

D-AIM towards Digital ATM

ENAV Group
Supporting requirements of ICAO 8126

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Main Driver for Strategic evolution (2020-2035)

European ATM Master Plan



ICAO ASBU and GANP



European AAS & Transition Plan









European Capacity & Resilience challenge

Airspace Architecture Study (AAS) and related Transition Plan

Decoupling of service provision from local infrastructure

Digital transformation (not limited to ATFM DCB): new infrastructure allowing air traffic and data service providers, irrespective of national borders, to plug in their operations where needed

Virtual centres implementation and delegation of ATS services **Changes in the way** on developing and deploying technologies, as well as in the way services are provided.

- Improved interoperability Levels: SOA/microservices approach, SWIM adoption, open standards
- **New business models**: ATM data distribution services: certified private service providers and ANSPs (e.g. ATFM ADSP)
- Subscription to public-service cloud-based data service (CCS)
- Al intelligence and incresed automation levels (e.g. Weather on Capacity service, TMI)



Industry trends the digital needs

Autonomous systems Avionics and Data



Digitalization



Augmented Reality



Artificial Intelligence Machine Learning



Blockchainpassenger and intelligent airport



IoT ATM/UTM Blockchain





Implications

Business model evolution **from asset** oriented **to service oriented**









Satellite
Technologies



Digitalization and Virtual Technologies





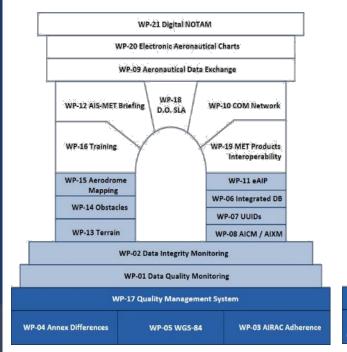
Service provisioning **decoupled** from **physical infrastructure** and **location**

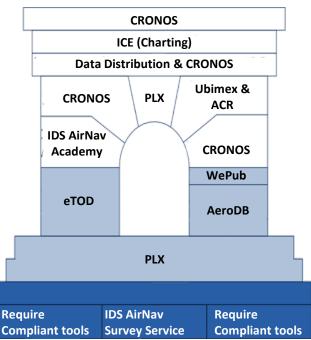


Automation

Leverage **automation** with **analytics** to efficiently and safely handle **growing amount of data**.

IDS AIRNAV to implement ICAO Transition From AIS to AIM





Phase 3: Information Management

- WP-09 Aeronautical Data Exchange
- WP-10 Communication Network
- WP-12 AIS-MET Briefing.
- WP-16 Training.
- WP-18 Agreement with Data Originators
- WP-19 MET Products Interoperability
- WP-20 Electronic Aeronautical Charts
- WP-21 Digital NOTAM

Phase 2: Going Digital

- WP-01 Data Quality Monitoring
- WP-02 Data Integrity Monitoring
- WP-06 Integrated Data stores
- WP-07 Unique identifiers
- WP-08 AICM / AIXM
- WP-11 eAIP
- WP-13 Terrain
- WP-14 Obstacles
- WP-15 Aerodrome Mapping

Phase 1: Consolidation

- WP-03 AIRAC Adherence
- WP-04 Annex 4 and 15 Differences
- WP-05 WGS-84
- WP-17 Quality Management System

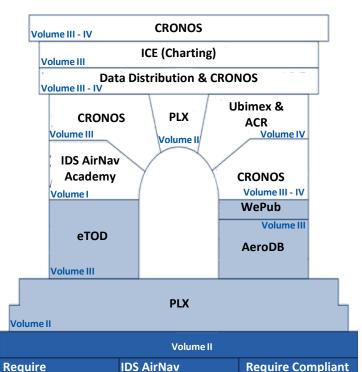


IDS AIRNAV Solution & ICAO DOC 8126 covering recommendations





- Volume I AIS Organizational Development
- Volume II The Aeronautical Data Process
- Volume III— Aeronautical Information in a standardized presentation
- **Volume IV** Digital Products and Services

