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Observation Platform for Technical and Institutional Consolidation of Safety research

OPTICS – Are we doing the right safety research?

Barry Kirwan (EUROCONTROL) for the OPTICS Team

Aviation Safety Research: Time to Take Off!

OPTICS is a Coordinated Action funded by the European Commission under the
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OPTICS Consortium

EUROCONTROL

EASA
European Aviation Safety Agency

CIRA
Centro Italiano Ricerche Aerospaziali

NLR

DLR

ONERA
THE FRENCH AEROSPACE LAB

DEEPBLUE
consulting&research

CDTI Centro para el Desarrollo Tecnológico Industrial

Rolls-Royce

Bauhaus Luftfahrt
Neue Wege.

Overview

- OPTICS Approach
- Preliminary Results
- Reflections on Aviation Safety R&I

Europe's Vision for mid-century

Safety & Security

Known and Emergent Hazard Mitigation
Customer friendly security
Mitigate Cyber and other risks

The European air transport system has less than one accident per ten million commercial aircraft flights.

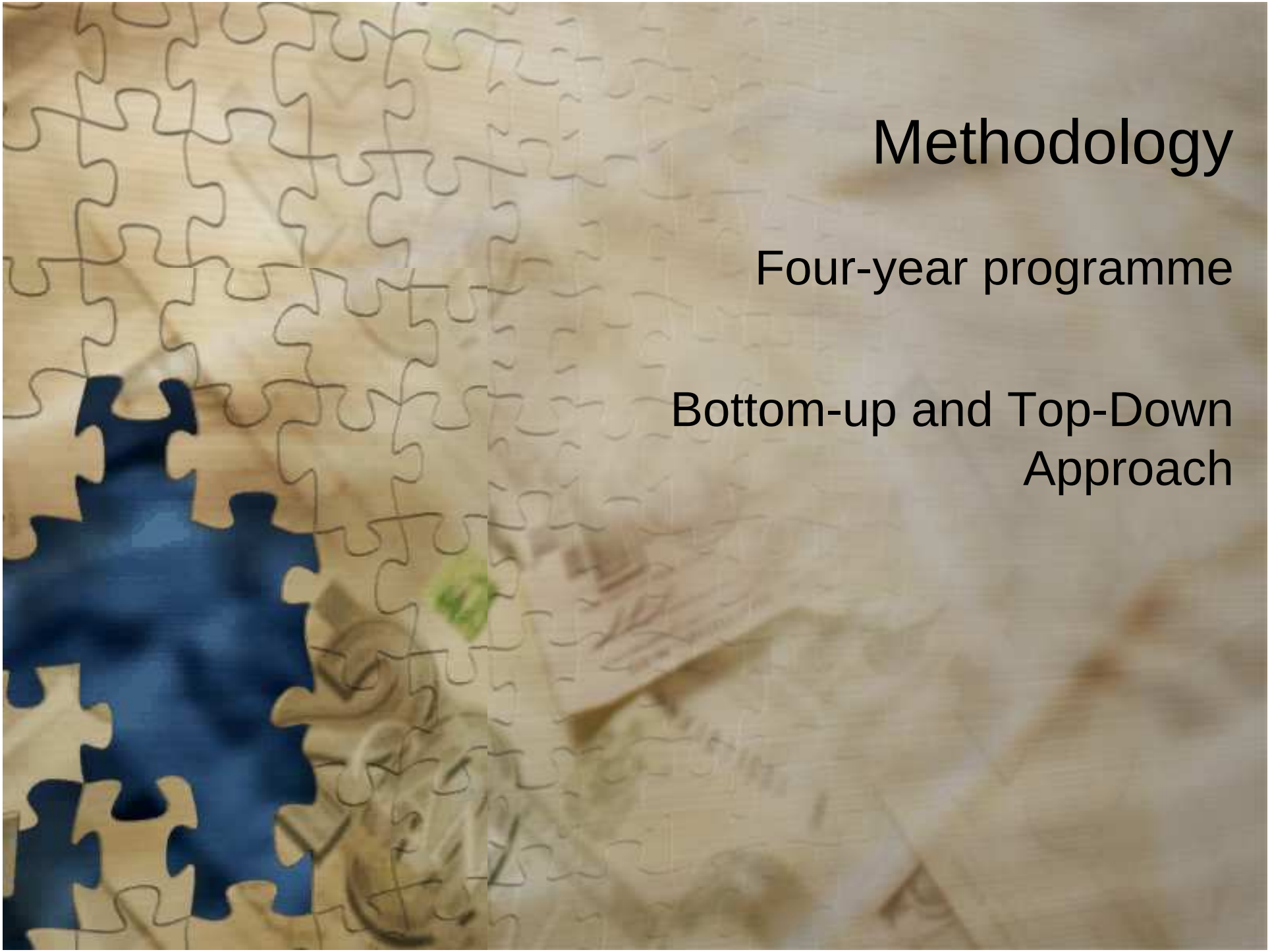
Weather and other hazards are precisely evaluated and mitigated.

Seamless operations through fully interoperable and networked systems (including manned and unmanned vehicles)

Efficient boarding and security checks allow seamless security

Air vehicles are resilient by design to security threats

The air transport system has a fully secured global high bandwidth data network.



Methodology

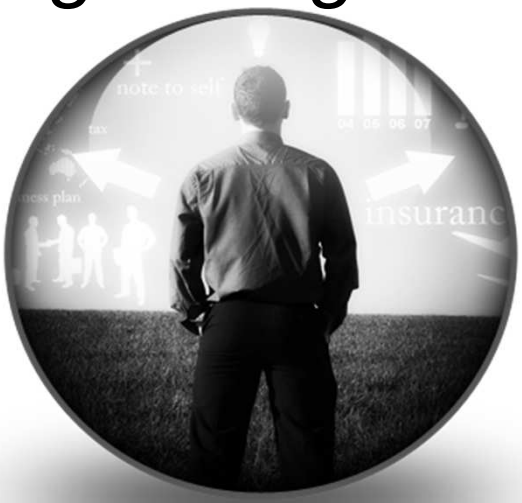
Four-year programme

Bottom-up and Top-Down Approach

2014 – FP7 Direct Safety Projects
2015 – FP7 + H2020 + SESAR + CleanSky
2016 – National & Regional Projects
2017 – International Projects: Global Picture

OPTICS: a two-pronged approach

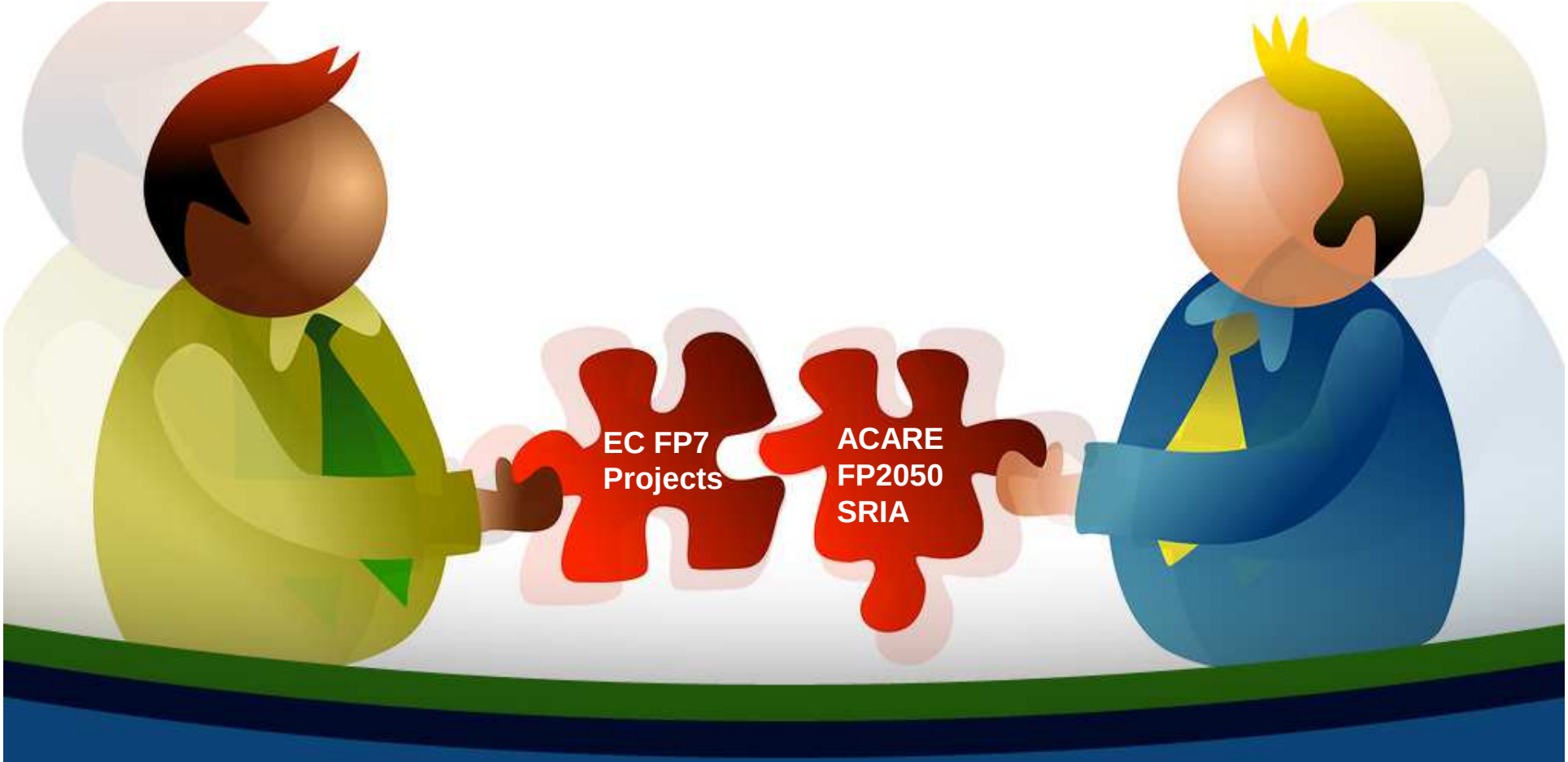
Are we doing the right research?



