Digital NOTAM

The Digital Age for Air Navigation

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IDS
INGEGNERIA DEI SISTEMI

Outline

- What is Digital NOTAM?
- Why Digital NOTAM?
- Data Model & Event Specification
- Static & Dynamic Data Integration
- Digital NOTAM Implementation Example (**CRONOS**)

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What is Digital NOTAM

Current NOTAM

"A **notice distributed by means of telecommunication** containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential **to personnel** concerned with flight operations"

Digital aeronautical information update

"A **dataset made available through digital services** containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential **to systems and automated equipment used by personnel** concerned with flight operations"

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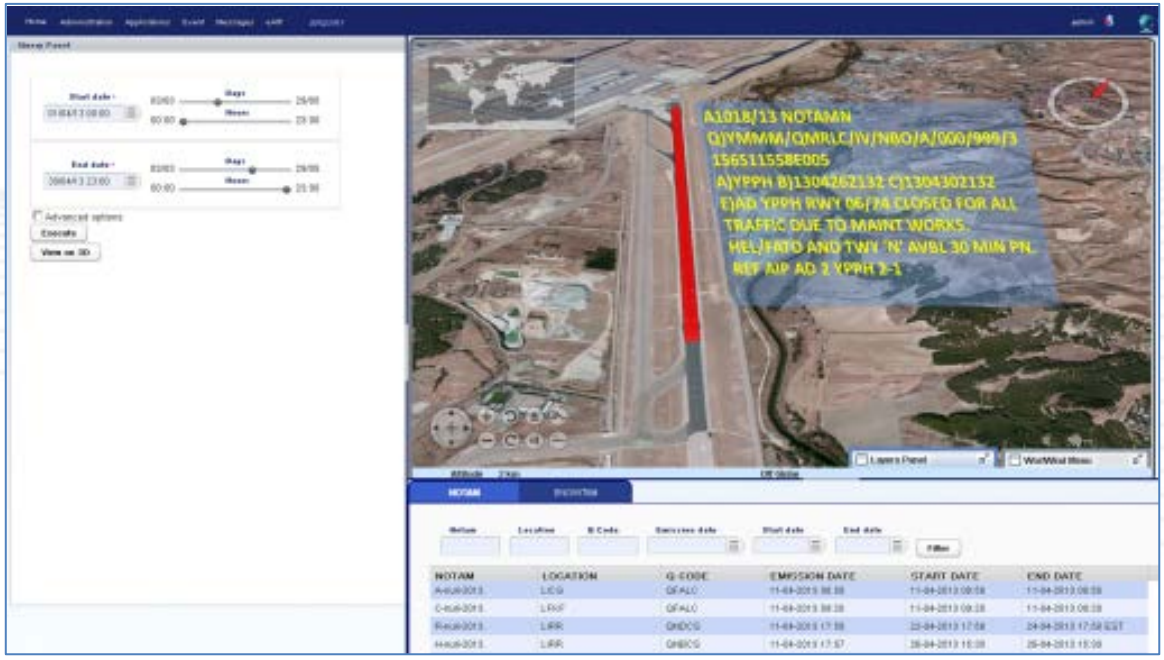
Why Digital NOTAM?

- **Data Quality**: Information provided as Digital NOTAM is suitable for automatic checks, which should ensure improved coherence and correctness of NOTAMs.
- **Geographical Representation**: Digital Aeronautical Information can be easily visualized on GIS platforms, enabling visual checks by human operators and eliminating the risk of mistyped or missing data



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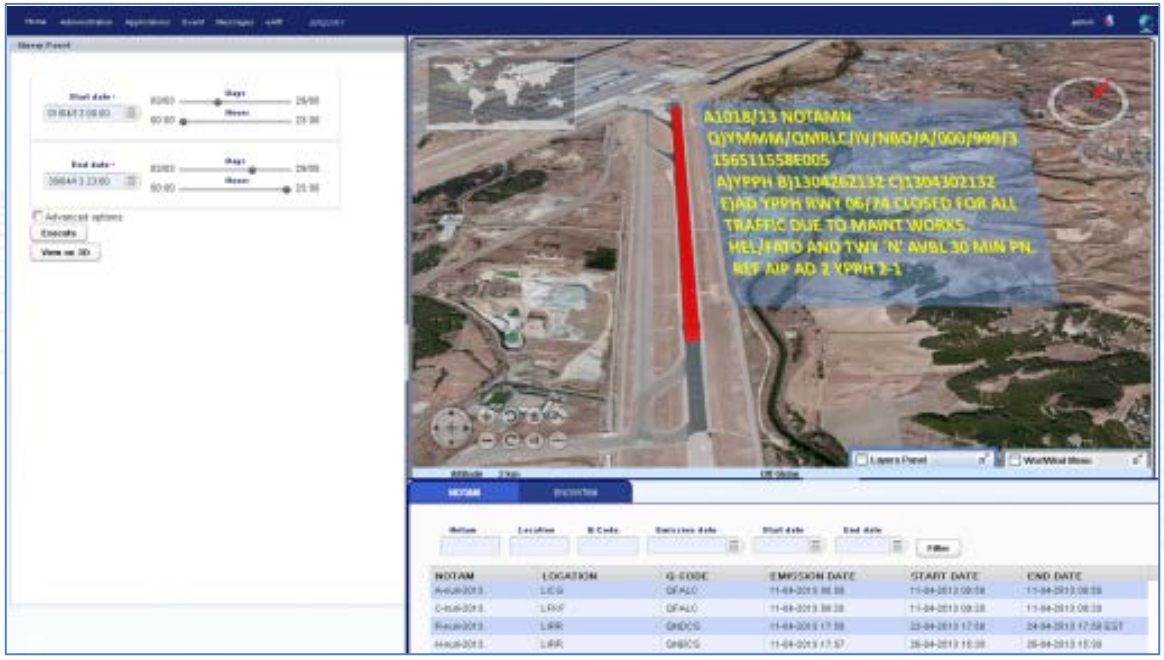

Why Digital NOTAM?

- **Digital Services** : the ultimate goal is a fully graphical, continuous briefing process including:
  - Flight Planning
  - Pre-Flight Briefing,
  - In-Flight Updates
  - Post-Flight De-Briefing

The **same** information package will be available on the ground and in the air, **continuously updated**

Why Digital NOTAM?

- **Enhanced PIB:** Digital NOTAM allows applying critical human factors aspects in the design of the PIB:
  - prioritize critical information;
  - organize information by item concerned (runway, gate, etc.);
  - embed graphics where appropriate (“a picture is a thousand words”);
  - filter out irrelevant information, which can represent more than 50% of the current bulletins;
  - reduce the risk of information overload, which is a growing problem because of the significant increase in the number of NOTAM in force world-wide.

These are not possible today because of the free text format of the current NOTAM

Why Digital NOTAM?

- **Fully Computer Readable:** The characteristics of a digital NOTAM include:
  - Geo-referenced - the information can be automatically plotted on a chart;
  - Temporal - the effective time can be computer interpreted;
  - Linked to static data - the change is cross-referenced to the baseline information;
  - Transformable – the information can be converted into any graphical or textual output, including the existing ICAO NOTAM format;
  - Query Enabled - a computer system can use complex queries to select temporary
  - and last minute updates of interest based on user-specified criteria;
  - Electronically distributable – the information can be directly transmitted
  - and incorporated into other computer systems without manual intervention.

In Summary

Digital NOTAM enables advanced air traffic management concepts (e.g. SES).

People and automated systems shall have access to and work with a common, up-to-date data set including the information that is currently distributed by NOTAM messages.

