



AVIATION SAFETY & CERTIFICATION OF NEW OPERATIONS AND SYSTEMS

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This presentation

- Background
- Project objectives
- Phases and work packages
- Intermediate results/outcomes
- Conclusions & recommendations



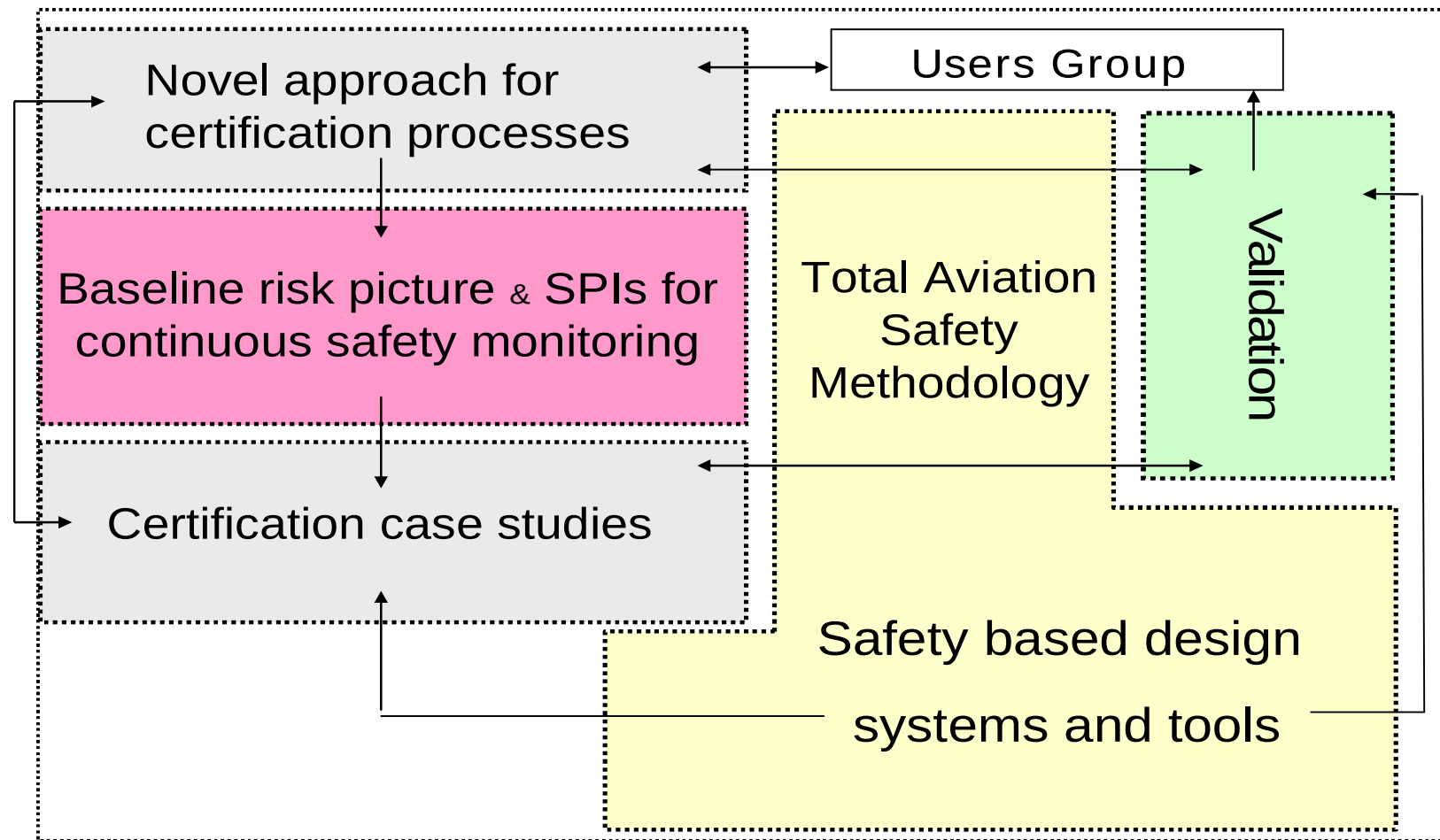
Background

- Many innovative technologies and operational concepts are not implemented due to issues arising with safety and certification
- Many operators and users are eager to use new developments
- To ease introduction of safety enhancement systems & operations, an innovative approach towards certification is required that:
 - Is more flexible with regard to the introduction of new products and operations;
 - Is more efficient, in terms of cost, time & safety, than current certification processes;
 - Considers safety impact of all aviation system elements and the entire system life-cycle in a complete integrated way.

Project objectives

- *To develop certification process adaptations, with supporting tools for safety based design and safety monitoring, so as to ease the introduction and certification of safety enhancements*
- To achieve this, six measureable and verifiable objectives are defined:
 1. To analyse the existing European certification and rulemaking process and propose potential adaptations to ease certification of safety enhancement systems & operations;
 2. To develop a methodology and supporting tools for multi-stakeholder Continuous Safety Monitoring, using a baseline risk picture for all the parts of the total aviation system;
 3. To develop a total aviation system safety assessment method and supporting tools that can be used for safety based design of new systems, products and/or operations;
 4. To apply proposed certification process adaptations and the design systems and tools in case studies, so as to show how they can be used by operators and manufacturers.
