High-Energy Fire Training Enhancement Workgroup (HEFTE WG)

International Aircraft Systems Fire Protection Forum Meeting

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Why Are We Here?

According to the FAA Air Traffic Organization, there are around 2.5 million airline passengers per day across the US airspace. If you assume somewhere between 2-3 lithium ion devices carried by each passenger (for calculation purposes we used 2.5 PEDs per person), this translates to approximately 2.3 billion lithium ion battery powered devices brought into the aircraft cabin per year just in the USA.

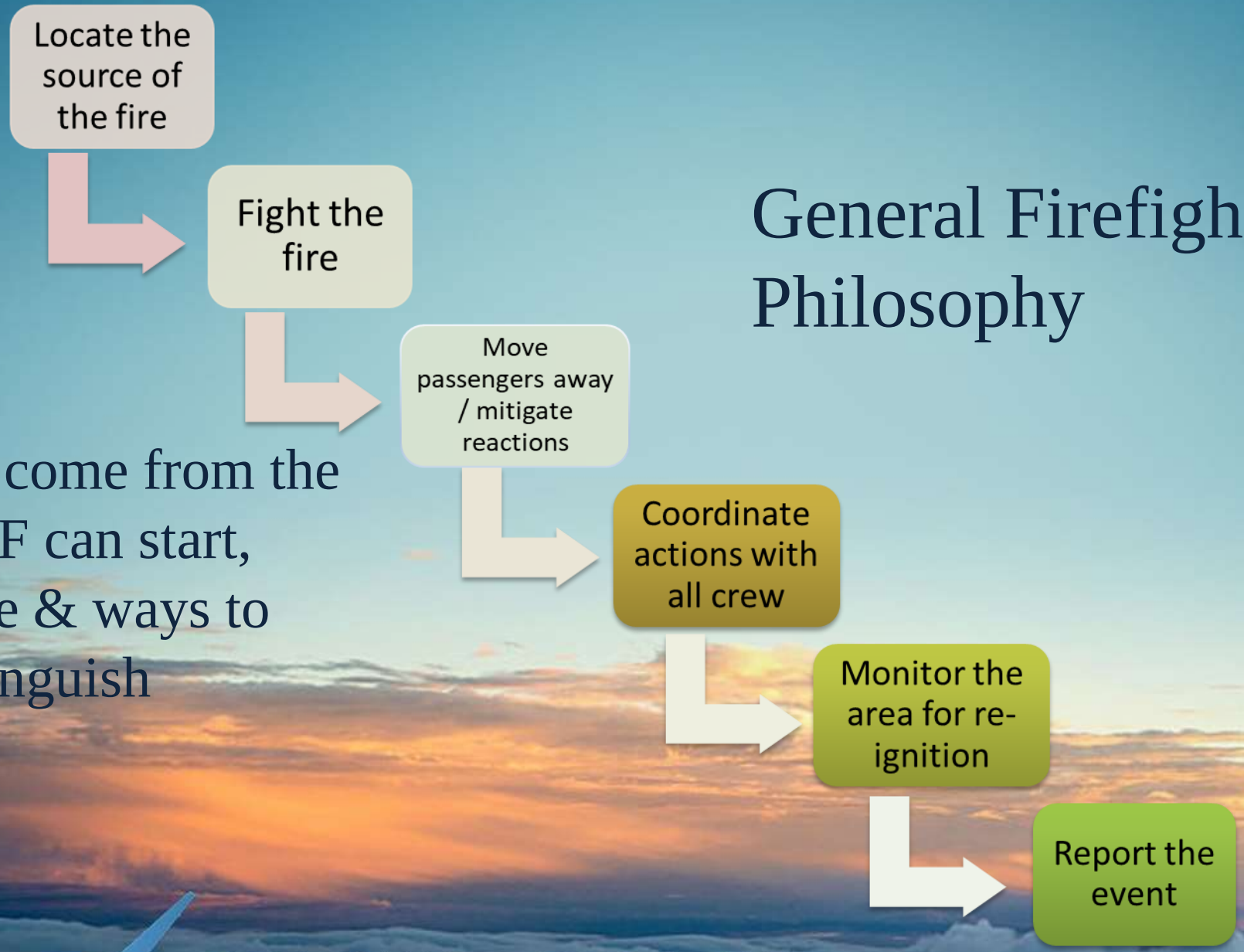
HEFTE WG Overview

- Air Carrier Training Aviation Rulemaking Cmt (ACT ARC)
- Tasked Aug. 2017 – Recommendations Nov. 2018
- 11 Members; 3 Industry SME; 2 FAA SME; 1 Support
  - Document Review
  - Work mainly via conference calls – 17 calls
  - One F2F – Feb. 2018 at FAA Tech Center in Atlantic City, NJ

HEFTE Scope of Work

- Recommend updates/improvements to current training and guidance around response to high-energy fires (HEF) that can occur in the occupied areas of the aircraft.
  - Multiple sub-recommendations under this main topic (1.a. to 1.g.)

