INTERNATIONAL AIRCRAFT SYSTEMS FIRE PROTECTION WORKING GROUP MINUTES

May 18-19, 2010

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TUESDAY, MAY 18, 2010

Class E Cargo Compartment Fire Suppression – R. Hill (for Dave Blake)

Research following an NTSB Recommendation after UPS aircraft fire. Water mist system tests with 4 nozzles (large container). Schematic of container was shown. Dave used a thermocouple or similar system as a means of detection prior to starting water mist system. Other suppression options to be tested: other fluids, passive systems, and fire resistant containers. Dave is looking for industry input and considering forming a Task Group in the future.
Mike Madden: Have any reports from the Class C work that Dave did been published? Dick: No, there are some issues with the test format. This work will not be published.
We currently have a graduate student doing some tests in the altitude chamber, and a Tech Note will probably be published later this year with the results of his research. Mike Madden: There is industry interest in forming a Task Group on Class E Cargo Compartment Fire Suppression.

PHMSA has put out an NPRM for the carriage of lithium batteries in cargo compartments.

Earlier this spring, the Administrator of PHMSA and some her staff members visited the FAA Fire Safety Team to hear about the battery testing they are conducting and their related research.

Smoke Transport CFD Code Status – R. Hill (for D. Blake)

The code was intended to assist in the certification process. The FAA has given a grant to Rutgers University to get the code to run more efficiently and with materials in the cargo compartment. The work is scheduled to conclude in June 2010.

Lithium Battery Testing Update – R. Hill (for Harry Webster)

Evaluate the feasibility of using water mist to extinguish both primary and rechargeable lithium battery fires, evaluate shipping containers (fire containment, molten lithium, pressure containment), and evaluate the ability of currently available shipping containers to protect the shipment of lithium batteries from an external fire.
Lithium Battery Test Program: Bulk shipment packaging upgrades –evaluate effectiveness of improved separation materials in preventing fire propagation between cells. Large scale lithium-ion fire tests: small scale tests have shown the effectiveness of Halon 1301 in controlling lithium-ion fires; the effectiveness of Halon 1301 in large scale cargo compartment tests with mixed fire loading and up to 1000 18650 cells will be evaluated.
Can batteries be intermixed with other freight? Needs to be investigated.
Water Mist Results:
Initial tests with relatively high volume water spray appear to be effective on both primary and ion batteries. Lithium-ion cells – water extinguishes electrolyte fire, cools cells, and stops propagation between cells. Lithium primary cells – water reacts with molten lithium, cools cells, and stops propagation between cells. Water cools the cells and stops the progression and stops them from going into thermal runaway.

Shipping Container Tests:
Two types of robust shipping containers have been procured: 5 gallon sized steel pail, with sealed crimped lid, 30 gallon sized steel drum with removable lid and locking ring. Preliminary containment tests: small number of cells (2-5); thermal runaway induced by 100 watt cartridge heater. Shipping Container Tests – Preliminary Results: Five gallon pail: two lithium-ion 18650 cells- cells overheated and vented electrolyte, electrolyte ignited. Video of 5 gallon pail test. Thirty gallon drum tests: lithium-ion cells (pending results of pail tests), lithium-primary tests – begin with 5 CR2 cells. Packaging material tests: replace cardboard dividers with themal resistant materials (thin cargo liner, insulation blocking layer), use 100 watt heater to initiate fire.
Near Term Test Schedule:
Full scale cargo tests: determine effectiveness of Halon 1301 in controlling a cargo fire.
Water Mist Tests
This research program is ongoing with many of these tests being conducted within the next 3 months, because an NPRM has been issued, and the FAA wants to get results to PHMSA as soon as possible. Is there a way industry can get involved? Dick: Comment on the NPRM. Contact Harry Webster (harry.webster@faa.gov) at the FAATC regarding the test program. Dave Blake (dave.blake@faa.gov) is the supervisor in that area. You can contact him, also. MPS Cargo Compartment: FAA is deciding if new agents should be considered. If any further research is done, it will be done through the Systems Working Group. Steve Summer is also doing some work on aircraft installed batteries. He has recently purchased some equipment to use in future testing. Cockpit flight bags are an issue – what if laptop battery overheats? How do you resolve this? This laptop is not part of the aircraft, so it is not certified.