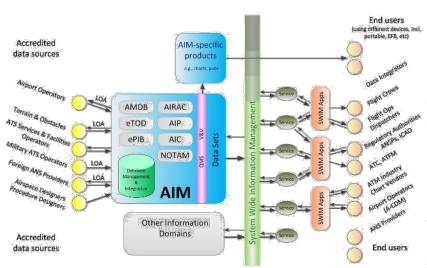


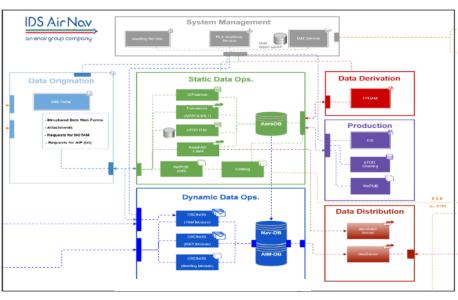
Survey Service

Compliant tools

tools

Logical view of the ideal AIM environment and actors VS the IDS AIRNAV







CRONOS

MET, Flight Plan, PIB

Dynamic AIS, NOTAM, D-NOTAM,

WePub

Aeronautical Publishing

AD Airspace Designer
Airspace and Route Design
ANNEX11
DOC8168 ANNEX14

EM analysis & virtual Flight Inspection

ANNEX 10 Doc 8071

Enabling SWIM and Aeronautical Data Framework



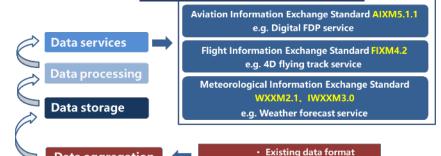




· SWIM data format

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- interoperability with third-parties systems
- Integration of multiple data sources
- Data provisioning to external systems
- SWIM Interfaces
- Provides data transformation, validation and integration functionalities to other products and systems

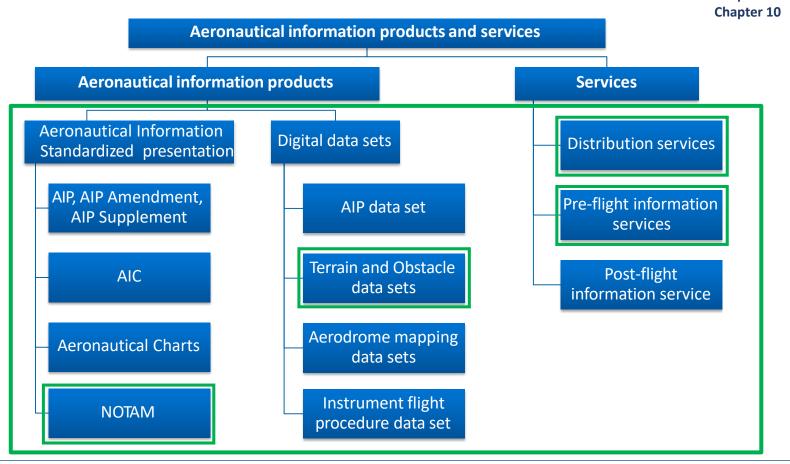


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Data aggregation

FOCUS on IDS AIRNAV Solution & ICAO DOC 8126 VOL III & IV

Chapter 6 Chapter 7





eTOD is the IDS AirNav answer to terrain and human made obstacles data management for:

 Import, validate and disseminate terrain and obstacle data coming from survey in accordance with ICAO doc 10066 (PANS-AIM)



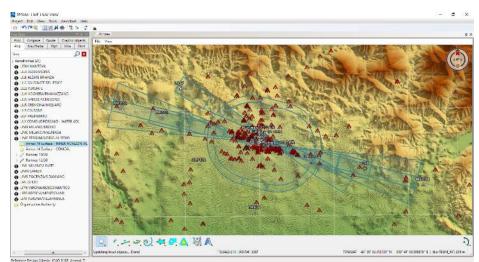
<u>Production</u> of Obstacle Chart (Type A, B and PATC)

Surveyor

eTOD – Main Modules

eTOD is composed of 3 modules:

1. Data Manager (DM): import, validate and disseminate obstacle and terrain data

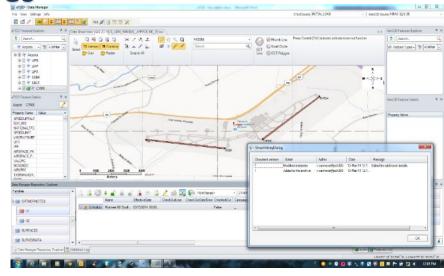


- 2. Airport Surface Designer (ASD): Design and assess ICAO Annex 4, 14 and 10066 surfaces and store them all in the database with the controlling obstructions
- 3. Charting: Type A, B and PATC charts generation

It can be deployed with existing AeroDB instances or with a dedicated validation (AIXM 5.1 extended, temporal based) database

eTOD – Data Manager Features

- <u>Import standard</u> input file formats:
 AIXM 5.1, KML, DVOF, DOF, ...
- <u>Import non-standard</u> input file formats: generic ASCII, xml
- <u>Define non-standard input file formats:</u> powerful tool for mapping the extended
- AIXM 5.1 schema with the input formats
- <u>Vector file formats management</u>: SHP, dgn, dxf file import and convert in aeronautical (AIXM 5.1 extended) forma
- <u>Validate the imported data</u>: before storing the data in the validation database data can be validated in accordance with the Annex 15 ICAO requirements or custom rules
- <u>Conflicts</u>: detection of conflicts on existing data done by identifier, logical key or position with a dedicated tolerances