Moreover Digital NOTAM allow to improve:

- **Safety:** through better data quality
- **Capacity**: by allowing automatic and more efficient information processing

Concept of Operations

Users

Internal Users

- AIM Officers
- NOTAM Officers
- Flight Planning Officers
- MET Officers
- Briefing Officers

External Users

- Airlines
- Pilots
- General Aviation
- Airports
- Foreign AIS/AIM

Services

- Briefing Service
- Messaging Service
- NOF Service
- MET Service
- ARO Service
- Self-Service Briefing
- Self-Service FPL Submission

Technologies

- SOA
- Web-Services
- AIXM v5.1
- AMHS AFTN
- HTTP
- GIS
- RDBMS
- High-Availability

Information

- Flight Information
- Static Data
- NOTAMs
- OPMETs
- Charts
- AIP
- Aircraft Info
- Terrain

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Data Model

AIXM 5.1 provides an extensible, modular aeronautical information exchange standard that can be used to satisfy information exchange requirements for current and future aeronautical information applications, including:

- Automated Aeronautical Publication Production (AIPs)
- Automated Aeronautical Chart creation and Production
- Digital NOTAMs

Encoding of Digital NOTAM in AIXM 5.1 is based on the implementation of a model extension that allows to represent **aeronautical events.**

Digital NOTAM systems will have to **mask** the complexity of the model allowing the final user to view the information in the format he better knows and understands

"What matters is the information, not how it gets distributed or stored"

Event Specification

The EUROCONTROL Event Specification defines **rules for harmonized encoding** as AIXM data sets (version 5.1 or later) of the information currently published through NOTAM messages.

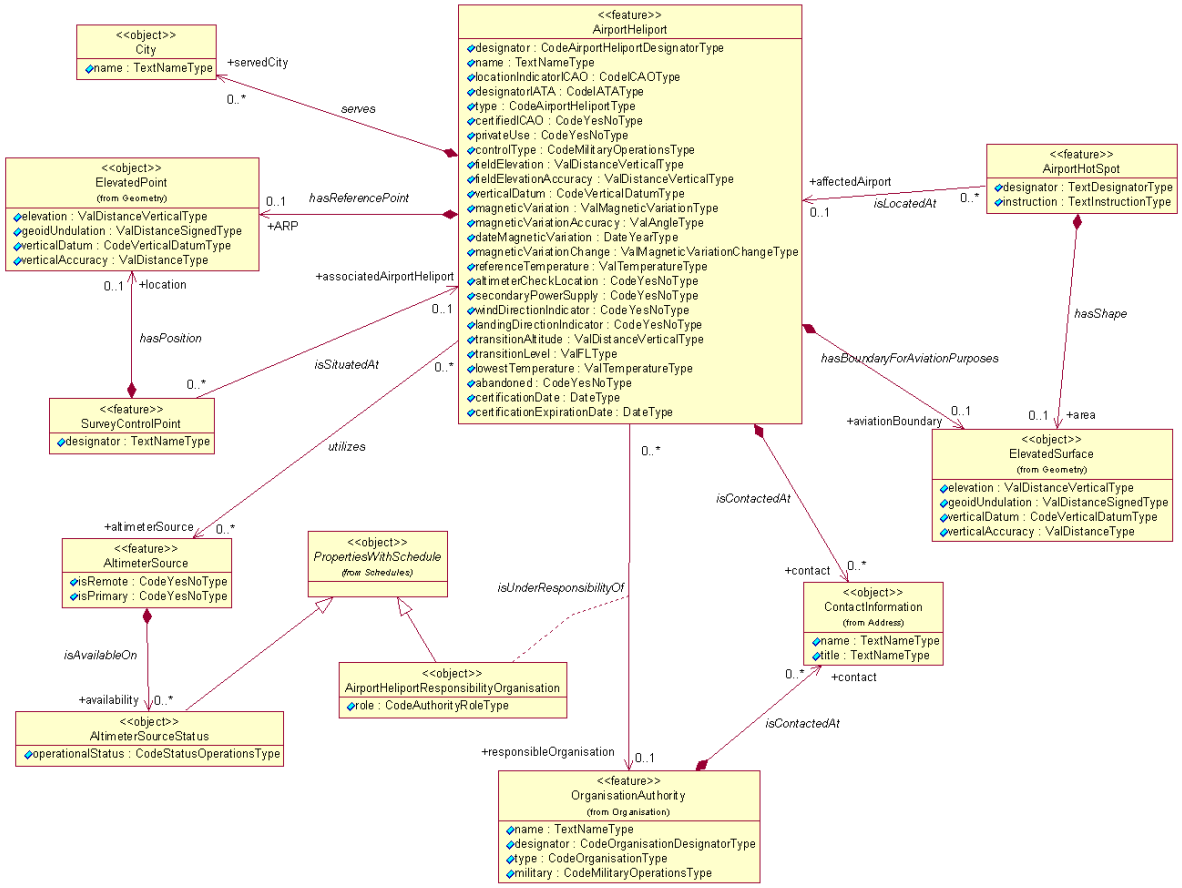
The document is **intended primarily to system developers**, as most of these rules will have to be translated into database structures, human-machine interfaces, data validation rules, etc.

The main goal of the document is to enable the **interoperabilit**y of the different systems that produce, transform, transmit and consume Digital NOTAM

The Event Specification is likely to **evolve** in future to include changes of generic duration to aeronautical **"static" data**.

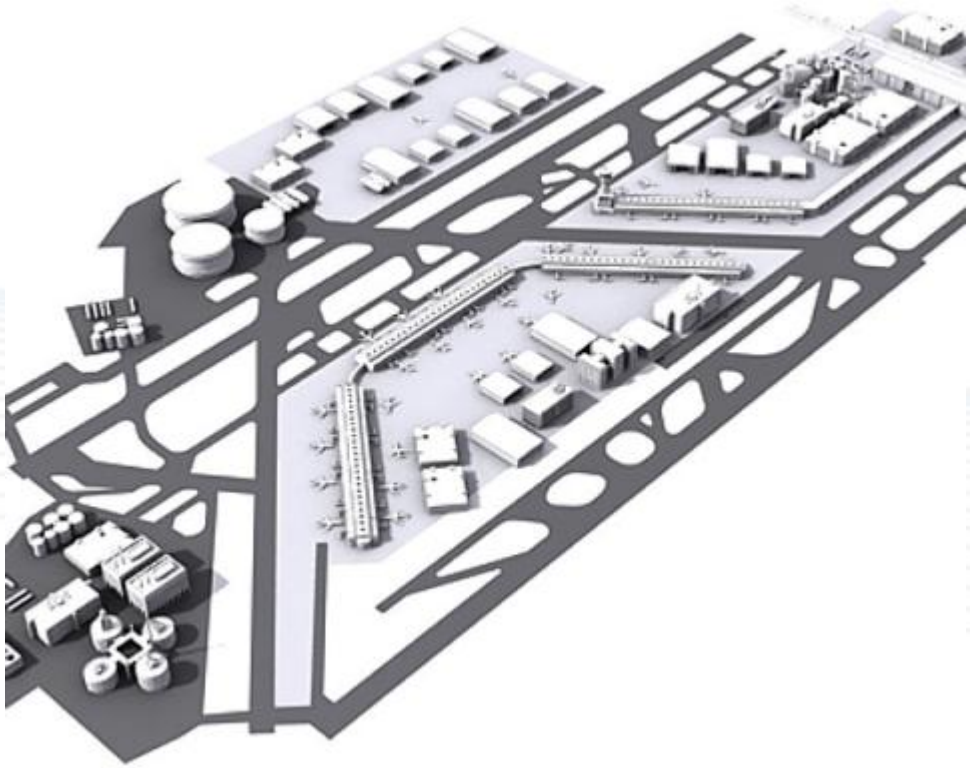
Event Specification

Direct Access to AIXM 5.1 data model can be **confusing** for final user



Event Specification

Systems shall present the information in the format the final user better understands



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Static & Dynamic Data Integration

