International Civil Aviation Organization

MID Region AIS Database Study Group

Second Meeting (MIDAD STG/2)
(Cairo, Egypt, 1 - 3 July 2013)

Agenda Item 4: MIDAD Project – Phase 2 (Detailed Study)

TECHNICAL NOTE MIDAD PROJECT – IDS VISION

(Presented by IDS)

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1. INTRODUCTION

1.1 Purpose

The scope of this technical document is to provide IDS Vision of the implementation of the MIDAD project for the implementation of the Regional AIM for the MID region.

1.2 Reference

The applicable versions of the following documents are the ones officially released at the time of the emission of the present document**.**

1.2.1 Applicable documents

[AD1.] ICAO Doc 8126: – Aeronautical Information Services ;

[AD2.] ICAO SARP Annex 4 10th Edition (incorporating amendments 1 to 54) and Doc 8697: – Charts (ICAO SARP Annex 4);

[AD3.] ICAO Doc 8168 – OPS/611 PANS-OPS Vol. I – Flight Procedures (ICAO PANS-OPS I) 5th Edition – (incorporating latest amendment);

[AD4.] ICAO Doc 8168 – OPS/611 PANS-OPS Vol. II – Construction of Visual and Instrument Flight Procedures (ICAO PANS-OPS II) 5th Edition – (incorporating latest amendment);

[AD5.] ICAO Doc 9906 Quality Assurance Manual for Flight Procedure Design

[AD6.] ICAO Doc 9905

[AD7.] ARINC Specification 424;

[AD8.] ISO 19100 series standards for geospatial information, including ISO 19107 spatial schema and 19108 temporal schema;

[AD9.] ICAO Doc 9674: World Geodetic System 1984 (WGS-84) 2nd Edition, 2002;

[AD10.] Eurocontrol eAIP Specification Edition 1.0.4;

[AD11.] AICM Primer v4.5 – 5.0 (AICM Primer);

[AD12.] ICAO Annex 11 - Air Traffic Services

[AD13.] ICAO Annex 10 Aeronautical Telecommunications. Volume I (Radio Navigation Aids). 5th edition, July 1996

[AD14.] ICAO, Annex 10 – Aeronautical Telecommunications, Vol. II Communication Procedures including those with PANS Status;

[AD15.] ICAO, Annex 15 – Aeronautical Information Services;

[AD16.] ICAO, Doc. 7910 – Location Indicators;

[AD17.] ICAO, Doc. 8585 – Designators for Aircraft Operating Agencies, Aeronautical Authorities and Services;

[AD18.] ICAO, RoadMap for the transition from AIS to AIM;

[AD19.] EUROCONTROL, EUROCONTROL Specification for Aeronautical Information Exchange, Ed: 0.23;

[AD20.] EUROCONTROL, FAA, AIXM 5 Temporality Model;

[AD21.] ISO 19136 – Geographic information – Geography Mark-up Language (GML);

[AD22.] RTCA DO-278 / EUROCAE ED-109, Software Integrity Assurance Considerations for Communication, Navigation, Surveillance and Air Traffic Management (CNS/ATM) Systems;

[AD23.] EUROCAE, ED-153 – Guidelines for ANS Software Safety Assurance;

[AD24.] AICM Manual -5.x (AICM Manual);

[AD25.] RTCA DO 208 - MOPS for airborne supplemental navigation equipment using global positioning system (GPS)

[AD26.] RTCA DO 229C - MOPS for global positioning system/wide area augmentation system airborne equipment

[AD27.] TSO-C129 & C129a

[AD28.] Eurocontrol Guidance Material for the validation of RNAV procedures

[AD29.] ARINC 424 - Navigation System Data Base Standard

[AD30.] Regulation (EC) No 549/2004 of the European Parliament and of the Council laying down the framework for the creation of the Single European Sky, 10 Mar 2004;

[AD31.] Regulation (EC) No 552/2004 of the European Parliament and of the Council on the Interoperability of the European Air Traffic Management Network, 10 Mar 2004;

[AD32.] Regulation (EC) No. 1070/2009 of the European Parliament and of the Council amending Regulations (EC) No 549/2004, (EC) No 550/2004, (EC) No 551/2004 and (EC) No 552/2004 in order to improve the performance and sustainability of the European aviation system, 21 Oct 2009;

[AD33.] Regulation (EU) No 73/2010 laying down the requirements on the quality of aeronautical data and aeronautical information for the Single European Sky, 26 Jan 2010;

[AD34.] Regulation (EC) No 482/2008 establishing a software safety assurance system to be implemented by the air navigation service providers and amending Annex II to Regulation (EC) No 2096/2005;