Analysis of Projects

Compatible?

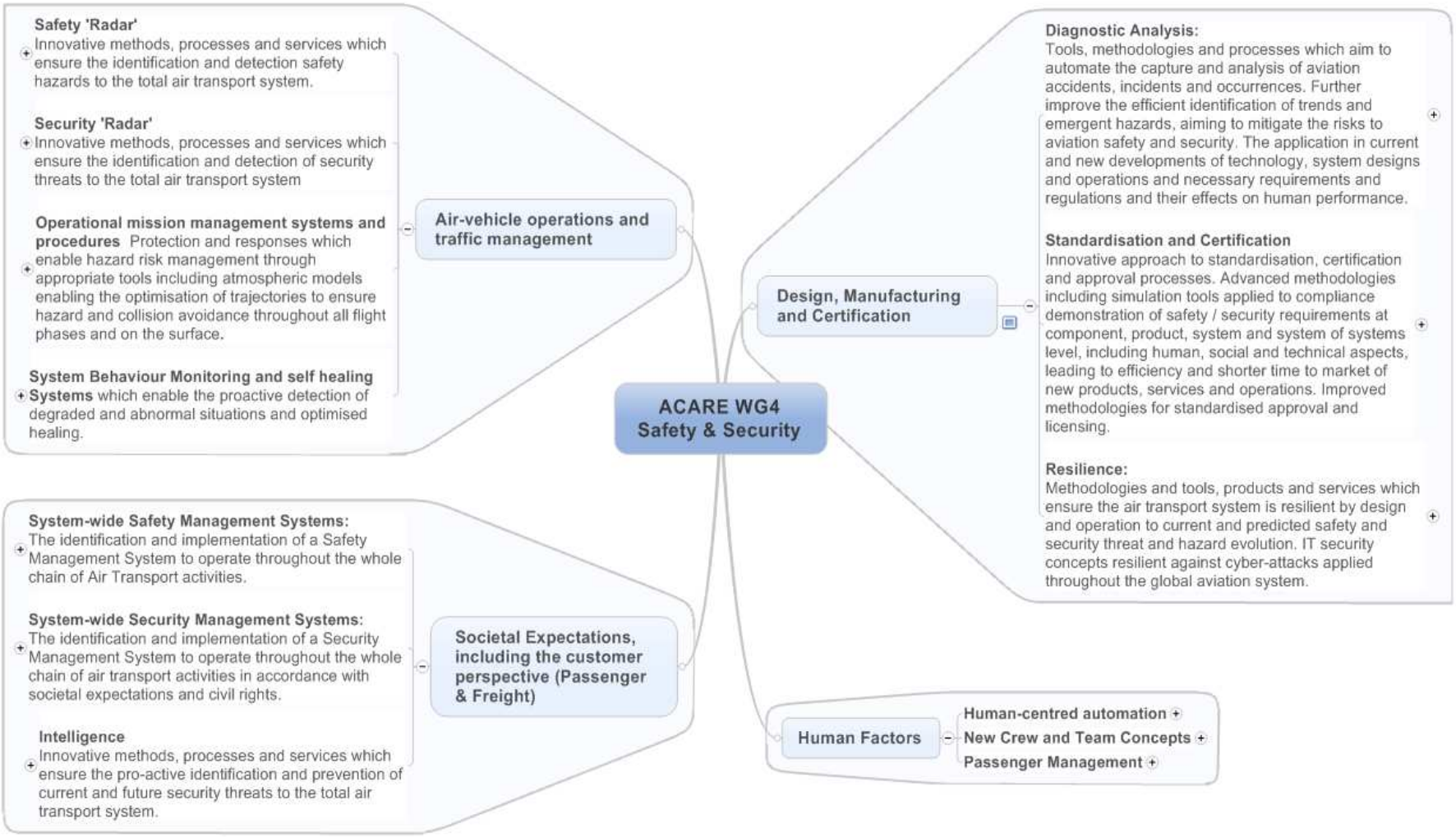
Ask the experts



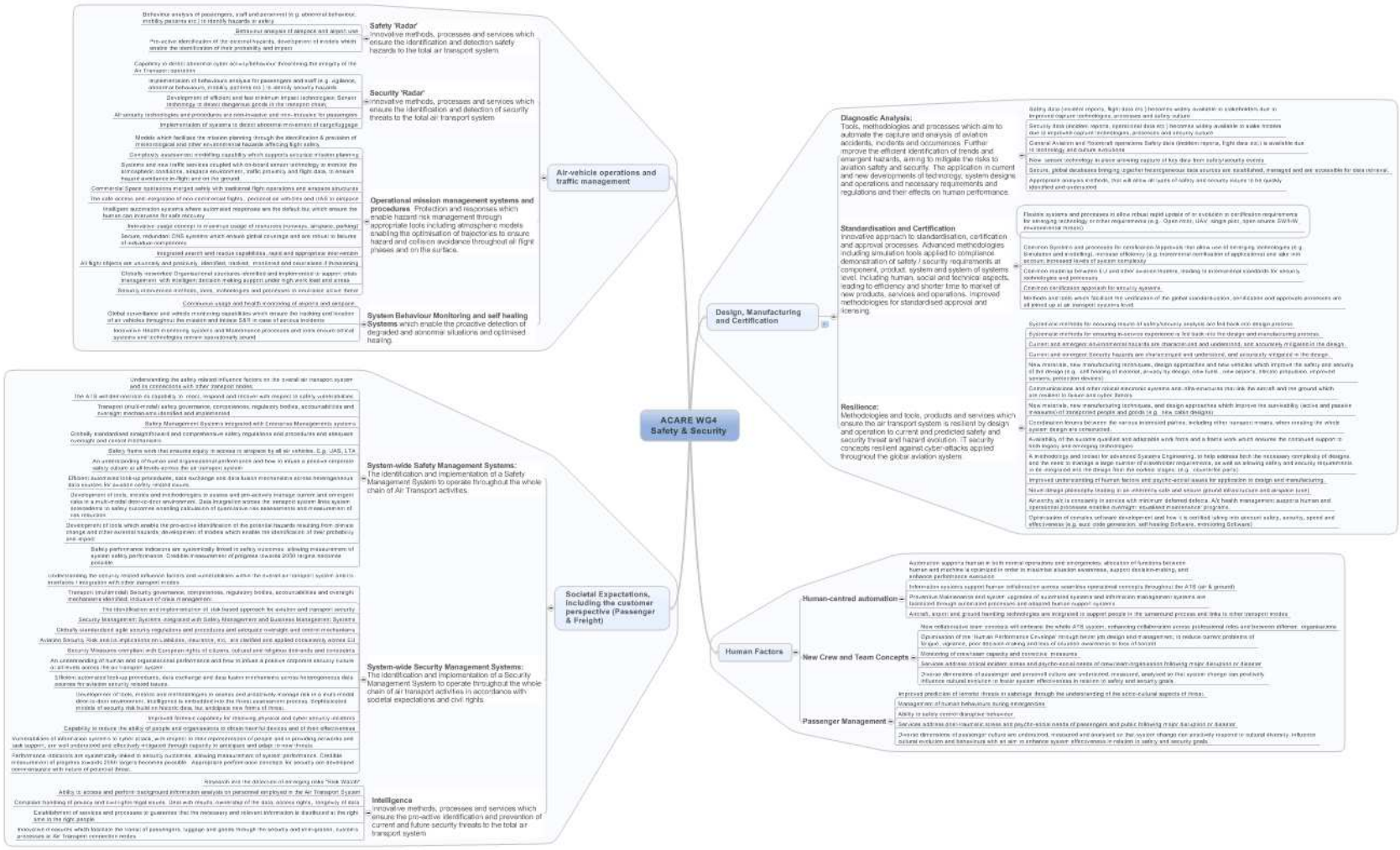
Analysing the safety contribution of 7th Framework Projects

