

All Condition Operations and Innovative Cockpit Infrastructure

New Projects Developing Avionic Systems and Flight Deck Operations, and their Contribution to Future Air Traffic Management

22nd June 2010

Pullman Hotel, Brussels

A European Commission Seventh Framework Programme

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Content of Presentation



1. Problem Domain
2. ALICIA Objectives
3. ALICIA work focus
4. Relationships with other EU Projects

PROBLEM DOMAIN



- Air transport demand is increasing – Europe/Global
- Legacy ATS requires modification – Europe/Global
- Weather related delays – significant cost impact
- Manufacturing industry; product innovation essential to sustain European employment
- Global competition
- Aircraft cockpit systems integration complexity
 - Aircraft/ATC level
 - Crew/avionic systems
- Emerging technological enablers
- Successful design definition only through teamwork
- Customer/consumer expectation

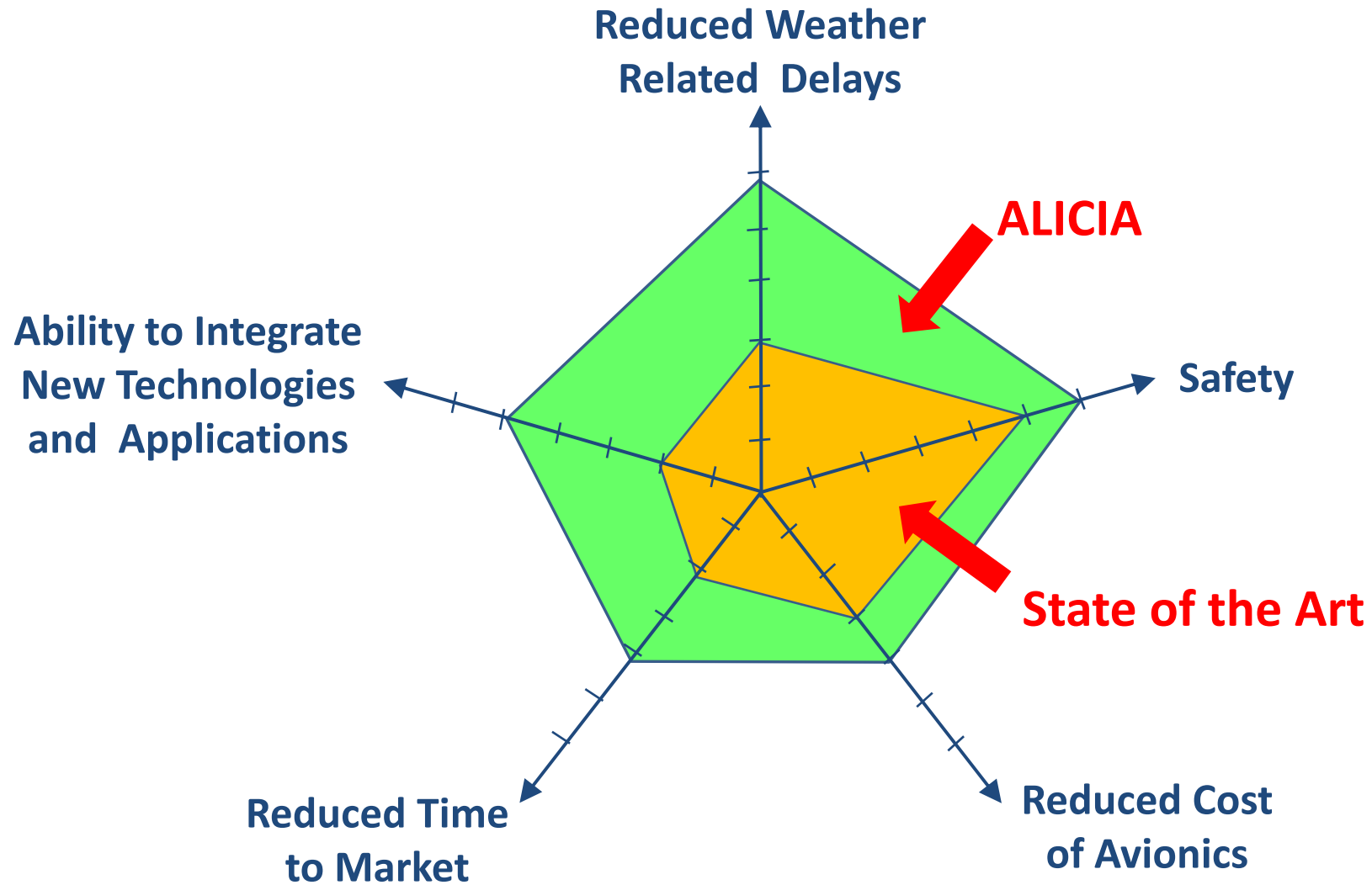


1. To develop and All Conditions Operations Capability to reduce weather related delays by 20%
2. To develop a new flight deck architecture facilitating the introduction of new technologies and applications, applicable to a broad range of aircraft types (professional operations)



