Flight Object - A Component of Global Air Traffic Management

ENRI Int. Workshop on ATM/CNS

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Future Needs (NextGen / ICAO)

Operational Improvement Flight Information Needs

ICAO flight planning provisions do not enable concept

- Increases in volume and dynamism of information
- Cross-domain sharing and consistency
- Increased levels of integration across domains
- Increased flexibility

- Multi-party info sharing
- Advanced Notification
- Information Consistency
- Information Security
- Flexible Information
NAS Flight Data Flow – Systems & Actors Example

- Private Weather Service
  - Flight Plans
  - Weather Briefings

- Airline Pilot
  - Flight Plans
  - NOTAMS from FDC
  - Flight Plans

- Aircraft Operation Centers (AOOC)
  - Flight Plans
  - NOTAMS
  - Flight Plans

- HOST FDP
  - Error Indication
  - Flight Plans

- Automated Flight Service Station (AFSS)
  - Flight Plans
  - Weather and ATC briefings, NOTAMS

- GA Pilot
  - Flight Plans
  - Weather and ATC briefings, NOTAMS

- Flight Data Center (Wash, DC)
  - NOTAM

- Military Pilot
  - NOTAM

- Airline and ATC briefings

- Military Operations
  - Flight Plans

- Controllers
  - Flight Plans
  - TFMS

- Direct User Access Terminal Service (DUATS)
  - Flight Plans

- Host FDP
  - Host FDP: Performs format and logic checks, determines if any PARs or PDRs are applicable, performs route conversion and posting determination, performs initial fix time calculations

- ARTCC responsible for the departure airport

- Flight Plan (ICAO)
  - Flight Plans
  - Flight Plans (ICAO)

- TFMS
  - Flight Plan Info

- International ATS Providers

- ARS/STARS

- TRACONS
Today’s Flight Data exchanges are not consistent across aviation-related systems

- Systems currently operate as separate entities servicing different flight domains
- Communication between systems is point-to-point
- Systems maintain different data about the same flight
- Current information exchanges do not reliably support coordination, situational awareness, and collaborative decision making across ANSPs
The Flight Object (FO) facilitates capturing and sharing the most up-to-date information on any flight.

The Flight Object is:

- a collection of **common flight information elements available electronically** for use by system stakeholders
- medium for sharing common flight information elements among **new and existing capabilities**, as systems evolve
- **enabler**, **harmonizer**, and **data management** provider
- **universal, flexible, dynamic discoverable**
- concept with **global appeal**
The Flight Object is data

- The FO is the **aggregated collection of flight data** and related information which supports the goal of improving system-to-system interoperability within the NAS and beyond.

- The FO is **not a system** although its operation will be facilitated by systems.

- The FO is **not a specific database**, although parts of it will reside in various databases.
The Flight Object collects, manages and provides a large and diverse set of flight-related data

- **Aircraft identifiers and parameters**
- **Current Flight Plan information** (filed, cleared, flown)
- **Operator preferences, constraints (limitations), SOPs**
- **Flight capabilities, preferences, constraints**
- **Security information**

*Input which must be complied with regardless of impact to ATM system optimization*

**Input which may or may not be complied with based on impacts to ATM system optimization**
A Critical Piece - Globally Unique Flight Identifier (GUFI)

• **Situation:**
  – Multiple and International aviation-related systems Create/Update/Access flight related data
  – Each system that exchange flight related data must correlate incoming data messages with stored flight data
  – Today’s systems correlate flight related data in a variety of ways

• **Problem:**
  – Each system “tries” to correlate flight related data in a consistent and unambiguous manner

• **What We Need:**
  – Solution to the data correlation problem that can be applied internationally
The Flight Object collects, manages and provides a large and diverse set of flight-related data

- **Aircraft identifiers and parameters**

- **Current Flight Plan information** *(filed, cleared, flown)*

- **Operator preferences, constraints (limitations), SOPs**

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- **Security information**

*Input which must be complied with regardless of impact to ATM system optimization

**Input which may or may not be complied with based on impacts to ATM system optimization
As an example, the Transportation Data Exchange can facilitate hazardous cargo monitoring

