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Pilots as a Resource for System Resilience

Cpt Max Scheck

European Cockpit Association (ECA)

“The representative voice of Europe’s airline pilots towards the EU institutions“

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Our mission

ECA represents the **collective interests** of its Member Associations at European level, striving for the highest levels of **aviation safety** and **fostering social rights** and **quality employment** for pilots in Europe.

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7	11	3
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Overview

1. Motivation
2. ECA Survey *"Pilots as Resource for System Resilience"*
3. Analysis so far
4. Involvement in-/Cooperation with other Organizations
5. Next Steps

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Why this survey?

- **Safety II**
  - **Added focus on "things that go right"**

- **Resilience** ***"ability of systems to anticipate and adapt to the potential for surprise and failure"***
  (Hollnagel, Woods, Leveson – 2006)

- **Resilience Engineering** ***"a paradigm for safety management that focuses on how to help people cope with complexity under pressure to achieve success"*** (Hollnagel et al. – 2006)

Why this survey?

- **Flight Safety Foundation Webinar (2020) & Whitepaper (2021)** ***"Learning from all Operations"***
- **Presentations**
  - **E. Hollnagel** ***"Is Safety Really Enough?"***
  - **J. Holbrook** ***"How Safety Thinking Impacts Safety Learning: Creating Opportunities to Learn"***

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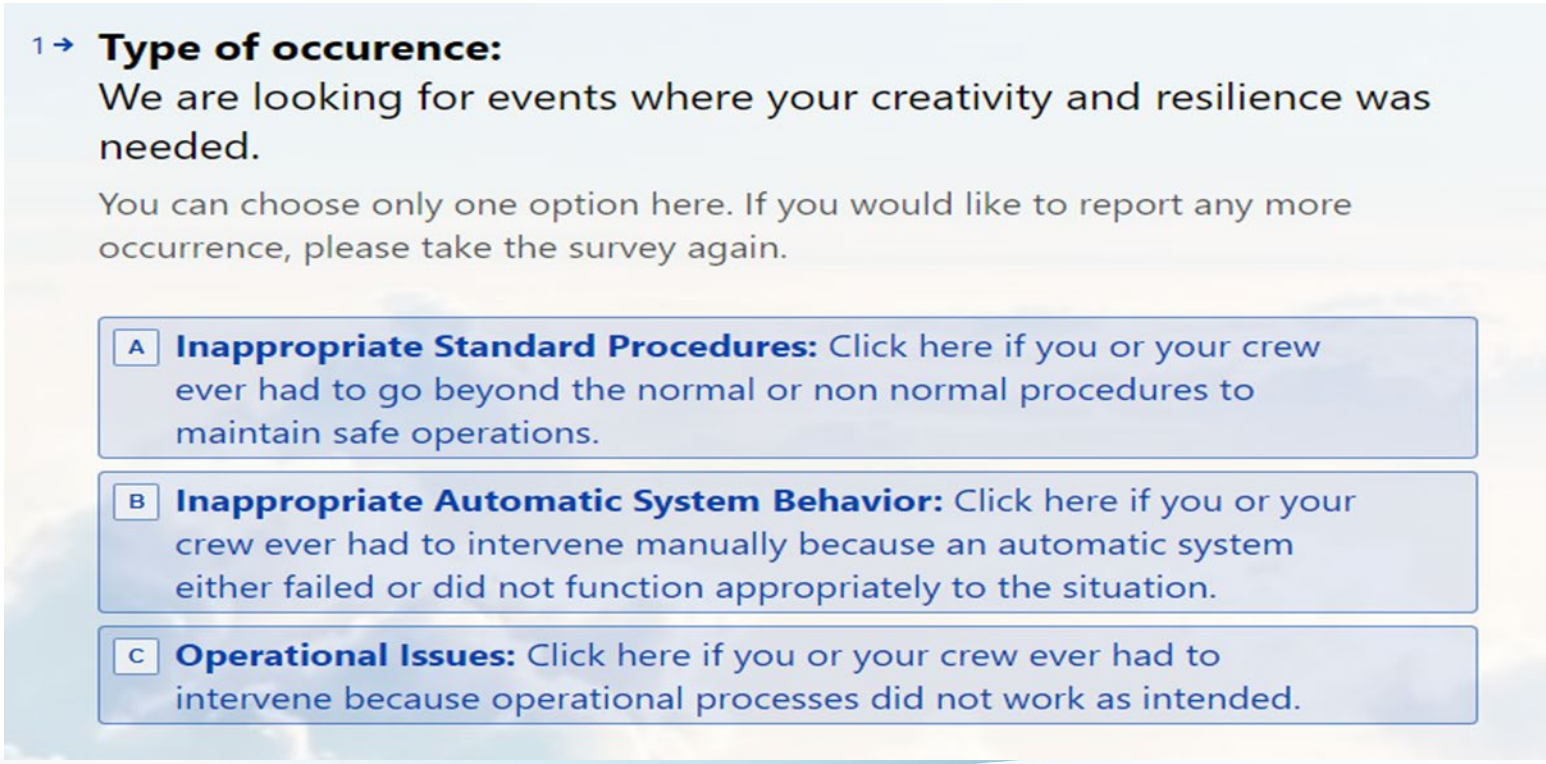
Survey “Pilots as Resource for System Resilience“