[AD35.] ICAO, Annex 3 – Meteorological Services for International Air Navigation;

[AD36.] ICAO, Doc. 4444, ATM/501 – Procedure for Air Navigation Services – Air Traffic Management;

[AD37.] ICAO, Doc. 7910 – Location Indicators;

[AD38.] ICAO, Doc. 8585 – Designators for Aircraft Operating Agencies, Aeronautical Authorities and Services;

[AD39.] ICAO, RoadMap for the transition from AIS to AIM;

[AD40.] ICAO, AFI OPMET Data Banks Interface Control Document for AFI OPMET Database Access Procedures;

[AD41.] ICAO, ASIA/PACIFIC OPMET Data Banks Interface Control Document;

[AD42.] ICAO, EUR OPMET Data Management Handbook;

[AD43.] EUROCONTROL Guidelines – Operating Procedures for AIS Dynamic Data (OPADD);

[AD44.] EUROCONTROL, EUROCONTROL Specification for Aeronautical Information Exchange, Ed: 0.23;

[AD45.] EUROCONTROL, FAA. AIXM Digital NOTAM Event Specification – Incr. 1;

[AD46.] EUROCONTROL, FAA, AIXM 5 Temporality Model;

[AD47.] EUROCONTROL, EUROCONTROL-SPEC-0136, EUROCONTROL Specifications on the Air Traffic Services Message Handling System (AMHS);

[AD48.] EUROCONTROL, EUROCONTROL-SPEC-0107, EUROCONTROL Specification for ATS Data Exchange Presentation;

[AD49.] ISO 19107 – Geographical Information – Spatial Schema;

[AD50.] ISO 19108 – Geographical Information – Temporal Schema;

[AD51.] ISO 19136 – Geographic information – Geography Mark-up Language (GML);

[AD52.] RTCA DO-278 / EUROCAE ED-109, Software Integrity Assurance Considerations for Communication, Navigation, Surveillance and Air Traffic Management (CNS/ATM) Systems;

[AD53.] OASIS, Web Services Brokered Notification.

1.3 Definition

ACU	Airspace Co-ordination Unit
AIP	Aeronautical Information Publication
ATC	Air Traffic Control
ATS	Air Traffic Service
AIXM	Aeronautical Information Exchange Model
ICAO	International Civil Aviation Organization
IFP	Instrument Flight Procedure
RTCA	Requirement and Technical Concepts for Aviation
GIS	Geographic Information System
RDBMS	Rational DataBase Management System
DEM	Digital Elevation Model

AIP	Aeronautical Information Publication
APCH	APproaCH
ARINC	Aeronautical Radio INC
ATC	Air Traffic Control
ATS	Air Traffic Service
BADA	Base of Aircraft Data
B-RNAV	Basic RNAV
DOP	Dilution Of Precision
DTM	Digital Terrain Model
FMS	Flight Management System
GBAS	Ground-Based Augmentation Systems

GNSS	Global Navigation Satellite System
GPS	Global Positioning System
IAC	Instrument Approach Chart
ICAO	International Civil Aviation Organization
IFP	Instrument Flight Procedure
RNAV	aRea NAVigation
RNP	Required Navigation Performance
RTCA	Requirement and Technical Concepts for Aviation
SBAS	Satellite-Based Augmentation Systems
SID	Standard initial Departure
SSA	SID, STAR, APCH
STAR	STandard Arrival Route
SV	Space Vehicle

2. MIDAD SCOPE

The main scope of the MIDAD system is to overcome limitations and drawbacks related to the current operational structure and provision of AIS/AIM services in the MID Region were identified icluding:

- inconsistent quality of data;
- lack of cross border aeronautical information coherence checking;
- duplicated, redundant and dispersed investments in the development and
- maintenance of systems by both Aeronautical Information Services and the end users;
- no single integrated aeronautical information database has been implemented;
- no regional or sub-regional AIS database has been established;
- high maintenance costs for each State and end users; and
- lack of interoperability between systems.

For such reason the MIDAD shall provide to Data Providers and Data Users:

- a reliable source of aeronautical information;
- improved data quality enabled by constant data checking, including NOTAM
- validation and cross-border data coherence verification;
- ensure data integrity a secure channel for timely and efficient electronic distribution of aeronautical
- information to all users;
- reduced workload throughout the complete AIS process;
- reduced investment costs in the development and maintenance of local systems
- by both AIS Units and airspace users; and
- increased availability of data through easy access.