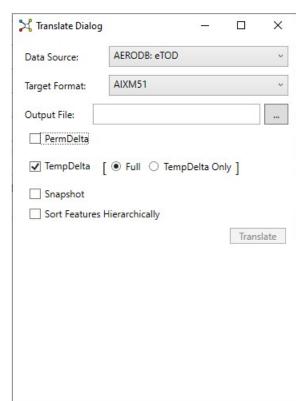


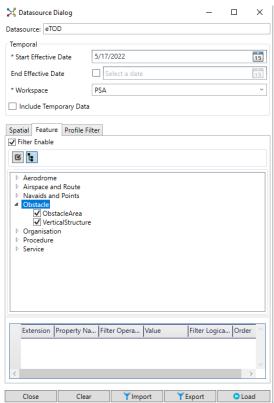
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eTOD – Data Manager Features

- GIS 2D/3D management: data directly imported from your raw file to GIS display
- Data preview: Preview in tabular and graphic views available for the data to be imported and data already stored
- Filtering: Powerful filtering capabilities based on any feature attribute
- Data storage and temporality: Store the data on the temporal based validation database or in AeroDB at a given effective date
- Calculation: Calculate the declared distances
- Repository: a dedicated repository for DTM/DSM/DEM, Raster, survey output, etc. with full traceability functions
- Export data: different formats (same as per input)
- What-if: create what-if scenarios and check the impact
- Expandability: able to be connected to Land Use Assessment system (LUAS) for obstacle proposals management

eTOD - Managing obstacles data set: PermDelta, TempDelta or Baseline

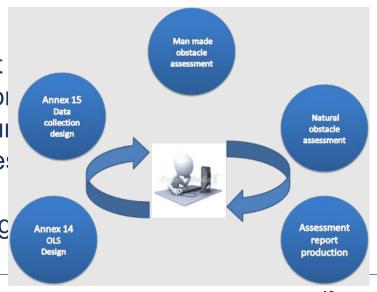




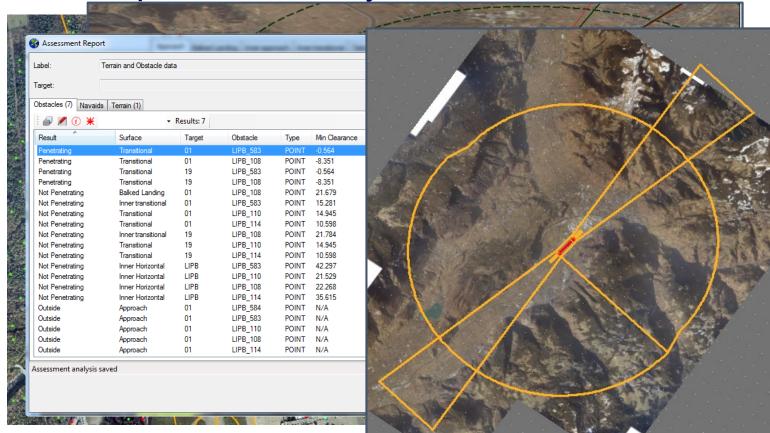
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eTOD – Airport Data Analyzer

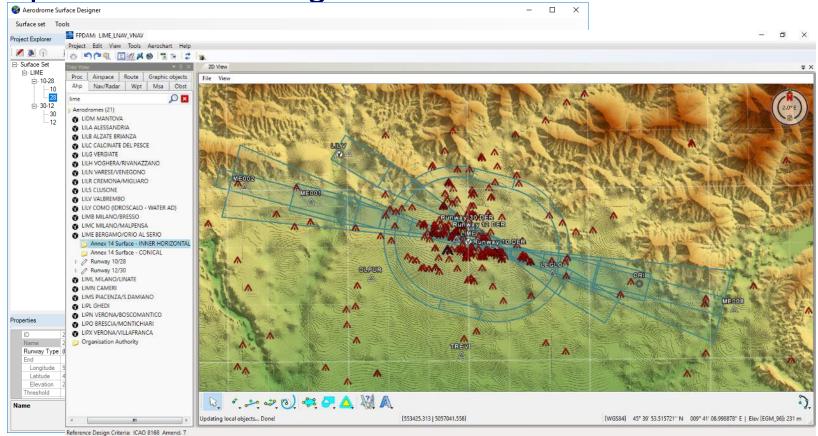
- Airport Annex 4 (Take Off Flight Path Area), 14 (OLS) surface design and assessment
- ICAO 10066 (former Annex 15) areas definition and design for data collection
- Full configurable parameters
- Airport data display and analysis
- Obstacle and terrain assessment
- Different criteria storage and tailor
- What-if analysis with fully configure
- DSM/DTM/DEM terrain files asses
- Raster data display
- Assessment results and surface g



eTOD – Airport Data Analyzer



Airport Surface Designer evolution





FOCUS on IDS AIRNAV Solution & ICAO DOC 8126 VOL III & IV NOTAM DIGITAL NOTAM to support changes of DOC 8126