The Bottom-up Approach

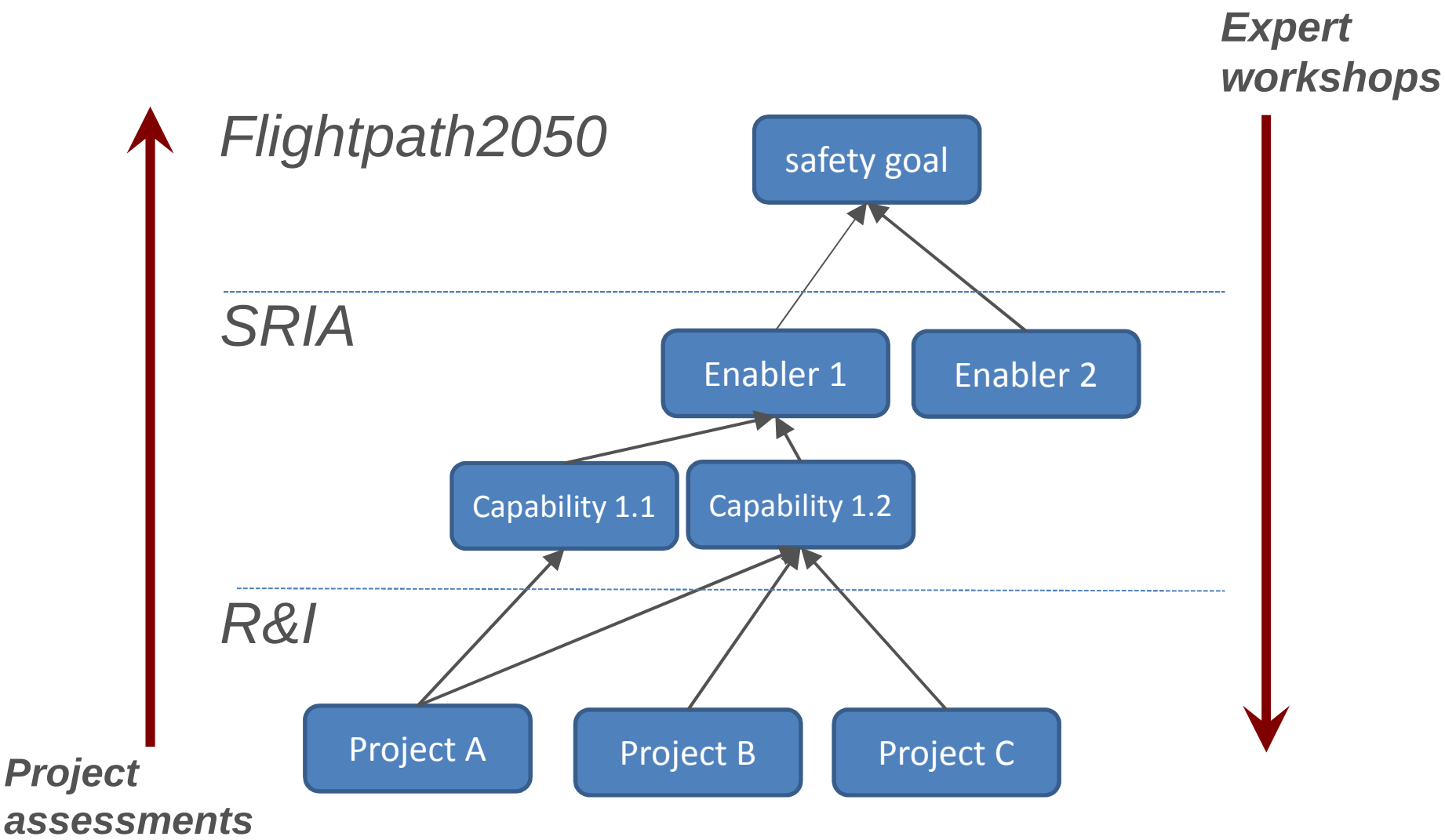
The ACARE SRIA for Safety & Security – top 2 levels



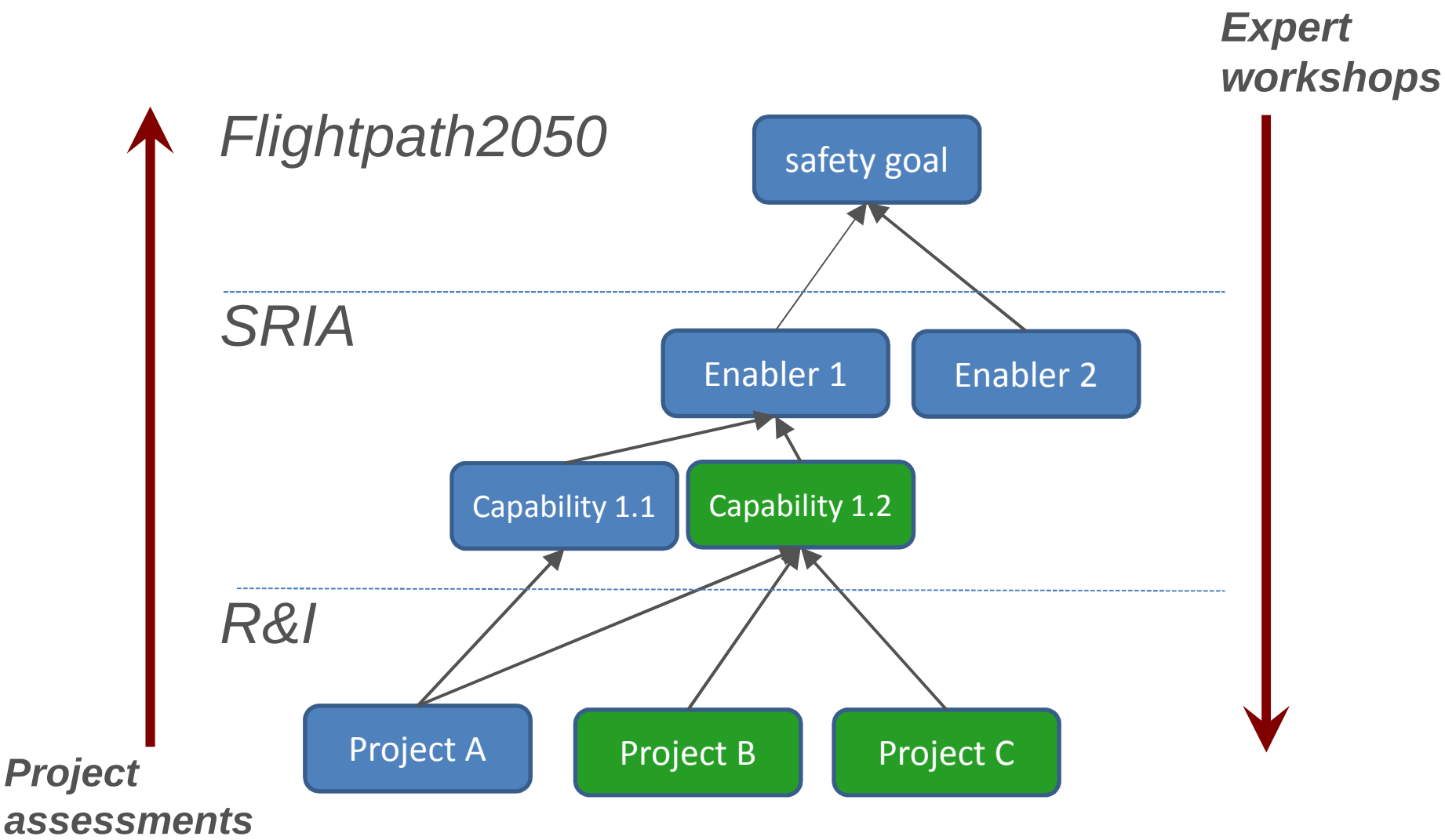
ACARE Safety & Security R&I Needs – *going deeper*