3. SOLUTION HIGH LEVEL ARCHITECTURE

This chapter describes the High Level Architecture of the MIDAD System identifying:

- Users
- Data
- Services
- Access Modes

3.1 Users

The MIDAD System will interact with the following Users/Users Types

- **Data/Service Providers**
  - AIS Offices, NOTAM Offices, ARO Units;
  - AIP Production Departments, MAP Production Departments;
  - Procedures Design Departments;
  - Military Authorities (AIS, ARO, AIP/MAP, TWR, APP, FIS);
- **Data/Service Consumers**

- NavData Integrator companies like Lido, Jeppesen, Navtech/EAG, Honeywell etc;
- ATM Systems (TWR, APP, ACC, FIC, FIS);
- Airline Systems (Briefing, AOC);
- General Aviation (Briefing);
- Aerodrome operators;
- Metrology offices; and
- Others.

All Data/Service Providers are intended to be also Data Consumers

3.2 Data

The MIDAD System will manage the following data:

- Aeronautical Static Data (AIXM 4.5, 5.1 scope, extensions).
- Aeronautical Obstacle Data.
- Aerodrome Mapping Data.
- Digital Terrain Data.
- Digital Service Models (man-made, grown).
- Topographic Data (rivers, cities, road, etc.).
- NOTAM, SNOWTAM, ASHTAM, BIRDTAM.
- OPMET Data, WAFS Data (later BUFR).
- AIP according to ICAO Annex 15 and AIS Manual (Doc 8126).
- MAPs and Charts according to ICAO Annex 4 and Aeronautical Chart Manual

3.3 Functions/Services

The MIDAD System will provide the following Functions/Services

- Data Change Request Collection
- Static & Dynamic Data Management
- Publication
- Charting
- Procedures Design
- Collaborative Airspace & Route Design
- Workflow Management
- NOF
- Central FPL Correction
- Training Service
- Help Desk

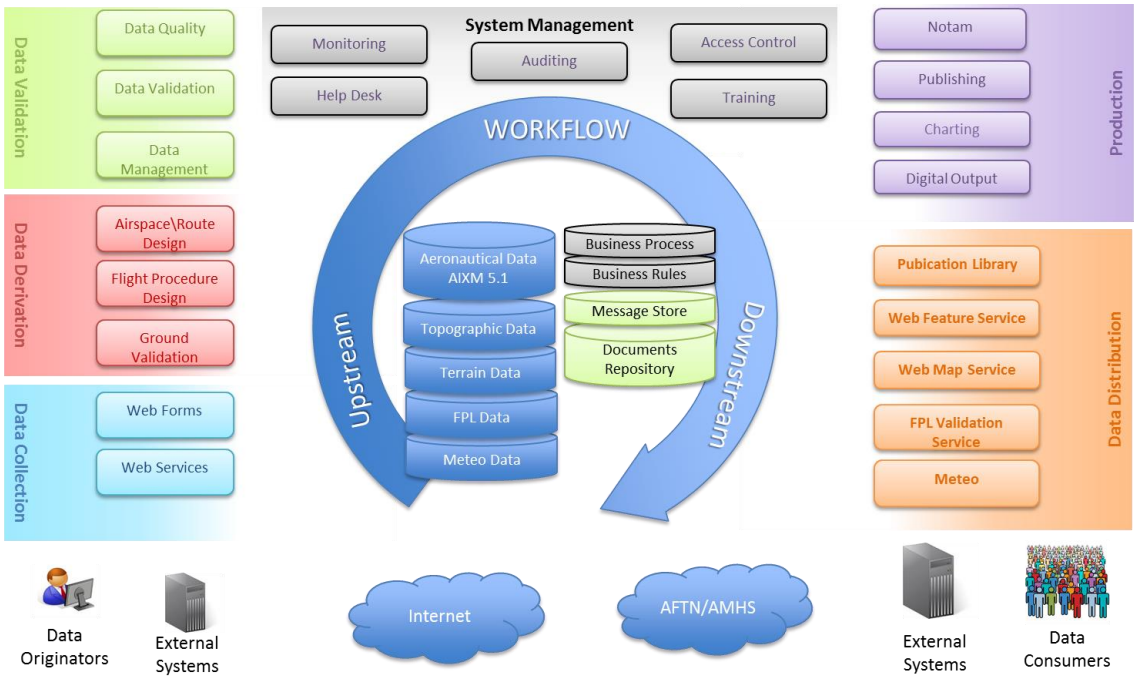


Fig. 1 Midad Main Functions\Services

3.4 National Service Providers Access Modes

The MIDAD system shall support the following access modes for the National Service Providers to Functions/Services

