INTERNATIONAL AIRCRAFT SYSTEMS FIRE PROTECTION WORKING GROUP MEETING

May 12-13, 2015

Hosted by AOA, Dresden, Germany

AGENDA:

TUESDAY, MAY 12, 2015

9:00-9:20 AM	AOA Welcome from Dr. Helbach
9:20-9:40 AM	Meeting Logistics and Attendee Introductions
9:40-9:50 AM	Smoke Source Project Plan – (FAATC)
9:50-10:05 AM	Modeling of Hidden Fire Smoke Signature in Aircraft– (FAATC)
10:05-10:20 AM	*Break*
10:20-10:50 AM	Status of NexGen Burner for Powerplant Testing – (FAATC)
10:50-11:05 AM	Updated Experimental Investigation of the NexGen Burner – (Ryan Hasselbeck - University of Cincinnati)
11:05-11:15 AM	SAE/ISO Standards on Fire Containment Covers and Fire Resistant Containers (J. Hughson - FAA)
11:15-11:30 AM	Commercial Aviation Safety Team (D. Blake – FAATC)
11:30-11:45 AM	Smoke, Fire, Fume Events Study – (FAATC)
11:45 AM-1:30 PM	*Lunch*
1:30-2:00 PM	Class E Cargo Compartment Fire Suppression Testing: FRC & Water Mist – (D. Dadia – FAATC)
2:00-2:20 PM	Class C Cargo Compartment ULD Suppression Agent Penetration – (D. Blake – FAATC)
2:20-2:35 PM	E-Tablet Fire Tests: Storage in the Aircraft – (T. Maloney –FAATC)
2:35-2:40 PM	Industry Working Group Updates – RTCA SC-225 (Lithium Batteries) and EUROCAE WG80/SAE AE-7AFC (H2 Fuel Cells) - (FAATC)
2:40-3:00 PM	*Break*
3:00-3:20 PM	Battery Heat Release Testing – (FAATC)
3:20-3:50 PM	Lithium Battery Thermal Runaway Vent Gas Analysis – (T. Maloney – FAATC)
3:50-4:20 PM	Lithium Battery Chemistry and Size Comparative Testing – (T. Maloney)

WEDNESDAY, MAY 13, 2015

9:00-9:30 AM	ICCAIA Presentation to the ICAO Dangerous Goods Panel – (D. Ferguson -Boeing/P. Rohrbach - Airbus)
9:30-10:00 AM	Status of ICAO Lithium Battery Activities (FAATC)
10:00-10:10 AM	Halon Replacement, Aircraft Engine Nacelle – (FAATC)
10:10-10:20 AM	Fuel Cell Project @ FAA TC (FAATC)
10:20-10:35AM	*Break*
10:35-10:50 AM	EASA Rulemaking Activity Regarding Halon – (T. Loevenich – EASA)
10:50-11:00 AM	Engine/APU Halon Replacement Industry Consortium - Halon Alternatives for Aircraft Propulsion (HAAPS) – Robin Bennett (for A. Macias)
11:00-11:15 AM	Cargo Compartment Halon Replacement Working Group Update (CCHRWG) (Robin Bennett - Boeing)
11:15 AM-	Working Group Member Presentations Additional Discussion/Closing

Meeting Minutes:

TUESDAY, MAY 12, 2015

Dr. Helbach AOA gave 'Welcome to Dresden'

Smoke Source Project Plans – D. Blake (FAATC) for R. Morrison

Dave described the background and plans for this project. The Planned Work was outlined. Objective is to compare different theatrical smoke generating sources to a 4800 lithium primary battery fire test performed in a Class E cargo compartment that resulted in completely obscuring the flight deck in a as little as 16 minutes on a Boeing 727 aircraft. (Harry Webster's test at FAATC). Two theatrical smoke generators will be compared (Rosco 1700 and Corona). Smoke tests will be conducted in the FAA Seat Toxicity Test section inside the TC-10 test article. The tests will begin within a couple of weeks. Rob Morrison can be contacted at 609-485-4507 or Robert.morrison@faa.gov. Carlo: is this leading to any changes to the AC? Blake: it has potential to impact that, but I don't know what the FAA regulatory side will do with this information. There is nothing definite now as far as revising the AC. Ferguson: Is Rob going to be re-burning the batteries before he does this work? Blake: he will be doing the work he has planned to see what kind of results he gets. Harriram: are you going to set the Thor Eklund unit for a specific temperature? Blake: we are going to use the ratios that are in the presentation to start with. This is a generalized average temperature. I don't know how the helium temperature correlates to a real fire. We will see where this brings us. I don't see a value in specifying an average temperature. Question: how is the air exchange rate of 1 every 5 minutes determined? Blake: from industry input, this is a generic average number we chose. If there are better numbers to use, let us know. Harriram: this is more conservative than what is used in industry. Blake: including recirc? Harriram: yes. Blake: if there are better numbers we should use, please let Rob know or me know.

