Safety Track

Dres Zellweger

With:
Hartmut Fricke
Sandy Lozito
Lluis Vinagre Solans

Budapest - 2003

- Safety – only 4 papers out of 13 selected – does the community really appreciate safety?

- THAT HAS CHANGED!

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Safety Track Continues to Grow

- 2007 – 10 papers: 5 Europe, 3 Joint, 2 US
  - 24 papers submitted
- 2005 - 7 papers: 1 Europe, 1 Joint, 5 US
- 2003 – 4 papers - joint session with HF

- Note: other tracks had papers with safety component

Papers covered spectrum from new and extended methodology to use of existing methods for specific analyses

- Collision risk has switched from technical to operational.

- Past models for studying collision risk were inadequate to study operational risks.

- New methodology, using trajectory analysis was developed to estimate collision risk resulting from operational errors.

- Initial work focused on errors which result from deviations from predicted trajectory.

- Common safety analysis framework accepted by US and Europe for evaluation of ADS-B Case
- Methodology:
  - Operational Hazard Assessment
  - Analyzed these based on their operational effects
  - Allocated Safety Objectives & Requirements
- Study:
  - Enhanced Air-Traffic Services in Non-Radar Areas using ADS-B Surveillance (ADS-B-NRA)

- Runway Incursions (RI) continue to be no.1 risk on ground.

(MIT, 2005)
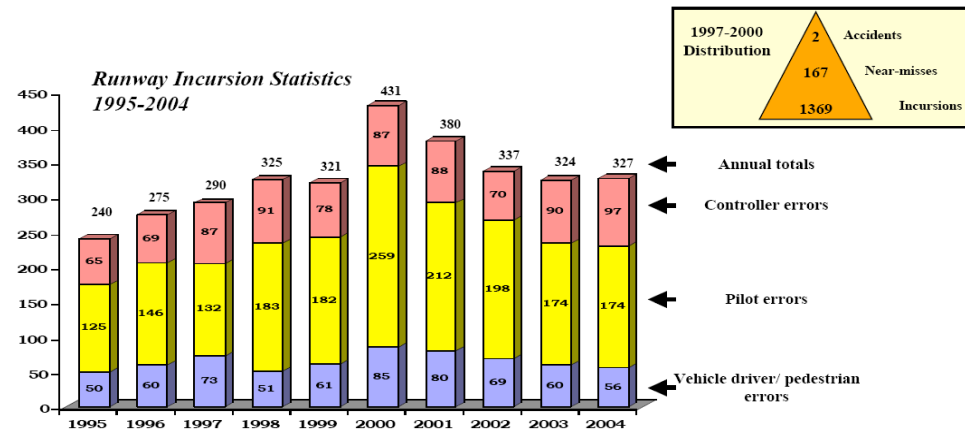
- A multi-agent model was used to study the combination of operator performance deviations, environmental conditions and (operational) barriers

- Operational Errors growing faster than traffic

- Analyzed the impact of URET on OEs
  - URET decreases both OE rates and their impact
    = safety benefits
  - Postulated reason - improved situational awareness and workload reduction

- This relationship between safety and capacity needs to be considered in future system development

TCAS Analyses (131/84)

- ## Study of Operational Errors when there are TCAS RAs

  - Controllers get incomplete information in over 40% of cases – can lead to contradictory clearances

  - Recommended more training and study of RA downlink

- ## RA Downlink Simulation (FARADS)

  - No contradictory clearances with RA downlink

  - No evidence for "cognitive tunnelling" as a consequence of RA downlink

  - General acceptance of RA downlink by participants

- Description and testing of 3D collision risk model for analyzing en route risks under high traffic volumes (63)
  - New method based upon track segmentation
  - Useful for analyzing "proximate" events
- Initial results of modeling and simulation of airborne time-based spacing using TOPAZ methodology (137)
  - Identified relevant agents (including humans), modeled these using Petri Nets, and specified connections between Petri Nets of different agents
  - Ran a Monte Carlo simulation to estimate probabilities of aircraft separation loss
  - A number of interesting results – appropriate spacing, interaction with ASAS etc etc

New Approaches (41/167)

- Demonstration of a new framework for safety assessment
  - Focus on RELIABILITY misses SAFETY question
  - How safe is system when operating to specification?
  - How safe is it when there are failures?
  - Approach is more comprehensive – addresses functional and performance issues relating to the Concept, not just reliability issues
- Development of an Integrated Risk Picture (IRP) to assess gate-to-gate operations
  - IRP looks at complete ATM system, not just at parts
  - Description of baseline risk picture for 2005 and predictive risk picture for 2012
  - Will be used for assessing safety of SESAR transition steps

Some Conclusions

- Many papers were joint effort of multiple organizations, especially in Europe
- ?? Greater recognition of safety in ATM research in Europe than US??
- Broader thinking in looking at safety
- Becoming more of a science
  - In approach to problem
  - In building on state of the art
  - Noticeable difference between content at Santa Fe (2001) and this week (2007)
  - Benchmarking/safety indicators still an issue
  - Need faster/cheaper certification
  - Need to make safety integral to ATM research

More Conclusions

- Most of papers addressed problems of TODAY
- BUT researchers are starting to think about longer term (SESAR/NextGen)
- Traditional approaches (Operational Hazard Analysis, safety requirement definition, fault tree analysis …)
  - Now usually include humans
  - Work fine for small, incremental changes (ADS-B study) BUT limited applicability for paradigm shifts
- Recognize need for:
  - System level risk picture
  - Studying interaction of components of complex system
  - Agent based approaches capture interactions, BUT
    these depend on validated human performance models
- No good solution for capturing EMERGENT system behavior

THANKS TO ALL PARTICPANTS IN SAFETY TRACKS!