INTERNATIONAL AIRCRAFT SYSTEMS FIRE PROTECTION WORKING GROUP

May 11-12, 2011

Hosted by EASA – Cologne, Germany

WEDNESDAY, MAY 11, 2011

ULD FIRE SUPPRESSION CERTIFICATION AND UPDATE – D. Blake

Horizontal Bunsen Burner test is required for the material used for construction of cargo containers – must not exceed a burn rate of 4" per minute when subjected to this test. 25.857e
FAATC will work with and do some testing for any freighter airlines that have systems that they are seriously considering using on their aircraft.
Dick: We were at UPS discussing fire protection on their freighters a couple weeks ago. Many of their containers are Class C that used to be Class D containers. UPS said when they have a fire detection warning, they discharge agent and depressurize the airplane to 25,000 feet. Any comments/thoughts on from this group? Doug Ferguson: I know that's not the procedure for the MD-11.

Smoke Transport in an Aircraft Cargo Compartment – D. Blake

Sandia National Labs previously had a contract to do this work. Recently, Ezgi Ozetkin from our on-site contractor has been begun working on this project due to renewed industry interest. Smoke detectors have high false alarm rates. Standardization of certification process is necessary. Ground and in-flight tests required for the certification process are costly and time consuming. For these reasons, a CFD (computational fluid dynamics) code would be useful. Ezgi is investigating a number of CFD solvers for this project. Dave showed the schematic of the 707 test apparatus used for 15 tests with: 40 thermocouples, 6 smoke meters, and 3 gas analyzers. Ezgi is still working out the heat transfer issues for the sidewall. Dave described the model set-up used for this series of tests. Comparison of FAATC validation test data and FDS was shown. Conclusions: this was the preliminary work done. There is more work to be done on the heat transfer issue. CO and CO_2 concentrations are predicted within experimental uncertainty, however, mass checks show added CO_2 to be well above that of the experiment. If anyone is interested in working with us on this, please let us know. Future Work: model parameter must be examined for radiation and turbulence modeling; continue code validation for other B707 scenarios. Multi-criteria detector: this was the potential benefit we saw in using a code when this work began through Sandia National Labs. FAATC will work with anyone who wants to look into modeling in any further/additional detail.

Fire Suppression in a Class E Cargo Compartment – D. Blake for Dhaval Daddia

FAATC built a galvanized test cargo container for this project. NEA Test Matrix: tested with NEA alone and with NEA and water. It is difficult to make conclusions from this next set of tests. Observations: temperature and oxygen concentration profiles are similar when using only NEA with changes in oxygen concentration. The least amount of boxes burnt were at lower flow rates of NEA at the higher oxygen concentrations. Future work: conduct tests using ANSUL foam. Conduct tests with Lithium Batteries in the container, but first look into using batteries in different types of containers (external fires) – use of intumescent paint. If anyone from industry is interested in working with us on this, let us know.

Utilizing Intumescent paint in the Packaging of Lithium Batteries – D. Blake for Dhaval Daddia

The swelling of certain substance when they are heated. It provides passive fire protection most commonly used in the construction industry. Test set-up: 5"x5" test sample, propane torch placed 2" away to see how intumescent paint would protect sample. Videos of Comparison of Aluminum Samples and cardboard samples (similar to battery packaging) uncoated and coated with intumescent paint. Next Dhaval tested treated and untreated cardboard and aluminum samples under a cone heater. Observations: Intumescent paint works well on aluminum samples. Future work: Cover packaging dividers with intumescent paint to observe heat transfer from a battery in thermal runaway to its surroundings. Cover the exterior of a lithium battery container in intumescent paint and place it in a cargo container fire. Is anyone looking at intumescent paints for this application? No comment.