Traditional NOTAM Management System

- NOTAM, OPMET, FPL management & dissemination
- minSDO AIXM Database
- Briefing Functionality
- · High Availability & Replication
- AMHS / AFTN Interface



Digital System

- Digital NOTAM management
- Full SDO AIXM5.1
- FIXM in FPL management
- Advanced Briefing
- SWIM interfaces



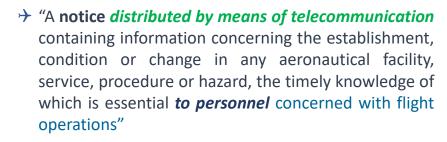




- Quality on NOTAM Proposal (ADQ)
- Advanced Briefing Functionality
- AIXM FIXM WXXM
- SWIM AMHS AFTN networks
- High Availability Architecture
- Dual Environment

What is a Digital NOTAM?

→ Current NOTAM

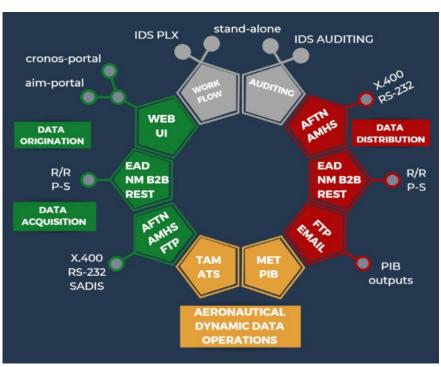


→ <u>Digital aeronautical information update</u>

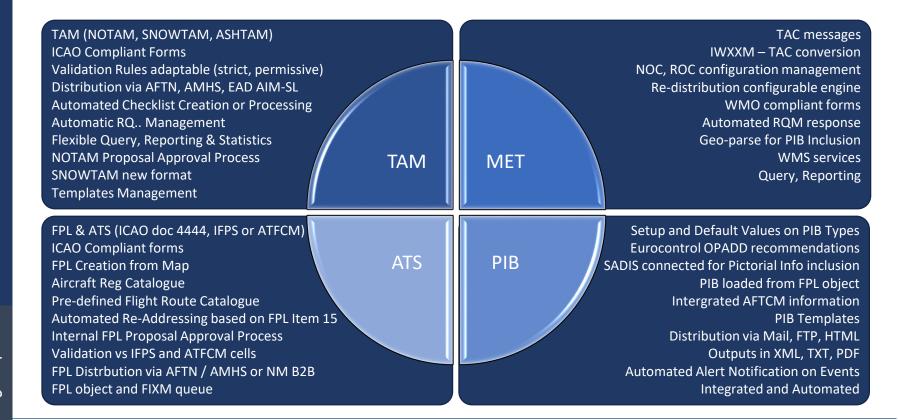
"A dataset made available through digital services containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to systems and automated equipment used by personnel concerned with flight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

Logical scheme of CRONOS environment





CRONOS Modules overview





Advantages

▶ Data Quality

Fullfillment of Data Integrity and Data Quality Requirements, from data origination to its distribution through digital NOTAM module and IDS PLX Integration

Workflows

Efficient Tracking of the main activities on aeronautical data (Incoming/outgoing messages)

Data Dissemination

► Multiples Network Communication Patterns (AFTN, AMHS, SWIM)

№ Technology

- → 3-tier architecture
- ★ Compliancy to standards and european regulations

Strategic

AIXM5.1 Event, FIXM, WXXM Ready



Strengths' Points

- From Data Origination, to Information Distribution:
 - Fulfillment of Data Integrity and Data Quality Requirements
 - Efficient Tracking of main activities on aeronautical data
 - Static-to-Dynamic and viceversa data flows in a common solution
 - Seamless integrated environment for information management
 - Paperless solution

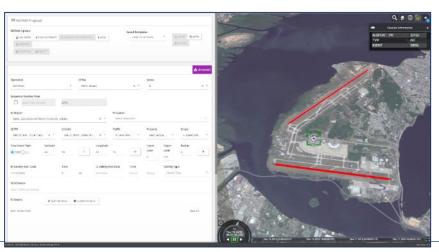
CRONOS Dashboard



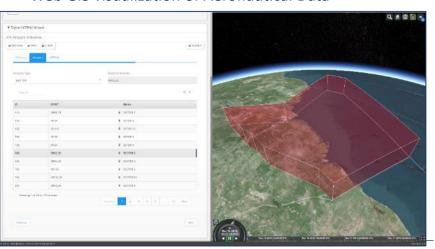


TAM Capabilities

- Dual Environment for traditional and D-NOTAM
- NOTAM Proposal Approval Process
- NOTAM Dissemination via different channels
- TAM lists, querying and reporting
- Templates management
- Replacement and Cancelation
- ICAO Rules and data consistency validation
- SDO Linkage
- Auditing and traceability