Modeling of Hidden Fire Smoke Signature in Aircraft – D. Blake (FAATC) for E. Oztekin (TAMI)

The area of in-flight hidden fires that Ezgi will concentrate on is the overhead area (above the cabin ceiling). The overhead area that will be modeled is in the FAATC 747-SP test article. The fire source will be the polyurethane foam block as the standard fire threat for in-flight fires. Methodology: the rates of heat release and mass loss are measured in bench-scale tests. The heat of combustion is calculated from experimental data (cone calorimeter). The stoichiometry and the radiative fraction for the fire source are still unknowns. She will use assumptions. LIDAR technology is used in the determination of the internal dimensions of the overhead area of the 747-SP. She will take the CAD of the geometry of the clutter in the overhead area and generate a mesh for the modeling work. She has modeled the area without the clutter (empty hull geometry) for some preliminary results. 50 thermocouples are being installed in the overhead area. These are fine gauge thermocouples. Ezgi requests input from anyone who has done this type of work. Ezgi's email address is ezgi.ctr.oztekin@faa.gov. Josephine: I can't understand why she is using the type of fire fuel she is using. It will create turbulence. Blake: she is the CFD expert for our branch, so I gave her the benefit of the doubt. We recognize this is different. This is the starting point. Carlo: is there airflow? Blake: the area she is modeling is pretty far forward of the recirc fan. She is assuming there still is a little bit of airflow through there. Carlo: for the ground tests, what will be running? Blake: the APU will be running, for now it will be unventilated.

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

Background information was provided regarding the Federal Regulations and Advisory Circulars for these tests. None of the oil burners listed in the regulatory materials are commercially available at this time. The propane burner is the only burner called out in the regulatory material that is still commercially available. This is the reason the FAATC has done research to use the NextGen Sonic burner for these tests. There will eventually be a revision to AC20-135 to include information from this work and incorporate the NextGen sonic burner. A sub-group has been formed with the goal of developing proposed rewording of AC20-135 in a

parallel effort with NexGen burner development. Dirk Kearsley (BAE Systems) has drafted a request and submitted it to FAA (6/2014) to make this sub-group more formal. The FAA is now finalizing how this will be carried out. Steve Summer is considering holding the meetings of this sub-group in conjunction with future Systems Working Group meetings. Steve's contact information is 609-485-4138 or steven.summer@faa.gov. There seems to be some confusion as to whether use of the sonic burner will be mandatory or not.

Updated Experimental Investigation of the NexGen Burner – R. Hasselbeck (Univ. of Cincinnati)

Ryan reviewed the Project Overview and the previous work. Current Approach: Fuel nozzle spray characterization (Delavan spray pattern much more consistent to other manufacturer nozzle); burner assembly sensitivity; effect of fuel nozzle depth; effect of cone depth (on temperatures & burnthrough time); effect of cone type (temperatures & burnthrough) UC recommendation is to have a well-defined cone type; and effect of FRH deformation (temperatures & burnthrough) – in normal wear and tear of the FRH, you are not going to see too many differences. Conclusions & Recommendations: cone depth shown to have a negligible effect on temp calibration, though with distinct differences in burnthrough times. Question: do you have a venting hood? How big is it? Hasselbeck: we do, but I don't know the dimensions. We can take some measurements. Question: are you planning to do any DOE testing maybe on the felt material? Hasselbeck: we could do that, but there was some talk of doing some composite material testing.

