

International Aircraft Systems Fire Protection Working Group Meeting

Hosted by Air Liquide/DTA

June 21-22, 2004

MONDAY, JUNE 21, 2004

Handheld Extinguisher Guidelines - R. Hill

The MPS was written for the replacement of the halon 1211 extinguishers that are required by regulation. The MPS deals with how to get a replacement agent to meet the halon 1211 equivalent (for the required halon 1211 extinguishers). The toxicity issue is very complex. Dick suggested that this Task Group concentrate on the new agents as to what advice to give people on toxicity of these agents (Via an Advisory Circular). Howard Hamel explained that the numbers for the toxicity of 1211 have not changed, but some members of this group want to look at the numbers differently. This is really complicating things. Some members of this group want to do total mixing. Not all group members are in agreement on this. Brad Colton provided some additional background about this Task Group's discussions relating to the old guidelines vs. the development of new guidelines. Dick will talk to Louise Speitel about obtaining some additional information on stratification numbers for the aircraft cabin. Felix Stoessel mentioned the requirements for extinguishing a cockpit fire and questioned why a similar requirement could not be established for fighting cabin fires. Dick mentioned that he would discuss the methods for fighting cabin fires later in the meeting during the discussion of the development of a new In-flight Fire Training Video. Brad mentioned the group's discussion of hoses vs. fixed nozzles. Bob Glaser provided background on why United was a proponent of hoses for the cabin extinguisher. What is the background of where 2B extinguishers are allowed? Brad mentioned Louise has included that 2B are allowed in aircraft that are 90 cubic feet or smaller. Dick recommended that the Task Group continue this discussion during this afternoon's Task Group meeting. Claude Lewis asked for the status of a policy letter that was to be written by the FAA NWM Region office to go to the FAA Certification Offices describing the use of the Handheld MPS to show equivalency to Halon 1211 (ref: October 2002, IAFPWG Minutes, Page 3). Dick said to follow-up with Steve Happenny at the FAA NWM Region Office.

Cargo Fire Detection Update - D. Blake

Update on service difficulty reports (SDRs) since the 2000 report was published. The jump Dave was expected did not show up. There are a lot more airplanes with detection systems now than there were when the 2000 report was produced, but the data from the SDRs shows less reported false alarms. Russell Stark asked to get a copy of the raw data Dave used. The updated report does not have regional vs. large transports, but this information can be obtained.

False Alarm Source Testing - D. Blake

Arizona Test Dust A2 is used in this test program. The FAATC will be continuing this test program in July 2004.

Flaming Resin Block - D. Blake

Dave updated the group on the testing he has conducted at the FAATC. He explained what the ceiling mounted smoke meter read as compared to what the smoke detector activity. There was

no smoke detector activation. He then ran two tests using smoke generators. A diagram of the ventilation system in the test article was displayed to explain why the smoke reaching the ceiling area is so diffuse (photograph). The present status was explained. Typical smoke detectors presently in use respond very differently to liquid particles from smoldering fire or artificial smoke generators than they do to smoke from flaming fires.

Sandia CFD Model Development Update - D. Blake

The first version of the code is set to be released for the initial tester evaluation in September 2004. Initial discussions have begun on the method for the public release of the code.

Future Work - D. Blake

- Continue main deck smoke testing.
 - Develop "dry ice" false alarm scenario. Test new detectors to false alarm sources.
 - Continue testing to support CFD model validation.
 - Attempt to identify a "smoke" source with appropriate particle size and optical properties. Combine gas species of interest to the smoke source and recommend settings/generation rates appropriate for detector certification tests in various cargo compartments. This would be for inclusion in an advisory circular. Working Group members asked to provide information on the smoke sources they would use in certification testing.
- This presentation is available on the FAATC Fire Safety website.

Aerosol Can Explosion Testing - D. Blake (for J. Reinhardt)

- 2-BTP was selected by members of this Working Group as a possible candidate to replace Halon 1301 as an extinguishing agent for cargo compartments.
 - The ODP and toxicology data was provided.
 - Preliminary tests were conducted in the FAATC's pressure chamber.
 - Test Procedure reviewed.
 - Baseline tests were conducted to establish a comparison benchmark.
 - BTP was not tested in the full-scale test articles out of concern of damage to the test article.
 - John Reinhardt wrote a report on this program. It is available on the FAATC Fire Safety Website (www.fire.tc.faa.gov).
 - Should the MPS Acceptance Criteria be changed to address the issue of agents enhancing the propane explosion at sub inert concentrations?
- OR
- Should we just rely on the MPS statement that says that "the performance of the replacement agent and system (must) provide the same level of safety as the currently used Halon 1301 system"?
- The Cargo Compartment Task Group will discuss this further.
This presentation is available on the FAATC Fire Safety website.

