Unusual Atmospheric Conditions

Mitigating Actions

Content

- ✓ Context
  - ✓ The current situation
    - ✓ What still needs to be done
      - ✓ How to make it happen

Context

Unusual Atmospheric Conditions

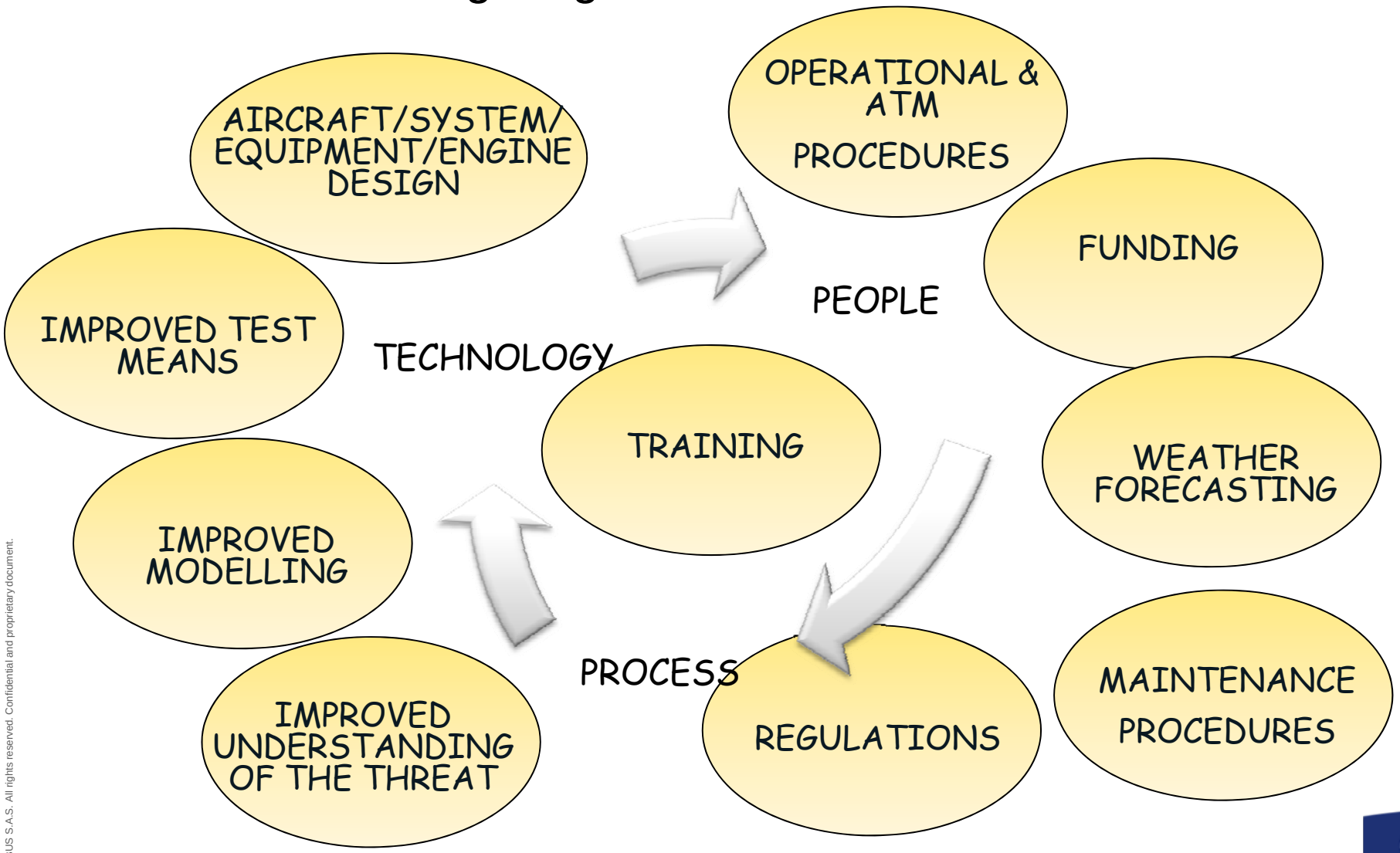
- Supercooled Large Droplets
- High Altitude Ice Crystals
- Mixed Phase Icing Conditions
- Hail, ash, dust, heavy rain…

