Presented by

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Air Transport Safety

Technology & Training

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Agenda

- Review of accident statistics per aircraft type
- Review of accident statistics per accident categories
- Lessons learnt from accident statistics
- Security aspects
- Some challenges valid for most of transport means

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Aircraft accident statistics

The accident statistics which follow:

- Include western built airplanes > ~100 pax
- Exclude test flights, training flights, ferry flights, terrorism & acts of war
- Include all known fatal accidents during revenue flights

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Aircraft accident statistics

- These accident records are split into 4 generations of aircraft according to the following classification:

  - 1st generation = early jet airplanes

    (Comet*, Caravelle*,CV880*, CV990*, B707, B720*, DC-8, Trident*, VC10*)

    ** No longer in commercial service*

  - 2nd generation = 2nd jet generation

    (A300, BAC 111, B727, B737-100/200, B747-1/2/3, DC-9, DC-10, L-1011, Mercure)

  - 3rd generation = glass cockpit / FMS equipped A/C

    (A310/A300-600, B737-300/400/500, B737-600/700/800 (NG), B757, B767, B747-400, B717, BAE 146 (RJ70, RJ100), MD11, MD80, MD90, F70, F100)

  - 4th generation = fly-by-wire, flight envelope protected airplanes

    (A318/A319/A320/A321, A330, A340-200/300, A340-500/600, B777, A380)

