International Aircraft Materials and Fire Test Working Group

Aging/Contamination Task Group

Task Group Status

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International Aircraft Materials and Fire Test Working Group

Aging/Contamination Task Group

Topics:

- Aging - Artificial Aging Test Results
- Contamination – CIC Flammability Testing
- In-service Sample Test Results
- Aging Wiring Information Summary (ATSRAC)
- Understanding Fleet Wide Issue - Proposal
  - Situation – Target – Proposal
  - Data gathering & testing approach proposal

Aging/Contamination Task Group

Artificial Aging Test Status

Q-TIP Test Results on Aged PET Film (AN-36W)

Aging Method	Exposure Time	Q-Tip Results	Flame Propagation Behavior in Crease
CONTROL	Unaged	Passes	Film shrinks away vertically very quickly; 8" Length and 1.5" Width. Burn length <1".
Oven; 200F	100 Days	Passes	Similar to Control
	12 Months	Passes	Similar to Control
	16 Months	**Passes**	Film shrinks away vertically slower than control; 7" Length and 3.5" Width. Edges of film catch fire causing slight propagation and a burn length of ~ 4 inches. Discoloration in scrim adhesive.
Humidity Chamber; 160F/100%RH	100 Days	Passes	Similar to Control
	12 Months	Passes	Similar to Control
	16 Months	**Passes**	Film shrinks away vertically slower than control; 5.5" Length and 2.5" Width. Edges of film catch fire causing slight propagation and a burn length of ~ 4 inches.

Red – New data since November 2003 Meeting

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Artificial Aging Test Status

CONTROL
Unaged

- Film Shrinkage - Fast
- Burn Length < 1”

16 Month
at 200F

- Film Shrinkage - Moderate
- Burn Length ~ 3 - 4”
- Discolored Scrim Adhesive

16 Month
160F/100%RH

- Film Shrinkage - Moderate
- Burn Length ~ 3 - 4”

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Flammability of Corrosion Inhibiting Compound on Insulation Blankets

- Evaluated radiant panel performance of Cor-ban 35 (heavy duty, similar to AV-15) on all types of insulation blanket films.

- Evaluated a single spray pass (0.7 g/ft^2) and a double spray pass (1.4 g/ft^2).

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Corrosion Inhibiting Compound

Radiant Panel Test Results; Cor-Ban 35

	Corrosion Inhibiting Compound (CIC)				
	Uncoated (Typical)		Single Pass 0.7 g/ft2 (Unaged)	Double Pass 1.4 g/ft2 (Unaged)	Coated (Aged)
FILM TYPE	**Q-tip**	**Radiant Panel**	**Radiant Panel**	**Radiant Panel**	**Radiant Panel**
PET, 0.5 oz/sq yd	P	Marg. (P/F)	P	F	
PET, 0.9 oz/sq yd	P	Marg. (P/F)	F	F	
MPVF, 1.0 oz/sq yd	P	P	P	P	
MPVF, 1.4 oz/sq yd	P	P	P	P	
PVF, 1.0 oz/sq yd	P	P	P	P	
Polyimide	P	P	P	F	
Ceramic Paper	N/A	P	P	F	
Experimental	P	Marg. (P/F)	P	P	

Results Oct 04

Q-Tip Test Requirement: No burn length shall exceed 8 inches (FAA Fire Test Handbook Chapter 22)
Radiant Panel Requirement: FAR 25.856
Aging Protocol: Thermal Cycle; -65F to 160F, 2000 Cycles

P = Pass
F = Fail
Marg. (P/F) = Marginal results

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CIC Radiant Panel Test Results

Cor-Ban 35 on Polyimide Film

CONTROL- **PASS**

SINGLE COAT - **PASS**

DOUBLE COAT - **FAIL**

		Single Coat		Double Coat	
Polyimide Film	Control	Sample S1	Sample S2	Sample D1	Sample D2
Afterburn (s)	0.00	0.00	0.00	0.00	0.00
Burn Length (in)	0.50	0.75	0.75	5.00	10.50
Pass/Fail	P	P	P	**F**	**F**

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CIC Flammability Test Results