 5. To validate key results: a) new certification approach, b) method and tools for Continuous Safety Monitoring, and c) all the supporting safety based design systems and tools.
 6. To inform air transport stakeholders on the proposed certification approach through promotion workshops, supported by exercises and an e-learning web-site environment.

Relation between the objectives (and WPs)



Phase 1

- Analyze existing European certification & rulemaking process and identify potential shortcomings and bottlenecks in view of foreseen regulatory changes & technology developments
- Define and evaluate innovative approaches to certification
- Further develop proposed certification process adaptations

WP1 Option(s) of an adaptation of regulatory/ certification process

- 1 Integrate all domains within the Authority / total concentration of expertise in Authority
- 2 Change to “Performance based” i.l.o. “Compliance based”, or the other way around
- 3 Abolish all certification by Authorities and transform into a voluntary compliance with a certain safety level
- 4 Make more use of competent (certified) entities to supplement workforce of authorities
- 5 Certify applicants instead of their products
- 6 Use of Proof of Concept approach
- 7 Do not change anything but enforce existing rules / improve existing processes
- 8 Cross-domain fertilisation



Address the shortcomings & bottlenecks per domain from process & stakeholders aspects

WP1 Proposed certification approach: staged application



Outline Proposed Certification Approach

A. Simpson (Ebenei), S. Bull (Ebenei), T. Longhurst (CAA)



This document explains how a logical argument approach can be applied to unify existing certification approaches from across the aviation industry and to provide a flexible means to achieve certification for new concepts and technologies.

