PRELIMINARY RESULTS FROM A EUROPEAN SAFETY R&D PROGRAM

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Overview

- Safety Needs
- 7 Safety R&D ‘threads’
  - Interim Results
  - Interim Conclusions
Safety Needs

- Recent accidents involving ATM
- Increasing traffic (capacity)
- Advanced systems (2012; 2017; 2025)
- *Keep ATM safe*
- *Anticipate & Resolve Problems*
- *Learn before accidents occur*
1. Safety Learning & Early Warning

- Interpretation of incident causes in context of new concept
- Example – CORA – Conflict advisor
- 36 relevant incidents; 6 ‘lessons’:
  - Detrimental quality of Information
  - Misjudgement by controller
  - Over-reliance on technology
  - Sector boundaries
  - Sequence of conflicts
  - Military conflicts
- Added benefits of CORA-D/ L
- CORA Concept adapted to make it more robust
2. Safety Methods (Toolbox) [Enabler]

Toolbox of 30+ methods (FAA + Eurocontrol + ANSPs):

- Hazard and human error identification
- Representation in fault and event trees
- Quantification of events & human errors; evidence from incidents/simulations
- Analysis of dependence and common mode failures
- Evaluation of uncertainty, sensitivity, and risk impact
- Determination of safety requirements
- Documentation for re-usability
3. Safety in Design

50% of accidents have their roots in the design phase

- EEC has a safety policy, and safety plans for sector tools, traffic flow, and airport research areas
- Safety activities are ongoing for each project in these areas
- Integrative project for 2012
4. Key Risk Areas

Level busts

- Climbing FL 140 Green one

- At eight miles FL 140 Red one

- Descending FL 150 Red one

- Red one traffic at eight miles, level 140

- Red one, descend FL 150

- Green one, climb FL 140
SMART: modelling the Level Bust ‘Safety Architecture’: Hard & Soft Barriers

- Emergency avoidance of imminent collision
- Short term Conflict, detected and solved by ATC
- Deviations recovered by ATC
- Separation assurance by airspace design
- Separation assurance by tactical control
- Deviation from the assigned flight path

Generic Initiator
Prevention
Recovery

Generic Initiator
Prevention
Recovery

Accident

Emergency avoidance of imminent collision
Short term Conflict, detected and solved by ATC
Deviation recovered by ATC
Separation assurance by airspace design
Separation assurance by tactical control
Deviation from the assigned flight path
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<td>106: Pilots report their FL/ALT</td>
<td>0 0 0 0</td>
<td>141: Next sector ATCOs detect and c</td>
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<td>107: Next sector ATCOs check report</td>
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<td>111: Proper inputs are made to syst</td>
<td>0 0 0 0</td>
<td>146: The ATCO in control becomes aw</td>
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<td>112: The A/C has a unique call sign</td>
<td>0 0 0 0</td>
<td>147: TCAS switched on and fully ope</td>
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<td>113: The crew correctly picks up th</td>
<td>0 0 0 0</td>
<td>148: At least mode C transmitting p</td>
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<td>114: The crew doesn’t identify its</td>
<td>0 0 0 0</td>
<td>149: Situation within the design</td>
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<td>115: The ATCO in contact with the A</td>
<td>0 0 0 0</td>
<td>150: Visibility allows for conflict</td>
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<td>116: The ATCO in contact with the A</td>
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<td>151: Pilots scan for conflicting tr</td>
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<td>117: The ATCO in contact with the A</td>
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<td>118: The ATCO in contact with the A</td>
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<td>153: Conflicting A/C is visible (l</td>
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<td>119: Another party detects a vertic</td>
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<td>154: The ATCO in control detects (u</td>
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<td>120: Another party detects a latera</td>
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<td>155: The ATCO in control recognizes</td>
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<td>121: Another party detects a longt</td>
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<td>156: ATC detects the risk of inimin</td>
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<td>122: Another party detects a time d</td>
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<td>157: The ATCO in control recognizes</td>
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<td>123: ATCOs are aware of the traffi</td>
<td>0 0 0 0</td>
<td>158: Situation within TCAS specific</td>
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<td>124: ATCOs generate an appropriate</td>
<td>0 0 0 0</td>
<td>159: TCAS algorithm is able to pred</td>
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<td>125: The ATCO in contact with the d</td>
<td>0 0 0 0</td>
<td>160: TCAS works as per design (cons</td>
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<tr>
<td>126: Another party makes a relevant</td>
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<td>161: TCAS works as per design (cons</td>
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<td>127: In the situation, ATCOS corre</td>
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<td>162: In the case of a recognition b</td>
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<td>128: ATCOs articulate the instruct</td>
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<td>163: In the case of both TCAS on an</td>
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<td>129: Transmission medium is clear a</td>
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<td>164: In the case of a recognition o</td>
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<td>130: The shared ATM phraseology use</td>
<td>0 0 0 0</td>
<td>165: All flight crews share the sam</td>
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<td>131: The crew/airport system propo</td>
<td>0 0 0 0</td>
<td>166: The contents of the priority t</td>
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<td>132: Crews have sufficient resource</td>
<td>0 0 0 0</td>
<td>167: In the case of TCAS RA(s), the</td>
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<td>133: A correct perception of verbal</td>
<td>0 0 0 0</td>
<td>168: The crews involved know the pr</td>
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<td>134: The incorrect understanding by</td>
<td>0 0 0 0</td>
<td>169: The instructions coming from t</td>
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<td>135: An incorrect understanding by</td>
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<td>170: ATCOs correctly use a ‘standa</td>
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<td>136: At least one pilot actually u</td>
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<td>171: Standard ICAO phraseology is s</td>
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<td>137: If in doubt, pilots cross chec</td>
<td>0 0 0 0</td>
<td>172: ATCOs correctly use national A</td>
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<td>138: Pilots detect and correct erro</td>
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<td>173: National ATS provider phraseol</td>
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<td>139: Pilots report their FL/ALT (an</td>
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<td>174: The speed and pace of the ATCO</td>
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<td>140: Next sector ATCOs check report</td>
<td>0 0 0 0</td>
<td>175: The number of instructions inc</td>
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Impact of SMART analysis