General Firefighting Philosophy



Differences come from the way HEF can start, propagate & ways to extinguish

Recommendation 1.a.

The FAA update advisory guidance related to HEF, by encouraging & supporting certificate holders to update their firefighting training and procedures related to HEF.	Recognizing the early warning signs of battery overheating
	Cooling of batteries experiencing thermal runaway
	Emphasis on use of PPE and volatility of HEF
	Flight deck/cabin procedures and SMS
	Smoke and fume concerns

A Closer Look

Recommendation 1.a. - continued

The FAA update advisory guidance related to HEF, by encouraging & supporting certificate holders to update their firefighting training and procedures related to HEF.

Training Environment Realistic environment (poss. mockup)
Training Techniques Hands-on exercises
Training Scenarios - cabin HEF on a tray table HEF in a seat back pocket HEF in an overhead bin
Training Scenarios – flight deck High EFB temperature, no visible smoke EFB in runaway, light smoke EFB in runaway, smoke & flames

Recommendation 1.b.

Publish guidance advising air carriers electing to equip aircraft with HEF containment products to develop procedures for hands-on training on use of that equipment.	Air carriers have begun installing equipment not required (gloves, goggles, fire blankets, containment devices)
	Survey found training varied at carriers that equipped a/c with products, many trained by bulletin, some used DL (CBT) to launch the devices.
	Lack of hands-on training was a concern. Inadequate training can disrupt the process.
	Time elements should be trained (immediate, imminent, potential). Guidance suggests 15 min waiting period.
	Considerations for fire gloves.

Recommendation 1.c.

Update guidance to include more specific information for pilots responding to HEF to ANC*, including the handling of toxic & flammable fumes emitted by HEF.	Electronic Flight Bags (EFB) represent possible HEF sources
	HEFs can produce a considerable amount of smoke and fumes obstructing viewing of controls.
	Emphasis on use of PPE
	Research into clearing the smoke to support guidance development
	Research into vision enhancement devices

*Aviate, navigate, communicate

Recommendation 1.d.

Develop guidance for crewmember training with respect to effective communications related to HEF.	Emphasize skills among cabin and flight deck and/or ABP for clear, concise exchange of information.
	Communication/coordination procedure interface with cabin for safe "hand-off" to flight attendants.
	Standardized verbiage, aircraft specific, information for hidden and/or aircraft installed HEF.
	Pre-departure and post-event communications.
	The benefits of a joint CRM type training cannot be understated.

Recommendation 1.e.

<u>Future</u> initiatives to develop technical performance standards for HEF containment and/or extinguishing products; update training products; update testing for smoke concerns.	Research to develop a definitive performance standard for containment products, including addressing toxic fumes or flammable gases
	As Halon alternatives implemented, research to ensure new agent is at least as effective as Halon against HEF.
	More up-to-date videos to reflect volatility, intensity and hazards of HEF.
	There is a need for a centralized repository for HEF reporting.

Recommendation 1.e. - continued

<u>Future</u> initiatives to develop technical performance standards for HEF containment and/or extinguishing products; update training products; update testing for smoke concerns.	Update FAA materials to ensure consistency and up-to-date information. Attachment 5 has suggested language.
	Research and testing of clearing the smoke to support updating guidance (AC 25-9A) to reflect current concerns of volume & toxicity. Current tests reflect three minutes to clear a non-continuous or dense smoke.
	Define containment and control for smoke and fumes for possible inclusion in guidance materials.

Recommendation 1.f.

Update guidance to identify items likely to be involved in HEF and potential hazard scenarios based on chemical content, size and form factors.	New products are continuously coming to market – all with the potential for thermal runaway.
	Chemistry behind the batteries is as varied as products with potential energy increasing. Continued evaluation is important.
	Other new energy technologies are being developed which could present new challenges to crews.
	Some aircraft designs have permanently installed batteries in varying locations that may be difficult to identify then when "hidden fires" was originally contemplated.

Recommendation 1.g.

Standardize terms and definitions related to HEFs used in FAA guidance material and in air carrier manuals.	High Energy Fire (HEF)
	Personal Electronic Device (PED)
	Thermal Runaway
	Containment
	Possibly Control – but not defined by WG

A Closer Look

- Containment Products (and/or extinguishment?)
- Containing/controlling toxic and flammable smoke/fumes
- Smoke generation in the flightdeck
  - Procedures to clear the volume of smoke
  - Maintain aircraft control (PPE or other)

Containment Products

- Research to develop a definitive performance standard for “containment” products, including addressing release of toxic fumes or flammable gases
  - Now we rely on vendors for product facts
- Clarify the intent of use –
  - extinguish a burning device, or
  - contain an extinguished device?