Cor-Ban 35 on Ceramic Paper

Dupont Ceramic Paper	Control	Single Coat		Double Coat	
		Sample S1	Sample S2	Sample D1	Sample D2
Afterburn (s)	0.00	0.00	0.00	47.20	9.70
Burn Length (in)	0.75	1.00	0.75	9.75	2.25
Pass/Fail	P	P	P	**F**	**F**

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CIC Flammability Test Results

Cor-Ban 35 on PET Films

PET Film		Single Coat		Double Coat	
0.5 oz/sq yd:	Control	Sample S1	Sample S2	Sample D1	Sample D2
Afterburn (s)	0.00	0.00	4.30	0.00	20.70
Burn Length (in)	0.50	0.50	3.50	0.50	4.75
Pass/Fail	P	P	F	P	F
PET Film		Single Coat		Double Coat	
0.9 oz/sq yd:	Control	Sample S1	Sample S2	Sample D1	Sample D2
Afterburn (s)	15.30	20.40	70.70	25.80	56.80
Burn Length (in)	12.00	13.50	16.25	14.75	13.75
Pass/Fail	F	F	F	F	F

NOTE: Failures on PET are caused by reinforcing fibers and film residue sticking to the glass batting.

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CIC Flammability Test Results

OBSERVATIONS

- CIC as a “contaminant” behaves as a fuel source on non-shrinkable materials such as polyimide film and ceramic paper.

- Scrim (reinforcement) and film residue can have a significant role in flame propagation results.
  - Different vendor materials may behave differently based on scrim material/configuration and CIC amount.
  - Film type and weight may also likely have an influence on results.
  - More investigation is necessary.

- The results clearly indicate the need to better understand contamination effects on flammability performance. Improved understanding will determine criteria for future design and maintenance philosophy to ultimately improve continued airworthiness.
  - Design; evaluating/selecting insulation blanket films, CICs, etc…
  - Maintenance; cleaning approaches, material selection/usage, etc…

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Preventing Contamination

Updated Service Letters - *25 June 2004*

PREVENTING CONTAMINATION THAT AFFECTS FLAMMABILITY OF INSULATION BLANKETS

707-SL-25-025-A	*717-SL-25-105-A*	*DC9-SL-25-103-A*
727-SL-25-036-A	*737-SL-25-077-A*	*DC10-SL-25-101-A*
747-SL-25-170-A	*757-SL-25-064-A*	*MD10-SL-25-101-A*
767-SL-25-084-A	*777-SL-25-018-A*	*MD11-SL-25-103-A*
		MD80-SL-25-104-A
		MD90-SL-25-102-A

The updated Service Letter includes information regarding contaminants that can support fire propagation, identifies Boeing SRP 25-0237 to address AN-26, and recommends airlines increase attention to periodic inspection and cleaning during maintenance.

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Flammability Test Requirements for Cleaners/Disinfectants/Insecticides

Approval of Vendor Materials For Use in General Aircraft Maintenance

Service Letter 767-SL-20-2-B

This Service Letter outlines the recommended approach for airlines to verify vendor materials. Boeing recommends vendor materials not listed in the maintenance manuals be evaluated to the requirements of D6-7127 (Interior) & D6-17487 (Exterior). These documents identify testing protocol to evaluate the materials.

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In-service Blanket Test Status

(Update to November 2003 Presentation)

