INTERNATIONAL HALON REPLACEMENT WORKING GROUP MEETING

April 15-16, 1997

Hosted by Douglas Aircraft Company, Long Beach, California

TUESDAY, APRIL 15, 1997

Discussion on Halon Replacement Schedule

This schedule was distributed to all Working Group members as part of the March 3, 1997, mailout. R. Hill discussed modifications to halon replacement schedule for the cargo area recently instated. H. Mehta: Do you plan to update the Halon Replacement Schedule to reflect these modifications? R. Hill: Yes, we will update the Schedule periodically and try to include a revision with the Minutes from time to time.

Update on Class ‘D’ Cargo Compartment to Class ‘C’ Cargo Compartment Meeting held February 6, 1997, in Seattle

New discussion on simulants and consideration to use HFC-125 as a simulant in cargo area certification. One of the new Task Groups established at the February 6, 1997, meeting will address this issue.

R. Hill discussed the purpose of the February 6, 1997, meeting and the formation of the 4 new Task Groups:

1) to define range of leakage for given models of aircraft so that the number of certification tests could be limited
2) to determine how leakage is currently being measured and address the following issues:
   - “What is a realistic way of measuring leakage at altitude or while the aircraft is ascending and descending and what kind of flight profile should we be concerned with?”
   - “How do you measure the concentration in a cargo compartment when you have stratification, where do you put the probes, do you take an average, etc.?”
3) to survey the present acceptable methods of smoke detection for certification and to develop a method to standardize the amount of smoke and how it is produced when certifying a detection system
4) to look into simulants for use in certifying halon 1301 systems in cargo compartments.

Task Groups 1, 2 and 3 have been combined into one Task Group chaired by Dave Blake of the FAA Technical Center. Task Group 4 is chaired by John Reinhardt of the FAA Technical Center. During the discussion at this meeting we learned that most people felt that as long as Halon 1301 was allowed to be used it would be the agent of choice in the cargo compartment. R. Hill: We hope to have a resolution within six to nine months. Please contact John if you would like to participate. At this point we are still defining the focus of this Task Group.

R. Hill: There have been a number of accidents over the years that have led us to believe there is a need for detection and suppression systems in the cargo compartments.
F. Stossel: Does the FAA plan to discuss this ‘D’ to ‘C’ conversion with the JAA? K. Larson: The JAA has been advised of this conversion. J.F. Detienne: The JAA and the European countries will try to harmonize their position with the FAA when the NPRM comes out. R. Hill: The JAA has been invited to attend the meeting that will be held April 22-25, 1997, at the FAA Technical Center for certification personnel around the world to discuss certification issues of the ‘D’ to ‘C’ conversion and the NPRM. R. Stark: Will there be a means of telling the rest of industry of the outcome of the April 22-25, 1997, meeting? R. Hill: There are members of industry who are DERs who should be at the April 22-25, 1997, meeting. D. Dierdorf: Will this group be issuing a minutes or outcome of the meeting? R. Hill: I do not know if there will be any type of advisory material prepared as an outcome of this meeting. K. Larson: A decision has not been made on the distribution of the meeting outcome yet. We plan to discuss that at the conclusion of the meeting.

**Task Group Leader Presentations**

**Bob Tappscott - Task Group on Halon Options**

This Task Group has published two reports through the FAA Technical Center. Draft of the third report is on the Internet. This draft can be located through this Website http://nmeri.unm.edu/cget/ihrwg.htm. Comments on the third report are requested. An update on this Task Group is included in this package.

**Frank Hughes (for J. O’Sullivan) - Update on Montreal Protocol Meeting held in Melbourne in February 1997**

Provided update on all areas of discussion at this February 1997 meeting. Discussion on importance of airline involvement.

R. Hill: There is no use restriction at the present time in the use of Halon 1301 in ‘D’ to ‘C’ conversions.

**Bill Leach - Simulants Task Group Update**

Gave background on simulants work within the Navy. This simulants Task Group saw little activity since its formation, but the simulant issue has been brought up through the discussion at the February 6, 1997, ‘D’ to ‘C’ cargo compartment conversion meeting in Seattle.

R. Hill: The group working on the engine nacelle should consider putting together a report on what has been done to date (including background on what has been done). D. Dierdorf: Is there a way that you are able to handle business confidential information in this? R. Hill: The FAA can do that, and I’m sure the Navy can do that, but if you are talking about a Task Group which includes members from industry that would be difficult because it is shared publicly.

**Dave Blake - Final Minimum Performance Standard for Cargo Compartments Update**

Report on April 14, 1997, Meeting: We outlined the areas that we felt needed to be covered by this Minimum Performance Standard and got feedback/comments from the Task Group members on this. We need to agree on the definition of a successfully suppressed fire - this is open for comment. We also need to determine what the ambient conditions will be in order to make it repeatable. Two draft documents are being distributed to Task Group
members for comments. These comments should be returned to Dave Blake by June 15, 1997. He will then try to incorporate the two documents into one working document including those comments. We (at the FAATC) have begun to do some work with aerosol cans.

**Konstantin Kallergis - Handheld Work at DLR**

Showed viewgraph of one hidden fire test rig and described its configuration. Explained results of tests conducted using this apparatus. A report on this work is available, if you would like a copy of the report contact Konstantin Kallergis.

**Subgroup Leader Presentations**

**Lavatory - R. Hill**

There has been a lot of work in this area. The test method was developed to what we thought was a final version some time ago and we then did a series of round robin tests and found that a number of variables made a difference in the results and repeatability. We made some adjustments we modified it and prepared a report including an Appendix that includes the Minimum Performance Standard. A copy of this report is included with this package. Working Group members not receiving this Minutes Package will receive a copy of the report in a separate mailing. This report went through the FAA and a Policy Letter was drafted through the FAA Northwest Mountain Region Transport Airplane Directorate. A copy of this Policy Letter is included in this Minutes Package.

**Handheld - R. Hill**

Some of the handheld work was previously done through the CAA when Nick Povey was involved in this Working Group. We (at the FAATC) have built the same test apparatus that was created through the CAA work to determine if it is a reproducible test and the test method is repeatable. R. Gautreau: CEAT is currently doing some work on toxicity and will have some information to present at the next Working Group meeting. R. Hill: Toxicity is probably the next area where we will have to create a Minimum Performance Standard. The Minimum Performance Standard references all requirements for replacements for handheld extinguishers (environmental issues, toxicity, hidden fire test method, seat fire test method, approval requirements). The Minimum Performance Standard is not a test or a list of tests, it references the test methods that the handheld extinguisher would have to meet. Harry Webster at the FAATC is now the Subgroup Leader for the handheld extinguisher work. Member Question: Is it still your best estimate that the Minimum Performance Standard will be complete by February 1998? R. Hill: It will definitely be the next Minimum Performance Standard that we will work to complete. There is still a chance that it will be ready next spring.

**Engine - R. Hill**

In October 1996, the Engine Task Group got together to discuss the work that had been done to develop a Minimum Performance Standard. We (FAATC) are working to get our engine nacelle simulator up and running. The FAATC engine nacelle simulator has been moved to a larger facility at the FAATC.
Cargo - D. Blake

Dave Blake showed graphs explaining test set-ups and data for cargo compartment testing done at the FAATC. Dave gave an explanation of the results of the tests of various agents conducted at the FAATC since the last Working Group meeting in February 1997. A copy of his presentation is included in this package.

Other Cargo Tests Recently Conducted at the FAATC - R. Hill

Oxygen Canister Cargo Test conducted April 11, 1997 - The idea was to detect the smoke and get a discharge of halon and determine how long it would take to suppress the fire. The fire load was cardboard boxes and shredded newspaper (similar to the fire load Dave Blake uses in his cargo tests with one modification). The difference was that this fire load also included 100 solid oxygen canisters. Dick Hill described the events of the test. He will have the test data available at the next meeting. This makes it evident that it is extremely important to have detection. In this particular fire with this particular source the smoke detector did not detect the fire early enough.