- Aeronautical Event Approval Process
- D-NOTAM Dissemination
- D-NOTAM Event Lists, Querying and Reporting
- Scenarios Formats
- Eurocontrol Rules
- Event AIXM51 > TAM conversion
- Auditing and traceability
- Collection & Distribution via AFTN, AMHS, or Publish-Subscribe
- Web GIS visualization of Aeronautical Data





Digital NOTAM Packages

• CRONOS implements 100% of the Event Scenarios of Eurocontrol Digital NOTAM Specifications

Aerodrome (Airport, Runway)

- Closure
- Limitation

Airspace (ATS, SAA)

- Activation
- De-Activation
- Creation

NAVAIDS

Unserviceable

Airways

- Route Portion Opening
- Route Portion Closure

Obstacle

Creation





MET Capabilities

OPMET – TAC from AMHS, AFTN

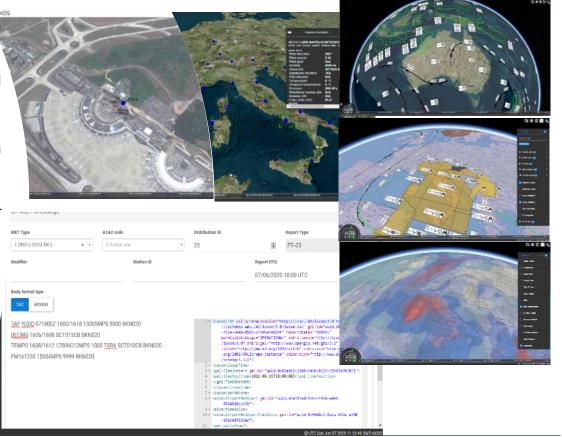
 OPMET – IWXXM from SWIM Gateway

 OPMET automatic bulletin collection & distribution

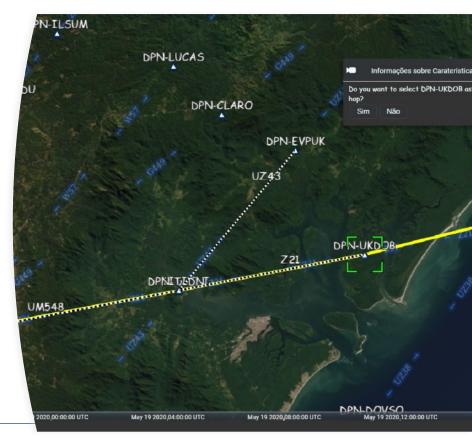
 Storage and visualization of MET Products







- FPL functions to create from a textual panel or directly on a WEB-GIS Map
- Composition wizard to compose a FPL and update it via ATS messages
- Update of SDO dataset from
 - Aero-DB (domestic flights)
 - SDO Import (AIXM, ARINC, DAFIF)
- Pre-defined flight route, Aircraft Reg Catalogue and Automatic Addressing of AFTN/AMHS in relation to the Flight Route

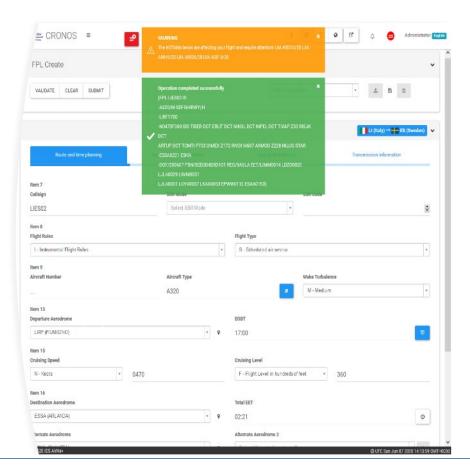




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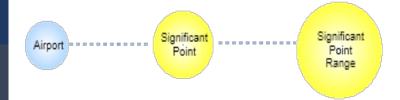
ATS Module

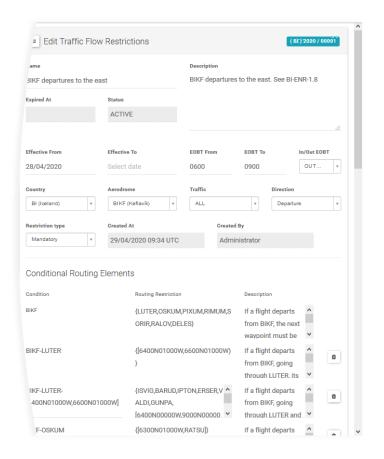
- A cartographic interface to build up Item 15 of FPL
- Domestic Flight validated against SDO data synchronized with Aerodb
- Flights also evaluated against
 - SDO data imported from
 - AIXM packages from EAD-ESI
 - ARINC datasets from Jeppesen
 - DAFIF datasets
 - Dynamic data (TAM)
 - Aerodrome Working Hours
 - Special Activity Areas
 - IFPS / ATFCM
 - ICAO Doc 4444 / ADEXP
 - ICAO Annex 2