**Planning:**
- Verifying carrier certification and preparedness (periodic training)
- Ensuring presence of trained personnel where they are required
- Security deconfliction (trajectory, crew, passengers, aircraft/ship/vehicle)

**Monitoring:**
- Identifying location of hazardous cargo at all times
- Periodically monitoring cargo status (e.g., temperature, pressure, tamper sensor readings)

**Analysis:**
- Retrieve all relevant historical information in case of an incident
- System-wide optimization through data mining
The Flight Object provides tangible benefits to the community of interest

<table>
<thead>
<tr>
<th>Interoperability</th>
<th>Harmonization</th>
<th>Data Management</th>
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</thead>
<tbody>
<tr>
<td>➢ Mediates interaction between systems, agencies, countries</td>
<td>➢ Provides standardization of transportation and security data</td>
<td>➢ Provides consistent data lifecycle management</td>
</tr>
<tr>
<td>➢ Common Situational Awareness</td>
<td>➢ Incorporates semantic context for transportation and security data</td>
<td>➢ Provides data mining opportunities for retroactive performance evaluation and predictive modeling</td>
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<td>➢ Incident Management</td>
<td>➢ Exposes institutional knowledge about how transportation information is used across systems, agencies, countries</td>
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<tr>
<td>➢ Facilitates use of future transportation and security data, whenever it becomes available</td>
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<td>➢ Simplifies global data exchange</td>
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The FO development is supported by two different tracks

<table>
<thead>
<tr>
<th>Data Standards Development</th>
<th>Engineering Prototypes / Demonstrations</th>
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<tbody>
<tr>
<td>➢ The FAA is working on developing a flight data standard similar to AIXM</td>
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<td>➢ SESAR is undergoing a similar effort</td>
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<td>➢ FAA and SESAR are collaborating in converging their efforts</td>
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<tr>
<td>➢ The goal of this effort is to define an international standard for flight data interchange</td>
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<td>➢ Several prototypes / demonstrations have been created which use a FO-like construct called the Flight Data Object (FDO)</td>
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<td>➢ The FDO</td>
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<td></td>
<td>➢ enables verifying engineering alternatives</td>
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<td></td>
<td>➢ Provides opportunities to present practical ways in which the FO can solve interoperability problems and create new efficiencies</td>
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<td></td>
<td>➢ Creates a framework for international collaboration</td>
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The Data Standard Development Process is in its first phase

Current State

Future State

FO Track

Flight Data Interchanges

Other data sources

Data Dictionary

Conceptual Model

CONUSE

CONOPS

UML Model

XML Schema

F(F)IXM

Harmonization

Reuse

Collaboration

NAS EA

SWIM

AIXM

ANSPs

Industry

Contributors

Legend:

Previous Work

Current

Phase 2

Phase 3
The FO is dynamic; the iterative approach can be used to manage the FO’s evolution over time.

Current Flight Data Inventory

Some data elements are eliminated

New data elements are added based on scenarios

Published FO Data Standard

Future data elements are added as the need arises

Revised FO Data Standard

Certain data elements will become obsolete over time

Scenario Validation Phase

Future Enhancements
On the Engineering Prototype side, there are a few, limited implementations of the FO

Flight Data Models have been developed for specific uses (e.g., Lockheed Martin, ICAO, MITRE, EUROCONTROL)

Some initial Flight Object Data Elements are being defined but there is not formal agreement on them at this point

The Data Models have been used for limited (point to point) interoperability within the same operating system (e.g. ERAM)

http://www.eurocontrol.int/aim/public/standard_page/foips.html
Two demonstrations have been conducted so far, and more are scheduled

March 2009

Exchange of flight information using Flight Data Objects (FDOs) between international air traffic control systems

November 2009

Demonstrate potential benefits from enabling FDO exchanges between airport surface stakeholders and ANSPs and flight operators

Analyze FDO to recommend new surface operations related content to support collaborative air traffic management
International Flight Data Object (IFDO) Demonstration Overview (March 2009)

- **Objective**
  - Develop a FDO to support information sharing between NAS domestic and international stakeholders

- **Benefits**
  - Facilitate better coordination, situational awareness and collaborative decision making