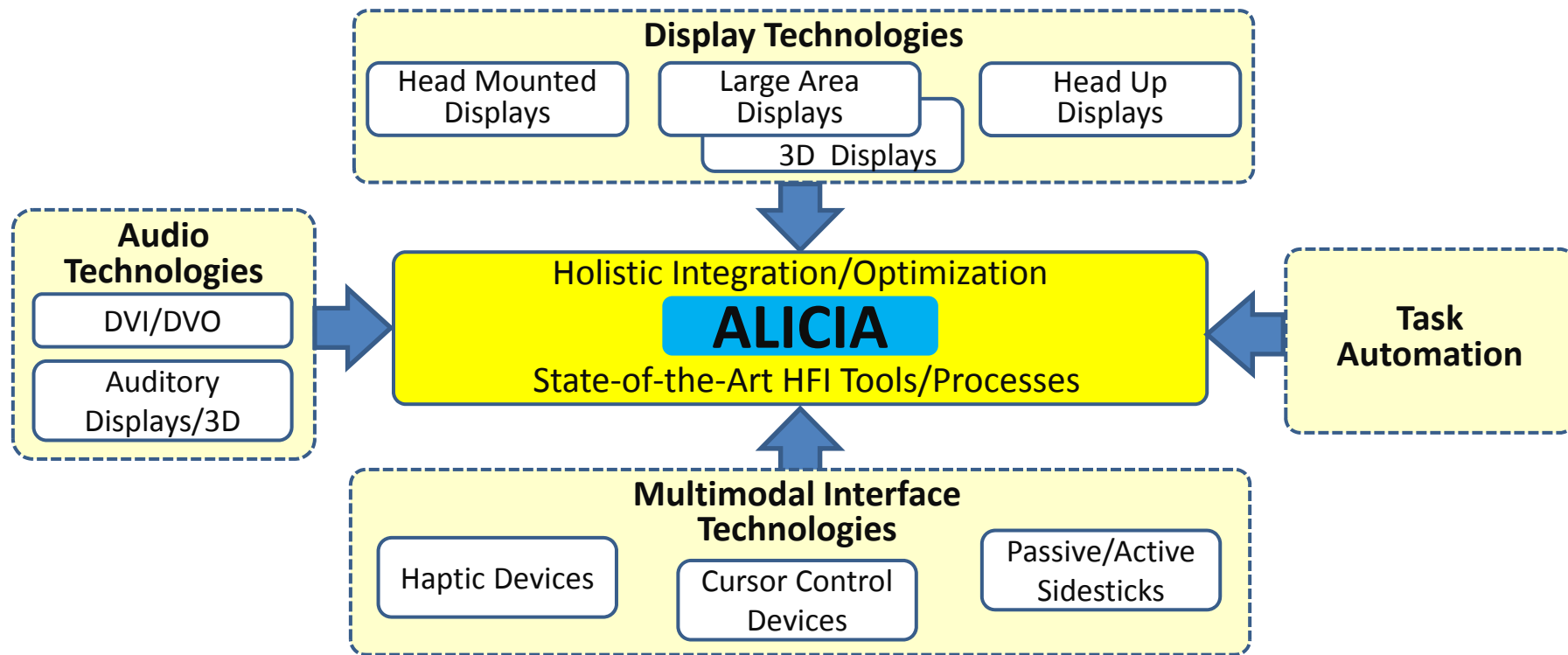
- To enhance safety within the air transport system
- To reduce the time-to-market of complex, integrated avionics systems
- To reduce through-life costs
 - Crew training and type approval; common HMI philosophy
 - Obsolescence; equipment interoperability
 - Re-design & certification; cross platform standards

Business Context – The Goals



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- All Condition Operations is just one axis of a technology frontier that will arrive in the next generation cockpit