Containment Products

- Handling the device
  - Require the PPE equipment
- Hands-on training (HEFTE was a training group!)

Smoke in the flightdeck

- Electronic Flight Bags (EFB) more prevalent now
  - It is the Air Line Pilot's Association, International (ALPA) position that EFBs are an integral part of safety and support their continued use, including in the flightdeck.

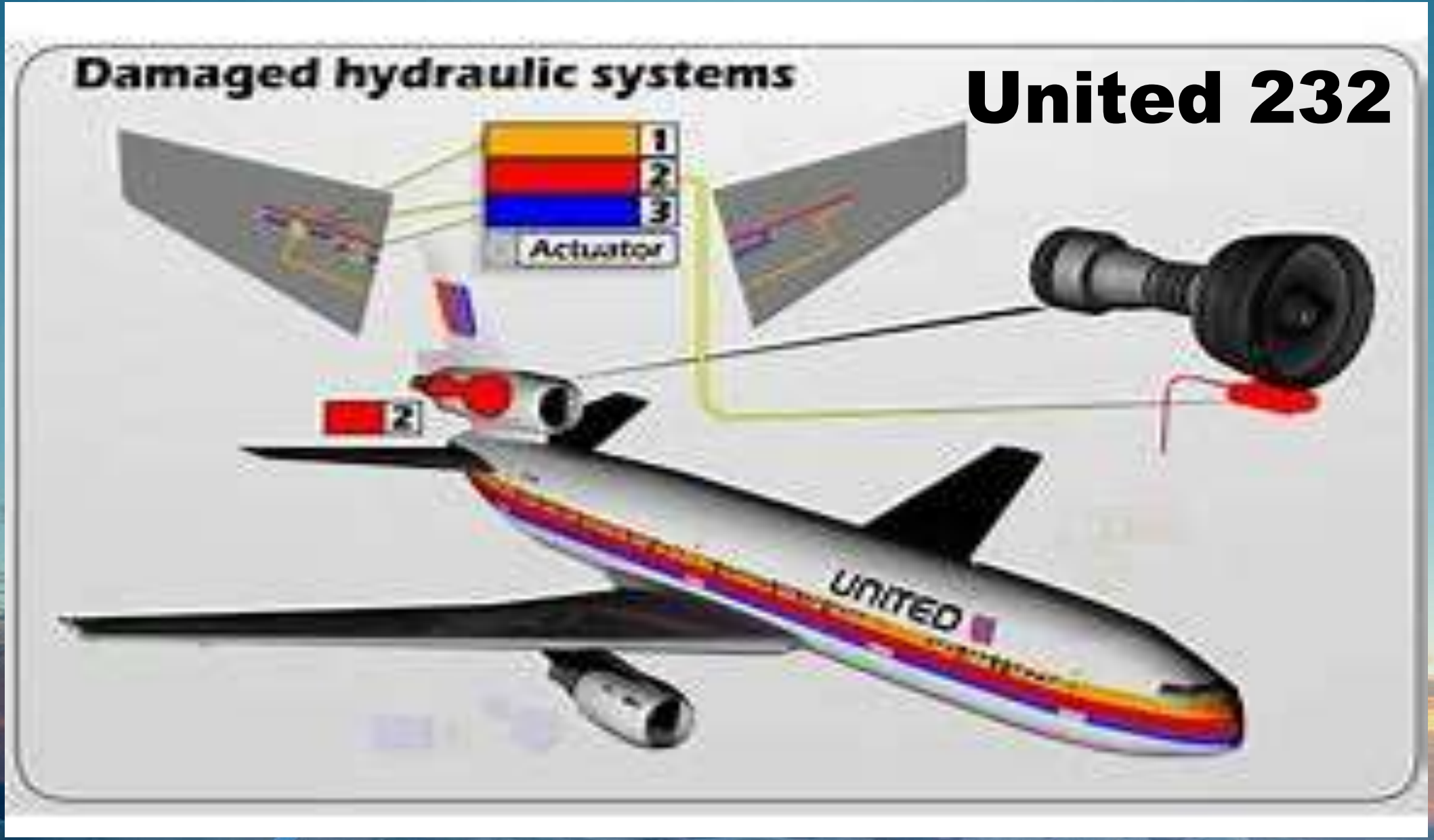
BUT. . .