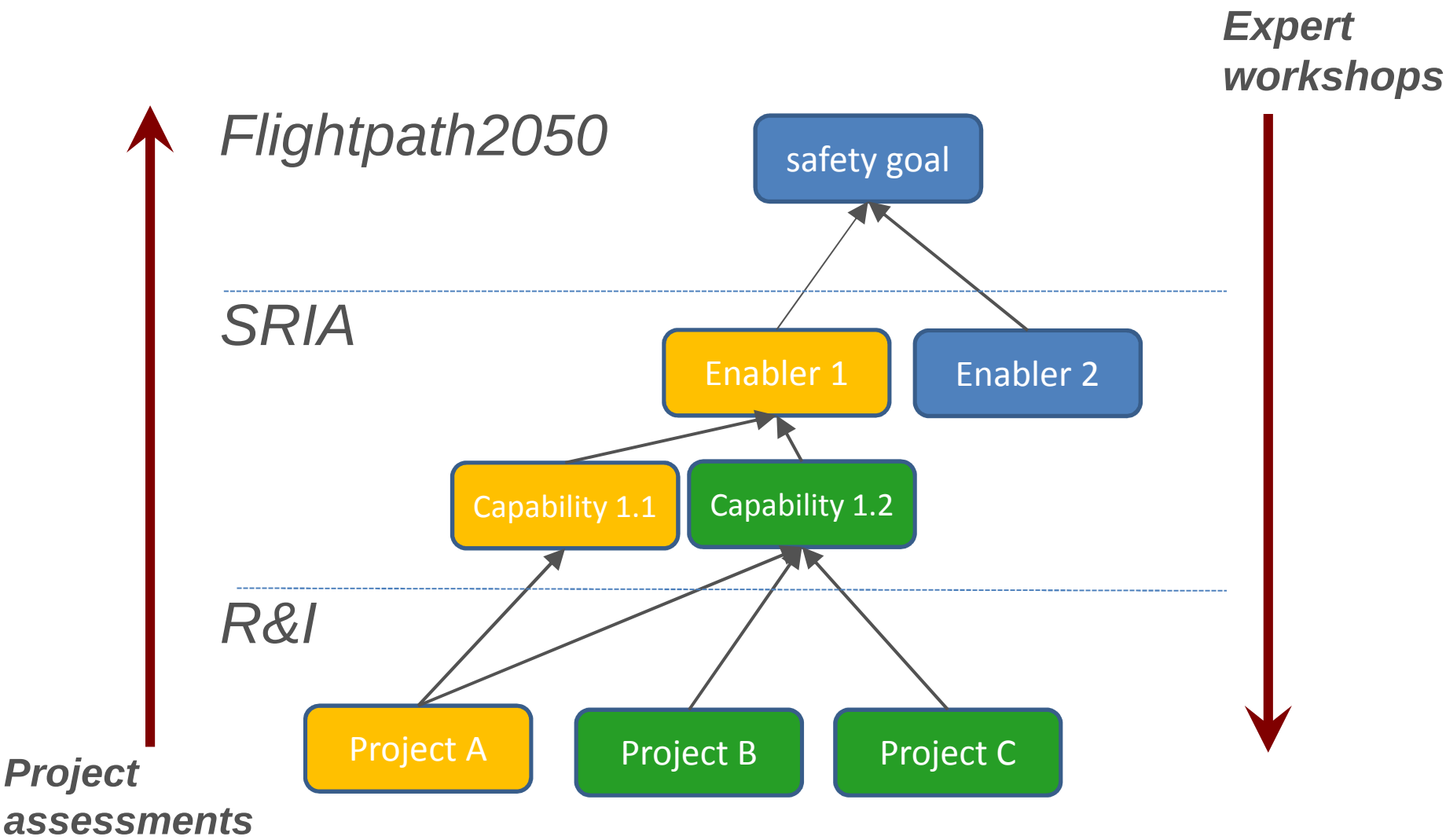
Overall methodology



Overall methodology



Overall methodology



Selecting projects

Reviewed 44 FP7 projects in detail

ACCENT EXTICE GREEN-WAKE HIRF-SE HISVESTA HUMAN LAYSA MISSA TRIADE AAS ADDSAFE BEMOSA DELICAT ON-WINGS PICASSO SUPRA AEROMUCO AIM^2 AIRCRAFTFIRE ARISTOTEL DOTNAC SMAES SVETLANA WEZARD ACROSS ALAMSA ASCOS HAIC MAN4GEN PROSPERO RECONFIGURE RESILIENCE2050 SAFUEL UFO JEDI-ACE HYPMOCES A-PIMOD

SUPRA: realistic simulation of stall events

Managing Situation Awareness on Airliner Flight Decks

A-PiMod

Applying Pilot Models for safer aircraft

Multimodality? Pilot Models?

How does it help?

ASCOS
safety certification

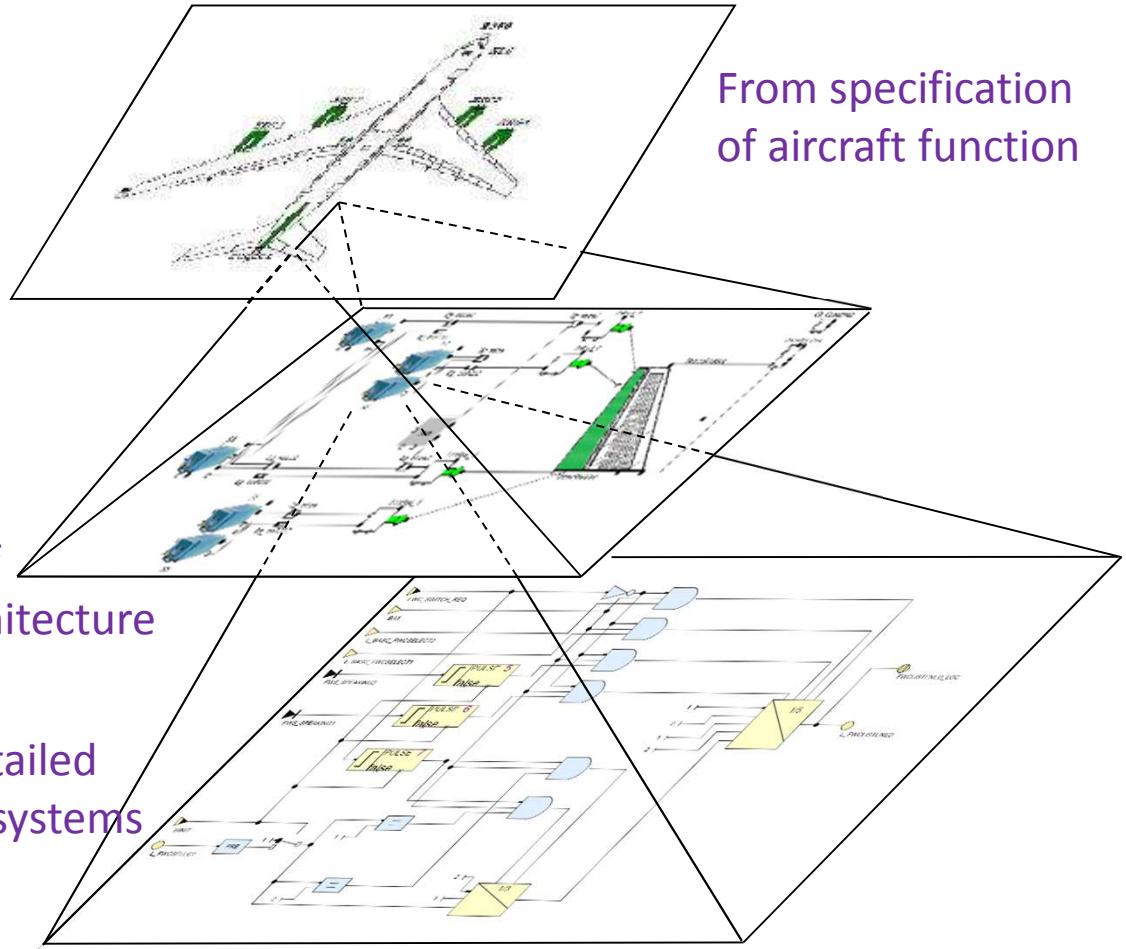
http://www.ascos-project.eu

New affordable approach to ease certification

Innovative safety based design systems & tools

Methods & tools for continuous safety monitoring

More Integrated System Safety Assessment



From specification
of aircraft function

To design of
aircraft system architecture

Until detailed
design of systems

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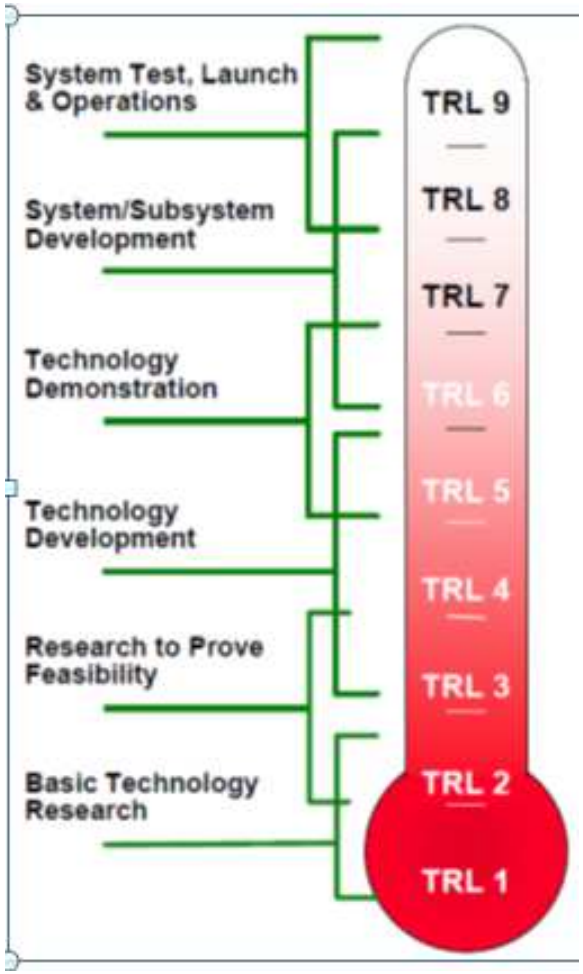
How do we assess Projects

Assessing contribution

Does the subject of the project cover a small or a big part of the scope of the capability?

Project capabil.	A	B	C	D	E	F	G	H	n
1	med	high							
2			high	low	high		low		
3	low					low			
4				low			med		high
5									
6							low		
10					low			low	

Assessing Maturity



Maturity: Generalised scales, based on

- NASA's Technological Readiness Levels
- OPTI approach for Institutional Readiness Levels

TRL 7,8,9: out of scope of OPTICS

TRL 5,6: High maturity

TRL 3,4: Medium maturity

TRL 1,2: Low maturity

Assessing Ease of Adoption

Score	Economic	Legal	Organizational
Low	Very large costs. (e.g., high technical complexity).	Major legal constraints. Resolving requires significant effort.	Major organizational, institutional or political constraints. Resolving would take significant effort.
Medium	Required investments not significantly high. (relative to considered benefits)	Minor legal constraints.	Organizational, institutional or political constraints. Resolving will take time but is rather straightforward.
High	Low costs. (relative to considered benefits).	Fits in current legal framework.	Stakeholders keen to adopt because of perceived benefits.