Freighter Fire Suppression Cost Benefit Analysis and Risk Model – R. Cherry (RGW Cherry & Associates)

Ray reviewed the background of this work. Transport Canada commissioned a re-evaluation of these conclusions following the fatal accident to the UPS 747 freighter in Dubai in September 2010. The average value of the U.S. freighter fleet (Aircraft 24%) has increased significantly in the last few years per the FAA Study of 2009. FAA and Transport Canada Study 2011: Aircraft 79%. Other factors that have changed since 2009 FAA Study: the rapid growth in the volume of freight being carried by the North American freighter fleet especially carriage of secondary lithium batteries. Objectives: Cost Benefit Ratios, Risk Model (to assess the number of accidents likely to be experienced by the US fleet attributable to Freighter Fires). Ray demonstrated the Monte Carlo model simulation and gave explanation. The model considers each freighter airplane type in the US fleet individually and in combination. R. Hill: Lithium Ion batteries are not tracked as hazardous materials and there are no restrictions on the carriage of lithium ion batteries. There is rulemaking in progress in the U.S. This would change the classification of lithium batteries to hazardous materials. This rule is now in OMB review. PHMSA is looking into an NPRM on packaging of lithium ion battery. The FAA put out a rule a few years ago that prohibits bulk shipment of lithium batteries in a passenger aircraft, however, you can bulk ship lithium ion batteries on a passenger aircraft. Ray is looking for weight, cost, manhours, and other data on the mitigation systems if anyone has any they can supply to him.

Forced-flow Fire Testing with "cold"-soaked FK-5-1-12 (Novec 1230) – R. Hill for D. Ingerson

Purpose: This work is a result questions from FAA certification officials on the use of Novec in cold weather conditions (-65 degrees F). Dick described the test conditions. Conclusion: If you would like any additional information on this series of tests, contact Airbus directly due to proprietary reasons. T. Gehrig: Have you considered having the nacelle cooled and the agent cooled and the engine hot? A report will be published at a later date.
Solid aerosol testing/analysis testing will be picked up again.
Further changes to MSPe rev04 not expected.

Lithium Battery Update – Comparison of Battery Chemistries Flammability – Medium Scale Propagation Tests – D. Blake for H. Webster

Relative Flammability of Various Common Battery Chemistries: tests were conducted using AA size cells tested in two modes: external alcohol flame and cartridge heater (100 W). Results in order of risk: lithium metal, lithium-ion, nickel metal hydride, alkaline, nickel cadmium. Future tests: cone calorimeter, measure of heat release. Medium Scale Propagation Tests – lithium-ion batteries tested. Tests designed to measure propagation between cells when a single cell fails (thermal runaway), tests with multiple boxes of cells in original shipping material. Preliminary results: 280 cells went into thermal runaway, 158 vented as designed, releasing flammable electrolyte, 122 exploded, ejecting contents, large pressure release, flash fire near end of test.

Future tests: medium scale propagation tests with Lithium Primary cells, halon 1301 suppressed compartment propagation tests: lithium-ion cells, lithium primary cells.

Intermixing of Cells in Nickel-Cadmium Batteries for Aircraft Usage – R. Hill for S. Summer

Dick gave background on the issue behind this project. Dick reviewed the test equipment and procedures. A series of tests from RTCA/DO-293 were conducted. Results: Repeated Rated Capacity Test: both batteries successfully passed the test.

Next Generation Fire Test Burner for Powerplant Fire Applications – R. Hill for S. Summer

Numerous FARs mandate fire protection in aircraft powerplant zone. All of the specified burners are no longer commercially available. Current status: new lab space is being built at the FAATC facilities for powerplant burner testing. Burner and associated calibration and test rigs are complete, instrumentation, wiring and installation of burner is currently being worked on, lab should be ready for testing in 4-6 weeks. Planned work: in conjunction with DGA and EASA, a detailed user survey has been developed and will be released shortly on the Powerplants KSN site. Mark Cummings: asked about revision to the AC. Dick: we have to finalize the burner situation first before potential AC groups would be established. The sonic burner is approved for burnthrough tests. The sonic burner is much more repeatable and reproducible. It is much easier to use than the Park oil burner. The intent is to eventually use the sonic burner for the Part 25 tests where the Park oil burner was specified.

Powerplant Fire Testsing Status – R. Deletain (EASA)

Summary of DGA test results: effect of size of specimen to be tested. The size of the specimen to be tested, the type of burner (oil/gas), the choice of the testing laboratory.

Survey: Collect data from fire testing facilities on: specification referential, burners (types, dimensions), setting and calibration apparatus and procedures, testing conditions, etc. As soon as survey is ready, communication will be made through the FAA KSN site.
ISO-2685 Revision Status: on-going, need to restrict the use of gas burners, may consider introduction of the NexGen burner, need to harmonize fire testing conduction to demonstrate for powerplant fire resistance. Variations due to labs: burners, specimen size, burner orientation.
Mark Cummings: I noticed some differences between the presentation Dick gave on this topic and your presentation, is there going to be some harmonization on these?