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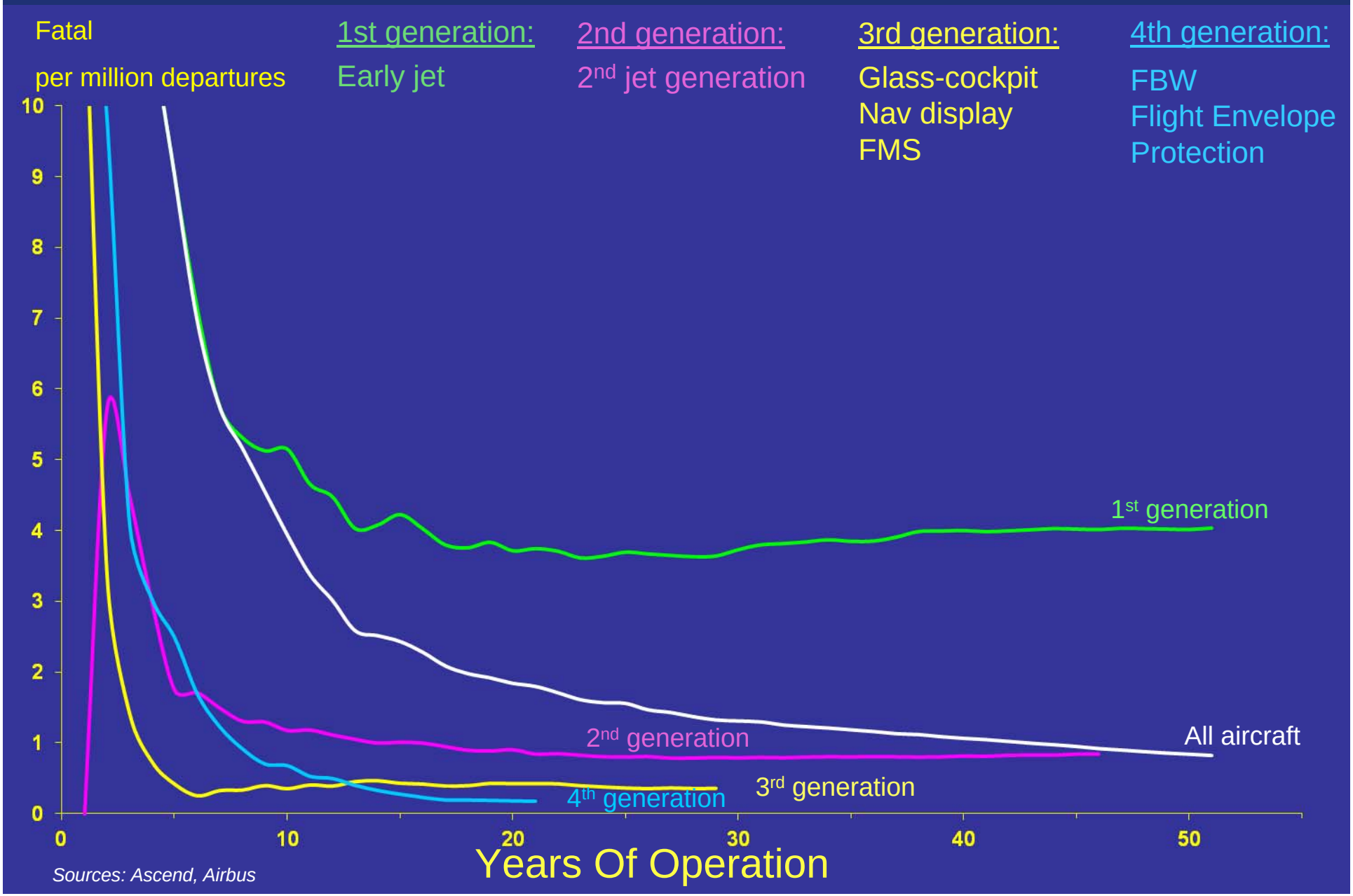