WEDNESDAY, APRIL 16, 1997

Task Group Meetings

New Task Groups 1, 2, 3, 4 met. The Handheld extinguisher subgroup met.

Task Group Reports

R. Hill - Handheld - Discussed the status of the two test methods that are still being developed: the large seat fire/toxicity and the hidden fire tests. Discussed approving extinguishers or approving an agent. The hidden fire test lends itself to approving extinguishers, and we will look at halon 1211 extinguishers on a pass/fail basis and test some new agents/extinguishing systems to see how they rate.

D. Blake - New Task Groups 1, 2, 3 - We have volunteers from Boeing, Douglas, Airbus, and Transport Canada who are going to go back and research how their organizations measure leakage rate, how systems are certified, and how smoke is generated in different models and provide this information back to Dave by May 31, 1997, and he will put it together and redistribute to the Task Group for further work.

J. Reinhardt - New Task Group 4 - Simulants for Cargo Bays - Planning to create a test plan in order to test FE-25 as a simulant. The group members will provide some information by May 15, 1997, to be reviewed prior to the testing.

B. Tapscott - Halon Options - A number of assignments were made during the Task Group meeting. Gave update on plans for next report and layout of next report.

FAATC INTERNET INFORMATION

We (Fire Safety Section - FAATC) will be providing more information on the Internet in the near future. We are in the process of bringing someone in to set this up.
Discussion on Minimum Performance Standards


Copies of Policy Letter made available to those attending this meeting.

R. Hill: Briefly reviewed and explained layout and information provided in the report. Discussed the areas of environmental concerns, toxicity, test requirements, test conditions, how you conduct the test, what the pass/fail is, and a test report that would be issued from that data.

R. Hill: Are there any questions on the other Minimum Performance Standards?

Engine Nacelle Discussion

Member Question: When is Doug Ingerson actually going to start the engine nacelle testing? R. Hill: Doug has expanded the nacelle recently. The main problem is building the facility to meet the range of standards for the higher air temperatures. Would the group rather see us develop the facility to the point where it does everything that’s in the Minimum Performance Standard and then do some testing or do some testing and then develop the facility to where it will meet the range of the Minimum Performance Standard specification? H. Mehta: I prefer that the facility be completely developed to meet the specs of the Minimum Performance Standard prior to testing. D. Dierdorf: I would like to see some confirmatory work done to show that the Minimum Performance tests are sound. If these tests are not sound, the whole facility might need to be reworked. We need to clarify the approach. S. Hariram: Why don’t we go ahead and start testing so that we can get some data that we can all start looking at. H. Mehta: I don’t have a problem with running a few tests to see how the facility is operating, however, we will eventually need to cover the entire range of temperatures covered in the Minimum Performance Standard. I believe that if we interrupt the work of building the facility, it will impact the construction. J. Paillet: What is the time difference between the two? R. Hill: I will talk to Doug and see what the time scales are for each. I do know that the big hold up is going to be the inlet air. H. Mehta: I discussed the project with Doug last week. He is hopeful that the facility will be ready for testing within two months if all goes as planned. R. Hill: The engine Task Group will meet after lunch and set some goals oriented toward time frame so that we don’t keep slipping. See Engine Task Group update later in these Minutes.

Cargo Minimum Performance Standard - R. Hill

Copies of the two documents for comparison were provided at the meeting.

Additional Discussion

D. Blake - New Task Groups 1, 2, 3 - C. Lewis (Transport Canada) will provide some information on Bombardier Airplanes (CanadAir, DeHavilland) on the issues/questions raised during the Task Group meeting.

D. Blake - CF3I Testing - Do group members want to see more testing with CF3I in the Cargo Area? This question is addressed to the users. J. Paillet: We are interested in the possibility of using CF3I in the engine area. S. Hariram: We have concerns with toxicity, because we
would be concerned with leakage to the passenger deck. We would like to see the data and would like to see the toxicity levels. D. Blake: Conclusion: Nothing has changed.

**Toxicity**

R. Hill: One agent for cargo compartments and engines or two agents? F. Stossel: The agents will have to be evaluated on a case by case basis. One agent would be preferable, but Swissair can live with two agents if one has a high toxicity and cannot be used in the cargo compartment area.

Suggestion from J. O’Sullivan as presented by R. Hill - Develop the criteria for halon replacement, but work on areas where we can impact the accidental discharge of halon on the ground, etc., work with simulators, keep from discharging halon.

**New Task Groups**

**Hydrostatic Testing Exemptions**

R. Hill: The Navy has recommendations to stop hydrostatic testing of their extinguisher bottles. Our group should try to compile this information to show what the impact of these tests has on the release of halon and show what requirements the rest of industry has and what the military is doing, what impact this will have on environmental conditions. We (FAATC) agree that something should be done. B. Bowen: Certain airlines have gained an exemption from the DOT except when the rupture life comes due. This was done under a program with the Air Transport Association (ATA) airlines. This allows us to go 14 years without hydrostatic tests. R. Hill: We are aware of this program. We are thinking of putting a package together to try to get the DOT to change the requirement instead of having it only as an exemption. If we can compile all the data that the Navy and military and airlines have, we will put something together to forward to the DOT. Bill Leach said that he would be involved with this project. We would like a representative from an airline, an airframe manufacturer, and a systems manufacturer to participate in this Task Group. We can also show this to the environmental organizations to show them that we are taking action on this matter. If you are interested in participating in this Task Group, please contact April Horner by May 9, 1997.

**Working Group Member Presentations**

The following presentations were given by members of the Working Group:

Dennis Quirk - Cease Fire - “Cease Fire’s Synergistic, Suppression Technology for Fire Extinguishment”

Matt Kolleck - Booz, Allen, Hamilton - “Fire Protection Technology Benefit Methodology Development Project” (A copy of Matt’s presentation is included in this package.)

Lawrence Hardge - New Millennium Environmental Research “Knock Out Fire Suppressant”

Richard Dirks - KDI Precision Products - “Watchtower”

Ernie Dahl - “TW Arses Systems” “FAA Fire Detection Tests and Suppression Test at Atlantic City”
John Huntington - Huntington Research and Engineering - Update on their Engine Nacelle
Fire Suppression Work

**Engine Nacelle Task Group Report**

**Outcome of April 16, 1997, afternoon meeting:** The current plan is that the engine nacelle
should be ready by the date of the next meeting (July 1997). The Task Group will keep in
contact with each other prior to the meeting and will meet sometime during the next
Working Group meeting to discuss the status. Should there be a delay in the completion,
a decision will be made at the July Working Group meeting as to the course of action to
take (see discussion under Engine Nacelle section of Minutes).

**Final Discussion/Next Meeting/Closing**

B. Tapscott - The Environmental Protection Agency (EPA) has a restriction that states “no
testing using Halon”. It may be a good idea to look into this. R. Hill: They are well-aware
of what we are doing. In addition, they are in the process of putting together a paper for
the exemption for certification tests. M. Sanders at the EPA is working on this exemption.

