

PROTECTION OF AIRCRAFT HANGARS BY WATER MIST SYSTEMS BASED ON FULL-SCALE FIRE TESTS

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BIO:

Bogdan Racięga has got 15 years' experience in industrial projects, last 10 years working with fire suppression systems starting from fire protection systems on Oil & Gas industry drilling rigs thru cruise vessels, yachts, and land-based systems as last area of carrier development. His current work has primarily focussed on fire testing of water mist systems & sprinkler systems in full scale fire tests but not limited to, with different fire extinguishing agents such foam systems, clean agent and aerosol systems fire test as well. He is involved in the research and development of new fire test protocols for water mist systems and currently is fire laboratory director at Baltic Fire Laboratory. Bogdan is also the IWMA representative for the European Commission / Expert Group on Marine safety. He is a member of various international water mist guideline working groups for marine & land-based systems e.g., IMO, CEN 14972, CEN 17450, CEN 12845.

Abstract

Current needs for the protection of aircraft hangars require innovative, ecofriendly, and safe solutions which are in line with current legislative changes related to current extinguishing / suppression agents. Most of hangars currently has installed high expansion foams system which start to be banned due to difficulties in evacuation from in case of system release and current foam bans as some of them including fluorine ingredients that have a long-term impact on health.

Increased number of aircraft hangar accidents with false alarms and high expansion foam system leads to fire casualties such as the 2022 Clinton County Airport accident in the United States where one death was reported (airport hangar worker) and eight firefighters were injured due to a false high expansion foam system causing the system to discharge in a not evacuated hangar on time.

For about 20 years, water mist systems have been installed in military hangars in Scandinavia based on the results of fire test protocols for total flooding IMO MSC/Circ.1165 and local applications IMO MSC/Circ.913 water mist systems as case-by-case solution approved by AHJ.

Due to the current needs of the market, the Baltic Fire Laboratory, together with a team of fire protection consultants, the owner of a newly built hangar in Switzerland, a hangar team, an aircraft manufacturer, and a hangar insurance company, developed together fir test protocol for protection of hangar area with use of water mist technology.

The fire test scenarios are intended to reflect the possible fire scenarios that in the hangar could cause such pool fires with maximum fuel spillage, the area under the aircraft fuel tanks, spray fires at aircraft engine area simulates a failure based on aircraft manufacturer FMEA analysis.

BFL laboratory built a full-size aircraft with dimensions of 12 x 12 x 6 [m] and conducted a full-scale fire test with the designed maximum fire load of 14 [MW] in laboratory hall size of 9500 m³ simulating zoned deluge system. Different fire scenarios were simulated with ceiling nozzles and pop-up nozzles (floor nozzles) at the same time, ceiling nozzles only, pop-up nozzles only with scrubber system on/off (laboratory ventilation system). The data acquisition system recorded various parameters during the fire test, such as ceiling temperature, thermocouple trees, temperature in zones shielded and unshielded by the water mist system, and oxygen levels.

The water mist system is an ideal system to protect the hangar areas with pure water as the fire suppression agent, which is safe for the hangar crew, moreover, water does not cause damage to the avionics, which is one of the greatest advantages over foam systems which cause damage to aircraft which were not involved in the fire in the hangar area. Post-fire damage in case of water mist system release on associated aircraft does not create total damage on associated aircraft as in case of foam systems which is for Insurance & hangar Owner the most attractive solution to use water mist system.

KEYWORDS: water mist systems, aircraft hangar, hangar protection, pool fire, spray fire, structure protection, cooling effect, pop-up nozzles, ceiling nozzles.