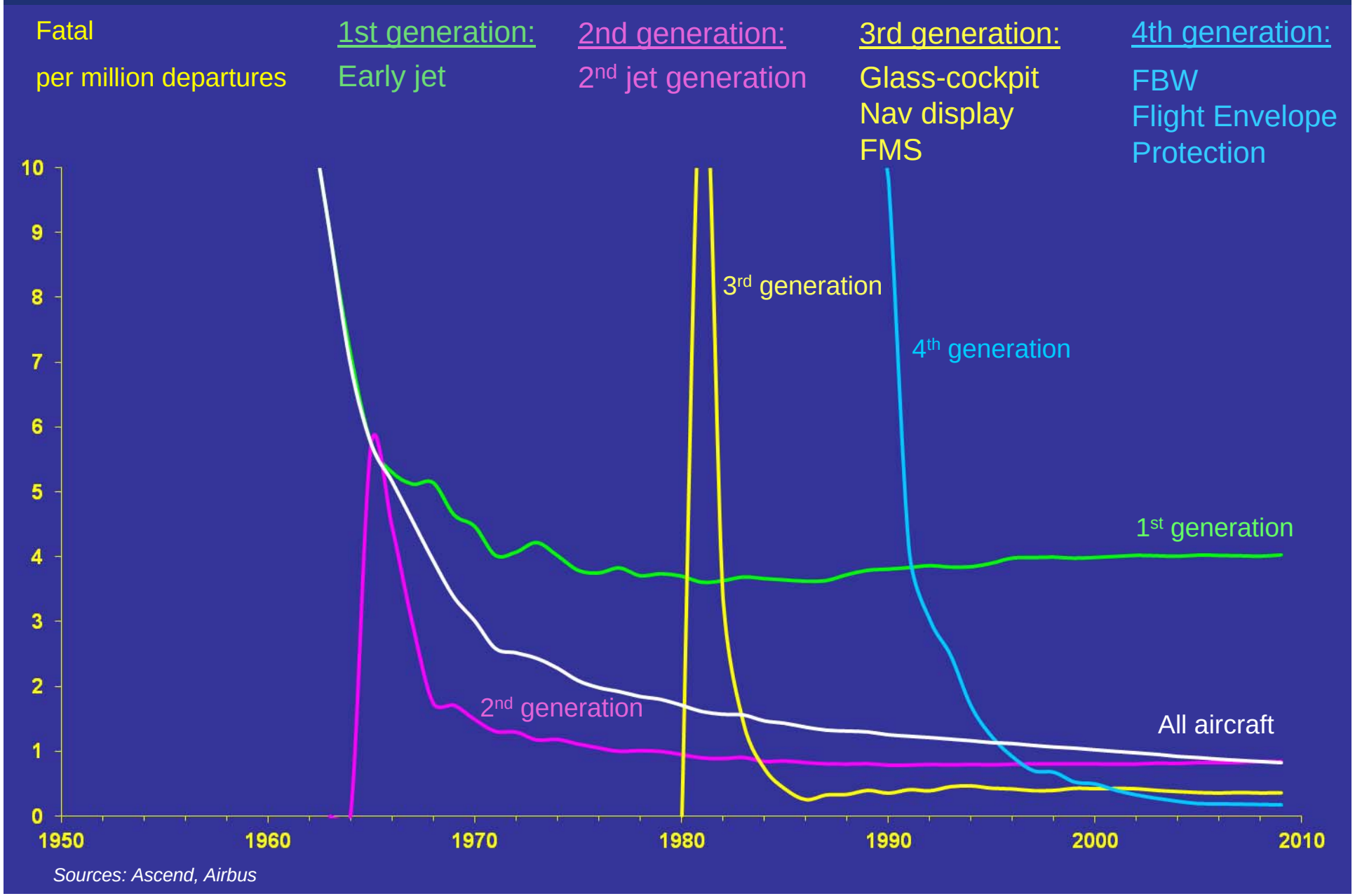
Fatal rate since Entry Into Service - valid end 2009