Has a validity time interval

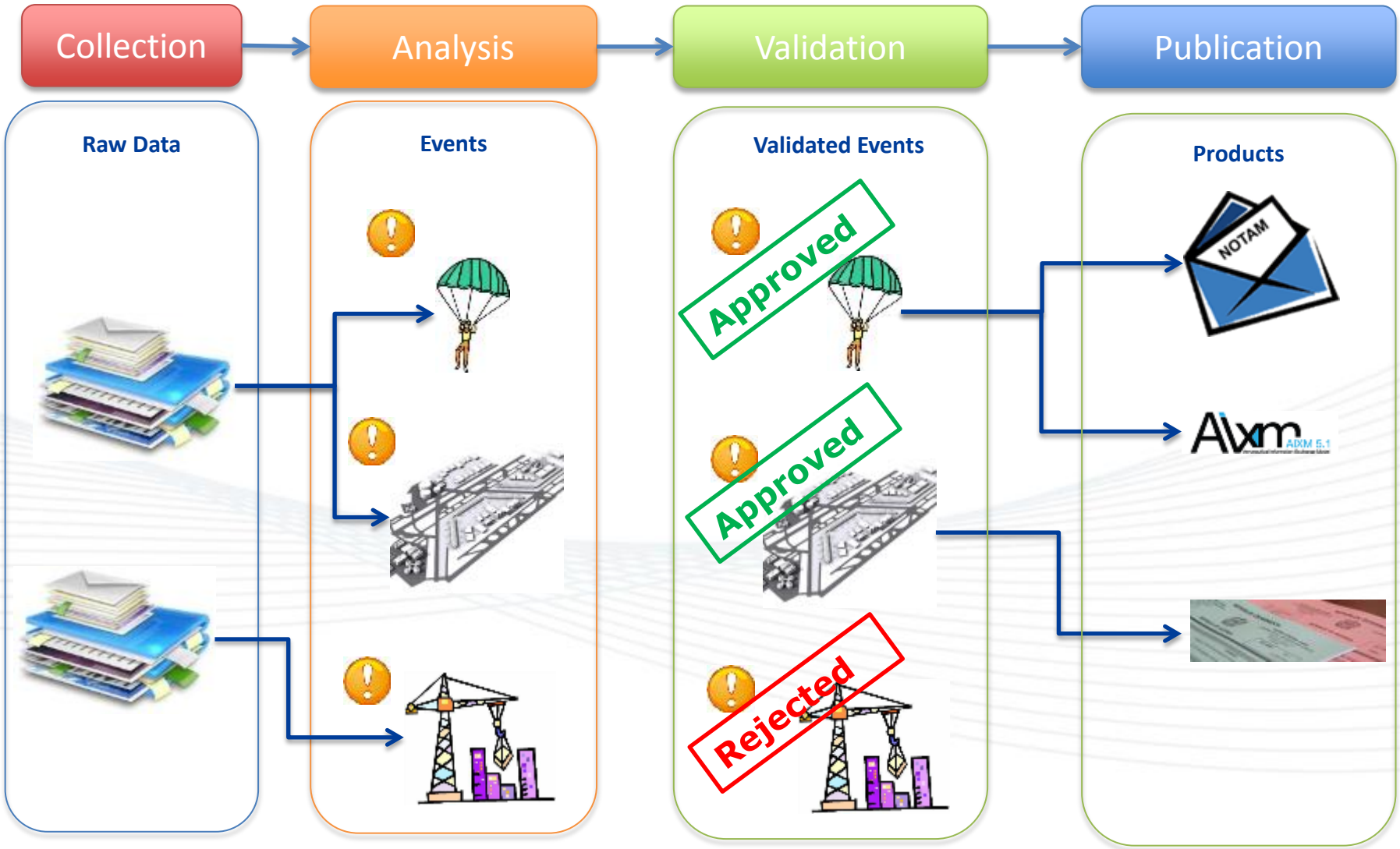
Represents Changes To Aeronautical Features