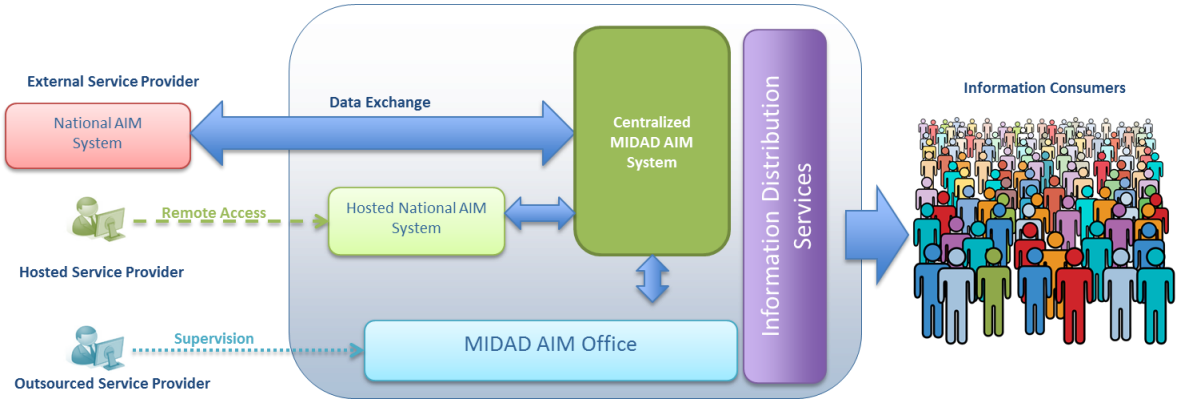


Fig. 2 MIDAD Access Modes

3.4.1 External Service Provider

In such access mode the service\function is implemented by a National AIM System External to MIDAD. Such system will be connected and synchronized to MIDAD via regular data exchange, based on the AIXM data exchange format. Information provided will be the integrated within MIDAD database and distributed to Information Consumers

3.4.2 Hosted Service Provider

In such mode the System providing the service/function is hosted by MIDAD.

National AIM operators remotely access the workstations and directly operate the system.

Data synchronization and system management are directly managed by MIDAD.

3.4.3 Outsourced Service Provider

In such mode the function/service is outsourced to the MIDAD AIM Office. The National office will have access to the system in order monitor the function/service performances

3.5 Key Requirements

This section focus on some of the key requirements (both functional & technical) that the MIDAD system shall satisfy in order to successfully fulfil the project goal.

- **Electronic Connection with Data Originators**. That is necessary to guarantee that data comes from the right source, at the right time and having the required quality. Originators shall be suppported in entering data by:
    - Electronic Data Transfer
    - Data Entry Validation
    - Data Access Control
- **Workflow Engine.** A workflow Engine is a key component for the definition, implementation and tracking of the Aeronautical Data Process. It shall allow to automatically provide all the evidence necessary to guarantee an adequate level of assurance for different kind of data (critical, essential, routine). It shall also provide measures and indicators on the performance of the processes in order to support the continuous improvement.
- **Static & Dynamic Data Integration**: The system shall allow to manage within the same framework all the Aeronautical Events disregarding if they are temporary or permanent and if they shall be Published via NOTAM, Supplement or AIRAC amendment.
- **Digital NOTAM**. Implementation of Digital NOTAM is a key step for the transition to AIIM as it enables:
    - NOTAMs graphic visulization
    - NOTAMs automatic management validation
    - More Accurate Briefing
- **Scalability:** Necessary to manage the evolution of the system in terms of:
    - Number of Users
    - Amount of Data
    - Services Provided
- **Implementation Flexibility:** The system shall allow a very flexible configuration of the Air Service Providers access mode. It shall be possible for Service Providers to host or outsource both single services and the full national system.

4. IDS AIR NAVIGATION SUITE

The IDS Air Navigation Suite is based on state of the art commercial of the shelf products (COTS) specifically developed for air navigation purposes and deployed in many large aeronautical service providers all over the world. All applications, except third party applications specified, are completely owned by IDS.

The IDS Air Navigation Suite allows to enhance the production and efficiency of the existing activities, by implementing a New Generation system based on the latest available technology able to satisfy the AIS to AIM roadmap as defined by ICAO, Regulators and other Industries.

IDS promotes uniformity in the design, collection and dissemination of aeronautical information, the integration of all individual sub-systems, respecting the criteria of quality, accuracy, integrity, timeliness and cost effectiveness as a common operating picture of aeronautical information for customers and stakeholders.

