

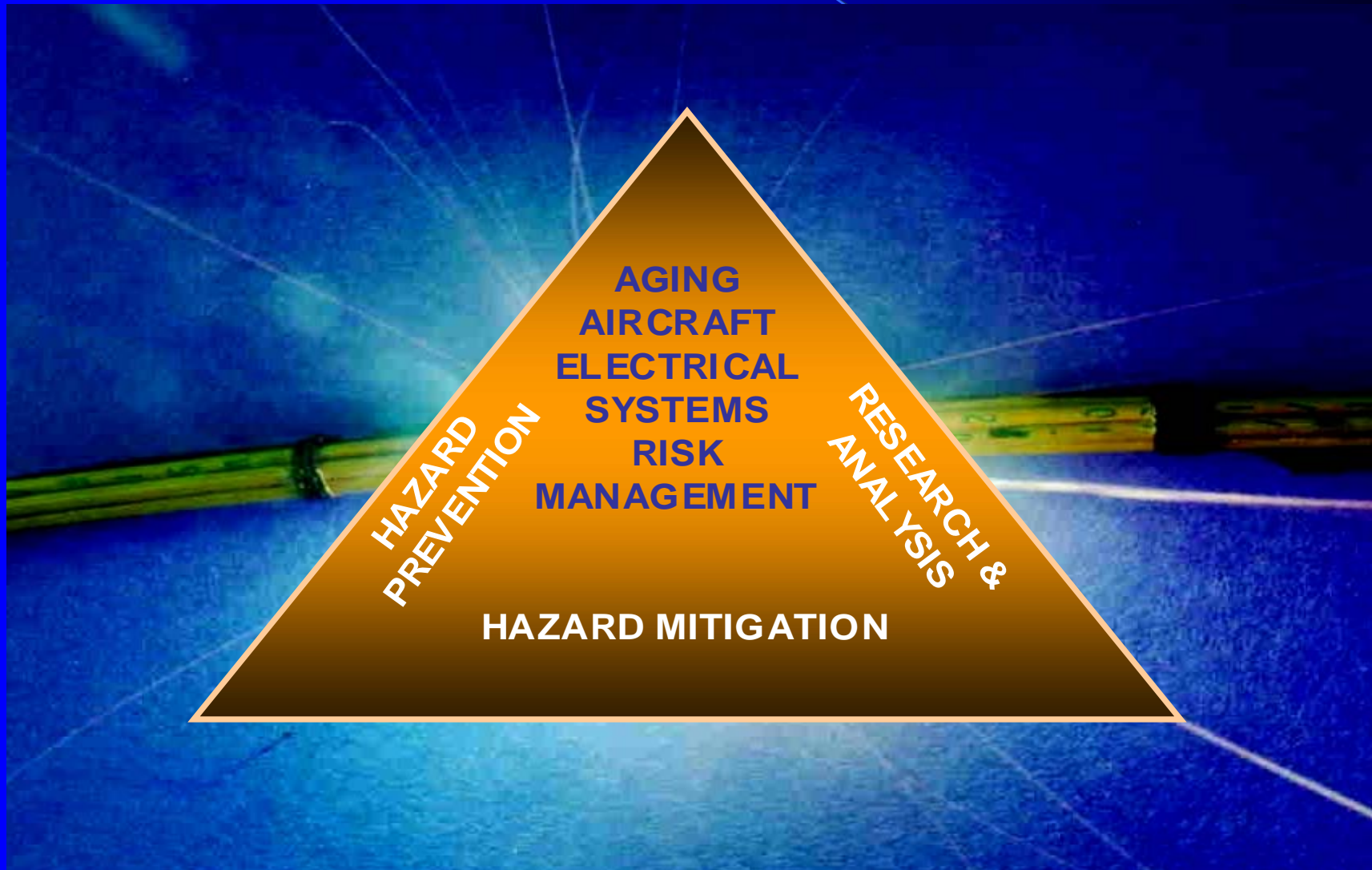


# Arc Fault Circuit Breakers Implementation

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ATSRAC  
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# Electrical Wiring R&D Approach



