



EUROPEAN COMMISSION
European Research Area



MINISTERIO
DE CIENCIA
E INNOVACIÓN



Centro para el Desarrollo
Tecnológico Industrial



SEVENTH FRAMEWORK
PROGRAMME

Sixth European Aeronautics Days

Aerodays 2011

Innovation for a Sustainable Aviation in a Global Environment

30th March - 1st April 2011

Madrid (Spain), Palacio Municipal de Congresos

<http://www.aerodays2011.org/>



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Weather hazards : How to best respond to this challenge?

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Content

- Preamble
- WEZARD Project
- Conclusion & Way forward



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Content

- **Preamble**
 - Context
 - Needs
 - Technical topics
- WEZARD Project
- Conclusion & Way forward



Weather Hazards - Context

- **Volcanic Ash**
 - The recent volcano eruption in Iceland has revealed to which extent our society and our economy relies on the availability of a safe and efficient air transport system and management.
- **SLD, Mixed phase & Ice Crystals**
 - Peculiar icing conditions, like rapid ice build up under encounter with **Supercooled Large Droplets** (SLD) have been incriminated as significant contributors in accident which involved aircraft icing in flight (ATR-72 accident at Roselawn, Indiana, USA in 1994).
 - An increasing number of Aircraft in-service issues (engine damage, power loss,...) is suspected to be linked to the encounter of other particular icing conditions: **High Altitude Ice Crystals**
 - In 2009, the EHWG and IPHWG proposed a draft of regulation to FAA/EASA
 - The corresponding regulation (**Appendix O and D** for FAR25/33 and CS25/CS-E) has been proposed for comments to industry (FAA **NPRM 10-10** in June 2010, **NPA 2011-03 CS25 & 2011-04 CS-E** based on FAA NPRM 10-10 in March 2011) and could be **applicable by beg 2012**
- **Other weather hazards**
 - Dust, sand, hail,...

NPRM : Notice of Proposed Rulemaking ; NPA : Notice of Proposed Amendment



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Weather Hazards - Needs

- To ensure **safe operation of Aircraft** wrt hazardous weather conditions
- To optimize the use of the **Airspace** in hazardous weather conditions
 - ATM procedure improvement, Operational meteorological prediction, monitoring and dissemination systems,...
- To support international **rulemaking** wrt Aircraft operation in hazardous weather conditions
 - Ash encounter policy,
 - SLD, mixed phase & Ice crystals: The whole European aeronautical industry needs to anticipate the regulation change, and to develop means of compliance.
- To optimize **economic operation** in hazardous weather conditions
 - Economic tolerance threshold definition, Monitoring, Maintenance requirements, opportunity for more robust design



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Weather Hazards – Technical topics

- **The improvement of the identification and the characterization of the so-called hazardous weather conditions** in order to define international standards regarding for instance the nature, the size and the density of all kind of particles e.g. in the plume of a volcano, in high altitude clouds, etc..
- **The development of test facilities** for the reproduction of the hazardous weather conditions and the analysis of their effects on airframe, engines, flight control systems etc...
- **The development of needed technologies**
 - **Measurement means** to support the characterization of those conditions and the calibration of the test facilities
 - **Detection or awareness technologies** (probes or/and radar) for realistic on board integration (acceptable cost/availability/performance etc.) enabling the crew to identified encountered hazardous weather conditions and to respond to them in an appropriate manner
 - Any other requested technology such as surface coating in order to increase component service life (e.g. windshield)



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Weather Hazards – Technical topics

- **The development of models and computational means**
 - Understanding of macro-physics and micro-physics of phenomena and modeling
 - Deterioration modeling
- **Enhanced coordination and collaboration** to further improve access to observations, and to improve numerical weather prediction modeling for aviation
- The development of capabilities aiming at monitoring the flow of information, the implementation of operational and **Air Traffic Management**-related procedures and process to improve the response in the case of major air traffic disruption linked to “hazardous weather conditions”



