Cargo MPS Task Group

5/17/2019
9:00 AM
EASA, Köln, Germany

Type of meeting: Task Group Meeting

Note taker: Dhaval Dadia

Attendees: Dhaval Dadia, Robert Ochs, Enzo Canari, George McEachen, Doug Ferguson, Pat Baker, Karsten Kirbach, Jan-Boris Philipp, Rainer Beuermann, Konstantin Kallergis, Terry Simpson, Ian Campbell, Xavier Tiger, Chen Long

Minutes

Agenda item: Size of pressure vessel in aerosol can simulator

Discussion:

The issue of varying dimensions in the document was presented. The group agreed that the simulator that has been used at the tech center through all the prior testing should be measured. The dimensions obtained from this measurement should be recorded into the document including the internal volume of the vessel.

Conclusions:

Obtain dimensions and internal volume of vessel.

Action items	Person responsible	Deadline
✓ Measurement of dimensions	Dhaval Dadia	July 10, 2019

Agenda item: Aerosol can simulator valve opening timing

Discussion:

A high speed video of the opening of the valve on the simulator was shown with the analysis of the video. The analysis showed the valve opening in less than 0.1 seconds which is in accordance to the MPS document. The part number for the pneumatic valve has changed and should be changed in the document,

Conclusions:

Change part number of the pneumatic valve in the MPS document.

Action items	Person responsible	Deadline
✓ Change part number of pneumatic valve	Dhaval Dadia	July 10, 2019

Agenda item: Placement of pan for surface burning fire scenario

Discussion:

Look further at data available from Boeing MPS test cell. Compare data sets to see if there is any observable difference. Use temperature data from no-agent tests to see if the MPS development tests were conducted with a TC centered above the pan. Conversations in this topic led to questions whether we would have to run baseline testing and establish new criteria if we add a requirement of an added TC. Conversations about worst case scenario for the location of the pan were had. Spray patterns of the agent dispersion and what is actually meant by it. Removal of the wording “maximum horizontal distance” was agreed upon. Height measurements for the pan need to be clarified by specifying the frame of reference. The top edge of the pan will be used as the frame of reference.

Conclusions:

Use top edge of pan as the height frame of reference. Remove “maximum horizontal distance” from the most difficult location definition. Compare data from Boeing MPS test cell as well as run no-agent tests in the DC-10.

Action items	Person responsible	Deadline
✓ Add edge of pan as frame of reference	Dhaval Dadia	Enter deadline here
✓ Remove wording from criteria	Dhaval Dadia	Enter deadline here
✓ Compare Data	Dhaval Dadia	Enter deadline here

Agenda item: Miscalculation of standard deviation in surface burning fire.

Discussion:

Mentioned that the standard deviation was calculated incorrectly and the corrected value will result in a 10 degree decrease of the peak temperature value. The table mentions 570 F to be the criteria peak temperature. The corrected value changes this to 560 F. 560 F is mentioned in some portions of the text which will remain unchanged.

Conclusions:

Update table with correct standard deviation value.

Action items	Person responsible	Deadline
✓ Correct Value	Dhaval Dadia	July 10, 2019

Agenda item: Galvanized steel in LD3 containers

Discussion:

Concern that galvanized steel was used only due to the availability during the time of the development tests. Some test facilities might not be able to use galvanized steel in fire tests due to zinc off-gassing. Discussions led to agreement that the mention of the galvanized steel should remain, but alternate metals that can be used in its place should be mentioned. Also, challenges in finding the right thickness for 22 gage for the steel resulted in changing the annotation for the thickness of the galvanized steel. The correct thickness with a tolerance should be mentioned in the document, Incorrect spelling for “gage” in the document should be corrected.

Conclusions:

Provide alternate sheet metal information. Change annotation used for the thickness of the material.

Action items	Person responsible	Deadline
✓ Alternate sheet metal information	Dhaval Dadia	July 10, 2019
✓ Thickness annotation of the sheet metal	Dhaval Dadia	July 10, 2019
✓ Correct spelling errors “gage”	Dhaval Dadia	Jul 10, 2019

Agenda item: Aerosol Can Simulator – Compartment Pressure Transducer

Discussion:

The pressure transducer prescribed in the MPS does not have the resolution to measure the pressure rise created by the opening of the simulator in the compartment. There is a possibility that the measurements obtained thus far could be false due to the readings not being in the measurable range. Xavier recommends using a pressure transducer with a smaller range and with a measurable range being that of the readings obtained thus far from the simulator. Recommendations were made by the task group to change the pressure transducer to a smaller range since any pressure rise would be considered as a failure for this test scenario. Measurement of the pressure rise created by the opening of the simulator can be established and subtracted from a pressure rise obtained during agent testing.