SAE/ISO Fire Containment Covers (FCC) and Fire Resistant Containers (FRC) Standards – J. Hughson (FAA)

FCC TSO was issued last summer TSO-C203. It references SAE AS6453 with modifications. Modifications are mostly for removal of references to non-FAA requirements. The last meeting was April 14-15, 2015, in Nashville, TN.
FRC – ISO/CD 19281 is in Stage 40.20 (Ballet initiated). Stage 50 (Approval) and 60 (Publication) to follow. Unresolved issues: Should FRC standard still include the 14 CFR Part 25 Appendix F. Part III requirement? Lithium batteries? Possible delayed smoke detection from a fire originating in either a FCC covered pallet or inside an FRC. FCC-CS203 adequate sample size. Danker: what kind of commercial applications are covered by the TSO-CS203? Hughson: the cargo air carriers (UPS, Fedex). Danker: is UPS required to use fire safe containers? Hughson: no, they are not required. There are no fire regulations that cover any kind of FCC. Carlo: Are FCCs one means of compliance for the ADs for combis and for EASA proposed Class F cargo compartments? Blake: yes. Question: SAE AS6278 is finished will it be covered by an FAA TSO? Hughson: it may be incorporated into the C90 TSO. Blake: UPS and Fedex voluntarily started using FCCs on some cargo on some of their routes. Ferguson: could you explain a little more by what is meant by 'an adequate test sample was not available…"? Blake: the size of the sample for the abrasion test is smaller than for this test. That's the issue.

Commercial Aviation Safety Team (CAST) Cargo Fire Protection – D. Blake (FAATC)

Senior-level safety officials from CAST organizations meet regularly. There are working groups Joint Safety Analysis Teams (JSATs) and Joint Safety Implementation Teams (JSITs). Joint Implementation Measurement Data Analysis Team (JIMDAT) develops master safety plan, measures effectiveness and identifies future areas of study. Their results are passed back to the senior-level safety officials. Safety Enhancement 126: JSIT plans to finish by end of summer 2015 and give report to JIMDAT. JIMDAT plan then goes to CAST for final approval. Safety Enhancement 127: cargo-fire containment – this SE reduces cargo fires through new or revised standards for the construction of standardized and improved cargo containers that include fire-suppression or fire-containment systems.

Research Into Smoke, Fire, Fume Occurrences on Transport Airplanes Study – D. Dadia (FAATC) for R. Hill

This work commissioned by the FAA and the UK CAA. The work is contracted to RGW Cherry & Associates (UK). Date range: 2002-2014. The data collected will be compiled into an Occurrence Database. Over 800,000 records have been synthesized to approximately 16,000 as being relevant. The contract completion date is January 2016. A report containing the data sources, analysis methods, results and conclusions will be published when the work is completed. A few ways the data can be analyzed were shown.

Fire Suppression in a Class E Cargo Compartment – D. Dadia (FAATC)

Background: increasing number of fire incidents in Class-E cargo compartments; steady rise in battery shipments via air cargo; understanding propagation behavior of thermal runaway; determine methods to prevent/contain lithium battery fires.
A video of the March 2014 test of 5000 Lithium-ion batteries in a FCC was shown. Test revealed that the FCC cannot contain a lithium-ion battery fire. Fire was observed to escape from underneath the FCC.
Thermal propagation in plastic cases: new form of packaging, 2 batteries in plastic case. Tenergy Battery and UltraFIre battery in plastic cases were each tested @ 50% SOC with cartridge heater. Question: how is temperature measured? Dadia: a 16-inch thermocouple that was wire-tied. 100 UltraFire Li-ion Batteries in plastic cases were tested next. The entire 100 batteries were consumed and the intensity seemed higher than in previous tests possibly because of the plastic cases.

AOA Water Mist System – the system is pressurized through Nitrogen. We will be conducting some tests on one pallet load on Class A and pan fires, full and half load, vary droplet size.
Future Work: test propagation of thermal runaway in other packaging options; further test the water mist system against pan fires, class-A fire loads, and lithium battery fires conduct lithium battery fire tests in FRCs. Gatsonides: have you compared this work to the water and nitrogen water mist work previously done by the FAA? Dadia: the previous work was done in a Class C compartment. We are trying to control the fire in order to give the pilots enough time to take action not completely extinguish the fire. Ferguson: how far are the boundaries beyond the fire load? Dadia: it is one pallet load. It is a zone-based system. Danker: when you terminated the test at 70 minutes was that according to criteria? Dadia: it escaped the bounds of the FCC – that's why it was terminated. Danker: what is a Class E compartment? Dadia: Class E is freighter aircraft. It is not required to have a fire suppression system. Ferguson: the early stages of your testing, you are not going to have a FCC or FRC. Dadia: for the lithium batteries it will be an open load in an AUI container. We are going to start small for proof of concept and then increase.