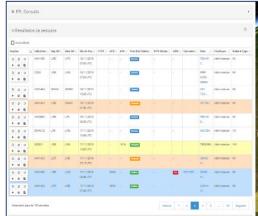
Traffic Flow Restrictions

- Configurable by Type
 - On departure flight
 - · On arrival flight
 - · On En-Route connectivity constraints
 - On DCT connectivity constraints
- · Based on Time
- Constrained by Points or Segments or Areas



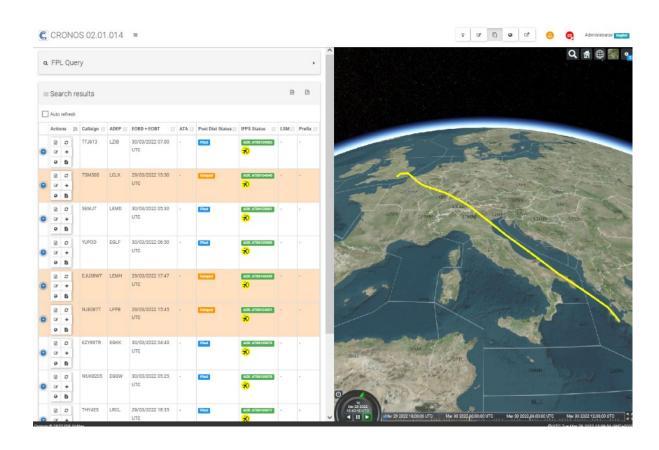








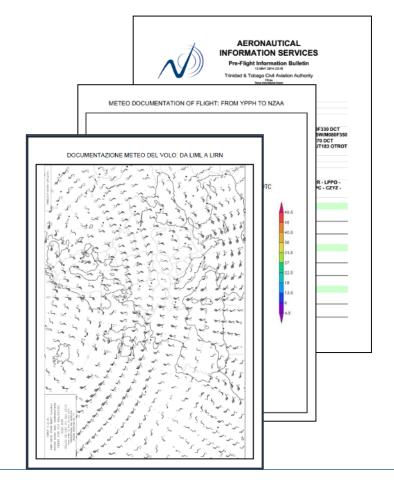






PIB Module

- In addition to the aeronautical data, CRONOS can also manage meteorological data and charts by means of CRONOS – MET Module
- Interfaces like AMHS or SADIS are used as source of information also to build up a Pre-Flight Information bulletin
 - <u>Automatic</u>: bulletins (Full, Updates, Event) are sent automatically to the pilots
 - <u>Integrated</u>: bulletins can contain aeronautical and meteorological data, meteorological charts WMO and customer-constrained

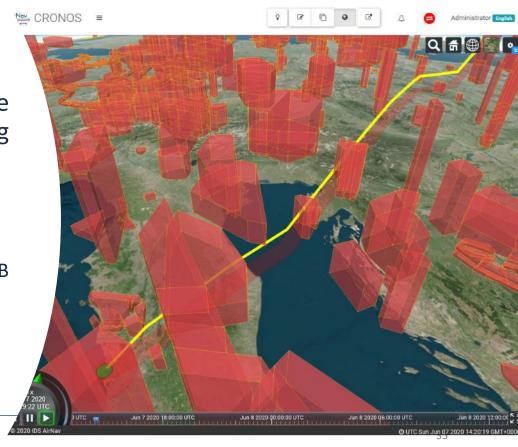


PIB Module

Different PIB types can be requested, according Eurocontrol OPADD rules

• PIB output is

- Graphical > immersed into the WEB
 GIS Map component
- **Textual** > presented as a report
- Received automatically by
 - email, ftp





Integrated Briefing ... not only for AIS-TAMs



AERONAUTICAL INFORMATION SERVICES

Pre-Flight Information Bulletin

Aeronautica Militare Italiana

Report Name ARANCINO (LICC-LSGG) STANDARD ROUTE Report Type Service Type OPMET, CHARTS Message types Validity (UTC) 15 DEC 2021 08:58 - 15 DEC 2021 10:58 Height Limits (lower/ First: 100/340 Other: 000/340 Last: 000/340 upper) Route Departure Aerodrome LICC Arrival Aerodrome LSGG Alternate Arrival LFLS - LOWI Aerodromes Alternate En-Route LIBV - LIRF - LIPC - LIPS Aerodromes En-route FIRs LIRR - LIMM - LFMM - LSAS - LOVV - LIBB

AERODROME (DEPARTURE): LICC (CATANIA/Fontanarossa)

M

METAR LICC 150920Z 23005KT 200V260 CAVOK 13/08 Q1023=

TAF LICC 150500Z 1506/1606 VRB06KT CAVOK=

AERODROME (ARRIVAL): LSGG (GENEVE)