The implementation of the latest available version of the AIXM data model (AIXM 5.1), the functionality to process D-NOTAMs and the usage of integrated common services such as a Task and Workflow Management systems, enables the seamless integration between the static and dynamic data management, historically separated into two distinct areas.

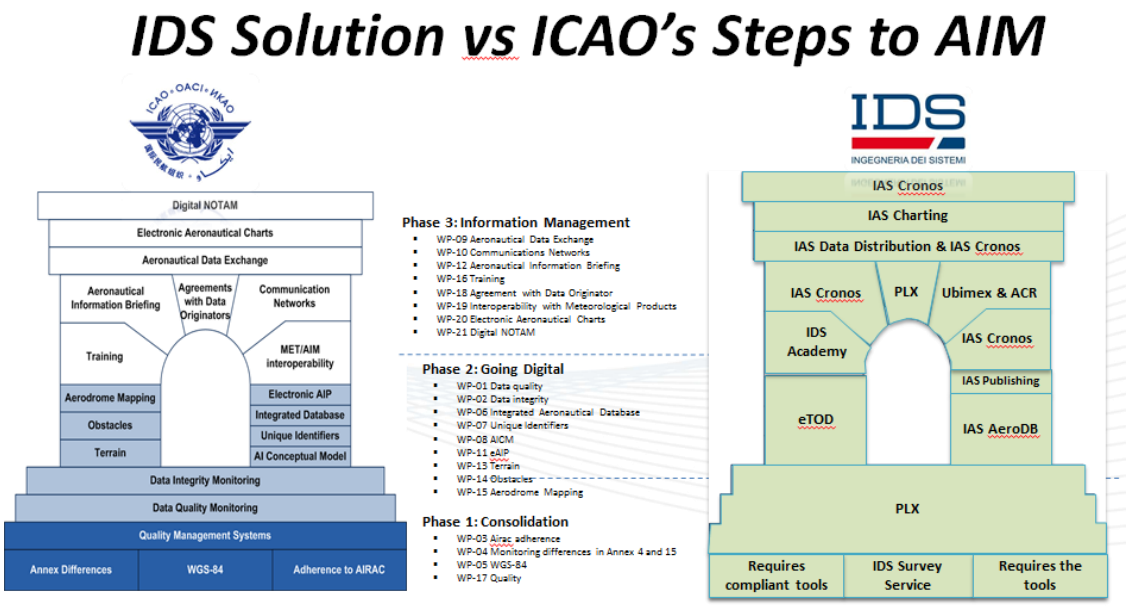
Although designed as one single fully integrated solution, with an architecture that supports the use of a Service Oriented Architecture (SOA) principle, the implementation can be performed modularly and/or at different stages.

When talking about the IDS AIS system we generally refer to the big picture below (**Error! Reference source not found.**) .

The usage of AIXM 5 is only one of the advantages of the chosen solution; compliancy with the Data Quality and Safety requirements, as expressed by EU regulations, (which fully take into account ICAO regulations and prescriptions) is considered of utmost importance by IDS and its customers.

Compliancy will be maintained and optimized continuously as the products evolve. By adopting the IDS solution our customers are guaranteed Data Quality and Safety compliancy and are able to enjoy the same benefits other well-known ANSP’s have gained by using the IDS suite of products.

To conclude we hope that is clear that IDS is offering a state of the art system which is an enhancement of the current version aimed at satisfying the requirements of ADQ and all the applicable aeronautical standards and practices. The IDS AIS solution has the advantage of being a well proven and field tested system which is running in operational environments since many years. The wide and first class customer’s base ensures an almost continuous and unlimited source of requirements from the heart of the operational needs of the aeronautical information management. The following picture maps the ICAO AIS to AIM roadmap versus IDS Solution evolutionary path.



The current version of the IDS AIM Solution is based on IAS that relies on an AIXM 5.1 data model with the necessary extensions to support the production subsystems (document publishing and GIS charting), the PLX (Planning Extension) devoted to track all the data flow from origination to the dissemination by implementing an advanced Workflow & Task Management system, the eTOD suite (electronic terrain and obstacle database), FPDAM & Airspace Designer for the flight procedure and airspace design subsystems.

When talking about IDS AIS system we generally refer to the big picture below.

