



Fire & Cabin Safety R&D Program

Transport Canada Civil Aviation (TCCA)



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Research Conference – Atlantic City, 25-29 Oct. 2010*

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TCCA's Fire & Cabin Safety R&D Program

Overview

- Objective
- Background/Perspective
- Modus Operandi (MO)
- Main Activities
- Partners' R&D Work
- Final Message

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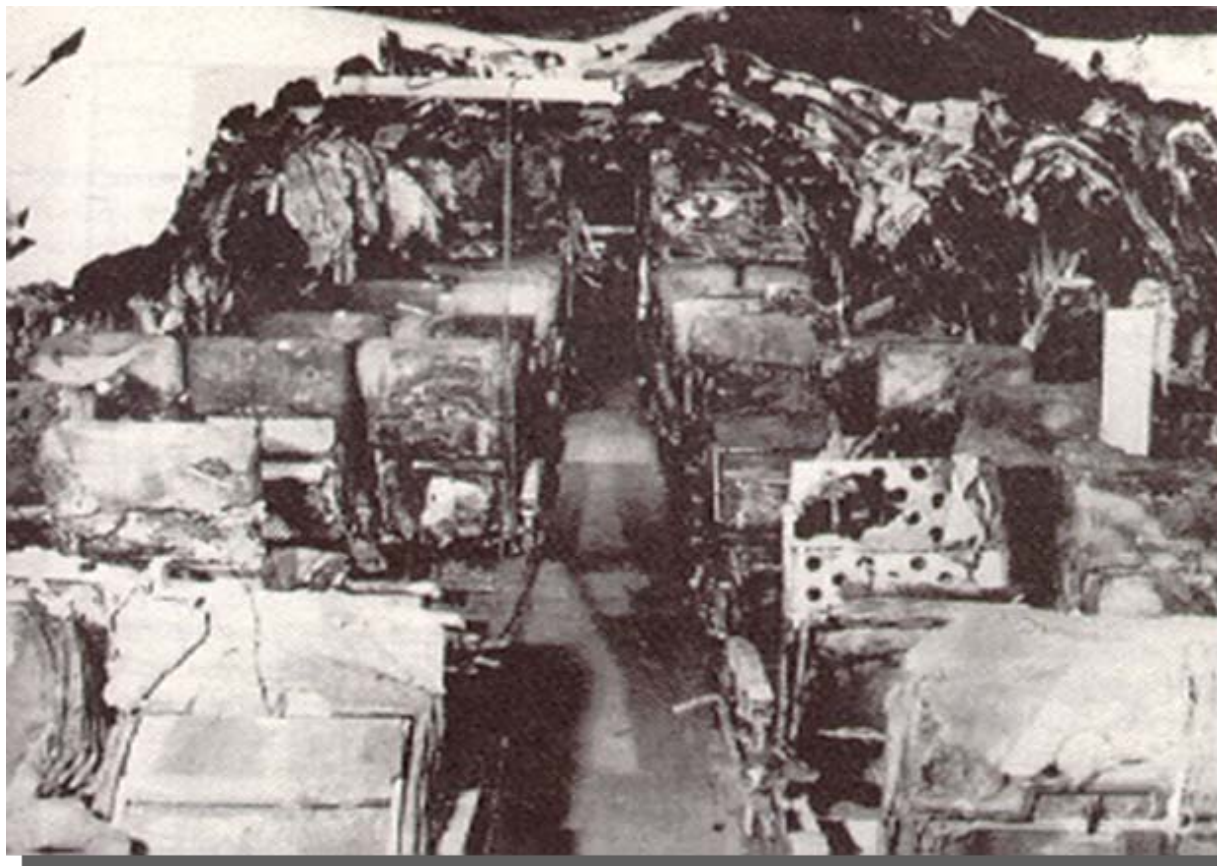
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TCCA's Fire & Cabin Safety R&D Program

Objective (or “Why we do what we do!”)

To go
from this:
multiple
fatalities...



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Objective (or “Why we do what we do!”)

...to this:
no fatalities



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TCCA's Fire & Cabin Safety R&D Program

Objective (or “Why we do what we do...!”)