R. Hill: We would like feedback on whether Working Group members would still like
Working Group members presentations.

**The contacts for the various Task Groups are as follows:**

- **Halon Options** - Bob Tapscott (NMERI) Phone: 505-272-7252/Fax: 505-272-7203
- **New Task Groups 1,2, 3** - Dave Blake (FAATC) Phone: 609-485-4525/Fax: 609-485-4810
- **New Task Group 4 - Simulants** - John Reinhardt (FAATC) Phone: 609-485-5034/Fax: 609-
485-5582
- **Halon Restrictions Update** - John O’Sullivan (British Airways) Phone: 44 181 562 5460/
Fax: 44 181 562 2928
- **Cargo Compartment Minimum Performance Standard** - Dave Blake (FAATC)
Phone: 609-485-4525/Fax: 609-485-4810
- **Engine Nacelle Minimum Performance Standard** - Doug Ingerson (FAATC)
Phone: 609-485-4945/Fax: 609-646-5229
- **Lavatory Trash Receptacle Minimum Performance Standard** - Tim Marker (FAATC)
Phone: 609-485-6469/Fax: 609-485-5580
- **Handheld Extinguisher Task Group** - Harry Webster (FAATC) Phone: 609-485-4813

**Next Meeting**

The next meeting will be hosted by Claude Lewis of Transport Canada on July 8-9, 1997,
at the Government Conference Center in downtown Ottawa, Canada. A Meeting Details
package will be sent under separate cover.
<table>
<thead>
<tr>
<th>NAME</th>
<th>ORGANIZATION/ AFFILIATION</th>
<th>ADDRESS</th>
<th>PHONE/FAX</th>
</tr>
</thead>
<tbody>
<tr>
<td>JOHN REINHARDT</td>
<td>FAA TECH CTR</td>
<td>AAR YDD BLK 375 ATLANTIC CITY INTL AIRPORT, NJ 08405</td>
<td>PHONE: (609) 485-5034 FAX: 609-485-5382</td>
</tr>
<tr>
<td>DAVE BLAKE</td>
<td></td>
<td></td>
<td>PHONE: 609-485-4825 FAX: 605-485-4820</td>
</tr>
<tr>
<td>BOB GLASER</td>
<td>WALTER KIDDE AEROSPACE</td>
<td>4200 AIRPORT DR WILSON NC 27896-9643</td>
<td>PHONE: 919-237-7004 FAX: 237-4717</td>
</tr>
<tr>
<td>Jean Francois DETIENNE</td>
<td>DGAC FRANCE</td>
<td>48 rue Camille De Monluc 92452 Issy les Mouline France</td>
<td>PHONE: 33 41 09 44 35 FAX: 33 41 09 45 13</td>
</tr>
<tr>
<td>Stephane DEHARVENGT</td>
<td>DGAC FRANCE</td>
<td>48 rue Camille De Monluc 92452 Issy les Mouline France</td>
<td>PHONE: 33 41 09 46 87 FAX: 33 41 09 45 13</td>
</tr>
<tr>
<td>TERRY SIMPSON</td>
<td>WALTER KIDDE AEROSPACE</td>
<td>14200 AIRPORT DRIVE WILSON NC 27896-9643 USA</td>
<td>PHONE: 919-237-3004 ext 296 FAX: 919-237-4317</td>
</tr>
<tr>
<td>Régis GAUTRAUD</td>
<td>D6A/DAS/SPAE FRANCE</td>
<td>26, bd Victor 00460 ARMESSE</td>
<td>PHONE: 33 7-45 52 44 80 FAX: 33 7-45 52 55 60</td>
</tr>
<tr>
<td>Laurent Grue</td>
<td>DGAC/SPAE</td>
<td>26, bd Victor 00460 ARMESSE</td>
<td>PHONE: 33 14 55 81 48 FAX: 33 14 55 81 76</td>
</tr>
<tr>
<td>Jean PAILLET</td>
<td>AEROSPATIALE/AIRBUS</td>
<td>376 route de Bayonne TOULOUSE 31060 FRANCE</td>
<td>PHONE: 33 56 19 38 65 FAX: 33 56 19 38 74</td>
</tr>
<tr>
<td>ALBERT LAM</td>
<td>FAA, LAKEWOOD</td>
<td>3960 PARAMOUNT BLVD, NV-1301 LAKewood, CA 90712-4137</td>
<td>PHONE: 362-627-5385 FAX: 362-627-5210</td>
</tr>
<tr>
<td>John Blackburn</td>
<td>BAE REGIONAL AIRCRAFT</td>
<td>P/ S 23A Avro House CHESTER ROAD WOODFORD, STOCKPORT, CHESHIRE, SK7 1CR, ENGLAND</td>
<td>PHONE: (44) 161 955 4028 FAX: (44) 161 955 4038</td>
</tr>
<tr>
<td>NAME</td>
<td>ORGANIZATION/ AFFILIATION</td>
<td>ADDRESS</td>
<td>PHONE/FAX</td>
</tr>
<tr>
<td>--------------------</td>
<td>----------------------------</td>
<td>----------------------------------------------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>Neil Percival</td>
<td>Percival Aviation Limited</td>
<td>The Bishops, Lichfield, Lichfield, Warwick, Warwickshire, ENGLAND</td>
<td>Phone: (44) 1543 833884</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fax: (44) 132 834018</td>
</tr>
<tr>
<td>Matt Kolleck</td>
<td>202, Allen + Hamilton</td>
<td>4141 Col Glenn Suite 131</td>
<td>Phone: 937-429-9599</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dayton, OH 45431</td>
<td>Fax: 937-429-9795</td>
</tr>
<tr>
<td>Joann Teshluka</td>
<td>FAA Lakeview</td>
<td>ANMM-130C 3960 Paramount</td>
<td>Phone: (562) 627-3855</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lakewood, CA 90712</td>
<td>Fax: (562) 627-5210</td>
</tr>
<tr>
<td>Richard Lamontagne</td>
<td>MITRE</td>
<td>202 Burlington Rd</td>
<td>Phone: 617-271-6930</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bedford, MA 01730</td>
<td>Fax: 617-271-6143</td>
</tr>
<tr>
<td>Gerald Flood</td>
<td>Cease Fire by Discover Inc.</td>
<td>10355 C Richmond</td>
<td>Phone: 810 398 6600</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Oak Park, MI 48237</td>
<td>Fax: 810 398 8081</td>
</tr>
<tr>
<td>R.H. (Dick) Lewis</td>
<td>GEC-Marconi Avionics</td>
<td>Air Marconi Rochester</td>
<td>Phone: 631 816001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kent ME 2XX UK.</td>
<td>Fax: 163 816036</td>
</tr>
<tr>
<td>Kevin Frido</td>
<td>GEC-Marconi Avionics</td>
<td>Airport Works Rochester</td>
<td>Phone: 44 1634 564400</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kent MEI 2XX UK</td>
<td>Fax: 44 1634 56721</td>
</tr>
<tr>
<td>Teresa Monserratte</td>
<td>MDC Transport</td>
<td>Long Beach</td>
<td>Phone: (310) 982 5918</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fax: (310) 982 5788</td>
</tr>
<tr>
<td>Richard Mazzone</td>
<td>Boeing</td>
<td>P.O. Box 3707 M/S OR-1L</td>
<td>Phone: (206) 266-9994</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Seattle, WA 98124</td>
<td>Fax: (206) 717-0433</td>
</tr>
<tr>
<td>Harendra (Harry) Mehta</td>
<td>Boeing</td>
<td>M.S. 49-53</td>
<td>Phone: 206-655-5069</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P.O. Box 3707</td>
<td>Fax: 206-655-4955</td>
</tr>
<tr>
<td>Jerry White</td>
<td>Primex</td>
<td>P.O. Box 97009</td>
<td>Phone: 206-885-5800</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Redmond, WA 98073</td>
<td>Fax: 206-882-5747</td>
</tr>
<tr>
<td>NAME</td>
<td>ORGANIZATION/AFFILIATION</td>
<td>ADDRESS</td>
<td>PHONE/FAX</td>
</tr>
<tr>
<td>----------------</td>
<td>--------------------------</td>
<td>----------------------------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Jerry Gilbert</td>
<td>PRIMEX Aerospace Co.</td>
<td>11441 Wil lows Rd NE</td>
<td>PHONE: (206) 882-5768</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Redmond WA 98053</td>
<td>FAX: (206) 882-5744</td>
</tr>
<tr>
<td>Gary Holland</td>
<td>PRIMEX Aerospace Co.</td>
<td>11441 Wil lows Rd NE</td>
<td>PHONE: 206/882-5800</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Redmond WA 98053</td>
<td>FAX: 206/882-5757</td>
</tr>
<tr>
<td>Bill Brown</td>
<td>United Airlines</td>
<td>SFOEG - UAL MOC</td>
<td>PHONE: (415) 634-4283</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S.F. Int. Airport</td>
<td>FAX: (415) 634-4234</td>
</tr>
<tr>
<td>Glenn Harper</td>
<td>McDonnell Douglas</td>
<td>P.O. Box 516</td>
<td>PHONE: (314) 233-4599</td>
</tr>
<tr>
<td></td>
<td></td>
<td>St. Louis Mo. 63166</td>
<td>FAX: (314) 232-4141</td>
</tr>
<tr>
<td>Mark Kay</td>
<td>McDonnell Douglas</td>
<td>P.O. Box 516</td>
<td>PHONE: (314) 234-0218</td>
</tr>
<tr>
<td></td>
<td></td>
<td>St. Louis Mo. 63166</td>
<td>FAX: 314-232-4141</td>
</tr>
<tr>
<td>Rob Sklesvig</td>
<td>Douglas Aircraft Co.</td>
<td>39855 Lakewood BL</td>
<td>PHONE: (562) 593-3026</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Long Beach CA 90846</td>
<td>FAX: (562) 593-0143</td>
</tr>
<tr>
<td>Carol Hipsher</td>
<td>Douglas Aircraft Company</td>
<td>39855 Lakewood BL</td>
<td>PHONE: (562) 496-4448</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Long Beach CA 90846</td>
<td>FAX: (562) 496-4448</td>
</tr>
<tr>
<td>Layton Walker</td>
<td>FAA</td>
<td>3960 Paramount</td>
<td>PHONE: (626) 627-5339</td>
</tr>
<tr>
<td></td>
<td>LA ACO</td>
<td>Lakewood CA 90712</td>
<td>FAX: 626-5210</td>
</tr>
<tr>
<td>William Grosshandler</td>
<td>N.I.S.T.</td>
<td>BFRL</td>
<td>PHONE: (301) 975-2310</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gaithersburg MD 20899</td>
<td>FAX: (301) 975-4052</td>
</tr>
<tr>
<td>Ronn Blumke</td>
<td>MD-17</td>
<td>39855 Lakewood BL</td>
<td>PHONE: (301) 972-5858</td>
</tr>
<tr>
<td></td>
<td>Douglas Aircraft Company</td>
<td>Long Beach CA 90846</td>
<td>FAX:</td>
</tr>
<tr>
<td>Larry Dvorak</td>
<td>Raytheon Aircraft Company</td>
<td>P.O. Box 85</td>
<td>PHONE: (314) 676-8911</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B-6</td>
<td>FAX: (314) 676-5591</td>
</tr>
<tr>
<td>NAME</td>
<td>ORGANIZATION/ AFFILIATION</td>
<td>ADDRESS</td>
<td>PHONE/FAX</td>
</tr>
<tr>
<td>--------------------</td>
<td>---------------------------</td>
<td>----------------------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>JOE MANCHOR</td>
<td>NAVY/NAWCWPNs CHINA LAKE</td>
<td>NAWCWPNs (4153000) 1 ADMINISTRATION C</td>
<td>(614) 939-4622</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CIRCLE CHINA LAKE, CA 93553-6100</td>
<td>FAX: (614) 939-2062</td>
</tr>
<tr>
<td>Alison Bird</td>
<td>Federal Express</td>
<td>3975 Airways Blvd, Memphis, TN 38116</td>
<td>(901) 367-4966</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>FAX: (901) 362-2042</td>
</tr>
<tr>
<td>Philippe Mancion</td>
<td>CERBERUS GUINARD</td>
<td>617 rue Founay, 78530 BUC FRANCE</td>
<td>(33) 1.3084 6736</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>FAX: (33) 1.36 56 57 11</td>
</tr>
<tr>
<td>Patrice Fassier</td>
<td>CERBERUS GUINARD</td>
<td></td>
<td>(33) 1.3084 6736</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>FAX: (33) 1.36 56 58 11</td>
</tr>
<tr>
<td>Sham Hariram</td>
<td>MCDONNELL DOUGLAS,</td>
<td>M/C 800-B2 3855 LAKewood BL,long Beach,</td>
<td>(562) 593-4305</td>
</tr>
<tr>
<td></td>
<td>DOUGLAS AIRCRAFT</td>
<td>CA 90846</td>
<td>FAX: (562) 982-7114</td>
</tr>
<tr>
<td>Alan Kepper</td>
<td>MCDONNELL DOUGLAS</td>
<td>M/C 57-03 2401 E. WARDhow Rd NEW</td>
<td>(562) 593-4837</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BEACH, CA 90846</td>
<td>FAX: (562) 7114</td>
</tr>
<tr>
<td>Kristin Larson</td>
<td>FAA TRANSPORT STDs.</td>
<td>1601 LIND AVE SW REIDFORD USA 98055</td>
<td>(206) 227-1260</td>
</tr>
<tr>
<td></td>
<td>STAFF</td>
<td></td>
<td>FAX: (206) 227-1120</td>
</tr>
<tr>
<td>Andreas Schoenwaldt</td>
<td>Fairchild/ Daurier</td>
<td>P.O. Box 1103 0-82230 Wessling</td>
<td>(08453) 32 45 38</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Germany</td>
<td>FAX: (08453) 32 45 38</td>
</tr>
<tr>
<td>Kevin Smartout</td>
<td>NORDAM GROUP</td>
<td>624 E. FOURTH TULSA, OK 74120</td>
<td>(918) 560-8823</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>FAX: (918) 560-8896</td>
</tr>
<tr>
<td>Steven Earl</td>
<td>NORDAM GROUP</td>
<td>624 E. 4TH ST TULSA, OK 74120</td>
<td>(918) 560-8897</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>FAX: (918) 560-8896</td>
</tr>
<tr>
<td>Alankar Gupta</td>
<td>Boeing</td>
<td></td>
<td>(206) 294-3177</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>FAX: (206) 294-7736</td>
</tr>
</tbody>
</table>

