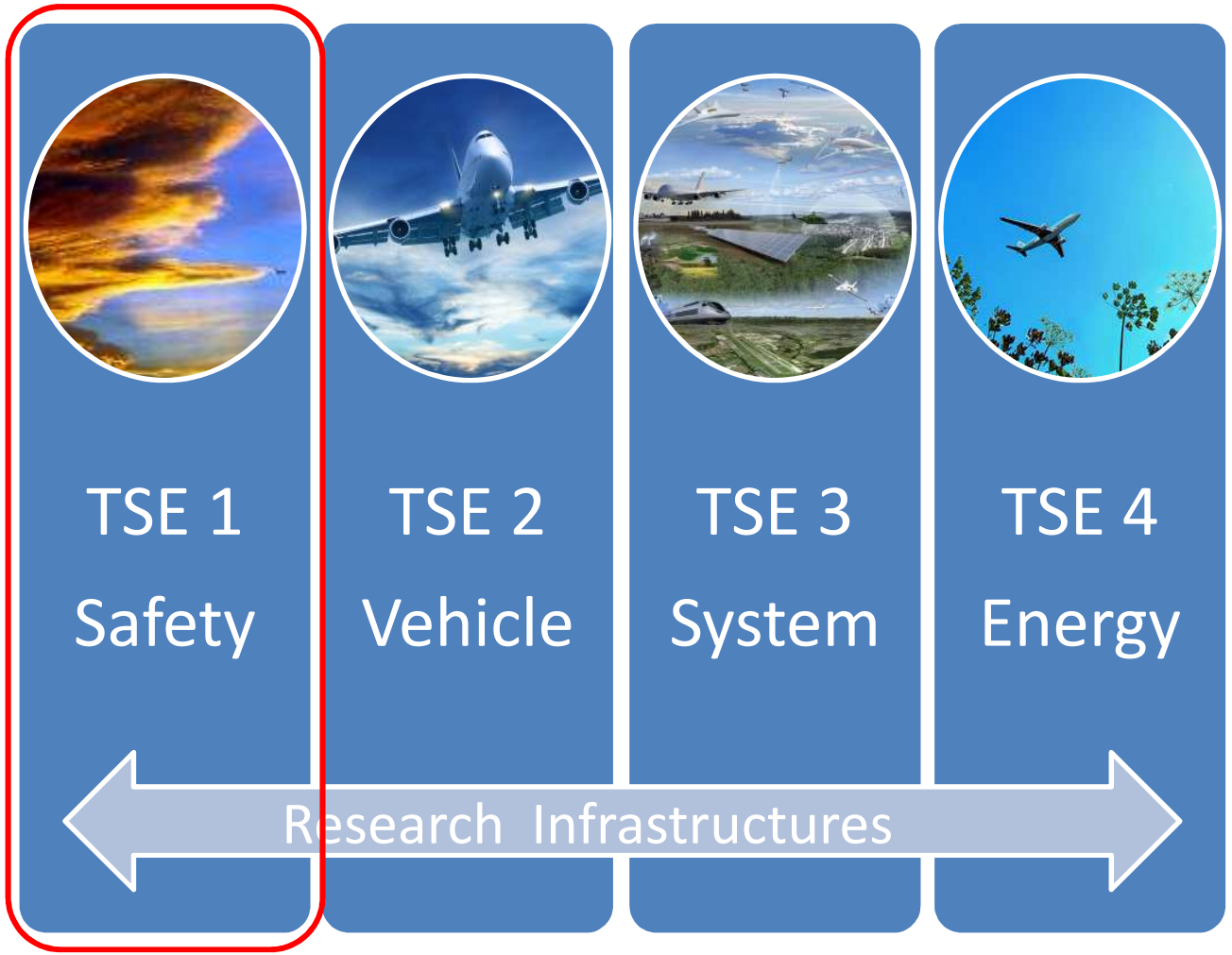
EREA

FUTURE SKY

The four pillars of Future Sky



Association of
European Research Establishments in Aeronautics

European JOINT RESEARCH INITIATIVE for Aviation

Joint Research Programme on

SAFETY

Joint Research Program

- Two main activities:
  1. Research coordination
  2. Coordinated research

- JRP will be open and in coordination with Clean Sky, SESAR2, EASA, EUROCONTROL and ongoing projects

