THE NINTH TRIENNIAL INTERNATIONAL AIRCRAFT FIRE AND CABIN SAFETY RESEARCH CONFERENCE

Authors: Adam Chattaway, Terry Simpson

Halon Replacement Session

Abstract

The search for acceptable replacements for Halon 1301 for cargo compartments has been on-gong for two decades. Various replacement fire suppression agents have been proposed and evaluated but none have been found to be acceptable and put forward for certification. In 2004 the candidate agent 2-bromo-3,3,3-trifluoropropene (2-BTP) was shown to enhance combustion in the exploding aerosol can test [1]. Similar behaviour was observed with HFC-125 and the fluoroketone Novec 1230 [1]. This effectively eliminated two widely used classes of suppressants in ground based suppression applications. An analytical analysis was carried out to model this behaviour, led by NIST [2].

In 2014 Kidde proposed a test method to "screen" agents rapidly and at low cost [3]. This method examined the performance of candidate agents at sub-inert concentrations again very lean propane-air explosions, just above the lower explosive limit (LEL). Testing with HFC-125 and Novec 1230 closely mirrored these agents' behaviour in the full scale aerosol can test. It was concluded that when used at sub-inerting concentrations and at lean propane-air mixtures the agents were exhibiting "fuel-like" behaviour.

More recently Kidde has been investigating blends of agents as possible cargo compartment halon replacements. The first step in evaluating these blends was to screen them against the propane inerting test.

Blends of CF_3I and HFC-125, CF_3I and Novec 1230 and CF_3I and HCFO-1233zdE were tested. For each blend the minimum quantity of CF_3I to render the blend "non-flammable" was determined. This gives interesting insights into the extent of the fuel-like behaviour of some of these less stable suppressants.

Having define several blends it is then possible to draw up trade tables of weight and volume efficiency compared with halon 1301 and other agents.

References

[1] "Behaviour of Bromotrifluoropropene and Pentafluoroethane When Subjected to a Simulated Aerosol Can Explosion", John W. Reinhardt, DOT/FAA/AR-TN04/4 (May 2004) https://www.fire.tc.faa.gov/pdf/TN04-4.pdf

[2] "Thermodynamic Analysis of Suppressant-Enhanced Overpressure in the FAA Aerosol Can Simulator", Gregory Linteris et al., Fire Safety Science-Proceedings of the Tenth International Symposium, pp. 307-320.

[3] "Halon alternatives for aviation Behaviour of fluorinated compounds at sub-inert concentrations in explosion suppression" Josephine Gatsonides and Adam Chattaway at the International Aircraft Systems Fire Protection Working Group Meeting, Bremen, Germany, May 14-15, 2014. https://www.fire.tc.faa.gov/pdf/systems/May14Meeting/Gatsonides-0514-HalonAlt.pdf