New cockpit architecture supporting the integration of new technology

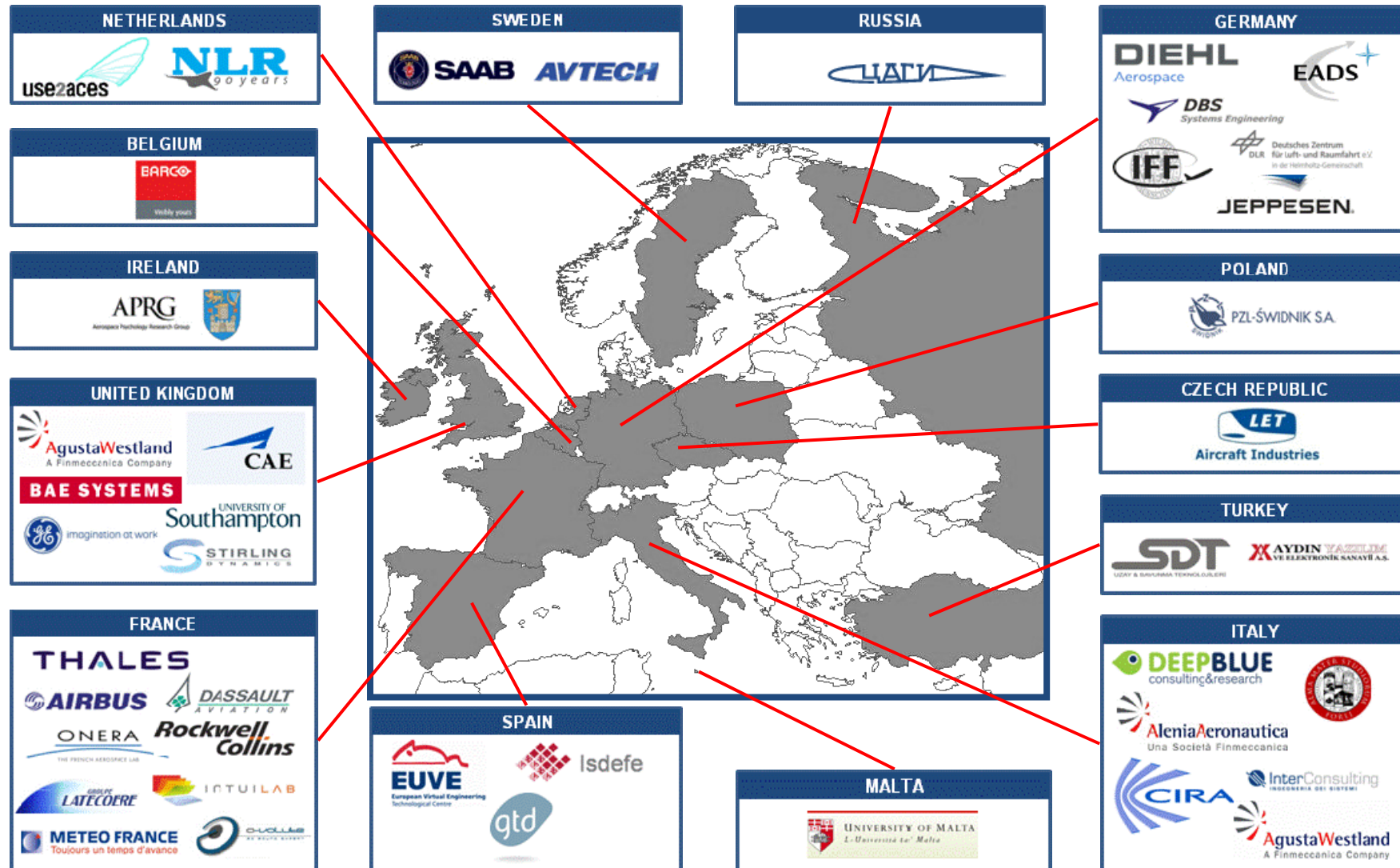
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Overview of the project