- One program, 7 year roadmap, two calls
- Aiming at 40 – 50 M€ total budget

Why Safety

- Transverse domain of common interest to all stakeholders and with reduced competitive aspects.
- Closely linked to key European research and test infrastructures operated by EREA members.
- Aviation safety policy/regulation/certification have EU dimension, hence the European added value of the JRP.
- JRP on Safety could help overcome some "regulatory challenges" for introduction of "innovative products" and thus help innovation.
- The 80% reduction target in the accident rate is not being achieved. Therefore, a stronger focus on safety is needed.

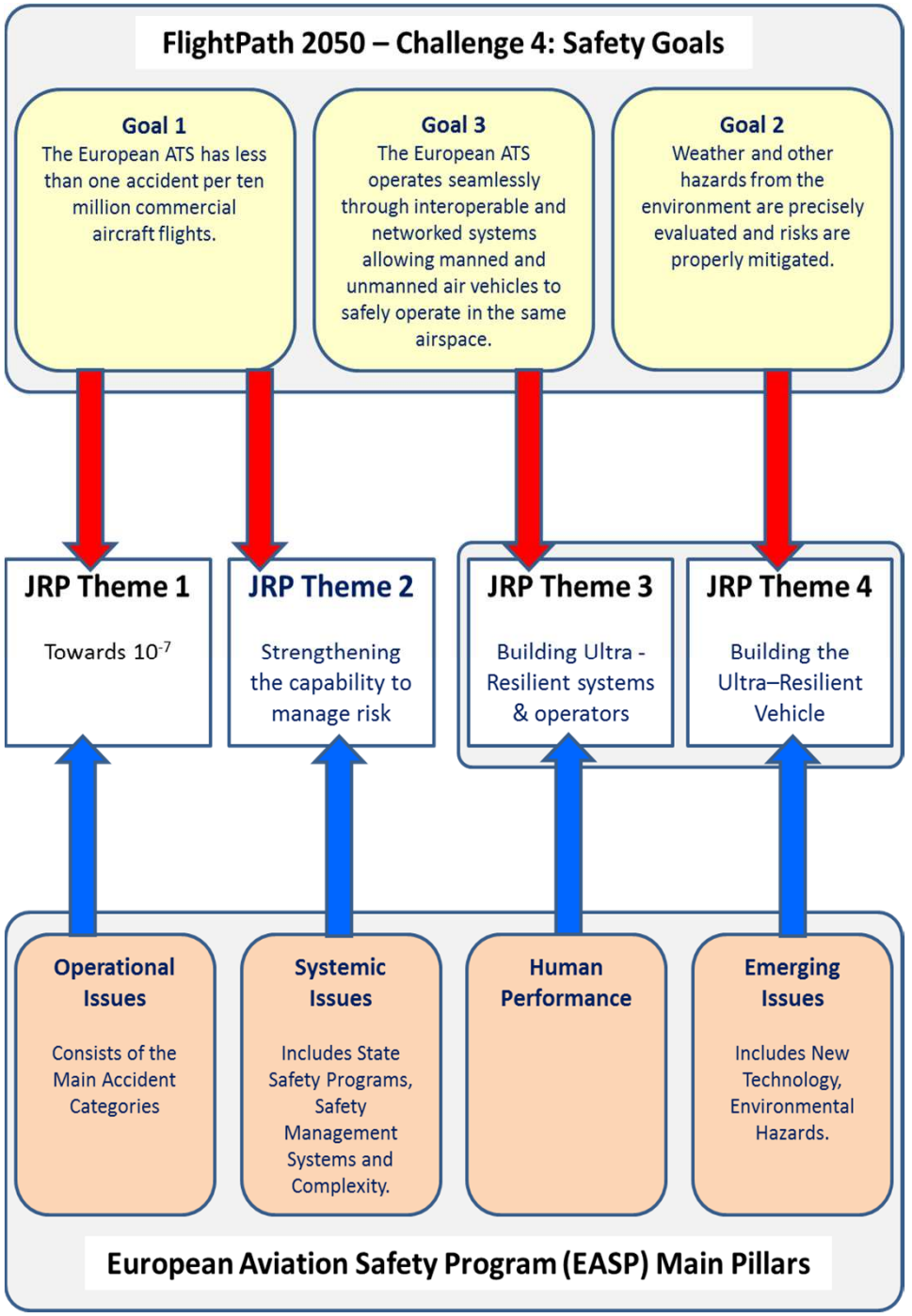
Scope & Size

- Focussed, not every safety concern merits a research solution
- Not Security
- Not Military.
- Address Short Term (2020), Medium Term (2035), and Long Term (2050) in a balanced way, from exploratory phases of system development up to the demonstration of methodologies in the relevant environment.
- TRL 2 to TRL 4, with work up to TRL 5 in specific domains.

  Higher TRLs for operational and organizational safety issues and lower TRLs for vehicle & systems level

Link with Policy

- Flight Path 2050
- EASP



Themes

- ***Theme 1 - Towards 10^{-7}***

  Breakthrough research to address a single current main accident category and a current main common causal domain in accidents in commercial air transport with the purpose of enabling a direct, specific, and significant risk reduction in the medium term.

- ***Theme 2 - Strengthening the capability to manage risk***

  Projects under this theme conduct research on processes and technologies to enable the aviation system actors to achieve near-total control over the safety risk in the air transport system.

- ***Theme 3 - Building ultra-resilient systems and operators***