Event

May be Notified via NOTAM

May Be Published within an AIP Amendment

Static & Dynamic Data Integration



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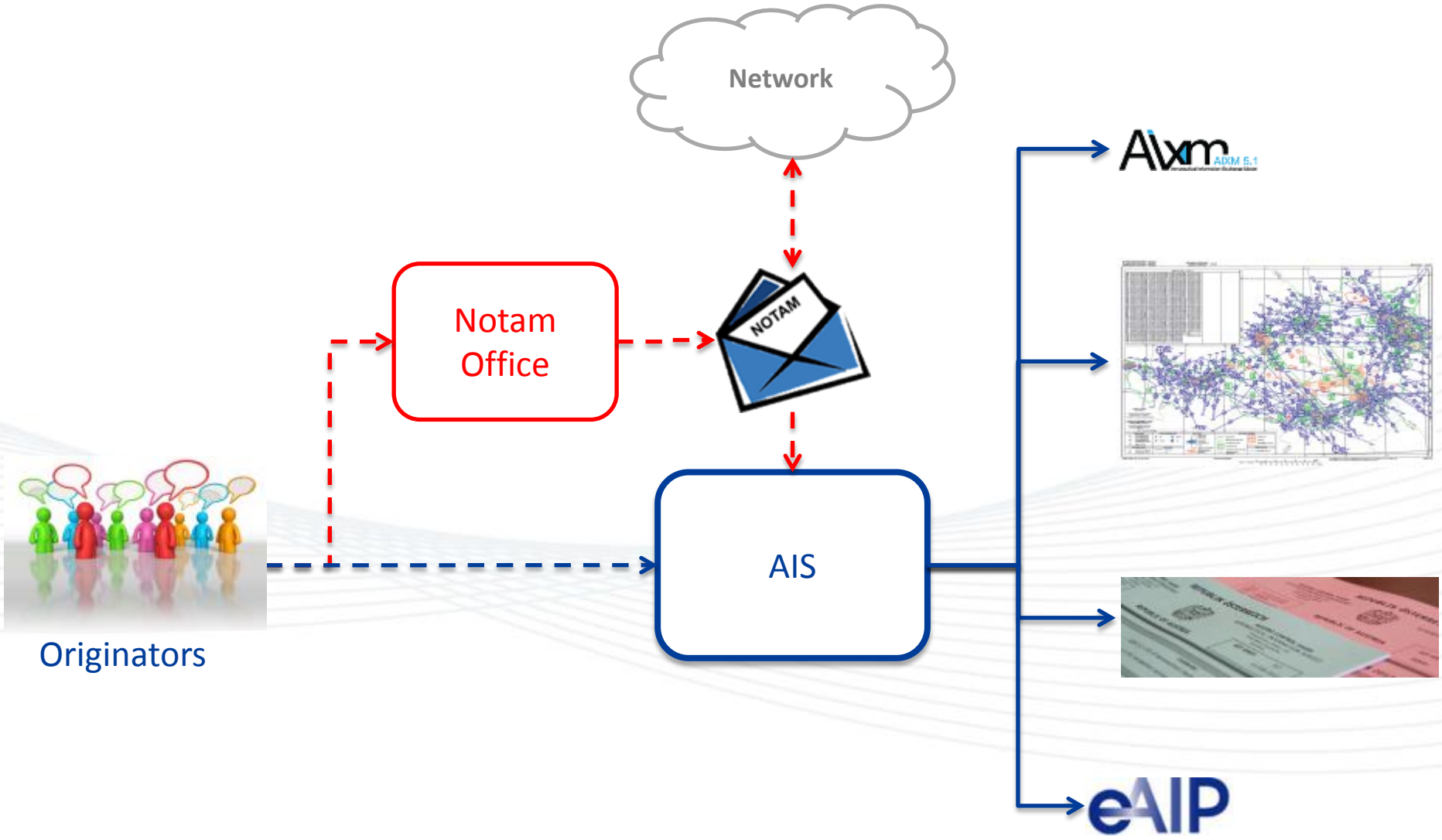
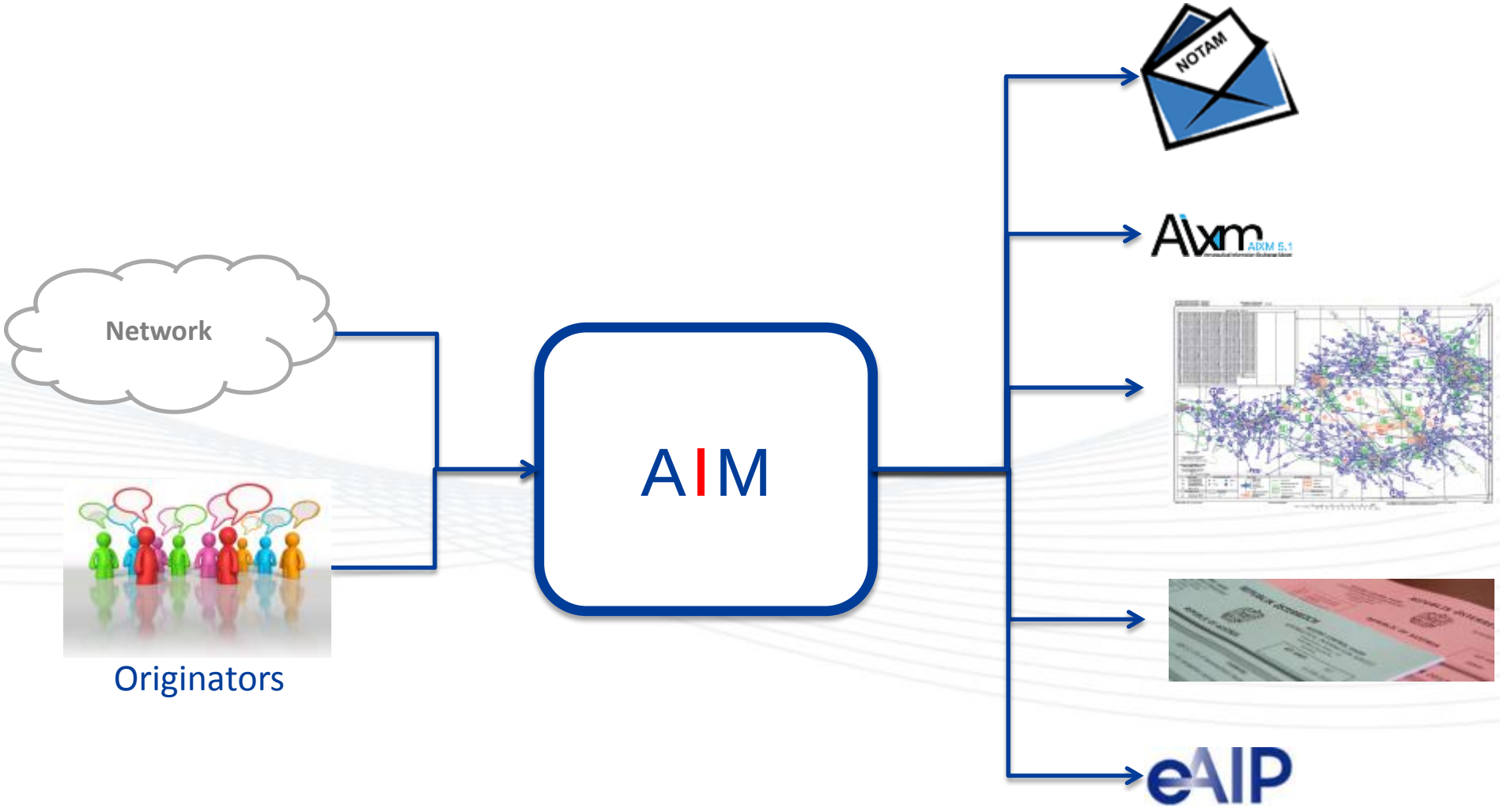
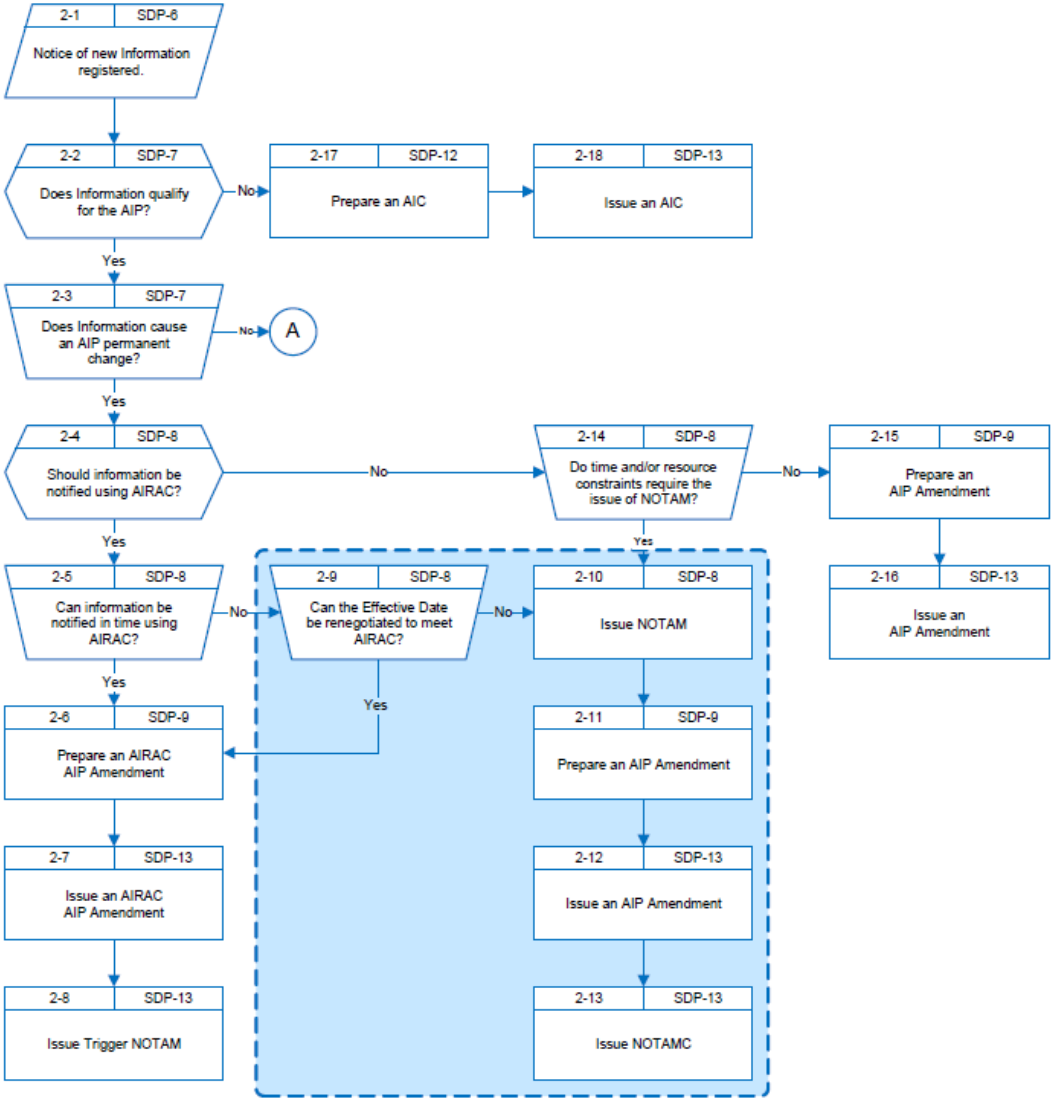


To Be



Static & Dynamic Data Integration - ADP



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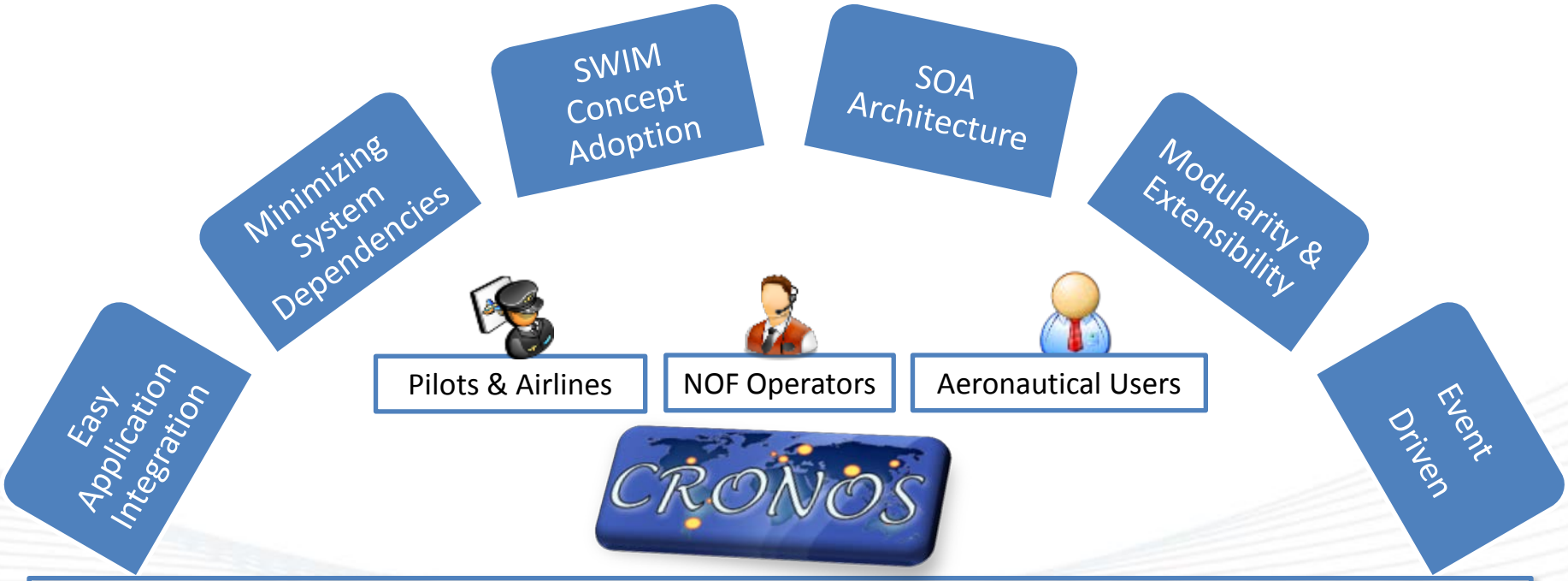
Implementation Example - CRONOS