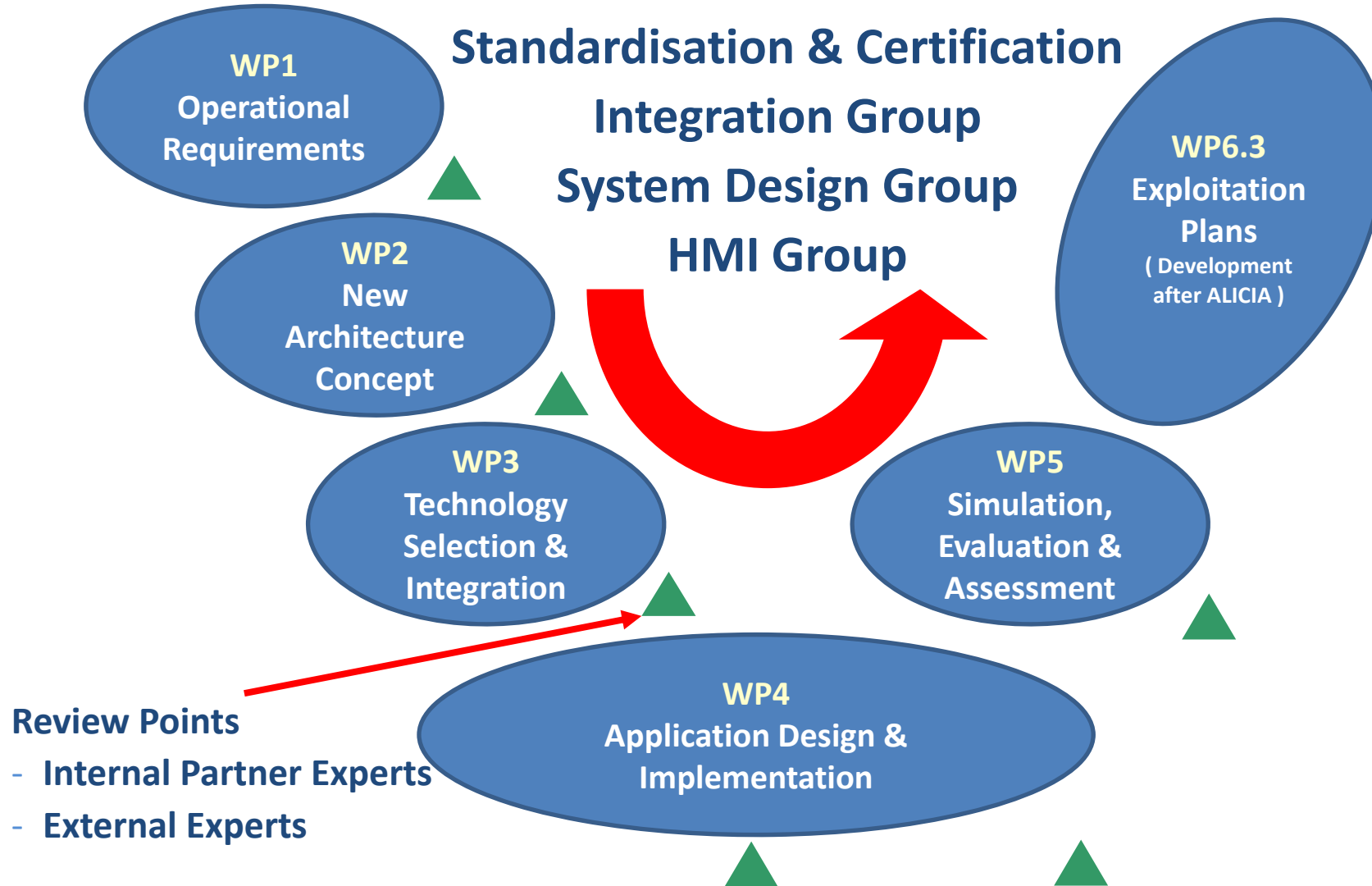


- The ALICIA consortium has been formed from 42 partners
- Consortium Balance:
 - Platform Integrators (8)
 - System / Equipment Suppliers (8)
 - Technology Specialists (8)
 - Research Organisations (7)
 - Universities (5)
 - Experts (6)
- 48 months duration
 - Started September 2009
 - Finishes August 2013
- Overall Value: 46.7M Euro , EC Grant: 27.8M Euro

