

# INTERNATIONAL AIRCRAFT SYSTEMS FIRE PROTECTION WORKING GROUP MEETING

November 14-15, 2012

Hosted by Boeing Commercial Airplane Group, Long Beach, California

## WEDNESDAY, NOVEMBER 14, 2012

### Flight Deck Smoke Penetration Testing – D. Blake

These tests will be conducted in the FAATC 747SP in the next couple of weeks. Smoke penetration tests will commence following the ventilation measurement tests. Smoke source will initially be Rosco mixed with helium and Corona theatrical smoke generators. Airflow conditions will include operating just pack 1, pack 2, and pack 3.

### Smoke Transport Code in an Aircraft Cargo Compartment – D. Blake (for E. Oztekin)

Dave explained the background of and potential uses for the smoke transport model including reducing the false alarm rate in cargo compartments. He reviewed the current FAA Regulations (Part 25, Section 858) for fire detection in cargo compartments. Standardization of certification process is necessary. Ground and in-flight tests required for the certification process are costly and time consuming. The commercial and open-source solvers available were identified. The 707 set-up was reviewed. The fire source was a compressed plastic resin block. The model set-up for the DC-10 was also reviewed. Only the flow fields where gradients are expected are further resolved – the flow quantities of interest (selected temperatures and species concentrations) are examined. Amount of time needed for each model computation: 40 hours for B707 cases and over 240 hours for DC-10 case. Results: test case 1 – B707 base fire: predictions for both CO and CO<sub>2</sub> follow the experimental mean very closely. Test case 2: corner fire, and test case 3: side fire. Results test case 4/DC-10: ceiling temperatures are consistently higher for DC-10 test case. A Summary plot was presented. Conclusions: good agreement for light transmission, CO and CO<sub>2</sub>. The agreement was not as good for vertical temperatures. G. Linteris: what do you anticipate using the code for? D. Blake: use it to allow detection manufacturers to put virtual detectors in the algorithms – development of algorithms; 2). Possibly to run a bunch of different scenarios to determine which would be the most critical for certification and possibly take the place of flight tests. D. Blake: FAA Certification TAD is receptive to use of the smoke transport code, so take it to them and see what you can work out with them. It would probably need to be an aircraft manufacturer or detector manufacturer to approach a regulatory authority, and the authority would hopefully contact us for input. I would think they would want some experimental data at least initially to compare. The information on the type of computer and processing capabilities are listed in the presentation.

### Cargo Smoke Detection False Alarm Rejection Standard AS 8036 Revision – I. Campbell

In March 2011, the FAA approached SAE to update AS8036 Standard to include nuisance tests (previous update was 1985). There is international participation in this committee. Ian reviewed the progress since May 2012. The original dust testing of 10%/ft suggested in Cologne was found to be

unrealistic. Aerosol/Insecticide Testing: 7%/ft obscuration for alarm set points of  $<$  or  $=$  5%/ft obscuration. +2%/ft obscuration above  $>$ 5%/ft alarm set points. Ambient Light: simple test – Primary. EN54 Part 7 test Summary: We have been meeting via telecom weekly. Agreement has been made on dust and insecticide and light test procedure. Combined environment (cycles of changes in temperature, humidity and pressure has been proposed. Testing to take place to confirm it produces the intended results.

