Ultra-Fast wind sensors for wake-vortex hazards mitigation

FP7 UFO Project Dissemination Workshop

23/04/2015

NLR, Amsterdam
**UFO OPERATIONAL GOALS:**

- UFO will study dedicated Wind sensors compliant with future Airport Weather operations requirements.
- Safety margin of Wake-Vortex Separations are dependent of Wind/EDR assessment accuracy (Wind for WV transport, EDR for WV decay), UFO will improve the update rate and the accuracy of Wind/EDR assessment:
  - to optimize this Safety Margin
  - to generate Alert in case of abrupt changes of wind/EDR conditions
- UFO will also improve other wind hazards ultra-fast monitoring capabilities
  - Low Level Wind-Shear
Studies of new Ultra Fast Lidar/Radar Wind & EDR monitoring sensors, usable for:
- Wake-Vortex Hazards Mitigation
- severe Cross-Wind, Air Turbulence and Wind-Shear.

High update rate and high accuracy Sensors:
- 2D electronic scanning antenna based on low cost X-band tile
- New high power laser source of 1.5 micron Lidar 3D scanner

New design tools developed through simulators, able to couple:
- Atmosphere models
- Electromagnetic, Radar and LIDAR models.

Advanced Doppler signal processing algorithm developed and tested for 3D wind field and EDR monitoring, including sensors resources management

Comparison with following sensors:
- C band meteorological radar
- Upgraded Weather Channel of S band ATC radar
- ADS-B Downlink

Calibration of the ground sensors and the simulators achieved through a set of experimental trials in Munich and Toulouse
Goals of UFO Dissemination Workshop

- Make some recommendations about R&D Needs ➔ FP8 H2020
  - Technologies (Radar & Lidar)
  - Quality/Availability of Wind/EDR measurements for airport operations
  - Gap in foggy weather (Need for additional sensors)
  - Fusion & Assimilation of ultra-fast data in High Resolution Forecast models

- Disseminate on UFO Technical & Operational Requirements ➔ SESAR H2020
  - Technical requirements for Radar/Lidar on airports
  - Operational requirements for SESAR H2020 Enhanced Runway Capacity
  - Collaborative Airborne/Ground Wind/EDR assessment

- Safety validation & Standards ➔ EUROCAE WG86, WMO, EUMETNET, AESA
  - Safety Analysis for Wind/EDR Information for Airport
  - Radar & Lidar standards for airport
  - Wind and EDR Algorithms standards
## Agenda: Dissemination Workshop