Class C Cargo Compartment ULD Suppression Agent Penetration- D. Blake (FAATC)

Dave provided background. Recent test results have shown the potential for vapors vented from lithium ion batteries in thermal runaway to produce flammable gas mixtures inside ULDs. This testing is being conducted in the DC-10 test article aft cargo compartment. Dave used drawings to show where the probes are located. Test results are very preliminary. No conclusions should be drawn at this point. Additional testing will be conducted to understand preliminary results. Probe locations will be varied after initial results are better understood. Input and test data from others is welcome. Rohrbach: what was the distance between the containers? Close together or space between them? Blake: we didn't use the pallet locks. They are brand new aluminum containers. There are numerous variables that we haven't tested yet. If anyone has done this type of testing and has data they can share, it would be appreciated. We did discuss potentially starting a Task Group to give input on this project at the October 2014 meeting, but I have not heard from anyone regarding this. Please let April know if you are interested in participating in a Task Group for this project.

E-Tablet Fire Tests: Storage in Aircraft – T. Maloney (FAATC)

Background: tests were conducted in a galley cart to assess hazard of bulk-stored e-tablets. The report on these tests was recently published and is available on the FAA Fire Safety website. Introduction: e-tablet fire tests were performed in the forward galley of a fully functional 727 to assess potential fire and explosion hazards of the compartment, toxic gas. Tom described the test set-up. The test procedure was explained. The tablets were all charged to 100% SOC with the chargers that were provided. Results: a video of one of the tests was shown. Summary: the galley compartment was able to withstand the pressure rise from combustion in these configurations. Question: did you try tablets with different types of materials? Maloney: yes, one tablet was a metal tablet and one was plastic.

Industry Working Groups:
RTCA SC-225: Rechargeable Lithium Batteries – D. Blake (FAATC) for S. Summer

This group has developed RTCA/DO-311 and RTCA/DO-347. Current status: this committee is working on the revision of DO-311A, an update to current DO-311. Will integrate coverage for all sizes of batteries. FAA has requested RTCA to form a committee to update DO-227. Information on the formation of this committee will be available in the Federal Register.

EUROCAE/SAE 7AFC (H2 Fuel Cells)

There are short, medium, and long term goals. SAE AIR-646 – Aircraft Fuel Cell Safety Guidelines. Currently working on a MASPS/AS Document to more generally cover installation of any PEM H_2 fuel cell system. There is a recently formed Energy Supply ARC. It is a little unclear how these two groups will coordinate at this time. They are in the process of working out these details now. The FAA official to contact regarding the ARC is massoud.sadeghi@faa.gov.

Fire Hazards of Lithium Ion Batteries – D. Blake (FAATC) for R. Lyon et al.
Objective: measure fire hazards of Lithium-ion batteries. Methods: Hazard measurements: energetics of cell failure; thermal effects of cell failure; and fire behavior of lithium cells. Test apparatus used: bomb calorimeter; slug calorimeter; cone calorimeter. A pie chart of fire and thermal hazards of 18650 cell showing flaming combustion of cell contents; decomposition reactions; discharge of stored electrochemical energy by internal short circuit was presented. An analytic model was created. The model was applied to the full scale test data for comparison. Contact Dr. Richard Lyon at 609-485-6076 or Richard.e.lyon@faa.gov,for additional information.

Lithium Battery Thermal Runaway Vent Gas Analysis – T. Maloney (FAATC)

Background – Class C Compartment: tests had not been performed to quantify the effectiveness of the onboard extinguishing agent on a lithium battery fire. Objectives: three series of tests were performed to further understand the gasses vented from lithium batteries. Pressure rise of the flammable gases. Tom described the test set-up. Results – Pressure Rise were presented. Validation and Halon Effectiveness: test article was a $10m^3$ pressure chamber. Summary: volume of gas emitted from cells increased as SOC increased; the number of cells that can vent in an LD3 before the LFL is reached decreased as SOC increased; Halon 1301 was less effective than previously expected. Contact Tom Maloney at 609-485-7542 or Thomas.maloney@faa.gov. Chattaway: was Halon concentration measured prior to start? Maloney: we had a Halon analyzer that measured the concentration at spark time.