#### Next Generation Fire Test Burner for Powerplant Fire Testing Applications – D. Blake (for S. Summer)

Dave reviewed the background of this work. The background has been presented in a few previous Systems WG meetings. Update on Burner Configuration: cooler/ice water bath has been replaced with a small (5.1 cu. ft.) freezer filled with a 50/50 mixture of antifreeze and distilled water. Attempts to use a new stator that would eliminate igniters/wires within burner tube were abandoned after seat cushion testing results showed poor correlation. New wire length and positions minimize airflow disturbance. Photos of the igniter positions were shown. A Roadmap to NexGen Burner Implementation for Powerplant Testing was shown (to Rev. AC 20-135). The Powerplants User Survey was created in conjunction with EASA and DGA. The survey data has been tabulated. A graph of the Propane Burner Results was shown. Member Question: what was your orientation of propane burner? Serge: the burner was vertical and the sample horizontal. A graph of the Oil Burner Results was shown. Member Question: How thick was the aluminum plate? Serge: It was 3mm thick. Current Status –Round Robin Testing: Round Robin testing to be initiated with various labs and burners (Park DPL 3400, NexGen, and Propane). A number of materials will be tested. This testing at FAATC has been delayed due to a severe roof leak in the test lab which will take 2-3 months to repair. This has halted testing. T. Gehring: Looking at the test results from the various labs, could you say that some of the labs use a more severe flame? D. Blake: Serge will cover this in his presentation. Member Question: is there an eventual plan to not allow propane in the future? D. Blake: I believe that is the plan and it will come out in the AC in the future. A date is not estimated for this yet. Remi: We systematically discussed this within EASA. We do not yet promote the use of the NexGen burner since there is no setting, however, we may go to the NexGen burner in the future. Member Question: I think you have to tell the complete story between the two burners. D. Hill: You have to remember that the burners are calibrated using water, so the calibration device never heats up. That's why there is a difference when you reradiate. University of Cincinnati gave a good presentation a few meetings back that explained that. It is available on the FAA Fire Safety website. Remi: This is a long-term activity, but it may eventually become some rulemaking activity. D. Hill: We use the oil burner for flammability tests of materials inside the fuselage, such as seats, fuselage burnthrough, and other areas. Over 50 years in propulsion, everyone is not testing the same things. We've seen that even on the materials side running the same oil burner on the same materials, there is great variability. Now, we are trying to correct this on the propulsion side since we know how to make the burner better and more repeatable, and the NexGen burner can be set. The Round Robins are conducted to find out where the different labs are. Participation in the Round Robin will help us get the information we need to make the tests repeatable and reproducible.

#### EASA Powerplant Installation Fire Certification Issues – R. Deletain Rulemaking Activities at EASA

Rulemaking Task 25.0070 Generic CRI: proposal to amend 25.1193(E)/25J1193(E). Objective: take credit of the relative airflow (flight). It is highly dependent on the powerplant installation and will be visited on a case-by-case basis. Symmetry may vary. Comments have been received and reviewed and considered whenever felt necessary.

EASA Rulemaking Tasks on Halon Replacement: Remi reviewed a number of EASA Regulations involving Halon replacement and Halon issues. Amendment 103 to ICAO Annex 8: 2012 – CS-23 and CS-25 has been amended. CS-29 is being amended. RMT.0560 planned to capture 2016 handheld deadline. An ETSO will be published in 2013 on portable extinguishers. Remi provided a table including all the EASA Rulemaking activities in these areas. MQ: Do you have any planned discussions with the first two rulemaking activities? Remi: 2D Nacelle: The second one: The issue paper exists, but I do not think they have rulemaking activities planned yet. We have some small differences from the FAA, but it will be very similar. We will still release an issue paper. MQ: 867 Surfaces: you appear to be looking at it in 2D from top and side. Remi: that was a point of discussion. It is a diameter. This is where we start the discussion to agree on the volume. S. Hariram: is that (2D) going to come out for public comment? Remi: we only raise it when we have a different interpretation. There will be a rulemaking consultation within EASA. Maybe there will be a rulemaking activity on this in the future.

#### Powerplant Task Group Progress of the Survey and Test Results – S. Le Neve

Serge reviewed the preliminary work. Comparative fire tests were performed with the 2 types of burners according to ISO 2685 standard on various specimens. A graph of these results was shown. The temperature increase velocities are also different.