<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Presenter/ Session Chair</th>
</tr>
</thead>
<tbody>
<tr>
<td>09:00</td>
<td>Registration &amp; Welcome Coffee</td>
<td></td>
</tr>
<tr>
<td>09:20</td>
<td>Opening Session of UFO Dissemination Workshop</td>
<td></td>
</tr>
<tr>
<td>09:40</td>
<td><strong>Session 1</strong></td>
<td></td>
</tr>
<tr>
<td>09:20</td>
<td>Evolving standards and regulatory framework for weather-dependent separations</td>
<td>Emmanuel Isambert (EASA)</td>
</tr>
<tr>
<td>09:30</td>
<td>Enhanced Runway Throughput with Wind/Wake-Vortex sensors</td>
<td>Philippe Juge (THALES)</td>
</tr>
<tr>
<td>09:40</td>
<td><strong>FF7 UFO Trials</strong> Results: Main Achievements &amp; Results</td>
<td></td>
</tr>
<tr>
<td>09:40</td>
<td>New Generation Ultra-Fast E-scan X-band Radar/1.5 μm Lidar Sensors – Lessons learnt from UFO Toulouse trials</td>
<td>F. Barbaresco (THALES) &amp; J.P. Cariou (LEOSPHERE)</td>
</tr>
<tr>
<td>09:40</td>
<td>Performance and application of X-band radar and 1.6 μm lidar low-level wind measurement at Frankfurt and Munich airports</td>
<td>T. Ernsdorf (DWD) &amp; M. Hagen (DLR)</td>
</tr>
<tr>
<td>10:30</td>
<td>Coffee Break</td>
<td></td>
</tr>
<tr>
<td>11:00</td>
<td><strong>Session 2</strong></td>
<td></td>
</tr>
<tr>
<td>11:00</td>
<td>Physics of the Atmosphere (EDR in the Convective Boundary Layer ) based on Radar/Lidar Profiler measurements and simulation</td>
<td>D. Vanhoenecker (UCL) &amp; R. Wilson (UPMC)</td>
</tr>
<tr>
<td>11:00</td>
<td>Ultra-Fast Wind/EDR Monitoring Algorithms &amp; their performances</td>
<td>A. Oude Nijhuis (TUDELFIT) &amp; A. Dolfi (ONERA)</td>
</tr>
<tr>
<td>11:00</td>
<td>Other Sources of Weather Datalink (Mode-S EHS, ADS-B) &amp; Radar/Lidar Data Ingestion in High Resolution Forecast Models</td>
<td>S. de Haan (KNMI), T. Feuerle (TU Braunschweig)</td>
</tr>
<tr>
<td>12:15</td>
<td><strong>Session 3</strong></td>
<td></td>
</tr>
<tr>
<td>12:15</td>
<td>FF7 UFO Trials Database available for European/International Collaboration</td>
<td>O.Krasnov (TU DELFT)</td>
</tr>
<tr>
<td>13:05</td>
<td>Lunch Break</td>
<td></td>
</tr>
<tr>
<td>14:00</td>
<td><strong>Session 4</strong></td>
<td></td>
</tr>
<tr>
<td>14:00</td>
<td>Enhanced MET Services for Aviation in SESAR</td>
<td>Jean-Louis Brenguier (Météo-France, manager of SESAR WP11.2)</td>
</tr>
<tr>
<td>14:00</td>
<td>Focus on Airport Meteorology as key enabler for enhanced performance of the European Air Transport System</td>
<td>Herbert Pumpl (WMO Chair of the CAeM Expert Team on Aviation) (EUMETNET &amp; AUSTROCONTROL)</td>
</tr>
<tr>
<td>14:00</td>
<td>Translation of probabilistic Weather forecast into impact for Aviation stakeholders</td>
<td>Thomas Gerz (DLR)</td>
</tr>
<tr>
<td>15:30</td>
<td>Coffee Break</td>
<td></td>
</tr>
<tr>
<td>16:00</td>
<td><strong>Panel Discussion</strong></td>
<td></td>
</tr>
<tr>
<td>16:00</td>
<td>Challenges for new tactical weather systems for airport</td>
<td>Panel of external &amp; UFO experts</td>
</tr>
<tr>
<td>16:45</td>
<td>Closure of the workshop</td>
<td></td>
</tr>
</tbody>
</table>
Title: Enhanced MET Services for Aviation in SESAR

Speaker: Jean-Louis Brenguier (Météo-France, SESAR WP11.2 Manager)

Abstract: As part of SESAR WP11.2, a significant effort is dedicated to the harmonization of the MET information in order to provide ATM and airspace users with seamless information over Europe. Innovative MET capacities are also developed to more accurately detect weather hazards and provide quantified information about MET forecast uncertainty. Such new services will pave the way towards more integration of MET information in the impact assessment and decision support tools. The overall architecture of the MET services in SESAR will then be described to show how MET information will be made available on SWIM.

Biography:

- Dr Jean-Louis Brenguier is presently the coordinator of the R&D programme of Météo-France for aeronautics and the manager of the SESAR WP11.2.2 project for the development of new MET services to aviation. Till 2011, Dr Brenguier was the head of experimental research at the Météo-France research centre. Dr Brenguier got his PHD in 1978 and his habilitation in 1991. His research carrier was devoted to studies of aerosol, clouds and radiation, rain formation and climatic impact. He published more than 70 peer reviewed articles in scientific journals. Dr. J. L. Brenguier has a long experience of coordinating international research projects, mainly for the European Commission. In the research field, such as ACE2-Cloudy-Column (1996-98: airborne field experiment on aerosol indirect effects) and PACE (1999-2003: Parameterization of the Climatic Impact of Aerosol). For the Research Infrastructure Unit, Dr Brenguier has initiated the EUFAR project in 2000 (European Network of Research Aircraft for the Environment). Since 2000, He coordinated the FP5 (650 k€), FP6 (5 M€), and FP7 (8 M€), contracts. In the field of aeronautics, J. L. Brenguier has been acting as Co-chair of the WMO-WWRP AIFI Committee on Aircraft Icing. He actively participated in the preparation of the FLYSAFE (FP6), WEZARD (FP7) and HAIC (FP7) R&D projects.
Title: Focus on Airport Meteorology as key enabler for enhanced performance of the European Air Transport System

