Sistemas Aeronáuticos de Gestión y Producción: El Desafío AIM

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Agenda

1. Referencias de Base
2. AIM: Una aproximación por fases
3. Sistemas: Indicaciones e consideraciones tecnológicas
4. Implementaciones y Herramientas
5. Sugerencias y Alertas
6. Algunos Ejemplos

1. Referencias de Base

Normas de Referencia

- RoadMap for the transition from AIS to AIM
- ICAO annex 15 y ICAO Doc 8126
- Mandato OACI a los Estados sobre Data Quality
- CHAIN guidelines
- EUROCAE ED-76, 'Industry Standards for Processing Aeronautical Data'
- EUROCAE ED-77, 'Industry Standards for Aeronautical Information
- SES (Single European Sky)

ICAO Annex 15

"The object of the aeronautical information service is to ensure the flow of information/data necessary for the safety, regularity and efficiency of international air navigation. The role and importance of aeronautical information/data changed significantly with the implementation of area navigation (RNAV), required navigation performance (RNP), airborne computer-based navigation systems and data link systems. Corrupt or erroneous aeronautical information/data can potentially affect the safety of air navigation"

Importancia de la Información Aeronáutica

De la "**Roadmap for the transition from AIS to AIM**" de OACI

- In the global ATM system, **AIS** will become **one of the most valuable and important enabling services**, providing timely availability of high-quality and reliable electronic aeronautical, meteorological, airspace and flow management information.

- The **role of AIS** will need to transform to **an information management service** to cope with and manage the provision of these information.

- **High-quality aeronautical information** is a prerequisite for the development of new tools that future aircraft will carry to improve their effectiveness, safety and efficiency.

- The transition to AIM will **not involve many changes in the scope** of information to be distributed; the major change will be the **introduction of new products and services** and an increased emphasis on **better data quality**, integrity and timeliness.

AIS al AIM – Cambios

- **Users** - The provision of aeronautical information today is mainly focused on the requirements of pre-flight briefing. The provision of aeronautical information tomorrow will address the requirements of **all components of the ATM system** for all phases of flight.

- **Data** - Both graphical and text products will be based on the same underlying, standard definition of **geo-referenced atomic digital data**. This will enable the definition of new products where both text and graphics will be presented in a more readable form.

- **Products** - Pre-flight information bulletins combining textual and graphical information, electronic chart displays, in-flight information bulletins, integrated aeronautical information package.

- **Static versus dynamic information** - These two types of information will be transferred by **common networks** under the same data exchange mechanisms using the same data standard definitions.

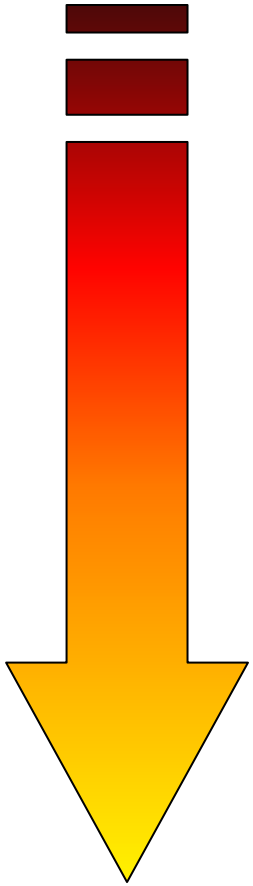
- **AIRAC cycle** - The future ATM system will be **free to identify a better cycle** that will adequately balance the need for improved reactivity with the need for advanced planning.

Transición al AIM. Desafíos

- Definición de procesos y protocolos para la recepción, vealidación y incorporación de información que llegue del externo
- Definición de procesos y protocolos para la producción y distribución de productos al externo
- Los dos puntos anteriores estrictamente conectados al Proceso de Calidad de la Entidad
- Todas las relaciones entre proveedores de información, integradores de información, generadores de productos, y usuarios finales, tienen que ser claramente definidas y formalmente normatizadas
- Los estándares de intercambio y los alcances y performance tienen que ser monitoreados permanentemente para verificar la obtención de lo espectado
- Mas especialización de tareas y cargos en las varias fases de elaboración (gestión y validación datos, producción, distribución) con objetivos nuevos cuales productos específicos necesarios al ATM, que hoy solamente de forma puntual el AIS provee bajo requerimiento
- Capacitación especifica del personal

2. AIM: Una aproximación por fases

AIS to AIM Roadmap



Consolidation (2008-2009)

- Quality procedures
- WGS-84 implementation

Going Digital (2010-2011)

- Data quality and integrity monitoring
- Integrated aeronautical information database
- Aeronautical information conceptual model
- eAIP
- Aerodrome mapping, obstacles, terrain

Information Management (2012-...)

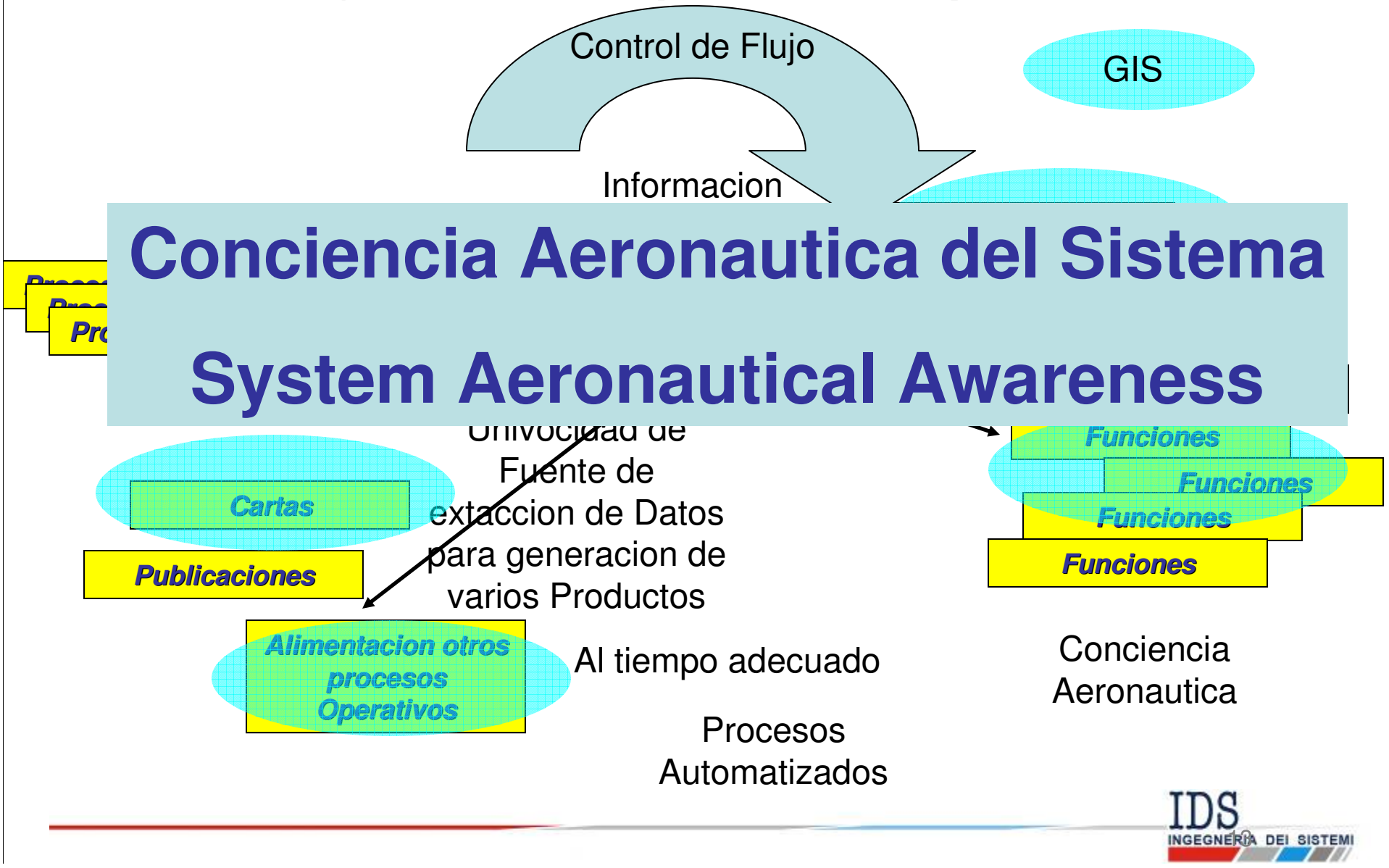
- Digital NOTAMS, aeronautical information briefing
- Aeronautical data exchange, communication networks
- Electronic aeronautical charts