Survey Update: Serge reviewed how the participating labs performed the tests, the calibration methods of the participating labs, how they performed heat flux measurements, burners, nozzles, and fuels used. He reviewed the significant differences on the heat transfer device between the different participating labs. Round Robin Update: 2024 T3 aluminum specimen. Oil burner tests revealed bad reproducibility. Propane burner results revealed good repeatability and bad reproducibility. Serge presented a comparison chart of the results of the oil burner and propane burner. Failure times are usually higher for gas burner. A graph of the effect of the propane burner orientation was presented. Conclusions: Many differences between the labs – too many differences to determine one difference causes the different results. Serge provided some ideas for potential improvements including: harmonize the heat transfer device and/or harmonize the thermocouples; standardize the type of burner used; or wait for the adjustment of the NexGen burner for powerplant fire resistance tests. D. Lichtman: is there going to be any focus on the methodology for the calibration (i.e.: number of times a thermocouple is used)? D. Hill: the NexGen burner nozzle gets calibrated to get the exact amount of fuel. You don't need to set the temperature and heat flux for NexGen burner. There are so many variables/problems with thermocouples. You can get better definition of the flame by measuring inputs. The NexGen burner is designed to eliminate these variations. Serge is saying it may be better to wait until NexGen burner is set and then standardize. The NexGen burner is being used in cargo compartment tests. The more labs who get involved in the Round Robin tests, the better off you are going to be in the end. M. Cummings: is there enough data submitted to give any information on why there is so much variation (order of magnitude/to give any indication why this is happening? Serge: no, there is not enough data provided by these labs at this point. Member Question: Have there been any components that have passed in the lab and failed in the field? Do we get any input from field

events? Remi: This is what I explained a bit earlier. There is no reverse engineering on this at this time.

#### NexGen Burner Effect of Flame T° on the Fire Resistance Behavior – S. Le Neve

The tests were performed according to the burnthrough test method. Serge reviewed the burnthrough test results of the first series of tests. He also reviewed the whole of the test results of the entire series of tests. Conclusion: There was a very good repeatability when the burner is set according to the burnthrough test method. Currently flame temp is not a calibration parameter: it would be relevant to investigate this point further. D. Hill: did you measure the fuel flow for each of the different fuels? Serge: no.

#### Updated Experimental Investigation of NexGen Burner – S. Tambe

Project Objective: develop the final operating settings for the NexGen burner for powerplant fire tests. NexGen burner should simulate previously FAA approved oil burners. Samir reviewed the conclusions of the previous work. Gas burner does provide more favorable test condition at horizontal orientation, as compared to NexGen burner. The burnthrough time reduces as burner inclination angle is increased. Samir presented the test set-up and burner configuration used for these tests. Two sets of tests were conducted: one with ambient air and one with hot air. Significant differences in burnthrough times were observed between the two air temperatures. Samir explained the theory behind the experimental results. Conclusions: the fuel and air temp did not have a significant effect on burner calibration.

#### Bulk Storage of iPads – D. Hill

Airlines are considering using iPads or tablets on board the aircraft for passenger entertainment systems, so they will need to be stored in bulk on the aircraft. Dick showed a video of iPad battery cells test (raw battery pack). In a tablet you have the housing, the battery sits towards the back, printed circuit board, and screen, and glass cover. FAATC has been attempting to acquire tablet or iPad devices to test. We have been working with other aviation authorities to attempt to acquire these. We then attempted to buy the components and mock-up tablets for testing. We are still in the process of acquiring the components to make up tablet devices to conduct bulk storage tests having one battery go into thermal runaway. Member Question: are the batteries going to be in the charging mode when you conduct the test? D. Hill: probably not.

#### Ice Formation in Fuel Lines – T. Maloney

Tom discussed some incidents and described the test set-up. Tom reviewed the results of initial conditions variation test. Conclusion for initial conditions variation: the softer ice may stick to the pipe material but it stuck to hard ice substantially more. The case that fuel flowed continually through the flow loop as the fuel cooled was chosen for further quantitative tests. The test conditions variation was explained. Summary of results: repeatability was good when ice was accumulating, the ice accumulated at -11°C, a greater heat transfer from the pipe increased ice accumulation, fuel contaminants contribute to ice accumulation. The ice had a tendency to collect on the pipe welds. Future work: continue to test various contaminants. K. Hoff: did you test any biologic contaminant like

algae? T. Maloney: we can do that in the future. P. Dang: did you notice that the ice in the pipes that were insulated released differently than the ice in the pipes that were not insulated? T. Maloney: we were not testing for that in this set of tests. Member Question: have you heard of Aquarius by BASF? It absorbs all of the water out of the fuel. D. Hill: Bill Cavage started doing this work when he was at the FAATC. The FAA TAD asked us to look into this. Tom didn't mention that some of the soft ice is fuel as well as water – it's a combination of water/fuel/other material.