- TCCA's mandate is to enhance the safety of Canada's civil aviation system
- The objective of TCCA's *Fire & Cabin Safety R&D Program* is to improve the safety of transport category aeroplanes
- Emphasis of the *Program* is on **fire**, both in-flight and post-crash, together with associated evacuation issues
- TCCA's Program consists of a 3-tier approach:
 - Reduce the number of accidents
 - Mitigate the accidents that do occur
 - Improve occupants' capability to evacuate

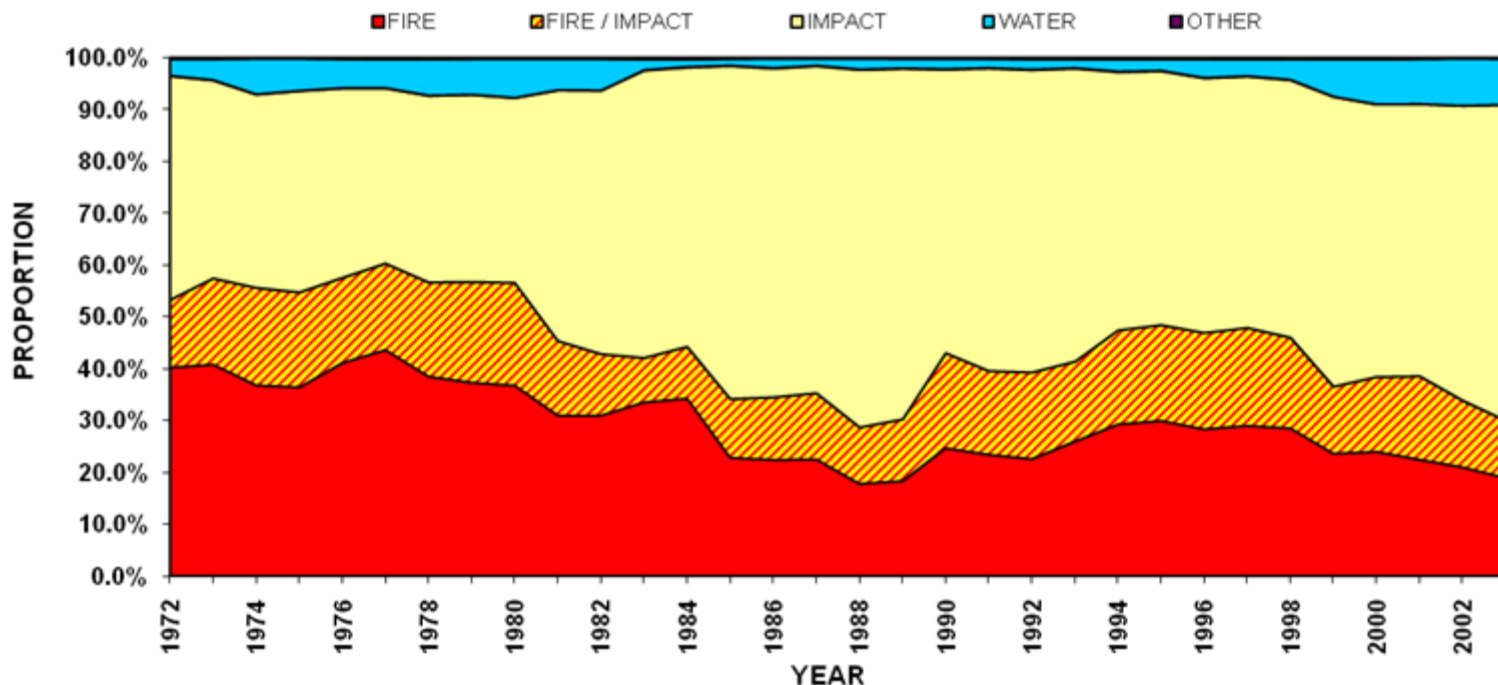
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Objective – Why Fire & Cabin Safety?

Proportion of Fatalities by Cause in a Survivable Accident - 9 Year Moving Average



PROPORTION OF FATALITIES PER CAUSE – ACCIDENTS TO WESTERN WORLD TURBOJET/TURBOPROP AEROPLANES WITH MORE THAN 20 PASSENGER SEATS -PERIOD 1991-2000

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TCCA's Fire & Cabin Safety R&D Program

Objective

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- Emphasis of the *Program* is on **fire**, both in-flight and post-crash, together with associated evacuation issues
- TCCA's Program consists of a 3-tier approach:
 - Prevent accidents
 - Mitigate / reduce the intensity of the accidents that do occur
 - Improve occupants' capability to evacuate