Engine Halon Replacement Test Update - D. Blake (for D. Ingerson)

The presentation includes:

- Equivalence Methodology - Overview
- Photo of Engine Nacelle Test Article
- Two ventilation conditions (low and high).
- Sampling Probe Locations for the different types of fires

Effectiveness of Handheld Extinguishers and Ceiling Mounted Ports Against Overhead Area Fires in Narrow body Aircraft - R. Hill (for T. Marker)

Dick described the FAATC 727 test set up design that will be used for hidden fire testing.

In-flight Fire Training Video - R. Hill

This will be a follow-on to the recent A/C on in-flight fire fighting. This received mixed comments from industry. Some felt that the FAA did not go far enough on fire fighting. Dick gave examples of fires in aircraft cabins where common sense on the part of the flight attendants is essential beyond following their airline's procedures. The video will be produced in conjunction with Transport Canada and the U.K. Civil Aviation Authority. Distribution method: the FAA is looking into production of a DVD that could be copied and distributed to the airlines sometime in summer 2005.

International Environmental Update - R. Hill

Dick provided information from an email John O'Sullivan sent recently. There was a study conducted recently on the obstacles in the road to replacement agents for use in commercial aircraft (Hughes report). Brad said that the EPA commissioned this study. The EPA funded Hughes Associates to do this study.

NASA Work Update - B. McKnight

Inerting: A new project to determine the amount of nitrogen required for fuel tank inerting (taking the volume of ullage, fuel composition, etc., into consideration). This runs throughout FY08. NASA is currently investigating instrumentation for this project.

-Work with industry partners to increase technology of inerting technology. Project conclusion fall 2005.

-High temperature forms of hollow fiber membranes. Conclusion expected in fall 2005.

-Combustion derived inerting: an idea for enhancing the hollow fiber membrane for separating nitrogen from the airstream. Clarence Chang is the chief researcher for this project.

Fuel: Chemistry changes in fuel composition in low sulfur or no sulfur diesel fuel for jet fuel. This project will conclude in fall 2004.

Fire Detection: Micro electromechanical devices are being designed at NASA Glenn as sensors of the different components of smoke. Tests will be conducted in the near future at the FAATC. This project concludes in fall 2004. Some of NASA's tests have been conducted at the NIST facility. Gary Hunter is the lead on this project

Hidden Fire Detection: A follow-on to a program to investigate compact, wireless sensors for hidden area.

Intrinsically Safe Current Limits for Fuel Tanks - B. Cavage (for R. Ochs)

- Purpose of Testing
- Previous Work
- Current Test Apparatus
- Test Matrix

- Preliminary Results
- Voltage and Current Traces (Charts)
- Future Work:

Complete test matrix with different materials; Use inline resistors or arc fault protection to dampen transient current spikes; and Develop methods to determine or approximate filament surface temperatures.

Jet Fuel Vaporization and Condensation (Modeling and Validation) - B. Cavage (Dr. Polymeropoulos' work)

- Motivation
- Physical considerations
- Principal assumptions
- Heat and Mass Transport
- Liquid Jet A Composition
- Composition of Fuels Used (graph)
- Dry Tank Tests
- Dry Tank Ullage Temperature (graph)
- Overview

Fuel Vaporization Experimentation (conducted by Rob Ochs - Graduate fellow student at FAATC)

- Model Inputs
- Experimental Setup
- Experimental Procedure
- Experimental Results (graphs)
- Flight Profile Tests (graph)
- Simulated Flight
- Pure Component Fuel
- Isooctane (chart)
- Conclusions and Future Work

Low Fuel Load Flammability Work - B. Cavage (for S. Summer)

- Objective
- Apparatus
- Preliminary Results (graph)
- Ongoing Testing

Dick explained that it is not uncommon for wing tanks to leak into center tank (it's not a safety hazard, however, it does happen). If you were to try to reduce flammability in the center tank, are you really doing anything if some fuel leaks back into the center tank from the wing tanks?

Fuel Flammability Combustion Sphere Testing - B. Cavage (for S. Summer)

- Background (the 20L combustion vessel was originally designed for testing simulants)
- Past Simulants (Hexane, Caltech Mixture)
- Test Apparatus
- Propane Test Results (graph)
- Future Testing

Task Group Meetings

Advisory Material for Handheld Extinguishing Agents

MPS on Cargo Compartments and the Implications of the BTP and HFC-125 overpressure

Propulsion Task Group

TUESDAY, JUNE 22, 2004

FAA Inerting System Flight Testing on an Airbus A320 - B. Cavage

The report on this work is close to finalized. It will be available on the Fire Safety website as soon as it is finalized.