#### Water/Ice Fuel Research Activities – R. Deletain

3 AAIB Safety Recommendations related to water/ice in fuel research. These were shared with FAA and EASA. 2009-030 Review use of additives: end of 2010 a Call for Tender was released. Interim reports received 4/2012-7/2012. We hope to release a final report end of 2012 or early 2013. Call for Tender EASA.2010.OP.08 “WAFCOLT” – final report was delivered March 2012. Remi reviewed research of 2009-031: Conduct research on ice formation. Summary: complex and wide range of possible activities in this research field. Only a small portion explored. Quite an interesting range of fuels tests (Chinese, Russian, etc.). Final report in EASA for review and the final report should be released by EASA for dissemination by end of 2012. 2009-032: Conduct research on ice accumulation and release: Call for Tender EASA.2012.OP14 “ICAR” – deadline for responses was October 29, 2012. One proposal received. Contract should be signed December 2012. The length of the contract will be 12 months.

#### SAE/ISO Standard for Fire Containment Covers – D. Blake

The FAA formally requested that the SAE develop the Standard. The two organizations are independent but agreed that the Standard should be as similar as possible. If the SAE Standard meets the FAA requirements, it will be referenced by an FAA TSO. Based on the draft of the SAE Standard, the FAATC was requested to run some tests to determine if wording on allowable gaps between the bottom edge of the FCC and the pallet were needed in the SAE Standard. Four FCC tests were conducted to determine damage tolerance and bottom edge gap effects. The standard fire load was used: cardboard boxes containing shredded paper. J. Peltz: the SAE document has been voted on and we did make some changes to the wording. We also noted that the FCC should be installed per manufacturer's instructions. Conclusions: all 4 tests failed due to exceeding 400°F on thermocouples 4” away from outside surface of FCCs per draft SAE/ISO Standards. All 4 tests were contained by FCCs but not extinguished. K. Stehman: The vendor was working on the fire retardant net that is required by the ISO and SAE Standard. J. Peltz: based on your conclusions, we addressed these with a couple of ISO members that were at the SAE meeting. O. Meier: is the SAE/ISO committee looking at how the FCCs interact – the greater fire detection strategy? D. Blake: no that is not part of this work. It's not part of this Standard. C. Lewis: Will there be a specification for where the thermocouples have to be located? J. Peltz: there are a couple of figures in the Standard that show. C. Lewis: how do you do this without an AC or Policy Statement? J. Hughson: we do not put this specifically in the TSO, because we point to the SAE Standard. J. Peltz: it's in the Standard. D. Blake: It says 4” away, but it does not give you more details. The diagram in the Standard is similar to the diagram Dave had in his presentation. D. Lewinski: is there been any sort of thought in regard to backside ignition? D. Blake: I don't believe words are in the SAE Standard that addresses that. That's a good point. Maybe some words on that should be included somewhere. I don't remember that topic of discussion coming up.

## Fire Suppression in Class E Cargo Compartments – D. Blake (for D. Dadia)

The FAATC is looking for a cost-effective way to control freighter fires: oxygen starvation, aerosol based agents, foams, fire containment covers, and zone based water mist systems. Dhaval has built a pretty robust test article that he can control ventilation in. It is meant to be a more repeatable test article. There is a series of thermocouples both inside and outside the container. Dhaval has also run tests in a composite test article (ULD). He has conducted a series of tests in both containers with oxygen starvation and aerosol based agent to control fire. The test procedures were described. Comparison of Oxygen Starvation: Test Container vs. Composite Container graph was shown. Comparison of Aerosol Agent: Test Container vs. Composite Container graph was shown. Medium Expansion Foam Tests: photos of the test set-up for these tests were shown. Zone-based water mist system: photo of DC-10 cargo deck has been rebuilt to perform fire testing within. It has been completely refurbished to conduct these tests in. Future Work: conduct tests to determine a worst case scenario fire load that contains lithium batteries (both types). Conduct tests with medium expansion foam and zone based water mist system.