Film Cover	Film Weight (oz/sq yd)	Model	Delivery Date	Blanket Descriptions	Contamination Level	Q-TIP Results	Approx. Burn Area (sq. inches)	Propagation Behavior
PET	0.5	737-300	Oct-86	Behind sidewall	Low to moderate contamination levels including local areas of contamination.	FAIL 20" Burn Length	200	Fire consumed most of horizontal surface and part of vertical surface.
PET	0.5	757-300	May-86	Aft bulkhead above floor	Low to moderate contamination levels including local areas of contamination.	FAIL. 10" Burn Length	80	Fire consumes part of both horizontal & vertical surfaces.
PET	0.5	767-200	Nov-85	Unknown	Low to moderate contamination levels including local areas of contamination.	FAIL. 17" Burn Length	150	Fire consumes most of horizontal surface and part of vertical surface. Fire continued around to the backside.
MPVF	0.85	767-200	Nov-85	Unknown	Moderate contamination levels including local areas of contamination.	PASS 5.5" Burn Length	40	Fire propagates slightly on horizontal & vertical surface.
MPET	0.95	DC-10	N310FE	Unknown	Moderate contamination levels including local areas of contamination.	FAIL. 14" Burn Length	285	Fire consumes entire horizontal surface and half of vertical surface. Fire continued around to the backside.
MPVF	1.05	DC-10	N310FE	Unknown	Moderate contamination levels including local areas of contamination.	PASS 5.5" Burn Length	40	Fire travels slightly left to right on both vertical horizontal surface.
MPVF	1.4	DC-10	N310FE	Unknown	Moderate contamination levels including local areas of contamination.	PASS 6.5" Burn Length	25	Fire traveled up vertical surface.

Q-Tip Test Requirement: No burn length shall exceed 8 inches. *(FAA Fire Test Handbook Chapter 22)*

Note: 8" Radius = 200 sq. inches

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In-service Q-tip Test Results

PET In-service Blanket
Weight = 0.5 oz/sq yd

Q-Tip Result: **PASS**
Burn Length = 6.5”
Burn Area = 80 sq in.

PET In-service Blanket
Weight = 0.5 oz/sq yd

Q-Tip Result: **FAIL**
Burn Length = 17”
Burn Area = 150 sq in.

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In-service Q-tip Test Results

PET In-service Blanket
Weight = 0.5 oz/sq yd

Q-Tip Result: **FAIL**
Burn Length = 10“
Burn Area = 80 sq in.

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In-service Q-tip Test Results

PET In-service Blanket
Weight = 0.5 oz/sq yd

Q-Tip Result: **FAIL**
Burn Length = 20“
Burn Area = 200 sq in.

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In-service Q-tip Test Results

MPVF In-service Blanket
Weight = 0.85 oz/sq yd

Q-Tip Result: PASS
Burn Length = 5.5“
Burn Area = 40 sq in.

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In-service Q-tip Test Results

MPET In-service Blanket
Weight = 0.95 oz/sq yd

Q-Tip Result: FAIL
Burn Length = 14”
Burn Area = 285 sq in.

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In-service Q-tip Test Results

MPVF In-service Blanket
Weight = 1.0 oz/sq yd

Q-Tip Result: PASS
Burn Length = 5.5“
Burn Area = 40 sq in.

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In-service Q-tip Test Results

MPVF In-service Blanket
Weight = 1.4 oz/sq yd

Q-Tip Result: PASS
Burn Length = 6.5“
Burn Area = 25 sq in.

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Aging Wiring Results Summary (ATSRAC)

http://www.mitrecaasd.org/atsrac/index.html

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Aging Wiring Results Summary (ATSRAC)

I. The Approach for Gathering and Reviewing Data
FINAL REPORT Task 1 & 2

REPORT: http://www.mitrecaasd.org/atsrac/final_reports/Task_1&2_Final%20_August_2000.pdf

II. Intrusive Inspection Final report

REPORT: http://www.mitrecaasd.org/atsrac/intrusive_inspection.html

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Understanding Overall Fleet Safety

Commercial Airplane Flammability
Safety Risk Evaluation – An approach for evaluating flame propagation on aged/contaminated insulation blankets in the commercial airplane fleet.

I. Situation – Target - Proposal

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Understanding Overall Fleet Safety

SITUATION

I. Flammability test results on some types of in-service insulation films indicate a degradation in flame propagation resistance.

- Flammability data exists only on a limited number of cover film products. Data consists primarily of single blanket tests, and “Intermediate Scale” installation configurations have not been performed for correlation.
- Flammability data does not exist on most cover film products that have been qualified/used in the fleet over the last 20 years.
- Unknown whether degradation is due to changes in material composition/morphology, contamination or a combination. Testing to-date has not been successful in determining quantifiable effects or understanding the interactions between aging and contamination.