  Projects under this theme conduct research on the improvement of Systems and the Human Operator with the specific aim to improve safety performance under unanticipated circumstances.

- ***Theme 4 - Building ultra-resilient vehicles***

  Projects under this theme will aim at reducing the effect of external hazards on vehicle integrity as well as reducing the number of fatalities in case of accidents.

reactive

pro-active

prognostic

Safety research program

- overview -

Theme	*Project*	
Theme 1 "Towards 10^{-7}"	P1	Specific solutions to address runway excursion accidents.
	P2	Resolving the organizational accident.
Theme 2 "Strengthening the capability to manage risk"	P3	Total system risk assessment; next generation of safety assessment techniques and a permanent risk observatory for the total ATS in support of industry risk management programs.
	P4	Getting ahead of the curve; emergence detection from deep understanding and big data.
Theme 3 "Building ultra-resilient systems and operators"	P5	
	P6	
	P7	Human Performance Envelope (development and protection).
Theme 4 "Building ultra-resilient vehicles"	P8	Next generation Envelope Protection for Air Vehicles
	P9	Reducing the effect of external hazards (Composite damage, structural health monitoring, EMC, etc…)
	P10	Protection of the vehicle occupants (crashworthiness, fire protection, icing, etc.)

Theme 1 projects

P1 - Specific solutions for runway excursion accidents

The European Action Plan for the Prevention of Runway Excursions (EAPRRE) has identified areas were research is needed to further reduce runway excursion risk:

1) Flight mechanics of runway ground operations on slippery runways under crosswind conditions,
2) Impact of fluid contaminants of varying depth on aircraft stopping performance,
3) Advanced methods for analysis flight data for runway excursion risk factors.

A fourth workpackage will look into new technologies* to prevent excursions or the consequences of excursions.