## Lithium Fire Scenario – D. Blake

FAA Regulatory requested the FAATC to develop a lithium fire scenario fire load for the Cargo MPS. Dave is looking for input from industry on this. O. Meier: I thought the MPS addressed Halon replacement. D. Blake: I don't really think this is going beyond the scope of the MPS. K. Hoff: We have some dangerous goods specialists that could contribute. D. Ferguson: Boeing would also like to work with you on this scenario as well. D. Hill: We are not saying a separate test is needed. We are going to do research to determine if a separate test is needed or if the replacement agent has a similar effect as Halon on these types of fires. This research will determine if the current tests are adequate or if a separate test is required.

## Lithium Battery Cargo Awareness – D. Noe

Darrin reviewed the causes of energetic failures of lithium batteries. Boeing issued a Multi-Operator Message: MOM-MOM-12-0356-01B (dated 22 May 2012) to share regulatory and guidance information. Boeing Message to Operators: Boeing also provided non-mandatory suggestions to help minimize hazards when transporting lithium batteries as cargo. Boeing supports industry initiatives. In conclusion, Darrin reviewed Boeing's Recommendations Going Forward.

## Risk Benefit Cost Analysis for Freightier Fire Suppression – Mitigation Model Update (R. Hill)

The report and model are available on the FAA Fire Safety website ([www.fire.tc.faa.gov](http://www.fire.tc.faa.gov)). FAATC Fire Safety asked RGW Cherry & Associates to do some new work in this area. Current Model published in March 2012. Dick reviewed the additional model capabilities the FAA asked RGW Cherry & Associates to include in updated model. The updated report and model is expected to be published on the FAA Fire Safety website by the end of 2012.

## Composite and Aluminum Wing Tank Flammability Comparison Testing – D. Blake (for S. Summer)

Initial test results were published in FAA Report #DOT/FAA/AR-11/6 available on the FAA Fire Safety website. The conclusion of the new test series is that there was no correlation to unpainted aluminum skin (reflective coatings, panel thicknesses, etc.). Steve has some additional testing planned.

#### Propulsion Firewall Fire Tests FAA & EASA Interpretations – S. Hariram

This presentation provides some of the different interpretations that are being enforced by the ACOs with the premise that the new burner and the revised AC 20-135 clarify the interpretations. Sham reviewed a few of the FARs and their interpretations and concerns as a result of these different interpretations. D. Laborie: We should do this in parallel with the FAA if they agree to put together a Task Group on this. D. Hill: Originally when we put this program together that was the intent – first: develop the burner, then look at the AC and determine how to incorporate this and what else had to be done to bring the AC up to where it should be. S. Hariram: I think we should address the AC. The sooner we address it, the better. S. Pugliese: Airbus would like to start working on this as well. P. Dang: I also fully support Sham's presentation. These are some of the main issues we have dealt with. These questions/issues are not going to go away with the new burner. The FAA offices should be involved and maybe Transport Canada and EASA, also. This is good timing and about time someone raised these issues.