Email: Alankar.Gupta@boeing.com
<table>
<thead>
<tr>
<th>NAME</th>
<th>ORGANIZATION/ AFFILIATION</th>
<th>ADDRESS</th>
<th>PHONE/FAX</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRANK HUGHES</td>
<td>BRITISH AIRWAYS</td>
<td>Heathrow Airport London UK</td>
<td>PHONE: 562-5460</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>FAX: 562-2026</td>
</tr>
<tr>
<td>DAVE CATCHPOLE</td>
<td>BP Exploration</td>
<td>P.O. Box 196112 Anchorage AK 99519-6612</td>
<td>PHONE: 907 566-5038</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>FAX: 907 566-5020</td>
</tr>
<tr>
<td>CHARLES MAY</td>
<td>MASS SYSTEMS INC.</td>
<td>9601 Littlejohn Baldwin Park CA 92106</td>
<td>PHONE: 818-337-4640</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>FAX: 818-337-6411</td>
</tr>
<tr>
<td>PATRICK GOLDEN</td>
<td>Micro Safe Flight Safety Sys.</td>
<td>P.O. Box 2007 Bellingham, WA 98227</td>
<td>PHONE: (360) 676-6256</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>FAX: (360) 676-6276</td>
</tr>
<tr>
<td>GREG JUEN</td>
<td>Micro Safe Flight Safety Sys.</td>
<td>44934 SE 145th Nth Bend WA 98045</td>
<td>PHONE: (206) 831-5460</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>FAX: (206) 999-6037</td>
</tr>
<tr>
<td>KARL BEERS</td>
<td>AIR LIQUEFIED AIR SEPARATION MEMBRANE MFG.</td>
<td>305 Water St. Newport, WA 98049</td>
<td>PHONE: (513) 943-2105</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>FAX: (513) 943-2317</td>
</tr>
<tr>
<td>SAL MIRA</td>
<td>KDI</td>
<td>Cincinnati, OH</td>
<td>PHONE: (513) 943-2105</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>FAX: (513) 943-2317</td>
</tr>
<tr>
<td>LOREN RUSSAKOV</td>
<td>KDI</td>
<td>241 S. Summertree Anaheim</td>
<td>PHONE: 714-282-8048</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>FAX: 714-282-0202</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>FAX: 505-1966</td>
</tr>
<tr>
<td>RICHARD DIRENCES</td>
<td>KDI</td>
<td>Cincinnati OH</td>
<td>PHONE: 513 943 2364</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>FAX: 513 943 2288</td>
</tr>
<tr>
<td>KEN CARDELLA</td>
<td>KDI</td>
<td>Cincinnati OH</td>
<td>PHONE:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>FAX:</td>
</tr>
</tbody>
</table>
# List of Attendees