Speaker: Herbert Pümpel (WMO Chair of the CAeM Expert Team on Aviation)

Abstract: While Direct Routing, Trajectory-Based Operations and Free Flight all contribute to a smoother en-route part of any commercial flight, the real limiting factor remains very often airport capacity. Hub Airports and busy regional airports are all facing a critical dilemma to make available increasing capacity without, in most cases, the possibility to add runways in a densely populated environment. Environmental aspects and the principle of “good neighborhood” with the residents around an aerodrome require a minimum of noise disturbance, for which a smooth and continuous descent operation is key. Smooth approach and departure operations, seen as the best approach to solving these problems, depend on a highly accurate knowledge of existing and expected wind, stability and turbulence conditions along the approach path. All these parameters determine the conditions for Time Based Separation, and are thus an essential prerequisite for optimal performance and throughput. The ubiquitous need to determine an optimal performance while maintaining safety requires the best instrumentation, software and expertise to strike this balance in the interest of safe and efficient airport throughput, in particular when it comes to wake turbulence and its avoidance. The exemplary efforts undertaken in different SESAR research and development packages such as WP 11.2, WP 12.2.2 and WP 6.5.5 all address this critical issue, and the funding and support for the this project for a Wake Turbulence Advisory System by an FP 7 project is highly appreciated by the aeronautical and meteorological community. Ultra-Fast sensing technology, a combination of several fit-for-purpose, but still cost-effective techniques combining Radar and Lidar technology together with fast computational methods will provide the critical information in quasi-real time to ATM and Pilots, a fundamental requirement in an area where fast decisions in close proximity to the ground leave little room for error.

Biography:

Title: Translation of probabilistic Weather forecast into impact for Aviation stakeholders

Speaker: Thomas GERZ (DLR)

Abstract: Weather forecasting always bears uncertainties. Translating uncertainties or probabilities of occurrence of a meteorological event into useful information for aviation stakeholders is a cumbersome endeavour that requires skills and preparedness on both sides, the meteorological services and the aviation industry. For meteorological information to become really effective and useful for aviation, it must be tailored to the user’s needs, especially when comprising weather phenomena that are potentially hazardous to aviation. The stakeholder then has to qualify and quantify the impact of that information on his business. Hence, the reaction of each stakeholder, i.e. if, when and how to take action (in a pro-active anticipatory way or just reacting when the event happens), depends on his individual business case. The talk will give examples of meteorological information preparation and tailoring for different forecast time horizons as well as glance on the impact of such information for various stakeholders.

Biography:
- Dr. Thomas Gerz is heading the Department of Transportation Meteorology at the Institute of Atmospheric Physics in the German Aerospace Centre, DLR, in Germany. He graduated as a meteorologist with a Diploma Degree in 1984 and obtained his Dr. rer. nat. in 1988, both from Ludwig-Maximilians-Universität in München. Since then he works at DLR as a scientist and research manager. His interest in research encompasses turbulence, vortex dynamics, wake vortex physics and advisory systems, as well as aviation meteorology and wind energy. Dr. Gerz is experienced in coordinating national and international research projects on aircraft wake vortices and weather & aviation. He was involved in the preparation and execution of European projects as C-Wake, ATC-Wake, AWIATOR, FLYSAFE and ALICIA. Today he plays a coordinating role in setting up the meteorological instrumentation at a German test field for wind energy research.
Website

- Is containing:
  - An introduction page with a short description of the project,
  - a page with a more detailed description,
  - a contact page to reach the coordinator.

Website:

http://www.ufo-wind-sensors.eu/home

- European Commission website:

http://www.transport-research.info/web/projects/project_details.cfm?ID=45116
Hard copy available on request:

UFO Trials on Toulouse Airport (3 mn video)

http://www.wakenet.eu/fileadmin/user_upload/News%26Publications/Thales%20UFO%20MASTER%20FINAL%20MUET%20LQ.mp4