Context - Focus of the presentation

- ✓This presentation will focus on two aspects
- ✓The draft new icing regulations and guidance material
- ✓Looking beyond the new regulations

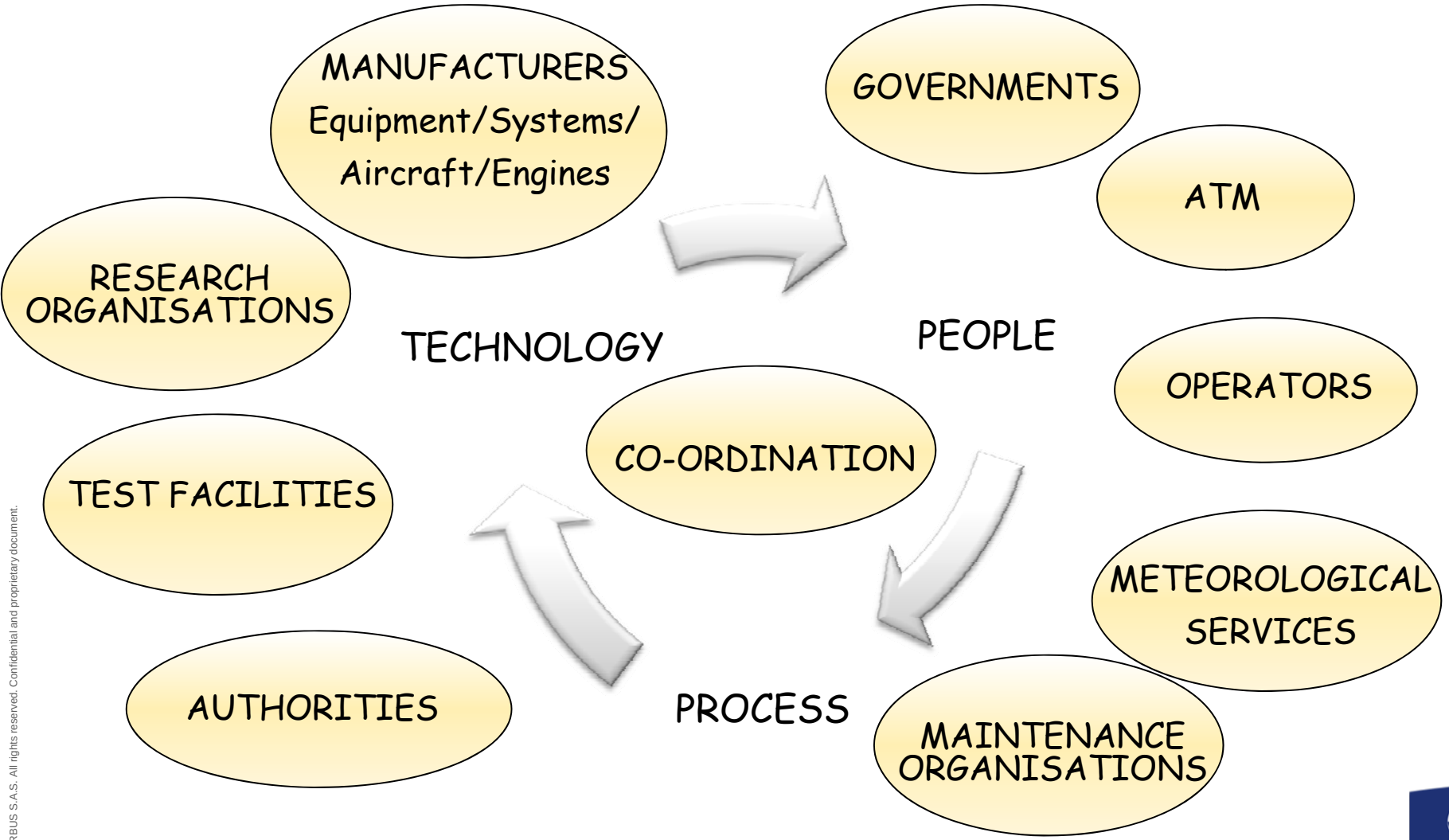
Context

- What are the mitigating measures?



