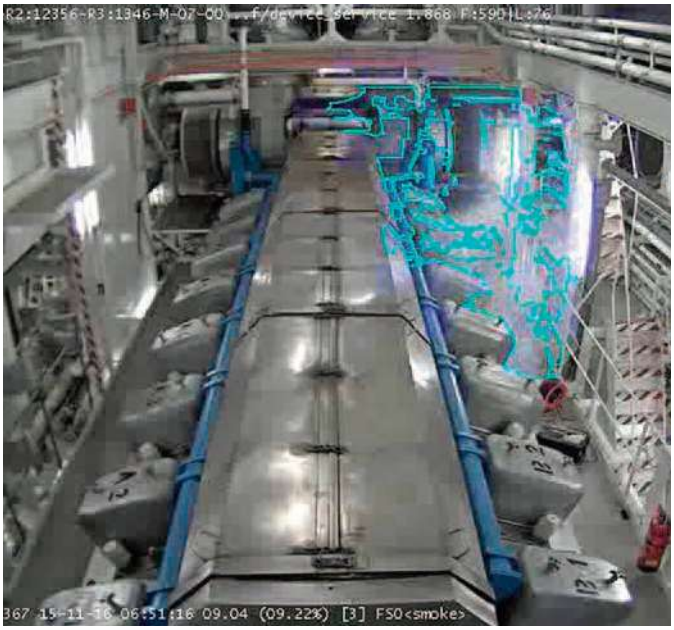

Blue shadow indicates oil mist.

"Standard flame detectors monitoring engine and fuel modules receive energy directly from the flame in order to raise the alarm and any obstruction would prevent them from receiving that energy," explains Jeffress.

A key point is that a video analytics system makes use of video cameras that are already installed. "We aim to use 'off-the-shelf' cameras and make the most of their functionality," says Jeffress. "Ships have numerous cameras and there is a lot you can do with them. In airports, for example, security camera algorithms will detect if someone puts down a bag and walks away, setting off an alarm automatically. This is reducing the load on personnel to physically monitor cameras 'in case' there is an event."

the monitoring equipment and an alarm is set off. "Live video from the relevant camera is displayed on a computer monitor or large screen, and this includes analytics overlay as well as an indication of the type of event, location and time at the bottom of the screen," says Jeffress.

The analytics server provides enough storage for 35 days of full-time video recording. The software tracks date, time and duration of the event to allow for event identification, post-event video viewing and download.

Rapid installation

Installation is often done during a one-day port visit – including server installation, alarm integration with the engine automation system (or other monitoring systems), camera programming, detection settings configuration, testing and crew training. System programming of detection settings is carried out by technicians with knowledge of the shipboard machinery space environment. Remote connection is also possible if configured and managed by the ship owner's IT staff.

Jeffress says: "We ran pilot systems on multiple ships for more than two years, to develop our solution and refine the algorithms. We have added proprietary analytics and interface capabilities to simplify the actions by the crew and added features to disable the system easily during work in machinery spaces, with automatic turn-on when the work is complete."