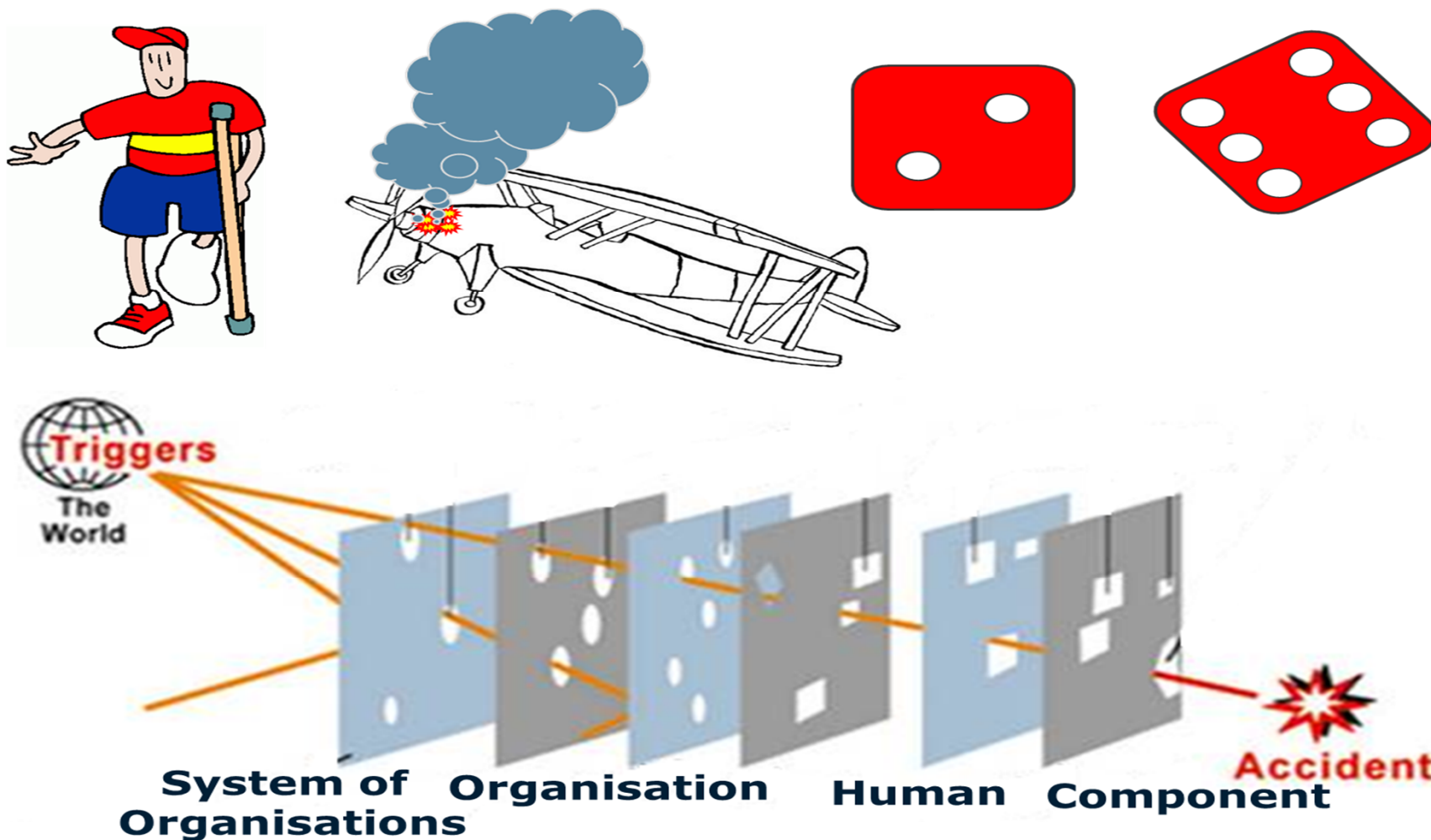
→ The ASCOS approach is to propose use of a **logical argument** for the certification of any changes to the Total Aviation System (TAS), and support the top level claim that the change is acceptably safe

1. Define the change
2. Define the certification argument
3. Develop/agree certification plan
4. Specification
5. Design
6. Refinement of argument
7. Implementation
8. Transfer into operation – transition safety assessment
9. Define arrangements for continuous safety monitoring
10. Obtain initial operational certification
11. Ongoing monitoring and maintenance of certification

Phase 2

- Set up a baseline for the current risk level of the various parts of the total aviation system during its complete life cycle.
- Aviation safety data will be used to establish a baseline risk picture for main operational issues identified in the European Aviation Safety Plan (EASp) with Safety Performance Indicators
- This risk picture will be used as baseline to set up a process (and develop tools) for continuous safety monitoring

WP2 Framework Safety Performance Indicators (SPIs)