Context

- What are the mitigating measures? Co-operation between all stakeholders.



Context

- To ensure continued **safe operation of aircraft** in unusual atmospheric conditions
- 4 classical methods
  - Avoidance
  - Detect and then operate safely while exiting these conditions
  - Detect if conditions are beyond a predetermined tolerance threshold, and then operate safely while exiting the conditions
  - Operate w/o restriction in the unusual atmospheric conditions
- Optimize the use of the **Airspace** in unusual atmospheric conditions
  - ATM procedure improvement,
  - Reliable Meteorological prediction, communication and archiving
- International **rulemaking** with respect to aircraft operation in unusual atmospheric conditions

Current Situation

- Increase of globally reported in-service events
- FAA NPRM related to new icing regulations and draft guidance material released for public comment between June and September 2010.
- The regulation and guidance material address:
  - Supercooled Large Droplets
  - Ice Crystals
  - Mixed Phase

Current Situation

- The weather conditions under which SLD and ice crystals may occur are largely understood

- Ongoing work to characterize ice crystal atmospheric conditions: water content, particle size etc.

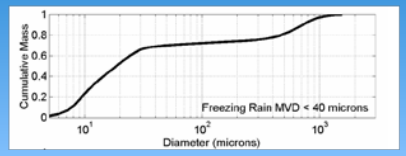
- Development of Means of Compliance
  - Icing tunnels, models, measurement means…

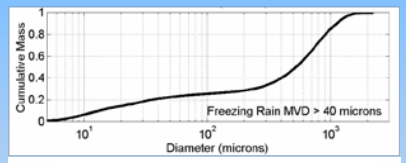
- Development of meteorological forecasting techniques

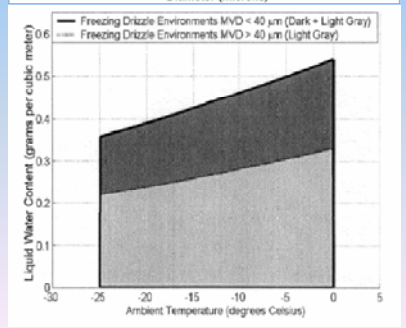
What has already been done? Regulations.

- Regulations NPRM 10_10 affects Part 25 and Part 33
  - Address SLDs, mixed phase and ice crystal conditions
- Draft Guidance Material: AC 20-147A, AC 20-XX, AC 25-1329-1B, AC 25-629-1X