<u>Engine Nacelle Halon Presentation</u> – R. Hill (for Doug Ingerson)

MPS Revision 4: modified the MPS to include non-gaseous agents. FAATC is in the process of running a non-gaseous agent through the MPS to show equivalence. Tests: 2 airflows (low & high) and 2 fire types (spray & pool). Photo of test apparatus was presented and described – photo available in the presentation. Test process retains its ties to halon 1301 behavior in MPSe revision 3. Evaluation: a “bracket” concept is used to evaluate a candidate agent.

The FAATC is hoping to wrap up Rev 4 testing of this novel agent within a month or so. The real engine demonstrations of this novel agent would follow later this year.

<u>Development of the Next Generation Fire Test Burner for Powerplant Fire Testing Applications</u> – Rob Ochs (FAATC)

Numerous FAR’s mandate fire protection in aircraft powerplant fire zones, no definition of test method, apparatus, or criteria. Advisory material has been used to define the test methods. ‘Powerplant Engineering Report No. 3A, Standard Fire Test Apparatus and Procedure, Revised March 1978’. Chaper 11 & 12 of *Aircraft Materials Fire Test Handbook*.
Current Status: all of the specified oil burners are no longer commercially available. Industry is left with the propane burner, which can be obtained and is typically preferred due to its consistency and ease of use. The FAATC Fire Safety Team has been tasked by the Transport Directorate to carry out this work. The NexGen burner has been developed by the FAATC Fire Safety Team as an equivalent burner to the Park DPL 3400 which is no longer in production. It relies on the same operating principles as the Park DLP 3400. It uses compressed air and fuel to supply the burner. Major advantages of NexGen burner: precise metering of inlet parameters, can be constructed in-house with easily obtainable materials, can be easily modified for future upgrades (as a result of FAATC research). A drawing of NexGen Burner Components was shown and described. The drawings are available on the Materials page of the FAA Fire Safety website (www.fire.tc.faa.gov). NexGen Burner Calibration: the heat flux

measurement has been removed from the calibration process, flame temperature is measured and used to determine proper burner output, and ultimate test of similarity between Park DPL 3400 and NexGen was comparative burnthrough testing.
Thermcouple Effects: tests were performed to determine the effect of the thermocouple on the measured flame temperature. Thermocouple size, construction, and age all have an effect on the measured flame temperature.
Next Steps: perform comparative testing between a calibrated Park burner and a 2.0 gph NexGen Burner. Develop guidance materials that includes the NexGen burner – harmonization with EASA and other regulatory authorities. Contact Rob Ochs at the FAATC with any questions or comments (Robert.ochs@faa.gov, 609-485-4651).
Sham Hariram: vibration should be investigated, and the loads should be investigated as well.
Dick: Yes, we plan to start a Task Group through the Systems Working Group to look into all the issues.

ISO 2685 Revision Fire Testing for Propulsion – Remi Deletain (EASA)

ISO 2685: CEAT Study assessed fire effect onto various components when using different methods, standards used for fire resistance, fireproofness testing (Designated Fire Zones) – Chapter 12 Aircraft Materials Fire Test Handbook. CEAT performed comparative tests: oil burner vs gas burner using 3 different samples. Issue: gas burner is less severe than oil burner. Oil burner is representative of powerplant fire threat environment (not gas). Status: November 2008 first meeting (EASA, DGAC, CEAT) to present CEAT preliminary results. Working Group will start May 26, 2010.
Serge asked if there is an ISO committee in the U.S. Dick indicated that there is an SAE committee that deals with the oil burner. FAATC could provide a contact from this SAE committee for the European ISO Working Group to coordinate with.