3. Sistemas: Indicaciones e consideraciones tecnologicas

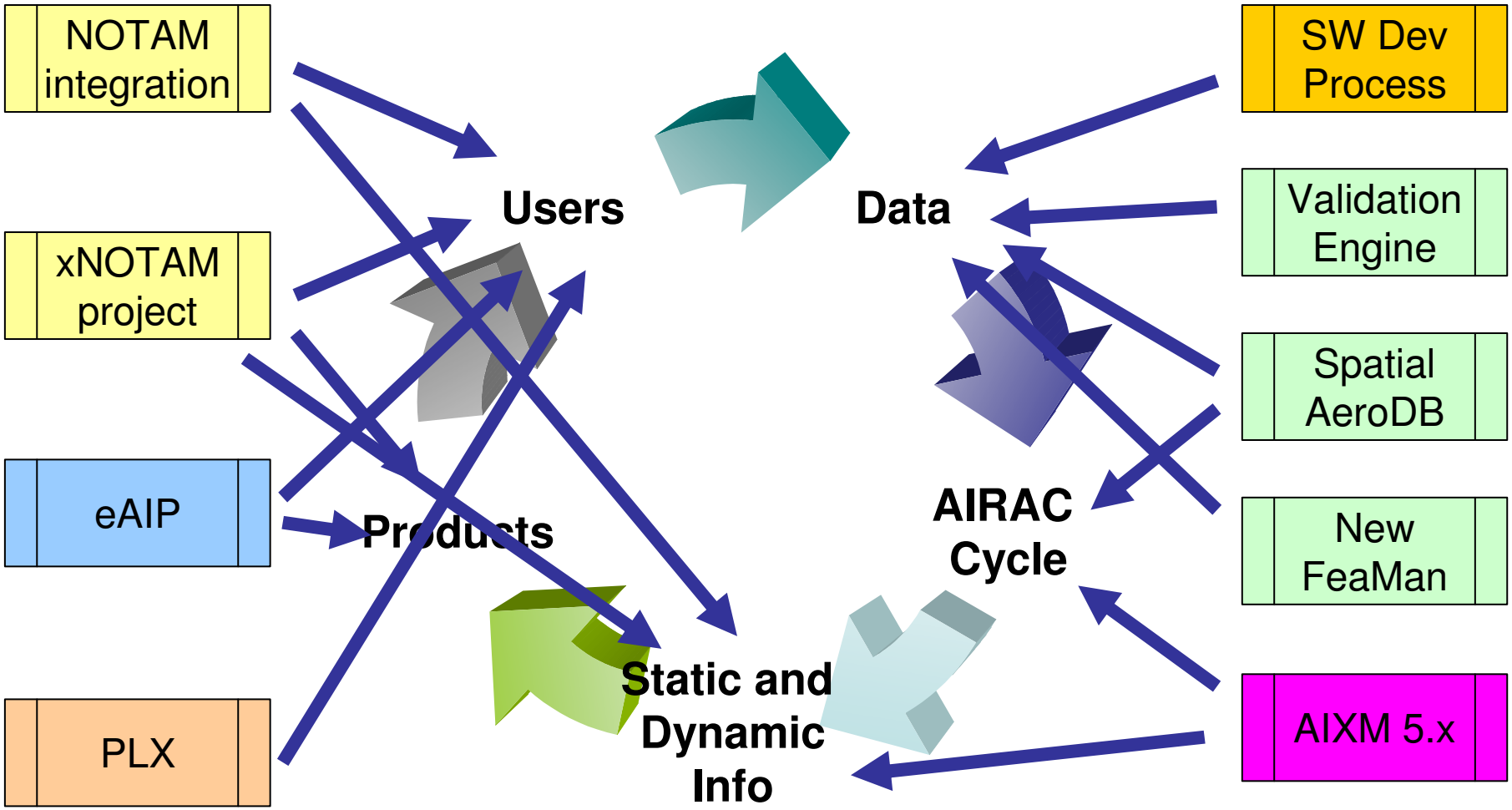
Sistemas de Gestión y de Producción hoy: Indicaciones de tipo Técnico Operativo

1. Información Centralizada, o de cualquier forma almacenada una sola vez y extraída desde su repositorio univoco para el siguiente uso
2. Transferencia controlada de la información para control de integridad
3. Filtro en el ingreso de datos para comprobar por los menos los niveles mandatarios mínimos de consistencia
4. Extracción univoca de los datos para generación de todos los productos
5. Disponibilidad “al tiempo requerido” de la información a tratarse para la publicación (AIRAC)
6. Proceso lo mas posible automático para evitar errores humanos
7. Control de CRC en los pasos varios de uso de los paquetes de datos
8. Control de flujo end-to-end
9. AIXM para intercambio de paquetes de datos aeronáuticos
10. Conformidad con las normas OACI, u otras aplicables: **“consciencia aeronautica del sistema”** en su funciones y lógica de trabajo
11. Implementación **modular** complementando lo ya existente

Sistemas de Gestión y de Producción hoy: Sugerencias de tipo Técnico Operativo



AIS al AIM – Cambios

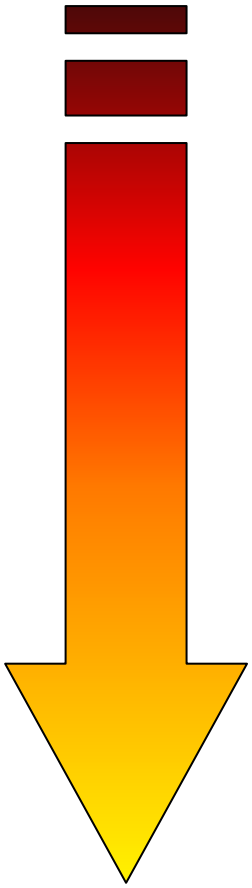


AIS to AIM Roadmap. IDS approach

(Q1 2009)
- PLX
- eAIP

(Q3 2009)
- Spatial AeroDB
- New G/FeaMan
- Validation Engine
- NOTAM integration

(Q2 2010)
- SW Development Process
- AIXM 5
- xNOTAM project



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Proceso de desarrollo del software IDS

Toma en cuenta:

MIL-STD-498
Software development and documentation

ISO 12207:2008
Systems and software engineering – Software life cycle process

IEEE 1074
Guide for Developing Software Life Cycle Processes

ED 153
Guidelines for ANS Software Safety Assurance

IEEE STD 1028
IEEE standards for software reviews

MIL-STD-1521
Technical reviews and audits for systems, equipments, and computer software

IEEE STD 730
IEE Standards for Software Quality Assurance Plan

Requerimientos de “System Safety”

General

- 11.1 RQS.SA.01 DO-201A Standard Compliance
- 11.2 RQS.SA.02 Aeronautical Data Timeliness
- 11.3 RQS.SA.03 Data retention
- 11.4 RQS.SA.04 Data structure configurability
- 11.5 RQS.SA.05 Use of standard data electronic format
- 11.12 RQS.SA.12 CRC use

Data input

- 11.9 RQS.SA.09 Manual Data Introduction
- 11.10 RQS.SA.10 Batch data introduction
- 11.11 RQS.SA.11 Data validation

Data export

- 11.13 RQS.SA.13 Publication Validation
- 11.14 RQS.SA.14 Aeronautical Chart Validation
- 11.15 RQS.SA.15 Electronic Format Output Validation

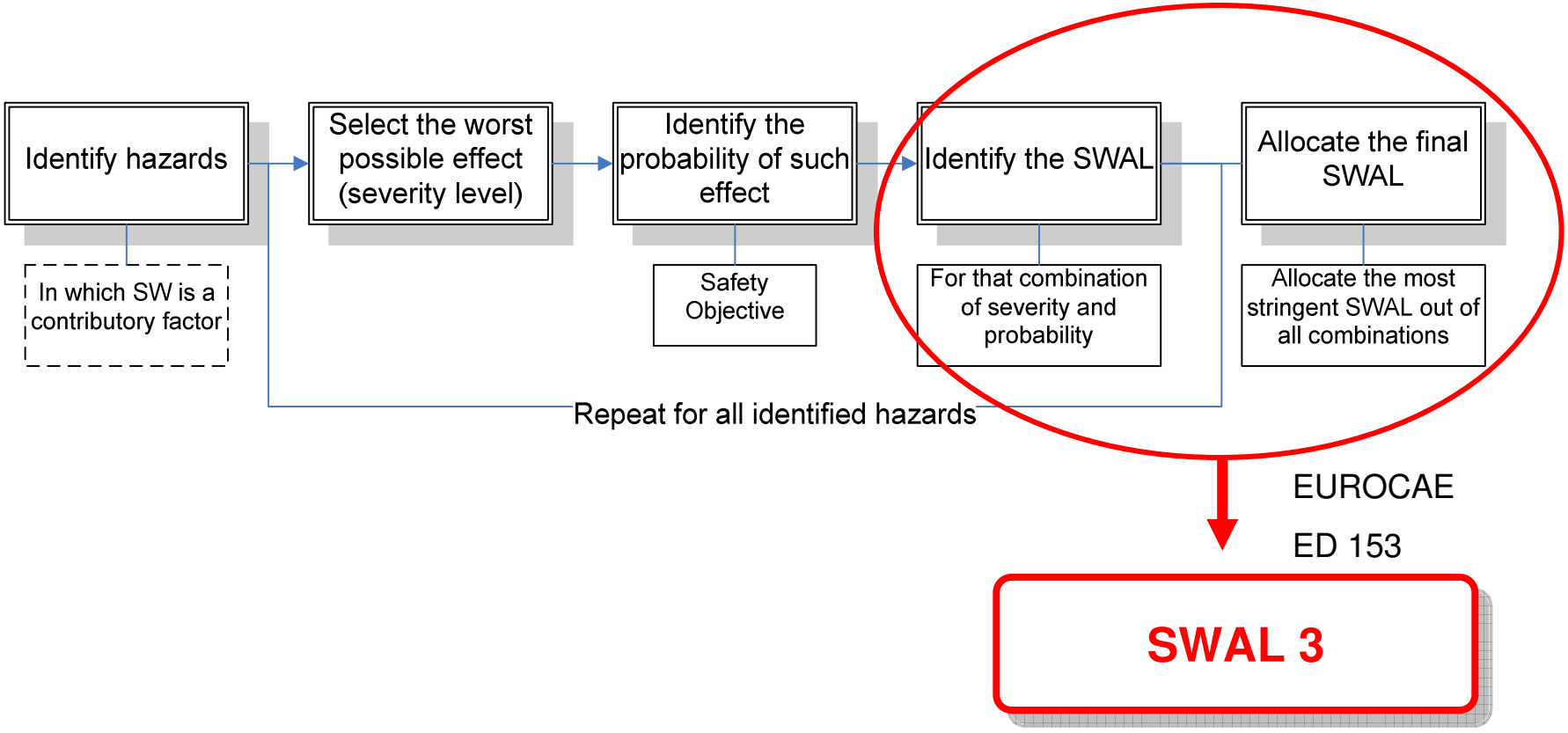
Data safety analysis
and requirements
follow the guidelines set forth
in DO-200A and DO-201A