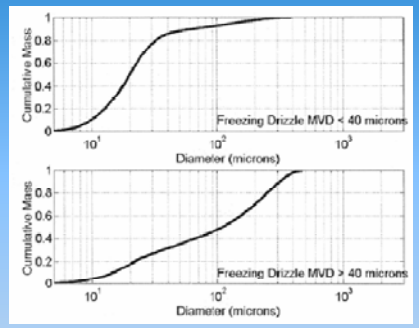
App. O SLD Freezing Drizzle

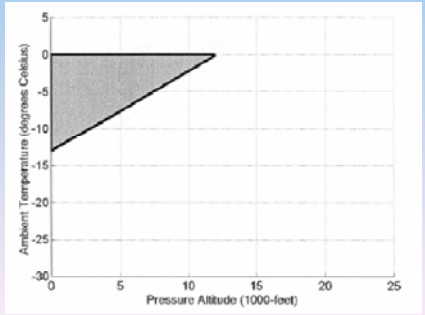




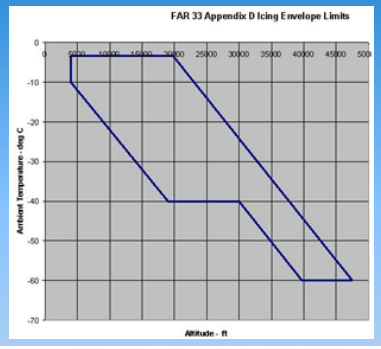


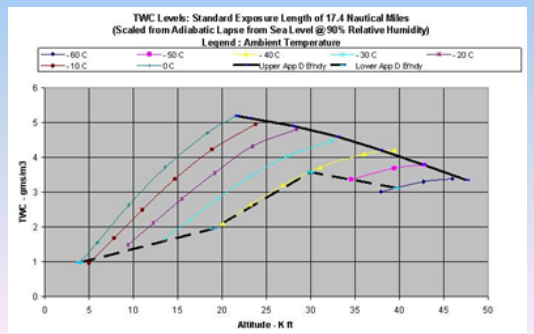
App. O SLD Freezing Rain





App. D Ice Crystals & Mixed Phase





What has already been done? Ongoing Activities

- Various relevant European icing, meteorological and ATM research projects completed or ongoing
  - EXTICE (FP7), EUSAAR (FP6), EARLINET (FP6), EUCAARI (FP6), FLYSAFE, JTI-SGO-MTM, SESAR…

- Many icing related research projects in North America. Two important groups working on the ice crystal challenge are:
  - Engine Icing Working Group (EIWG)
    - Partners: Boeing, Airbus, RR, GE, PW…
    - Content: F/T, IWT/T, modeling…
  - Ice Crystal Consortium (ICC)
    - Partners: Industry, FAA, NASA, Environment Canada…
    - Content: characterization of ice crystal atmospheric conditions

- EUROCAE WG 89

Background

- Many research activities launched in the US and Canada
  - European companies are participating
  - Significant infrastructure and capabilities in US

- Significant benefits if Europe improves its capabilities
  - Infrastructure is in place but gaps do exist in the current capabilities
  - The required institutions and experts exist
  - Funding vehicles exist

All enablers required to address the challenges posed by Unusual Atmospheric Conditions are present in Europe
Significant benefits of European involvement

What next?

- Step 1
  - Build networks
  - Develop comprehensive roadmap of what needs to be done
- Step 2
  - Implement roadmap to improve capabilities addressing each area identified during step 1
- Step 3
  - Industrial application of research results
- Rulemaking is part of this process

In coordination with airworthiness authorities, engine manufacturers, systems suppliers, airframers and research institutes, Airbus has proposed to lead a study on future research needs concerning aviation and unusual atmospheric conditions.

How to make it happen?

- Airbus has proposed to lead a European project:

  "CSA on Unusual Atmospheric Conditions"

- **Objectives & Strategy**
  - Review of the State-of-the-art
  - Review of the actions of research launched at national and/or European level & **global coordination**
  - **Analysis** of the data
  - Definition of the **gaps & prioritisation**
  - Set-up of a **comprehensive roadmap**

➢ **The objective is to address step 1: "Develop the roadmap "**

CSA Structure

Where is it safe ?

Competence of **MET Services** and FIR Authorities

- detection and observation
- precise predictions and information on unsafe/safe airspace
- improve communication broadcasting
- up-date with feed back (allow dynamic model update)

What is Safe ?

Manufacturer's Competence

- understand the threat
- aircraft operating limits
- engine operating limits
- system operating limits
- develop instruments and equipment
- operating restrictions
- operating instructions
- maintenance instructions

Grant it's safe

Competence of **AAs and GOVs, ICAO**

- establish safety standards
- monitor safety
- inform, coordinate
- establish approved procedures and guidelines
- encourage enhancements
- Inform Operators, Met offices and FIR Authorities

SCIENTIFIC SUPPORT

Operate Safely

***Operator**'s Competence*

- *routes + timing*
- *operating procedures*
- *operation monitoring*
- *maintenance*
- *training*

