

A close-up photograph showing layers of thermal and acoustic insulation. The insulation is a fibrous, greyish material that appears heavily contaminated with dark, sooty particles. A white, flexible pipe or cable runs along the left side of the frame, partially covered by the insulation. The overall scene suggests a hidden fire or significant contamination of the building's thermal envelope.

## **Hidden Fires – Contaminated Thermal Acoustic Insulation**

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## **Some Relevant In-service Occurrences**



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**L-1011, N753DA, NEWFOUNDLAND,  
CANADA, 17-MARCH-1991**

# **Lockheed L-1011-385-3 March 1991**

**Flames entered the cabin through a return air vent at the bottom of the interior side wall panel. The flames were reported to have extended approximately two feet above the cabin floor. A passenger's coat that was lying on the floor caught fire, as did a few smaller, personal items.**

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OF CANADA – AVIATION  
INVESTIGATION REPORT**



**Beneath the cabin floor, the main generator cables from the number two engine and the cables from the APU were also severely burn-damaged. A wire bundle was also severely damaged.**

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INVESTIGATION REPORT**

**Grease and tar residues appeared to have provided a bond, and the material (dust & lint) had accumulated to an average depth of approximately three-eighths of an inch with the depth in some areas exceeding two inches.**

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INVESTIGATION REPORT**



**The material was on all wiring bundles, cables, lines, ducts, insulation blankets and other aircraft components and parts throughout the area. Samples from the lint and dust accumulation in the area were tested for flammability. These samples were found to support combustion and would serve as a source of fuel for a fire.**

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INVESTIGATION REPORT**

# **Some Relevant In-Service Occurrences**

**B767-300, C-GHML, TORONTO,  
CANADA, 13-MAY-2002**



# Boeing 767-300 May 2002

**DUST AND LINT  
ACCUMULATION - INSULATION**



**The Master Warning Fire/Overheat light illuminated, the fire warning bell sounded, and the Aft Cargo Fire light illuminated.**

**The flight crew followed the procedures for a cargo fire and activated the cargo fire extinguishing system. An emergency was declared.**

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INVESTIGATION REPORT**

# **Boeing 767-300 May 2002**

**The fire was effectively extinguished even though it was beginning to spread up behind the right sloping sidewall of the aircraft, outside the cargo compartment. The last line of defence, the compartment liner that was designed to contain the fire, had been breached. The fire spread and increased in intensity until it was successfully detected and extinguished by the on-board system.**

**TRANSPORTATION SAFETY BOARD  
OF CANADA – AVIATION  
INVESTIGATION REPORT**



# **Boeing 767-300 May 2002**

**The polyethylene terephthalate (PET) covering material of the thermal acoustic insulation was contaminated. The contaminated material provided an ignitable source of fuel for a self-sustaining fire.**

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INVESTIGATION REPORT**

# Boeing 767-300 May 2002



The contamination consisted of soiled insulation blankets and of flammable debris in the form of paper, candy wrappers, Styrofoam packing peanuts, small polyethylene beads, and rubber powder from a Power Drive Unit.

**CONTAMINATED  
INSULATION BLANKETS**

**TRANSPORTATION SAFETY BOARD  
OF CANADA – AVIATION  
INVESTIGATION REPORT**

# Hidden Fires – Contaminated Thermal Acoustic Insulation

## Threat Mitigation

# Threat Mitigation

**Much work has already been carried out by the industry in providing guidance to aircraft operators on the maintenance practices to be adopted to reduce the fire threat from contaminated Thermal Acoustic Insulation materials. The industry initiatives introduced under the Enhanced Zonal Analysis Procedures would seem to provide a practical way forward in mitigating the threat from the majority of in-service contaminants of Thermal Acoustic Insulation materials.**

# Threat Mitigation

**However, Transport Canada are carrying out research intended to identify the primary Thermal Acoustic Insulation contamination threats and propose improvements that might be considered to the current mitigation strategies**



# **Hidden Fires – Contaminated Thermal Acoustic Insulation**

## **Transportation Safety Board of Canada - Recommendations**

# Transportation Safety Board of Canada - Recommendations

**Canadian TSB Recommendation A02-05 (14 November 2002) stated as follows:**

***“The Department of Transport take action to reduce the short term risk and eliminate the long term risk of contaminated insulation materials and debris propagating fires, and coordinate and encourage a similar response from other appropriate regulatory authorities.”***