Fatal rate by year - valid end 2009



Aircraft accident rates figures - valid mid 2009

Accident rate *since Entry Into Service*

Aircraft Generation

accident rate	1st	2nd	3rd	4th	All
Hull Loss accident per million Flight Cycles	7.49	1.61	0.58	0.34	1.53
Fatal accident per million Flight Cycles	4.03	0.84	0.35	0.17	0.83

Accident rate *for the last 10 years*

Aircraft Generation

accident rate	1st	2nd	3rd	4th	All
Hull Loss accident per million Flight Cycles	29.06	3.69	0.56	0.29	0.98
Fatal accident per million Flight Cycles	6.92	1.20	0.30	0.10	0.38

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Sources: Ascend, Airbus

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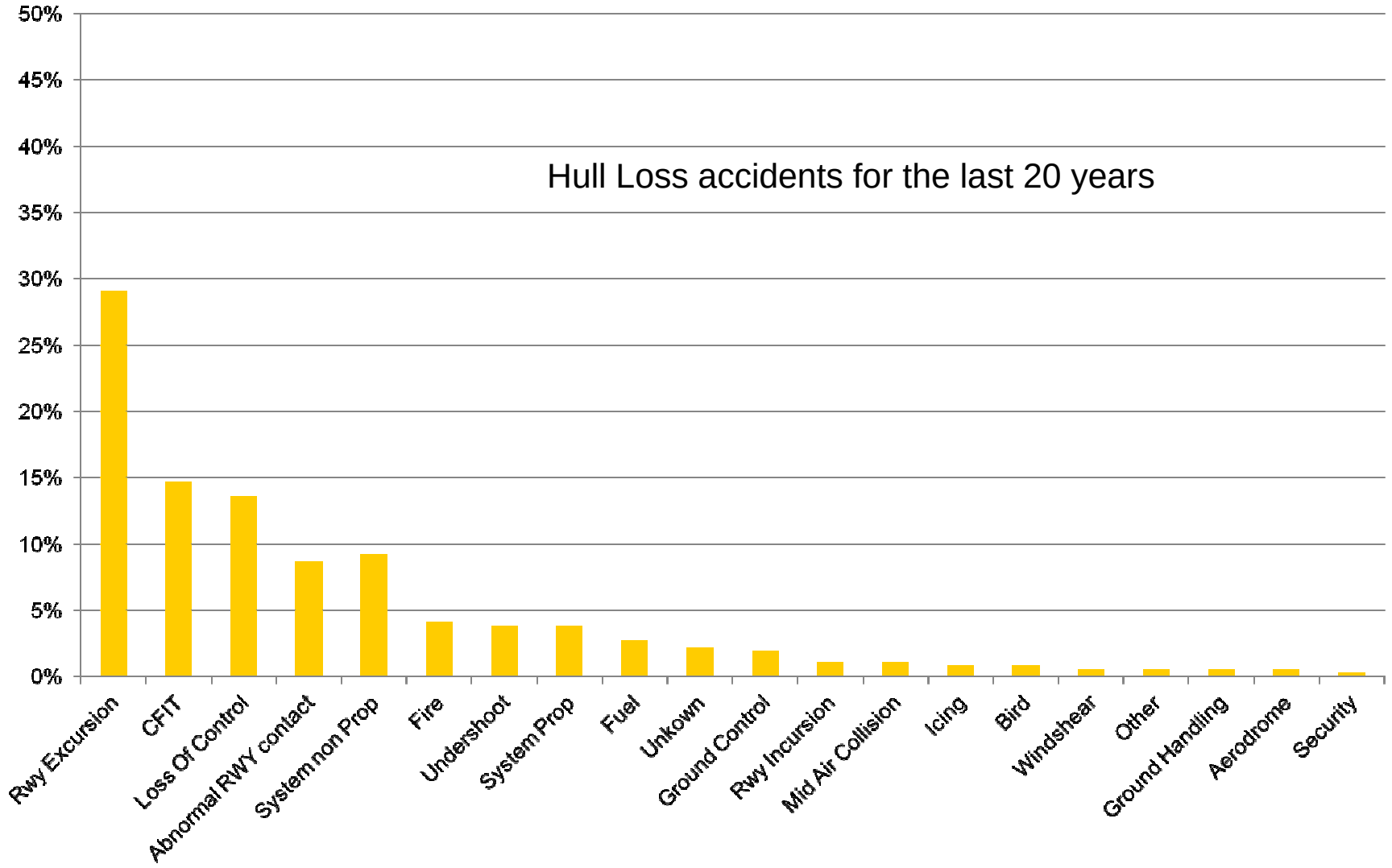
Statistics per accident categories (ICAO classification – All aircraft generation included)