Liquid Burner Development for Powerplant Fire Test – San-Mou Jeng (Univ. of Cincinnati)

Project Objective: Develop the operating settings for NexGen burner for powerplant fire tests. NexGen burner should simulate previously FAA approved liquid burners.
Temperature Calibration: thermocouple rack. He presented videos of flames in burner with and burner without tabs and discussed differences (with and without use of tabs). He reviewed the Park Oil Burner and NexGen Oil Burner performances. Fuel Sensitivity-NexGen Burner: air mass flow rate is fixed around 63.9 SCFM. Conclusions: NexGen Burner is more sensitive to fuel flow rate change than air flow rate change, TC bead size impacts on the measured “TC temperature” under the same flame. TC temperature is significantly lower than true flame temperatures. Higher total mass flow rate can produce more uniform flame temperature.

Handheld Fire Extinguisher MPS Update – D. Blake for R. Morrison

Presentation Outline: Recreating the 1999 MPS seat test set-up, achieving hydrogen fluoride (HF) numbers, replacing gasoline as a test fuel, comparing test data, future work.

Recreation of 1999 MPS seat test set-up: acid gas sampling. A photo of the test set-up in FAATC test aircraft. This is a new testing area, because the area the 1999 tests were conducted in is no longer available. These tests were done in the back of the TC-10. Reproducing the 1999 HF numbers was elusive. It took 8 tests to find the best combination of fuel pour rate, fuel soak rate, and position template on the seat cushions without sacrificing seat fire intensity. One issue identified is that gasoline today can be up to 10% ethanol, back in 1999 it was 100% gasoline. N-Heptane will be used as the fuel for future MPS tests.
Fire Extinguisher Optimization Market Survey: we are putting out a contract for optimization of a 5BC handheld extinguisher using a SNAP approved streaming agent. We are looking for the lightest, smallest volume, and most practical design.

Halon Replacement for Airplane Portable Fire Extinguishers: Progress Report – M. Madden (Boeing)

BTP progress report. EC, ICAO, and UL Standard cut-off dates: Halon Replacement Dates that are driving this program. List of major steps to commercialize BTP. The Initial BTP Toxicity Test Results were reviewed. BTP also passed NFPA 704 required flammability tests in March 2011. Uinversity of Illinois was contracted to do 3-D modeling of BTP using WACCM model. Toxicology testing is estimated to be completed in 2nd Quarter of 2013. BTP has to pass toxicology testing in order to get SNAP/REACH approval. Boeing suggests reconvening the Handheld Task Group to develop guidance material based on stratification testing. Contact Mike Madden at Boeing with any questions or comments: 425-342-2517, mike.r.madden@boeing.com.

Halon Options Team Lead Updates:

Options for Use of Halons Report Update 2011

Chapter 4.5 Lavatory Trash Receptacle – M. Madden (Boeing)

Minor corrections to 'Background' information.
Added new sections to status each airframe manufacturer.

Chapter 4.3 Handhelds – D. Ferguson (Boeing)

Revisions to:
Section 4.3.1:
Section 4.3.2
Section 4.3.3

Three agents have passed the MPS and have been UL listed since the 2002 release of the document (HFC-227ea, HFC-236fa, and HCFC Blend B).

Cargo Chapter – O. Meier (Boeing)

Section 4.4 – added discussion of Aerosol Can Test failures, discussion of alternate test procedure, corrected some errors in MPS Acceptance Criteria Table, added in FAR references for requirements.

Engine Chapter – S. Pugliese (Airbus)

Updated: a figure describing typical Nitrogen pressurization mode and a gas generator pressurization mode. A recap of agents that went through the MPS rev 03 test protocol. Include a section on considerations for an aircraft installation, establishing that this process is not sufficient

referring to discussions between FAA Transport Airplane Directorate and airframers for last Boeing and Airbus civil transport aircraft under design.

Chapter 2: Halocarbon Replacements – T. Cortina (D. Blake gave presentation for Tom)

Chapter Overview
Toxicology information was added including new methods for computing toxicology
Environmental Considerations updated (ODP, GWP)
Regulatory Restrictions

ASTM D7673-10 Standard Specification for Halon 1211 – D. Blake for M. Robin (DuPont)

Need arose from discovery of contaminated Halon 1211 in mid-2009
This has not been finalized.