- Survey “Pilots as Resource for System Resilience” (2021)
- Goal: why, when, how pilot actions contribute to the day-to-day success in commercial air transport operations
- Help to determine potential “core-areas of interest”

Survey “Pilots as Resource for System Resilience“

Survey Team Members:

Cpts Damiano De Tomassi, Maria Murtha, Michael Petry, Rudy Pont, Max Scheck, SFOs Niklas Ahrens, Veronica Schömer, and Johannes Bade, LL.M.



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Survey „Pilots as Resource for System Resilience“

- Some survey Limitations
  - Open questions, resulting responses varied significantly

⇒ focus more on qualitative, rather than quantitative analysis

ECA Survey Quantitative Results

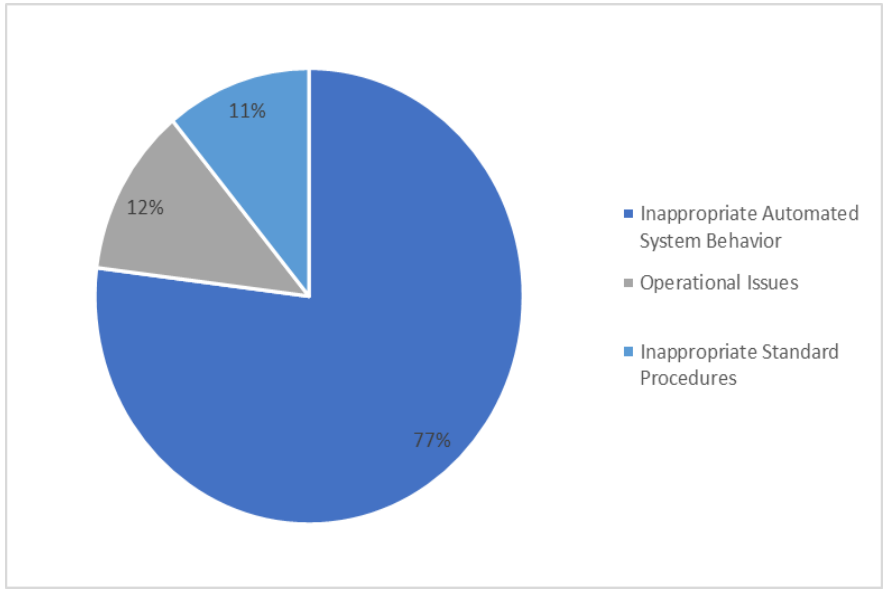
Quantitative Analysis:

Total responses: 1611
Usable reports: 1428

77% referred to Inappropriate Automated System Behavior

12% Operational Issues

11% Inappropriate Standard Procedures



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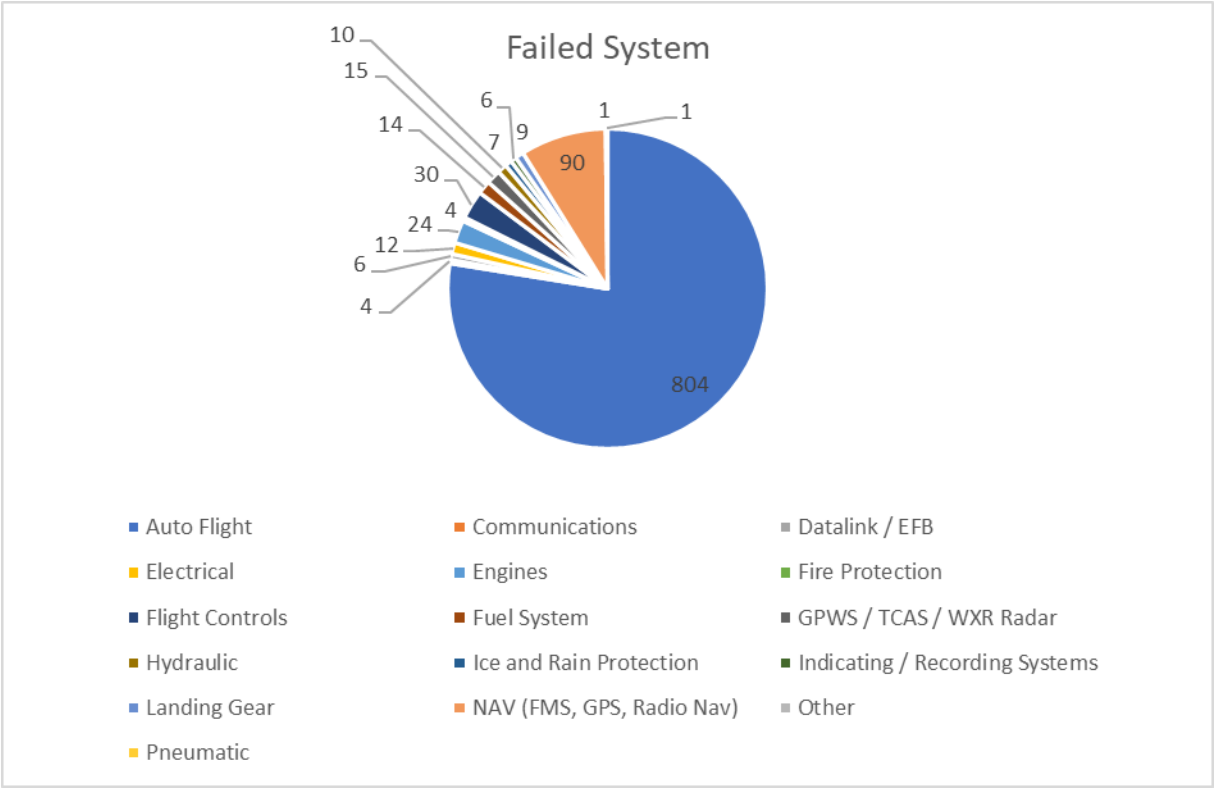
Inappropriate Automatic System Behavior

1037 of the 1095 reports relating to Automated System Behavior referred to a particular system, with:

- **Auto-Flight Systems by far the most often reported (804 ≙ 78%)**
- **followed by Navigation Systems (90 reports ≙ 9%)**



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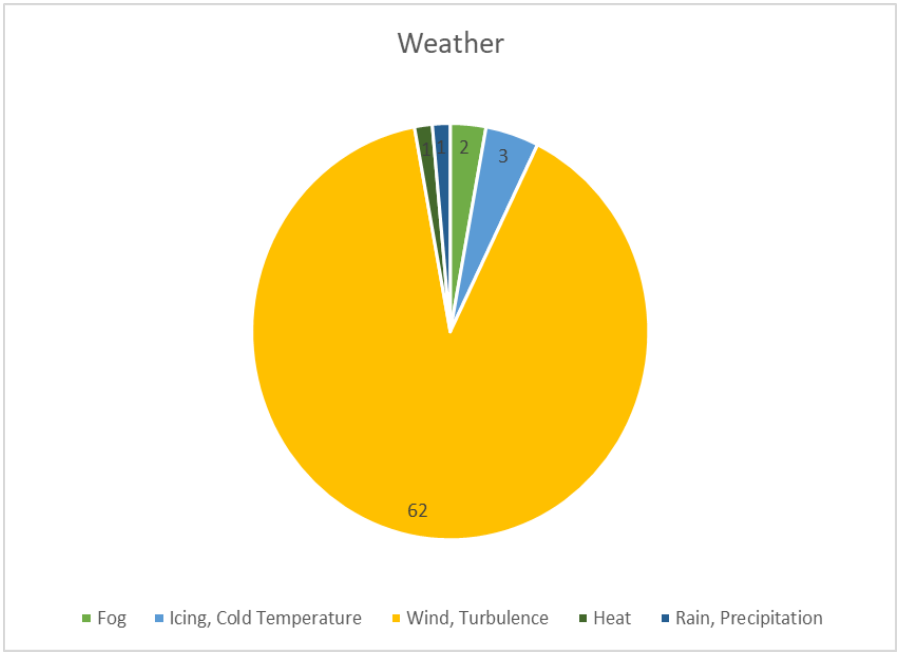
Inappropriate Automatic System Behavior