- ***CRONOS v1.1***
  - **has been tested with AIS & NOF Operators**
  - **has been tested with Pilot for FPL generation**
  - **advanced PIB module and automatic notification**

Capabilities

NOTAM Module

- Management of NOTAM MSGs: NOTAM (N, R, C), SNOWTAM, ASHTAM, BIRDTAM
- xTAM messages to/from AFTN or AMHS
- ICAO compliant forms for the creation of all NOTAM types
- Validation engine for both domestic and foreign NOTAMs
- NOTAM distribution by series
- Automatic Checklist generation
- Automatic validation of foreign Checklists and RQN issuance
- Automated response to received RQN/RQL/RQO messages
- Flexible NOTAM querying & reporting
- Geographical visualization of NOTAMs

MET Module

- Management of Meteo MSGs: METAR(SA), SPECI(SP), TAF(FT/FC), SIGMET(WS/WC/WV), AIRMET(WA), ARFOR(FA), GAMET(FA), SYNOP(SM),AIR Report (UA), WINTEM(FB), ADWarnings(WO), Tropical Cyclone Advisory(FK), & Volcanic Ash Advisory(FV)
- Sends/receives MET messages to/from AFTN/AMHS and SADIS
- WMO compliant forms for the creation of MET messages
- Validation engine for both domestic and foreign MET messages
- Flexible MET querying & reporting
- Automated response to RQM

Flight Plan Module

- Management of ARO MSGs: FPL , SPL, CHG, DLA, CNL, DEP, ARR, EST, CDN,ACP, ALR, RCF, CPL, LAM, RQP, & RQS
- Sends/receives FPL messages to/from AFTN or AMHS
- ICAO DOC 4444 compliant forms for FPL message creation (including 2012 FPL format)
- Validation engine for both domestic and foreign FPLs
- Support for Repetitive Flight Plans [RPL]
- Flexible FPL querying & reporting
- Geographical FPL Route visualization
- Automated response to received RQS/RQP messages

Briefing Module

- PIB query types: Narrow Route, Standard Route, Airspace, & Aerodrome
- PIB direct from FPL
- PIB contains consolidated NOTAM & MET information
- Customizable PIB formats
- PIB output in ASCII, HTML/XML, PDF

External Communications

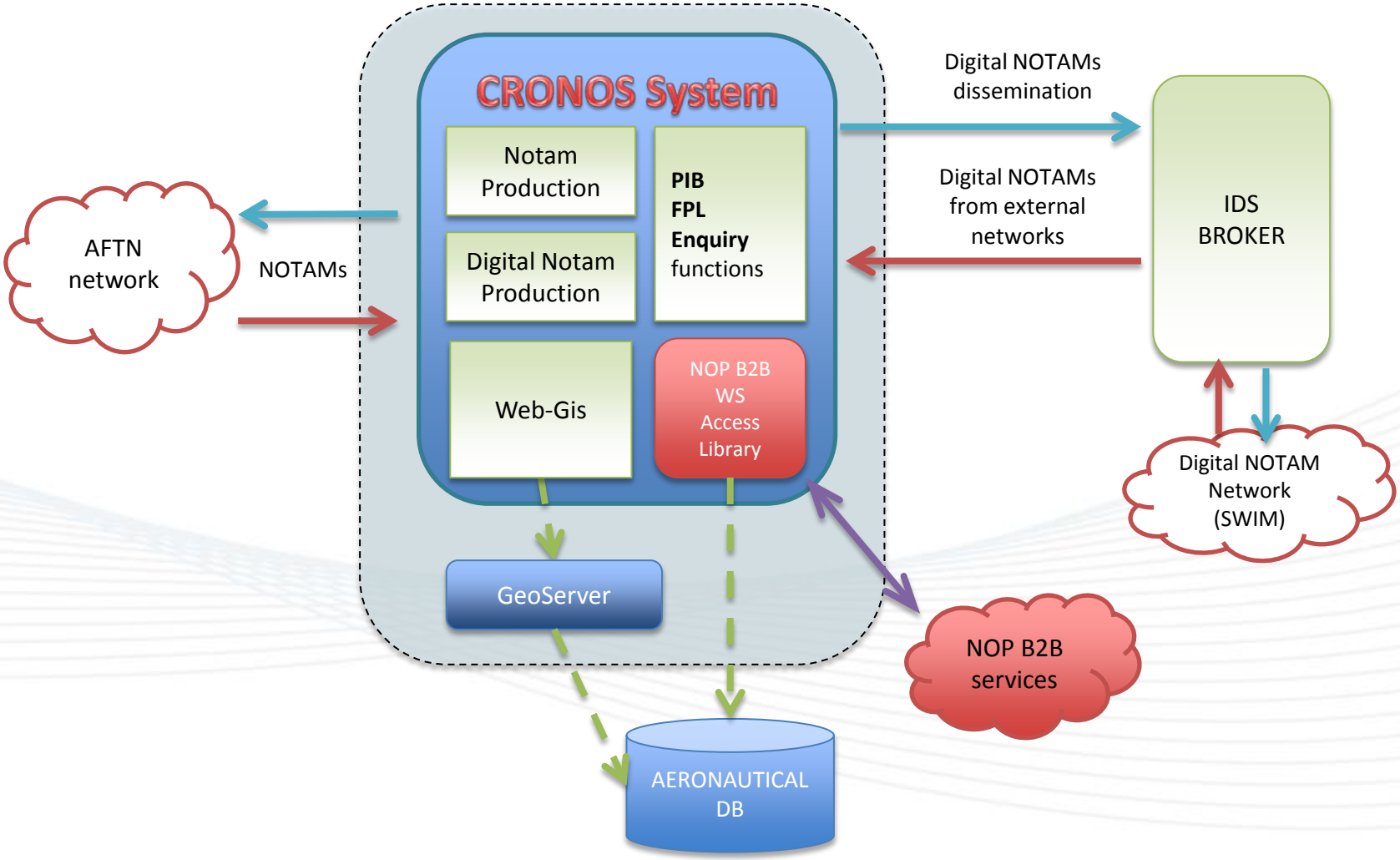
- ***Connectivity to AMHS Systems:***
  - *X.400 P1/P3 over TPO/RFC1006/TCP-IP*
  - *X.400 P1/P3 over* TP4/CLNP
- ***Connectivity to SADIS Workstation***
  - *FTP over TCP-IP*
- ***Service InBox***
  - *Handling of AFTN SVC and CH Messages*
  - *Handling of AMHS DR/NDR*
- ***Reject InBox***
  - *Displays rejected messages with the reason for rejection*
  - *Provides facilities for message correction and resubmission*
- ***Free-form message creation***