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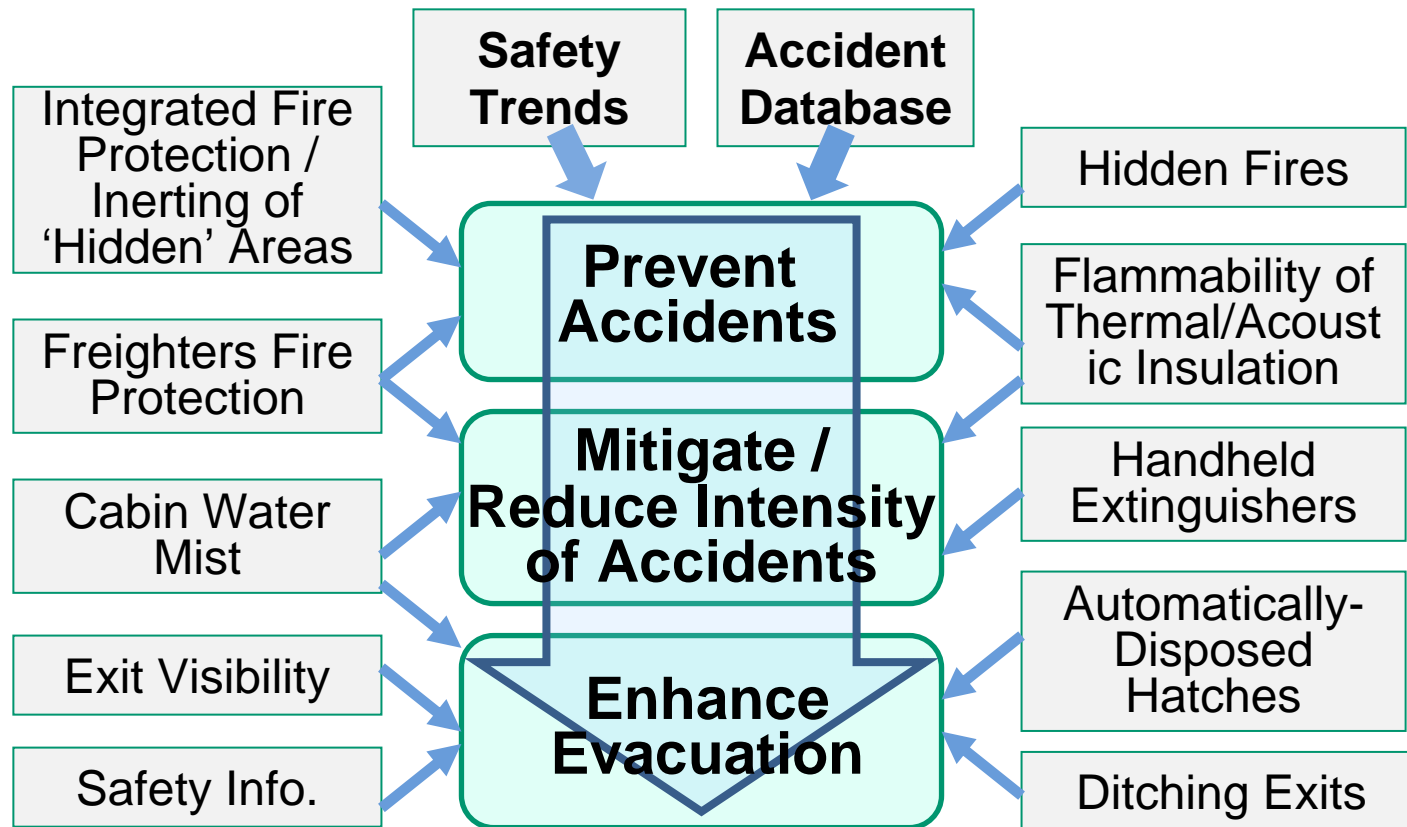
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Objective

3-Tier Approach



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TCCA's Fire & Cabin Safety R&D Program

Objective

TCCA conducts *Fire & Cabin Safety R&D* primarily to provide the basis for:

- Improved regulations & standards
→ must be '*data driven*'
- Responses to TSB (as well as NTSB, AAIB, etc.) recommendations

but also to:

- Identify emerging safety issues
- Support *Certification* activities
- Respond to industry needs
- Foster technical improvements/innovation

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TCCA's Fire & Cabin Safety R&D Program

Background/Perspective

- What's the situation...?
- Other factors 'enter into the equation':
 - New fire/cabin safety issues/problems, e.g. new materials, new systems, larger more complex aeroplanes, 'new' cargo, etc.
 - The *value of human life* has significantly increased in the past few years, making improvements more cost-effective
 - Changes in fleet composition, aircraft size, flight duration...