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Understanding Overall Fleet Safety

SITUATION (Cont)

II. Rules and requirements do not clearly define the aging/contamination issue.

- Industry requirements/criteria do not exist to evaluate aging/contamination effects on new materials.
  - Artificial aging on some materials have shown a change in flame propagation behavior.
  - Controlled testing of CICs as a contamination type indicates a change in flame propagation behavior on some materials.
- Standardized test methods do not exist to evaluate aging effects on new materials.
- Standardized test methods do not exist to evaluate effects of different types & quantities of contamination on new materials.

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Understanding Overall Fleet Safety

SITUATION (Cont)

- Criteria are not defined on what constitutes an unsafe condition, in accordance with FAR 39. Need Industry consensus.
- No consensus that flame spread and arc-and-spark are the only criteria that determine fleet safety levels.
- AC guidance does not exist regarding aging/contamination.
- Existing maintenance information is not well defined.
- FAR 28.856 does not address aging/contamination of new materials.

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Understanding Overall Fleet Safety

SITUATION (Cont)

III. Current focus is at an "AN-26 level", and as a result, an overall understanding of the fleet issue relative to contamination and aging is not moving forward very quickly.

- Based on Boeing fire incident data, there is no statistical difference of in-service insulation fire events except when moderate contamination was involved.

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Understanding Overall Fleet Safety

TARGET

- Chartered harmonization working group (Like ATSRAC). Integrate with Structures Maintenance Conference?
- Industry defined and committed plan to work 'aging and contamination' across the commercial fleet for all insulation blanket materials to balanced approach and solutions.
- Industry criteria that defines aging/contamination "level of magnitude" that creates an airplane level safety threat.
- Industry adopted standardized test methods for evaluating aging and contamination effects on new insulation blanket material.
- Industry recommendations for appropriate cost effective safety improvements and mitigating solutions.
- Industry defined SOW for academia support of aging contamination research and secured funding (FAA-TC).

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Understanding Overall Fleet Safety

PROPOSAL

- Aging/Contamination Working Group chartered and supported.
- Define and implement a data collection plan to collect in-service blanket samples from across the fleet (all models and ages).
- Evaluate flammability performance on all types, thicknesses, and ages of in-service blanket samples. Samples should be selected from all fuselage locations and should include typical ranges of contamination.
- Support the FAATC to perform small/intermediate scale tests to further quantify fleet safety issue and correlate with single blanket test results.

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Understanding Overall Fleet Safety

PROPOSAL (Cont)

- Identify data to be used to determine “safety risk” criteria.
  - Heat release a criteria? Heat release must play a role to safety threat?
  - Medium scale test results? Need data to support understanding? Pass/Fail criteria?
  - Location important?
  - Material classifications?
- Incorporate criteria, test methods, etc… into AC to provide guidance for new rule FAR 25.856.
- Develop mitigation options; remove and replace, cleaning, spray-on fire retardants, barriers, etc...

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Understanding Overall Fleet Safety Issue

II. Data Gathering and Evaluation Approach for Assessing the Flammability Safety Risk of In-service Insulation Blankets Across the Commercial Airplane Fleet