WP2 Baseline risk picture for total aviation system

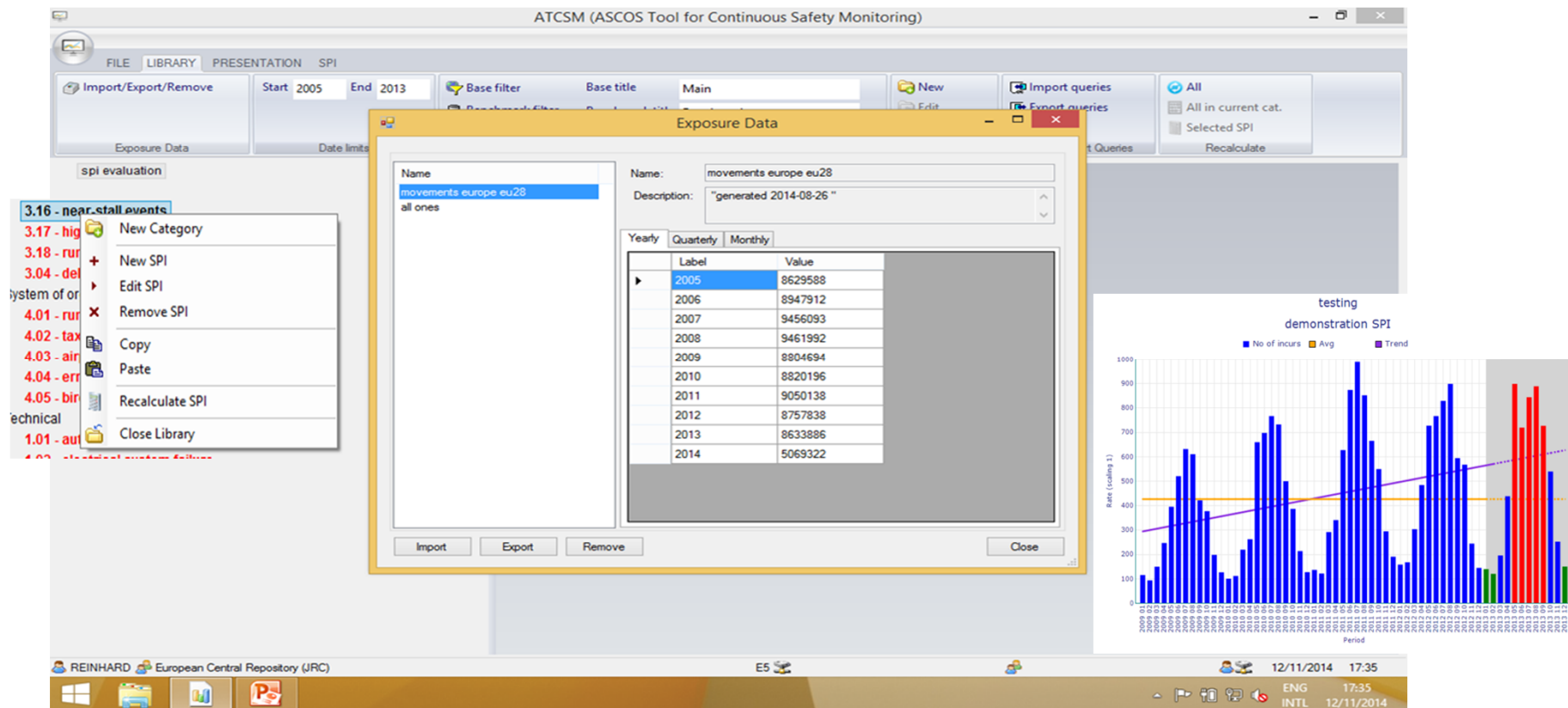
Quantification of key operational issues identified in the EASp using the NLR Air Safety Database (which uses ECCAIRS to manage safety data) and an improved Causal model for Air Transport Safety (CATS).