# Transportation Safety Board of Canada - Recommendations

**TSB has classified this Recommendation as  
“Inactive”:**

***“As the safety deficiency associated with Recommendation A02-05 is considered rectified, no further action is necessary. This deficiency file is assigned an Inactive status.”***

# Transportation Safety Board of Canada - Recommendations

However, Transport Canada has made the following statement to TSB:

***“The International Aircraft Materials Fire Test Working Group (IAMFTWG) has formed an industry Task Group to recommend means for reducing the risk of hidden in-flight fires from contaminated or aged TAI.”***

# **Transportation Safety Board of Canada - Recommendations**

**As part of its activities, the Task Group has:**

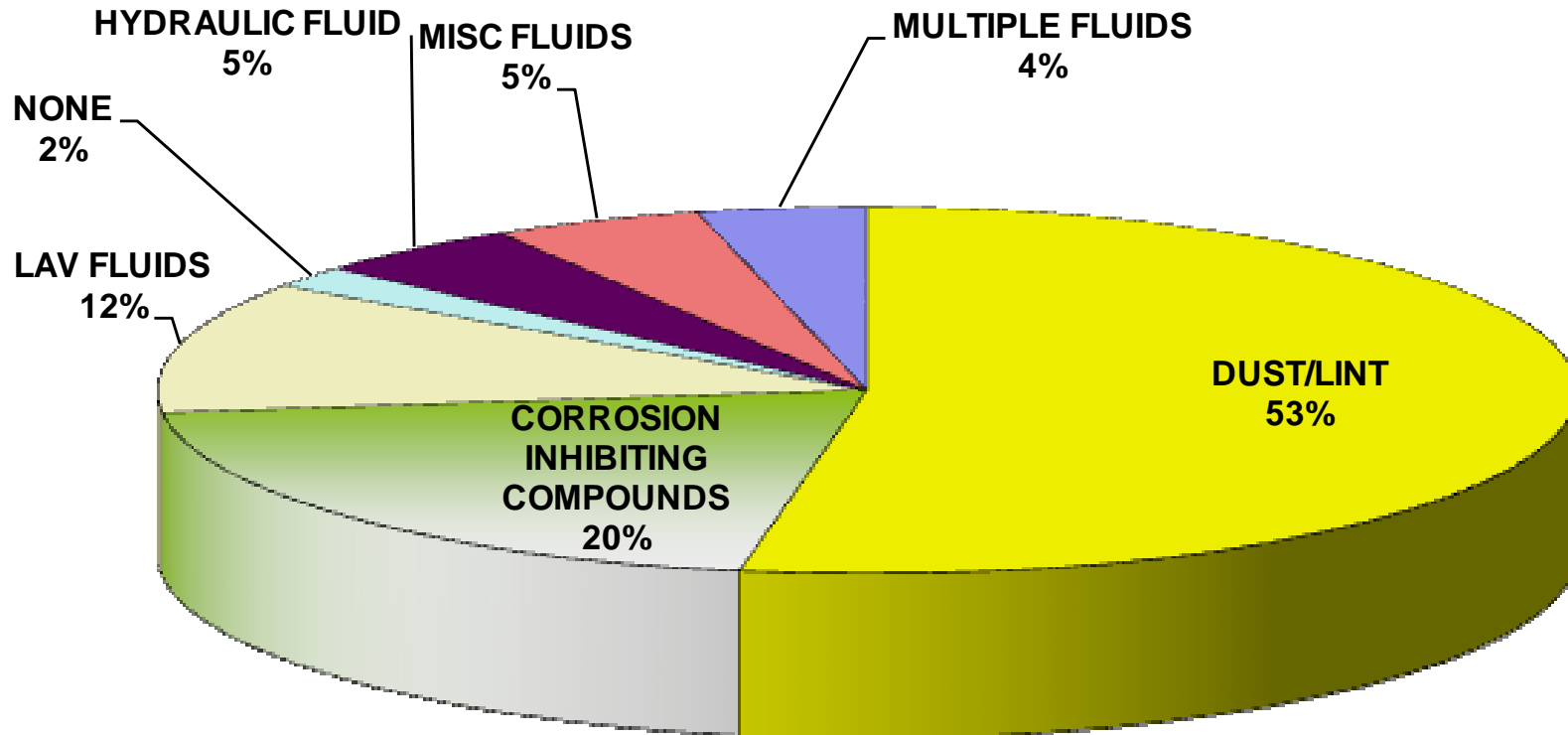
- **Performed an airline contamination survey**
- **Investigated the flammability of contaminants commonly found on Thermal Acoustic Insulation**