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Preliminary Results

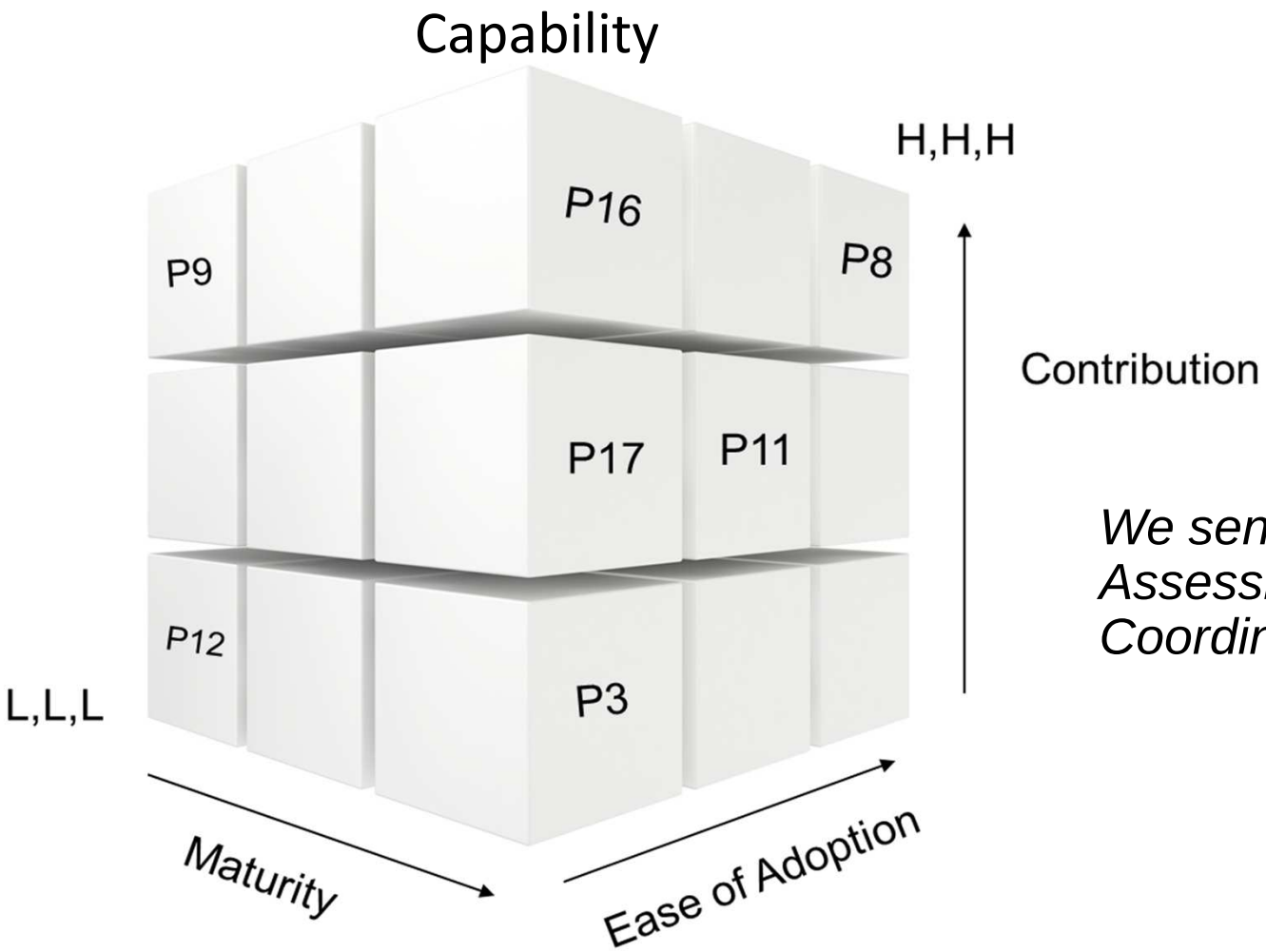
Bottom-up Assessment

Synthesising assessment results

Example preliminary result: Enabler 8 (Human-centred automation)

Capabilities	Projects	Coverage of capability	Maturity	Ease of adoption
1. Automation supports human in both normal and degraded operations; allocation of functions between human and machine is optimized in order to maximise situation awareness, support decision-making, and enhance performance execution	PPLANE, ALICIA, ACROSS, ODICIS, MAN4GEN, A-PIMOD, ARISTOTEL, BRAINFLIGHT	Medium	Medium	M-M-M
2. Information systems support human collaboration across seamless operational concepts throughout the ATS (air & ground)	Not addressed by research yet assessed by OPTICS			
3. Preventive Maintenance and system upgrades of automated systems and information management systems are facilitated through automated processes and adapted human support systems	Not addressed by research yet assessed by OPTICS			
4. Aircraft, airport and ground handling technologies are integrated to support people in the turnaround process and links to other transport modes	AAS	Low	High	M-H-M

Visualizing the Results



We send back our Assessments to the Project Coordinators for verification

FIRST IMPRESSIONS

Results

Does the OPTICS approach work?

How complete are the Enablers?

Where are the gaps?

Are we on target for 2050?