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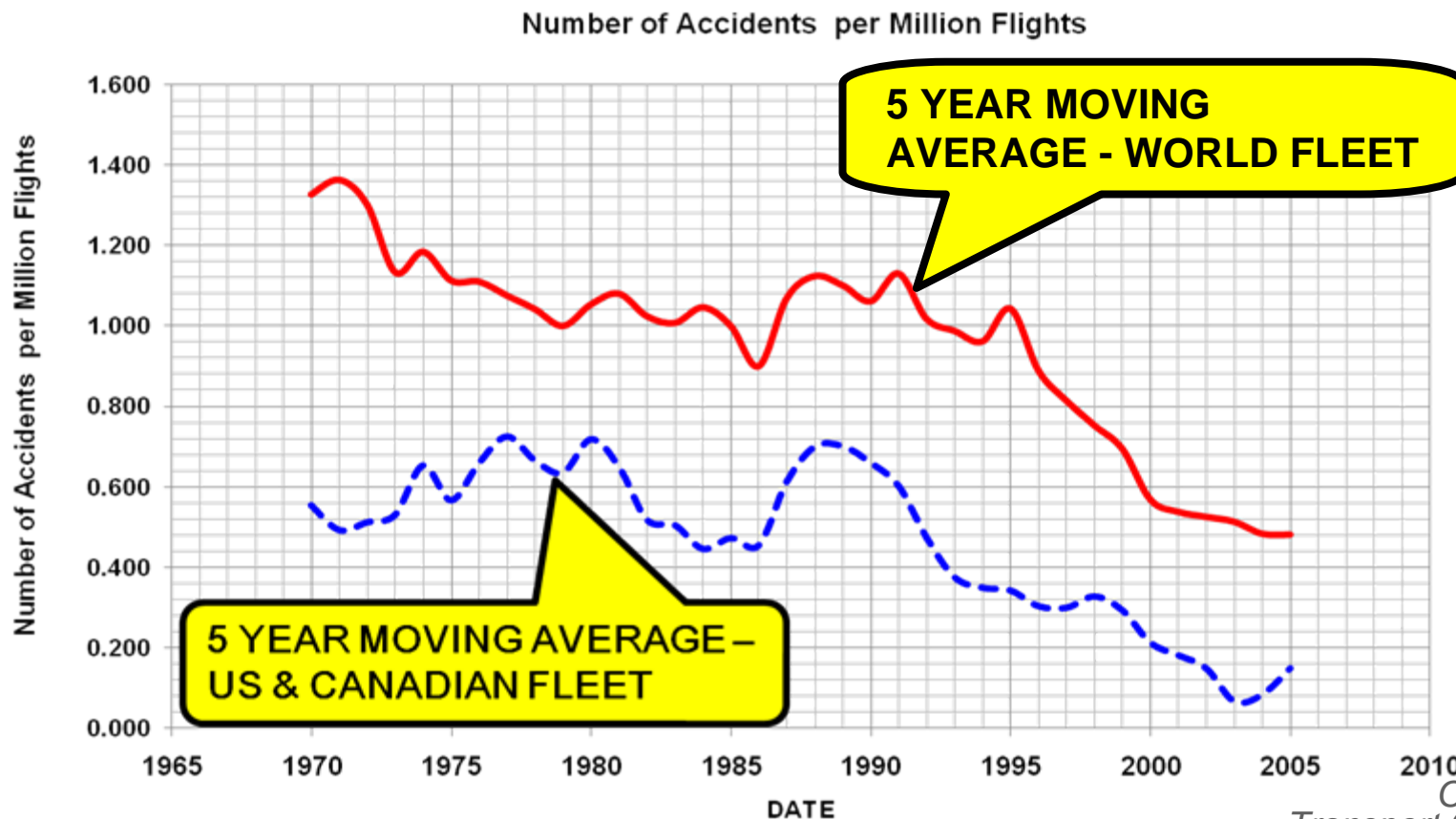
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Background/Perspective

NEW

- Accident rate is decreasing...