THURSDAY, MAY 12, 2011

Composite and Aluminum Wing Tank Flammability Comparison Testing – R. Hill for S. Summer

Test Apparatus-Airflow Induction Test Facility: FAATC subsonic induction type, non-return design wind tunnel. Photos of test apparatus and wing specimen were shown. Planned work: 727 wing surge tank testing – has been re-skinned with composite material and placed alongside aluminum 727 wing surge tank. We will be conducting this testing over the summer.

Fire Containment Cover ISO Standard Development – D. Blake

The FAA has requested that ISO develop a standard for Fire Containment Covers (FCCs). At least four working group meetings have been held to develop the standard (EASA, FAA, Airbus, FedEx, UPS, SATCO and others are members). Revision of TSO-C90d and referencing this standard is the reason for this request. The standard is still in draft form. There has been discussion on developing other ISO Standards for fire resistant ULDs. Does anyone have any additional knowledge on this that I haven't mentioned?

Halon Purity Certification Methods – R. Hill for C. Lewis

This is work proposed by Transport Canada. Claude Lewis has a joint program with the UK CAA. Transport Canada is proposing work to look at how halon in handheld extinguishers (and possibly in the future for 1301) how it gets approved to go on the aircraft, and how in this process can regulators put a check to ensure we can stop contaminated halon from getting onboard aircraft. We'd also like to find out what the checks and balances are and any differences between what is done in North America and Europe. We envision this to be a fact-finding mission talking to companies who make extinguishers, finding out what the checks and balances are, what all the international standards mean, what the specifications are, and other related information. If anyone would like to know when the contract is let, please let April know the contact person.

The CSRTG Accident Database – R. Cherry (RGW Cherry and Associates)

CSRTG=International Cabin Safety Research Technical Group (see Cabin Safety Section of FAATC Fire Safety website for additional information on this group).
Ray provided the background on the creation of this database. This database was initiated by Transport Canada, FAA and the UK CAA. Primary purpose: as a tool to assist in carrying out Cost Benefit and Risk Analysis, and identifying safety issues. Recent studies and analyses carried out using this database: Aircraft Accident Fire Survivability Data, Trends in Accidents and Fatalities in Large Transport Airplanes, A Water Mist Cost Benefit Model, A Benefit Analysis for Enhanced

Protection from Fires in Hidden Areas on Transport Aircraft, A Benefit Analysis for the Installation of Automatically Disposable Hatches, Cost Benefit & Risk Analysis for Fire Suppression on Freighter Airplanes. Database Content: 3,926 Accidents 1967-2009 passenger and cargo operations on aircraft type certificated with 20 seats or more. The database is now web based: http://www.rgwcherry-adb.co.uk. Ray provided a demo of the database.

Analysis of 2-BTP Overpressure Test Results – G.Linteris (NIST)

Investigation into Halon 1301 replacement for use in cargo bays. This is a status update as of November 2009. Goals: understand the overpressure phenomena in the FAA Aerosol Can Test. Why is the overpressure occurring with the added suppressants? And, what can be done about it? The test approach was explained. D. Blake: do you have a timeframe on when you'll finish this work? Greg: we planned it as a 3-year project, and we've finished one year so far. We are open to collaboration with others. The work is public.

Cargo Smoke Detector False Alarm Rejection Standard – A. Freiling (Airbus)

Status on Test Procedure Development. We are looking at optical measurement sizes and particle sizes. D. Blake: When Kai Behle had given a related presentation on this project, he mentioned the idea to have a working group on this subject? A. Freiling: we have moved away from that due to intellectual property concerns for detector manufacturers. I can share information on the laboratory tests with other airframe manufacturers if anyone is interested. Do you have a different test procedure for an aspirated detector than an open air detector? We are currently focusing on the open air detector.

Additional comments from the Group?

Next Meeting

The next meeting is tentatively scheduled for November 16-17, 2011, in Atlantic City, New Jersey. Upon confirmation, a notice will be emailed to all those on the Systems Working Group email distribution list, and meeting details will be posted to the FAA Fire Safety website at www.fire.tc.faa.gov.