Of the 1095 reports relating to Automated System Behavior 69 (≙ 6%) included "Weather Elements" at the time of the event

- **vast majority (62 ≙ 90%) referred to wind/ turbulence**



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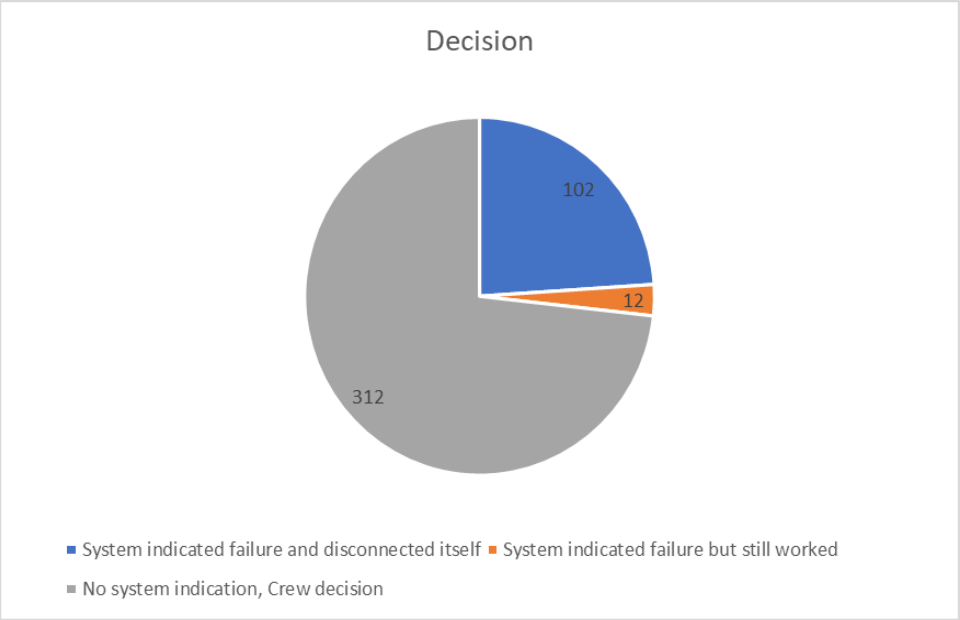
Inappropriate Automatic System Behavior

In 73% of reports relating to disconnection of an automated system (total 426 reports), the crew decided to disconnect the system while there were no direct indications by the respective system



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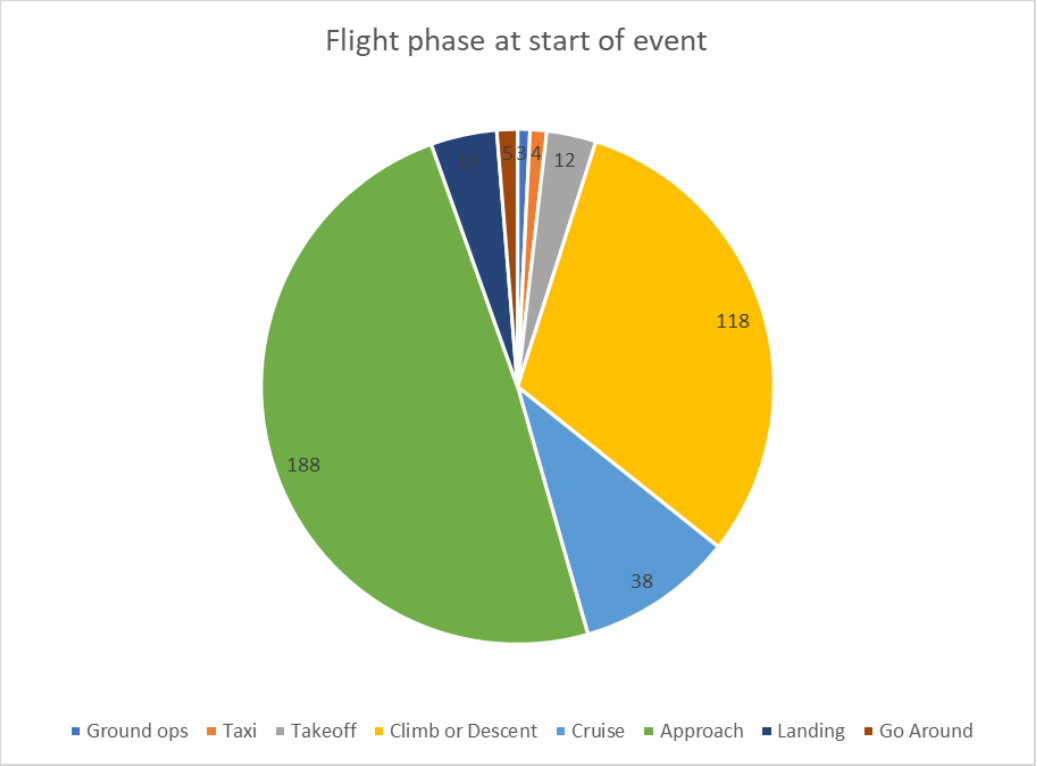
Inappropriate Automatic System Behavior

