

# Digital NOTAM Overview

## Technical Approach to NOTAM Scenarios

Presented to: Technical Interchange Meeting

By: Jocelyn Cox, CNA

Date: October 6, 2010



Federal Aviation  
Administration

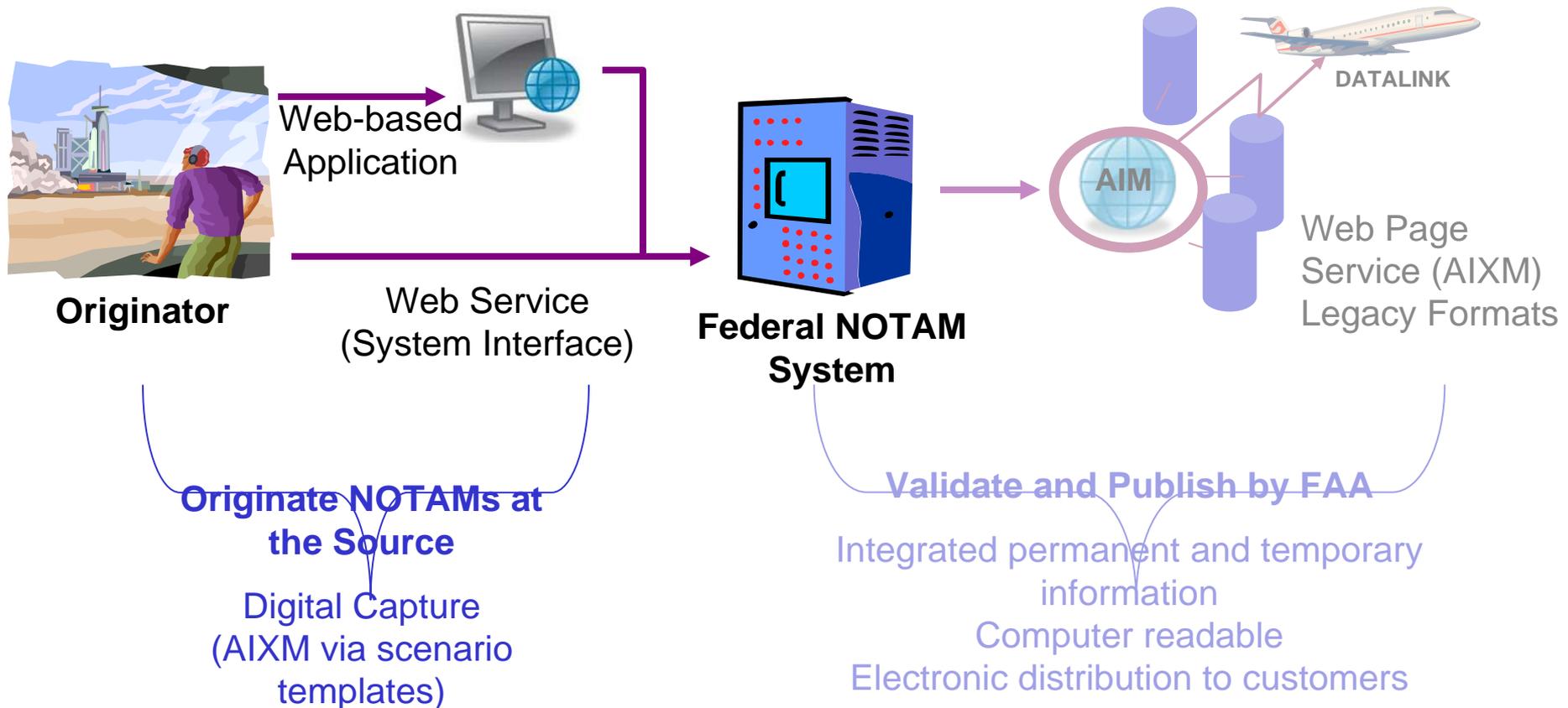


# Outline

- **Brief Introduction to FNS**
- AIXM and Digital NOTAMs
- Overview of Scenarios
- Verification of Baseline Data
- Mapping of NOTAM Elements to AIXM
- **Implementation of Business Rules**
  - Digital Encoding Business Rules
  - Policy Business Rules
  - Formatting Business Rules