Aircraft Installed Lithium Battery Hazard Analysis – T. Maloney (FAATC)

Many lithium-metal and lithium-ion batteries are installed on aircraft today and have a risk of thermal runaway. There are a large variety of cell chemistries and it was previously unknown how thermal runaway of each of them behaves comparatively. The 3 types we looked at are lithium-ion, lithium-metal; and lithium-pouch (similar to lithium-ion but rectangular container). The batteries tested were readily available. The majority of these tests were done in the $10m^3$ pressure chamber at the FAATC. Propagation tests consisted of 5 cells with one of the outmost cells exposed to the heat source (cartridge heater or hot plate). Test data: data collected in each test includes cell case temperature, test chamber pressure, and hydrocarbon concentration. Tom reviewed the results of the tests of each type of battery and showed video clips of the tests. We also noticed that the cell orientation of LiBrCl batteries affected runaway (horizontal vs. vertical orientation when tested). Summary: thermal runaway behaves differently for the various cell chemistries tested. Differences between cell design/construction has also been observed. Cell temperature increased with the electrical energy density of the cell (Wh/gram). Contact Steve Summer at 609-485-4138 or steven.summer@faa.gov, or Tom Maloney at 609-485-7542 or Thomas.maloney@faa.gov for additional information.

WEDNESDAY, MAY 13, 2015

Transport of Lithium Batteries as Cargo via Air – (D. Ferguson –Boeing/P. Rohrbach –Airbus)

Doug and Paul are representing ICCAIA. This presentation was previously given at the ICAO Dangerous Goods Panel. A Working Paper was prepared for the ICAO DGP by ICCAIA and IFALPA. ICAO DGP has decided to create a Working Group to look into lithium battery packaging to contain the hazards of lithium battery fire to within the packaging. Packaging standard requirements will be developed. This is primarily focused on batteries packed together (not with equipment or in equipment). Question: Has there been a risk assessment for batteries in i-Phones or i-Pads or computers? Ferguson: The concern is lower for batteries in this type of equipment, because there is more space between batteries and less chance of thermal runaway. There is still investigation into batteries in this type of equipment. Mark Rogers has been very involved in lithium battery carriage for years. Rogers: we are certainly interested in the case. There is no real good definition of equipment from the UN. E-cigarettes are batteries packed together in equipment close together and we have seen several cell phone batteries shipped together with one cell phone because of the way the regulations read. We have really been working on this first step. We had great difficulty in getting the ICAO panel to move on the lithium metal batteries issue. Risk assessment is very difficult. No matter what you do, you are always going to have shippers that do not comply with the regulations. The major shippers will most likely comply, but other shippers may not. Wedler: Would it help to have a detector to distinguish between the lithium ion fire and another type of fire? Ferguson: I think the answer is mixed, because it would always be helpful to have detectors that are focued on the specific hazards, but then we would have multiple detectors. I think the answer is mixed, it would be beneficial, but then you have a detection system that is really really good for a specific type of fire only. There's a potential for benefit, but there is a trade off. Roudebush: What will the mission be of this ICAO Working Group? Ferguson: the mission of the Working Group that is being put together by the ICAO DGP is to propose packing that will be focused on keeping the hazards of the fire of the lithium batteries in the packaging.

Lithium Battery Shipping: ICAO Dangerous Goods Panel Update/Packaging Standard – D. Blake (FAATC) for H. Webster/R. Hill

This presentation is focusing on the development of the packaging standard. The ICAO DGP Working Group will develop a Performance Packaging Standard to ensure safe shipment of lithium batteries. No action was taken on the recommendation to stop shipment of high density cells at this time. IFALPA will submit a formal paper to ban such shipments at the October 2015 ICAO DGP meeting. FAATC realizes that there may be more than one solution – a combination of layers to mitigate the hazard. Harry Webster at the FAATC has been testing some prototype or commercially available products or packaging for evaluation. He is open to other companies submitting their packaging products for testing at the FAATC. Contact Harry at harry.webster@faa.gov or at 609-485-4183.

Halon Replacement, Aircraft Engine Nacelle – D. Blake (FAATC) for D. Ingerson

Post-test compilation and coordination is ongoing. Concluding presentation anticipated at the October 2015 Systems meeting. Resume/conclude activities for the powerplant halon replacement report: minor testing remains; authoring.