- **Description**
  - Atlantic-based demonstration in the Florida NextGen Test Bed (FNTB)
  - FAA’s ATOP, FAA’s ERAM and NAV Portugal’s SATL systems were adapted in the lab to exchange FDO
IFDO: ERAM, ATOP, and SATL Are FDO-Enabled

- Cross-Domain Situational Awareness
- Entry/Exit Planning
- Radar Transition
- Constraint-Free, User-Preferred Flight Path
- Domestic Metering
- Initial Planning Advisories and Reservation

ZNY FIR

SMA FIR

JAX

MIA
Surface Exchange Flight Data Object (SEFDO) Demonstration Overview (November 2009)

- **Objective**
  - Analyze FDO to recommend new content related to surface operations that supports collaborative ATM

- **Benefits**
  - Integrate, via FDO, awareness of surface operational status into NAS for effective collaborative ATM

- **Description**
  - Enable FDO exchange between airport surface stakeholders and collaborating ANSP entities and flight operators
SEFDO Demonstration Concepts

Regional Departure Scenario: MCO/DAB to CLT
Regional ARR Scenario: CLT to MCO
International Scenario: LHR to MCO

TFM/ER Wx integration
- 4D weather cube
- Weather Hazard/TBO integration

MCO Arr/Dep Mgt
- TMA SWIM Integration
- TMA, TFM, ERAM integration
- Terminal Conf Mon

MCO Surface Mgt
- SDSS/SWIM Enhance
- Dep Mgt
- TwrFlt DataMgt, TDDS, Display
- Taxi DL and Conf Monitor
- Surface Data to TFM

Oceanic/ER TMA
- TMA service to ocean
- TA/3D PAM

Oceanic/ER CFPM
- FDO Exchange
- CFPM
- AOC Integration
- FMS Integration

DAB Flex Terminal
- SDSS/SWIM Enhance
- Surf WL Comm DL
- Taxi DL and Conf Monitor
- TwrFlt DataMgt, TDDS, Display
- Real Aircraft, EFB

LHR
- Surface CDM
- ARR RTA
- SWIM Integration

Next Generation Surface Management Activities

IFDO
SEFDO
Goals for Future Asia/Pacific FDO Demonstration

- Leverage previous demonstration capabilities and infrastructure
- Demonstrate the benefits of exchanging FDOs via SWIM-like core services between ANSPs over the Pacific
- Demonstrate the feasibility of communication using multiple international SWIM (or SWIM-like) data transport systems
- Define common FDO data structure
- Jointly collaborate on appropriate FDO governance
Flight Data Object - Next Steps

• **Data Standards Development**
  – Complete Flight Object Data Dictionary Phase 1
  – Collaboration with international ANSPs and users

• **Engineering “Prototypes” / Demonstrations**
  – Transition and expand March 09 lab demonstration (Atlantic region) to Asia/Pacific region
  – Initiate realignment with SWIM (SWIM compliance)
  – Identification of Asia/Pacific FO demonstration partners
  – Establish expectation, roles, and responsibilities of demonstration partners
  – Establish demonstration scenarios and development of simulation environment
# Proposed Project Timeline

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<thead>
<tr>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
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<tr>
<td><strong>NextGen Testbed Planning (FNTB)</strong></td>
<td><strong>NextGen Testbed Development</strong></td>
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<td></td>
<td><strong>Oceanic CA Engr. Analysis (OCAT)</strong></td>
<td><strong>Oceanic CA Planning</strong></td>
<td><strong>Oceanic CA Ops Trial</strong></td>
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<td><strong>IFDO</strong></td>
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<tr>
<td><strong>SEFDO</strong></td>
<td><strong>Pacific FDO Planning</strong></td>
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<td></td>
<td><strong>Pacific FDO Demonstration (FDO Phase 1)</strong></td>
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<td><strong>Q1 - 2011 Concept Lab Demo</strong></td>
<td><strong>Q4 - 2011 FAA-JCAB FDO Demo</strong></td>
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The Flight Object is an outstanding opportunity for international collaboration

- ANSPs are encouraged to participate in the process of defining and developing the FO through –
  - sharing intellectual capital
  - involvement in demonstration projects

- Early ANSP involvement will be beneficial because it will speed up the development and adoption of an international standard

- Diversity and collaboration will ensure a robust implementation of the FO
Questions?