Compliance to Event Specifications

All Digital Events included into ECTL – Digital NOTAM Event Specification

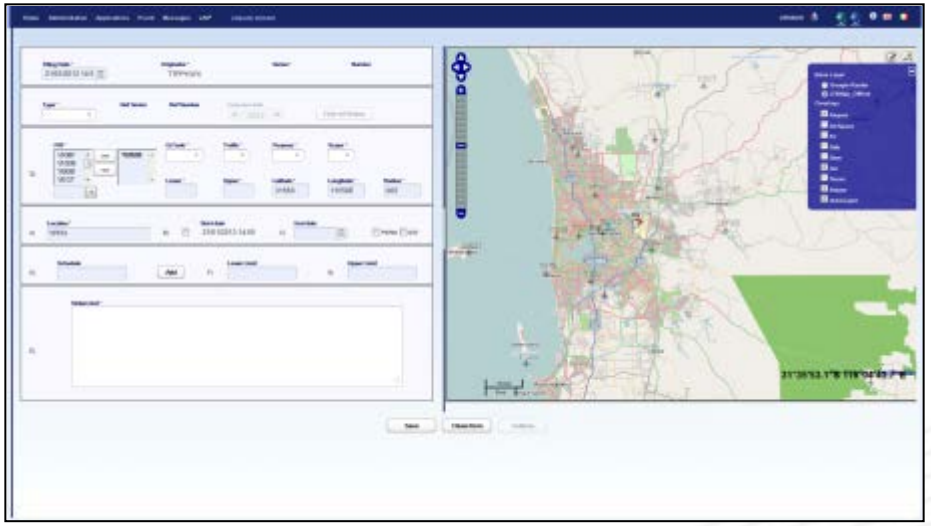
Published special activity area – Activation	Published ATS Airspace – Activation or Deactivation	Ad-Hoc special Activity area – creation
Ad-Hoc ATS airspace – Creation	Route Portion Closure	Route Portion Opening
Aerodrome Closure	Runway Closure	Navaid unserviceable
New Obstacle	Other Event	
Withdrawn Obstacle	**Taxiway Closure**	**Airport Surface Contamination**

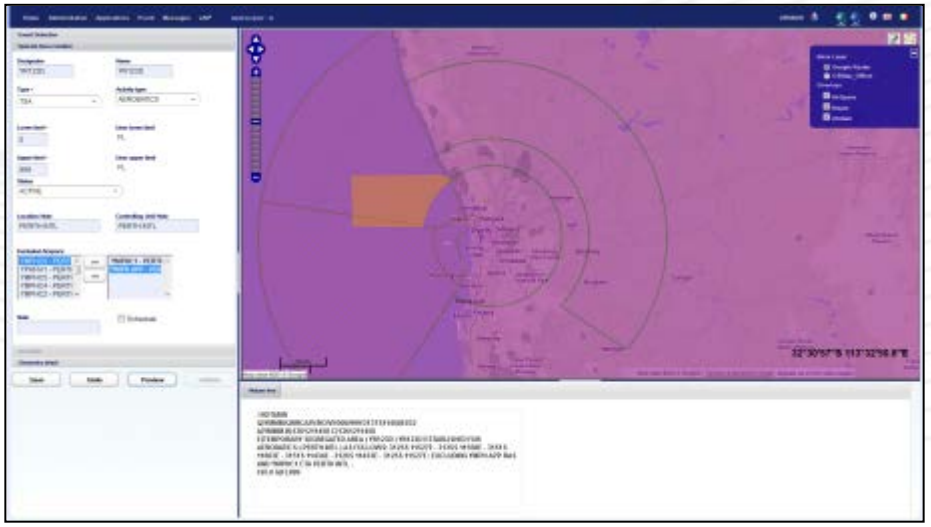
CRONOS Overview



NOTAM Capabilities

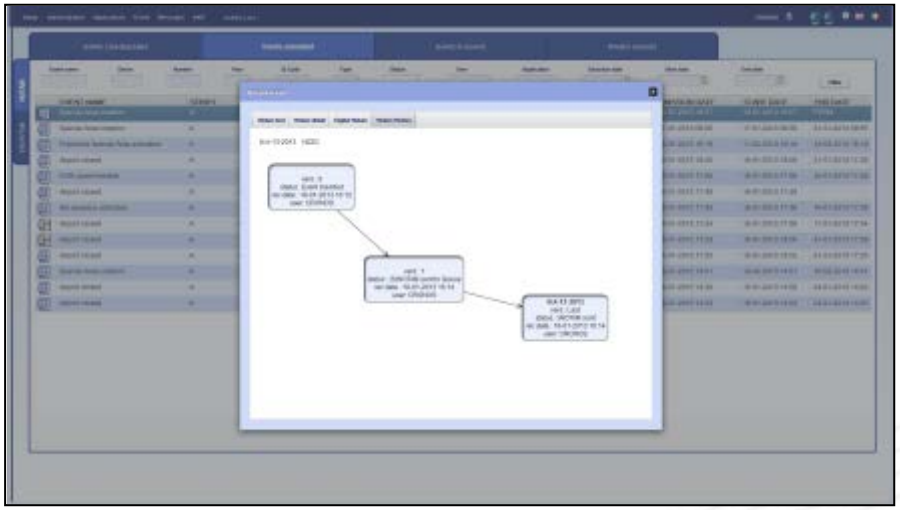
- *Dual Environment for traditional and digital NOTAMs*
- *D-NOTAM Creation*
  - *Traditional ICAO Templates*
  - *Wizard driven event creation*
- *Collection & Distribution of NOTAMs via AMHS & AFTN and D-NOTAMs via SWIM*
- *Integrated deeply with AeroDB AIXM 5.1 database*
- *Web-GIS visualization of Dynamic and Static aeronautical data*