Traceability

- 11.6 RQS.SA.06 Error Traceability During Validation and Verification
- 11.7 RQS.SA.07 Traceability Between Data Attributes And Generated Products
- 11.8 RQS.SA.08 Metadata Management

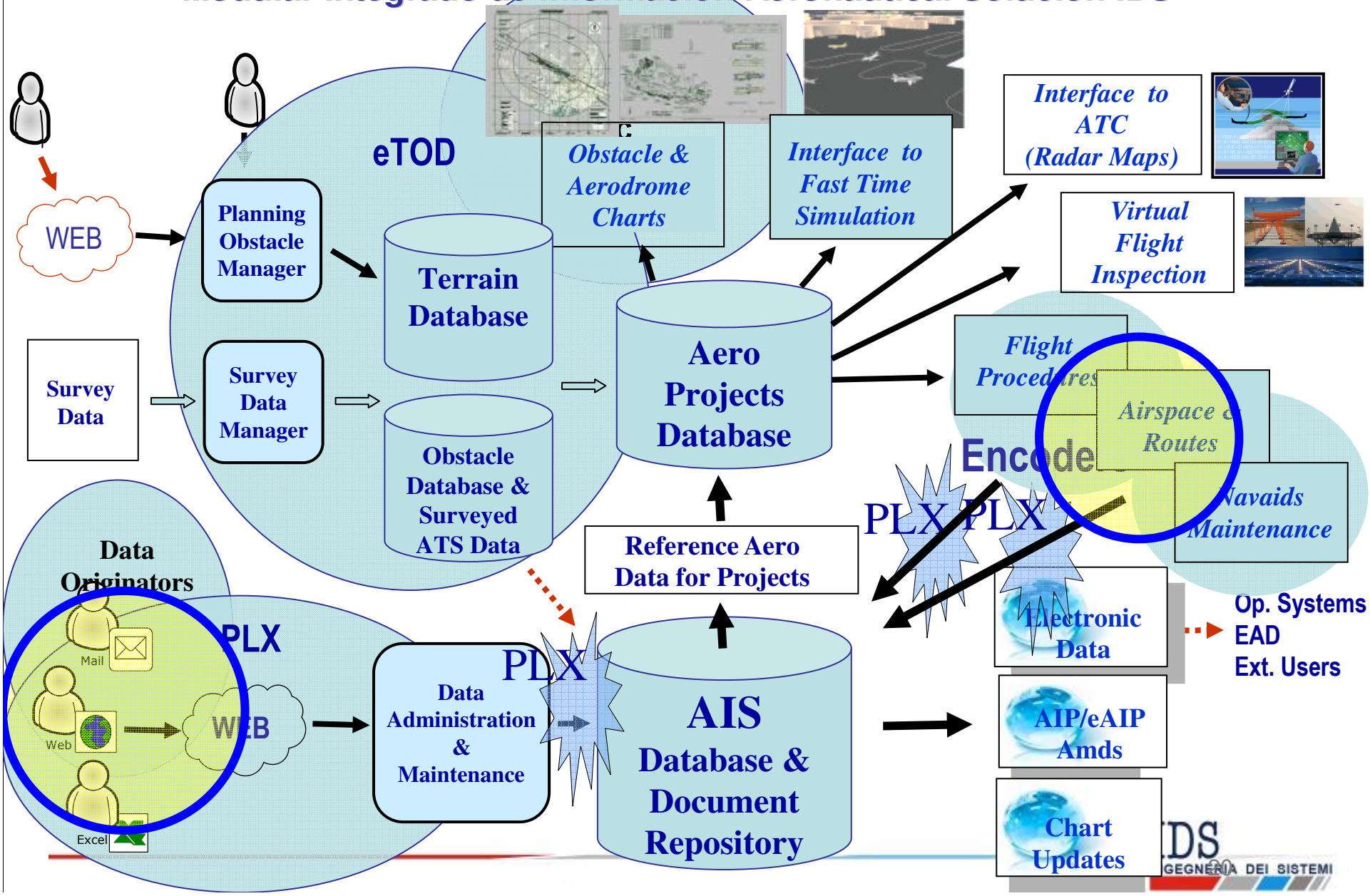
Resultados del "Safety Assessment"