#### THURSDAY, NOVEMBER 15, 2012

#### Full-Scale Demonstration 747 Engine Nacelle - Solid Aerosol Firex Agent – D. Blake (for D. Ingerson)

Boeing/Kidde interested in solid aerosol fire extinguishing (firex) agent for aircraft engine nacelle application. Firex subjected to MPSe rev4. Dave described the test conditions/circumstances. The test timeline was shown. Schematics of the test set-up including location of firex bottle were shown. Doug's observations were presented. Photos of the tests while underway were shown. Outcome: FAA & industry goals diverged. FAATC offered additional/constrained support. Industry will do some additional work on their own. No significant testing planned. Significant report creation/writing planned for various tests conducted over the past few years. L. Seebaluc: From our perspective, it's still a work in progress. G. Linteris: Were different agents tested in the full-scale set-up, what agents were they? D. Blake: Only this agent was tested in this full-scale set-up. None of the other agents previously tested were tested in a full-scale set-up. R. Hill: There was agreement of all involved (FAA, FAA TAD, Kidde, Boeing) prior to the tests on the set-up, concentrations, etc., for the tests. R. Bennett: This effort started quite a number of months before the actual tests took place. A. Macius: It took basically a year. D. Blake: Concentration was measured optically before the test. R. Deletain: any idea when Doug will have these reports available? D. Blake: He has 10-15 years worth of testing to document in a number of reports. He is planning to have the reports written by spring. He has been asked to release a number of reports instead of one large report on all agents tested over this time period.

#### Full-Scale Lithium Battery Testing – T. Maloney

To document characteristics of large battery fires in a realistic aircraft environment. 727 test aircraft is used as test article for these tests. Tom showed photos of a number of the set-ups for these tests including Class E cargo compartment, Class C cargo compartment, and flight deck instrumentation. Aircraft ventilation settings were set as they would be when the aircraft is in flight. Air exchange tests were conducted. An external cart was used to represent what the engine packs would have been

doing. Air exchange rate results were presented. Tom showed photos from the baseline tests. Fire load was 18"x18"x18" cardboard boxes with shredded paper. A test was conducted yesterday (Nov. 14, 2012) at the FAATC with 5,000 lithium battery cells. The main deck got up to about 1,000°F and there was smoke in the flight deck. From the photos we saw, just about everything that was plastic melted. D. Blake: Do you know how long they ran before the sprayed water to extinguish the fire? D. Hill: It sounds like about 17 minutes before they dumped water. Not all of the batteries were involved before they dumped water on the fire. S. Hariram: what about mixed cargo (clocks with battery in them, electronic products shipped with batteries installed, etc.). Is there something in the works that will test this configuration, also? D. Blake: the purpose of this series of tests was to test bulk shipments of these batteries. K. Hoff: In January we will be testing a mixed load like you described. S. Hariram: Will results be made available or will they be proprietary. K. Hoff: they are proprietary, but maybe in the future we can release the information. J. Peltz: Fedex has also done some company proprietary testing. Are you going to come out with some standard so each test is the same every time? D. Blake: that's what I mentioned yesterday – the lithium battery cargo scenario. Yes, that's what I invited industry to participate in yesterday. That work will be starting this fiscal year. Member Question: A single piece of consumer electronics should also be addressed, especially since a number of the incidents Dick mentioned yesterday involve a single piece item not bulk shipments. J. Peltz: I think that is important right now, also. D. Hill: When the FAA came out with the SAFO we discussed at length the carriage of lithium-ion batteries – carry them in Class E not Class C containers on passenger aircraft – it's all probability and there are a lot more people on passenger aircraft. M. Rogers: As a pilot, we would prefer to carry them in Class C compartments on freighter aircraft. ALPA is trying to put a limit on the number of lithium batteries that can be carried on a cargo aircraft.

#### Passive Fire Protection for Lithium Battery Shipments – T. Maloney

This is planned work. Look at the inexpensive ways to improve the safety of the shipments and decrease the propagation from cell to cell. Some testing on various means of separating the cells has been conducted already at the FAATC. Objective: Future testing will look at state of charge and packaging. Planned tests: 4 cell x 4 cell boxes are to be made from cardboard. A diagram of the proposed box set-up was shown. The planned test matrix was shown. A number of types of dividers will be tested. J. Peltz: what timeframe do you plan to start working on this? T. Maloney: we have started making the small boxes already. M. Rogers: are you going to look into gel packs or something similar that when heated up will leak onto the batteries. T. Maloney: we can look into it. D. Blake: We are open to hearing any industry ideas and will consider them. P. Philipp: why isn't any work being done to look at isolating boxes instead of the individual batteries? It seems that from a manufacturer's standpoint, they might put the batteries into a protective box but not go to the expense to separate individual batteries. T. Maloney: we can look into this. D. Blake: we are not bounded by anything. We are trying to see what works and let industry know the costs and the weights. P. Hunt: Are there any plans to test lithium polymer batteries – the ones used in remote control cars. We had an incident recently that caused a larger reaction than the lithium-ion batteries. D. Blake: The testing will include all lithium battery types; ion, polymer and primary.

