



Improvements in Aircraft Fire Detection

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Jim Milke, Irene Lemberos, Nick Schraffenberger,
Selena Chin

Dept of Fire Protection Engineering
University of Maryland



Motivation

- ❖ **Need for timely fire detection in cargo compartments on board aircrafts**
- ❖ **High proportion of nuisance alarms from smoke detection systems**
- ❖ **Nuisance alarms lead to**
 - **operational delays**
 - **unscheduled landings**
 - **unnecessary safety recourse**
 - **potential to ignore alarms if nuisance alarms become frequent**

Overview

❖ Background study completed

- Requirements for detection in FAR
- Nuisance:fire source ratios
- Configuration of spaces
- Detection technologies

❖ Planning for experimental portion of project initiated

Discrimination Strategies

- ❖ **None: Single sensor, single threshold**
- ❖ **Health-monitoring of sensor**
- ❖ **Alarm confirmation (necessitates time delay)**
- ❖ **Multi-sensor**
 - **“or” logic**
 - **Algorithm**

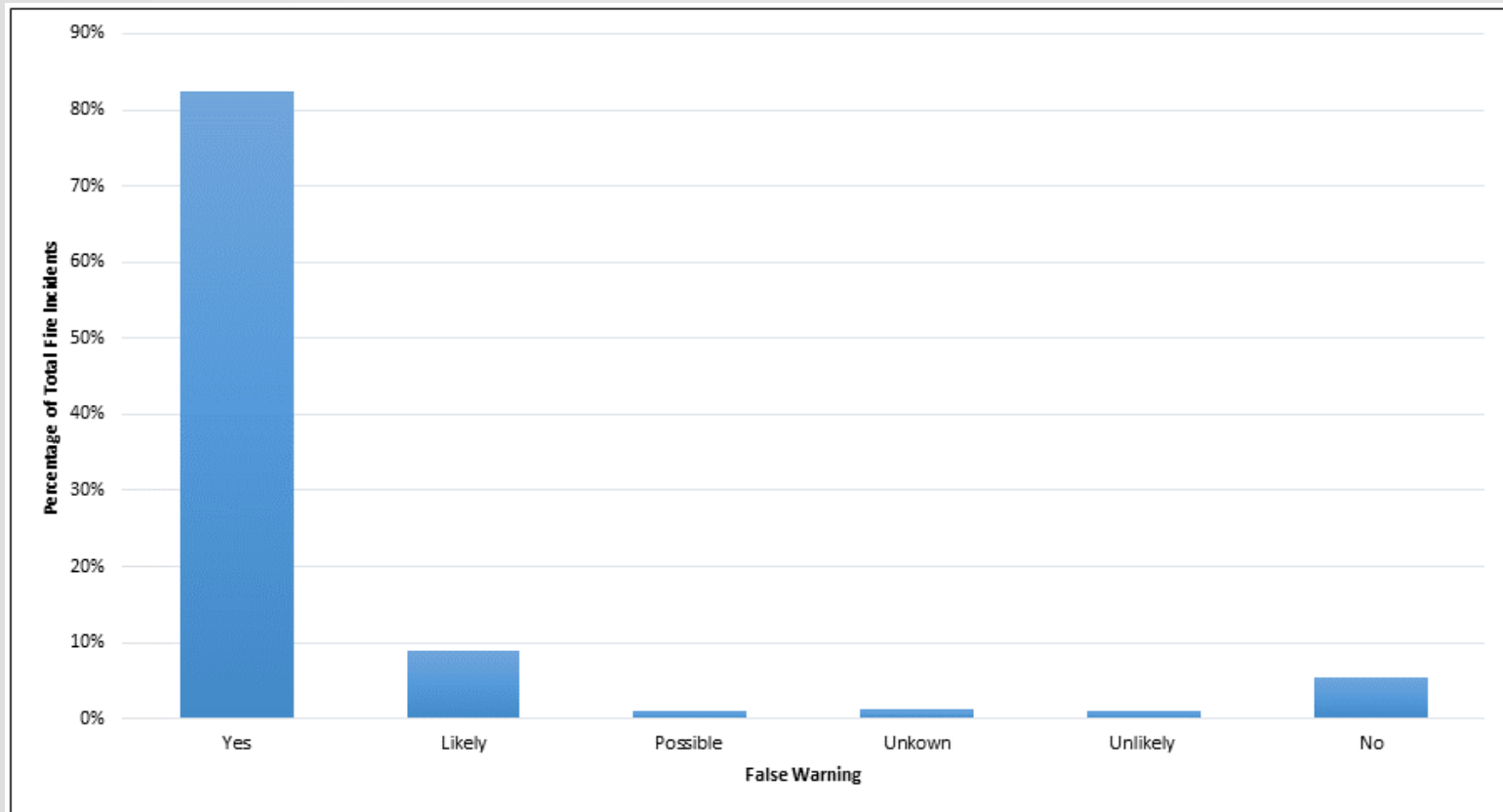
Nuisance Alarms-Cargo Compartments

- ❖ **Analyzed frequency of nuisance alarms in cargo compartments**
 - **FAA database of reported fire related events for all civil flights between 2002-2014**

- ❖ **Event categories**
 - **nuisance alarm**
 - **likely a nuisance alarm**
 - **possibly a nuisance alarm**
 - **unlikely a nuisance alarm**
 - **Unknown**
 - **real fire condition**

Smoke Detection Deficiencies

- ❖ **91.5% of reported incidents in all cargo compartments are from nuisance alarms or likely nuisance alarms**