The Methodology Works

Selection of Projects

Analysis of Projects

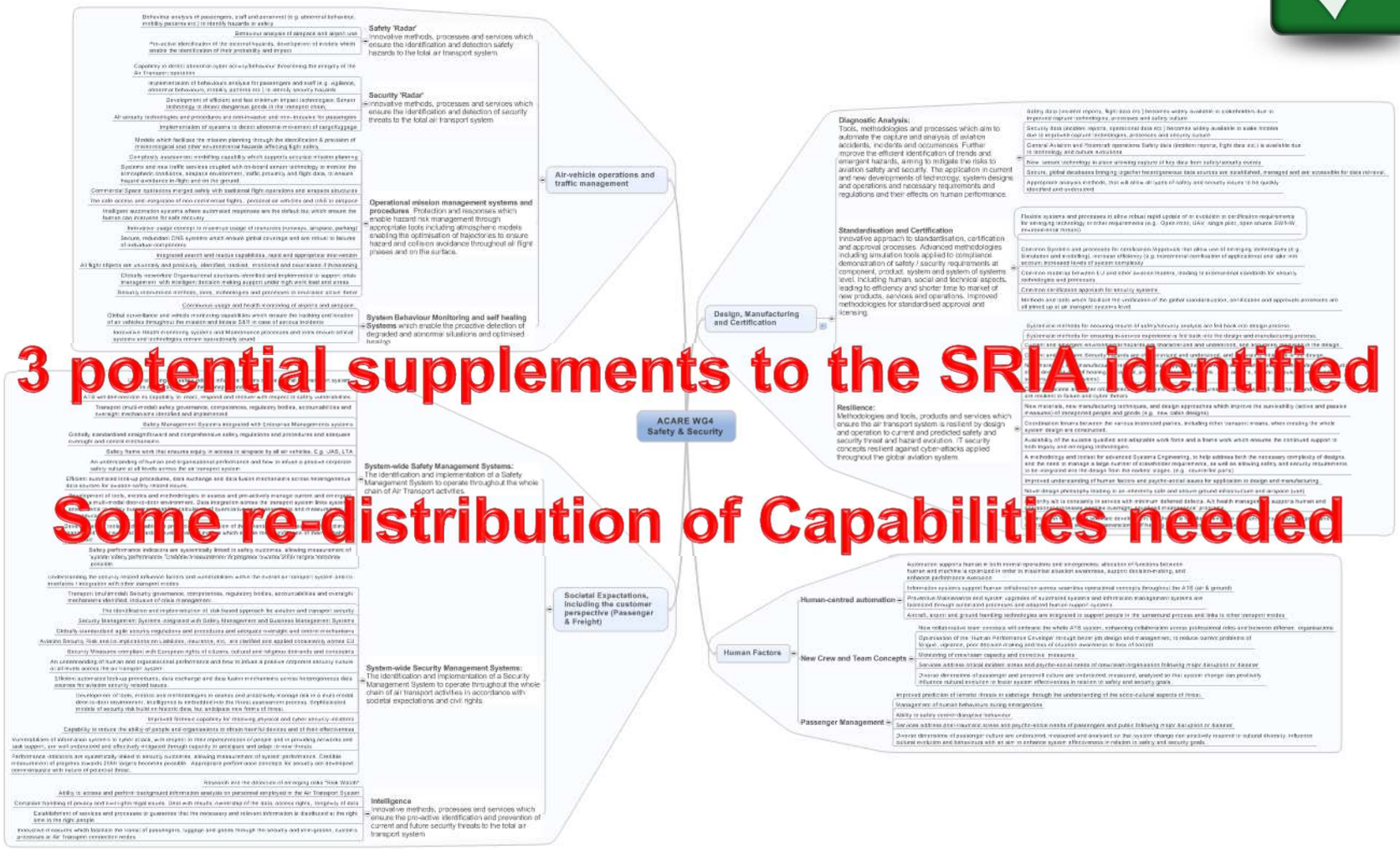
Criteria

Assessment Process

Review & Verification

Interpretation

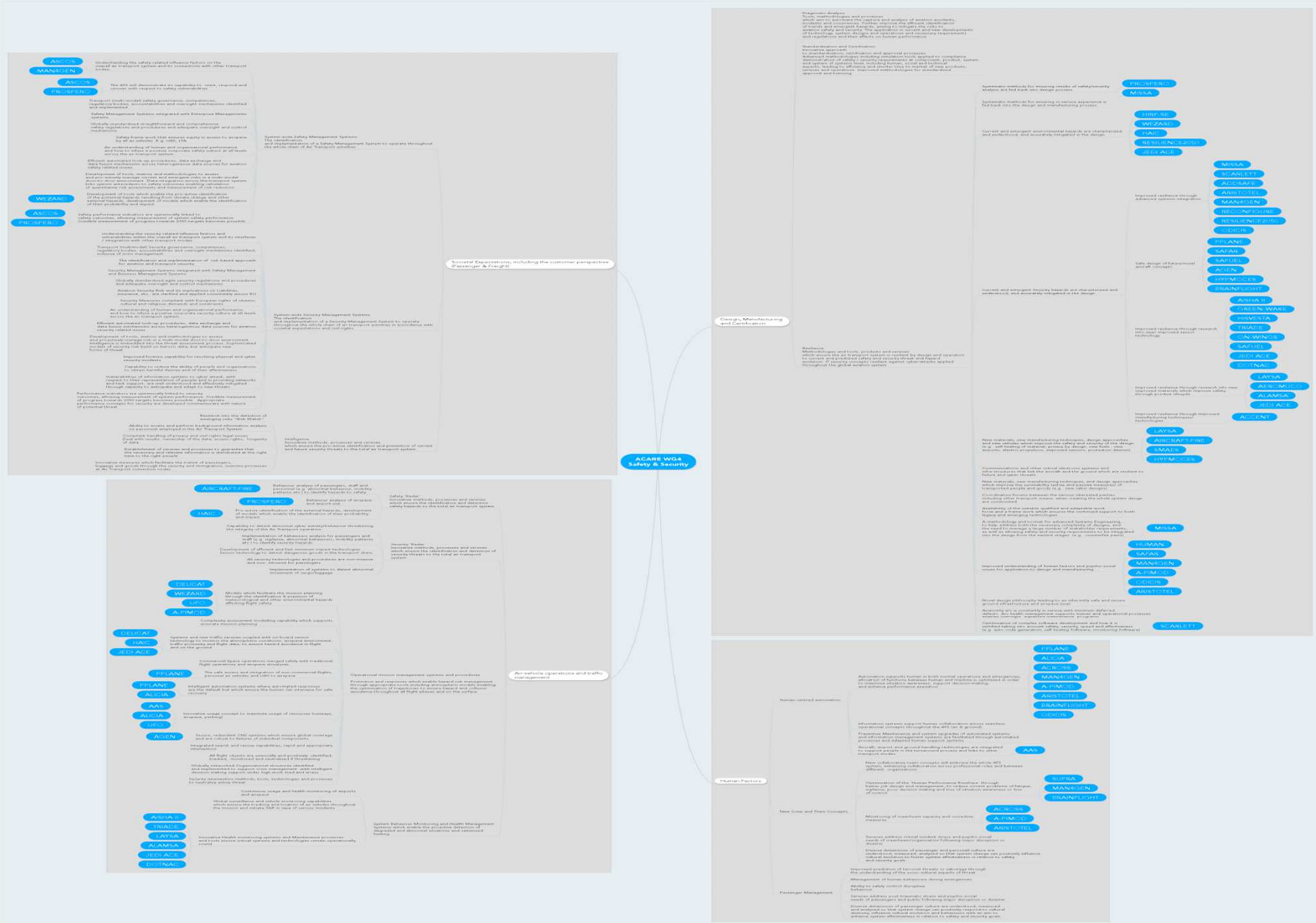
The SRIA is ‘Fit for Purpose’



3 potential supplements to the SRIA identified

Some re-distribution of Capabilities needed

Mapping the Projects to the SRIA



How are we doing at the Enabler level?

Enablers	Coverage	Maturity	EoA Economic	EoA Legal	EoA Organizational
1. System-wide Safety Management Systems	Low-Med	Med	Med-High	Low	Med
2. Safety radar	Low-Med	Low	Med	Low-Med	Low
3. Operational mission management systems and procedures	Low-Med	Med	Med	Med	Med
4. System behaviour monitoring and health management	Low	Med	Med-High	Med	Med-High
5. Forensic analysis	Low-Med	Med	Med	Med	Low
6. Standardisation and Certification	Low-Med	Med	Med-High	Med	Med-High
7. Resilience by design	Low-Med	Med	Med-High	Med	Med-High
8. Human-centred automation	Low-Med	Med	Med	Med	Med
9. New crew and team concepts	Low-Med	Med-High	Med	Low-Med	Med
10. Passenger management	Low	n.a.	n.a.	n.a.	n.a.

Is the spread of R&I balanced?

Projects per Enabler

Resilience

Mission Management

Standardisation & Certification

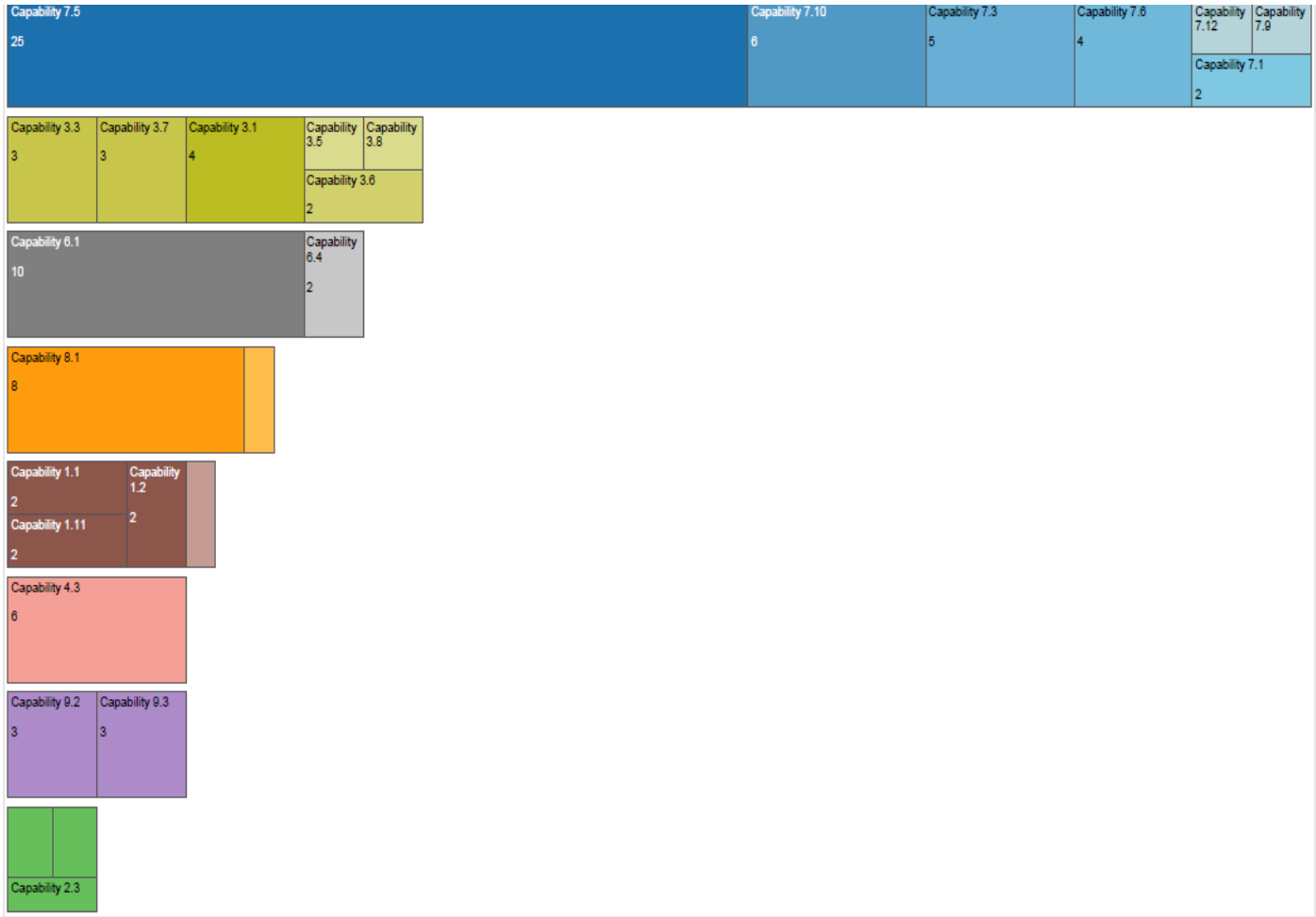
Human-centred Automation

System-wide SMS

System Monitoring

New Crew & Team Concepts

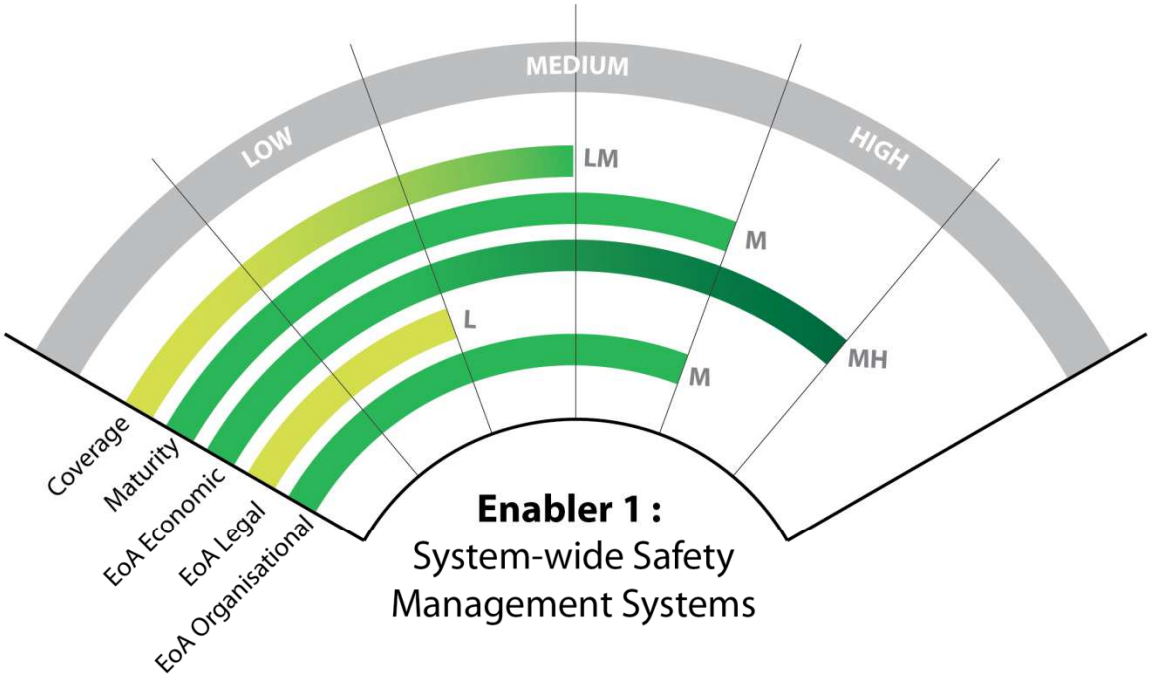
Safety radar



How to gain an overview?