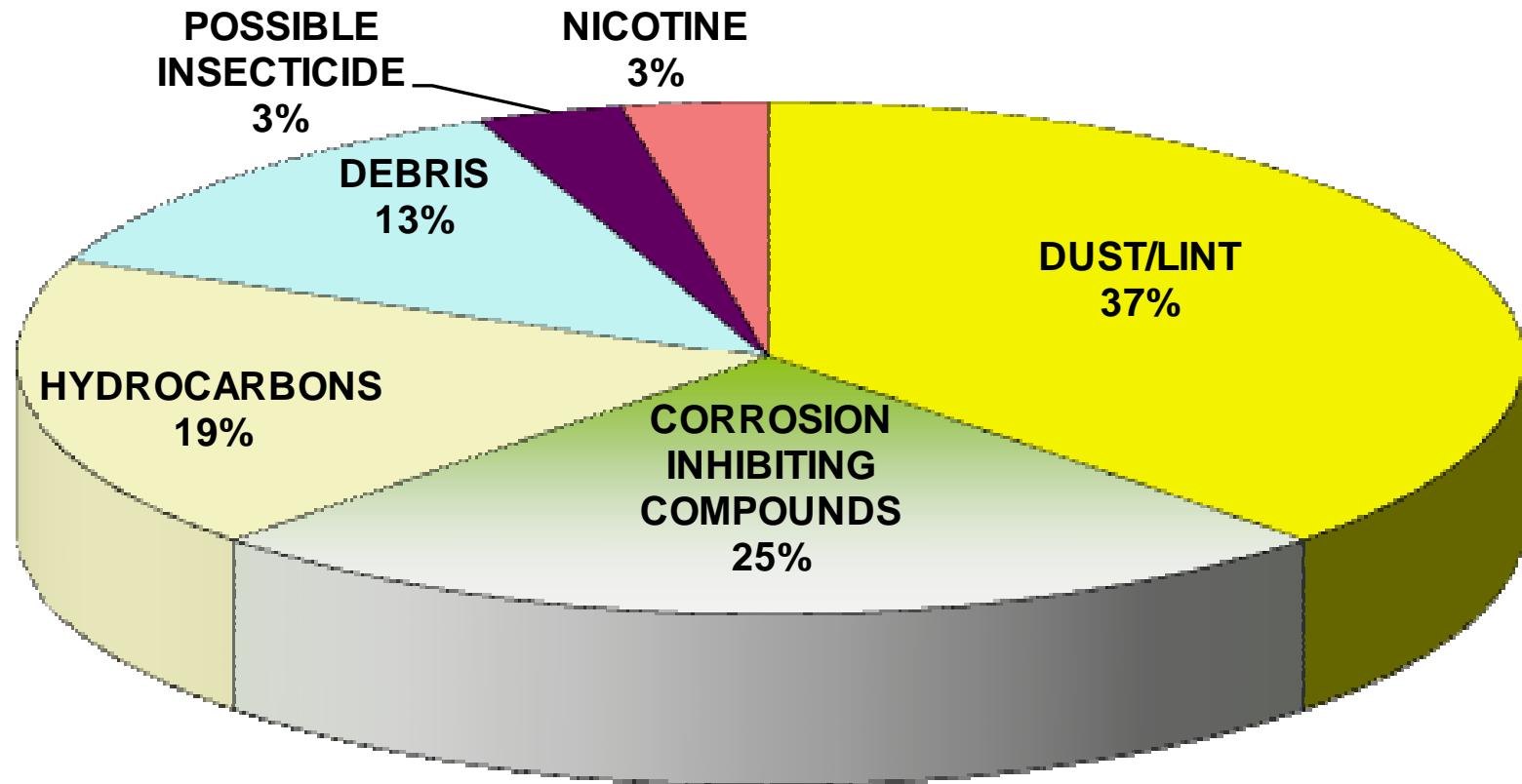
# **Hidden Fires – Contaminated Thermal Acoustic Insulation**

