A SMART SYSTEM FRAMEWORK ENABLING AN INNOVATIVE WEATHER AWARENESS SYSTEM FOR AIRPORTS AND BEYOND

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WSN16
WMO WWRP 4th International Symposium on Nowcasting and Very-Short-range Forecast
25-29. July 2016 Hong Kong
BUILDING A NEW ATM SYSTEM IN EUROPE

Single European Sky Air Traffic Management Research

European Commission

Phase

Development Phase

2005-2008
Create European ATM Master Plan

2009-2016
Develop new standards, operational procedures & technologies

Implement results of development

2016-2020
Deployment Phase

Overall Goals

Capacity Increasing

Improving Safety

Greener Sky

Cutting ATM Costs

Budget of 2.1b€

~300 Projects

16 Work Packages

Eurocontrol

Industry

European Commission

Eurocontrol

Industry

~300 Projects

16 Work Packages

Overall Goals

European Commission

Eurocontrol

Industry
WHY IS A NEW MET SYSTEM APPROACH NEEDED?

- MET plays a key role in aviation

For airport operations, Weather is the main source for delays!

WHY IS A NEW SYSTEM APPROACH NEEDED (2)?

- **Needs** to reduce the weather impact on ATM are identified:
  
  - **Improved** MET capabilities
    - Improved MET products in terms of accuracy, update rate and reliability
    - New MET products to serve all MET phenomena properly by using new MET Sensors capabilities
  
  - **Improved** MET data availability and provision
    - A services oriented approach guarantees access and tailor-made data for each Users (SWIM concept)
  
  - **Improved** MET Translation & Presentation
    - A tailor-made provision for a common understanding between Users
    - Enhanced MET Products and/or pure Alerts and Warnings presentation for a complete “MET-Picture” to support the decision making process
A SMART SYSTEM FRAMEWORK AS A SOLUTION

- Key Features of System Framework

- Flexibility of MET input

- Using Data Distribution Services (DDS) technology ensures a service oriented architecture

- Interoperability to the SESAR System Wide Information System (SWIM)

- A highly configurable web-based graphical interface

- Just a standard Browser is needed

- Using open source service Open Street Map / GeoServer for the geographical mapping

- Representation of MET from abstract to any details thanks to a multi layer structure
THE FIRST DEPLOYMENT INSIDE SESAR

- The Framework Set-up

- AWOS Sensors (Yellow Markers)
  - 2 Ceilometers (Runway heads)
  - 3 Transmissiometers (Runway heads and middle)
  - 2 Anemometers (Runway heads, 10 m wind)
  - Thermometer (2 m temperature)
  - Pressure sensor
  - Humidity sensor

- Raymetrics 3D-scanning Ceilometer
- Leosphere Wind Cube 400S 3D scanning Doppler Lidar
- Selex ES 50DX mobile polarimetric X-Band weather Radar
- Selex ES RS3DP Compact Solid State polarimetric X-Band Radar
- Axis Fish Eye Camera (M3027-PVE)
- FLIR Infrared (IR) Camera (A315)
- Nowcast Lightning Data
- Numerical Weather Prediction Model (COSMO DE)

Braunschweig Airport/ Germany 02-05.2015
THE FIRST DEPLOYMENT INSIDE SESAR (2)

- MET Products Generation based on Data fusion and Sensor Synergies

- Cloud base
  - Ceilometer & Doppler Lidar

- Cloud amount
  - opt. Camera & IF Camera

- Cloud amount
  - Camera & Ceilometer

- Runway oriented Windshear
  - Radar & Lidar

- Thunderstorm
  - Radar & Lightning
**THE FIRST DEPLOYMENT INSIDE SESAR (3)**

- **MET Products Portfolio**

<table>
<thead>
<tr>
<th>Wind</th>
<th>Winter Weather</th>
<th>Visibility</th>
<th>Standard MET</th>
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<tr>
<td>• Low Level Windshear</td>
<td>• Snow</td>
<td>• RVR</td>
<td>• 2 m air &amp; dew point temperature</td>
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<td>• Runway oriented shear</td>
<td>• Snowfall probability</td>
<td>• Cloud base height</td>
<td>• Relative humidity</td>
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<td>• Low Level Turbulence</td>
<td>• Freezing rain</td>
<td>• Cloud amount</td>
<td>• Air pressure (QNH &amp; QFE)</td>
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<td>• Surface wind speed &amp; direction observation</td>
<td>• Freezing rain probability</td>
<td>• Surface Visibility</td>
<td>• Runway surface temperature</td>
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<td>• Surface wind gust observation</td>
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<td>• Ceiling or Vertical Visibility</td>
<td>• Low level temperature inversion</td>
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THE FIRST DEPLOYMENT INSIDE SESAR (4)

• MET System Specification

**Observation (in-situ & remote Sensors)**
- ~20 Sensors integrated
- Sensor specific parameters (range, update rate etc.)
- Sensor Network integrated (Lightning)

**Nowcast (X-Band Weather Radar)**
- ~100m horizontal resolution
- 100km range
- 1h nowcast horizon
- 5 min update rate

**Forecast (COSMO DE)**
- 2.8Km horizontal resolution
- 3h update rate
- 27h forecast horizon
WEATHER DECISION SUPPORT DISPLAY

- List of current Alerts
- Nowcast-Wheel
- "Now"-Button
- Forecast Bar
- Sensor "Clickables"
- Runway extensions
- Geospatial Element
BEYOND AVIATION….

Technology
- Service oriented architecture via DDS
- Open Street Map Geo-Server
- Flexible of MET Input Sources

Meteorology
- Providing MET Observations, Nowcasts & Forecasts
- Configurable MET Alerts and Warnings
- Data Fusion capability

Visualization
- Visualization via a standard Browser
- Applicable to every Location
- Multi-Layer GUI

Flood Warning System  |  Hydrology  |  Tactical Weather for special Events  |  Others…
OUTLOOK

• Further Developments

- 4D Trajectory integrated Weather objects (SESAR 2020)
  - Met Hazards Geo Ref. Volumes (Space and time) correlated to flight path
  - New Products based on Requirements

- 3D Weather Objects
  - 3D Convection
  - Short-term Forecast of 3D Convection
  - 3D Windfield
  - Short-term Forecast of 3D Windfield

- Customized services
Thank You

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