Approved by EUROCONTROL in 2003
Mandatory (in EU) in January 2009

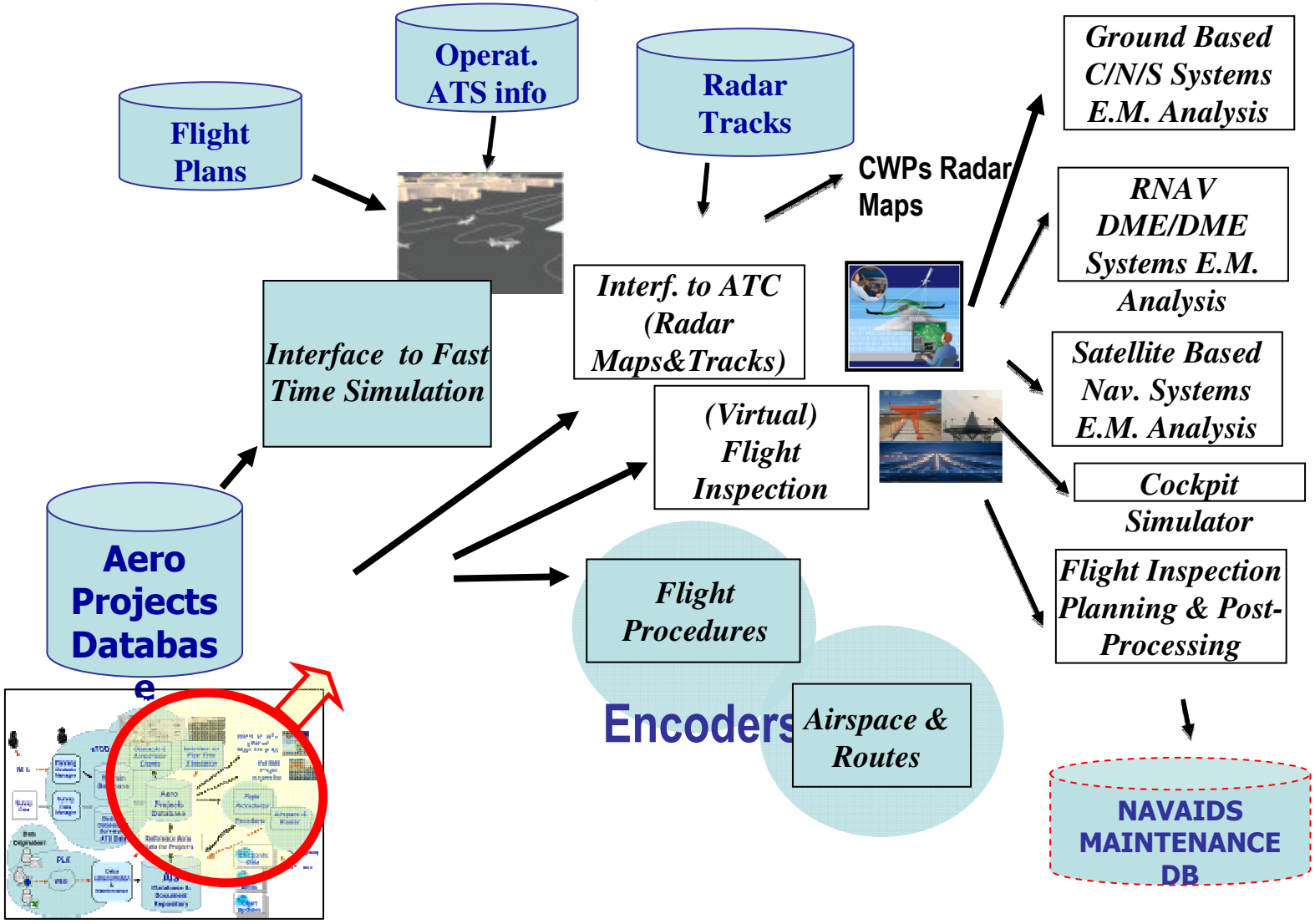


4. Implementaciones y Herramientas

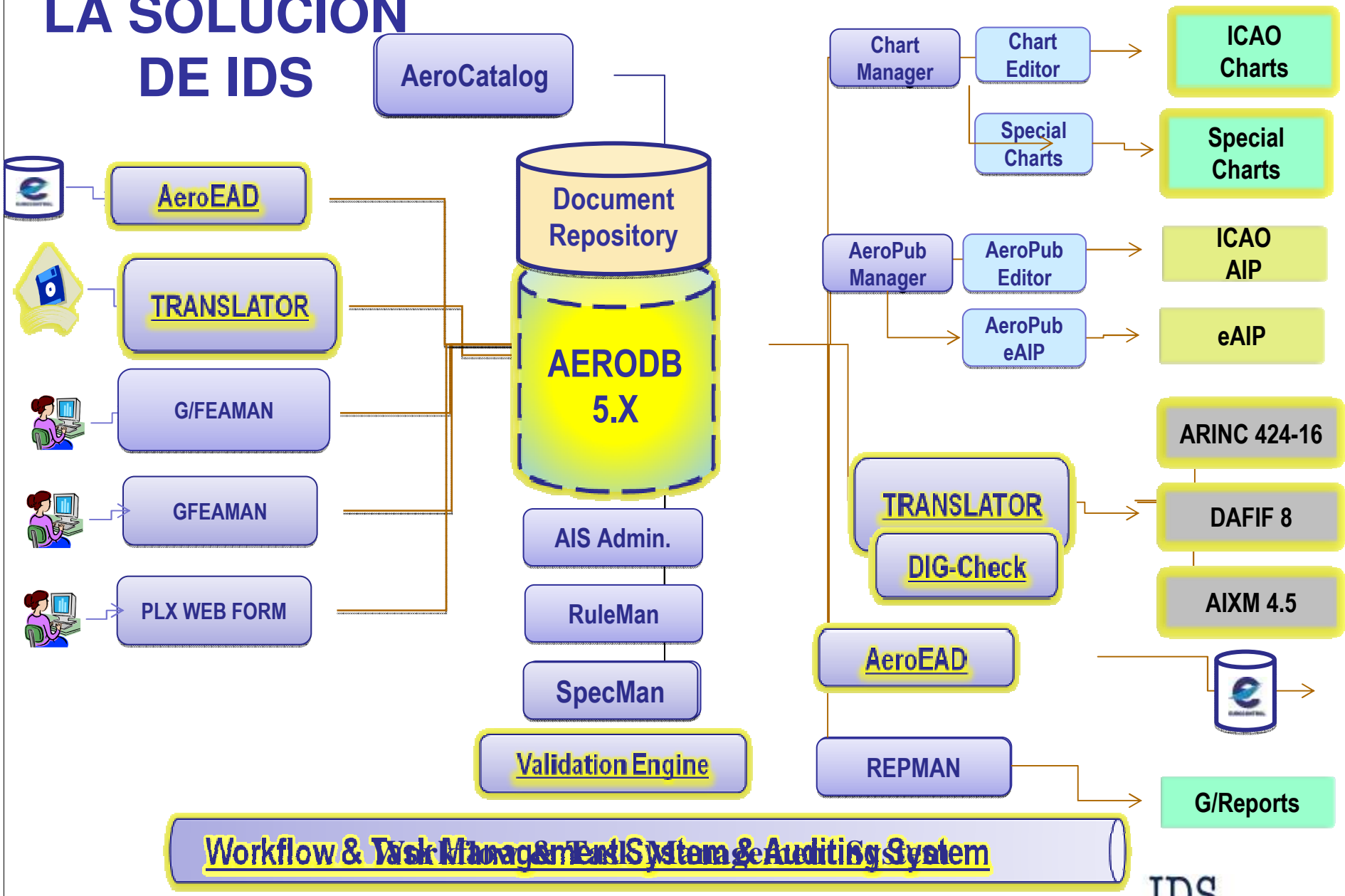
Diseño, Gestión Datos, Producción. Hoy. Implementación de un Sistema Modular Integrado de Información Aeronáutica. Solución IDS



Diseño. Hoy. Solución IDS



LA SOLUCION DE IDS



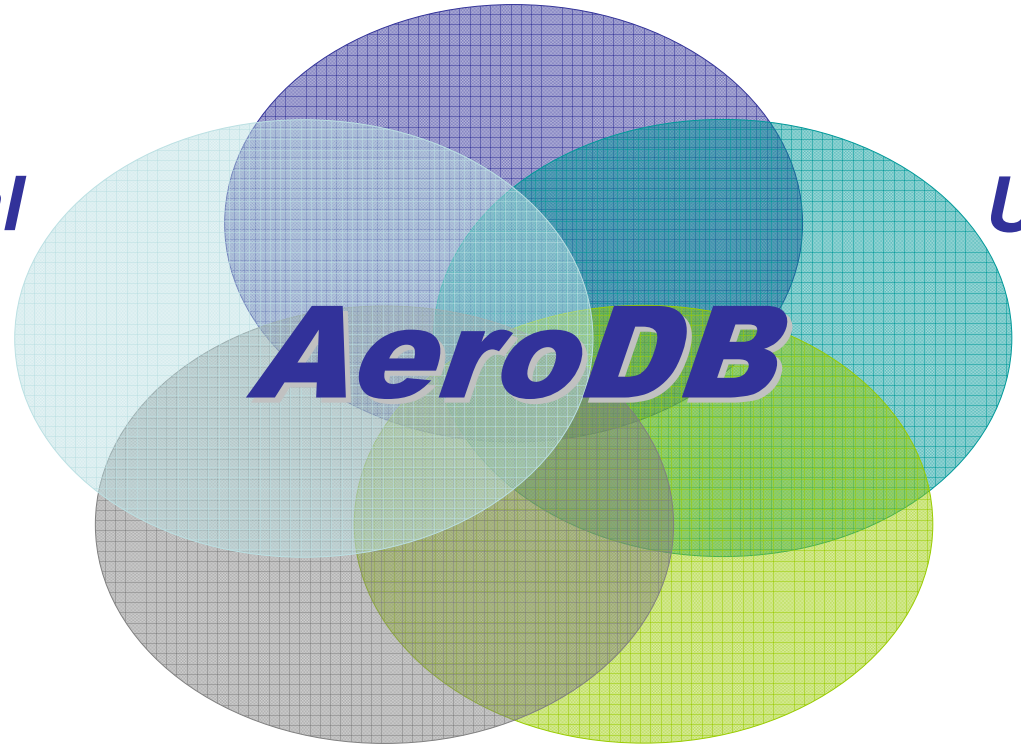
IDS INGEGNERIA DEI SISTEMI

Tecnologias de Bases de Datos

OWM

Groups different versions of table row values in different workspaces

Versioning by effective date and by validation level



Spatial

Access and analyze quickly and efficiently spatial data

Unicode

Effort to have a unified encoding of every character in every language

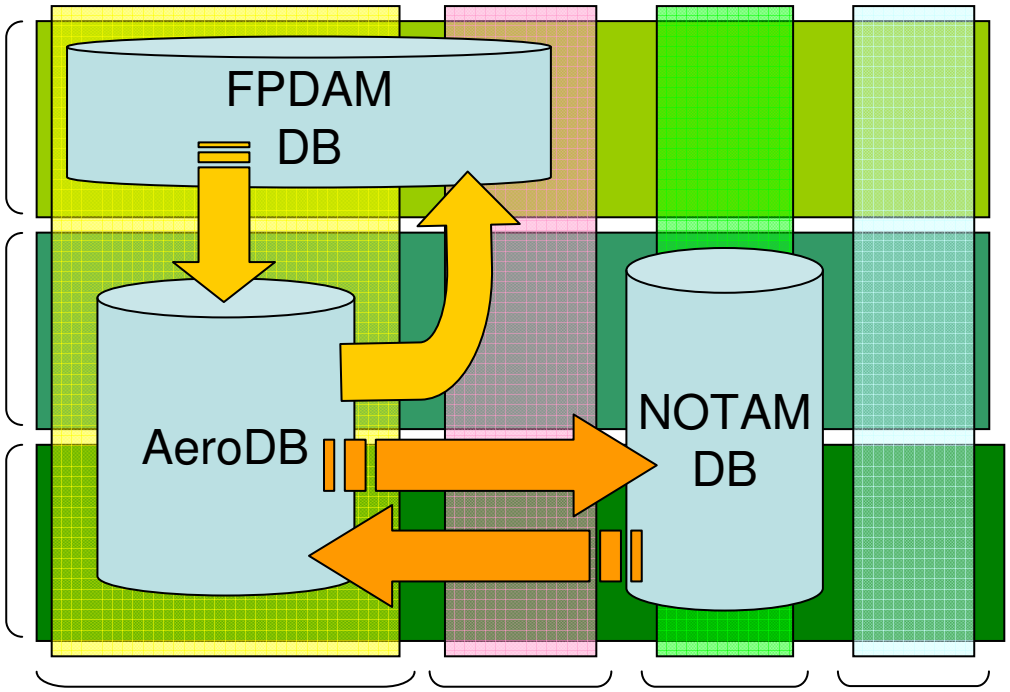
Temporality

Extensibility

AIXM 5 compliant

Database Extensibility and Integration

Workspaces enable different applications to operate on shared tables while segregating unapproved changes.