Conclusions:

Obtain recommendations of pressure transducer to be used in the MPS.

Action items	Person responsible	Deadline
✓ Find applicable pressure transducer	Task Group Members	June 13, 2019
✓ Change the pressure transducer specifications once the pressure transducer is agreed upon.	Dhaval Dadia	Enter deadline here

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Agenda item: Air Exchange Rate calculations

Discussion:

Airbus will conduct testing to determine air exchange rate calculations using two different techniques and present results to the task group. Diehl might have the capability to perform similar results and establish a correlation between the two methods – carbon-dioxide decay and positive pressure method.

Conclusions:

Awaiting testing to be conducted and analyzed.

Action items	Person responsible	Deadline
✓ Perform tests and analyze result to present to task group	Rainer Beuermann Karsten Kirbach	Enter deadline here

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Agenda item: Analyzing agent test results to criteria

Discussion:

The wording in the document left the analysis open to interpretation. Averaging 5 peaks in one test and comparing it to the overall criteria versus obtaining a single peak from each test and averaging the peaks from the five conducted tests and comparing it to the criteria. A change in wording has been suggested and needs to be worked on to fit it better in the document. "average of the single highest peak temperature for each of the five tests shall". There were talks of including an example of how the data should be analyzed including a test that had a higher peak than the criteria which will show that as long as the average is less than what is required in the criteria, the agent will pass.

Conclusions:

Change the wording of the acceptance criteria as well as provide an example data set.

Action items	Person responsible	Deadline
✓ Construct a new wording scheme	Dhaval Dadia	Enter deadline here
✓ Example data set	Dhaval Dadia	Enter deadline here

Agenda item: Meetings recurrence

Discussion:

Set a date and time for future WebEx meetings so that there are more talk than just during the systems forum meetings. Follow up meeting will be on June 12, 2019 and also a WebEx every 4 weeks will be scheduled after that.

Conclusions:

WebEx meeting every 4 week from June 12, 2019

Action items	Person responsible	Deadline
✓ Setup WebEx meeting	Enzo Canari	June 12, 2019

Agenda item: Toxicity in the MPS document

Discussion:

A brief conversation regarding the possibility of including the toxicity requirements in the MPS document was had. There were comments mentioning that if toxicity is going to be required then it should be included in the MPS. Further discussion will be had on this topic in the future meetings.

Conclusions:

Further discussions to be had.

Action items	Person responsible	Deadline
✓ Continue Toxicity conversations	Task Group	Enter deadline here

Agenda item: Aerosol Can Explosion Simulation Test method

Discussion:

The slides from the presentation were shown to illustrate the unintended consequence of conducting the test as prescribed in the MPS. The agent stratifies leading to low concentration near the ceiling. The intention of the test is to ensure that there is no pressure rise at the minimum inerting concentration (MIC). Certification methods ensure that the lowest concentration will be equal to or greater than the MIC. The group looked at the data from the raised stand method and the mixing fan method and agreed upon using the mixing fan method moving forward. The method of the mixing fan involves stirring the agent in the test compartment using 3 fans until 30 seconds prior to the activation of the simulator. The simulator will be activated at a point concentration of 3% ± 0.1% measured at the ignitor height.

Conclusions:

Use the mixing fan methodology for the aerosol can explosion simulation test scenario and update the method in the MPS document. Also write up a statement regarding the changes to the method and get official agreement from the task group to pass the statement to FAA.

Action items	Person responsible	Deadline
✓ Write statement regarding change in methodology	George McEachen	June 12, 2019
✓ Get agreement from task group	Task Group	June 12, 2019
✓ Amend MPS document	Dhaval Dadia	Enter deadline here

Agenda item: Aerosol Can Explosion Simulation Acceptance Criteria

Discussion:

The concerns with the acceptance criteria were presented again as explained in the presentation from Boeing, and the task group presentation. The wording makes it so that even a small flicker would fail the test and that wasn't the intent of the test. Tests from the Boeing facility were shown using the mixed fan test method to run the aerosol can simulator. The tests showed that with 3% Halon in the compartment, 3/5 tests showed some minor flaming activity near the ignitor, 1/5 tests showed a flash that was about 2 feet long, and 1/5 tests that showed no activity. We were reminded that the MEC of Halon is 6% and below that it acts as a suppression agent and not an extinguishing agent. A possible acceptance criteria was written with some key factors in mind:

1) Intent of the test is pressure criteria. Define the pressure at which the test fails. Zero without any definition or tolerance is too vague.
2) A small flame could exist based on Halon tests in a different chamber. 5 tests will be conducted at the tech center as well to develop a set of test videos as reference for flame size for perspective. Flame size from Boeing's test facility will be inserted into criteria.