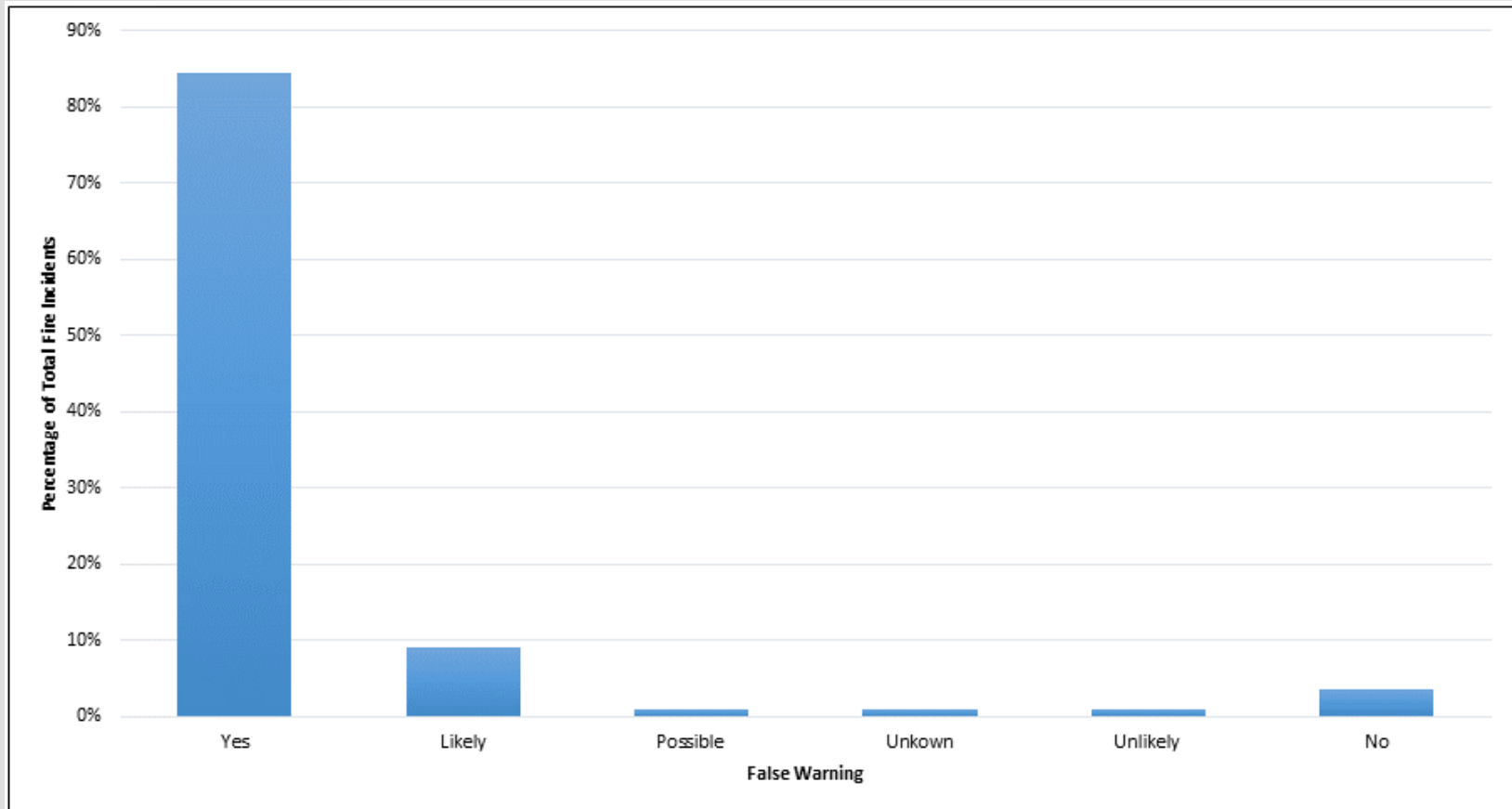


Rate of Nuisance Alarms in all Cargo Compartments



Rate of Nuisance Alarms in Inaccessible Cargo Compartments

- ❖ 93.5% of reported incidents in inaccessible cargo compartments are from nuisance alarms or likely nuisance alarms



ULD Smoke Detection Challenges

- ❖ **Response time set at 1 minute from ignition**
 - In regulations for buildings and industrial applications, detector response is associated with time for hazard development and time needed to respond
- ❖ **No detection requirements for fires originating within ULDs under FAR regulations**
 - Time delay to detect fire that originates within ULD (until breach of ULD)

Proposed Solutions

❖ ULD

- Prevent undeclared hazardous material from entering shipping system (SE 125)
- Develop or improve containment systems (SE 126)
- New standards for the construction of standardized cargo containers (SE 127)

❖ Detection (maintain responsiveness, reduce nuisance alarm susceptibility)