#### Halon 1211 Stratification Localization in Small 4-Seater Aircraft – D. Blake (for L. Speitel)

The revision to AC 20-42D, Chapter 4.4b(3), (4) states that concentrations may be adjusted to account for agent localization/stratification...a report will be published at the FAATC with method to adjust safe-



use concentrations. B-737 flight deck stratification/localization data for discharges of 2.5 lb Halon 1211 extinguishers was presented at the May 2012 Systems Meeting along with multiplication factors. Objective: develop test-based multiplication factors for that particular small aircraft to allow higher concentrations than AC 20-42D guidance provides. The FAA's Simplified Kinetic Model and Halon 1301 kinetics were used. Louise used data from a previous test project involving the measurement of discharged Halon 1211 in a small aircraft with inflight airflow. Analysis of this test data showed that localization and stratification occurred and multiplication factors could be applied. Dave reviewed the test set-up and results.

#### Handheld Fire Extinguisher Optimization Update – R. Morrison

FAA issued a solicitation for the redesign or optimization of an aircraft HHFE to replace the Halon 1211 5BC unit currently on civilian transport aircraft that will contain an EPA approved streaming agent on the Significant New Alternatives Policy (SNAP) list. After reviewing many proposals, the FAA was interested in developed research that was already being used inside the NASA's International Space Station in the form of a fine water mist extinguisher created and patented by ADA Technologies. A schematic and photo of the prototype unit was shown. This design calls for Novec 1230, known as FK 5-1-12, stored in a pressurized elastomeric bladder, pressurized to 500 psi with nitrogen, and discharged through a fine-mist delivery system. Planned work: demonstrate fire suppression performance in full-scale fire tests at the FAATC: FAA Hidden Fire Test, FAA Seat Fire Test, UL 711 Class 5B Fire Test. Demonstrations are planned for March 2013 and June 2013. They believe that they can use 1.5 lbs. of Novec and meet the criteria. This was their proposal. They can work this product to about 1,000 psi. They are down to about 1.1 in the hidden fire test. They have been moving the pressures around and are going to settle on something that is lower. Right now they are working on trying to keep the agent weight down and then move into the size/typing of the bottle. T. Cortina: Did you know that 3M has a new streaming agent that just got SNAP approved? I am shocked to hear about the use of Novec for this product. Is it the misting that makes the difference? R. Morrison: We would like to have the best performing streaming agent possible for this. This proposal was basically decided on in March 2012. D. Hill: We have talked to a number of people including a rep from 3M and it is a cooling agent and they applied for SNAP approval but have not done much streaming work with it. ADA has had a contract with NASA for quite a while to develop the misting technology. M. Madden: What is the final phase of your contract? Is it to get UL listed? R. Morrison: No. We are letting the requirements drive the mission, but more importantly, everyone else knows there is a new mixing valve available. I don't think we can do more than three phases in the government. FAA is coordinating with NASA. D. Hill: Bottom line is that ICAO has a date. Everyone had agreed that if 2-BTP does not work out, we are trying to come up with an alternative. Maybe this technology could also be used with BTP – I don't know. G. Linteris: ADA's NASA product uses water, correct? R. Morrison: Yes. We wanted a SNAP agent, not water. That's why they are targeting Novec.

#### 747 Hidden Fire 2-BTP Testing – R. Morrison

FAA, Boeing, American Pacific discussed the merits of BTP's decomposition. Test article – Boeing 747SP aircraft. Overview: does BTP contribute hydrocarbons to the fire threat when there isn't enough BTP present to put out a standard hidden fire test block. Rob described the test location in the 747SP aircraft and the test set-up. Photos of the test area were shown. Graphs of total hydrocarbons were presented. Summary of results: Video data suggests that BTP does not add energy to the fire threat

when there isn't enough agent present to put the fire out (at 1 atm). Further calibration needed to explain or rule out the peaks starting with neat agent. G. Linteris: was that last point that you were making might be that the total hydrocarbon might be picking up the 2-BTP itself? R. Morrison: Yes, that might be the case. We had to run these tests back to back. G. Linteris: my recollection is that I think 2-BTP will decompose into other more stable by-products not hydrocarbons. T. Cortina: This is good news, I guess. So, is this it now for overpressurization problem testing? R. Morrison: Yes, as of now. The hydrocarbon data still needs to be resolved.