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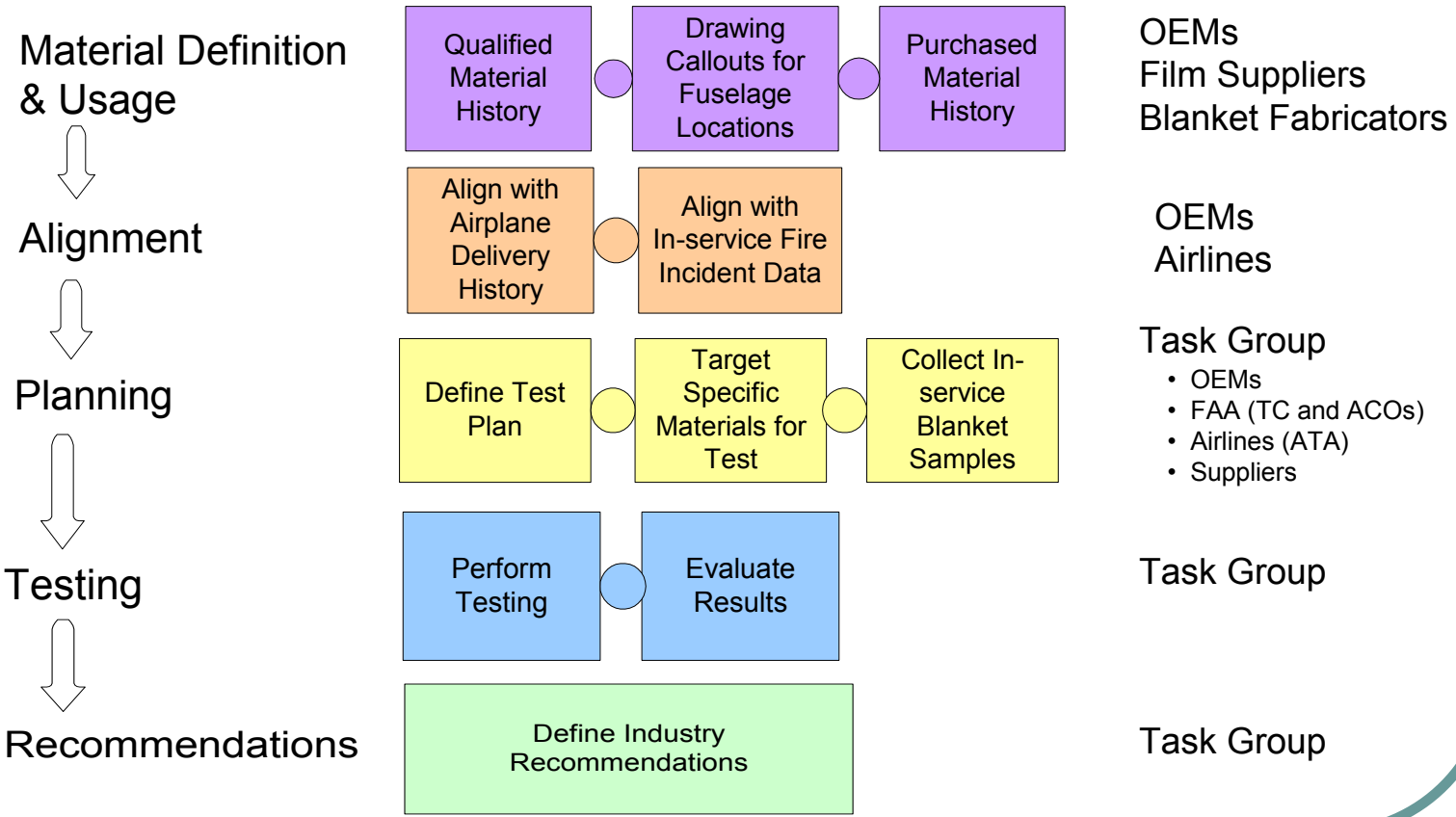
Understanding Overall Fleet Safety Issue