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WEZARD - Generality

CSA-SA WEather haZARDs for Aeronautics

- **Activity in Work Programme:** 7.1.7. CROSS-CUTTING ACTIVITIES
- **Area in Work Programme:** AAT.2011.7-23 - Technology support for crisis coordination for the air transport system following major disrupting events
- **Coordinator:** Airbus Operations SAS  AIRBUS
AN EADS COMPANY
- **Objectives:** To define and coordinate the actions of research related to weather hazards with the aim to increase the robustness of the air transport system
- **Project duration:** 24 months



WEZARD - Objectives

- Set-up an **interdisciplinary and cross-sectoral network** (comprising expertise from observation and measurement, modeling, the aeronautics industry, aircraft operators, network managers, risk management specialists, scientists, etc.)
 - Compile a list of the **main weather hazards** and their technical consequences on the A/C (failures, damages, etc.)
 - Perform a **state of the art review** of the research actions related to weather hazards for aeronautics.
 - Perform an in-depth analysis which will **identify the gaps** in the available knowledge, the **priority areas for improvements** and the type of activity needed to develop a safer air transport system and limit the effects of disrupting events caused by hazardous weather conditions.
 - Provide a consolidated **recommendation and roadmap report** validated by the main stakeholders of the aeronautics community.
- **To identify and propose activities and topics to be investigated by relevant Level 1 and/or 2 project(s) into the FP7, 5th and/or 6th call**



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WEZARD - Consortium

- **13 partners** comprising expertise from observation and measurement, the aeronautics industry, scientists, etc.

Airframers	Engine manuf.	Equipment & System suppliers	Research institutes	Meteorology	Test facilities	Authorities



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WEZARD - Consortium



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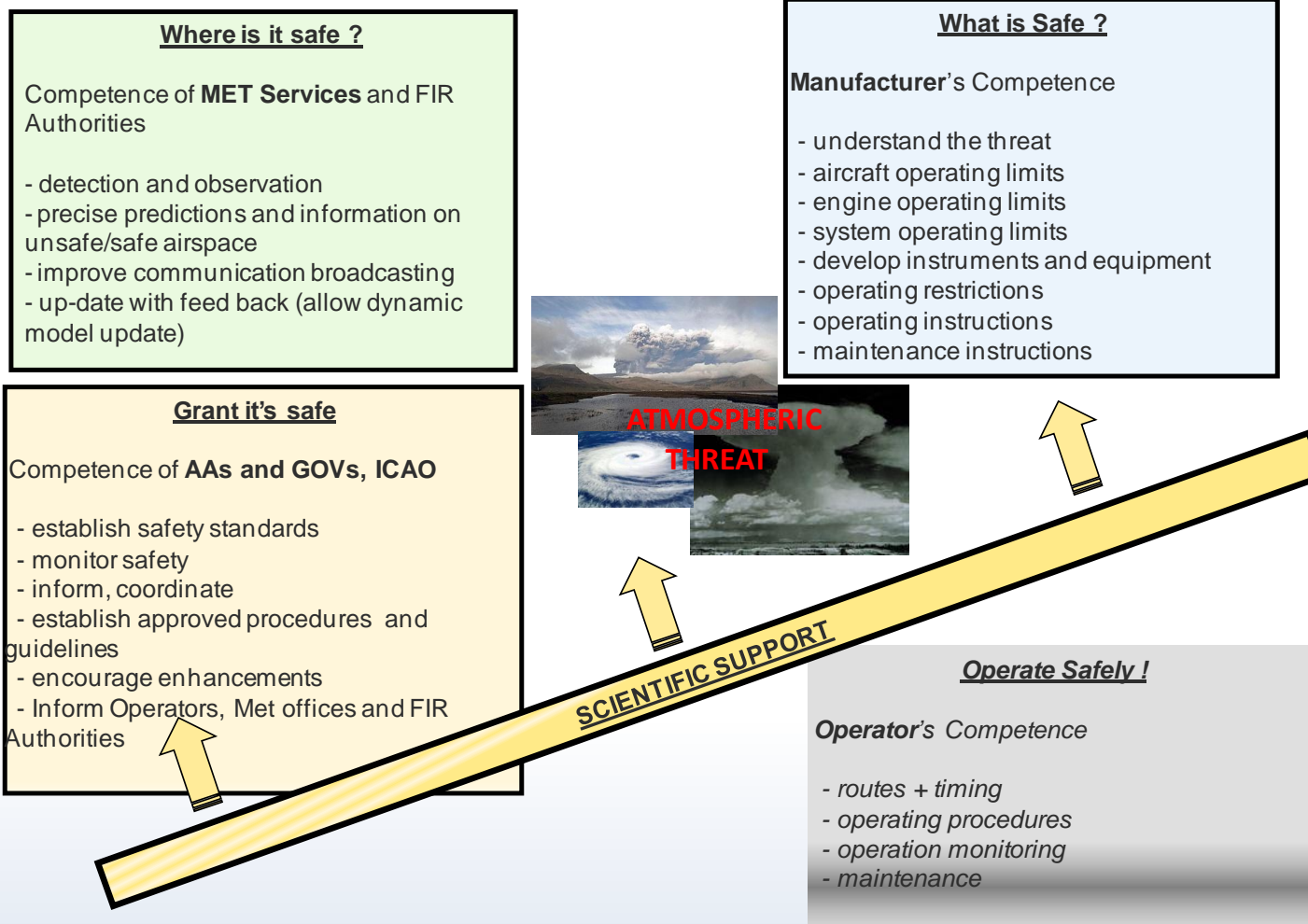
- An **Advisory board** to get access to a larger panel of experts from European companies, organizations and agencies