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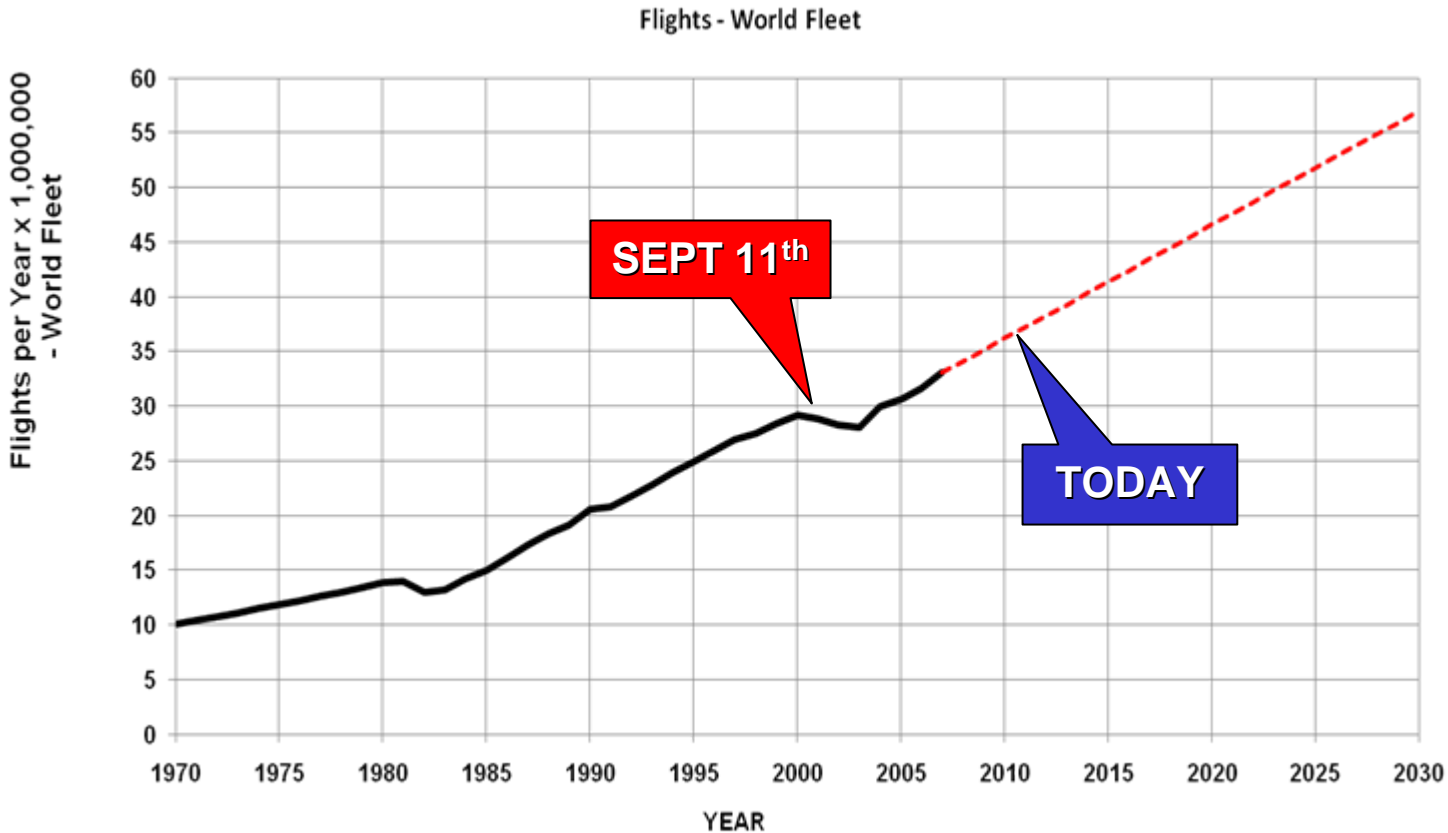