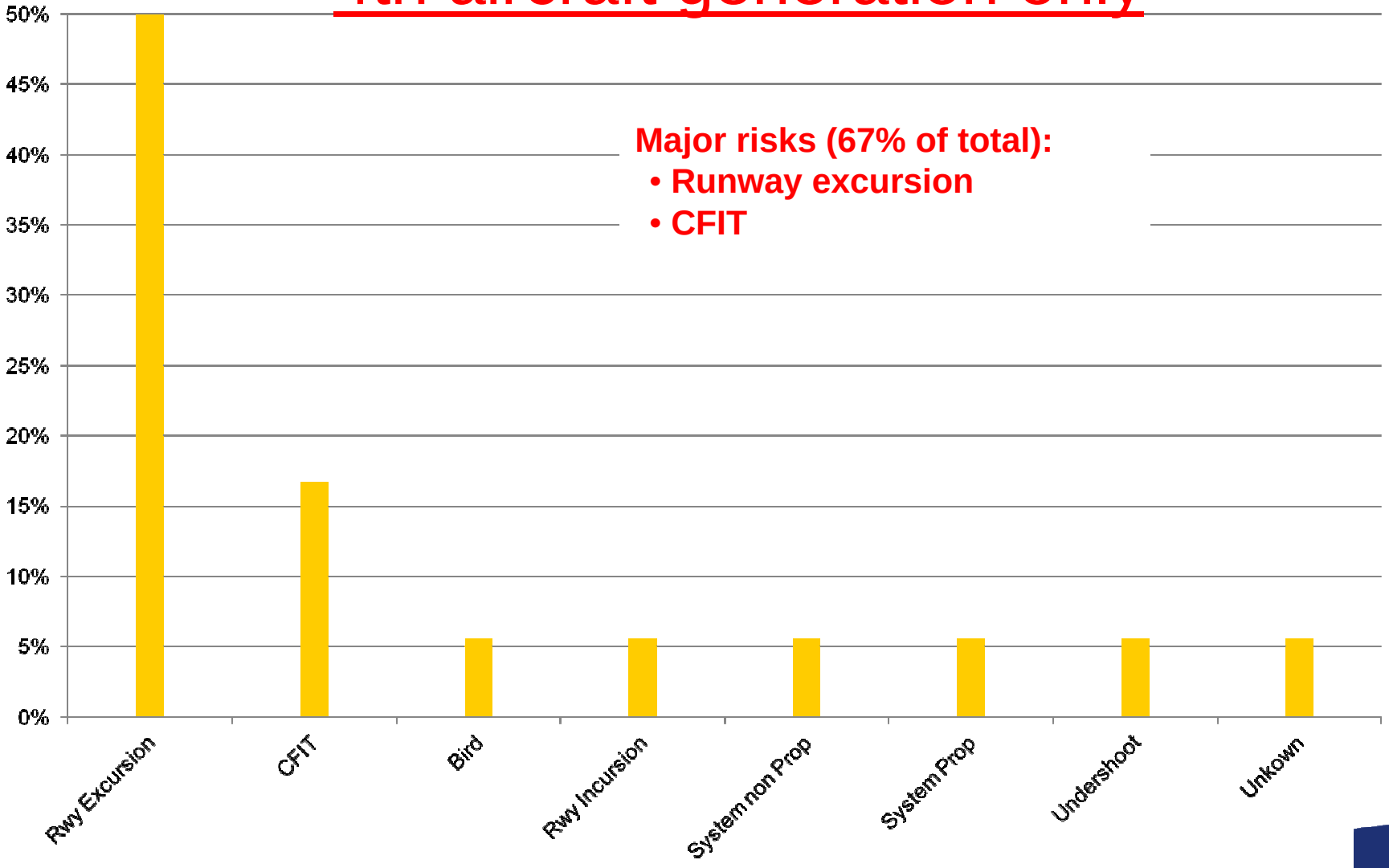


Sources: ICAO

Statistics per accident categories (ICAO classification)

% of total Hull Loss accidents over the last 20 years

4th aircraft generation only

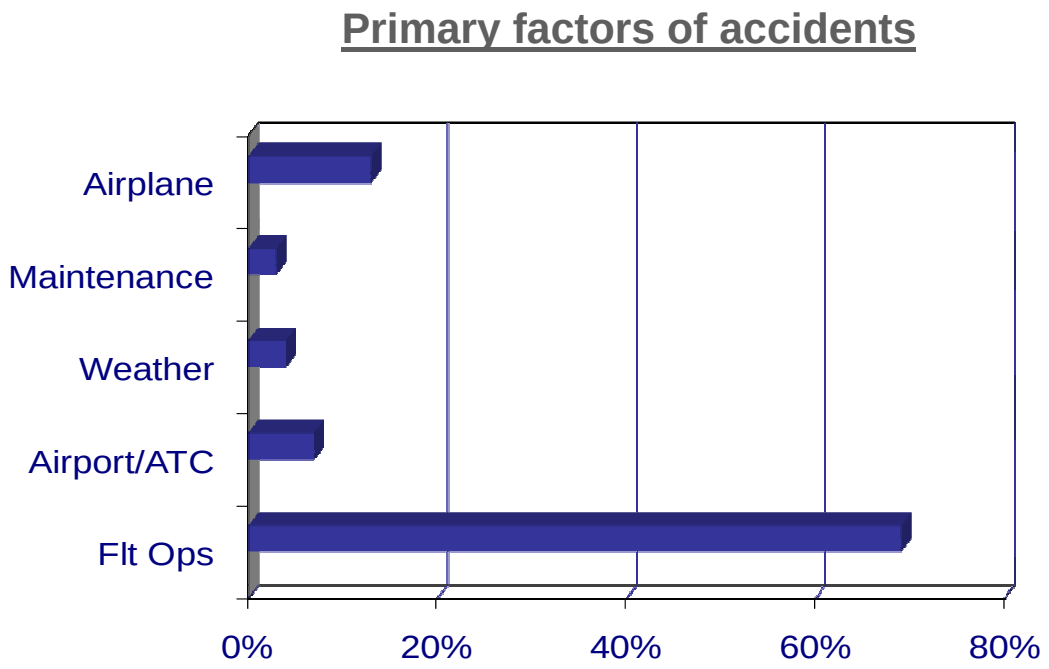


Major risks (67% of total):

- **Runway excursion**
- **CFIT**

Accidents – Operational causes

- It is generally agreed that the primary factors of accident are human performance related in a very large proportion.
  - About 85 % involve human performance issue



Accidents – Fatal rate by area

- Fatal accident rate per million flight cycles for the last 20 years (based on operator's country)

• Australasia	0.00
• North America	0.16
• Europe	0.35
• Middle East	0.71
• Asia	0.76
• Latin America and Caribbean	1.09
• Africa	2.65
• World	0.47

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Lessons learnt from accident statistics

- Air Transport accidents are very rare events
  - 0.4 fatal accident per million departures – all a/c type included
  - 0.1 fatal accident per million departures – latest a/c generation

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Lessons learnt from accident statistics

- Technology implementation has allowed to significantly reduce the accident rate
  - Reduction of the accident rate by a factor of 3 when comparing the last 2 aircraft generations
  - Quicker maturity rate
  - Increased survivability

⇒ To continue investing on technology for safety benefit

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Lessons learnt from accident statistics

- Most of the accidents now involve a significant proportion of Human Performance related issues
  - Understanding the Human Performance is most probably the biggest challenge
- Whatever the level of technology, the cockpit crew remains at the center of the aircraft operations