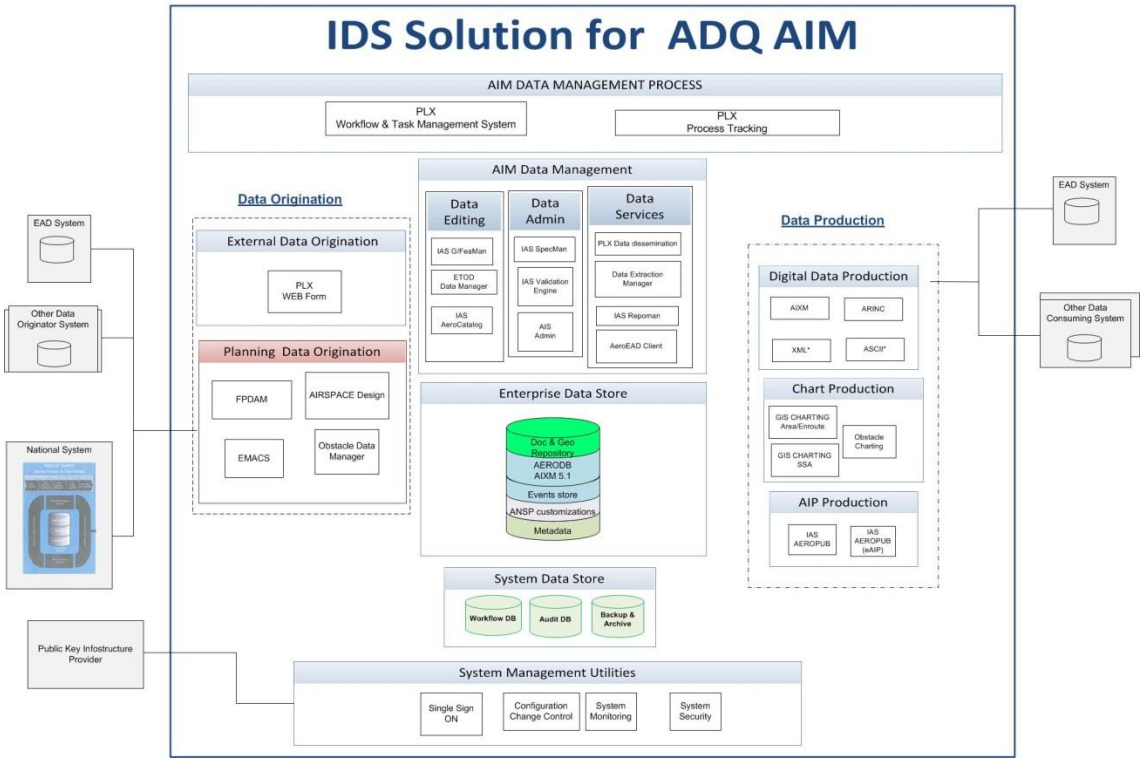


Fig. 3 IDS Air Navigation Suite

The picture above intends to group the products belonging to the IDS ADQ Solution in the following Functional blocks:

	Functional Block	Sub Functional Block	Product Family	Product
IDS SOLUTION	Data Origination	External Data Origination	**PLX**	PLX WEB
		Planning Data Origination	**Design & Validation**	FPDAM
				Airspace Designer
				EMACS
				Obstacle Data Manager
	AIM Data Management	AIM Data Management	**IAS**	G/FeaMan
				eTOD Data Manager
				Aerocatalog
		Enterprise Data Store		AERODB (AIXM 5.1)
				Document Repository
	AIM Process Management	Workflow & Task Management System	**PLX**	PLX WMS and WTS
		Process Tracking		
	Aeronautical Data Production	Digital Data Production	**IAS**	Aerotranslators
		AIP Production		AEROPUB Manager
				AEROPUB Editor
				AeroPUB eAIP
		Charting Production		GIs Charting (Area/Enroute)
				GIS Charting SSA
				Obstacle Charting
	System Management	System Data Store	**PLX**	System data

				Storage
		System Management Utilities		Single Sign On
				Configuration Change Control
				System Monitoring
				System Security

Tab. 4-1 IDS Air Navigation Suite Functional Blocks

The functional blocks related to the Planning Data Origination is satisfied by the products belonging to the Product Family "**Design and Validation** " whose products as FPDAM, Aerochart, FPSAT have already been delivered and implements in PANSA new product are needed to reach full coverage such as Airspace design and All the other functional blocks are covered by the product families IAS and PLX, main actors of the ADQ solution.

5. SOLUTION IMPLEMENTATION SCHEDULE

This Chapter describes an high level proposal for the Solution Implementation Schedule.

A phased approach to the implementation of the project is strongly suggested as some of the implementation steps shall be seen as prerequisite to the implementation of more advanced steps.

An analysis phase is required at the beginning to identify main system requirements and constraints. The system will be then implemented and validated against the system requirements and system design. After the setup phase, static data consolidation has to be implemented in order to harmonize the data from different states and achieve acceptable data quality. That will enable the subsequent phases of implementation of electronic data exchange, automated publishing and charting and the implementation of a quality management system having the scope of continuously improve the quality of data. Once static data have been consolidated most advanced concepts will be implemented including Aerodrome Mapping, Electronic Charting, and digital NOTAM.