TCCA's Fire & Cabin Safety R&D Program



Background/Perspective

- ...but traffic is increasing

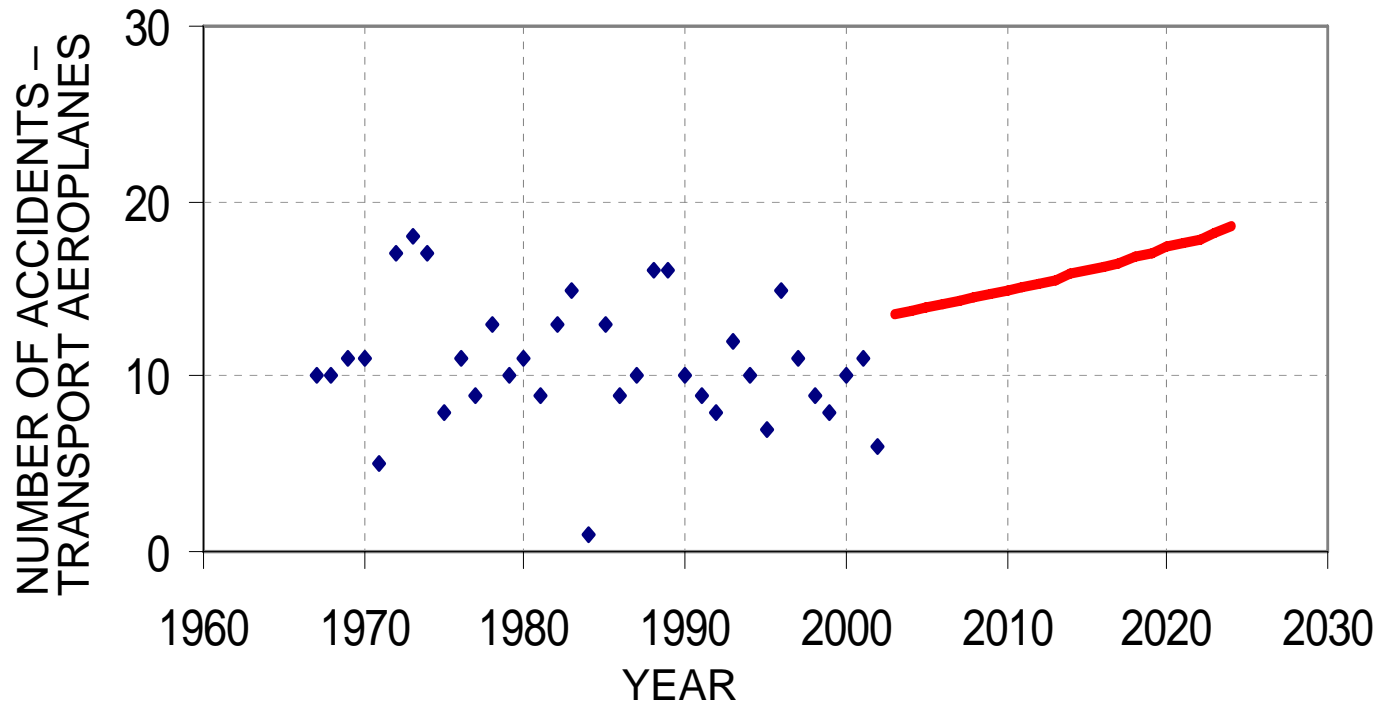


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Background/Perspective

- So, number of accidents is expected to increase



...which will result in more *lives lost* (many due to fire...)

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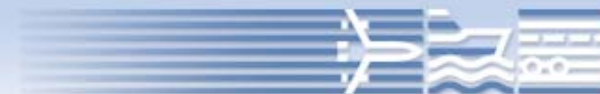


Background/Perspective

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- Other factors 'enter into the equation':
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 - The *value of human life* has significantly increased in the past few years, making improvements more cost-effective
 - Changes in fleet composition, aircraft size, flight duration...



TCCA's Fire & Cabin Safety R&D Program



Modus Operandi (MO)

- TCCA conducts its *Fire & Cabin Safety R&D Program* in cooperation with major Authorities, particularly the FAA and the UK CAA, as well as EASA
- TCCA contributes to other Authorities research efforts
- Activities are coordinated within the *Cabin Safety Research Technical Group (CSRTG)*

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Main Activities

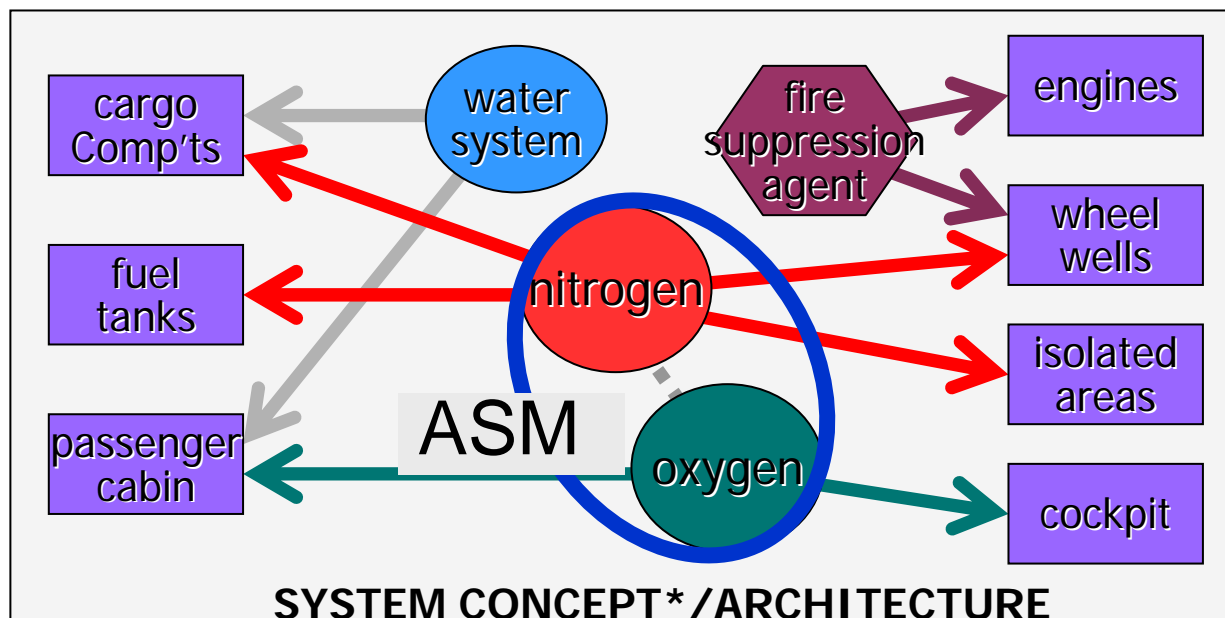
- Integrated Fire Protection (IFP)
- Cabin Water Mist
- Contaminated Thermal/Acoustic Insulation Flammability
- Freighter Fire Protection
- Ditching
- Handheld extinguishers
- Access to Type III Exits / Automatically-Disposed Hatches / Exit Jamming
- Accident DataBase (ADB)
- Safety Trends Analyses