Overview of the project



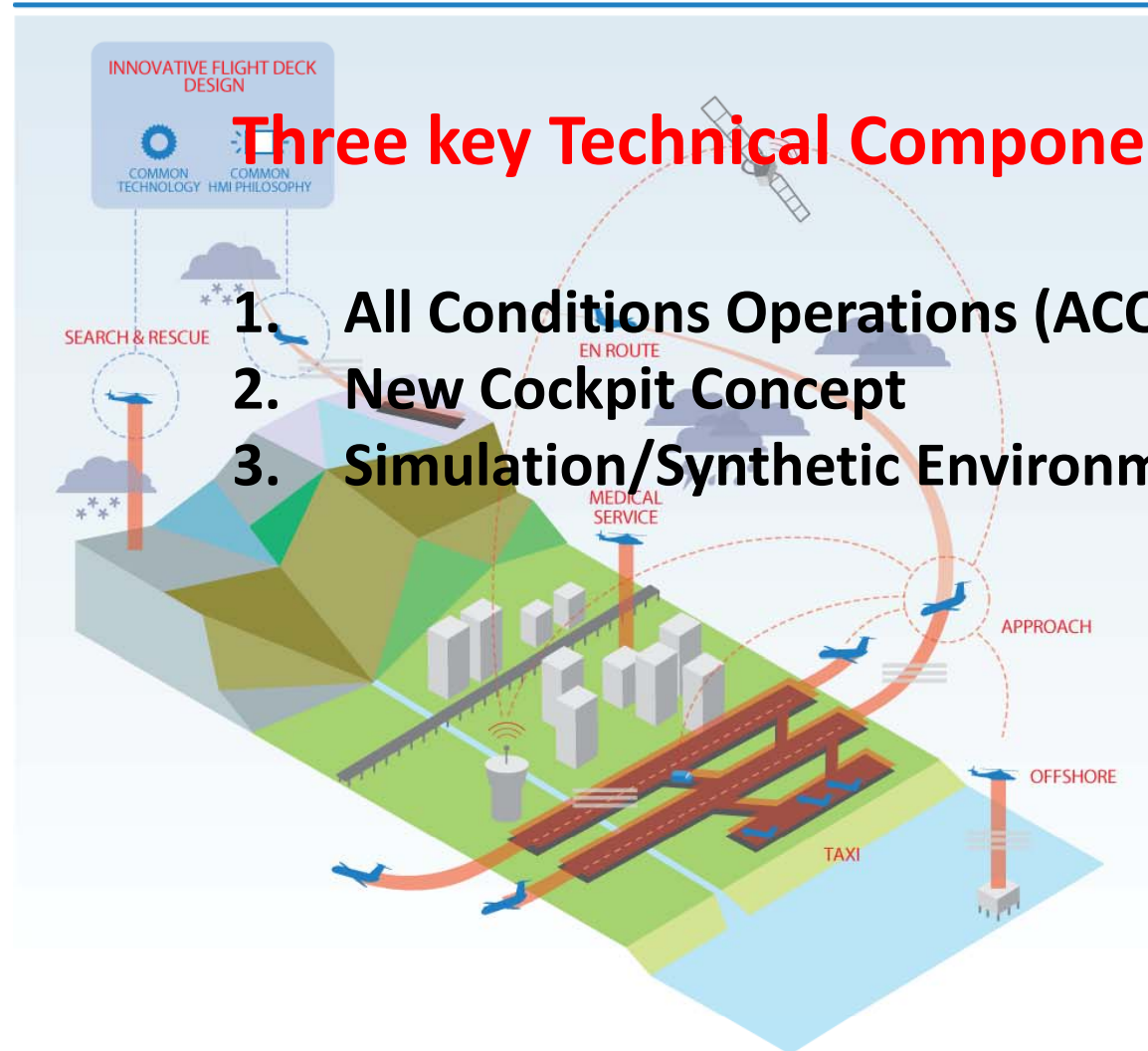
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ALICIA Overall Concept



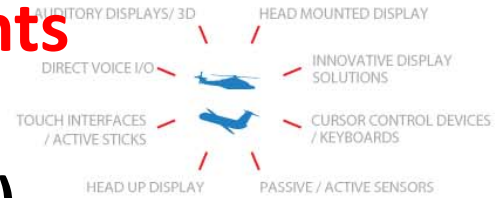
ALL CONDITION OPERATIONS AND INNOVATIVE COCKPIT INFRASTRUCTURE



Three key Technical Components

1. All Conditions Operations (ACO)
2. New Cockpit Concept
3. Simulation/Synthetic Environments

INNOVATIVE FLIGHT DECK DESIGN



- Designing a common innovative infrastructure both for fixed-wing and rotorcraft.
- Harmonising the presentation and management of common functions for any aircraft.

TRAFFIC AND WEATHER AWARENESS



Using situational awareness data transmitted by fixed-wing aircraft, rotorcraft, ATC, WIMS and airport ground vehicles.