⇒ To reinforce ab-initio and training

⇒ To integrate training aspects from design phase

⇒ To take benefit of new IT tools for training

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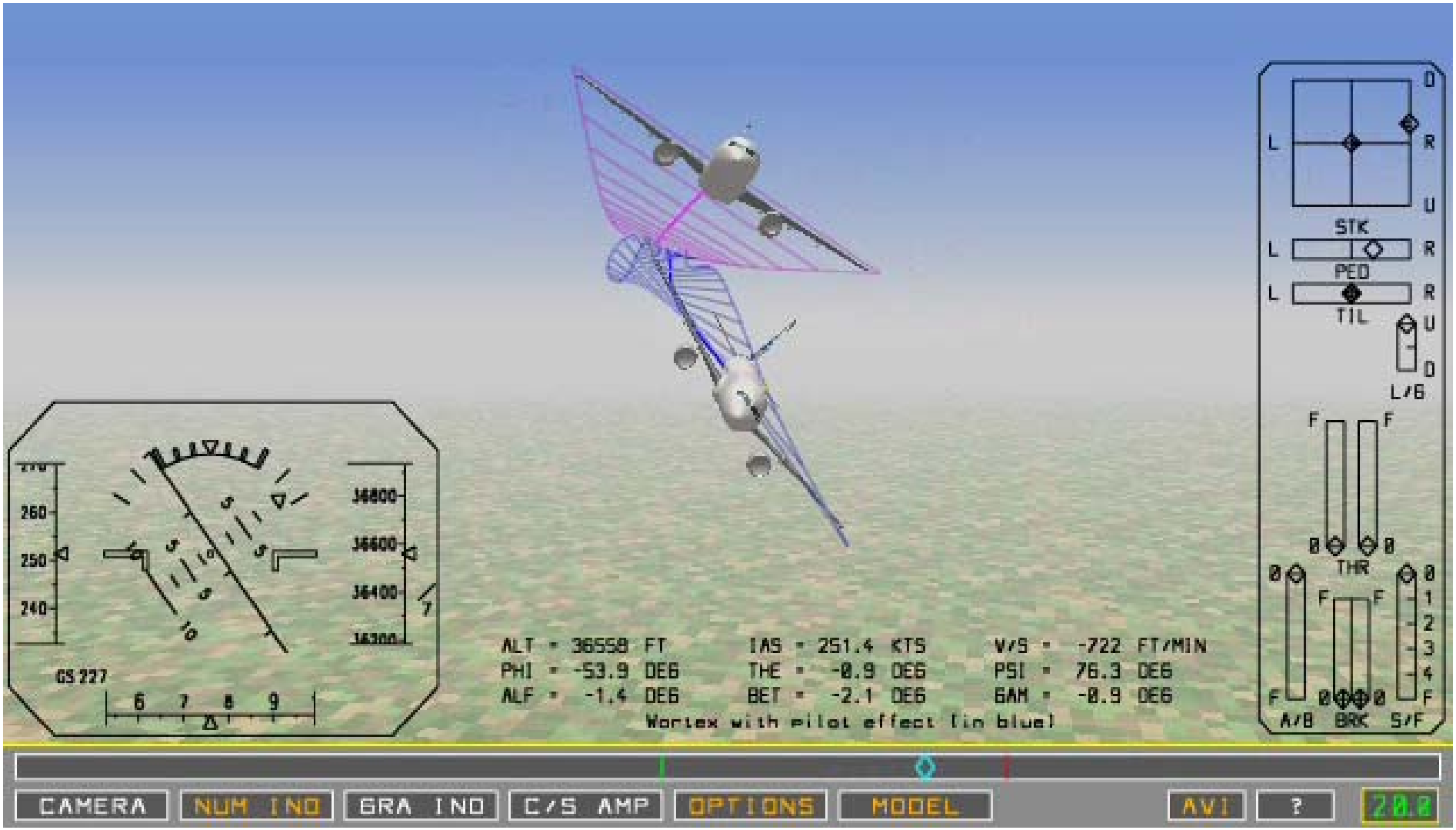
Video training



Lessons learnt from accident statistics

- CFIT – Controlled Flight Into Terrain

  - Significant improvements with
    - Improved navigation precision
    - latest TAWS (Terrain Avoidance Warning System)
  - Challenge to address « Loss of Situation Awareness »