Airframers						
System suppliers						
Research institutes & Univ.						
Meteorology, Sat Agencies						
Test facilities						
Authorities						

Airlines (action on going)



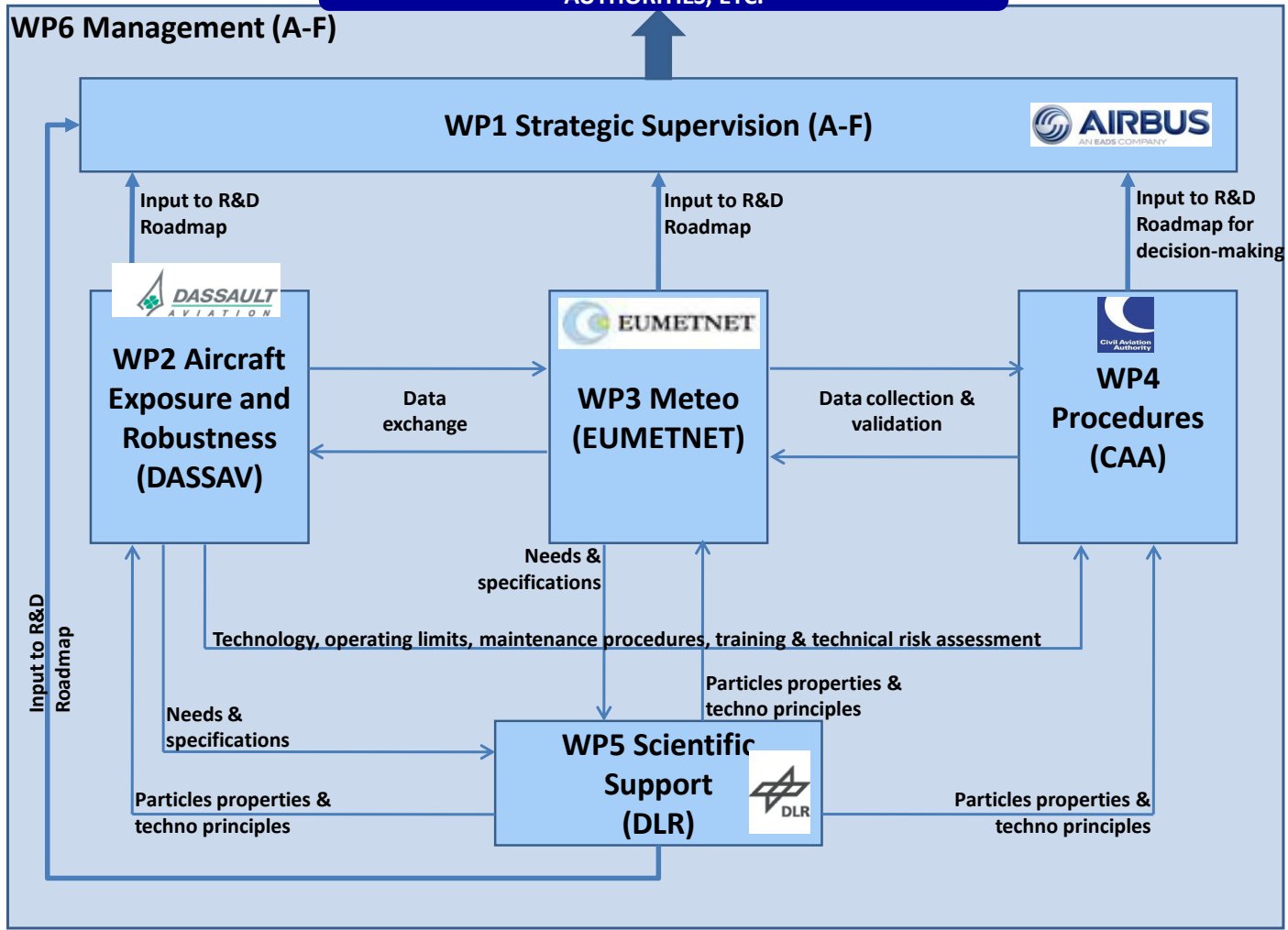
WEZARD - Concept





WEZARD - WBS

R&D ROADMAP RELEASED TO EC, ADVISORY BOARD, AUTHORITIES, ETC.





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WEZARD – Conclusion & Way forward



- Conclusion

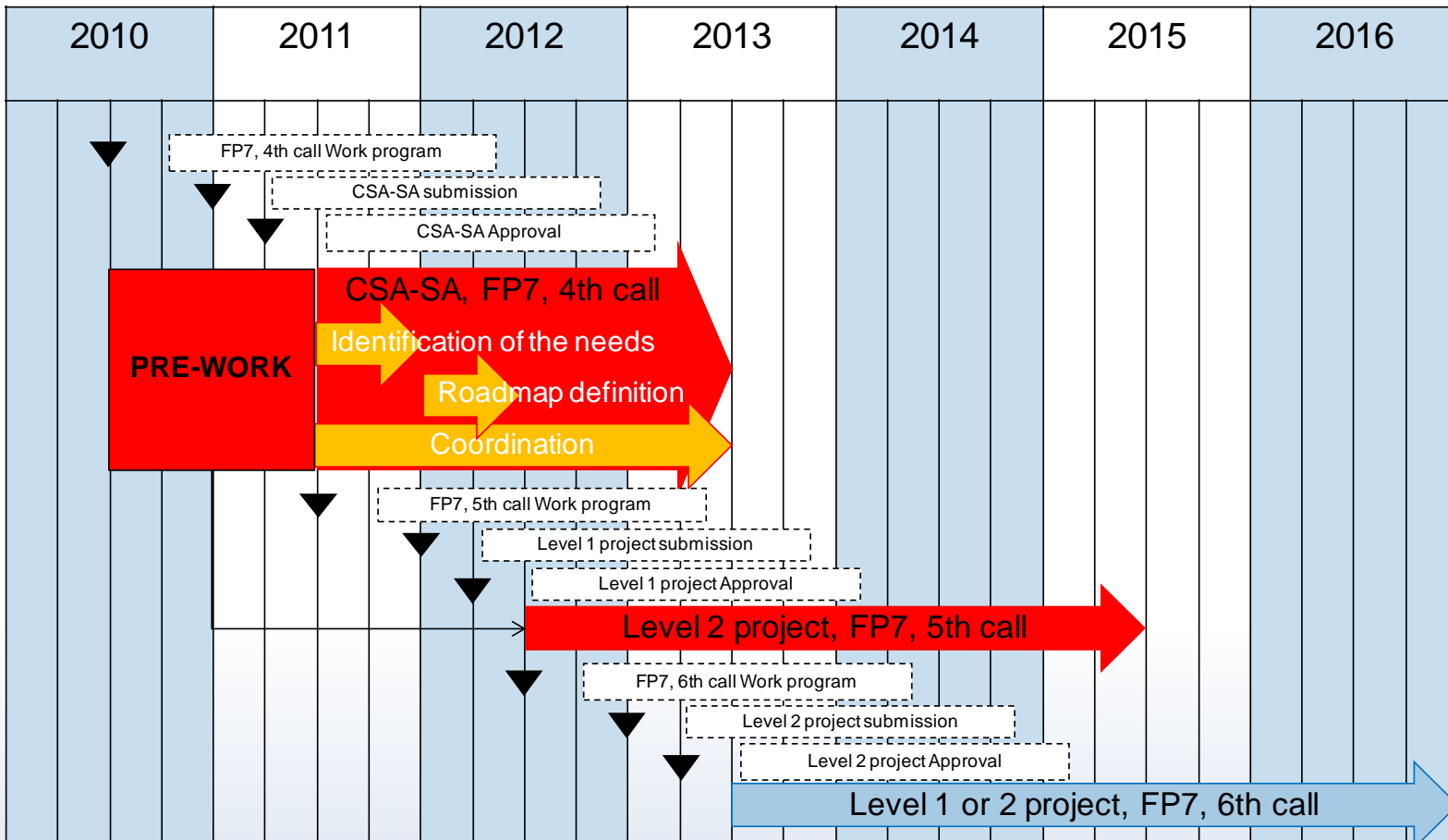
- The results of this work will provide:
 - **An interdisciplinary and cross-sectoral network**
 - **A state of the art review** of the on-going research actions.
 - An in-depth analysis which will **identify the gaps**, the **priority areas for improvements** and the **type of activity needed** to develop a safer air transport system and limit the effects of disrupting events.
 - **A consolidated recommendation and roadmap report** validated by the main stakeholders of the aeronautics community.
- This study should also **identify, federate and improve synergies that may emerge from already existing R&D projects or programs**
- Finally, WEZARD could contribute to the definition of the next Aeronautic and Air Transport Work Programme by **identifying and proposing activities and topics to be investigated by relevant Level 1 and/or Level 2 projects in the FP7 5th and 6th Call for proposals**
- **WEZARD proposal successfully passed all evaluation thresholds with a total of 13/15**
 - **GO for initiating negotiation process**