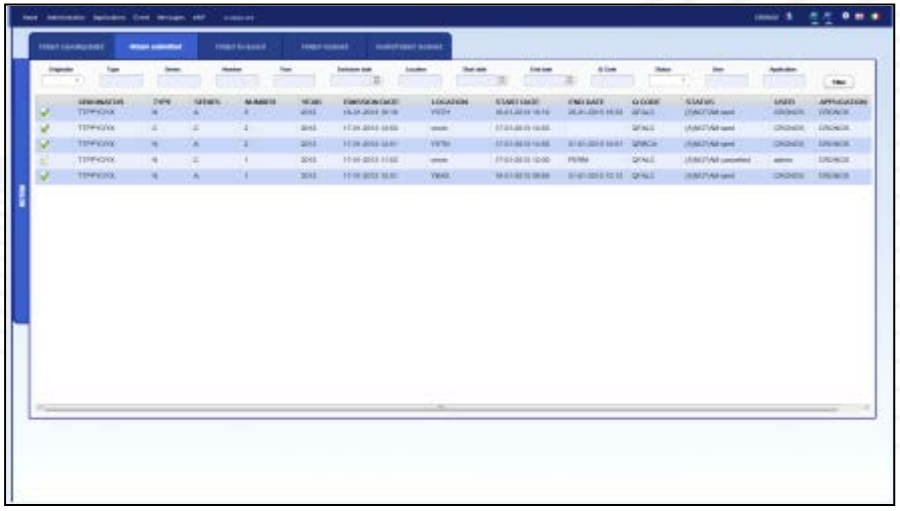


NOTAM Capabilities

- *(x) NOTAM History*
  - *Tracking of NOTAM status*
  - *NOTAM Workflow*

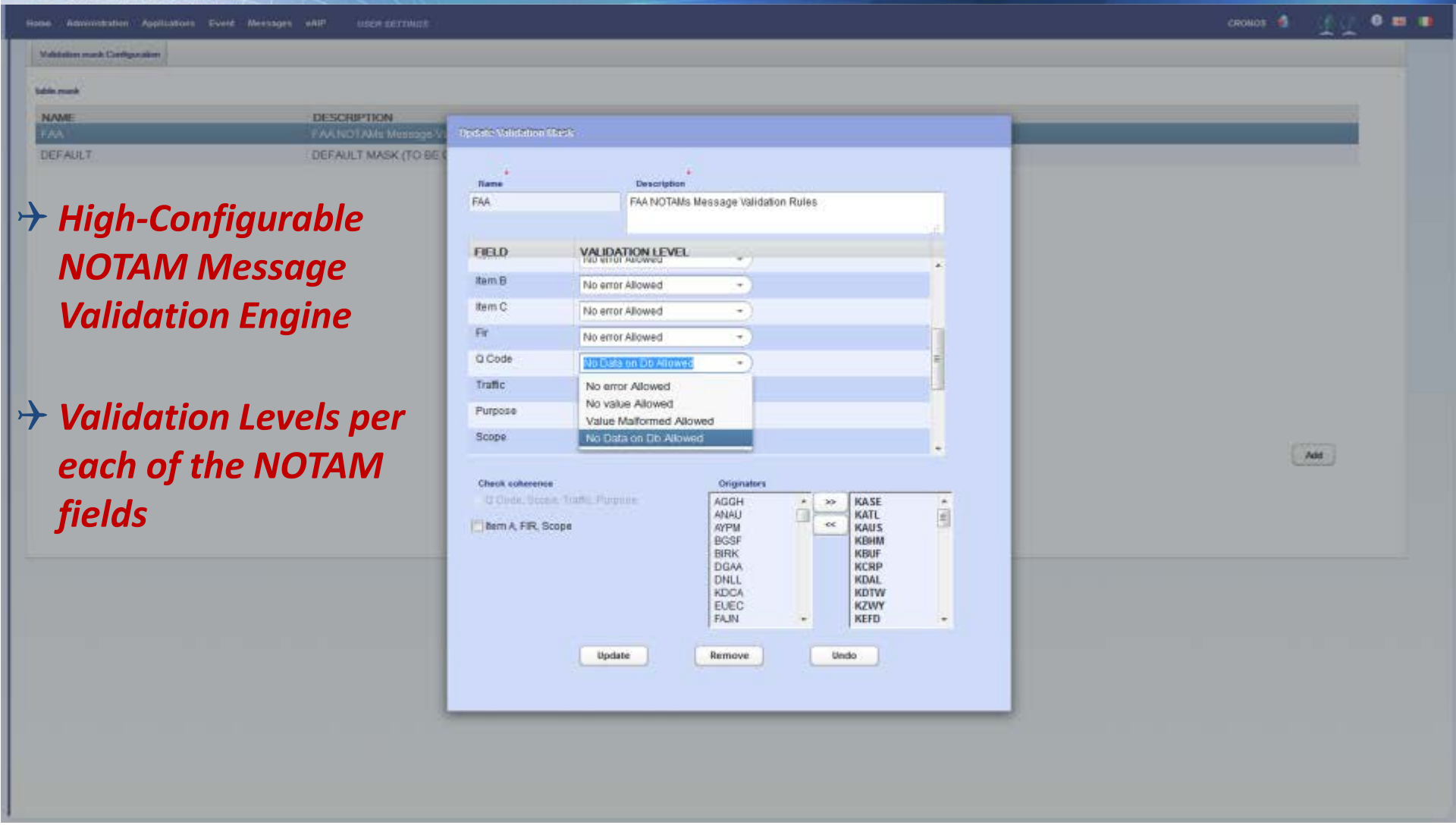


- *(x) NOTAM Listing*
  - *Proposal Events,*
  - *Submitted Digital NOTAM*
  - *Queuing Digital NOTAM*
  - *Digital NOTAM from externals*



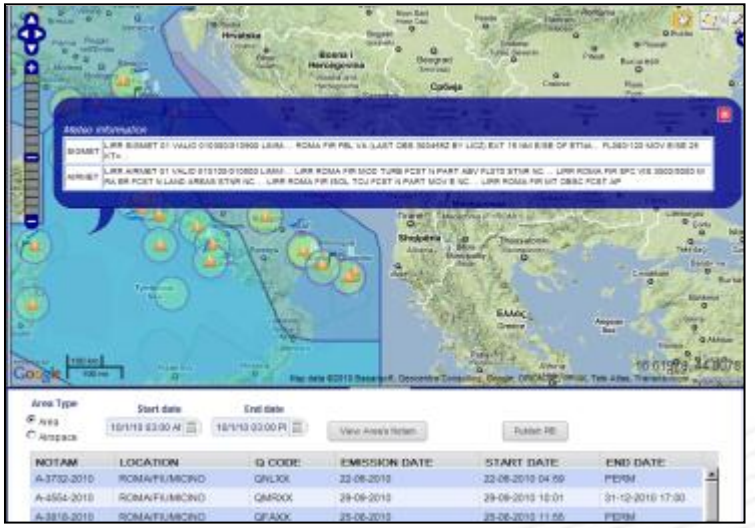
NOTAM Validation Module

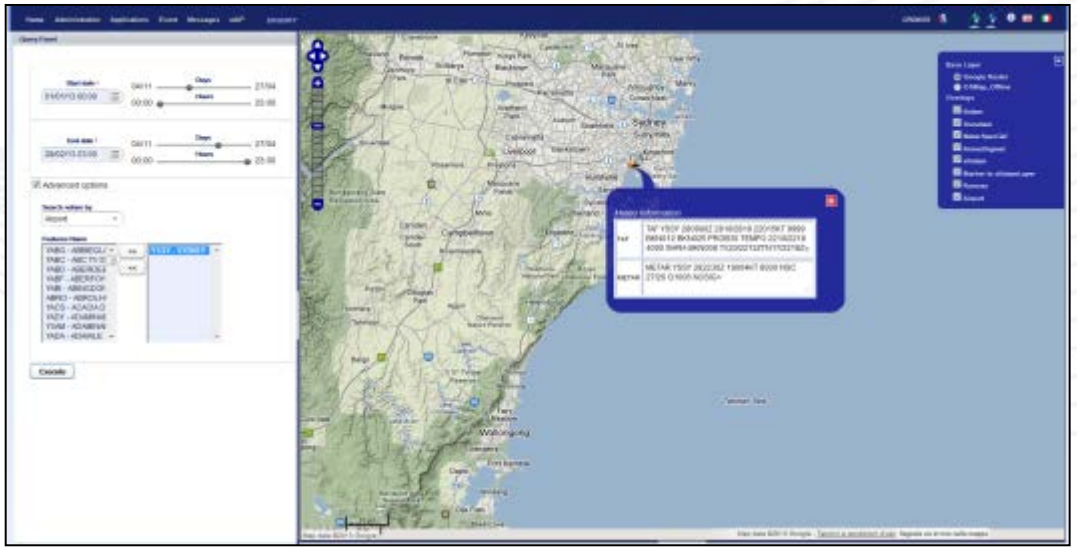
- *High-Configurable NOTAM Message Validation Engine*
- *Validation Levels per each of the NOTAM fields*



MET Capabilities

- *Collection of OPMET messages via AMHS, AFTN, SADIS*
- *Fully compliant MET bulletin collection and distribution*
- *Storage of graphical MET products*
- *Web-GIS Visualization of MET information*