The full implementation of all the operative functions and services will be then made available within Service Oriented Architecture with the introduction of an Enterprise Service Bus that will enable full system interoperability within the SWIM context.

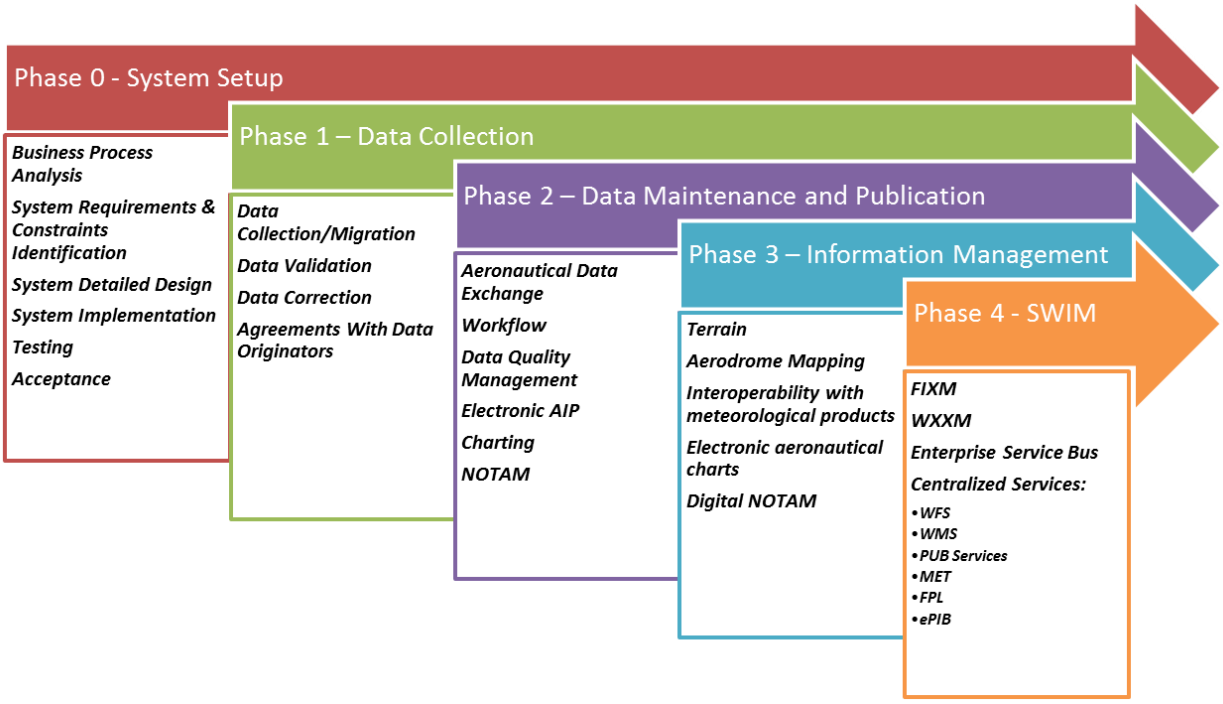


Fig. 4 Implementation Schedule Proposal

5.1.1 Phase 0 – System Setup

The main scope of the system setup phase is to:

- Define the MIDAD Business Process identifying Input, Output and the main processes\procedures for: data collection and derivation, data validation, aeronautical products production, information distribution. During such a phase sizing analysis will be executed including:

  - Number of Data Providers (External Originators, External Service Providers, Hosted Service Providers, Outsourced Service providers)
  - Number of Data Consumers of the different types
  - Amount and format of data to be migrated within MIDAD
- Identify system requirements and constraints, taking into account the outcome of the Business Process Analysis. During such phase technical constraints will be considerd including:
  - Network Performance Analysis
  - System Topology
  - System Redoundancy
  - System Availability
  - Security
- Define a System Detailed Design identifying:
  - Main System Components
  - System Internal and External Interfaces
  - Technological Framework
  - System Sizing
- Implement the System
- Validate the system against the requirements previously identified

5.1.2 Phase 1 –Data Collection

Once a first version of the system is set up and validated, data shall be collected from the national ANSPs in order to be loaded into the system.

In case of External Providers it will be necessary to define and implement formats and business rules for the Electronic data exchange.

For Hosted Providers a data migration activity will be implemented in order to migrate the actual data form the current system to the .new system hosted by MIDAD.