Data	Criteria
Time interval	Between 1-1-1995 to 31-12-2011
Occurrence class	Accidents and Serious incidents
Operation type	Scheduled revenue ops, Non-scheduled revenue ops
Aircraft category	Fixed wing
Aircraft mass group	> 5,701 kg maximum take-off weight
Aircraft propulsion type	Turboprop, Turbofan, Turbojet
State or area of occurrence	Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom, Iceland, Liechtenstein, Norway, Switzerland.



Main operational issue	Accident frequency (derived in ASCOS baseline risk picture)	Estimated accident frequency for 2012 (in Eurocontrol IRP)
Mid-air collision	$3.67 \cdot 10^{-8}$	$3.1 \cdot 10^{-9}$
CFIT	$3.72 \cdot 10^{-8}$	$1.5 \cdot 10^{-8}$
Loss of control in flight	$4.13 \cdot 10^{-7}$	$9.3 \cdot 10^{-8}$
Ground collision	$1.17 \cdot 10^{-6}$	$6.4 \cdot 10^{-8}$

WP2 ASCOS Tool for Continuous Safety Monitoring (ATCSM)



Rolled out in October 2014 to EU CAA's, Safety Investigation Authorities, EASA, EC DG-MOVE, ICAO, EUROCONTROL,

WP2 Continuous Safety Monitoring



→ Tool will be available through:
eccairsportal.jrc.ec.europa.eu

WP2 Final Report Continuous Safety Monitoring

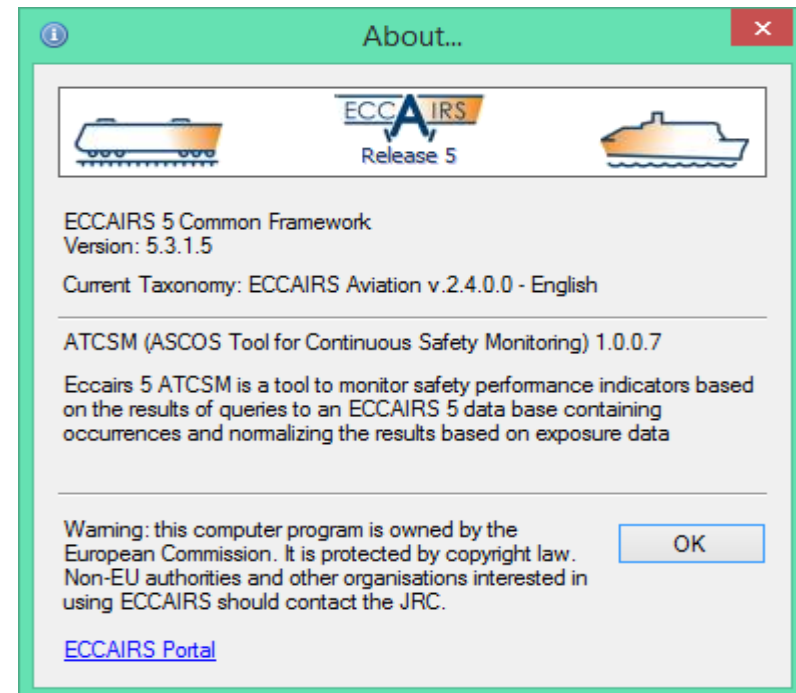
N. Aghdassi (Avanssa), A.L.C. Roelen (NLR), B. Dziugiel (ILOT) and R. Menzel (JRC)



The main purpose of ASCOS's Work Package 2 (WP2) "Continuous Safety Monitoring" is to develop a methodology and create supporting tools for multi-stakeholder continuous safety monitoring. This is achieved through 4 stages or sub-tasks which ultimately culminate in the development and implementation of tools in support of continuous safety monitoring. The final report provides an overview of the work and achievements within ASCOS WP2.