**International Halon Replacement Working Group Meeting**

Hosted by Douglas Aircraft Company  
April 15-16, 1997

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization/Affiliation</th>
<th>Address</th>
<th>Phone/Fax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ted Lewis</td>
<td>KDI</td>
<td>7975 M.Ment Road, Cincinnati, OH 45240</td>
<td>Phone: 513-947-2148</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fax: 2288</td>
</tr>
<tr>
<td>Eric A. Lyon</td>
<td>Chubb Fire Limited</td>
<td>Lancaster Road, High Wycombe, Bucks, HP12 3QF</td>
<td>Phone: +44 1494 477605</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fax: +44 1494 531710</td>
</tr>
<tr>
<td>Bill Leach</td>
<td>Navy - Lakehurst, NJ</td>
<td>Naval Air Warfare Center Code 45203, NOLC523</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lakewest, NJ 08733-5100</td>
<td>Phone: (908) 323-1184</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fax: (908) 323-7319</td>
</tr>
<tr>
<td>Steve Happenny</td>
<td>FAA/Transport Airway Directing Office, Propulsion Branch</td>
<td>1601 Lind Ave, SE</td>
<td>Phone: (206) 227-2197</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Renton, WA 98055-1855</td>
<td>Fax: (206) 227-1320</td>
</tr>
<tr>
<td>Brian Quirk</td>
<td>CEASE FIRE Midwest</td>
<td>13357 Olde Western Ave, Blue Island, IL 604</td>
<td>Phone: 708-371 5625</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fax: 708-371 5625</td>
</tr>
<tr>
<td>Dennis Quirk</td>
<td></td>
<td>11</td>
<td>Phone: 708-371 5625</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fax: 708-371 5625</td>
</tr>
<tr>
<td>Brian J. Quirk</td>
<td></td>
<td>11</td>
<td>Phone: 708-371 5625</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fax: 708-371 5625</td>
</tr>
<tr>
<td>Claude Lewis</td>
<td>Transport Canada Civil Aviation Aircraft Certification</td>
<td>Tower C, Place de Ville, 230 Sparks St, Ottawa, ON, Canada</td>
<td>Phone: (613) 990-5906</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fax: (613) 996-9178</td>
</tr>
<tr>
<td>John J. Petrakis</td>
<td>FAA Hq</td>
<td>880 Independence Ave, Washington, DC 20591</td>
<td>Phone: 202-267-9274</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fax: -5340</td>
</tr>
<tr>
<td>Gerry Bobby</td>
<td>US Navy</td>
<td>PhD-NSWC Code 4431, Port Hueneme, CA 90704</td>
<td>Phone: 805-787-3715</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fax: 805-782-0989</td>
</tr>
<tr>
<td>Robert Tapsell</td>
<td>University of New Mexico</td>
<td>NMBERI/CGET 901 University Blvd, SE</td>
<td>Phone: 505-272-7252</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Albuquerque, NM 87106</td>
<td>Fax: 505-272-7203</td>
</tr>
<tr>
<td>NAME</td>
<td>ORGANIZATION/ AFFILIATION</td>
<td>ADDRESS</td>
<td>PHONE/FAX</td>
</tr>
<tr>
<td>--------------</td>
<td>---------------------------</td>
<td>------------------------------------------------------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>John Chorba</td>
<td>3M</td>
<td>3M CENTER, BLDgs 223-46 S. P.O. Box 823223 St. Paul, Minn. 55133-3228</td>
<td>Phone: (612) 736-7569 Fax: (612) 736-8643</td>
</tr>
<tr>
<td>Konstantin Kallergis</td>
<td>DLR</td>
<td>LINDEN HOHE D-51147 KÖLN GERMANY</td>
<td>Phone: +49-2203-601-2168 Fax: +49-2203-64395</td>
</tr>
<tr>
<td>Felix Stössel</td>
<td>Swissair</td>
<td>SR-TECHNICS (CH 8058 ZURICH- AIRPORT TEP/SWITZERLAND)</td>
<td>Phone: 41-1-8126900 Fax: 41-1-8129098</td>
</tr>
<tr>
<td>Thomas Grasow</td>
<td>DASA-Airbus</td>
<td>HÜNE Feldstrasse 1-5 D-28155 BREMEN GERMANY</td>
<td>Phone: 45-421-538-4033 Fax: 45-421-533-4638</td>
</tr>
<tr>
<td>Volker Theiss</td>
<td>Daimler-Benz Aerospace Airbus</td>
<td>P.O. Box 950109 21111 HAMBURG GERMANY</td>
<td>Phone: 49-40-7437-3916 Fax: 49-40-7437-7427</td>
</tr>
<tr>
<td>Hans Humfeldt</td>
<td>Lufthansa Technik</td>
<td>P.O. Box 630300 D-22313 HAMBURG GERMANY</td>
<td>Phone: 49-40-5070-2406 Fax: 49-40-5070-2385</td>
</tr>
<tr>
<td>Jeroen van Dam</td>
<td>KLM Royal Dutch Airlines</td>
<td>P.O. BOX 7700 1117 ZL SCHIPHOL-AIRPORT THE NETHERLANDS</td>
<td>Phone: 31-20-649-9128 Fax: 31-20-640-8162</td>
</tr>
<tr>
<td>Russell Stark</td>
<td>Autonics Corporation</td>
<td>325 E. Live Oak Arcadia, CA 91006</td>
<td>Phone: (818) 445-5470 Fax: (818) 446-0014</td>
</tr>
<tr>
<td>Jeff Gibson</td>
<td>Américan Airlines Corp.</td>
<td>3770 Howard Hughes Pkwy #300 LAS VEGAS, NV 89109</td>
<td>Phone: 702-735-2200 Fax: 702-735-4876</td>
</tr>
<tr>
<td>Bill Meserve</td>
<td>Pacific Scientific</td>
<td>1800 Highland Ave., Duarte, CA 91010</td>
<td>Phone: 818-359-7317 Fax: 818-359-7013</td>
</tr>
<tr>
<td>Bob Lu</td>
<td>Pacific Scientific</td>
<td>1800 Highland Ave., Duarte, CA 91010</td>
<td>Phone: 818-434-1140 Fax: 818-359-7013</td>
</tr>
<tr>
<td>NAME</td>
<td>ORGANIZATION/ AFFILIATION</td>
<td>ADDRESS</td>
<td>PHONE/FAX</td>
</tr>
<tr>
<td>-----------------------</td>
<td>--------------------------</td>
<td>----------------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>BRIAN SECK</td>
<td>WHITAKER SAFETY SYSTEMS</td>
<td>3478, Bunker #235</td>
<td>PHONE: 510-280-4519</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pleasant Hill, CA 94591</td>
<td>FAX: 510-280-4598</td>
</tr>
<tr>
<td>STEPHEN BERNSTEIN</td>
<td>H.B.R. INC.</td>
<td>1810 Harrison St</td>
<td>PHONE: 415-221-3588</td>
</tr>
<tr>
<td></td>
<td></td>
<td>San Francisco, CA 94103</td>
<td>FAX: 415-221-3479</td>
</tr>
<tr>
<td>DR. JOHN HUNTINGTON</td>
<td>HUNTINGTON RESEARCH &amp;</td>
<td>P.O. BOX 90118</td>
<td>PHONE: (408) 293-9425</td>
</tr>
<tr>
<td>PRESIDENT</td>
<td>ENGINEERING</td>
<td>SAN JOSE, CA 95109</td>
<td>FAX: 291-2950</td>
</tr>
<tr>
<td>DR. VINCENT MCKOY</td>
<td>II</td>
<td>II</td>
<td>PHONE: 818-790-4357</td>
</tr>
<tr>
<td>ASSOCIATE</td>
<td></td>
<td></td>
<td>FAX: 790-1641</td>
</tr>
<tr>
<td>DICK HILL</td>
<td>FAATC</td>
<td>AAR-422/Bldg 287</td>
<td>PHONE: 609-485-5797</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A.C. Int'l Airport, NJ</td>
<td>FAX: 609-646-5229</td>
</tr>
<tr>
<td>APRIL HORNERS</td>
<td>FAATC</td>
<td>AAR-422/Bldg 287</td>
<td>PHONE: 609-483-4411</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Atlantic City Int'l Airport, NJ</td>
<td>FAX: 609-646-5229</td>
</tr>
</tbody>
</table>
CARGO COMPARTMENT AGENT QUANTITY