Options to the Use of Halons for Aircraft Fire Suppression Systems – Report Update – Louise Speitel (FAATC)

The Halon Options Task Group is currently updating the “Options to the Use of Halons for Aircraft Fire Suppression Systems – 2002 Update”.

Goals:
Update all Sections of the report
Regulatory Environment
New Agents/Systems
Testing/Validation with References

Chapter 2: Halocarbon Replacements (Tom Cortina)

Update on Classes of Halocarbon Replacements – which to keep and which to remove.
Toxicology – much remains the same/update SNAP exposure limits/add information ISO 14520 exposure limits
Environmental Considerations – regulatory restrictions
Commercialized Replacements

Chapter 3: Alternative Technologies – Bradford Colton

Covers all non-halocarbon agents in two categories: classical & new
Bradford reviewed updates
Update needed from Kidde Duegra on KD-A 96 generator

Chapter 4: Applicability of Technologies to Aircraft Application – Stephane Pugliese

Section 4.2 Review
Stephane reviewed the proposed plans for Chapter 4 (information to keep, update, add)
The plan has been circulated to the members of this group for comments. New group members welcome.

Chapter 5 – Handhelds – Bradford Colton

Revisions: Section 4.3

Dick mentioned that the FAATC will be coming out with an RFP for lightest weight handheld extinguisher. If your company is interested in getting a copy of this RFP, please let April Horner (april.ctr.horner@faa.gov) know.

Potty Bottle Update – Mike Madden

Section 4.5 Lavatory Trash Receptacle
Described new Sections to be added
Need input from other airframe manufacturers

Handheld Extinguishers

AC20-42D Handheld Advisory Circular – John Petrakis

There will be a Public Meeting on this AC beginning the afternoon of May 19 and continuing on May 20, 2010, if needed. The notice of this Public Meeting was sent out in advance to IASFPWG members and was posted to the FAATC Fire Safety website.

John would like to publish the AC in the next couple of months. He will accept written statements on the final draft until June 7, 2010, from those who are not able to attend the Public Meeting.

ICAO Phaseout Dates – D. Hill

Dick provided an update on the meeting held at ICAO in December 2009, where the ICAO Phaseout dates were proposed. There was concern expressed by the EC that their phaseout dates for certain agents may supersede the ICAO Phaseout Dates. Handheld issues were the point of contention at the ICAO meeting in December.

Halon Replacement for Airplane Portable Fire Extinguishers – Progress Report – M. Madden

Requirements review
Next Steps: aircraft materials compatibility testing at Boeing Labs by end of 2010, FAA MPS seat fire toxicity test at FAATC possibly by end of June 2010, and development of a market for BTP
Would companies at this meeting consider using BTP if commercialized? Contact Mike Madden at mike.r.madden@boeing.com.
Chris Dieter: Some EU countries have restrictions on use of HFCs, do you have any additional details on this? Bradford Colton: The EU has restrictions on HCFCs for fires unless you have an exemption.
Dick Hill: BTP was looked at for engines, cargo compartments, and handhelds about 8 years ago. At the time, it had issues in engines and cargo compartments. It was dropped from

consideration by most of the handheld companies, so what has changed to make you think they will consider it now? Mike Madden: It is listed in the EPA Green Air Act and U.S. House/Senate bills propose cap-and-trade requirements on HFCs. Dick asked if there was a market that would make it worthwhile for handheld manufacturers to produce BTP if it is only going to be used in the aviation industry.