Data format transformations are eliminated while project, staging and what-if functionalities are retained

Different applications share common aeronautical features but segregate application specific data

GIS Tools

IDS proposes a multi-tool geospatial solution.

Multiple GIS environments for graphical viewing and/or editing of the geospatial data (2D and/or 3D);

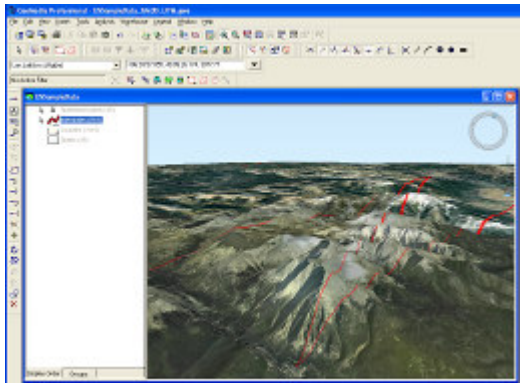
- **Bentley Map**
- **Intergraph GeoMedia**

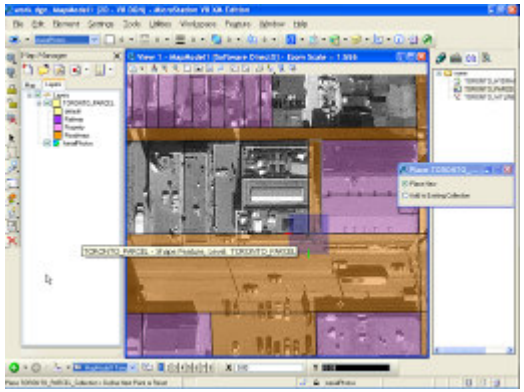
Two standardized **geographical storage** technologies:

- **Oracle Spatial** for relational data
- **GeoRepository** for flat file data.

Availability of **GIS functionalities in multiple environments with aeronautical consciousness**:

- procedure, route and airspace design,
- data editing and validation,
- aeronautical charting.





All this is developed with a particular regard to standards compliance (**OGC standards** in primis) to ensure present and future interoperability with other GIS environments.

PLX (PLanning eXtensions)

Web Application supporting the execution of the AIS data process:

- **Data Submission & Input:**
  - Internal\External Originator Interface
  - Handles unstructured data (.xls, .pdf, .doc, ...)
- **Data Processing Tracking**
  - Track all the operation performed data by users
- **Data Publishing**
  - Allows to publish a set of the reference data in tabular format

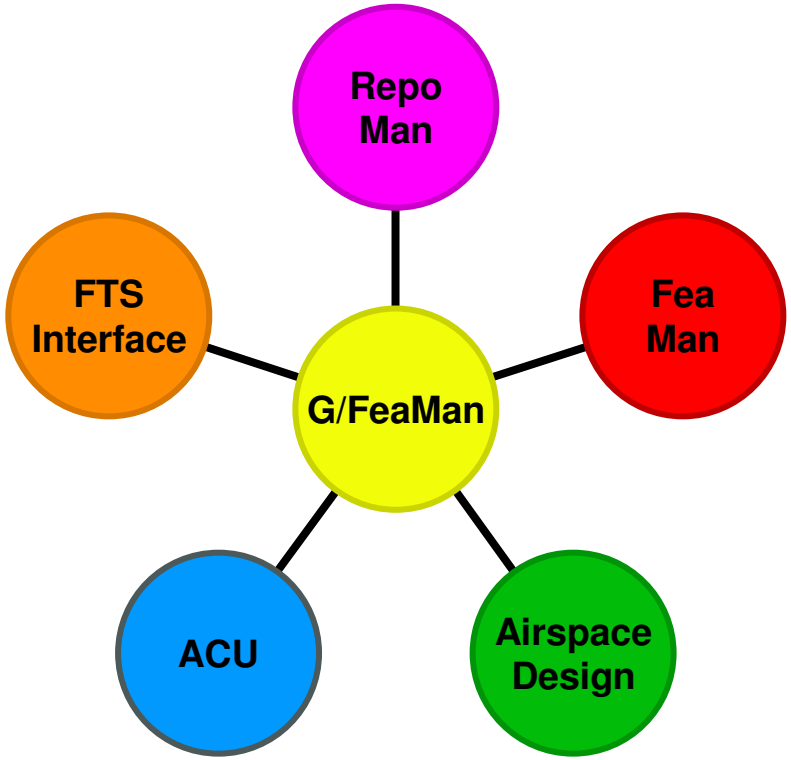
Supports aeronautical information regulators and service providers in implementing and monitoring **traceable**, **controlled** and **auditable** processes in compliance with ICAO Annex 15 requirements for data quality with a focus on data integrity.

PLX 2.0 Key Features

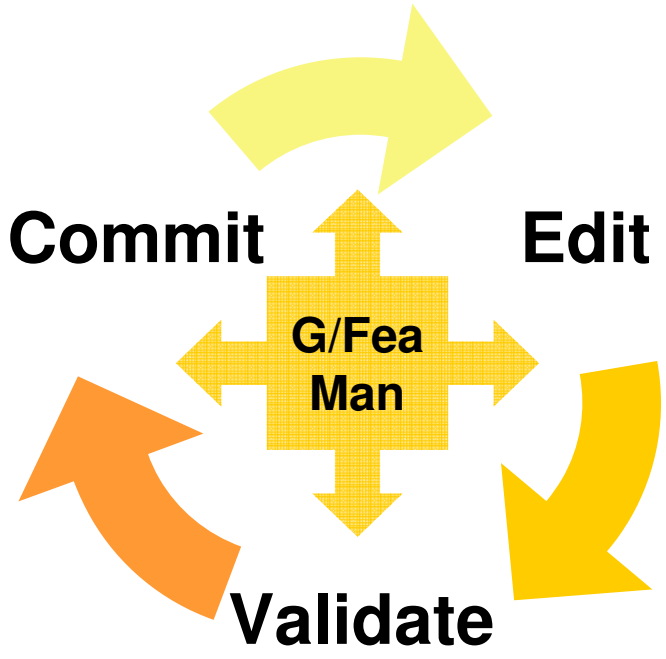
- Fully integrated with IDS Aeronavigation tools
- Supports the generation of the electronic data and the execution of the AIS Data process
- Assure Data Integrity by CRC checking
- Tracks and audits all the operation performed on the data during the process

G/FeaMan Product Family

- **Advanced tools** are required to manage aeronautical geographical digital data
  - structural complexity
  - validity checks
  - geometry checks
- G/FeaMan family provides **multiple integrated views** on aeronautical data
  - table-level view
  - geographical view
  - customized forms
  - user defined reports
- **Specialized applications** are being built on top of the kernel G/FeaMan functionalities
  - Airspace Design
  - Airspace Coordination Unit
  - Fast Time Simulator Interface



G/FeaMan Data Flow



Edit

- Modifications of Reference Data are done by G/FeaMan tools via **data entry forms** and **graphic visualization** of in-editing data.

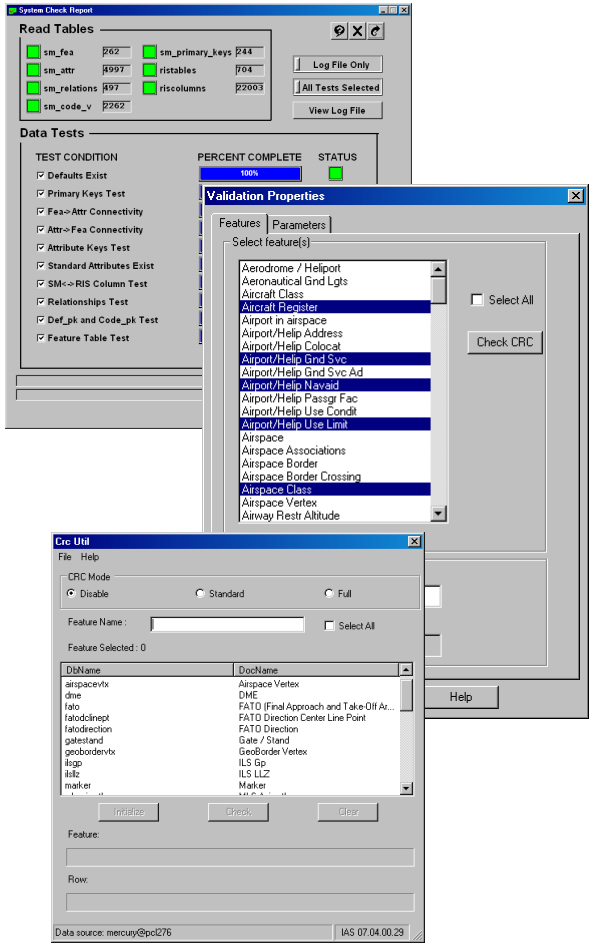
Validate

- **Basic consistency checks** (mandatory fields, data ranges, …) are performed while data is being modified; changes are registered in the database in staging status.
- Records in **staging status** are visible to all tools but are ignored when generating official information such as AIP documents or Charts.