Potential Criteria

"The criterion for the aerosol can explosion simulation scenario is that there is no evidence of an explosion or reaction that would be a threat to the integrity of the cargo compartment. Evidence of an explosion is that there shall be no pressure rise (in addition to its standard deviation) more than the measurement of the baseline simulator pressure release into a compartment. The baseline test shall be conducted three times in the presence

of the agent being tested without an ignition source. The baseline pressure will be calculated as the maximum value of the three tests and one standard deviation. The criteria of an unacceptable reaction is based on the observed performance with Halon 1301. With Halon 1301 it is typical to see evidence of a local flame or reaction near the ignitor in most tests and to see a small flash in 1 of 5 tests. The small flash involved a flame that separated from the ignitor and spread about 2 feet and self-extinguished in _ seconds. In the event of more than one test having a "small flash" event, it is acceptable to perform additional tests to demonstrate that the frequency of these events is not greater than 20%. In addition, when the agent concentration is below its inert concentration, the explosion intensity and peak pressures shall not be greater than the values exhibited during an explosive event when no suppression agent is present in the compartment. To find more information on this subject, refer to reference 2."

Conclusions:

Developed a potential criteria that needs to be created into a statement that will be presented to the FAA. The task group has agreed upon this criteria.

Action items	Person responsible	Deadline
✓ Write a statement mentioning the new criteria to be submitted to the FAA	George McEachen	June 12, 2019

Agenda item: Challenge Fire

Discussion:

Challenge fire was asked to be developed as a fire that is likely to occur in a cargo compartment. Concerns were brought up that a challenge fire test should be conducted unsuppressed as well as with Halon to develop a pass fail criteria. EASA suggested using surface burning fire criteria as the acceptance criteria. Intentions explained by EASA about the need to have a test with Lithium batteries as part of the fire load. It started from a potential ban of laptops from being carried in the cabin which would lead to them being transported in cargo compartments. Hence the need to show a fire suppression agent could deal with such a potential situation. The fire load doesn't necessarily have to be similar to the one conducted with the water mist/nitrogen system, but could consist of various lithium batteries of different types (pouch, 18650, battery pack), chemistries, and states of charge to represent a realistic fire load. Doug Ferguson brought up some key points from a G-27 point of view. 10 cells at 100% SOC pose a greater risk than 50 cells at 30% SOC. A test fire load would have to explain the reasoning behind the selection of batteries and their state as present in the test scenario.

Conclusions:

Continue discussions regarding intent of a challenge fire test. Will there be a potential pass fail criteria?

Action items	Person responsible	Deadline
✓ Continue discussions	Task Group	June 12, 2019

Agenda item: Other discussions during the meeting

Discussion:

Possible use of another agent or inert gas to obtain comparison data between facilities. This will help in understanding how different chambers constructed as per the MPS are than the Tech Centers DC-10. The DC-10 has alternate leak paths due to it not being a completely sealed chamber. Also the leak rate changes as the temperatures in the compartment increase due to a fire. This difference was shown when Boeing conducted their own Halon tests and unsuppressed fire tests in their compartment. Using the Halon data led to lower peak temperatures leading to a stricter criteria. Boeing proposes test facilities with their own chamber to conduct their own Halon baseline to develop the criteria for their test facility. EASA's concern with this was that there could be a facility which would want to have elevated criteria with a chamber created as per the MPS. The control over air leakage rate and data from unsuppressed fires can show that this will not be possible. Also, comparing data from a prescribed agent/inert gas system would help in answering compartment comparisons. Terry Simpson also mentioned that there were efforts made 8-10 years ago to replicate a compartment that would have fire test results similar to the unsuppressed fire tests conducted in the DC-10. Their testing showed that they would need to make the compartment leakier as well as insulate the compartment to obtain almost similar results. They will try to find the information and lessons learned from their testing.

Better definition of the chamber was requested in terms of heat loss, insulation etc. Chambers that might constructed might be stationed out in the open and might not have the control over ambient conditions like at the tech center. Also the

MPS doesn't prescribe any insulation around the chamber whereas the DC-10 has an external skin that insulates the inner cargo compartment skin. There might be an effect on temperatures due to uniqueness of the DC-10 cargo compartment at the tech center. Robert Ochs recommended the usage of an unsuppressed surface burning fire as a heat loss test to develop some heat transfer criteria for compartments.

Questions about how the long version of the aerosol can explosion simulation was developed and if there is data available from the testing?