* Other than ROPS

Theme 1 projects

P2 - Resolving the organizational accident

- Safety focus has traditionally been on technical failures and human error as they occur in operations
- New approaches consider the overall sociotechnical system in the full operational and organizational context.
- Research will address the effects of organizational structures, processes and cultural phenomena on safety performance in aviation organizations.
- The findings will help to address both the fundamental scientific obstacles and the connection between the scientific theories and their practical application in safety performance management.

Theme 2 projects

P3 - Total system risk assessment

- Adequate means for safety risk assessment and safety performance monitoring of large, complex and dynamic systems of sufficient accuracy and depth not yet available.
- Explicit representation of latent factors in risk assessment and data, processes and techniques for continuous updating of the risk picture must be developed.
- Project will build on progress made in several programs:
  - EUROCONTROL IRP/AIM - FAA-ISAM
  - CATS-NL - ASCOS
- Project will develop a next generation of safety assessment techniques and a permanent risk observatory for the total air transport system.

Theme 2 projects

P4 - Getting ahead of the curve; emergence detection and big data

- In current diagnostic approaches, risk is identified by exploiting incident and/or accident reports or 'exceedances'. These are pre-defined "knowns".
- This project will develop methods to:
  - analyze big data to find evidence of the emergence of new risks
  - Develop data-traps to monitor approach to risk criticality
  - mitigate the identified emerging safety risks before realization
- The methods should allow for concurrent (daily) analysis enabling identification of emergent safety risks profiles.

Theme 3 projects

P5 - Ultra-Resilient Air Transportation Service

Theme 3 projects

P6 - Safe Integration of Future Air Vehicles into the ATS

Theme 3 projects

P7 - Human Performance Envelope

- The Human Performance Envelope is to some extent a new paradigm in Human Factors
- Rather than focusing on one or two individual factors (e.g. fatigue, situation awareness, etc.), it considers a range of factors and how they collectively influence performance.
- Through studies and simulations the project will:
  - find the points at which performance deteriorates
  - investigate the ability for performance recovery by a human operator, a team, or automation
  - determine behavioural or physiological markers and recovery measures that could be applied in real-time
  - Identify ways to augment the envelope in order to increase safety and improve performance.

Theme 4 projects

P8 - Next generation flight envelope protection

- This project will pursue three main research strands to seek higher levels of fixed and rotary wing flight operations integrity in nominal and off nominal conditions:
  - Flight envelope extensions through development of improved models to predict aircraft behaviour in off-nominal conditions.
  - Development of improved envelope protections based on real time, automatic tuning of protections
  - providing better situation awareness to the crew (not simply shutting off in case of sensor failures and abnormal conditions).
- In addition, methods and tools will be developed to retain adequate aircraft performance and controllability by actively reconfiguring systems in case of system or component failures or "exogenous" events like bird strikes, vortex encounters, and severe icing conditions.

Theme 4 projects

P9 – Reducing the effect of environmental hazards

- The physics of icing clouds containing of Supercooled Large Droplets & high altitude ice crystals are still not well known.
- Also building on FP7 WEZARD and HAIC ,this project will perform research – including laboratory experiments to:
  - improve the understanding of icing physics and of new Ice Protection System electrical behavior
  - Develop more capable numerical tools for ice accretion simulation, for (electro-thermal) ice protection systems performance, and for aerodynamic performance degradation
  - Generate data for feeding and validating icing modeling tools.
  - Develop innovative concepts for the (online) detection of ice and of the encounter of SLD or ice-crystal conditions.

Theme 4 projects

P10 – Protection of the vehicle occupants

- Important knowledge gaps exist around the crashworthiness and fire behavior of CFRP materials for primary structures.
- Project will study the dynamic behavior of composite materials in low to high velocity impact loads and:
  - develop measurement techniques for thermodynamic phenomena
  - develop material behaviour laws specific to composite material
  - model and solve multi-scale non-linear and rupture behaviour
- The project will also study the fire behaviour of CFRP:
  - develop better methods to assess thermo-mechanical properties
  - analyse composite decomposition under various flame and mechanical load conditions and develop better numerical methods

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