Commit

- Before promoting records to Production status, a configurable set of **validation routines** is executed on the modified features to ensure data quality.
- **Production data** is used to create AIP documents and Charts.

Data Quality Checks



System Check Report

- **Structure level** – System Check Report verifies the consistency of the data dictionary
- **Oracle level** – referential integrity constraints (father-child relationship, key uniqueness)

Validation Engine

- **Application level** – user-expandable set of validation rules, automatically run prior to every database edit or on demand in batch mode on the whole DB

CRC Utility

- **Application level** – CRC checks are automatically run prior to every database edit or on demand in batch mode on the whole DB

AIXM 5 – Current Status

- AIXM 5 is clearly a great step forward in enabling the management and distribution of Aeronautical Information Services (AIS) data in digital format.
- While the AIXM 5.1 model is finalized, some important ancillary data have not yet been developed and/or finalised (business rules, application schemas, official AIXM 5.1-4.5 mapping)
- IDS has directly participated to most founding AIXM 5 events (EuroControl xNOTAM trial, AIXM conferences)
- At the moment it is not completely clear when AIXM 5.1 will be used in production for data exchange between eterogeneous systems (for example for ESI data exchange with the EAD) (2015?)
- IDS sees AIXM 5 as the **reference data exchange model** for all future AIM related developments.