ME

METAR L8GG 150850Z VRB01KT 0500 R04/0700N R22/0650N FG VV002 02/02 Q1031 NOSIG=

TAF L8GG 1508282 1509/1618 VRB02KT 0400 FG VV001 TX03/18142 TN00/16082 TX04/16142 BECMG 1510/1513 3000 BR 0VC008 FR0B30 1515/1520 6000 BRN012=

AERODROME (ARRIVAL ALTERNATE): LFLS (GRENOBLE ISERE)

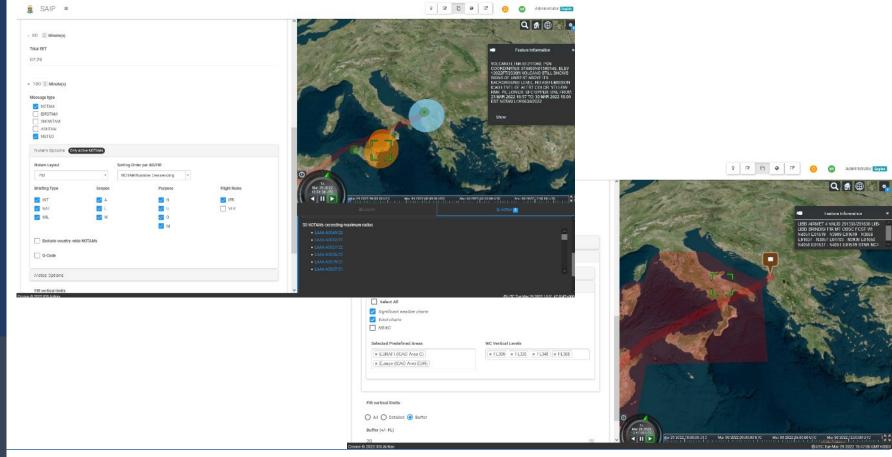
845

METAR LFLS 150900Z AUTO 00000KT 6000 NSC M00/M00 Q1029 NOSIG=





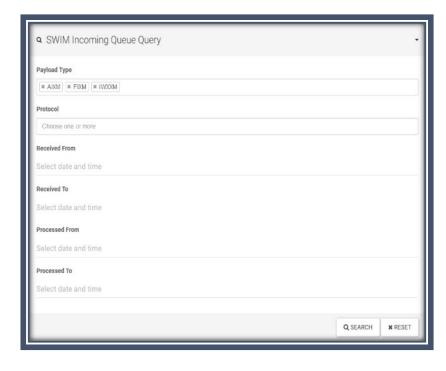
Digital Briefing ... not only in paper format





SWIM Gateway

- CRONOS supports ICAO Global Air Navigation Plan (GANP) and ICAO Aviation System Block Upgrade (ASBU) program by having included its own SWIM GATEWAY
- To support common knowledge and situational display, the information has been made
 - Aggregated from different available data packages (AIXM, FIXM, IWXXM)
 - Consumed via **SWIM** patterns
 - Accessible via **Open Interfaces**
 - Globally Standardized and
 - Secured
- AFTN / AMHS networks can be configured to act in synch to SWIM connectors or prioritized as second source of information



o√enav group

CRONOS allows integration with SWIM services like:

- EAD AIM-SL > for communication and exchange of "dynamic" aeronautical information (TAM)
 with EAD
- EAD PAMS > for the download of Aeronautical Information Publications and Charts from EAD
- Eurocontrol NM B2B > for the preparation, filing, and management ATS packages by means of Network Manager B2B
- SWIM over AMHS > for the exchage of the IWXXM packages using X.400 with FTBP
- CRONOS APIs used for
 - CRONOS MOBILE APP (Android / iOS) for Pilots
 - ARMS (Billing)
 - **D-FLIGHT** / UTM

CRONOS / Eurocontrol NM Service interoperability

CRONOS Flight Plan Module and Eurocontrol NM B2B

B2B Services are an enabler for more efficient operations

- Flight Plan Preparation services help an Airspace User to request the most efficient Flight Trajectory, based on criteria such as
 - Distance
 - Fuel
 - Charges
 - Duration
 - operational airspace structure
 - Airspace availability: actual traffic synchronization
 - Callsign de-confliction
- Flight Plan Filing services help an Airspace User to request the proper addressing and distribution
- Flight Plan Management regulates the effective operation start



- **Route Assistance**
- Validate FlightPlan
- **Propose Routes**





- **File Flight Updates**
- **Retrieve Filing Status**







- **Query Flights by Keys**
- **Retrieve Flights**
- **Submit Flight Confirmation**
- **Slot Improvements**





Global Reporting Format (SNOWTAM)