- Shows where safety is and is not working
- Helps identify new barriers
- Resource intensive
- Being applied to level busts & interactions between safety nets
- Safety nets work: - SMART analysis is helping understand the pro’s and con’s of downlinking to the controller the fact that a TCAS resolution advisory (RA) has occurred in the cockpit
5. Integrated Risk Picture & the Safety Roadmap

- Strategic Airspace, flow, and capacity management
- Pre-tactical demand and capacity balancing
- Tactical flow and capacity management
- Pre-departure phase
- Departure
- Taxiing
- En-route
- Arrival
- Arrival Taxiing
- Post flight phase

A year  A week  A day  Day of Operation

Time

CFIT  Runway collision  Mid air  Wake  Taxi
Types of insight

Failure to recognize loss of separation
- Direct cause of 1.3% of all accidents; 50% of mid-air collisions

Support to controllers to reduce distractions

Support to better detect potential conflict in the medium term

Civil-military interactions

Causes of Tactical Conflicts

- M5.1.2 Ineffective strategic conflict prevention; 40%
- M5.2.1 Conflict due to penetration of controlled airspace; 30%
- M5.2.2 Conflict in uncontrolled airspace; 10%
- M5.2.3 Conflict due to ATC induced deviation from route; 10%
- M5.2.4 Conflict due to pilot induced deviation from route; 10%
6. Safety Culture & the Future

- Survey of 4 ATCCs
- Main concerns
  - **Teamwork**
  - **Communications**
  - **Trust in equipment**
  - **Understanding each other’s roles**
  - **Responsibility for safety**
- Past changes have not had as much impact as expected
7. Collaboration: working together

- FAA-Eurocontrol Action Plan on Safety (AP 15)
- Eurocontrol Safety Team (European Air Navigation Service Providers)
- CAATS European Workshop on Safety R&D October 2005
- Seeking European Commission funding to support a Network of Excellence on Safety R&D
Interim Conclusions

- Need safety learning: early warning and learning from incidents
- Safety methods exist – need more application
- Safety in design/concept stage – progress being made
- Key risk areas – needs new (SMART-er?) thinking
- Delivering future safety –
  - where do we get most return on safety investment?
  - what extra tools, training and procedures will keep us safe?
  - need to monitor safety to see if it is improving fast enough
- Future safety culture – need to measure baseline now, and measure & understand impacts of coming changes
- Collaboration is needed
Thanks for your attention: Questions?
Guiding Principles

- ATM must become a learning organisation
- ATM must have suitable methods with which to anticipate and protect itself against risks
- Safety must be built in at the early stages of ATM system design, right through to implementation
- ATM must improve safety in key risk areas
- ATM must be sure that the systems it is developing will deliver the required safety levels
- ATM must retain its ‘High Reliability’ status and its ‘safe culture’
- The above collaboration should be achieved effectively and cost-efficiently
Some observations…

- Medium Term Safety Nets – too much reliance on last-minute defences
- Human factors importance – but this must be focused with safety
- Safety in degraded mode operations
- Safety culture – tolerating poor conditions or excessive workload/demands
- As complexity increases, second order phenomena begin to dominate
- We need a roadmap and a monitoring process
- We should increase capacity when it is safe to do so – this would be the policy of an industry that puts safety first
- There is a general shortage of qualified safety people in the industry – the industry as a whole is lacking in safety competence & understanding
- Are we really safe? Or just lucky?
Other Key Risk Areas: safety net interactions; low vigilance; complexity; runway incursions

- Not knowing the traffic situation
- Attention - I notice I’m just not focussed anymore and more complacent
- Surprised by call - Don’t understand a/c R/T
- Spot conflict only 1-6 minutes before
- Missing calls, have to ask a/c to repeat call;
- Less precise & small mistakes
- Not knowing a/c on frequency; looking for traffic that calls in
- Less pre-planning
- Work slower
- Fatigue
- Getting behind in work
- Not looking at the screen
- Easily distracted
- Getting behind in work
- Not looking at the screen
- Easily distracted

Less precise & small mistakes