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Extending The Aircraft Operating Envelope:

- Approach/Landing
- Ground Movement
- Atmospheric Conditions
- Obstacle/Threat Conditions



- Decision height below **200 feet** for all equipped aircraft on almost all runways/landing sites in low visibility/bad weather conditions
- More autonomous taxiing capability in low visibility/bad weather conditions
- Optimized flight efficiency and safety by providing an accurate picture of the weather situation around the aircraft and along its intended trajectory

New Cockpit Concept – ALICIA improvements



- Key drivers:
 - SESAR functionality
 - ACO functionality
 - Avionic equipment cost
- Optimising crew workload
- Increased standardisation across a broad range of aircraft platform types; architecture & HMI
- Significant reduction in cost and time to market for new cockpit systems

New Cockpit Concept – domain focus



- Cockpit Audio Environment
- Display Technologies
- System Management/Control Functions
- Human Machine Interface (HMI)
- Crew Station Layout
- Automation
- Holistic Integration



- ACO solutions – complexity of demonstrating safety compliance
 - Safety risk to the aircraft
 - Safety risk to the crew
 - Scheduling the weather conditions!
 - Boundary testing vs detailed testing

- Cockpit systems integration safety compliance
 - Cost of development testing
 - Cost impact of system change, e.g. test/re-certification
 - Availability of skilled resource



- Operational requirements
- System (avionic) Architecture
- Technology enablers
 - At the aircraft level
 - At the avionic equipment level