AIRBUS

- European Partners that constitute the ***Core Team***

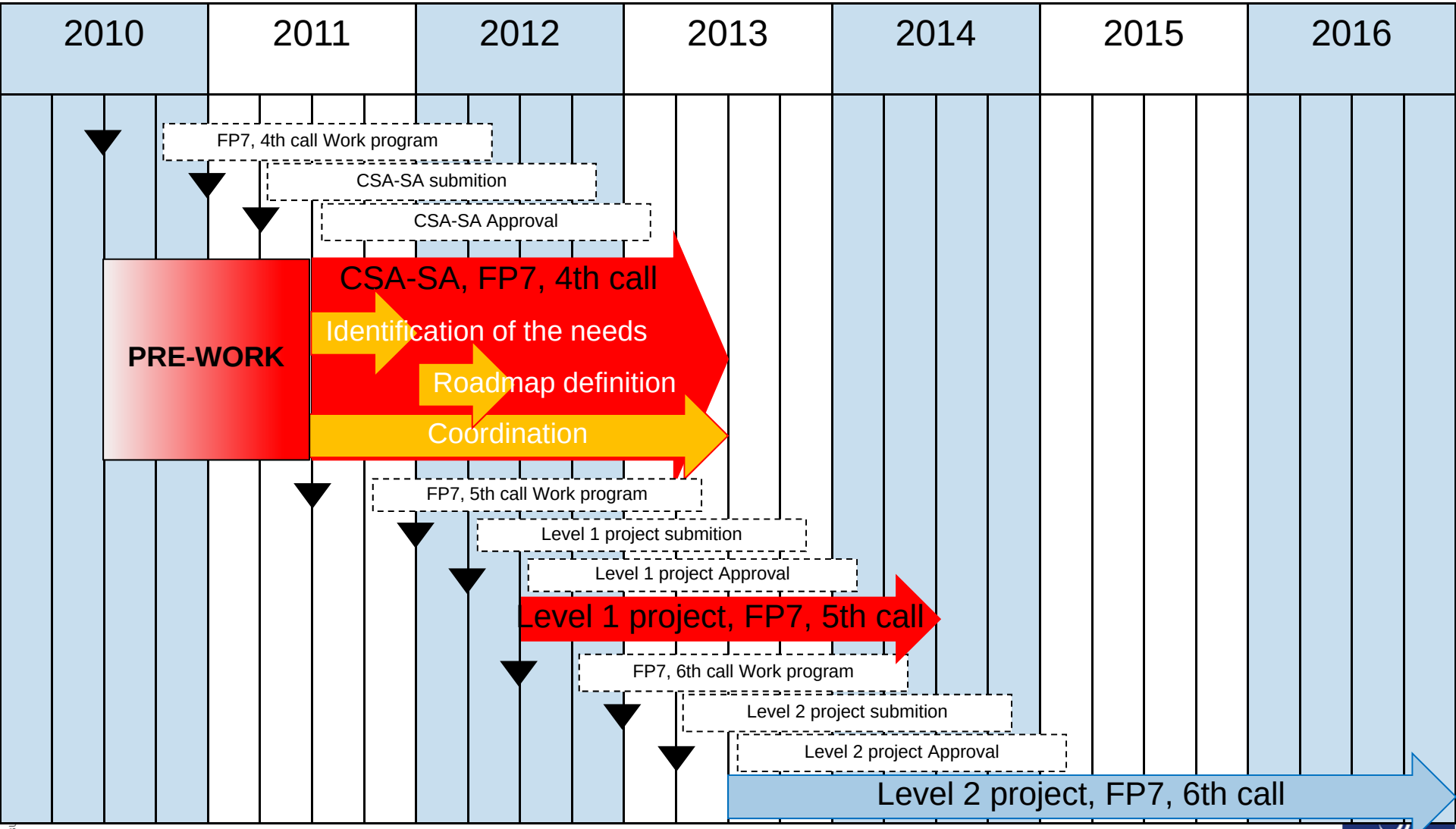
Airframers	Engines Manufacturers	System Suppliers	Meteo Office	Research Institutes
DASSAULT AVIATION	Rolls-Royce	THALES	METEO FRANCE	ONERA
AIRBUS	SAFRAN Snecma		Met Office	DLR
				EADS
				SAFIRE

- ***EASA involvement in the project is important***

Conclusion

- Unusual atmospheric conditions continue to pose a challenge to aviation
- The draft new icing regulations are an important step
- A co-ordinated multi-disciplinary effort is still required to address the ongoing challenges
- Airbus has proposed to lead a project to address these challenges

- Outline Schedule



What needs to happen next? Areas of Interest.

- **The improvement of the identification and the characterization of the so-called unusual atmospheric 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 unusual atmospheric 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 the 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 unusual atmospheric 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)
- **The development of models and computational means**
  - Understanding of macro-physics and micro-physics of phenomena and modeling
  - Deterioration modeling
- **The improvement of meteorological forecast methods** in order to improve weather forecasts (and the evolution of clouds in particular)
- **Training**
- **Development of capabilities** to monitor information flow, implementation of operational & **ATM**-related procedures and process to improve response