Research is fuel for the industry…

Fuel Gauge for Safety R&I Enablers



Addressed capabilities

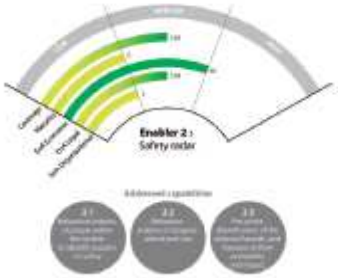
1.1 Understanding safety factors on transport system

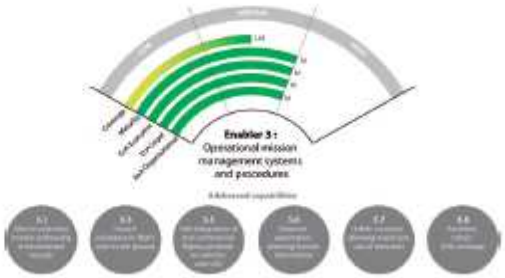
1.2 System-wide operational risk management system

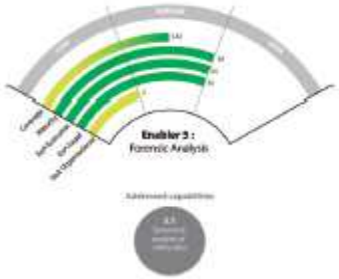
1.10 Pro-active identification of external hazards

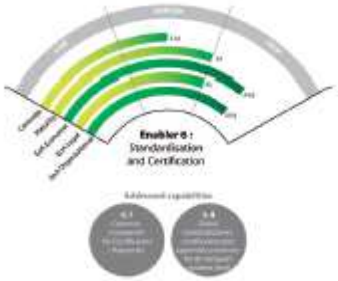
1.11 Measurement of system safety performance

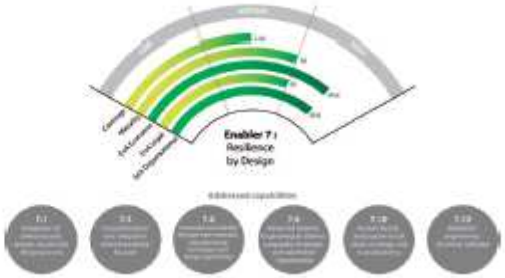
A Safety R&I Dashboard

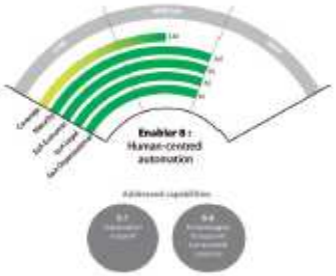


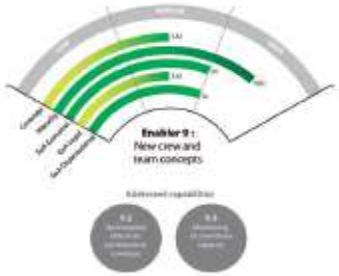


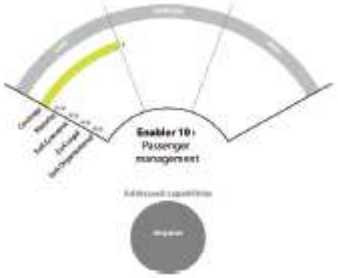












The FP7 safety contribution today is largely Low-Medium

Average Maturity is Medium

Ease of Adoption is Medium

Some Enablers have sparse Projects

Since this is a Roadmap for 2050, this is a reasonable place to be

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Results II

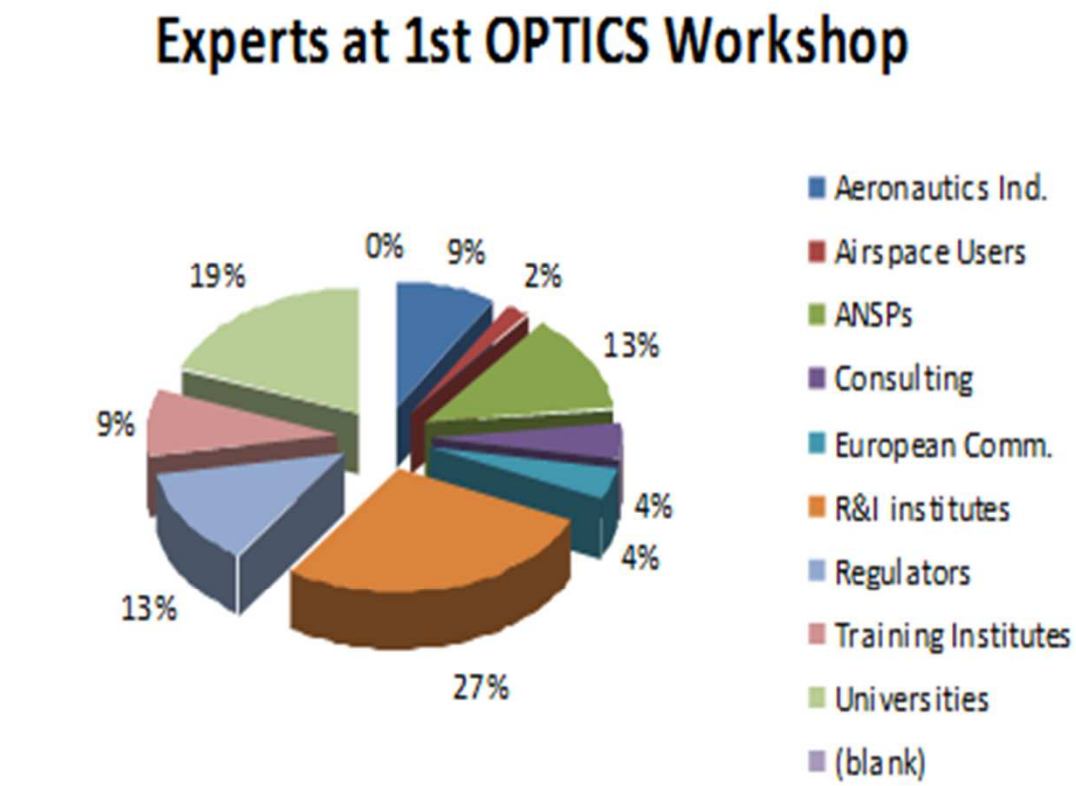
Top-Down Assessment

OPTICS Annual Workshops

1st Expert Workshop, 3rd July, Brussels

Human Factors – what are the safety R&I priorities?

70 HF Experts, 17 countries



Safety Capabilities - Human Factors

	INDIVIDUAL	TEAM	ORGANIZATIONAL
Technologies	ADAPTIVE AUTOMATION AUTOMATION SUPPORT HF IN DESIGN AND MANUFACTURING	CREW MANAGEMENT SYSTEMS MONITORING OF CREW/TEAM CAPACITY SYSTEMS FOR HAZARD AVOIDANCE INTEGRATED TECHNOLOGIES FOR TURNAROUND INFORMATION SYSTEMS SUPPORT FOR HUMAN COLLABORATION	TOOLS AND METHODS FOR EMERGENT RISKS INTEGRATED SEARCH AND RESCUE CAPABILITIES PREVENTIVE MAINTENANCE AND SYSTEM UPGRADES COMMON FRAMEWORK FOR CERTIFICATION
Understanding	HP ENVELOPE	CISM FOR TEAMS AND ORGANISATIONS NEW TEAM CONCEPTS UNDERSTANDING MULTICULTURAL INTERACTION BTWN CREW AND PASSENGERS UNDERSTANDING CULTURAL ASPECTS OF PASSENGERS	MANAGING HUMAN BEHAVIOUR IN EMERGENCIES BEHAVIOURAL ANALYSIS TO IDENTIFY HAZARDS SAFETY PERFORMANCE INDICATORS OPERATIONAL RISK MONITORING SAFETY DATA SYSTEMATIC ANALYSIS SAFETY CULTURE SAFETY INFLUENCES

Current focus mainly on pilot side?

Experts' HF Priorities

Automation Support

Human Performance Envelope (fatigue, SA, etc.)