- Multi-sensor detection, consider video back-up
- Include detection capability within ULD
 - ASD
 - Wireless spot detector



Hidden Areas

- ❖ Spaces not normally exposed or seen from inside of aircraft
- ❖ Contents include insulation, wire bundles, electronics, batteries, ducts, and piping
- ❖ Currently no detection in hidden areas



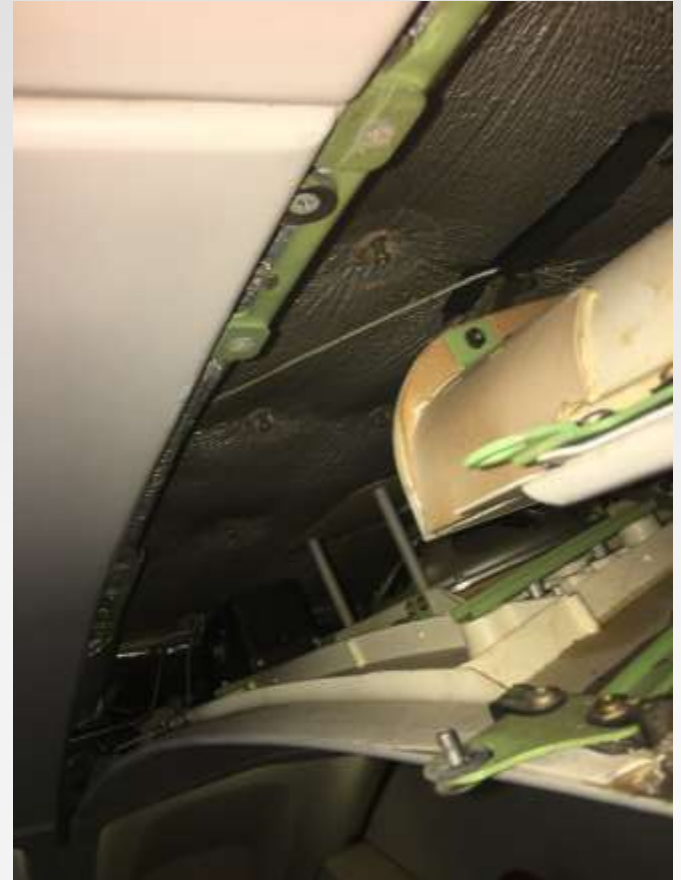
Proposed Solutions

❖ Linear heat detection

- Minimal maintenance after installation
- Can route along existing wire bundles in hidden spaces

❖ ASD

- Flexible tubing for easy routing



Next Steps

- ❖ **Identify detection technologies to be used in experimental program**
 - **Obtain agreement with manufacturers to use their components**
- ❖ **Outline experimental protocols**
 - **Small-scale experiments at UMD**
 - **Full-scale experiments at FAA Tech Center**
 - **Protocols to include:**
 - Fire/nuisance source(s)
 - Configuration of small-scale test space
 - Instrumentation to document environment