<table>
<thead>
<tr>
<th>Agent</th>
<th>Cup Burner Conc.</th>
<th>Cargo Conc.</th>
<th>Molecular Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Halon 1301</td>
<td>3.1 %</td>
<td>5.0 %</td>
<td>149</td>
</tr>
<tr>
<td>FE-25</td>
<td>8.8 %</td>
<td>14.2%</td>
<td>120</td>
</tr>
<tr>
<td>FM-200</td>
<td>6.6 %</td>
<td>10.6%</td>
<td>170</td>
</tr>
<tr>
<td>Triodode</td>
<td>3.2 %</td>
<td>5.2 %</td>
<td>196</td>
</tr>
</tbody>
</table>

Halon 1301: \((0.05)(2357 \text{ ft}^3)(28.3 \text{l}/\text{ft}^3)(1 \text{ mole}/24.13\text{l})(149 \text{ g/mole})(1 \text{ lb}/454 \text{ g})= 45.4 \text{ lbs}\)

FE-25: \((0.142)(2357 \text{ ft}^3)(28.3 \text{l}/\text{ft}^3)(1 \text{ mole}/24.13\text{l})(120 \text{ g/mole})(1 \text{ lb}/454 \text{ g})= 103.7 \text{ lbs}\)

FM-200: \((0.1065)(2357 \text{ ft}^3)(28.3 \text{l}/\text{ft}^3)(1 \text{ mole}/24.13\text{l})(170 \text{ g/mole})(1 \text{ lb}/454 \text{ g})= 110.2 \text{ lbs}\)

Triodide: \((0.0516)(2357 \text{ ft}^3)(28.3 \text{l}/\text{ft}^3)(1 \text{ mole}/24.13\text{l})(196 \text{ g/mole})(1 \text{ lb}/454 \text{ g})= 61.6 \text{ lbs}\)
Halon 1301 Containerized Fire Load

- Halon Inside Container
- O2 Outside Container
- T/C Ceiling 4

Time (Minutes)

Percent

Temperature (Deg. F)
<table>
<thead>
<tr>
<th>AGENT</th>
<th>CUP BURNER</th>
<th>CLASS A BULK FIRE</th>
<th>RATIO</th>
<th>CLASS A CONTAINERIZED</th>
<th>RATIO</th>
<th>CLASS B FIRE</th>
<th>RATIO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1301</td>
<td>3.1</td>
<td>4.1</td>
<td>1.3</td>
<td>4.2</td>
<td>1.4</td>
<td>3.0</td>
<td>1.0</td>
</tr>
<tr>
<td>FM 200</td>
<td>6.6</td>
<td>9.3</td>
<td>1.4</td>
<td>8.9</td>
<td>1.3</td>
<td>5.2</td>
<td>0.8</td>
</tr>
<tr>
<td>FE 25</td>
<td>8.8</td>
<td>11.3</td>
<td>1.3</td>
<td>10.7</td>
<td>1.2</td>
<td>8.9</td>
<td>1.0</td>
</tr>
</tbody>
</table>
Hydrogen Fluoride  TC10 Cargo Test 9704  05-Apr-97
Agent: CF3I

Concentration (ppm)

Time after Agent Discharge (Minutes)

(HF OSHA Ceiling 6 ppm
IDLH 30 ppm

Agent discharged at 0 minutes
Hydrogen Fluoride  TC10 Cargo Test 9704  05-Apr-97
Agent:  CF3I

Concentration (Percent)

Time after Agent Discharge  (Minutes)
(Agent Discharged 1 minutes 45 seconds after ignition)

HF OSHA Ceiling 6 ppm
IDLH 30 ppm

Cargo, 3'6"
Iodide and Iodine as Hydrogen Iodide (HI)  
TC10 Cargo Test 9704  5-Apr-97  
Agent: CF3I

\[ 3 \text{I}_2 + 6 \text{OH}^- \rightarrow 3 \text{H}_2\text{O} + 5\text{I}^- \]

- - - Sta. 80, 5'6"  
- - - Sta. 580, 3'6"

I2 OSHA Ceiling 0.1 ppm  
IDLH 2 ppm

Hydrogen Iodide (ppm)

Time after discharge (Minutes)  
(Agent Discharged 1 minute 45 seconds after ignition)

Agent discharged at 0 minutes  
a:\cargo\pnetacid\results\CF3ICHEM.XLS  4/10/97
Iodide and Iodine as Hydrogen Iodide (HI)  TC10 Cargo Test 9704  05-Apr-97
Agent: CF3I

\[3 \text{I}_2 + 6 \text{OH}^- \rightarrow 3 \text{H}_2\text{O} + 5 \text{I}^- + \text{IO}_3^-\]

I2 OSHA Ceiling 0.1 ppm
IDLH 2 ppm

Agent discharged at 0 minutes  a:\cargo\pnetacid\results\CF3ICHEM.XLS  4/10/97
Concentrations for Combined HI and I2 in Air Measured with a Mass Spectrometer

Readings were taken 48 hours after the completion of the cargo fire test

Inside cargo compartment at mid height: 0.7 ppm
Five feet outside of cargo compartment door at five foot height: 0.07 ppm
Five feet outside of cargo compartment door at floor level: 0.2 ppm

NIOSH/OSHA Ceiling Limit for I2: 0.1 ppm
NIOSH/OSHA IDLH for I2: 2 ppm
International Halon Replacement Working Group (IHRWG) Task Group on Halon Options

The following provides an update on the IHRWG Task Group on Halon Options. For additional information see the Internet site http://nmeri.unm.edu/cget/ihrwg.htm.

1. The IHRWG Task Group on Halon Options reviews and assesses halon substitution technologies for each major area of on-board aircraft use: (1) engine nacelles, (2) handheld extinguishers, (3) cargo compartments, and (4) lavatory protection. The Task Group maintains a review of new technologies as they appear and periodically submits updated reports. Past reports of the Task Group on Halon Options were published in February 1995 and September 1996:


2. The Task Group is now working on a third report for which comments are requested. The report is available on the internet site at http://nmeri.unm.edu/cget/ihrwg.htm in Portable Document Format (pdf). (You can obtain a free viewer for this file format at http://www.adobe.com.) The draft report does not contain the final recommendations and should not be quoted or cited. The opinions expressed are those of the Task Group and do not necessarily reflect the views of any sponsoring or supporting organization. If you have comments, suggestions, or recommended corrections or if you have trouble reading the report, please contact Robert Tapscott, Chair, Task Group on Halon Options.