Air Canada 797

Delta 191

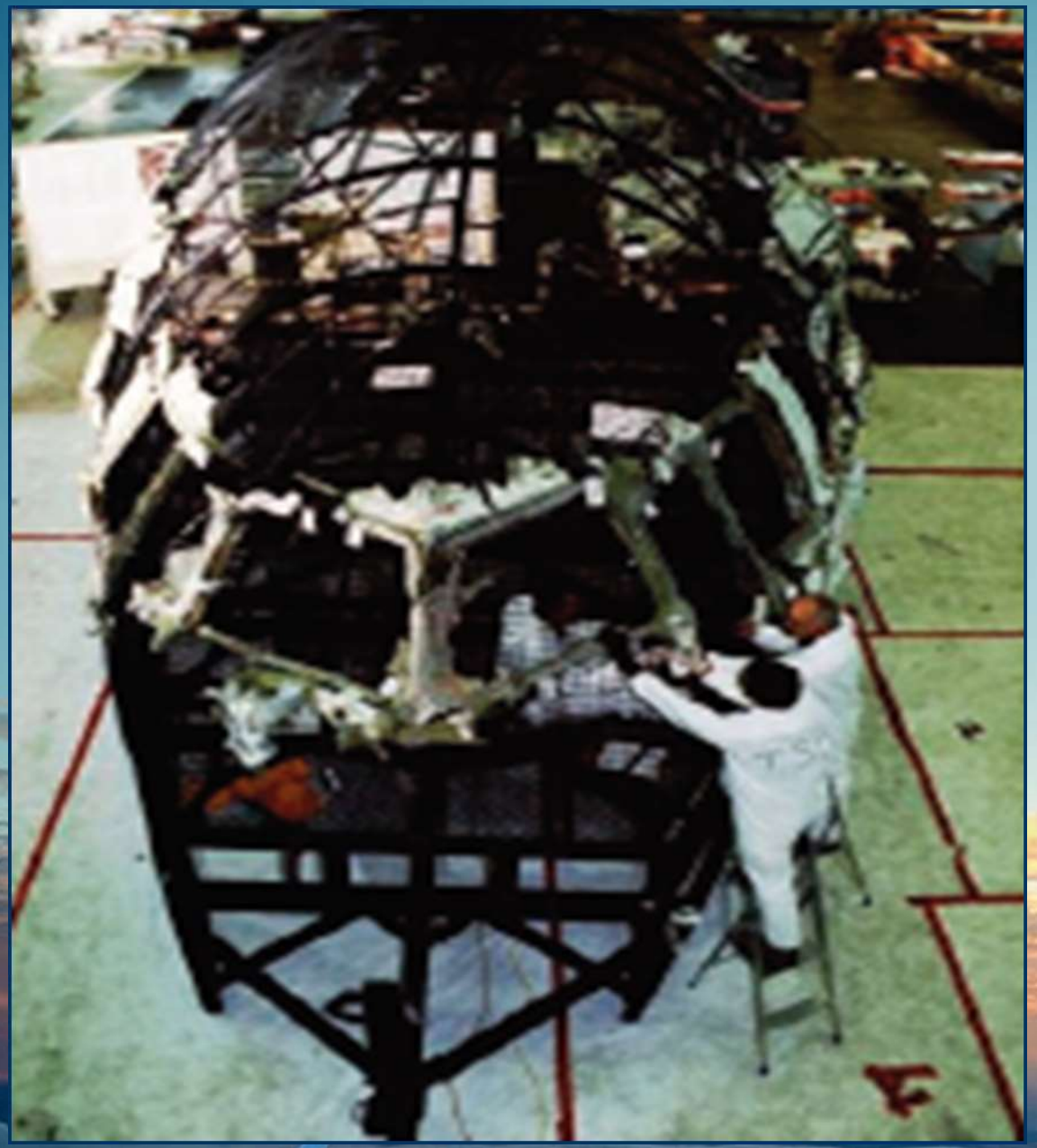
PSA 182

United 232



United 232

Air Canada 797



Swissair 111

Smoke & Fumes

- Cabin & Flightdeck both a concern, but differing designs in ventilation and volume
- HEF – potential for dense smoke and release of toxic vapors need to be addressed
- Define containment and control for smoke and fumes for possible inclusion in guidance materials.
- Research to ensure new agent is at least as effective as Halon against HEF

Smoke in the flightdeck

- Research and testing of clearing the smoke to support updating guidance (AC 25-9A – limits entry of SFG) to reflect current concerns of volume & toxicity.
- Use of PBE (toxicity) or other equipment

Smoke in the flightdeck

- The FAA Tech Center should conduct further lithium battery thermal runaway testing in one of its test aircraft or flight deck mock ups
- If smoke generated impacts pilot's ability to fly, testing must demonstrate that smoke can be cleared out
- If it cannot be cleared sufficiently, mitigation must allow for pilots to see the instruments and outside the airplane for landing

Conclusion

- Working together we can address this emerging threat:
  - Updating the guidance and training material
  - Developing performance standards for products
  - Ensuring adequate equipment onboard to fight the threat
  - Updating design standards to mitigate smoke, fumes and noxious gases out of the flightdeck

QUESTIONS?

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