⇒ Potential Technology benefits by increasing

⇒ the number of precision approaches (RNP/FLS)

⇒ the robustness of navigation performance & precision

to develop new safety nets such as Auto-Pull Up function

⇒ To reinforce training to detect « loss of situation awareness »

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Lessons learnt from accident statistics

- Runway Excursions
  - The current highest safety risk with the last 2 a/c generations
  - Known recurrent contributing factors
    - Energy management (too high, too fast, too long)
    - Economical pressure to avoid diverting
    - New airfield operations with challenging environments

⇒ Potential Technology benefits by

⇒ providing real time information regarding the stopping distance

⇒ assisting the crew in the « go-around » decision making process

⇒ To reinforce training addressing all known contributing factors

⇒ NPRM under review for new landing performance

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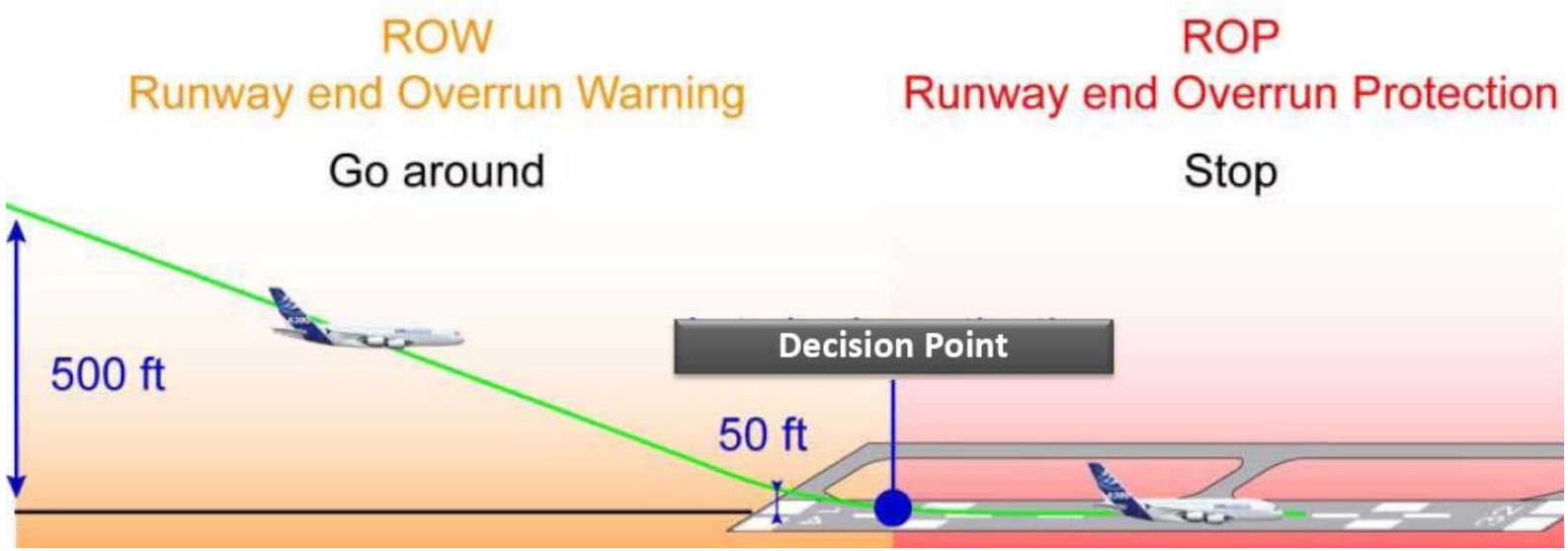
Lessons learnt: Runway excursion prevention

Runway end Overrun Prevention System (ROPS)

A Technology Contribution to Prevent Runway Excursion at Landing



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Threat evolution within the Air Transportation Industry