Need for a HF-in-Design culture in Europe

Help pilots/controllers manage adverse events

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Reflections on the Results

Observations so far

- Both top-down and bottom-up approaches worked and their results are compatible
- At the Enabler level there are clearly some gaps (e.g. Passenger Management) and imbalances.
- There are some high-safety-value projects, but few that collectively address the full safety capability, e.g.:
  - a focus on HF but only the pilot;
  - a focus on certain weather hazards but not all
  - A focus on commercial aircraft operations (and *not* GA, SAR, rotorcraft, personal vehicles, UAS, commercial space operations)
  - Little attention to ATM/ANS, airports and maintenance
  - Integration of safety data through all stakeholders is missing
  - Little FP7 focus on global aspects (global CNS coverage; data-sharing; crisis-handling)

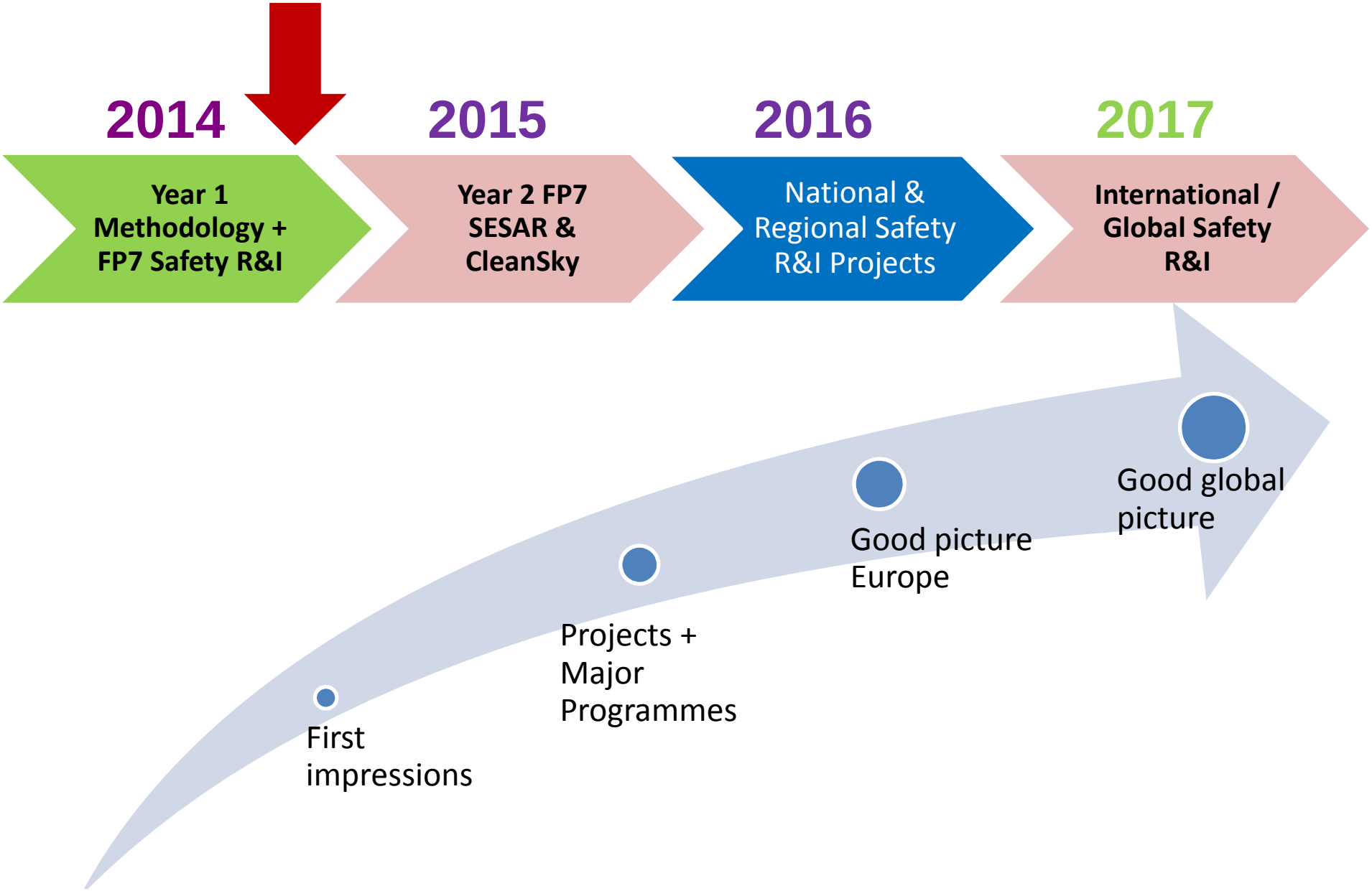
Bottlenecks…

- Data issues (sharing of data and data protection)
- Legal and organisational issues surrounding changing stakeholder responsibilities, e.g., automation
- Realising radical innovative ideas
- Certification issues regarding, e.g, automation and mitigation of environmental hazards

Reflections

- The Safety R&I reviewed will be useful both at the sharp end (e.g. pilots in emergencies; icing) and at the more systemic end (e.g. certification and risk management)
- A number of Projects are addressing key strategic safety issues
- However, from the SRIA perspective, the R&I is *tactical* rather than *strategic,* and there may be cost inefficiencies
- Some items for consideration:
  - Addressing under-researched Capabilities/Enablers
  - Projects/Programmes that have a full-capability scope
  - Human Factors is a key Enabler but is not sufficiently integrated into the Air Transport System in Europe

Next Steps

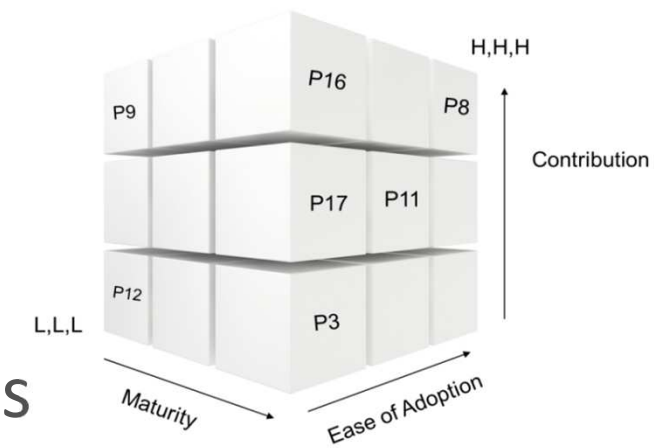

2014
2015
2016
2017
Year 1 Methodology + FP7 Safety R&I
Year 2 FP7 SESAR & CleanSky
National & Regional Safety R&I Projects
International / Global Safety R&I
First impressions
Projects + Major Programmes
Good picture Europe
Good global picture

Next time OPTICS will identify:

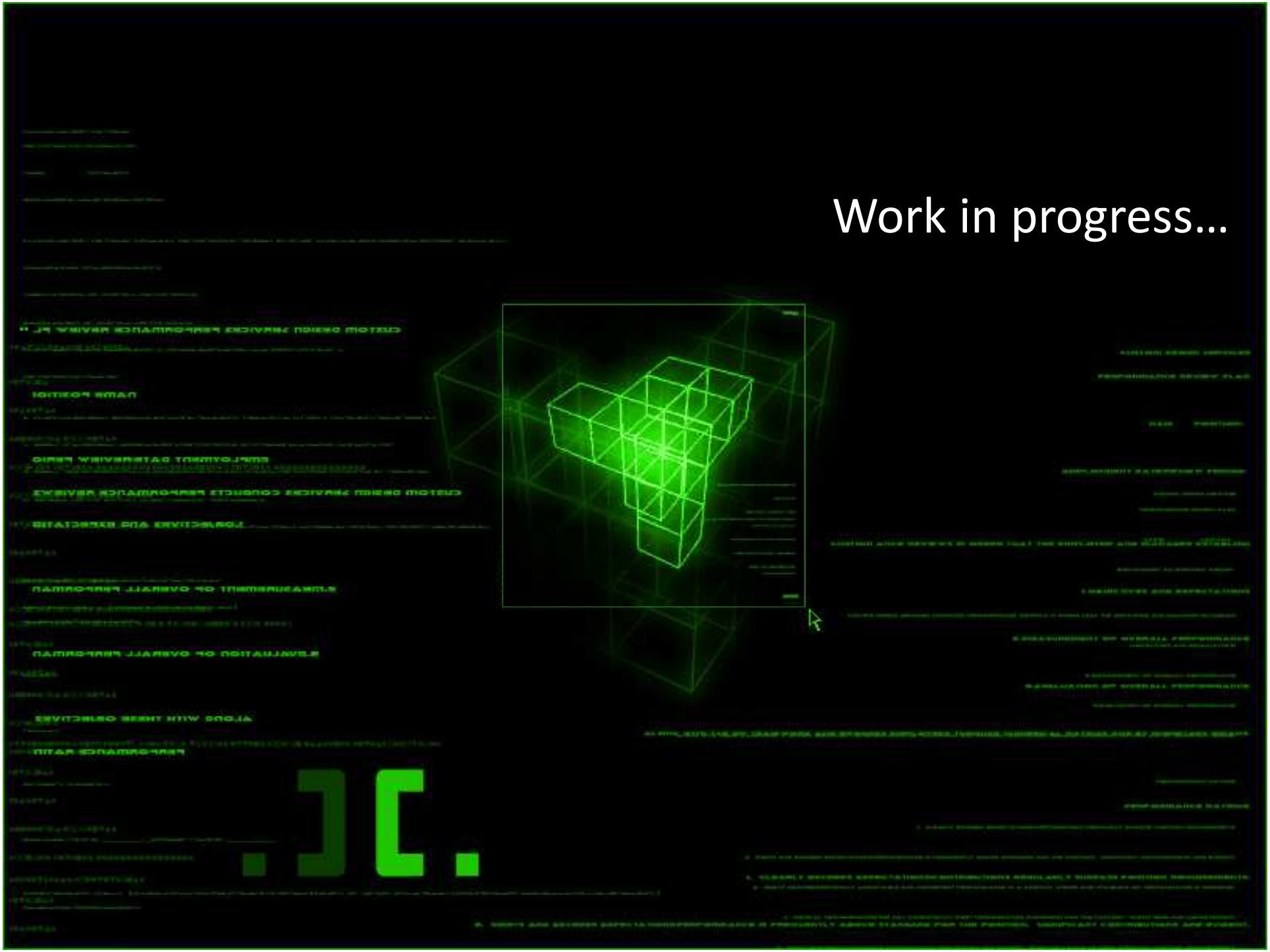
The Safety Value of these and other Projects

High-value Projects & Research Avenues

- Too much effort in an area
- Too little effort in an area
- Where effort is too fragmented
- Identifying common bottlenecks
- Where we need Low-TRL research
- Where it is time for High TRL research, rather than endless recycling



Work in progress…



Thank you for listening. Questions?

http://www.optics-project.eu/

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