PANS-AIM Doc. 10066
 Applicability Date: Nov 2021



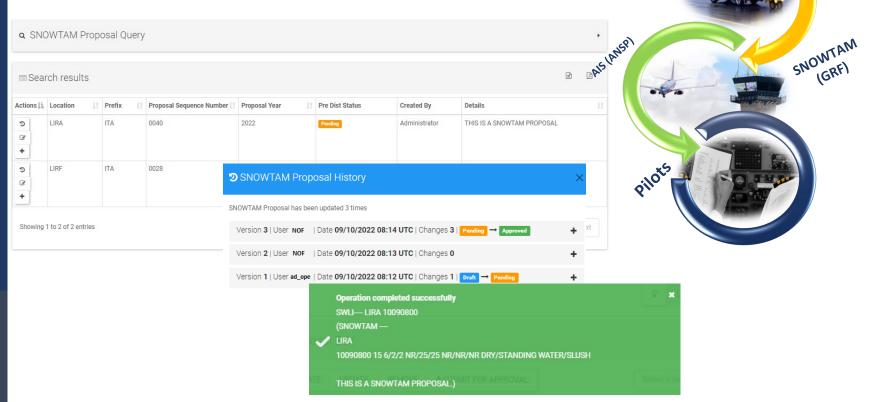
• EU Reg. no. 139/2014

Applicability Date: Aug 2022



CRONOS TAM Module

Global Reporting Format (GRF) Workflow





AD Operators

Flight Preparation

- For AOs' Users to request the most valuable flight route for their own FPL, or FPL Proposal based on the actual traffic conditions of the network
- For each proposed route, information about, Timing, costs, and fuel are indicated

(FPL-SP00HG
-PA31/L-SGY/S
-EPKK0500
-N0160F100 NUMBA4J NUMBA DCT DINOV T738 EKSEK Z348
NAROX DCT
BEBEX/N0170F060 Q230 GOTGI DCT
-EDVK0233 EDLN EDDK
-DOF/210624 EET/EDMM0113 EDWW0215 ORGN/EPKKZPZX
RMK/IFPS CHANGE OF
ROUTE ACCEPTED)

		Route Color on Map	Distance (NM)	Consumed fuel indicator (Kg)	Total EET (HH:mm)	Charges indication (€)	СТОТ
0	9	•	410	383	02:36	99	
0	v	•	414	387	02:38	99	
0	9	•	414	387	02:38	99	-

IDS AIRNAV Experience - EU SWIM Events

IDS AIRNAV actively attended last two SWIM global events using the same foundation frameworks and components behind ATFM Suite.

SESAR SWIMGlobal Demonstration

DEMO 3 Day 2: 09:15 – 10:30

Joint interoperability demonstration: Australia - United Arab Emirates - Europe

Air Services Australia, Austro Control, UAE General Civil Aviation Authority (GCAA), Dubai Air Navigation Services (DANS), Emirates Airlines, Qantas, EUMETNET, Eurocontrol, UAE National Centre for Meteorology and Seismology (NCMS), Frequentis, Honeywell, Ingegneria Dei Sistemi S.p.A. (IDS), Thales, TOPLINK, Boeing Jeppesen, Comsoft

CRONOS - Aeronautical NOTAM system

Ingegneria Dei Sistemi - IDS

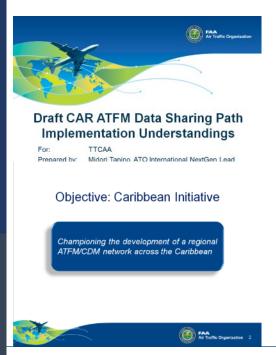
CRONOS is the IDS solution for an aeronautical 'dynamic' data management system that involves operational processes and is intended to be used by NOTAM offices (NOF) and aeronautical information services (AIS).

10 SESAR SWIM Global Demonstration, Rome ACC, 8-9 June 2016



IDS AIRNAV - FAA SWIM Events

IDS AIRNAV actively attended SWIM Mini Global (FAA) and supports Caribbean data provision to FAA via SWIM (FIXM adapter to FAA).













Information Management as a component of the **future ATM Operational Concept**













Air Traffic Management

- CNS/ATM/MET systems
- ATC Simulation systems

Ummanned Traffic Management

Solution for UTM Management

ATM



- Demanding/Capacity Balance
- Sectorization

Airspace Management

Civil/Military Coordination

Aeronautical Information Management

- NOTAM-D-Notam, FPL, MET, PIB
- **SWIM**

ASM

AIM

AIS

ATFM

AMHS

Aeronautical Information Services

- Aeronautical Charting/Publishing
- Flight Procedure and Airspace Design

Aeronautical

- Airspace Design/Management
- Flight Procedure Design
- Feasibility and Master Plan
- Safety & Security Services
- Aeronautical Publication

Services



- CNS/ATM System Inst.
- Solution Customization
- Validation/Testing
- System Integration
- On site Support





THANKS FOR YOUR ATTENTION