WEZARD – Conclusion & Way forward



- Way Forward





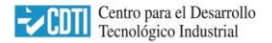
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Back up



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WEZARD - WBS

WP1 : Strategic Supervision

AIRBUS (Coord)	The Core Team
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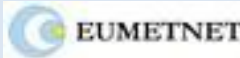


The objectives of the WP1 are to ensure momentum and **strategic guidance** to the WEZARD project. In particular, the WP1 will consolidate and integrate in a common roadmap the contributions of the WPx.0.

The WP1 will ensure as well the **coordination** of the project with others actions of research already launched at national, International or/and European level, such as, ICAO IVATF, SESAR, NextGen, IAGOS, EUFAR, EARLINET, EXTICE, EIWG,...

Finally, the WP1 will ensure **internal and external communication** (ECATS)



WEZARD - WBS

WP2 : A/C Exposure & Robustness							
AIRBUS	DASSAULT AVIATION (coordinator)	BOEING BR&TE	SAFRAN	ROLLS ROYCE	EUMETNET	DLR	THALES AVIONICS
							

The objective is to build an integrated and consolidated roadmap regarding
Manufacturer aspects

- Identify **threats** and **Technical risk assessments** applicable to aircraft and engine systems
- Review how those threats are accounted for at design level or operational level
 - **Identification of research priorities**: Ground tests, embedded sensors, meteorological data relay, communication datalink...