Actividades IDS para NOTAM / xNOTAM

```
USD 04/042 LAS LAS VEGAS THREE DEPARRTURE
     TAKEOFF MINIMUMS:
       RWY 25L, STANDARD WITH MINIMUM CLIMB OF 375 FT PER NM TO 2500
         TEMP CRANE 4612 FT FROM DEPARTURE END OF RUNWAY (DER),
           1400 FT LEFT OF CENTERLINE, 150 AGL/2377 FT MSL.
         TEMP CRANE 4719 FT FROM DER, 1757 FT LEFT OF CENTERLINE,
           150 FT AGL/2379 FT MSL.
         TEMP CRANE 4953 FT FROM DER, 1697 FT [illegible]
           150 FT AGL/2380 FT MSL.
       RWY 19R,
         TEMP CRANE 2668 FT FROM DER, 937 FT [illegible]
           150 FT AGL/2377 FT MSL.
         TEMP CRANE 3088 FT FROM DER, 132 FT RIGHT OF CENTERLINE,
           150 FT AGL/2378 FT MSL.
         TEMP CRANE 3036 FT FROM DER, 883 FT RIGHT OF CENTERLINE,
           150 FT AGL/2379 FT MSL.
         TEMP CRANE 3081 FT FROM DER, 1120 FT RIGHT OF CENTERLINE,
           150 FT AGL/2380 FT MSL.
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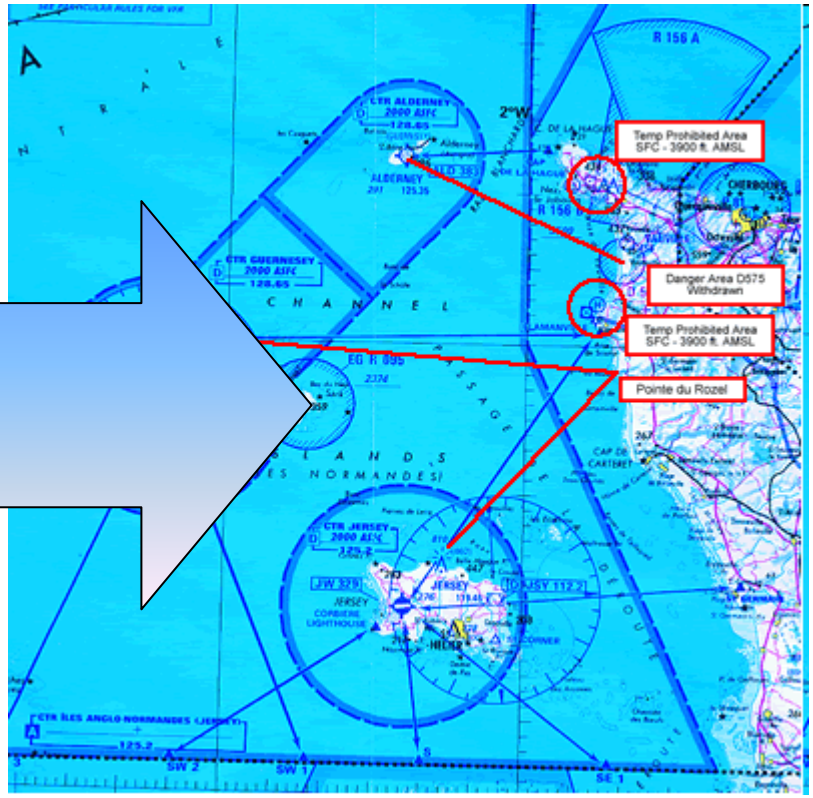
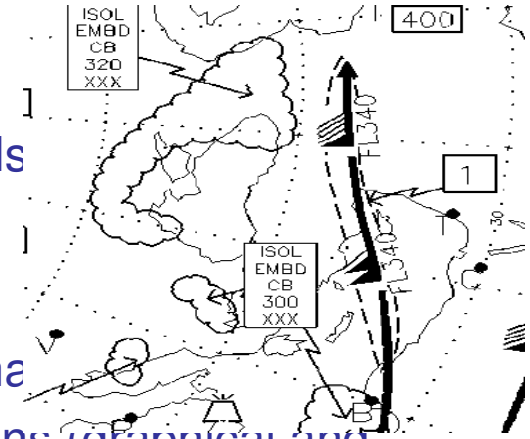


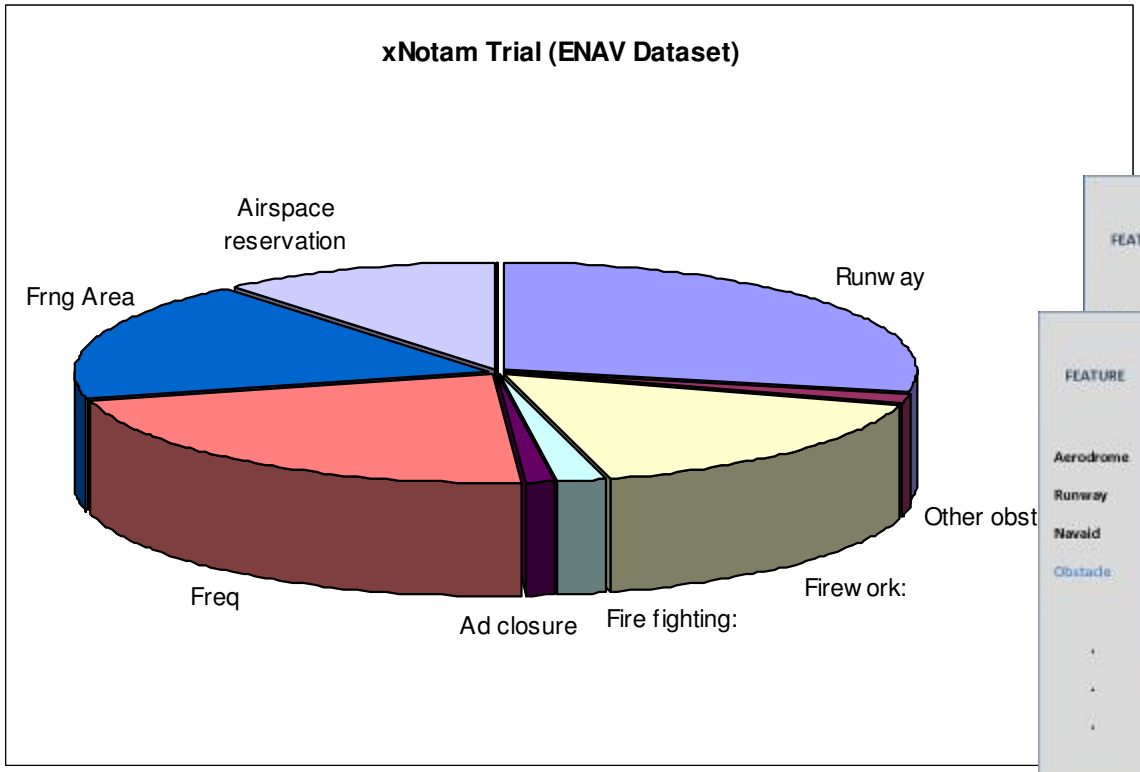
Proyecto xNOTAM

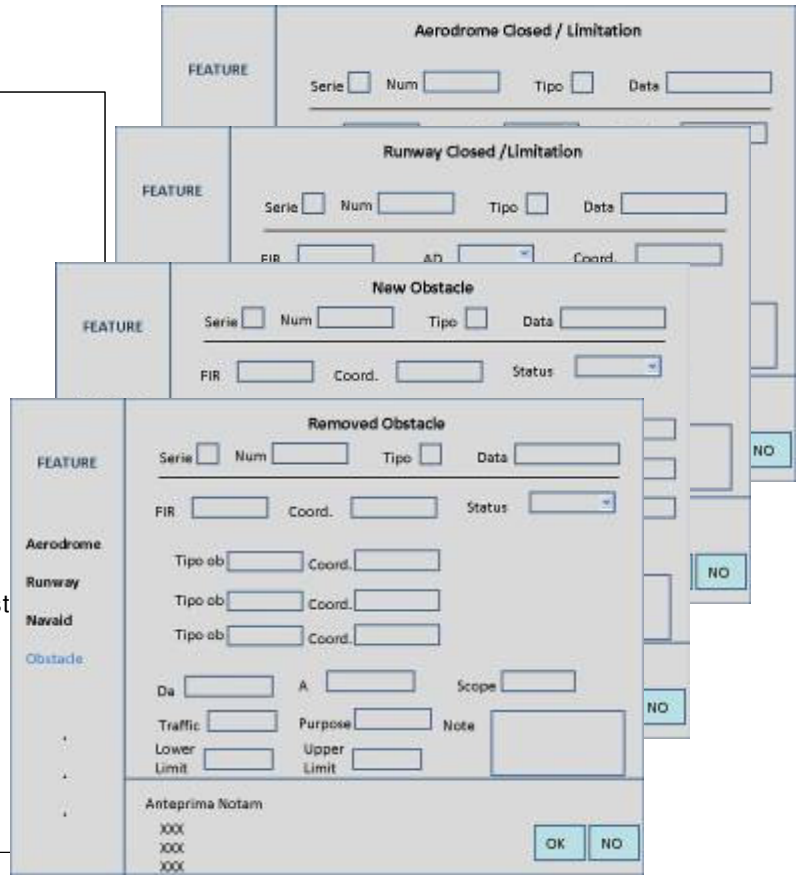
- **Phase 1:**
  - Acquire NOTAMs
  - Interpret NOTAMs and generate xNOTAMs
  - Store xNOTAMs in AIXM5 AERODB
- **Phase 2:**
  - Integrated graphical view of static and dyna
  - Next generation of FPL and PIB applications (graphical and interactive)
- **Phase 3:**
  - New NOTAM/xNOTAM system
  - Interactive and graphical xNOTAM entry
  - Transmit and receive NOTAM/xNOTAM
  - Update AIXM5 compliant AERODB



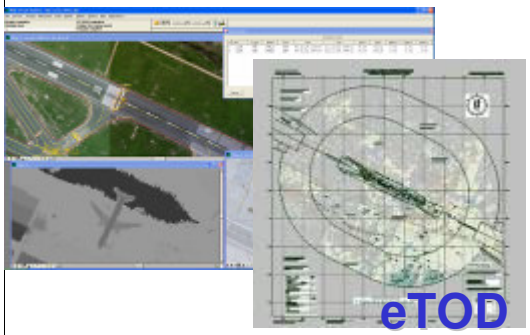
Proyecto xNOTAM

- Analyze NOTAMs to define data entry use cases that will lead to efficient and user-friendly GUIs





Una solucion integrada



eTOD

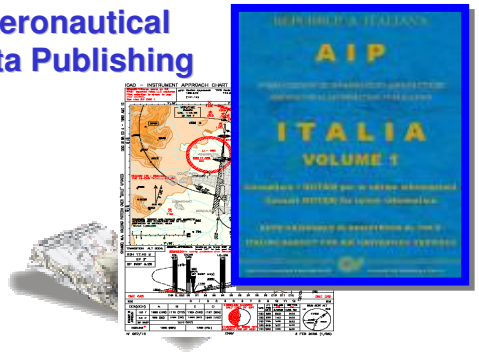
Terrain & Obstacle Database
Obstacle Charting

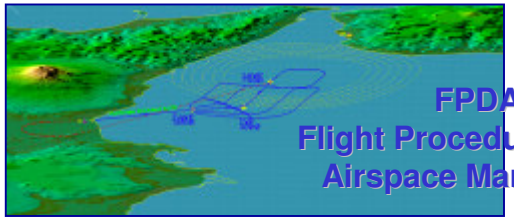
Digital Data
Distribution

EAD
European AIS Database

ARINC 424
AIXM
DAFIF

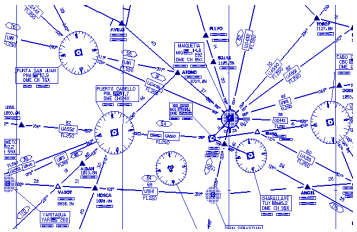
Aeronautical
Data Publishing





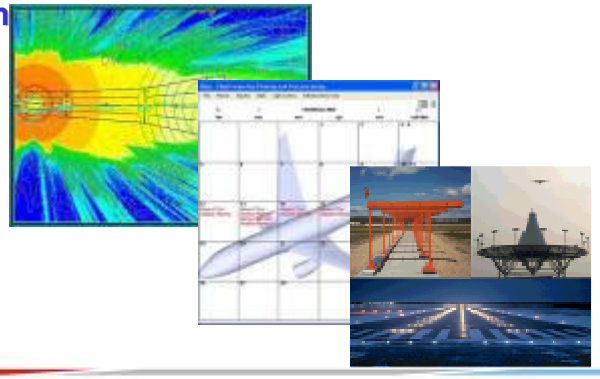
FPDAM
Flight Procedures Design
Airspace Management

Aeronautical
Charting

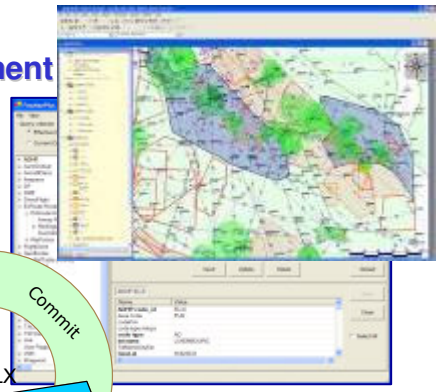


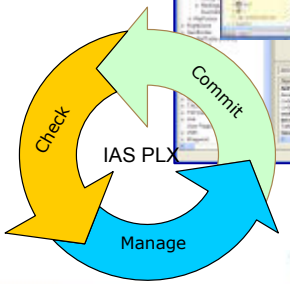
FPSAT
RNAV Procedure validation
And flyability analysis

EMACS
Virtual Flight Inspection

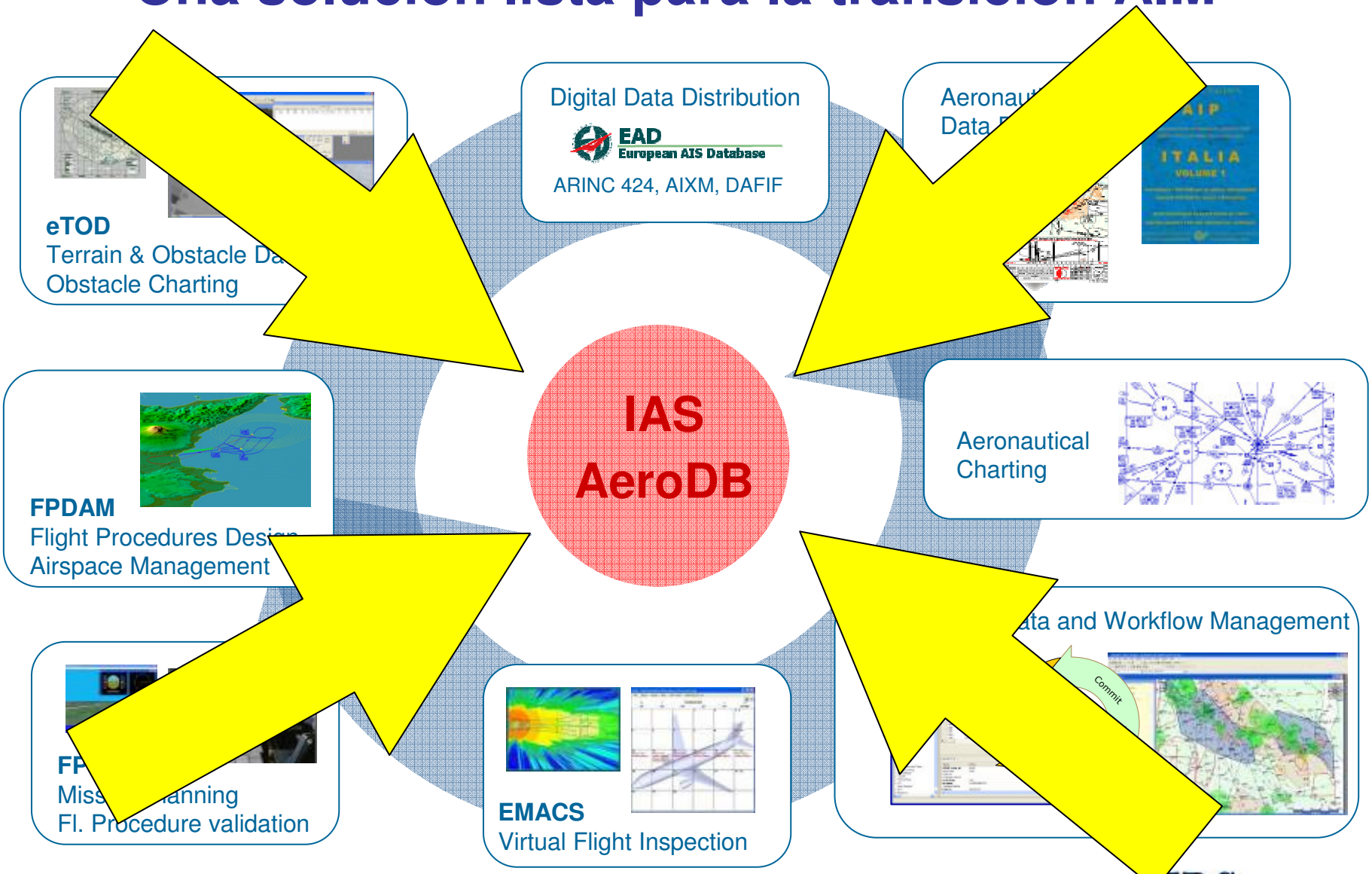


Aeronautical
Data and
Workflow Management





Una solución lista para la transición AIM



IDS INGEGNERIA DEI SISTEMI

IDS “Operational Testing Room”

5. Sugerencias y Alertas

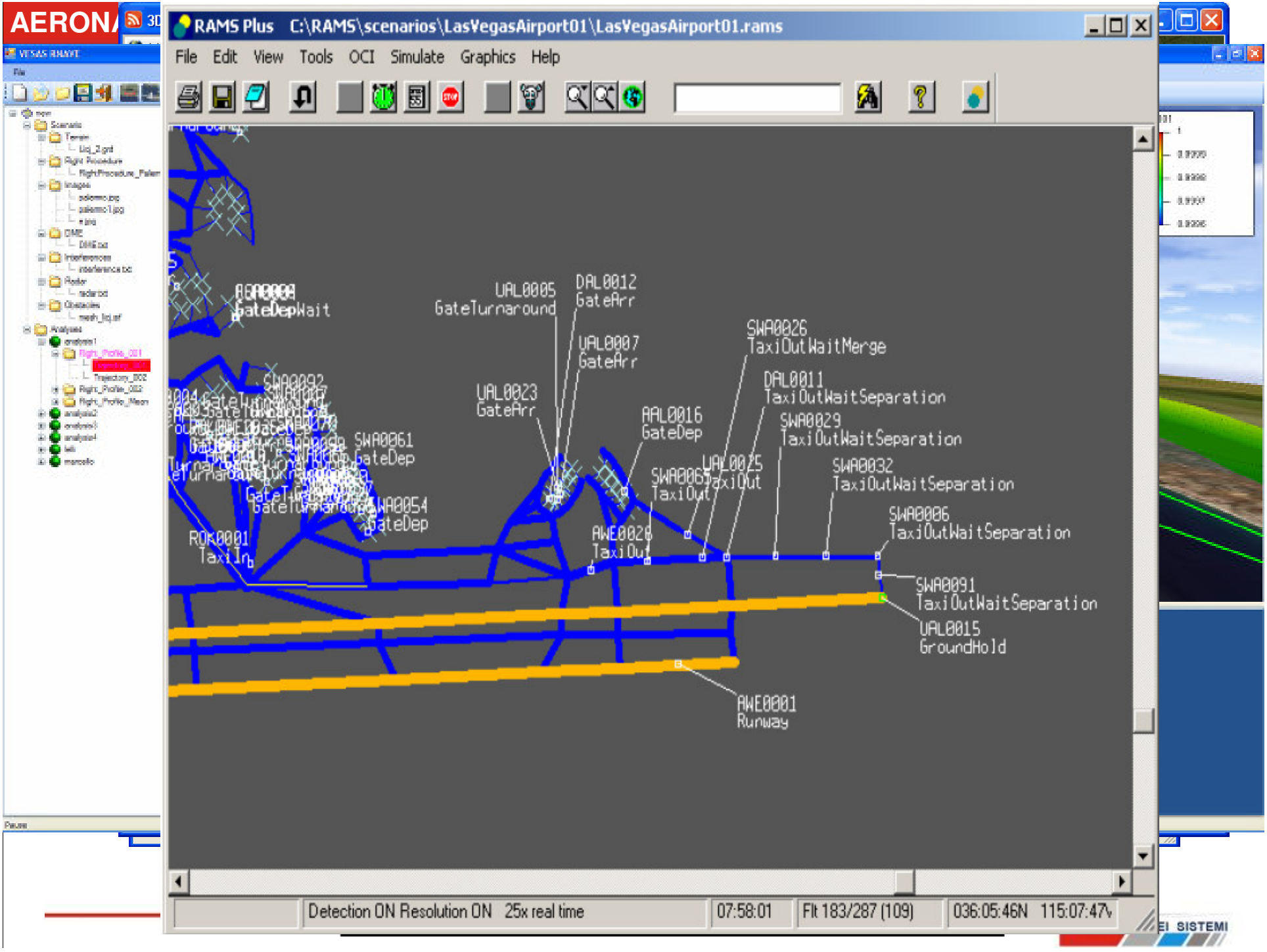
Sistemas de Gestión y de Producción: Sugerencias y Alertas (1/2)