Main Activities

Integrated Fire Protection (IFP)...

- System's approach in the use of on-board fire extinguishing/suppression 'resources'



(*Concept originated from Richard G. (Dick) Hill, FAATC)

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Main Activities

Integrated Fire Protection (IFP)...

- Initial project: investigate use of water mist / nitrogen inerting fire suppression system for cargo compartments
- Driven by availability of nitrogen (provided for fuel tank inerting) and upcoming ban on Halon use
- Work conducted to:
 - identify design concept issues
 - assess practicality (and potential benefits)
 - develop basic system parameters

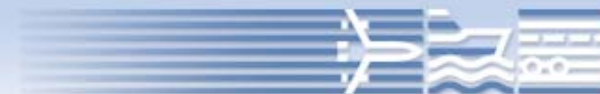


Main Activities

Integrated Fire Protection (IFP)

- Have defined the basic design characteristics, conducted an '*order of magnitude*' benefit assessment and identified main issues
 - industry involvement now needed to progress
- Work now focusing in on *Cabin Water Mist*

Joint with FAA (conducted support testing) and UK-CAA

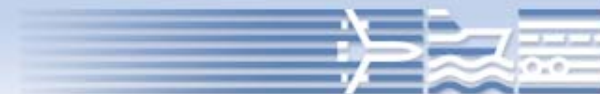


Main Activities

Cabin Water Mist...

- Work in the 80's suggested that Cabin Water Mist would likely be effective in providing protection against external fuel pool fires, but wasn't then cost-beneficial
- However, the increased value of human life coupled with the potential use of water mist in other applications (such as a knock-down 'agent' in cargo compartments) as well as possible use in hidden areas, has revived interest





Main Activities

Cabin Water Mist

- Recent preliminary work by TCCA concluded that Cabin Water Mist systems were essentially 'cost-neutral' (or slightly negative) – however, these conclusions were based on a crude system using unrefined weight & cost data
- Work is accordingly planned to investigate weight & cost reduction means (using more 'up-to-date data')



Main Activities

Contaminated Thermal/Acoustic Insulation (TAI) Flammability...

- The SW-111 investigation has highlighted the need to address threats from in-flight fires in 'hidden' areas, a large proportion of which involve TAI
- Data indicates contamination can significantly degrade the flammability performance of TAI
- Have developed a proposed methodology to mitigate the risk associated with contaminated TAI (in support of FAA's IAMFTWG's work) – methodology based on ignition risk level and cleaning frequency
- Methodology will be presented to pertinent industry groups for assessment (MPIG/IMRBPB)

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Main Activities

Contaminated Thermal/Acoustic Insulation (TAI) Flammability...

- TCCA has developed an Arc Test Rig (ATR) as a tool to 'assess/rank' the flammability performance of TAI
- Limited initial ATR testing shows that TAIs contaminated with dust/lint, some CIC's and 'wicked' hydraulic fluid are very flammable
- Previously-conducted surveys and analysis of in-flight fire occurrences indicate that dust/lint account for approximately $\frac{3}{4}$ of the contaminants found on commercial aircraft



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Main Activities

Contaminated Thermal/Acoustic Insulation (TAI) Flammability

- Will be conducting an extensive sampling and testing program of in-service contaminants to more accurately ascertain extent and impact on TAI flammability



Activity conducted in cooperation with UK CAA (with support from the FAA's IAMFTWG and Boeing)



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Main Activities

Freighter Fire Protection...