#### BTP Status Update – B. Colton

We are getting close to the end of the BTP project with a final 'go' or 'no go' product. Bradford provided a background on the BTP project. A. Coutu: If all goes well, are you looking for commercialization around 2014? B. Colton: Yes, we are. T. Cortina: In commercializing you are looking to go beyond aviation? B. Colton: Yes, we are. The use has to expand beyond aviation otherwise it will be a very expensive agent.

#### Exothermic Reaction of Fire Suppressants: An Update – G. Linteris

Goal: understand overpressure phenomena of various agents. Background: enhance combustion in the presence of fire suppressants has been observed previously. Part of this study: examine rates of reaction using detailed kinetics. Questions being investigated: 1) Does agent reaction add energy to the flame, and where? 2) Do pure agents burn? 3) Can addition of fire suppressant bring a non-flammable mixture into the flammable condition? Future: 4) Development of a lab-scale test method to investigate and validate the modeling and full-scale results.

#### Us/International Environmental Regulations Related to Use of Extinguishing Agents – T. Cortina

Tom provided an update on U.S. and International environmental regulations/actions. Climate Policy – International: Durham Platform for Enhanced Action – as part of this, the EU decided to extend the Kyoto Protocol until 2017, but Japan, Canada, and Russia did not. Aviation – ICAO Resolution: Resolution on GHG emissions from aviation was adopted by ICAO in October 2010 (2% increase in fuel efficiency per year until 2050, capping growth of aviation emissions in 2020). Beginning in 2012 aviation emissions are included in the EU Emissions Trading System (ETS). Covers all airlines flying in/out of EU airports. Climate Policy – U.S.: US Congress unlikely to take action on GHGs regardless of election outcome. EPA implementing regulations on large stationary sources, mandatory GHG reporting and fuel efficiency standards for cars and trucks. California is moving forward with implementation of cap and trade program. Climate Policy – HFCs: Montreal Protocol: Amendments proposed in 2012 would add HFCs to MP and slowly phase down their production. EU has written F-gas Regulation: This proposal came out last week. It includes a phase down within the EU. It starts with a freeze in 2015 and reach a 79% reduction in 2030. It bans the use of HFC-23 in new fire protection systems and extinguishers as of January 1, 2015. Australia's carbon tax started in 2012. Tom reviewed ICAO A37-9 adopted by ICAO in September 2010. M Heijl: Last Friday the ICAO Council met on the MBM framework and the Global Market-Based Measures (MBM) Scheme and decided to set up a high-level group to accelerate the work.

ASTM Standards for Halon 1211 Update – D. Blake (for M. Robin)

Purity Standard has been finalized. A new standard has been developed for the transport of 1211.

Working Group Member Presentations:

FireBlue Dot – R. Chauhan

A copy of Raj's presentation is available on the FAA Fire Safety website.

Air Cargo Containers – S. Oracheff

A copy of Scott's presentation is available on the FAA Fire Safety website.

Seventh Triennial International Aircraft Fire and Cabin Safety Research Conference – D. Hill

December 2-5, 2013 at the Philadelphia Marriott Downtown

Follow Up to Firewall Presentation by Sham Hariram on November 14, 2012:

Sham Hariram: After my presentation yesterday on firewalls, a number of people approached me to form a Task Group on Firewall Testing. Dave Blake will pass this information on to Steve Summer. Dick Hill and Joan Hughson are having some discussions on this and how to approach this.

Next Meeting:

The next meeting will be held in late spring/early summer 2013, most likely in Europe. The Working Group will be notified when the meeting dates/location have been confirmed.