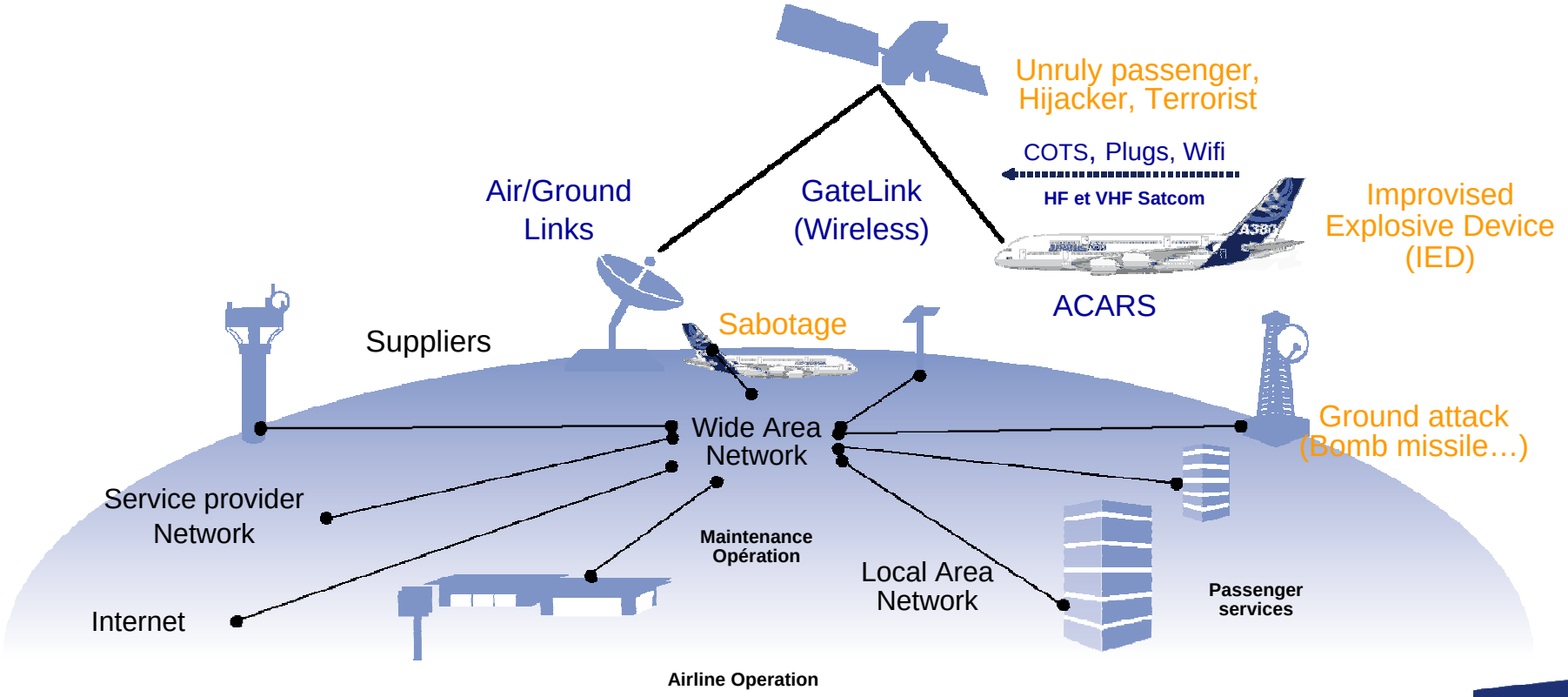
Aircraft security scope

Non exhaustive list

Physical threats

IT threats vectors

Overall Security depends on the weakest link of the Global Security Chain



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Some challenges

- Air Transport accidents are very rare events

- Technology opportunity has demonstrated its safety benefit
  - proven over more than 22 years of operations and 60 million flights and 140 million flight hours with more than 6000 aircraft from the latest aircraft generation

- Further decreasing the accident rate has became a significant challenge considering the already very low accident rate

⇒Any space for improvements has to be challenged in all fields

- Technology opportunity into the design
- Reinforcing ab-initio and training

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Some challenges

- Technology brings safety added value while increasing complexity

- Increased complexity may be a challenge to the human operator when faced to unexpected situation

⇒Technology must be thought together with training solution

⇒The future role of human operator

Some challenges

- Public & Political response to major events
  - Looking to RISK ZERO: the utopia
  - Major events are not accepted, even when hardly predictable
  - « Precaution Principle »

⇒Risk Management

  - To be implemented to all domains involved in any public transport system

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Some challenges

- Today environment is Global
  - Worldwide
  - Multi-partners

⇒Need to strengthen network amongst partners

- To increase responsiveness to properly manage risks
- To maintain independency

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WITH BAE SYSTEMS

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