# Federal NOTAMs System (FNS)



# What is a Digital NOTAM?

- **Digital NOTAM Definition**
  - A dataset that contains NOTAM information in a structured format
  - Fully interpreted by an automated system without human intervention
- **Characteristics of Digital NOTAMs**
  - Geo-referenced
  - Temporal
  - Linked to static data
  - Transformable
  - Query enabled
  - Electronically distributable

```
<event:Event xsi:schemaLocation="http://www.aixm.aero/schema/5.0/event/0.1 http://www.aixm.aero/schema/5.0/extensions/eur/iaa/FUA_Features.xsd" gml:id="Event-0003">
  <event:name>ESSA runways closed</event:name>
  - <event:description>
    RWY 08/26, 01L/19R, 01R/19L closed temporarily due to snow contamination and bad we
  </event:description>
  <event:type>TEMPORARY</event:type>
  <event:hasMember>
  - <aixm:AirportHeliportUsage gml:id="VID2678448">
    <gml:identifier codeSpace="http://www.eurocontrol.int/notam">0cfd1ea-bf39-4006-
  - <aixm:timeSlice>
    - <aixm:AirportHeliportUsageTimeSlice gml:id="VID2678449">
      - <gml:validTime>
        - <gml:TimeInstant gml:id="VID0000002">
          <gml:timePosition>2009-02-12T07:00:00</gml:timePosition>
        </gml:TimeInstant>
      </gml:validTime>
      <aixm:interpretation>PERMDelta</aixm:interpretation>
      <aixm:sequenceNumber>1</aixm:sequenceNumber>
      <aixm:correctionNumber>0</aixm:correctionNumber>
    - <aixm:featureLifetime>
      - <gml:TimePeriod gml:id="VID0000001">
        <gml:beginPosition>2009-02-12T07:00:00</gml:beginPosition>
        <gml:endPosition indeterminatePosition="unknown"/>
      </gml:TimePeriod>
    </aixm:featureLifetime>
  - <aixm:limitation>
    - <aixm:AirportHeliportUsageLimitation>
      <aixm:type>FORBID</aixm:type>
    - <aixm:condition>
      - <aixm:AirportHeliportUsageCondition>
        - <aixm:flight>
          - <aixm:FlightCharacteristic>
            <aixm:rule>ALL</aixm:rule>
          </aixm:FlightCharacteristic>
        </aixm:flight>
      - <aixm:operation>
        - <aixm:AirportHeliportOperation>
          <aixm:type>TAKEOFF</aixm:type>
        </aixm:AirportHeliportOperation>
      </aixm:operation>
    </aixm:condition>
  </aixm:limitation>
  </event:hasMember>
</event:Event>
```