# Research Overview

The Aging Aircraft Electrical Systems research programs are broken down into 3 Areas

- **Research and Analysis**

- Perform Proof of Concept Studies to support emerging Technology
- Generate reports to support ATSRAC and other rule making Committees

- **Hazard Mitigation**

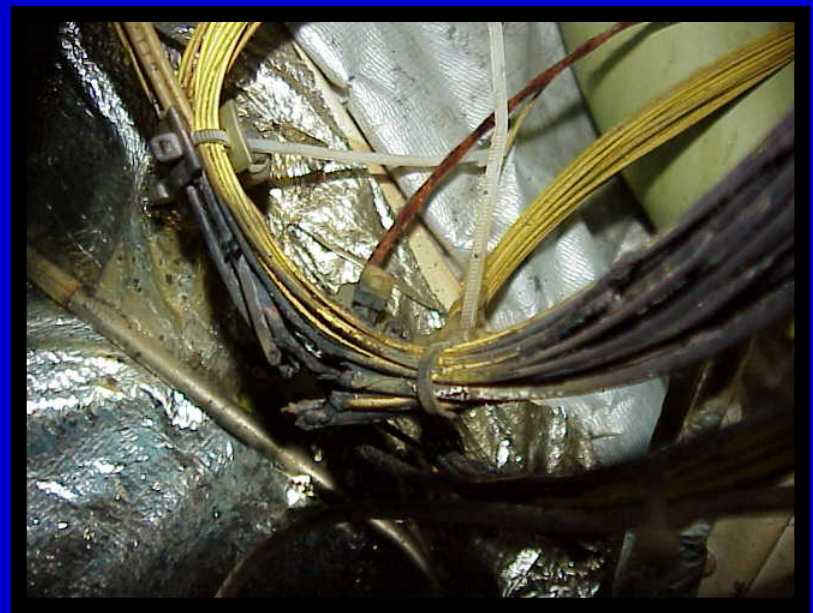
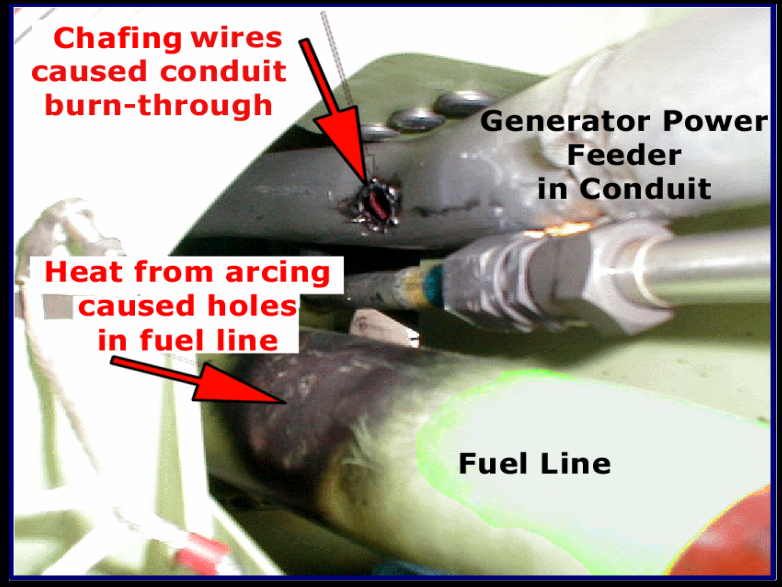
- Develop technology to reduce damage effects

- **Hazard Prevention**

- Develop NDI and NDT technology

# EAPAS Major R&D Projects

- Development of new technologies for wire testing/inspection (NDI)
- Development of wire separation/segregation requirements
- Development of wire performance requirements
- Study effects of related and unrelated maintenance on wiring
- **Development of Arc Fault Circuit Breakers**



Business class lavatory drip shield not installed – water shorted cannon plug in wire bundle below deck

# Why don't thermal circuit breakers provide protection from arcing faults?

- Simple answer is they are not designed to.
  - Arcing fault currents are sporadic or sputtering.
  - A serious arcing fault can briefly have an RMS current value several times the breaker's rating
  - But the relatively short duration and sporadic nature of the event causes little overall wire heating to occur
- Therefore the breaker's bimetal does not respond fast enough to prevent the arcing fault from cascading to other wires.