## **Task Group - Airline Contamination Survey**

# Contaminants based on Boeing Airline Survey



# Contaminants found in the vicinity of in-service hidden fires



# Hidden Fires – Contaminated Thermal Acoustic Insulation

## Testing

# **Thermal Acoustic Insulation Contamination**

## **FAA Radiant Panel Test**

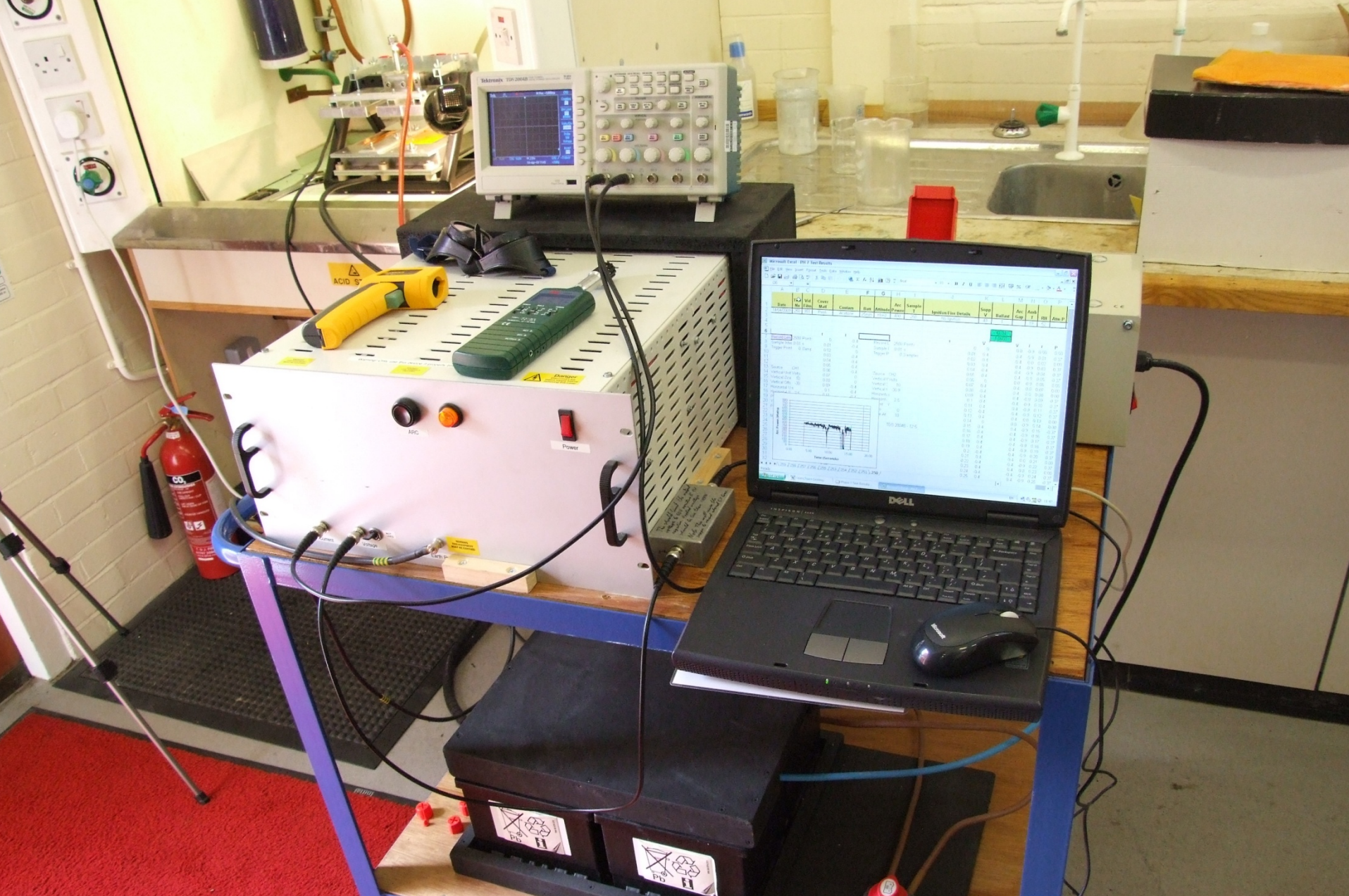




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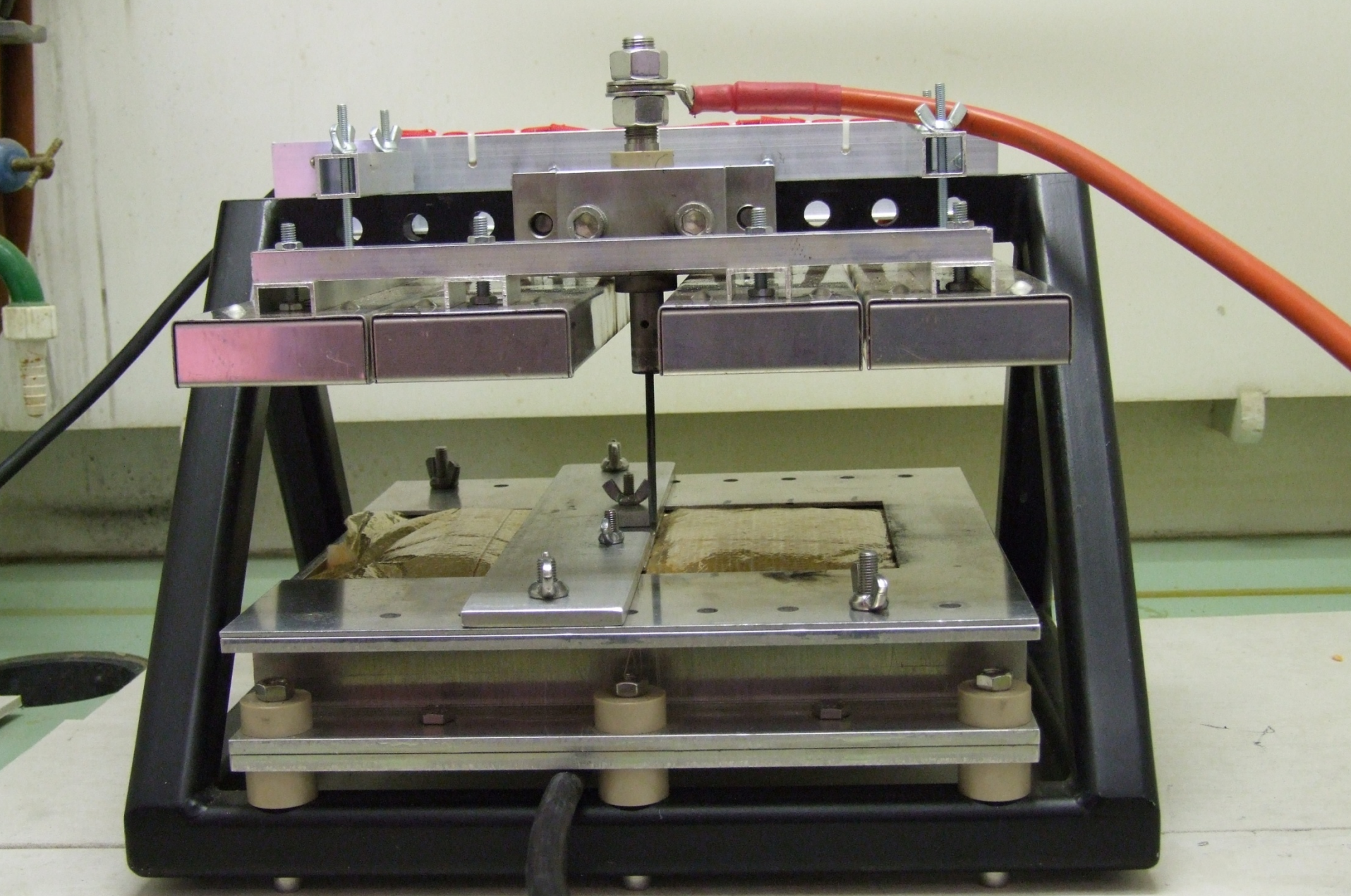
# **Thermal Acoustic Insulation Contamination**

## **Transport Canada Arc Fault Test Rig**



**Transport Canada – Arc Fault Test Rig**





**Transport Canada – Arc Fault Test Rig**

# Test Results - Transport Canada Arc Fault Test Rig

Test results for some of the more frequent contaminants of Thermal Acoustic insulation

<b>P</b>	Pass
<b>F</b>	Fail
	Not Tested



# Testing and Proposed Mitigation

## Corrosion Inhibiting Compounds

- 5 CICs have been tested on the Transport Canada Arc Fault Test Rig to date

# Contamination Testing - Corrosion Inhibiting Compounds

Testing for contamination with CIC - A (Non-Waxy CIC)