1. El fin está aclarado por las normas internacionales (ICAO Annex 15 statement: "ENSURE THE FLOW OF INFORMATION/DATA….)
2. GIS como herramienta y como un medio para obtener felizmente el fin
3. El Sistema tiene que tener la **"consciencia aeronáutica"** o **"aeronautical awareness".** Sin esto el riesgo de ser un beta tester de un prototipo es muy alto
4. El "dueño" de los datos no es el sistema adquirido, tiene que ser el usuario. Esto implica la certitud de poder crear paquetes de intercambio de datos estándar, que puedan llegar al "snapshot total" de los datos de la base centralizada (AIXM…)
5. Univocidad de los datos en los flujos de producción y gestión
6. Gestión de flujo total desde el originador del dato al usuario final (producción, diseño, ATM, etc…). Trazabilidad de la información y de su historia
7. Distribución de las funciones operativas para cumplir con tareas en organizaciones de grande tamaño
8. Acceso externo, con gestión del flujo de datos y de trabajo, con control de la seguridad, para optimizar las tareas de actualización, verificación, aceptación y ingreso de datos
9. Estrictas políticas de seguridad de acceso a los datos configurables y controlables

Sistemas de Gestión y de Producción: Sugerencias y Alertas (2/2)

10. Evaluación de la flexibilidad de configuración/expansión del Sistema y de la Base de Datos
11. Evaluación de la proyección de evolución futura del Sistema (planes de desarrollo futuro) con atención a la evolución de las normas aeronáuticas. Quiere transformarse la Entidad misma en un “System Integrator” ?
12. Conocimientos “aeronáuticos” del sistema y de quien lo provee
13. Capacitación adecuada para los operadores involucrados y en cada área especifica
14. Mantenimiento de los recursos humanos capacitados. No pierdan el trabajo hecho en la capacitación
15. Implementación que se pueda hacer en:
    1. Fases
    2. Por módulos
    3. Siguiendo y según la evolución de las normas de referencia necesaria a la transición (normas asociadas al AIXM, intercambios de datos, conectividad a sistemas ATM etc…)

6. Algunos Ejemplos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File Edit View Tools OCI Simulate Graphics Help
UAL0005 GateTurnaround
DAL0012 GateArr
UAL0007 GateArr
UAL0023 GateArr
SWA0026 TaxiOutWaitMerge
DAL0011 TaxiOutWaitSeparation
SWA0029 TaxiOutWaitSeparation
AAL0016 GateDep
UAL0025 TaxiOut
SWA0032 TaxiOutWaitSeparation
SWA0006 TaxiOutWaitSeparation
SWA0091 TaxiOutWaitSeparation
UAL0015 GroundHold
AWE0001 Runway
AWE0026 TaxiOut
SWA0061 GateDep
SWA0054 GateDep
Detection ON Resolution ON 25x real time
07:58:01
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036:05:46N 115:07:47

IDS CORPORATE VIDEO

Gracias por su Atención !!