Conclusions:

Consider inert gas or agent that can be used as a comparison between different locations. Define other boundary conditions of the test chamber.

Action items	Person responsible	Deadline
✓ Obtain lessons learned from Terry Simpson's group regarding chamber leak rate and insulation of chamber to replicate DC-10 unsuppressed fire test results.	Terry Simpson	July 9, 2019
✓ Find the development of the long version of the aerosol can test.	Dhaval Dadia	June 12, 2019

Agenda item: Aerosol Can Short vs Long Version

Discussion:

There were talks about whether you truly have the option of testing a gaseous agent using the long version of the aerosol can test. Although there is the option to test either version of the aerosol can test, Boeing voiced their concern that they were asked to test the short version for gaseous agents. There could have been a misunderstanding that after initially seeing results from the short version and then making a decision to run the long version might not be acceptable. The group also agreed that there is a choice in running either version as currently stated in the document. If there is an understanding that gaseous agents must be tested to the short version of the MPS, it must be explicitly mentioned to do so in the MPS. There were also talks about the disadvantages to running the short version with the current criteria. Using the long version, the ignitor is shrouded by a layer of smoke from the cardboard box fires and most likely the concentration of the agent near the ignitor is greater than the MIC. This makes the short version a harder test for gaseous agents to pass. The group also agreed that if the proposed criteria was accepted, then the task group would accept running the short version for gaseous agents.

Conclusions:

Mention in the MPS if gaseous agents are mandated to run the short version of the aerosol can explosion simulation test.

Action items	Person responsible	Deadline
✓ Enter action items here	Enter person responsible here	Enter deadline here

Appendix

Special notes: Raw information used during discussions

- Aerosol Can Simulator Test Method
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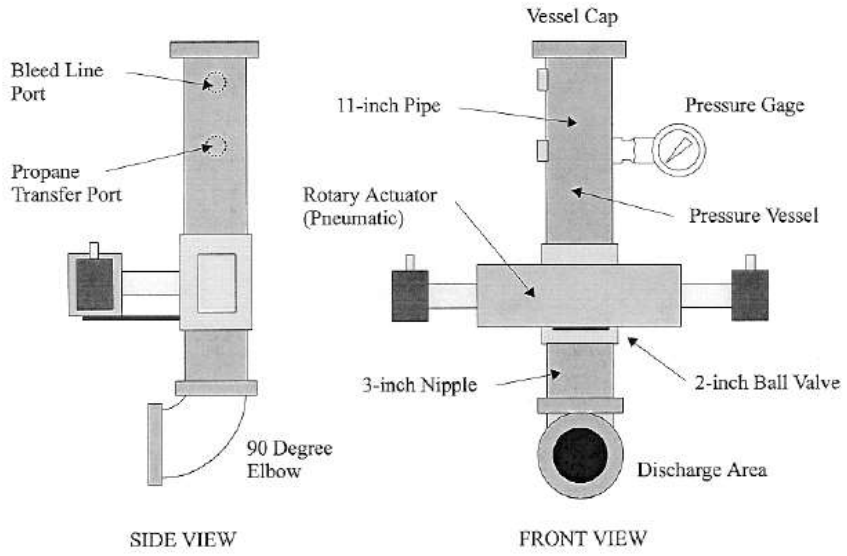
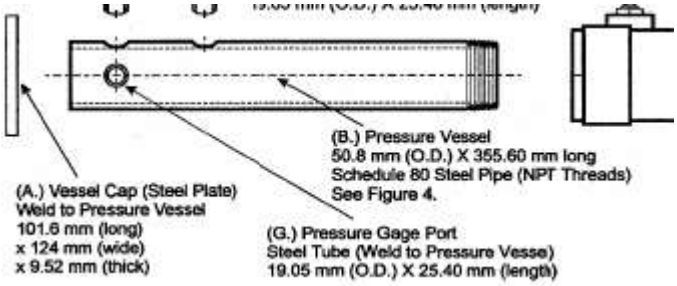
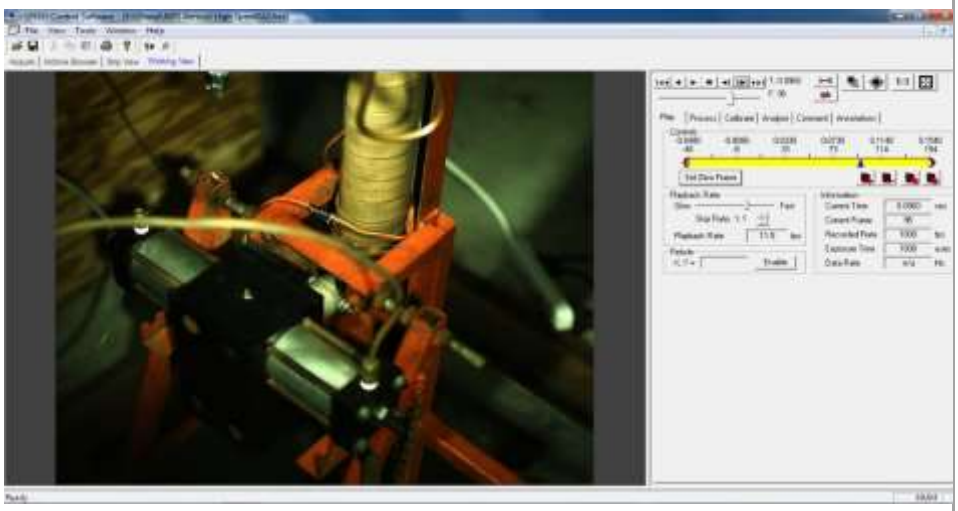
Wording of the pass/fail criteria.	The criterion for the aerosol can explosion simulation scenario is that there is no evidence of an explosion or reaction. Evidence of an explosion or reaction includes deflagrations, flashes, and overpressures, etc. There shall be no overpressures (zero pressure rise). In addition, when the agent concentration is below its inert concentration, the explosion intensity and peak pressures shall not be greater than the values exhibited during an explosive event when no suppression agent is present in the compartment. • MPS development report mentions the observation of a flash in Test 4.