- The Authorities have, for some time, been looking into the effectiveness of the fire protection means in Class E cargo compartments (freighters)
- Testing by the FAA has shown that the concept of 'oxygen starvation' does not provide adequate fire protection



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Main Activities

Freighter Fire Protection

- A study conducted for the FAA (in response to an NTSB recommendation re. the UPS DC-8 accident in 2005) concluded that implementation of full-compartment suppression systems would likely not prove cost-effective
- The recent accident to a UPS B-747 in Dubai has further focused attention on the subject
- As a result, TCCA is investigating the potential viability and cost-effectiveness of new/novel systems which do not rely on full-compartment suppression

Joint project with FAA, in cooperation with UK CAA

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Main Activities

Ditching

- Ditchings are very infrequent but, when they occur, they are most often catastrophic
- Further to the recent ditching of an Airbus A320, the authorities have initiated a review of the parameters considered in ditching certification and the adequacy of ditching exits
- TCCA has set-up a project to assess these aspects based on an analysis of past ditching occurrences and available ditching certification criteria data



Cooperative project with FAA

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Main Activities

Handheld Extinguishers

- The recent 'release' of contaminated Halon (1211) in aviation has raised serious concerns regarding the processes used for controlling the 'quality' of extinguishing agents, particularly in handheld extinguishers
- TCCA has accordingly initiated a research effort to ascertain the processes currently used and make recommendations as to best practice
- The study will consider both North American and European 'systems' (from production to installation on aircraft)



Cooperative activity with the FAA

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Main Activities

Automatically-Disposable Hatches (ADHs) / Exit Jamming...

- Accident and test experience has shown that the disposition of type III hatches can significantly impact egress rates
- Previous work conducted by TCCA (in cooperation with EASA) has concluded that positive life-saving benefits were likely to accrue from the implementation of Automatically Disposable Hatches (ADH) on Transport Category aeroplanes

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Main Activities

Automatically-Disposable Hatches (ADHs) / Exit Jamming...

- Since an ADH involves the use of more complex mechanisms than conventional Type III exits, there is concern that this might lead to an increase in their probability of jamming
- TCCA has accordingly commissioned investigation into the likely effects of increases in exit failure rate on the assessed benefit of an ADH, and
- TCCA will be developing guidance material (to ensure the projected benefits are achieved)

Joint project with EASA, FAA and UK CAA

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Main Activities

CSRTG Accident Database (ADB)...

- Driven by the need to have ready access to accident data and an effective tool to
 - conduct benefit assessments
 - identify safety issues & trends
 - Investigate mitigation strategies
 - prioritize R&D
- The ADB was initiated in the late-90's with funding from the UK CAA, FAA and TCCA
- ADB now comprises factual data on over 3900 accidents to turbine-powered T/Cat aeroplanes (20 passenger seats or more) since the mid-60's
- Emphasis is on fire/cabin safety

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Main Activities

CSRTG Accident Database (ADB)

- The ADB was recently converted to an on-line web-based application
- Further planned work includes:
 - annual update
 - incorporation of full text of Accident Reports (e.g. NTSB reports)
 - Linkage with the FAA Lessons Learned Database (LLDB)

The ADB is jointly funded by TCCA, FAA and UK-CAA



Main Activities

Safety Trends...

- Driven by need to ascertain the effect of improvements incorporated over the past years, so as to determine direction of future rulemaking and pertinent R&D
- More specifically, need to ascertain accident and survivability rates/trends in regard to various factors (e.g. aircraft type, size, flight duration, etc.)
- Had previously conducted initial analyses in regard to some parameters, which have revealed that previous improvements have been largely successful



TCCA's Fire & Cabin Safety R&D Program

Main Activities

Safety Trends

- Have now developed a flexible analytical 'tool' which allows analysis of the evolution of safety in terms of various criteria such as number of accidents, number of fatalities, occupant survivability, cause of death, etc.

Joint project with FAA, with UK CAA support

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Main Activities

Partners' R&D activities to which
TCCA has been / is collaborating (partial list)

- Thermal/acoustic insulation (TAI) flame propagation and burnthrough standards
- Flammability standards for 'hidden' materials
- Use of Magnesium in cabins
- Halon replacement MPS's
- Handheld fire extinguisher guidance (AC)
- Firefighting training video



In Summary...

- The prime objective of TCCA's *Fire & Cabin Safety R&D Program* is to provide a sound basis for regulations and standards
- TCCA's *Program* focuses on *fire safety*, both *in-flight* and *post-crash*
- TCCA conducts its work in cooperation with its CSRTG 'partners', particularly the FAA and EASA, as well as industry

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