TAI LINER MATERIAL 9914 /Tables 8/10	ARC FAULT TEST RIG			RADIANT PANEL	
	Ambient	100° C	200° C	Boeing	Airbus
Material A	P	P	F		
Material B	P	P	F		
Material C	P	P	P		
Material D		P	F		
Material E		P	F		

Testing for contamination with CIC - E (Waxy CIC)

TAI LINER MATERIAL 9914 /Tables 8/10	ARC FAULT TEST RIG			RADIANT PANEL	
	Ambient	100° C	200° C	Boeing	Airbus
Material A	F	F	F		
Material B					
Material C					
Material D					
Material E	F	F			

# CLCs Proposed Mitigation

**It is recommended that:**

- **The use of less flammable Corrosion Inhibiting Compounds may result in a more dependable means of flammability threat reduction than scheduled cleaning tasks.**
- **Consultation with Corrosion Inhibiting Compound manufacturers might also be undertaken to determine the feasibility of developing effective Corrosion Inhibiting Compounds with improved flammability characteristics.**

# Testing and Proposed Mitigation

## Cleaning Fluids

# **Contamination Testing – Cleaning Fluids**

**All 3 Cleaning Fluids tested exhibit  
relatively benign flammability properties**

# Testing and Proposed Mitigation

## Hydraulic Fluid

# Contamination Testing – Hydraulic Fluid

## Testing for contamination with Hydraulic Fluid

TAI LINER MATERIAL 9914 /Tables 8/10	ARC FAULT TEST RIG			RADIANT PANEL	
	Ambient	100° C	200° C	Boeing	Airbus
Material A		P	P		
Material B		P	P		
Material C		P	P		
Material D		P	P		
Material E		P	P		



# In Service Aircraft Contaminated with Hydraulic Oil





# Contamination Testing – Hydraulic Fluid

## Testing for contamination with Hydraulic Fluid

TAI LINER MATERIAL 9914 /Tables 8/10	ARC FAULT TEST RIG			RADIANT PANEL	
	Ambient	100° C	200° C	Boeing	Airbus
Material A		P	P		
Material B		P	P		
Material C		P	P		
Material D		P	P		
Material E		P	P		

## Testing for contamination with Hydraulic Fluid in the Fibreglass

TAI LINER MATERIAL 9914 /Tables 8/10	ARC FAULT TEST RIG			RADIANT PANEL	
	Ambient	100° C	200° C	Boeing	Airbus
Material A					
Material B					
Material C					
Material D					
Material E	F	F	F		

# Hydraulic Fluid Proposed Mitigation

**It is recommended that:**

- **Further consideration is given to Aircraft Maintenance Manual recommendations regarding the in-service repair and replacement of TAI materials.**

# Testing and Proposed Mitigation

## Dust & Lint

# In Service Aircraft Contaminated with Dust & Lint





# Contamination Testing

## Dust & Lint

Dust & Lint –

from an in-service Aeroplane  
undergoing Maintenance

Testing for contamination with Dust and Lint

TAI LINER MATERIAL 9914 /Tables 8/10	ARC FAULT TEST RIG			RADIANT PANEL	
	Ambient	100° C	200° C	Boeing	Airbus
Material A	F	F	F		
Material B					
Material C					
Material D					
Material E					



# **Dust & Lint**

## **Proposed Mitigation**

**It is recommended that:**

- **Further consideration is given to the rate of accumulation of Dust/Lint on in-service aircraft in order to ascertain whether the frequency of cleaning currently proposed will adequately mitigate the in-flight fire threat.**

# Hidden Fires – Contaminated Thermal Acoustic Insulation

## Way Forward



# Recommendations on Way Forward

- 1. The findings on contaminated Thermal Acoustic Insulation contamination are to be presented to the International MRB Policy Board (IMRBPB) and the Maintenance Programme Industry Group (MPIG) for their advice regarding the proposed mitigation**

**(MRB Maintenance Review Board)**

# Recommendations on Way Forward

**2. Transport Canada with the support of the UK CAA are to commission surveys of in-service aeroplanes to:**

- Determine the extent of TAI contamination and quantify the threat by carrying out testing**
- Assessing the rate of change of the threat with time from last cleaning**
- Assessing what factors influence the magnitude of the threat**