	• Detailed presentation to be given by Boeing Conducted test in the DC-10 cargo ★ Task Group Presentation
Test Method	Testing in the development was conducted using a bulk average concentration of 3% in the compartment. The MPS document mentions to conduct the test using the point concentration measurement at the probe near the ignitors. New proposal for test method (Fans/height increase) ★ Task Group Presentation
Size of Pressure Vessel	Mentioned to be 11" in the wording and Figure 8. Figure B-1 mentions it to be 355.6 mm long (14 ") The following list describes the major components of the aerosol can simulator. • Pressure vessel. A steel 2-inch (5.1-cm) -diameter, 11-inch (27.9-cm) -long schedule 80 pipe welded or capped at one end.  Figure 8. Aerosol Can Explosion Simulator 
Ball Valve Opening Criteria	The ball valve is capable of rotating from the fully closed position to the fully open position in less than 0.1 second in order to form a vapor cloud. Conducted high speed camera test to measure timing of opening - 0.096sec <<A2.mp4>>

	
Gaseous agents short version	Are gaseous agents required to conduct only the short version? Could also conduct the long version. Clarification on intentions of the short version. Is video recording mandated to observe reactions, flashes, etc…
Clarification on "overpressure "	Does it include or exclude
What would long version of aerosol can look like for Halon?	

- Surface Burning Fire Test Method
  -

Placement of Pan	The pan should be positioned in the cargo compartment in the most difficult location for the particular suppression system being tested • Testing revealed that by placing in the worst case scenario you might not have a thermocouple over the middle of the pan. Not sure about the location of TCs during the MPS development testing. Testing with a pan directly underneath a TC and slightly adjacent to the TC shows different peak and time-temperature integrals. Task Group Presentation Show data from Boeing Sponsored Agent
Standard Deviation for the peak temperature	The std. dev. for the peak temperature is calculated as 16.8. It should be 15.3. Changes Peak Temp criteria from 570°F to 560°F. • Mentioned to be 560°F in the Executive summary as well as acceptance criteria. Table A-1 has the std. dev. and 570°F mentioned.

Table A-1. Results From MPS Tests Conducted With Halon 1301

Test	Test ID	Bulk-Load Test Max. Temp (°F)	Bulk-Load Test Max. Area (°F-min)	Test ID	Containerized-Load Test Max. Temp (°F)	Containerized-Load Test Max. Area (°F-min)	Test ID	Surface-Burning Test Max. Temp (°F)	Surface-Burning Test Max. Area (°F-min)
1	081198T1	511	7979	082898T1	607	13573	111899T3	549	1150
2	081298T1	431	8885	083198T1	577	12998	111899T4	539	1160
3	081398T2	450	9068	090198T1	606	13108	111999T1	549	1167
4	081498T1	382	8939	090298T1	520	11937	111999T2	517	1119
5	081998T1	632	9413	090498T1	498	10966	111999T3	514	1114
6	082198T3	461	8704						
Standard Deviation		78.9	438.1		44.8	942.1		16.8	21.6
Maximum Value		632	9413		607	13573		549	1167
Sum of Std. Dev. + Max.		710.9	9851.1		651.8	14515.1		565.8	1188.6
ACCEPTANCE CRITERIA (°F)		**710**	**9850**		**650**	**14520**		**570**	**1190**
ACCEPTANCE CRITERIA (°C)		**377**	**4974**		**343**	**7569**		**299**	**608**

- Containerized Fire Test Method
  -

Usage of galvanized steel in the constructio n of the container	Can a different material be used to construct the test LD-3 container. 1 side polycarbonate, 2 sides Aluminum, rest are 22 Ga. Galvanized steel Compare data from unsuppressed fires in DC-10 to unsuppressed fire from other construction methods.