Destructive Fuel Cell Testing – D. Blake (FAATC) for S. Summer

Aviation industry is pursuing efforts to install Hydrogen Fuel Cells on aircraft for a number of potential operations. FAATC is working with industry partner to conduct initial destructive testing of H_2 fuel cell stacks. Objective is to better understand failure modes and consequences. Tests are planning for early June 2015. Tests will be conducted in the FAATC Fire Safety $10m^3$ Pressure Fire Modeling Facility. A schematic of the test plan Steve put together was presented. Contact Steve at steven.summer@faa.gov or at 609-485-4138. Ferguson: what sort of failures does he expect? Blake: the tests will be conducted inside the pressure vessel, so he does not expect the results to hurt anything. This is the first step – a somewhat conservative test to start the test program and see what happens and see what makes sense to go forward. Rohrbach: are they prototypes or already in use somewhere else? Blake: it is somewhat proprietary where these might be used on the aircraft, but it is a prototype system that will be tested. Question: will these be coordinated with the ARC that was mentioned on Tuesday? Blake: it is likely that Steve will participate in the ARC, but the results/information will shared with the ARC.

EASA Rulemaking Activity Regarding Halon – T. Loevenich (EASA)

RMT.0560, NPA 2014-26 in progress Title: Halon: Update of Part 26 to comply with ICAO Standards Schedule: NPA Draft: 13.03.2014, Final Draft: September 2014 NPA Publication: November 2014 The EASA responses are now being prepared and expected by end 2015. Then, the Opinion is submitted to the EC Q1 of 2016. EC needs approximately one year to come back to EASA. CRD Status: positive and supportive feedback received/few adverse comments and some concerns raised (health issues), (2-BTP availability).

RMT.0273, NPA 2011-14 closed. Removed all Halon from Book1 of CS-23/-25/-29.

RMT.0206, NPA 2015-02 issued. New ETSO-2C515 for halon-free portable fire extinguishers. Based on SAE AS 6271. NPA published 27.02.2015. NPA open for comments until 27.05.2015.

RMT.0368 planned for 2016. Protection against the used of contaminated halon. Guidance material to verify the quality of Halon in production and maintenance organizations. More information on this should be available at the next Systems Working Group meeting.

Thomas reviewed the ICAO and EC dates for halon replacement and pointed out the different dates for certain applications for ICAO and EC. These somehow need to be resolved/coordinated/solved. EASA contacts: Youri Auroque – Regulations Officer; Remi Deletain – Power Plant Expert; Lia Calleja-Barcena - Dangerous Goods Expert; Thomas Loevenich - Cabin Safety Expert.

Engine/APU Halon Replacement Industry Consortium – Halon Alternatives for Aircraft Propulsion Systems (HAAPS) – R. Bennett for A. Macias (Boeing)

The consortium will: define a non-halon fire extinguishing solution(s) for use in engine/APU fire zones. At this point, the airframers are primarily involved, but others will be brought in at a later date. The plan is in place. It has 3 phases. Phase 1 is currently in process: initial engagement, confirm interest, launch consortium formation activities, engage ME, business and working together agreements. This group was proposed approximately two years ago, and ICAO's General Assembly acknowledged the formation of this group. The commitment to form the consortium was signed in October 2014. They estimate the Joint Collaboration Agreement (JCA) will be signed by 3rd or 4th Quarter of 2015. Phase II: Technical Statement of Work Definition – this phase will hopefully begin later in 2015. Carol Cash at OAI is primary contact at 440-962-3073 or carol.cash@oai.org.

Cargo Compartment Halon Replacement Working Group (CCHRWG) Update – R. Bennett (Boeing)

Robin reviewed the Task. This group is under the authority of the ICCAIA-AC. The CCHRWG Stakeholder Meeting was held in Dresden, Germany, on May 11, 2015. An ICCAIA Working Paper will be put together later this year.

Next Meeting:

October 21-22, 2015 at the Tropicana in Atlantic City, New Jersey, USA. Hotel reservation details will be available at www.fire.tc.faa.gov, at a later date.

Spring 2016 Meeting:
We are looking for a host for the spring 2016 Systems Working Group meeting. It seems to work best to hold the spring meetings in Europe to enable members from Europe to attend more easily.

Meeting Presentations:

Copies of the meeting presentations will be available at www.fire.tc.faa.gov.