Proposed Plan



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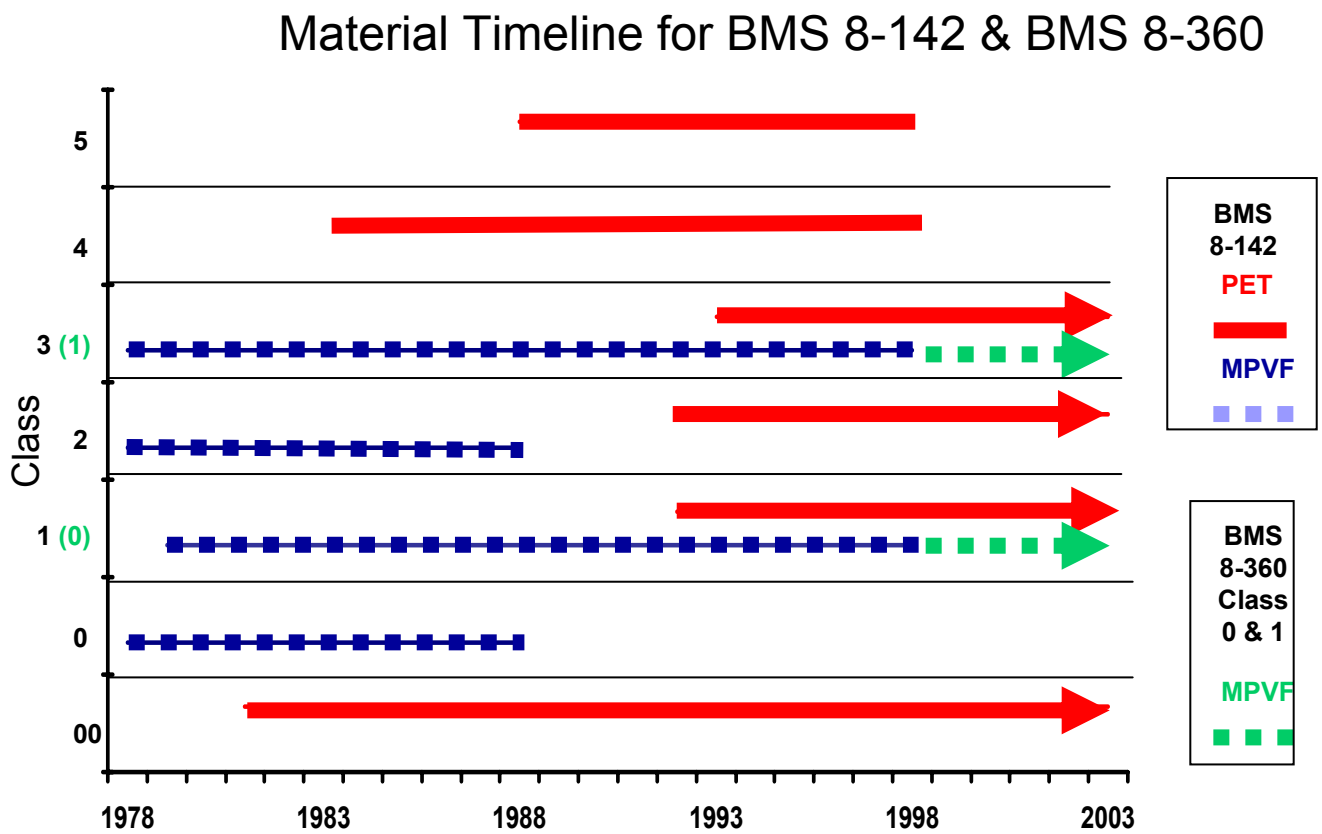
Understanding Overall Fleet Safety Issue



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Understanding Overall Fleet Safety Issue

BMS 8-142 Material Types (1978 – Present)

Material	Specification	Weight; oz/sq.yd	Suppliers	Number of Formulations	Active Dates
PET	BMS 8-142 Class 00	0.5 -0.65	3	**16**	1981 - Present
	BMS 8-142 Class 1	0.9 Max	3	**11**	1992 - Present
	BMS 8-142 Class 2	1.3 Max	3	**6**	1992 - Present
	BMS 8-142 Class 3	1.8 Max	3	**5**	1993 - Present
MPVF	BMS 8-142 Class 0	0.9 Max	2	**3**	1978 - 1988
	BMS 8-142 Class 1	0.9 Max	2	**3**	1978 - 1998
	BMS 8-142 Class 2	1.3 Max	2	**2**	1978 - 1988
	BMS 8-142 Class 3	1.8 Max	1	**1**	1978 - 1998