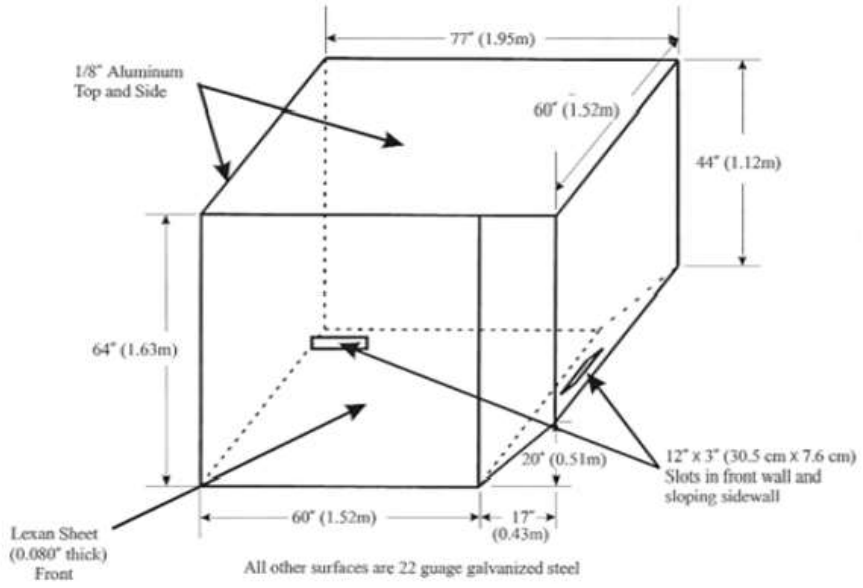


Figure 5. The LD-3 Container

- Air Leak Rate Test Method
  -

Method to measure the air leakage rate	A methodology is not mentioned to calculate the leakage rate in the compartment. Airbus uses blower door method while the tech center uses carbon di-oxide leak rate.

	Diehl/Airbus to evaluate difference in leak rate test methods.

- Challenge Fire
  -

Is Challenge fire going to be an additional fire test **Multi Threat Fire/Combination Fire**	Challenge fire is defined as a fire likely to occur in the cargo compartment. A quantification of how Halon performs against the Challenge Fire scenario. Perform unsuppressed challenge fire test to obtain peak temperatures. EASA would like to add the challenge fire to the MPS. ☐ Enzo will get in touch with FAA TAD* to look into it. Research project by EASA funded - stating tests next year - fire risk assoc to battery fire in luggage. Should Halon be tested against this scenario - ? Different name One additional test that includes batteries in the fire load. - test of agent CRI results in conducting same test multiple times for different configurations. Don't want the setup mentioned before in the Water mist campaign P/F criteria could possibly be Surface burn P/F criteria G-27 fails at 3 18650 @ 100% SOC Batteries not covered by G-27 is the concern Scenario that is not addressed in any other scenario Discuss rationale behind the selection of the quantity and types of materials included in the test 10 cells at 100% SOC poses a greater risk than a box of 50 batteries @ lower SOC spread around the fire load. Design distribution of cells - Different cells types at different locations, different SOC inside luggage. Vision of P/F - no explosion Higher SOC low qty could possibly show a more dangerous scenario… Distribute batteries within a piece of fire load.

- Thermal Mass of the Compartment
  - With the rebuild of the DC-10 cargo compartment, does the change in material type and thickness affect the temperatures and time-temperature integrals?
    - Measuring the temperatures 1" below the ceiling (gas layer). What is the overall effect?
    - Could compare unsuppressed fires for changes in peak temps and time-temp integrals