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→ Fine-tuning still possible, e.g. using ongoing validation in ASCOS WP5

Phase 3

- Establish a good view on potential emergent and future risks not present in today's aviation system
- Develop total aviation system safety assessment method with supporting safety based design systems and tools
- Proactive approach to ensure that potential future hazards and risks can be mitigated and safety will be maintained or even increased as compared to the baseline risk picture

WP3 ASCOS tool for risk assessment and methodology

→ Model and tool for risk assessment

- Management of the risk model
- Adaptations of the risk model
- Basic risk analyses
- Web-based



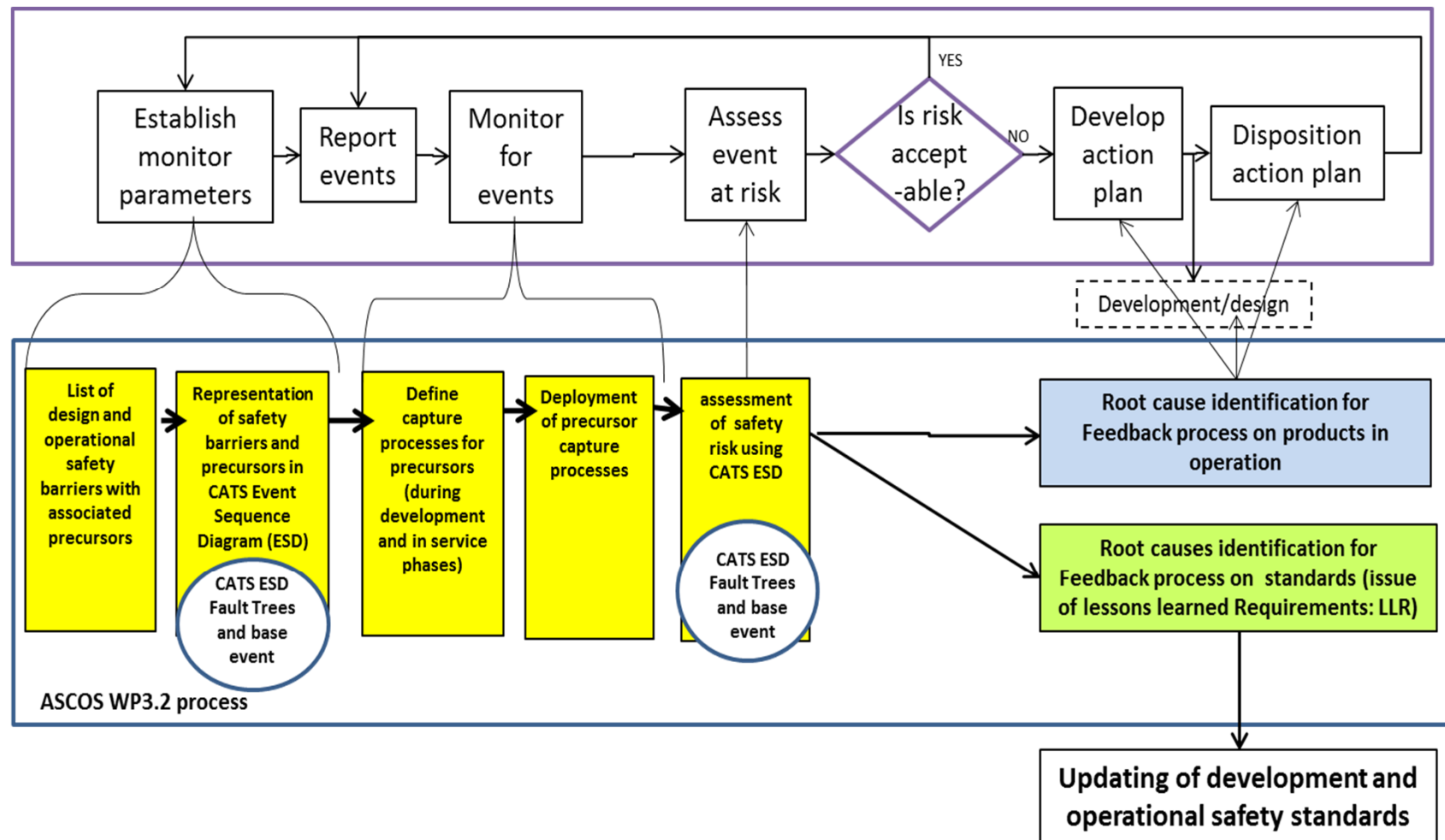
Prioritization methodology

1. Determine, for each of the AoCs, the target year of actual implementation (time frame)
2. Correlate AoCs with accident scenarios and the associated EASp operational issues
3. Correlate hazards, associated with AoCs, with accident scenarios & EASp operational issues
4. Assess for each hazard, associated with FAST AoCs, likelihood/severity of consequences
5. Estimate relative change of accident scenario frequencies, relative to the baseline risk picture