WEDNESDAY, MAY 19, 2010

International Environmental Update – John O'Sullivan

EU Regulation 2037/2000 bans the use of Halon 1211/1301 except for critical use
EU Regulation 1005/2009

Annex VII Critical Uses: the critical use list is being reviewed, will it affect aviation? Some EU countries have already banned the use of HFCs for ground based fire protection

HTOC Update (1):

HTOC has begun work on a 2010 report (draft approximately September 2010)
H2402 is being commercialized as a flame retardant paint. Russia/Ukraine are working on similar types of products

HTOC Update (2):
China production quantities are unknown assume same as 2008
Article 5 countries – decline in recovery & recycling
Operational costs have increased and technological skills are in short supply
One country's Halon Bank has ceased to function
H1211 in short supply – storing & disposing of contaminated halon is now a major issue

HTOC (3):
Contaminated Halons in the aviation industry
ASTM fast track update of H1211 standard of the analysis of purity determination (H1301 will also be reviewed

HTOC (4):
Working Group draft text as a Resolution for the 37th ICAO General Assembly
HTOC (5):
Urges states to issue guidance for halon alternatives and fire detection systems in cargo compartments for new production aircraft
HTOC (6):
Request by ICCAIA/Boeing/Airbus request that ICAO consider a two year delay in the installation of halon alternative handheld extinguishers for new production aircraft

Status on Halon Contamination – Remi Deletain (EASA)

UK based company delivered polluted Halon (H1211/H1301)
17 customers identified
Wide variety of applications

EASA Global approach for Halon 1211:
Identify suspected batches
Test suspected batches
Results: purity 90% issuance of an AD with defined applicability (P/N, S/N)
FAATC tests

EASA has issued 7 ADs covering:
Portable extinguishers FFE
Portable extinguishers Sicli H1-10 AIR
L'hotellier
Most batches have now been tested. ADs were issued where no test results available. New set of ADs might be issued to cover lower levels of purity depending on test results.

Halon 1211 is used also on engine fire extinguishing: fixed extinguishers L'H, total number around 120
Contaminated Halon 1301: level of risk is still under assessment
Contaminated Halon/ICAO State Letter: released January 12, 2010, letter does not formally require an answer, it requires member states "to assess halon fire extinguishing supplies and take action as appropriate", based on this letter, the strategy chosen by the Agency in cooperation with the EC is the following:
Short Term Action: Agency has issued an SIB to raise awareness of air operators, AMOs, aviation suppliers and manufacturers
Mid/Long Term Action:
Agency plans to draft AMC applicable to production organizations and maintenance organizations for guidance on how to perform the quality inspection of halon at incoming inspection.
The Agency/EC is drafting a letter in resonse to ICAO state letter for review by EC.

Handheld Extinguisher – Contaminated Halon – D. Hill (for Harry Webster)

FAA issued an AD that covered all the affected extinguishers and gave applicants 90 days to replace all affected extinguishers.
Initial FAATC analysis indicated some extinguishers may contain less than 50% Halon 1211.
The contaminated extinguishers were installed on European aircraft and some on US carriers.
The FAATC Fire Safety Team evaluated extinguishers using simulated triple seat fire, primed with 50ml gasoline, pre-burn time 35 seconds. Remote actuated and controlled extinguisher.
Toxic gas measurement by gas absorption tube and FTIR. Phosgene gas by colorimetric badge.
Hidden Fire Test: measures the flooding characteristics on the Halon 1211 mixture.
Results:
Seat Fire Test: all of the 90/10 mixtures were effective in extinguishing the triple seat fire; the 50/50 R600a mixture failed and actually increased the fire intensity.
Hidden Fire Test:
All of the 90/10 mixtures were at least as effective as pure 1211; the 50/50 R600a was not tested.
Toxicity:
Pending
Dick showed videos of some of the FAATC tests.
FAATC will be testing actual extinguishers coming out of a British Airways aircraft in support of U.K. CAA actions against Lyon Tech.
FAATC will also be doing some toxicity work and tested by National Refrigerants and DuPont to compare to what CAA has had done.

Draft Halon 1211 ASTM Standard – Louise Speitel

Scope of Halon 1211 Specification: requirements for Halon 1211 as a firefighting medium and does not address equipment.