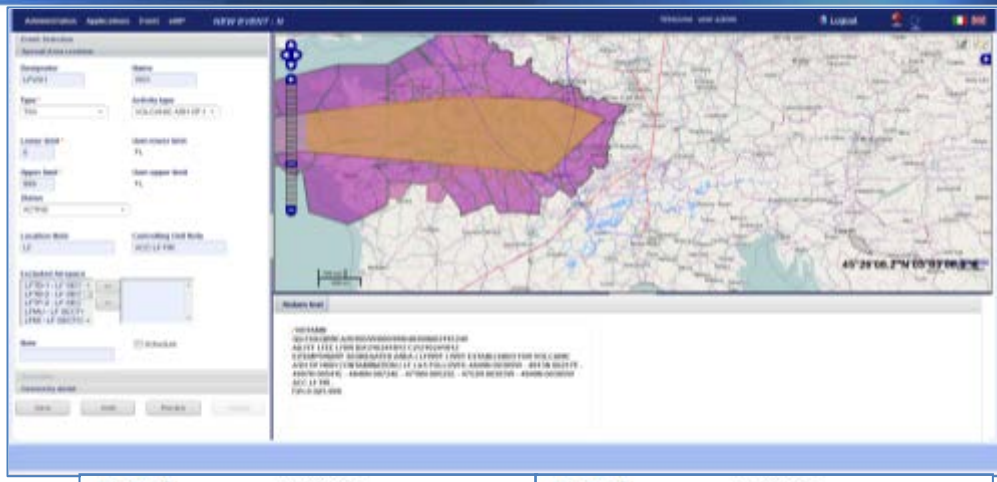


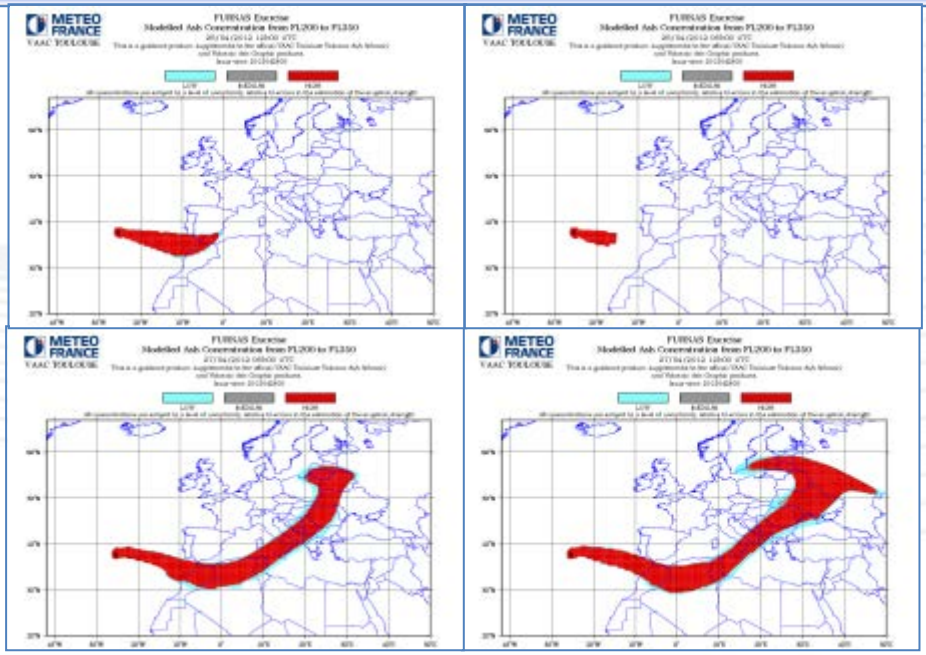


MET Capabilities

- *CRONOS is compliant with SESAR open specifications*

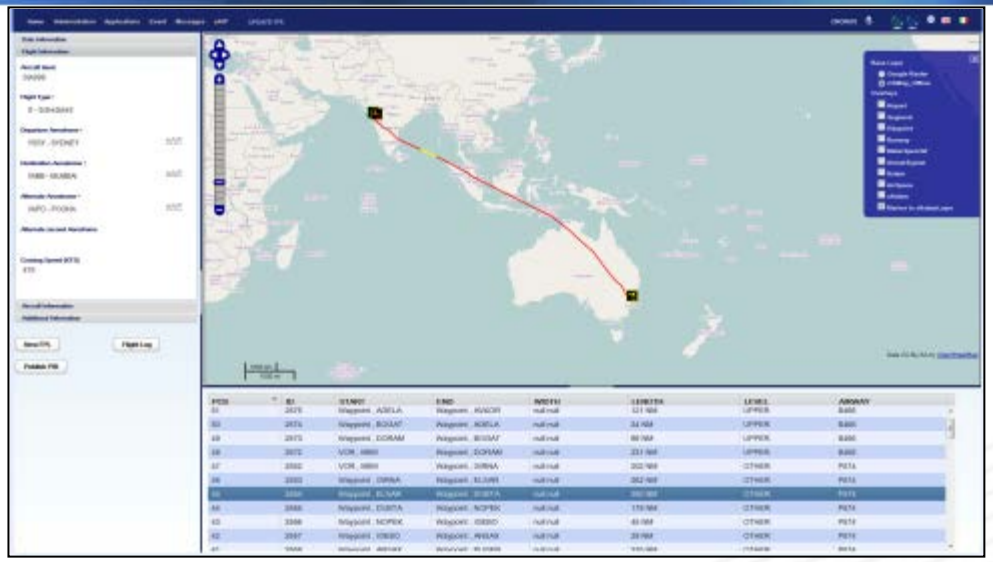
- *BENEFITS:*
  - *Reduced integration costs*
  - *Data Quality Improvement*
  - *Reduced redundant data*
  - *More efficient communication between all aeronautical stakeholders*





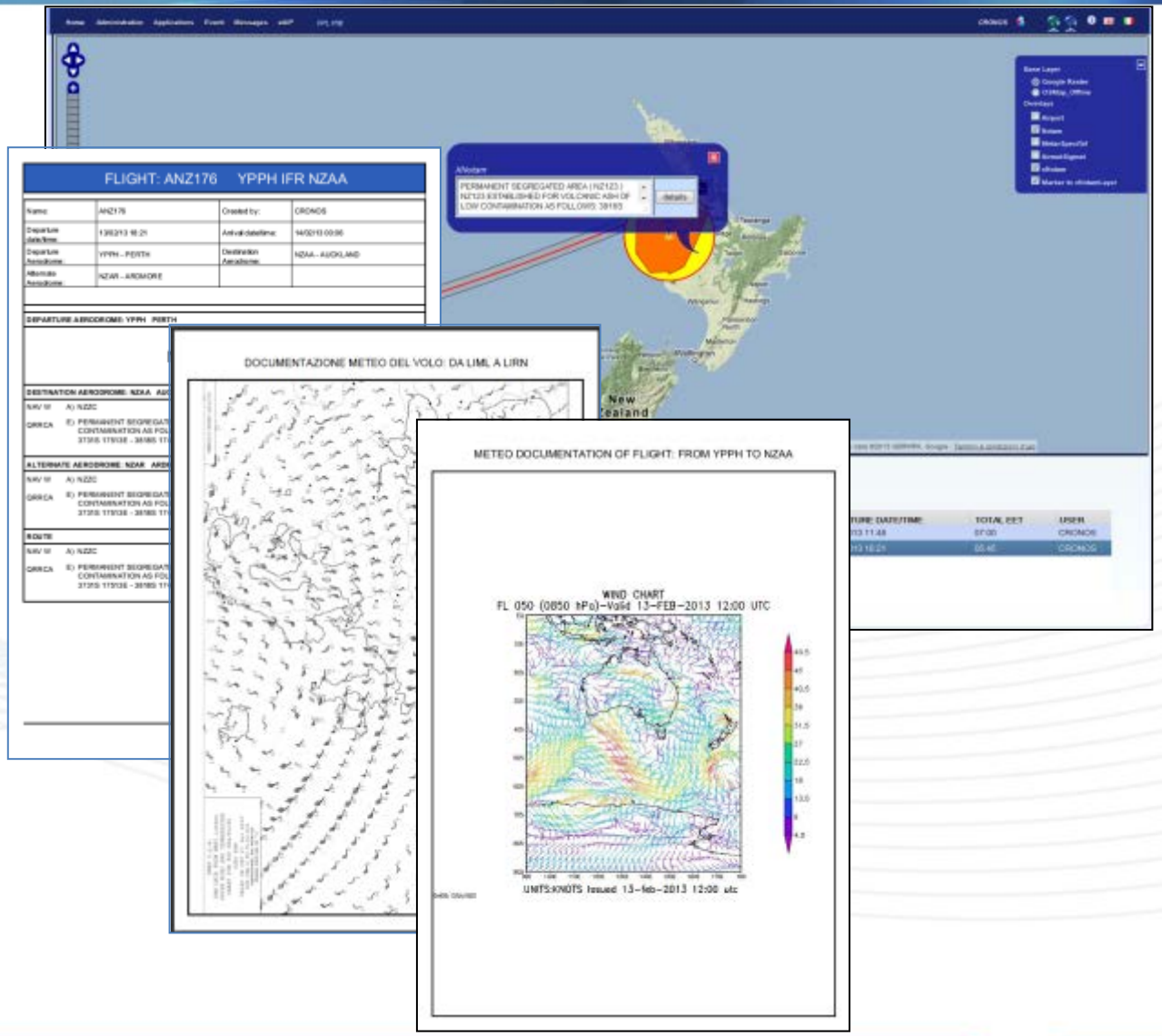
Flight Planning Capabilities

- *Management of Flight Objects and associated FPL and ATS messages*
- *Flight Plan Registration*
  - *Wizard based tool*
  - *Automated Routing*
  - *FPL Route assistance using Web-GIS visualization*
- *Flight Plan approval process*
- *PIB from FPL production*



Briefing Capabilities

- 5 Types of PIBs:
  - FPL
  - Area (2)
  - Airway
  - Aerodrome
- PIB Outputs
  - Graphical
  - Textual (ASCII)
  - HTML, XML, PDF
- Incremental Updates
  - Triggered email
  - Triggered sms



Questions?