Presentation Includes:

-Testing Goals and Objectives: validate the simplified inerting concept and develop/expand upon existing system performance models

OBIGGS - System Architecture

-Description of system design, installation, and operation

-Photo of FAA OBIGGS Installation

-System Instrumentation Diagram

-Flow Meter Diagram

-CWT Instrumentation Diagram

-Photo of OBOAS mounted in A320 Test Aircraft

-Test Plan

-Table of Airbus Flight Tests (describes tests)

-Data Analysis

-Results: System Performance

-System Performance Data

-One vs. Two ASM Performance Data

-Bleed air Consumption Data

-Results: Tank Inerting

-CWT Inerting Oxygen Concentration Data (single membrane test)

-One vs. Two ASM Tank Inerting Data (graph)

-High Flow Mode Benefit Tank Inerting Data

-Effects of Fuel Tank Inerting Data (graph)

-System Performance Data (graph)

-Summary: FAA simplified OBIGGS concept validated and Fuel Tank Inerting

Preliminary Results of FAA Fuel Tank Inerting Flight Testing on the NASA 747SCA (Shuttle Carrying Aircraft) - B. Cavage

The flight tests are complete.

-Testing Goals and Objectives

-OBIGGS: System Architecture; FAA OBIGGS Assembly Drawing;

OBIGG System Installation

- Instrumentation/Data Acquisition System (DAS)
- FAA-NASA 747 Inerting Flight Test (CWT Thermocouple Map)
- System Instrumentation Diagram
- Photo of Thermocouple Probe and Pressure Transducer
- Photo of OBOAS Mounted in AMCO racks
- OBOAS/FAS (2-channel flammability analysis system)
- Cabin Instrumentation/Rack Diagram
- Test Plan (included 7 flight tests ranging from 2 to 5 hours totaling approximately 30 hours of flight time)
- Preliminary Data
- System Performance Data (graph)
- System Flow Data (graph)
- CWT Inerting Data (graph)
- CWT Heating Data - Ground (graph)
- CWT Heating Data - In flight (graph)
- Status

Fuel Tank Flammability Update - R. Hill

Measurement of fuel tank flammability of the 747 tank on the ground and in-flight. Hydrocarbon measurements were taken. Bill discussed the instrumentation during his presentation. The measurements were taken at the top of the tank. Dick described the set-up.

Auxiliary Tank Testing - R. Hill

FAA Fire Safety Branch has a 737 center tank and some auxiliary tanks in order to run some on the ground flight simulations. The FAA will use their altitude chambers for this simulation. The 737 center tank testing apparatus will be set up so that it can be used in the future as a test facility for other tests requiring a 737 center tank. This project is ongoing as the facility that will house the 737 center tank is not constructed yet.

Avionics Bay Smoke Detection Systems - K. Schmoetzer

Based on current A380 design. This presentation was designed to give an idea of how to give separation of the smoke detectors in the avionics bays as will be done on the A380. A copy of this presentation will be available on the Fire Safety website (www.fire.tc.faa.gov).

2004 International Aircraft Fire and Cabin Safety Research Conference - R. Hill

November 15-18, 2004. A link is available on the Fire Safety website to the CAA website where the conference session agenda/schedule will be available within a few weeks.

Task Group Reports

Handheld Extinguishers Task Group - R. Hill

Consensus: Group does not agree on using Conservative estimates. The group is going to write a summary of their concerns on this and send it to Louise Speitel. There are agents now that are less toxic than halon 1211. Dick will also update Louise on the outcome of this Task Group discussion.

Cargo Compartment Task Group - D. Blake

Consensus: Dave will ask John Reinhardt To write up a statement for the MPS.

Engine Nacelle Task Group - G. Weyland

The future MPS will be done in two steps, the first step being fully agreed (Mass calculation).

The second step is still to be discussed with Doug Ingerson.

The Task Group's proposed RTD method (concentration criterion) will be discussed with Doug. The Group will contact Doug for a telecon in the next week or so to discuss this proposal.

Boeing and Airbus suggest that per previous meeting that the FAA propulsion fire extinguishing MPS testing include two proof demonstration test conditions with -65 degrees F agent. The Group will discuss this with Doug in the telecon as well.

If Task Groups would like to meet during the November 2005 Conference, contact April Horner by October 15, 2004, to request a small meeting room at the conference facility (if you want a meeting room for your meeting).