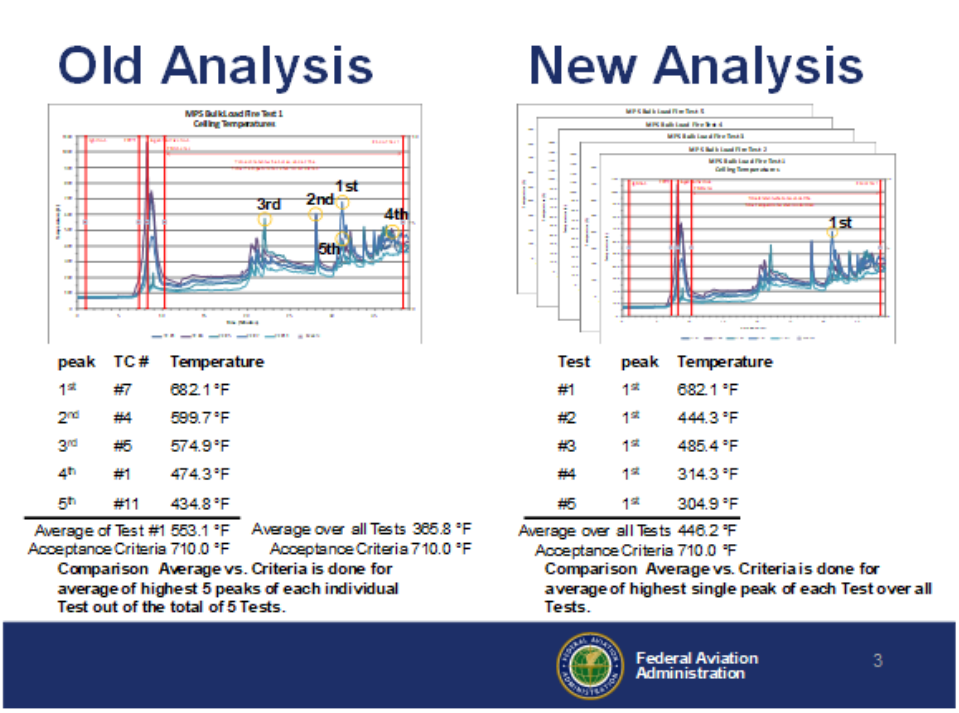
- Different types of shredded paper used in tests.
  - Diehl to look into quantifying the effects of different types of paper used.
  - Presentation from Meeting

- Toxicity in MPS?
- Measurement uncertainty
  -

Analyzers are expected to have a 5% tolerance (0.15% for 3% Halon) while short version aerosol can requires accuracy of 0.1%	containerized-load fire scenarios. The accuracy of the analyzer shall be ±5% of the reading. The gas analyzer is used to measure the concentration of the gaseous suppression agent. The data-sampling rate for all the temperature measurements and the gas concentrations should be at least one data point every 5 seconds. is discharged. The simulator device is activated at least 2 minutes after agent discharge. The activation time is dictated by the measured volumetric concentration, within ±0.1% of the minimum protection concentration. The minimum concentration is measured 2 feet (60.9 cm)
Source of Error table	

	Value	Units	tolerance / error	Suggested Instrument	Notes
Leakage Rate	50	CFM	±5	not identified	No requirement to measure in-situ during fire test
Temperature			±3.96F	Type K 22 Gauge Thermocouples 22 gauge	need spec for sheathing, grounded or ungrounded junction, exposed junction, etc
Agent Concentration		% vol	±5% of reading	Continuous Gas Analyzer	halon impurity adds error
Pressure Pulse	0-50	psig		Omega 0-50 psig @ 3000 Hz	
Simulator Pressure	240	psi	±5 psi		doesn't specify gauge or absolute
Simulator Contents				None (scale)	need scale accuracy
Evidence of Explosion	0	psig	none	Pressure Transducer	how to determine other evidence (deflagrations, flashes, and overpressures)?
Time Temp Integral				Thermocouples and Data Acquisition	no specification on temperature sampling frequency

- Clarification on acceptance criteria

Peak and time-temp integrals from individual tests could be higher than the acceptance criteria, but once it is averaged, the average value would pass.	 The acceptance criteria for the bulk-load fire scenario are that the average of the single highest peak temperature for each of the five tests shall not exceed 710°F (377°C), starting 2 minutes after the suppression system is initially activated until the end of the test. In addition, the average of the five tests areas under the time-temperature curve of the compartment thermocouples shall not exceed 9850°F-min(4974°C-min). The criteria for the containerized-load fire scenario are that the average of the five test peak temperatures shall not exceed 650°F (343°C), starting 2 minutes after the suppression system is initially activated until the end of the test. The average of the five test areas under the time-temperature curve shall not exceed 14,520°F-min (7,569°C-min). The acceptance criteria for the surface-burning fire scenario are that the average of the five test peak temperatures shall not exceed 560°F (293°C), starting 2 minutes after the suppression system is initially activated until the end of the test. In addition, the average of the five test areas under the time-temperature curve shall not exceed 1190°F-min (608°C-min).
If one peak is greater than the test criteria?	Acceptable as long as avg. is below acceptance. Show in example.