## Differences between AFCB and Normal Thermal Breaker

- AFCB uses electronics so it requires power
  - Requires a ground connection  $<10$  ohms
  - Draws about 10ma
- AFCB can be tripped by Arcing or thermal faults
- Some AFCB's have dual indication
- If the AFCBs electronics fail, thermal protection is still operating
- AFCBs are larger
- AFCBs are more expensive

# Overview

- Single phase development completed
  - Eaton and Texas Instruments have device commercially available
- Supplemental Type Certificate Awarded
  - Awarded to Eaton for Delta 737 aircraft
- SAE Draft Arc Fault Specification Completed
- Major industry acceptance of the technology
  - Boeing , and Bombardier are incorporating Arc Fault into new designs
- Solid state, 28vdc and 3phase prototype completed
- Arc fault devices have flown over 100,000 hours without a nuisance tripping incident

# Major Arc Fault Accomplishments

- Single phase development completed
  - Device commercially available
- Supplemental Type Certificate
  - Eaton AFCB for Delta 737 aircraft
- SAE Draft Arc Fault Specification Completed
- 28vdc and 3phase development underway
- Arc fault devices have flown over 100,000 hours without a nuisance tripping incident



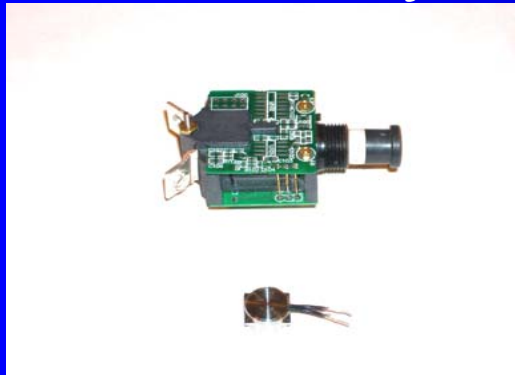
Normal  
overload  
Indication



Arc Fault  
Indication

# New AFCB Developments

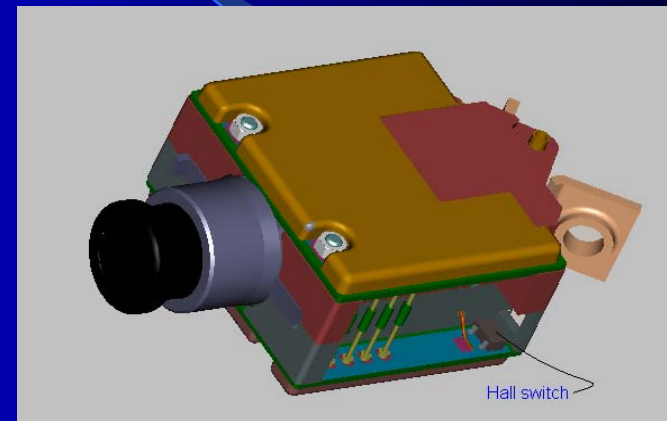
MS3320 style



28VDC



BIT Feature



3 - Phase



# AFCB Implementation Approach

In order to demonstrate the safety and economic benefit of AFCBs, FAA is developing a demonstration program plan that will:

1. Request in-service participation of a limited number of operators, AFCB manufacturers, and aircraft manufacturers.
2. Assess AFCB performance against traditional thermal circuit breaker performance on selected loads of typical large transport category aircraft.
3. Analyze data from millions of hours of AFCB usage.
4. Analyze the cost/benefit of AFCB equipage
5. Validating AFCB post-trip maintenance philosophies.

# Support for AFCB Installation

- Issuance of AFCB AC for installation
- Issuance of AFCB TSO for accepted performance requirements
- Prioritizing AFCB STC approvals
- Potential funding for in-service program
- Establishing acceptable post-trip maintenance actions
- Evaluate impact to EZAP intervals

# Contact Information

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*Any Questions?*

Thank You!