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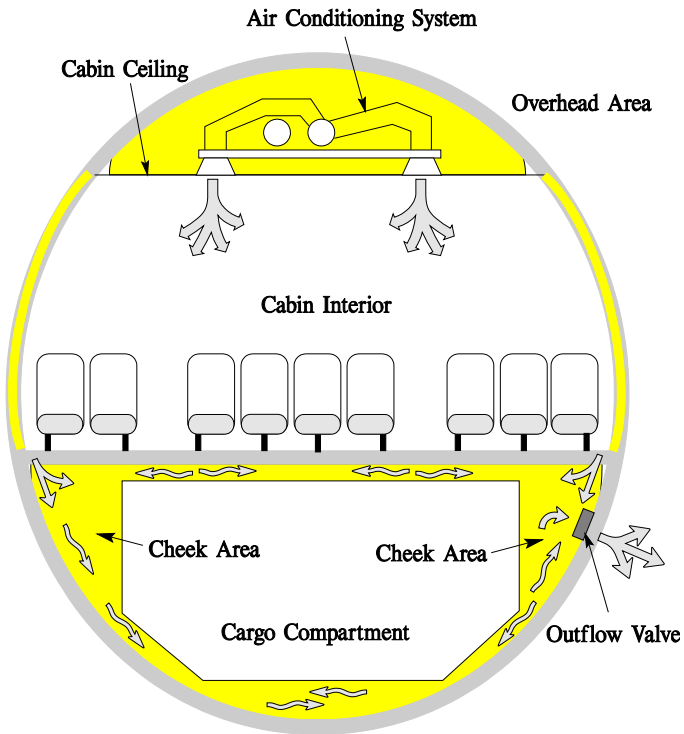
Understanding Overall Fleet Safety Issue

Fuselage Locations



Notional Example Data Collection

(Specific Time Frame for Model X)

Fuselage Location	Percentage Area	Engineering Definition	Purchased Material
Above Floor	**60%**		
Crown	15%	Class 00	Product X
Main Cabin	40%	Class 00	Product X
Flight Deck	5%	Class 1	Product Y
Below Floor	**40%**		
Cheek Area	20%	Class 00	Product X
Below Lavs/Galleys	10%	Class 1	Product Y
Below Cargo (Bilge)	10%	Class 3	Product Z

Usage; % of Fuselage Area:

Product X; 75%

Product Y; 15%

Product Z; 10%

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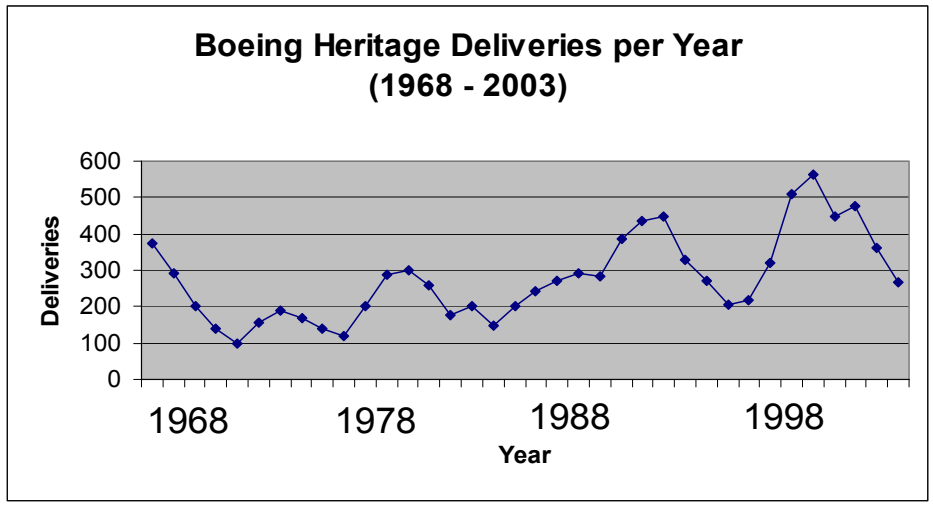
Understanding Overall Fleet Safety Issue

Other Information

- Airplane Deliveries (timeline and active status)

Boeing:
http://active.boeing.com/commercial/orders/displaystandardreport.cfm?cboCurrentModel=&cboAllModel=&optReportType=HistAnnDel&ViewReportS=View+Report

Airbus:
http://www.airbus.com/media/orders_n_deliveries.asp



- Incident Data Review – Statistically Significant Factors

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Understanding Overall Fleet Safety Issue

Testing

- Small Scale Fuselage Section
  - 40” x 60”
  - 3 Frames/2 Bays
  - Cotton Swab Ignition Source

Aging/Contamination Task Group

Flammability Safety Risk of In-service Insulation Blankets Across the Commercial Airplane Fleet

We are all here to evaluate
and improve safety.

Are you ready for action?

ACTION: Provide formal response & comments to the STP and Data Gathering Plan