6. Determine future risk pictures for all accident scenario frequencies per flight
7. Determine future risk pictures for the EASp issues (operational, systemic and/or emerging)
8. Prioritize EASp issues related to future risk pictures (using highest estimated frequencies)
9. Prioritize aviation domains by identifying all AoCs associated with prioritized EASp issues

FAST Areas of Change (AoC):

Check www.nlr-atsi.nl/fast/aoc

WP3 ASCOS safety assurance process in operation



The flowchart illustrates the Safety Issue Identification and Lesson Learned Requirement (LLR) process, showing the flow from events to product development and back to operation.

Events from operation and **Events occurred during development (e.g. tests results)** feed into the process.

Step 1: safety significant event identification involves identifying events in relation to a precursor list and other significant events, leading to **Safety issue identification**.

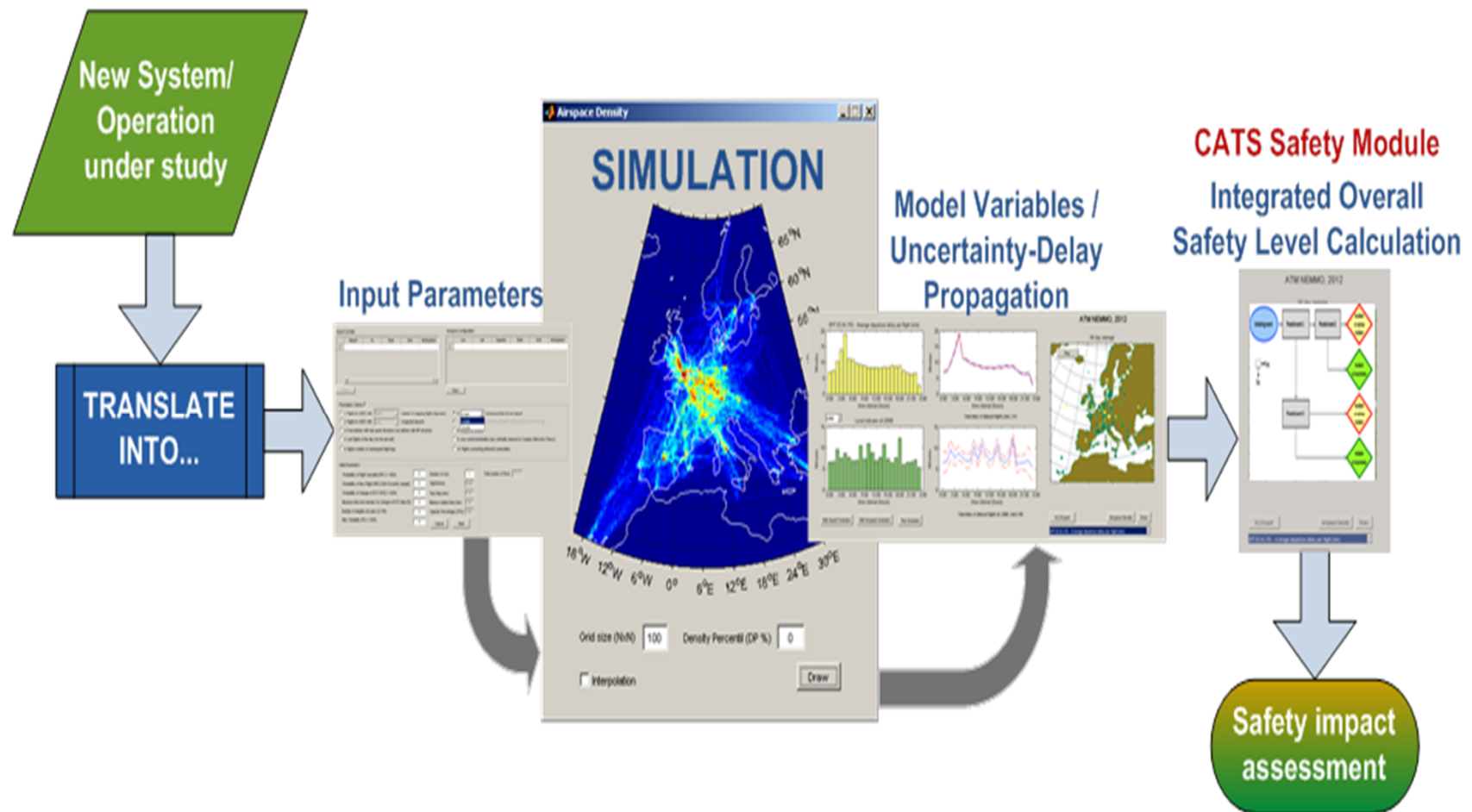
Step 2: Root cause investigation involves identifying the event family, investigating for root causes, and providing safety mitigation recommendations. This step leads to **Update precursor list** and **PRODUCT IN OPERATION**.