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WEZARD - WBS

WP3 : Meteo

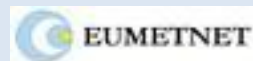


AIRBUS

EUMETNET
(Coordinator)

CNR-IMAA

DLR






The objective is to build an integrated and consolidated roadmap regarding **Meteo aspects**

- Improving **data usage**
- Improving **observation capabilities**
- Improving **data assimilation and outputs**
- Improving **communication broadcasting**



WEZARD - WBS

WP4 : Procedures					
AIRBUS	DASSAULT AVIATION	BOEING BR&TE	SAFRAN	ROLLS ROYCE	CAA (Coordinator)
					

The objective is to build an integrated and consolidated roadmap regarding

Procedural aspects

- Review **Safety standard**
- Review **Procedures**
- **Air Traffic Management**



WEZARD - WBS

WP5 : Scientific Support



DLR (Coord.)	AIRBUS	Dassault Aviation	SAFRAN	ONERA	EADS IW	EUMETNET	DGA	CNR-IMAA
								

WP5 Scientific Support will project on the capacity of the scientific community to better **understand, observe** (onboard sensor, Lidar, Radar, satellites, UAS,...), **reproduce** and **simulate on hazardous particles**, supporting the assessment performed in WP2, WP3 and WP4.



CSA-SA on Weather Hazards for Aeronautics

- **Activity in Work Programme:** 7.1.7. CROSS-CUTTING ACTIVITIES
- **Area in Work Programme:** AAT.2011.7-23 - Technology support for crisis coordination for the air transport system following major disrupting events

Expected impact: The Eyjafjallajökull eruption in Iceland and the dramatic consequences for air transport showed how important the quality of technological and data support available is to enable an appropriate risk assessment and adequate decisions to be taken in the case of incidences and events with potential effects on a large geographic scale and on complex systems with high safety requirements and a business driven approach as in air transport. On 27 April 2010 the Commission published an information note outlining the needs to accelerate research and development:

- To improve data collection and modelling methodologies such as satellite observation and imagery, atmospheric in situ measurements, dispersion models, etc.
- To establish input from geological, satellite and other observation and forecasting tools with technical risk assessments applicable to aircraft and engine systems, and the needs of safe air space and air traffic management.
- Reliability and more responsive validation of the risk assessment models supporting the decision making.
- To ensure that identified gaps of data and information are filled in order to support a robust and more detailed risk assessment for future such events.
- To adopt latest technology such as new onboard sensing technologies (e.g. Radar, Lidar, etc.).
- To analyse the use of unmanned aircraft systems (UAS) for atmospheric measurements, complementing as well as replacing the traditional in-situ measurements with balloons allowing continuous data collection.
- How different transport modes are able to react and compensate – in the event of a major shutdown of one of these modes – typically air transport.



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CSA-SA on Weather Hazards for Aeronautics

Scope: This Coordination and Support action is expected to support the stock-taking process for the above mentioned aspects through the **establishment of an interdisciplinary and cross-sectoral network** (comprising expertise from observation and measurement, aeronautics industry, aircraft operators and pilots, network managers, risk management specialists, scientists, etc.) and **to compile an inventory of recent and ongoing R&D activities** within relevant areas, and financed through different programmes at EU (FP5/6/7, environment, space/GMES, aeronautics, security, etc.) as well as at national level, and within relevant institutions, such as ESA and Eumetsat.

- The objective is **to compare, analyse and validate the results of relevant projects and activities in a structured peer review process**, and **to propose the most mature and relevant new developments** for concepts and methodologies, data sources and models, etc. for take-up in risk detection, assessment and risk management in the event of future such scenarios. For this purpose, one objective is to develop a coherent approach to the validation of the relevant input data, models, etc., targeted for the specific purpose of risk management in air transport, as developed and applied at European level and in ICAO.
- In addition, the needs and scope for further R&D and validation activities should be identified in an **R&D roadmap**.
- The areas considered should include **natural hazards** which have the potential to cause major disruption to air transport such as volcanic eruptions, earthquakes, unusual weather conditions, etc., as well as incidents resulting from human activities such as nuclear and other incidents/accidents, and terrorist attacks. The proposed network should involve input from manufacturers (airframe and engine manufacturers and equipment manufacturers for sensing issues) and operators (pilots) of aircraft, operations and safety related aspects. The involvement of relevant organizations from non-EU countries will be welcome.