3. All manufacturers of fire suppression technologies applicable to replacement of halons on aircraft should ensure that we are informed of their products. If we have already included your product in the report (see the Internet site), please review the discussion thoroughly. Final decisions on information and assessments presented are solely the responsibility of the Task Group; however, we welcome the submission of recommended changes and additions.
4. Appendix A of the Task Group report now being prepared will contain a list of manufacturers whose products are specifically discussed in the report with addresses and telephone/fax numbers. Manufacturers are requested to check to ensure that they are included in this list and that the information provided is correct.

5. The Task Group on Halon Options met on Wednesday, 16 April during the IHRWG meeting in Long Beach, California. One item discussed was the Task Group mandates. The Task Group has had two mandates in the past: (1) to review technologies for replacement of halons in aircraft use and (2) to recommend agent/systems for establishment of test protocols. The second mandate may be changed to assess the applicability of various technologies for each major on-board aircraft application. (engine, lavatory, handhelds, cargo).

6. The Task Group on Halon Options will meet during the NMERI Halon Options Technical Working Conference (HOTWC) (http://nmeri.unm.edu/cget/confinfo.htm), 6-8 May 1997. The Task Group meeting is scheduled for 5 to 6 pm, Wednesday, 6 May in the Weavers Room at the Sheraton Old Town, 806 Rio Grande Blvd. NW, Albuquerque, New Mexico 87104, USA (telephone: +1-505-843-6300, fax: +1-505-842-9863), the location of the HOTWC.

7. The Task Group would like one additional member in each of the areas of WATER MISTING SYSTEMS and INERT GASES. If you are interested, please contact the Task Group Chair. Although attendance at Task Group meetings is not required, members must be willing to spend time helping to review and write the report. It is essential that members have an email address and Internet access.

**Members**

**Robert E. Tapscott** (Chair)
Center for Global Environmental Technologies
University of New Mexico
901 University Boulevard SE
Albuquerque, NM 87106-4339
USA
Telephone: +1-505-272-7252
Fax: +1-505-272-7203
Email: tapscott@nmerigate.unm.edu
Jeff Gibson
Halotron Incorporated
3770 Howard Hughes Parkway, Suite 300
Las Vegas, NV 89109
USA
Telephone: 1-702-735-2200
Fax: 1-702-735-4876
Email: jegibson@apfc.com

William Grosshandler
Building and Fire Research Laboratory
Bldg. 224, Room B356
National Institute of Standards & Technology
Gaithersburg, MD 20899
USA
Telephone: +1-301-975-2310
Fax: +1-301-975-4052
Email: wgrosshandler@nist.gov

Elio F. Guglielmi
North American Fire Guardian Technology Inc.
700 West Pender St., Suite 304
Vancouver, BC V6C 1G8
CANADA
Telephone: +1-604-684-7374
Fax: +1-604-684-7415
Email: gzhb71a@prodigy.com

Estee E. Jacobson
Spectronix, Ltd
Sderot Industrial Area
P.O.B. 29
Sderot 80150
ISRAEL
Telephone: +972-7-6899173
Fax: +972-7-6890580
Email: spec@mail.netvision.net.il
William Leach  
Commanding Officer  
Naval Air Warfare Center Aircraft Division  
Highway 547  
Lakehurst, NJ 08733-5049  
USA  
Telephone: +1-908-323-1184  
Fax: +1-908-323-7219  
Email: leachws@lakehurst.navy.mil

Daniel W. Moore  
DuPont Fluoroproducts  
P.O. Box 80013  
BMP 13-1114  
Wilmington, DE 19880-0013  
USA  
Telephone: +1-302-992-2177  
Fax: +1-302-992-4163  
Email: mooredw@iscdcm5.profs.dupont.com

Dennis M. Quirk  
Cease Fire Midwest  
13357 S. Olde Western Avenue  
Blue Island, IL 60406  
USA  
Telephone: +1-708-371-5625  
Fax: +1-708-371-5635  
Email: gflourd@mailstreet.com

Terry A. Simpson  
Walter Kidde Aerospace, Inc.  
4200 Airport Drive N.W.  
Wilson, NC 27893-4717  
USA  
Telephone: +1-919-237-7004  
Fax: +1-919-237-4717  
Email: simpsont@wkai-lan.mhs.compuserve.com
Mark L. Robin  
Fluorine Chemicals  
Great Lakes Chemical Corporation  
1801 Hwy. 52 NW  
P.O. Box 2200  
West Lafayette, IN 47906  
USA  
Telephone: 1-317-497-6360  
Fax: 1-317-497-6304  
Email: mrobin@wlaf.glcc.com

Stephanie R. Skaggs  
Universal Technical Services, Inc.  
5850 Eubank Blvd. NE, Suite B-49  
Albuquerque, NM 87111  
USA  
Telephone: 1-505-856-1962  
Fax: 1-505-856-1966  
Email: srskaggs.uniserv@worldnet.att.net

Louise Speitel  
DOT/FAA/William J. Hughes Technical Center  
AAR-422, Bldg. 277  
Atlantic City Airport  
Atlantic City, NJ 08405  
USA  
Telephone: +1-609-485-4528  
Fax: +1-609-646-5229  
Email: Louise_Speitel_at_ct27@admin.tc.faa.gov

Carol C. Weisner  
U. S. Environmental Protection Agency  
401 M Street SW, MC 6205J  
Washington, DC 20460  
USA  
Telephone: +1-202-233-9193  
Fax: +1-202-233-9665  
Email: weisner.carol@epamail.epa.gov
FIRE PROTECTION TECHNOLOGY
BENEFIT METHODOLOGY
DEVELOPMENT PROJECT

PRESENTED AT THE INTERNATIONAL
HALON REPLACEMENT WORKING
GROUP MEETING

LONDON, ENGLAND
9-10 OCTOBER 1996

LONG BEACH, CALIFORNIA
15-16 APRIL 1997
BACKGROUND

- INTERNATIONAL LAWS HAVE RESULTED IN A BAN ON THE PRODUCTION OF HALONS
- RESULT HAS BEEN A RAPID EVOLUTION OF VARIOUS AIRCRAFT FIRE PROTECTION TECHNOLOGIES
- LITTLE EFFORT DEVOTED TO METHODOLOGY DEVELOPMENT TO EVALUATE VARIOUS REPLACEMENT TECHNOLOGIES
PROJECT OBJECTIVE

- DEVELOP AND DOCUMENT A METHODOLOGY TO QUICKLY AND COST-EFFECTIVELY ASSESS THE POTENTIAL OF PROPOSED FIRE PROTECTION TECHNOLOGIES
PROJECT TEAM

◆ BOOZ•ALLEN & HAMILTON, INC.

◆ MCDONNELL DOUGLAS AEROSPACE

◆ WALTER KIDDE AEROSPACE
APPROACH

Plan and Document a Preliminary Methodology to Assess the Potential of Proposed Fire Suppression Technologies

- Features
  - Quick and Cost-Effective Assessment
  - Minimum Entry Screen
  - Estimate of R&D Costs and Risks
  - Performance Screen
  - Airframe Integration Model and Screen
  - Probability of Success Derivation
  - Life Cycle Cost Estimates from Simplified Model
PRELIMINARY METHODOLOGY

1. **Input**
   - Agents/Technology Proposals

2. **Minimum Entry Filter**
   - ODP
   - GWP
   - Cup Burner
   - Weight/Vol. Factor
   - OSHA Regs.
   - EPA Regs.
   - SNAP List

3. **Baseline System**

4. **Aircraft Type**

5. **R&D Cost & Risk Assessment**
   - Material Tests
   - Environmental Tests
   - Toxicity Testing
   - Screening Tests
   - Certification Methodology
   - Small Scale Testing
   - Full Scale Testing
   - Live Fire Testing

6. **Nacelle/Dry Bay Model**

7. **Reject**

8. **Threshold Filter**
   - Material Properties
   - Material Compatibility
   - Relative Performance
   - Environmental Data
   - Toxicity Data
   - R&D Cost/Risk

9. **Nacelle/Dry Bay Model**

10. **Reject**

11. **Airframe Integration**
    - Installation Equations
    - Power Reqsmts.