Louise reviewed the list of referenced documents.
Material Requirements:
Type 1: Mixed with Nitrogen
Type 2: Meet requirements of type 1 and should not contain more than 1.5% by volume fixed gases in vapor.
Sampling: based on test being run, samples shall be taken from the liquid or vapor phase as appropriate.
Test Methods: Purity by gas chromatography/Mass Spectroscopy (GC/MS).
Louise reviewed the Test Requirements.
Lingering Concerns: purity by GC/MS vs. GC/FID – the current GC/FID testing methodology would have failed for the contaminated Halon 1211 samples. Cost of GC/MS is much more expensive. MS detector requires more maintenance.

Composite and Aluminum Wing Tank Flammability Comparison Testing – D. Hill (for Steve Summer)

Test Apparatus – Wing Tank
Will use subsonic induction type, non-return design wind tunnel, 5' in diameter, maximum airspeed of 0.9 mach can be reached.
Dick reviewed the test conditions. FAATC uses JP-8 fuel for flammability tests they conduct.
Results of previous tests were reviewed.
Current Tests: aviation grade primer with white topcoat and with black topcoat were used on wing tank test apparatus.
Summary: Based on wind tunnel tests, the topcoat color appears to have little or no affect on the resulting temperatures and flammability profiles on composite panels. Further wind tunnel tests with painted aluminum panels is needed to help confirm this behavior.
Planned Work: 727 wing surge tank will be tested in wind tunnel in future tests.
What about vacuum pump in bottom of tank?

Fuel Tank Flammability Assessment Method – Version 11 Update – D. Hill (for Steve Summer)

Dick provided a brief summary of this model. Version 10 was released with the Fuel Tank Flammability Reduction Rule in July 2008. Dick reviewed the minor changes to Version 10 that are needed.

Studying the Accumulation of Fuel Water Ice – D. Hill (for Bill Cavage)

Dick reviewed background. FAA/EASA seeking to study fuel system icing in the wake of two incidents, one of which was a CAT 1 mishap (0 fatalities).
Investigation focused on fuel water ice accumulation in fuel lines.
Some preliminary tests were conducted by Boeing. Preliminary tests conducted at FAATC using JP-8 allowed for no ice formation in test piece (FAATC found that the JP-8 has an ice formation inhibitor in it due to FSII in fuel).
Facility Improvements were reviewed.
FAATC testing will investigate if the requirements are good enough.
Planned Testing: tests to accumulate ice on the walls of an aluminum tube under a variety of conditions. Validation of entire facility capabilities has begun. Testing to start approximately June 2010.

EASA Water/Ice In Fuel – Research – Remi Deletain

Photos of probable cause factors B777 incident. 3 AAIB Safety Recommendations related to water/ice in fuel research. EASA and FAA have established a work plan to

coordinate/complement research programs. EASA will be conducting a literature search with major aviation fuel manufacturer. Remi explained the EASA research activities in this area.
May 2010: EASA Tender Specification Publication (Call for Tender).

Standardization of False Alarm Rejection Capability Assessment – Andre Freiling

Motivation: false smoke alarms in cargo compartments
This is an update on the work being done at Airbus (previous presentations were made by Kai Behle).
Andre reviewed the False Alarm Rejection – Standardization Proposal and testing conducted by Airbus.
Next steps: further characterization, detailed test definition in correlation to false alarm rejection ratio, characterization of different smoke detectors, extension from dust to other nuisance sources (ex: cosmetic spray, insecticides, fog).
Airbus is willing to support a standardization committee.

Sixth Triennial International Aircraft Fire and Cabin Safety Research Conference – R. Hill

October 25-28, 2010 at Tropicana Hotel-Casino, Atlantic City, New Jersey, USA, registration and information available at www.fire.tc.faa.gov.

Refreshment Break Sponsorships are available with a marketing opportunity. Please contact April Horner at april.ctr.horner@faa.gov for additional information or to sponsor a break.

Next Meeting:

The conference will take the place of a fall Systems Working Group meeting. Some Task Group may meet during the Conference week. Please contact your Task Group leader to find out if your Task Group is planning to meet during this time.