ALICIA Relationship with other projects

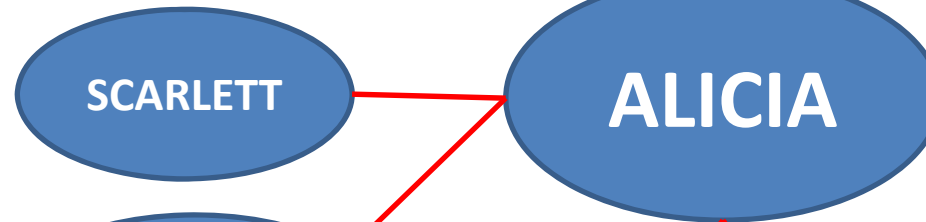


Joint Undertaking



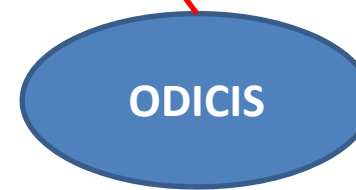
Level 2

Integrating Projects

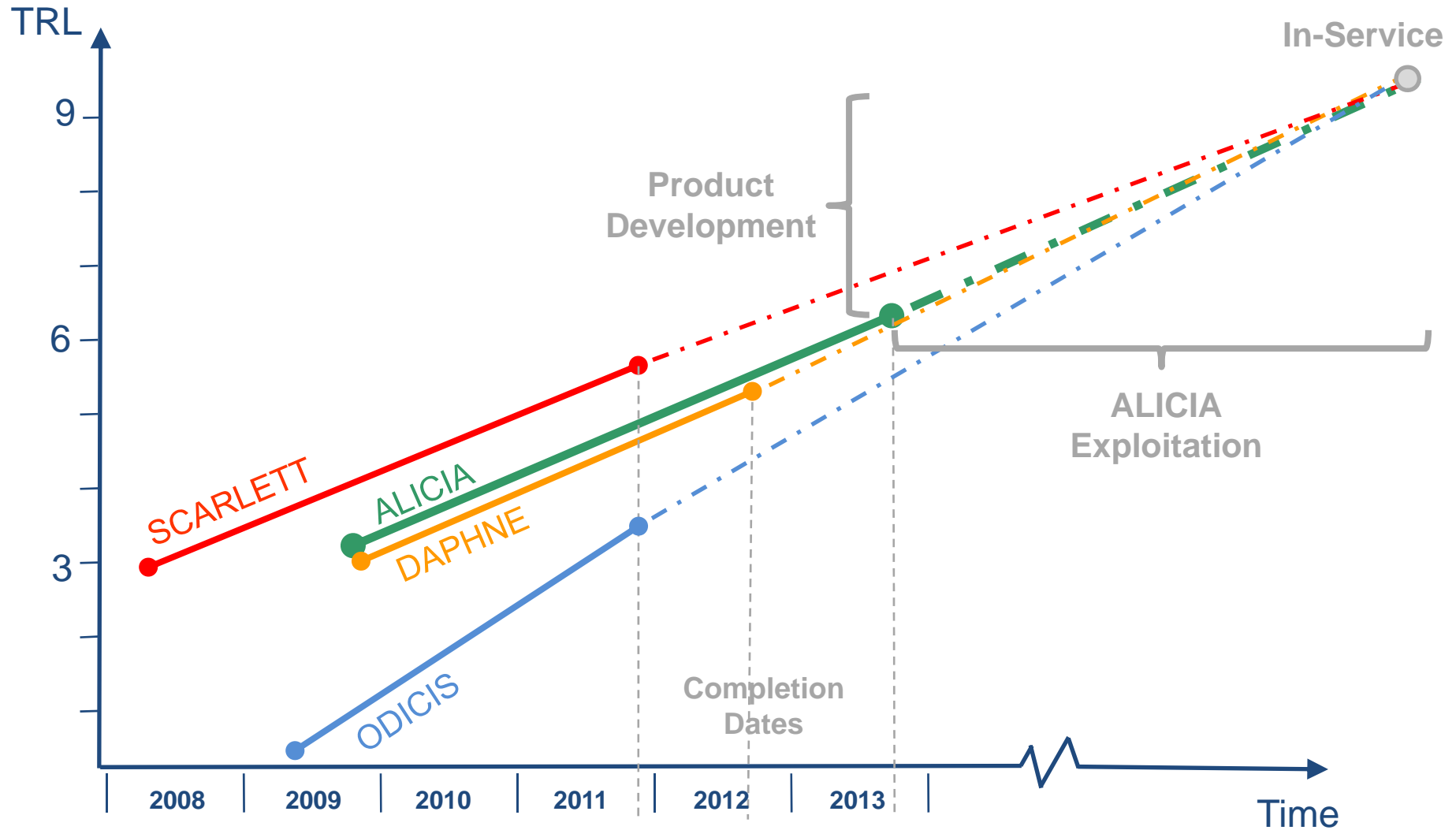


Level 1

Research Projects



ALICIA Relationship with other projects



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SESAR statements

- SESAR is the Technological Pillar of the Single European SKY programme
- Develop a modern, high performance Air Traffic Management - ATM
- Develop a New Concept of Operation – 4D Trajectory Management
- Full integration of the Aircraft in the ATM system
- Develop a new type of wireless communication and Data Exchange
 - *fundamentally different from present communication*



SESAR objectives 2020-2025

- Increase safety by a factor of 10
- Triple capacity
- Reduce ATM costs per controlled flight by 50 %
- Reduce environmental impact by 10%
- Also addressed:
 - Security, Efficiency, Flexibility, Predictability,
 - Global Interoperability,
 - Access, Equity



SESAR and ALICIA

- **SESAR** deals with Transport Operation – primarily Fixed Wing Aircraft →
ALICIA deals with multi-type Operation – Fixed and Rotary Wing Aircraft
- **SESAR** deals with the concept of transport operation and traffic goals →
ALICIA deals with needed tools and methods to achieve SESAR concept and objectives
- **SESAR** is largely european ATM oriented (ex. Eurocontrol, Single European Sky) →
ALICIA will have to be more global



SESAR and ALICIA

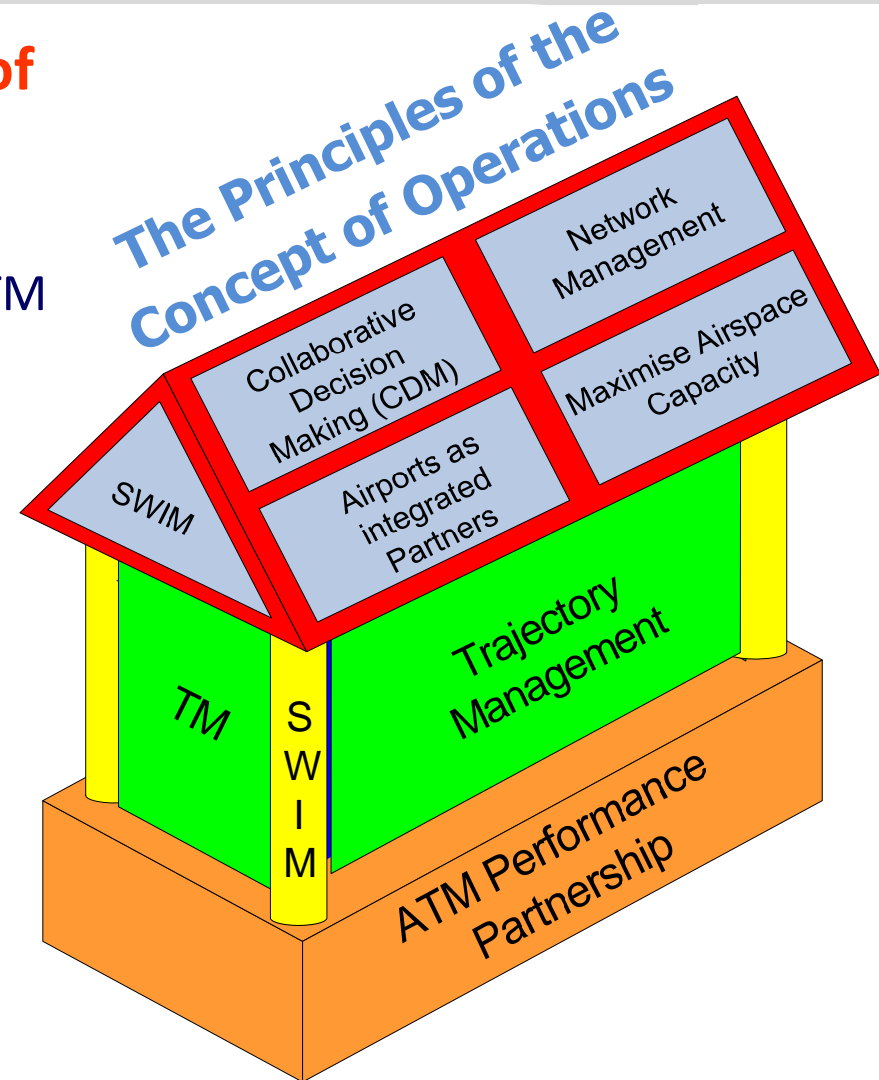
- Six key and vital enablers are identified:
 - Information Sharing
 - Collaborative Decision Making
 - Network Management
 - Airport as integrated partners
 - Maximise Airspace Capacity
 - Reduce environmental impact
- Trajectories are Managed through:
 - System Wide Information Sharing (SWIM)
 - Collaborative Decision Making (CDM)