12. **Retrofit**

13. **Nacelle/Dry Bay Model**

14. **Probability of Success**
    - Development
      - Design
      - Performance
      - Environmental Impact
    - Weight
    - Toxicity
    - Cost

15. **Aircraft Type**

16. **Integration Filter**
    - Risk
    - Weight
    - Volume
    - Power Requirement

17. **Reject**

18. **Baseline System**

19. **OSHA & EPA Regs.**

20. **Integration Filter**
    - Simplified LCC
      - Life Cycle Cost Model(s)

21. **Output**
    - R&D Cost
    - R&D Risk

22. **Cost & Availability**

23. **Nacelle/Dry Bay Model**

24. **Aircraft Type**

25. **Output**
    - Probability of Success
    - Cost/Benefit
    - R&D Cost
    - Acquisition Cost
    - Life Cycle Cost
    - Retrofit Impact
    - Open Issues
FIRE SUPPRESSION SYSTEM LIFE CYCLE

Proposal
- Agent/Technology Description
- SOW
- Critical Material Availability
- Anticipated Performance
- Anticipated Benefits
- Outline of Current Knowledge
- System Description
- Environmental Impact Testing (ODP etc., including production, storage, reclamation, and disposal)
- Material Hazard Data

R&D
- Literature Survey
- Chemistry Analysis
- Agent Material Properties Testing
- Suppression Screening Tests
- System Specification Prep.
- System Description Development
- Environmental Impact Testing
- Toxic Sensitivity Testing
- Material Compatibility Testing
- Small Scale Element Testing
- Full Scale Testing

Pre-Production
- System Sizing
- System Refinement
- Component Specification Prep.
- Configuration Specific Testing
- Component Qualification
- System Performance Qualification
- Logistics Plan Development
- Free Radical Analysis
- Decomposition Rates and Compounds

Integration & Deployment
- Detail Design for Specific Application
- Fly-Away Cost Determination
- System Procurement
- Spares Requirements

Support
- Cost of Consumable
- Special Handling and Storage
- Special Support Equipment
- Scheduled Maintenance Requirements
- Storage Stability

Decommission
- Disposal
- Agent Reclamation
- Cleaning and Decontamination
- Hazards from Decomposition
MONTREAL PROTOCOL MEETING
- MELBOURNE
HALONS TECHNICAL OPTIONS COMMITTEE
FEBRUARY 1997
1. Meeting discussed a number of Key Issues relating to Aviation.

2. These included:
   - Provide clear guidance for users who are critical
   - Costa Rica Decision VIII/14
   - Current production in Developing countries China/India/Korea
   - Development of 25 year plan for controlled phase out in none essential areas
   - Change of style of HTOC report to make it easier for the parties to understand
   - Australia position on banking and destruction
   - Commercial Aircraft installed base needs and support
   - Commercial Aircraft change of Class D cargo holds to Class C
   - U.S. EPA position on aviation
   - New task group assignments
Provide Guidance for Users that are Critical

- Identify critical use areas
- Define those that are short-medium or long term
- Aviation needs to segregate between its ground based facilities and aircraft needs
- They must immediately put this programme in place if they have not already done so
- Put in place a banking and recycling programme aircraft need
Costa Rica Decision VIII/14

- Further studies on availability of halons to meet the needs of those deemed critical
- Parties to estimate surplus on deficit relative to their assessment of critical need
- If there is a shortfall, prepare an action plan to overcome shortfall
- If there is a surplus provide guidance on disposal or redeployment
- Report to be prepared for the 10th Meeting of parties in 1998
Production in Developing Countries

- Review of current production
- Look at a reduction on the production date of 2010
- Example of help: U.S. may help Russia with some H2402
Develop 25 Year Plan

- Retirement
- Redeployment
- Recycling
- Banking
- Review 5 years critical use
- Destruction
HTOC Report - Change of Style

- More user friendly
- Executive summary
- Fact sheets on Technical Data
- WEB Site -
  ftp://www.taylorwagner.com
Australia Position

- Have a bank
- Large amount of H1211
- Recycling and destruction facility
- Has no intention of destroying H1301 for the foreseeable future
Civil Commercial Aviation H1301

- Estimated number of aircraft 30,989
- Installed base (fixed systems) for fleet 700 tons
- Annual service support and new build on current design 50 tons
- Aircraft 30 year life 1,500 tons
Cargo Holds Conversion D to C H1301

- Number of aircraft (approx) 3,000
- Average requirement 50 lbs of halon 67 tons
- Annual service support 6 tons
- Aircraft 30 year life 180 tons

30 year critical need for all fixed systems 1,500 tons

Total 1,680 tons
Civil Commercial Aircraft
- Hand Portables H1211

- Estimated number of aircraft: 30,989
- Average amount in each aircraft: 15 lbs
- Installed base: 207 tons
- Annual service and new requirement: 3 tons
- Average life of aircraft: 30 years, 90 tons
- Training of crew annually: 3 tons
- 30 year programme: 90 tons
World Installed Base

- None Article 5 Countries

99,000 tons
New Task Groups

DOD - Bob Darwin
Aircraft - John O'Sullivan
Retrofit Costs - John O'Sullivan
Oil/Gas - David Catchpole
National Programme - Eric Pederssen
Article 5 (1) - China/India reps
Future of Aviation

- Need to act now
- Each company develops its own programme
- Work with other interested bodies
- The need to maintain level of safety
- Provide information to John O'Sullivan on your current future needs for halons for aircraft use only
AGENDA

INTERNATIONAL HALON REPLACEMENT WORKING GROUP MEETING

APRIL 14-16, 1997

Hosted by Douglas Aircraft Company, Long Beach, California

MONDAY, APRIL 14, 1997

1:00 Task Group on Final Minimum Performance Standard for Cargo Compartments

TUESDAY, APRIL 15, 1997

9:00-9:15 Introduction/Background/General Information
9:15-9:30 Schedule for Halon Replacement Program
9:30-10:30 Update on Class ‘D’ Cargo Compartment to Class ‘C’ Cargo Compartment Meeting held February 6, 1997 in Seattle
10:30-10:45 Break
10:45-12:00 Task Group Leader Presentations
12:00-1:30 Lunch
1:30-4:30 Subgroup Leader Reviews/Presentations
   1:30-2:00 Lavatory
   2:00-2:30 Handheld
   2:30-3:00 Engine
3:00-3:15 Break
3:15-4:30 Cargo

WEDNESDAY, APRIL 16, 1997

8:30-9:30 Task Group Meetings as needed
9:30-10:30 Discussion on Minimum Performance Standards
10:30-10:45 Break
10:45-11:30 Additional Discussion
11:30-1:00 Lunch
1:00-2:30 Working Group Member Presentations - 10 to 15 Minutes Each
  Jerry Flood - Cease Fire “Cease Fire’s Synergistic, Suppression Technology for Fire Extinguishment”
  Lawrence Hardge - New Millennium Environmental Research
  Richard Dirks - KDI Precision Products “Watchtower”
2:30 Final Discussion/Next Meeting/Closing
2:30 Refreshments will be provided

THURSDAY, APRIL 17, 1997

9:00-12:00 Douglas Tour