For Outsourced Providers current AIP data will be delivered to the MIDAD AIM Office that will enter them into the MIDAD data base.

ANSPs will be required to sign Service Level Agreements with data originators in order to define how originators shall interact with the national systems and or the MIDAD data collection services in order to provide data change request having the required level of quality in terms of:

- Format
- Timing
- Quality

5.1.3 Phase 2 –Data Maintenance/Publication

Once the MIDAD database will be populated it will be possible to start the data maintenance process, implementing the Service Level Agreements signed with data originators.

In such a phase workflows will be implemented to support the collection a processing of the Aeronautical Change Requests.

Tradition NOTAM reception and dispatching and AIP, Charts and Digital Data set production and exchange will be also implemented during this phase.

It is very important that, once production is started, a Quality Management System is put in place in order to check and continuously improve the quality of data and products.

Services of Flight Planning definition and verification will be implemented at the end of this phase

5.1.4 Phase 3 – Information Management

The full implementation of Static & Dynamic Data Flow will enable the third phase that will close the transition from AIS to AIM by implementing more advanced concepts including:

- Terrain
- Aerodrome Mapping
- Interoperability of metereological products
- Electronic Charting
- Digital NOTAM

5.1.5 Phase 4 – Sistem Wide Information Management

Phase 4 will mainly consist of the installation of an Enterprise Service Bus that will allow to distribute MIDAD functions and services within an Service Oriented Architecture achieving full Interoperability within the SWIM environment.

Such architecture will allow MIDAD to implement and distribute a set of Centralized Services.

At this stage data exchange format specifications as FIXM and WXXM will be also mature enough to allow fully implementation of advanced services as FPL, ePIB and MET within a fully Service Oriented Architecture.

A brief description of such architecture is given in the picture below.

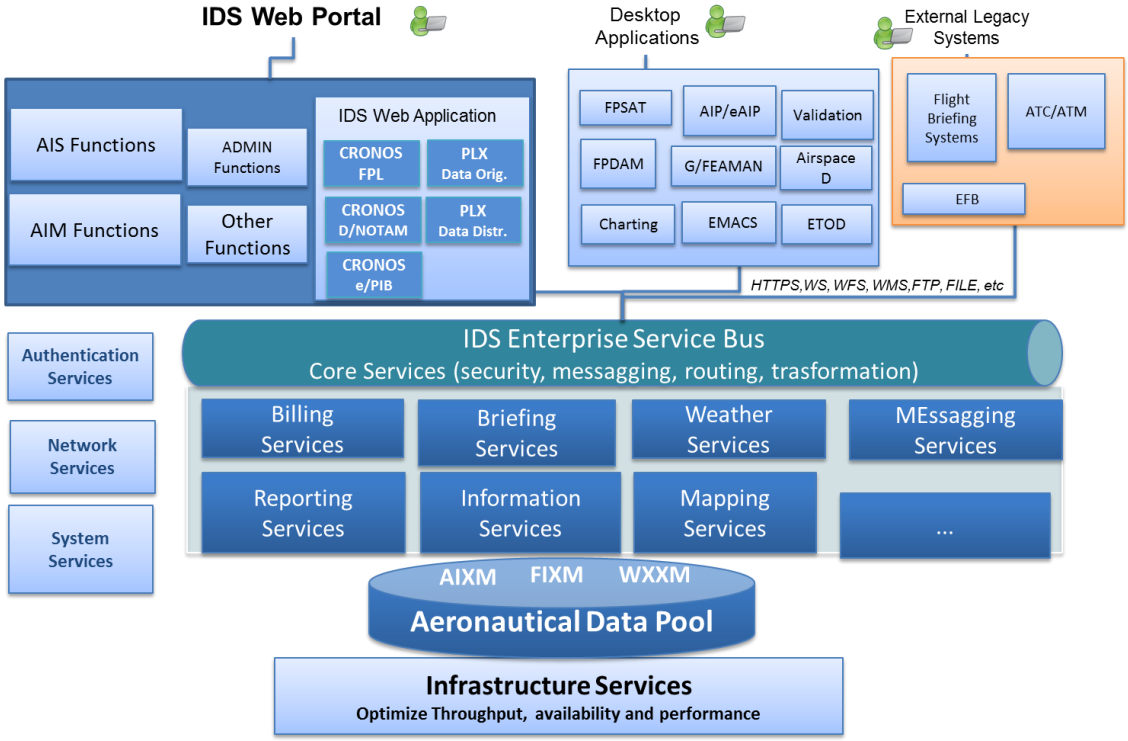


Fig. 5 Service Oriented Architecture – IDS View