Combination of Flight Phase at Start of Event (if included in the report) were reported predominantly for "Approach" and "Climb/Descent" (188 and 118 respectively).

However, 38 reports (≙ 10%) referred to the cruise phase of the flight.



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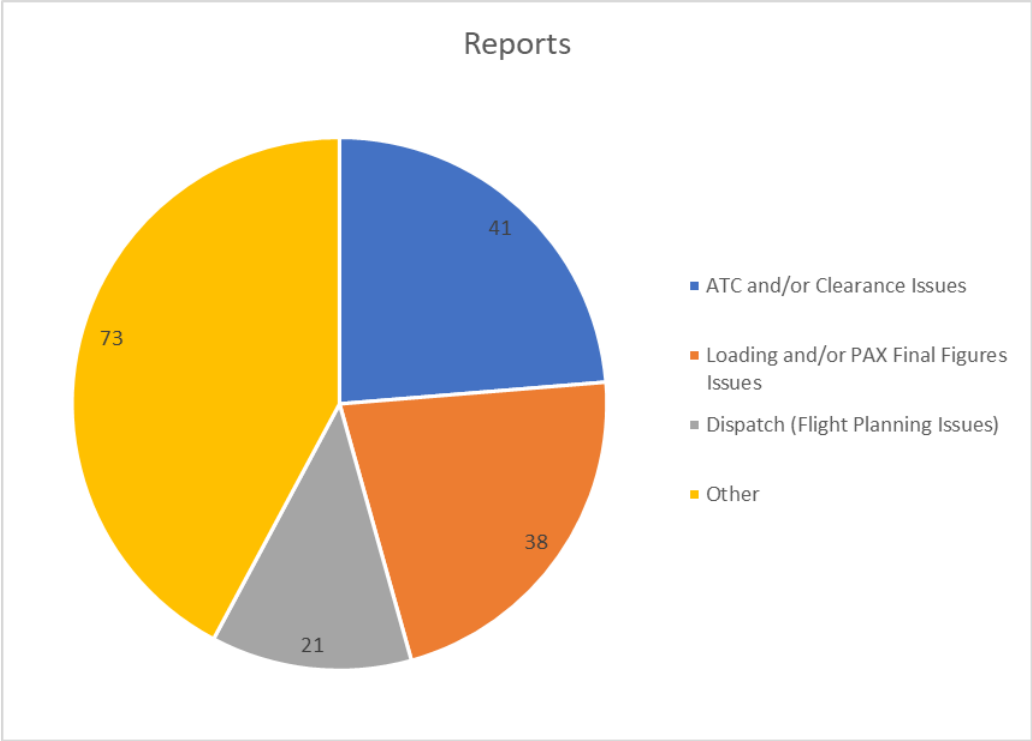
ECA Survey Quantitative Results Operational Issues

Total 173 reports relating to Operational Issues:

- 24% refer to ATC and/or clearance issues
- 22% refer to loading and/or PAX final figures issues
- 12% refer to dispatch (flight planning) issues
- 42% refer to Other issues