- Diversion time criteria??

- Better resolution for Fig 1 that shows locations for the gas probes.

Agenda for 2019 Cargo MPS Task Group

☑	Size of pressure vessel	Currently used simulator dimensions and volumes with tolerance.

- ☐ Add paragraph to explain halon baselines for own chamber
- ☐ Create a set of chamber comparison tests with other agents
- ☐ Terry Facility air leakage rate, insulation, and volume to match MPS dev numbers
- ☐ Nitrogen as a baseline agent. Define method of calibration
- ☐ Define lower limits and not higher and relative to the unsuppressed fires
- ☐ Boundary conditions around cell
- ☐ Define ambient temp and humidity
- ☐ Use pan fire as a heat loss test
- ☐ Find dev of long version aerosol can test..

☑	Valve opening timing of simulator	Update part number for the valve.

☑	Short version of Aerosol can for Gaseous agents?	Reasonable to use short version for gaseous agents. (depending on the outcome of criterion acceptability). Should be explicitly mentioned in the MPS document. Clarify with FAA whether it is truly an option to run either versions of the test. (EASA, FAA)

☑	Placement of pan in pan fire	Add requirement to add T/C above the center of the pan. Back burner for now. Define worst case scenario and most comparable to halon baseline. Pan in corner scenario? Maximum horizontal distance - Take out - Agreed Height of Pan - specify it is the top edge of pan - agreed
☑	Miscalculation of std. dev. of peak temp in surface burning fire	Correct with proper calculation
☑	Galvanized Steel on LD3 Containers	Keep info that 22 ga galvanized steel was used in the MPS dev testing. Mention alternative materials with same thickness + tolerance. Correct spelling of gage.
☑	Aerosol can wording criteria	Concern is the elongated flame. Defining flame acceptance criteria. Add tolerance on opening of simulator pressure as a guidance. Pick a pressure transducer with a lower FS. Overpressure is a starting point and can describe the intent as threat to the compartment and define the reaction/flame size/area of flame. Tolerance for "zero" overpressure "zero" overpressure should eliminate flames Do not allow a certain reaction flame size Describe a majority of the test. Cannot allow worst case behavior for all tests. Percentage of passed tests High speed IR for looking at flames through smoke/fog Proposed criteria "The criterion for the aerosol can explosion simulation scenario is that there is no evidence of an explosion or reaction that would be a threat to the integrity of the cargo compartment. Evidence of an explosion is that there shall be no pressure rise (in addition to its standard deviation) more than the measurement of the baseline simulator pressure release into a compartment. The baseline test shall be conducted three times in the presence of the agent being tested without an ignition source. The baseline pressure will be calculated as the maximum value of the three tests and one standard deviation. The criteria of an unacceptable reaction is based on the observed performance with Halon 1301. With Halon 1301 it is typical to see evidence of a local flame or reaction near the ignitor in most tests and to see a small flash in 1 of 5 tests. The small flash involved a flame that separated from the ignitor and spread about 2 feet and self-extinguished in _ seconds. In the event of more than one test having a "small flash" event, it is acceptable to perform additional tests to demonstrate that the frequency of these events is not greater than 20%. In addition, when the agent concentration is below its inert concentration, the explosion intensity and peak pressures shall not be greater than the values exhibited during an explosive event when no suppression agent is present in the compartment. To find more information on this subject, refer to reference 2."

☑

	Aerosol can test method for short version	Add in test procedure "It is acceptable to use mixing fans in the compartment to minimize stratification of the agent during this test. The mixing fans should be turned off at least 30 seconds prior to the activation of the simulator."
☑	Pressure Transducer change	Minimum value that is considered accurate. Absolute pressure gage Have suggestions by next meeting.
☑	Air exchange rate calculation (Airbus update?)	By end of year… Also see if Diehl can compare their compartment data sets.

☐ Challenge Fire (EASA Stance)
☐ Challenge Fire - fire load
☐ Challenge fire Halon comparison
☐ Thermal mass of compartment
☐ Type of paper used in the boxes
☐ More defining characteristic of the compartment
☐ Measurement uncertainty

☑	Analysis of results	average of the single highest peak temperature for each of the five tests shall
☑	Toxicity in the MPS document	Follow up if we should include in the MPS document.

☐ Better clarity on the drawings in MPS document
☑ Webex timeframe 7AM PST June 12 - every 4 weeks. Send Enzo list of participants to setup webex. (possible in person meeting in Seattle before triennial)