Remarks:

All actors (ex. Users, ANSPs and Airports) in the ATM System are integrated in The ATM Performance Partnership (ATMPP)

The Human will remain at the core of The Concept – at all levels

- All actors (Users, ANSPs and Airports) in the ATM System are integrated in The ATM Performance Partnership (ATMPP)
- Trajectories are Managed through:
 1. System Wide Information Sharing (SWIM)
 2. Collaborative Decision Making (CDM)
- Five Key enablers have been identified, each of them is vital:
 1. Information Sharing
 2. Collaborative Decision Making
 3. Network Management
 4. Airport as integrated partners
 5. Maximise Airspace Capacity





OPERATIONAL REQUIREMENTS

- ACO challenges for rotorcraft & small aircraft
- Genuine operating constraints (weather related):
 - Off-shore (rig) operations
 - EMS
 - SAR
 - Surveillance
- Operations from small sites/regional airports
- Extending the SESAR concept to unmanaged airspace?
 - Transitioning to/from managed airspace
 - Self separation and multi-lateration
 - Enabling of ACO operations
 - Minimum equipment fit



- Detailed discussions with SESAR
- Workshop with Regulatory & Airworthiness Authorities
- ALICIA Operational concepts will evolve over the life of the project
- End 2010 – Operational requirements baseline
- Mid 2011 - Safety requirements baseline



SYSTEM ARCHITECTURE PROCESSING

- Applicability to cockpit systems
- Scalable; small rotorcraft & fixed-wing aircraft (professional platforms) to large fixed-wing aircraft
- Improved health monitoring
- Redundancy management for improved safety and impact on operations; ACO functionality
- Data interface technologies; physical layer to application layer (protocols)



- Q1 2011 – System architecture baseline
- ALICIA system architecture concepts will evolve over the life of the project
- Common Partner involvement (cross-fertilisation)



COCKPIT HMI

- Road mapping beyond 2020; trade studies
- Display symbology/HMI
- New functionality from developments in system technology
- Rationalisation of Cockpit equipment.
- Increase system flexibility for upgrades
- Increase in display size – single display



- Q1 2011 – HMI philosophy baseline
- ALICIA HMI philosophy concepts will evolve over the life of the project
- EEAG interaction



SYSTEM ARCHITECTURE INFRASTRUCTURE

- ACO functionality dependency on high-bandwidth data distribution
- Real-time safety critical
- Scalable
- Ease of partitioning safety related and utility data
- EMI; high-bandwidth = data integrity risk
- Standardisation; components, configuration, protocols
- Current industry baseline – ARINC664 over multimode fibre



- Q1 2011 – System architecture baseline
- ALICIA system architecture concepts will evolve over the life of the project
- Common Partner involvement (cross-fertilisation)



- HEDGE*
- GIANT-2*
- EMMA II*
- FLYSAFE
- OPTIMAL
- ANASTASIA
- HILAS
- EMMA

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