Step 3: Lesson Learned Requirement (LLR) elaboration involves linking root causes to development process activities, extending the scope of recommendations, and defining LLRs with identification of impacted application standards and verification of application standard (including Validation, verification, and review question lists).

Step 4: Lessons Learned Requirement implementation on development standards involves updating standards for process and method and updating question lists for validation, verification and review. This step leads to **NEW PRODUCT DEVELOPMENT**.

The process flows from **PRODUCT IN OPERATION** to **NEW PRODUCT DEVELOPMENT** and back to **PRODUCT IN OPERATION**.

WP3 Overall Safety Impact using ATM-NEMMO/CATS Tool



Phase 4

- Apply the newly proposed certification process adaptations, and its supporting methods and tools for continuous safety monitoring and safety based design, in four case studies
- This is followed by quantification of the safety impact of introduction of new operations and systems in Europe

WP4 Certification case studies (*ongoing*)

Important aspects

- Logical safety argument approach
- Total system approach
- Complete life cycle

Case study topics

- 1: RPAS failure management systems
- 2: Automatic aircraft recovery system
- 3: Certificate for de-icers
- 4: ATM/CNS systems for improved surveillance



Phase 5 (*ongoing*)

- The fifth phase validates the scientific and technological advance that the proposed project is expected to bring:
 - New affordable certification processes to make certification easier;
 - Innovative safety based design systems and tools; and
 - New methods and tools to support continuous safety monitoring.



Status and preliminary conclusions

- ASCOS contributes to ACARE SRIA & Flightpath 2050 Safety goals
 - SMS to operate throughout whole chain of Air Transport
 - Standardisation and Certification
 - *Safety radar & Forensic analysis & Resilience by design*
- New certification approach proposed & applied in case studies
- New safety assurance methods & processes developed
- Supporting safety tools developed and made available:
 - Continuous safety monitoring tool (eccairsportal.jrc.ec.europa.eu)
 - Tool for risk assessment at request (*username/password required*)
- Methods, tools and processes are being evaluated/validated

Contact us

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A2COS
safety certification

Final Dissemination Forum
28/29 May 2015 *(tentative)*



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