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Operational Issues

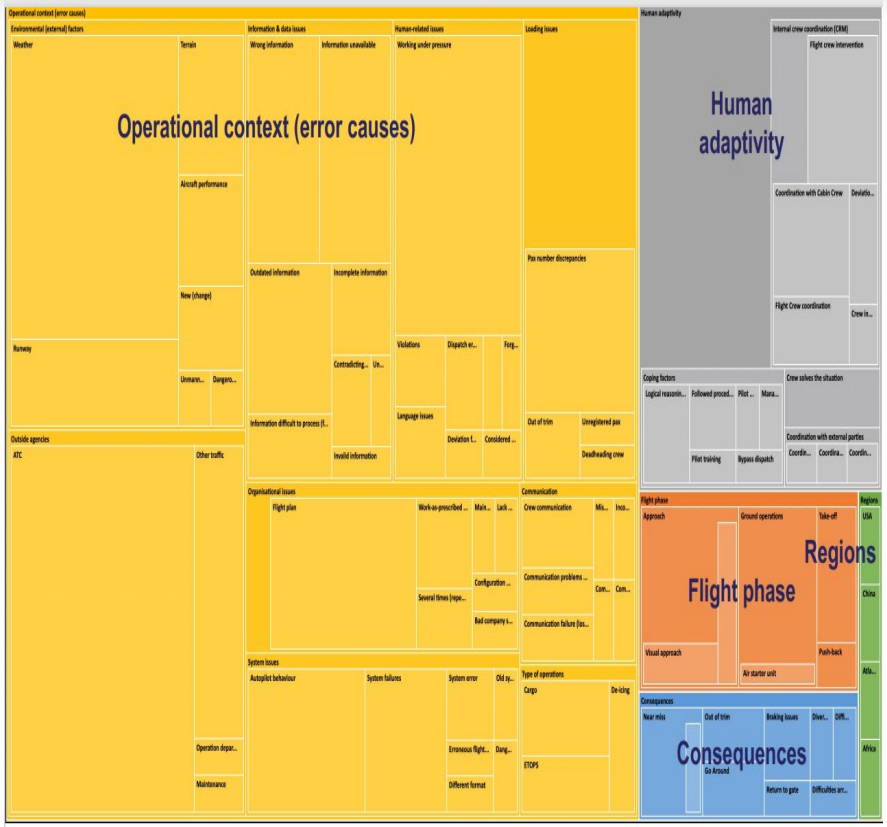
- Overall number of reports on Standard Procedures relatively small, thus the team considered any quantitative analysis to be of limited use
- Instead: qualitative analysis using ‘Grounded theory’
  - By means of induction, the text from the narrative reports would be used as the basis to formulate a theory
  - There are three steps involved in this process:
    (1) - Open coding (labeling)
    (2) - Axial coding (aggregating labels - classification)
    (3) - Selective coding (theory building - abstraction)

ECA Survey Qualitative Analysis
Operational Issues

A "demonstration-run" was conducted and resulted in an initial set of 345 sample codes for step one (Open Coding). These were then combined (aggregated) into the following five categories:

- Consequences
- Flight phase
- Human adaptivity (Safety-II)
- Operational context (Safety-I)
- Regions

Three members of the survey team are currently completing the EUROCONTROL Weak Signals Course



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Involvement & cooperation with other organizations

- **ICAO Personnel Training and Licensing Panel**
  - Automation Dependency Subgroup
  - Competency-Based Training and Assessment Subgroup
  - Flight Simulation Training Devices Subgroup
- **EASA**
  - Various Expert Panels/Stakeholder Advisory Boards
  - Rule Making Tasks (RMTs)
    - e.g., RMT230 (*Regulatory framework to accommodate unmanned aircraft systems in the European aviation system*)
- **Other Organizations**
  - DLR, NLR, EUROCONTROL

Involvement & cooperation with other organizations

- **Flight Safety Departments of Operators**

- **Academia**
  - **ESMT Berlin**
  - **TU Berlin**
  - **University of Frankfurt**
  - **La Sapienza University Rome (cooperation with EUROCONTROL “Weak Signals Project”)**

Next Steps

- Intensify qualitative analysis
  - Participation in EUROCONTROL Weak Signals Course
    - Conduct interviews
    - Qualitative analysis using Grounded Theory
  - Continue exchange with academia and other organizations
- Seek cooperation with EASA's Data4Safety (potentially also with FAA's ASIAS)
  - Run data-queries to see if operational data confirms results of survey
- Liaise with Flight Safety Departments of Operators to cross-feed information and exchange ideas
- Perhaps conduct follow-up survey(s)

Next Steps

Potential questions resulting from the quantitative and qualitative analyses so far:

(1) How do you gain enough data to adequately capture the operational environment?

a. What data is/should be looked at?

(2) How do crews make the decision to override/ switch-off the automation?

a. Is this decision-making process adequately captured/reflected in the current training curricula?

Next Steps

Potential questions cont'd:

(3) What are the reasons that current aircraft mostly use pilots as primary backup measures for insufficient automated system-behavior?

- **a. Cost?**
- **b. Technical feasibility?**

(4) How is the influence of wind and turbulence modelled within the design process of autopilot filters?

Pilots as a Resource for System Resilience

Thank You!

max.scheck@vcockpit.de

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