# What is AIXM?



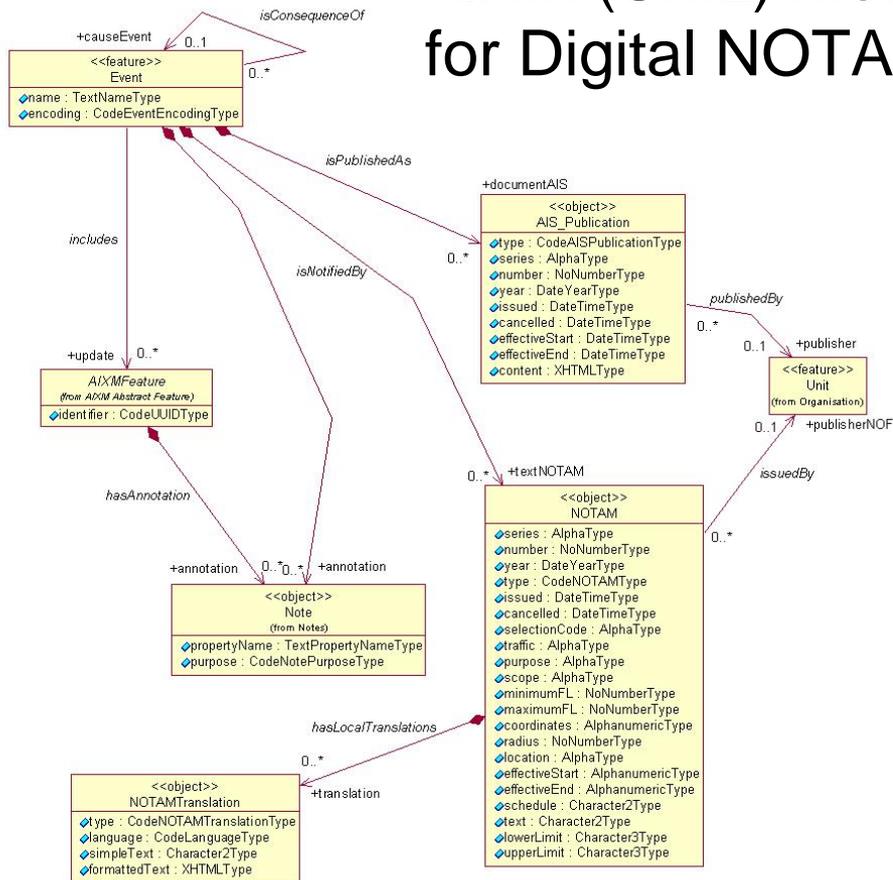
- **The Aeronautical Information Exchange Model (AIXM) is designed to enable the management and distribution of Aeronautical Information Services (AIS) data through the use of a common exchange model**
- **Developed by the FAA and Eurocontrol with support from the international community**

# Benefits to using AIXM

- **Achieve neutrality against applications and their local views of the data**
- **Improved safety**
  - Reduced data inconsistencies, computer readable data means fewer errors for pilots and other users.
- **Represents both static and dynamic data**
- **Enables authoritative sources for features through the Universally Unique Identifier (UUID)**

# Digital NOTAMs and AIXM

## AIXM (UML) Model for Digital NOTAMs



## AIXM (XML) Message

```

<aixm.designator>ACY</aixm.designator>
<aixm.name>ATLANTIC CITY INTERNATIONAL AIRPORT</aixm.name>
<aixm.locationIndicator>CAQ</aixm.locationIndicator>
<aixm.designator/ATA>ACY</aixm.designator/ATA>
</aixm.AirportHelicopterTimeSlice>
</aixm.timeSlice>
<aixm.timeSlice>
  <aixm.AirportHelicopterTimeSlice gml:id="CY01_TS02">
    <gml.validTime>
      <gml.TimePeriod gml:id="CY01_TS02_TP01">
        <gml.beginPosition>2010-01-15T09:00:00</gml.beginPosition>
        <gml.endPosition>2010-01-16T09:00:00</gml.endPosition>
      </gml.TimePeriod>
    </gml.validTime>
    <aixm.interpretation>TEMPDELTA</aixm.interpretation>
    <aixm.sequenceNumber>13</aixm.sequenceNumber>
    <aixm.availability>
      <aixm.AirportHelicopterAvailability gml:id="ACYAVAIL_02">
        <aixm.annotation>
          <aixm.Note gml:id="CY01_TS02_NT01">
            <aixm.propertyName>operationalStatus</aixm.propertyName>
            <aixm.purpose>REMARK</aixm.purpose>
            <aixm.translatedNote>
              <aixm.LinguisticNote gml:id="CY01_TS02_NT02">
                <aixm.note lang="en">due to snow</aixm.note>
              </aixm.LinguisticNote>
            </aixm.translatedNote>
          </aixm.Note>
        </aixm.annotation>
        <aixm.operationalStatus>CLOSED</aixm.operationalStatus>
      </aixm.AirportHelicopterAvailability>
    </aixm.availability>
  </aixm.AirportHelicopterTimeSlice>
</aixm.timeSlice>
</aixm.AirportHelicopterTimeSlice>
</message.hasMember>
    
```

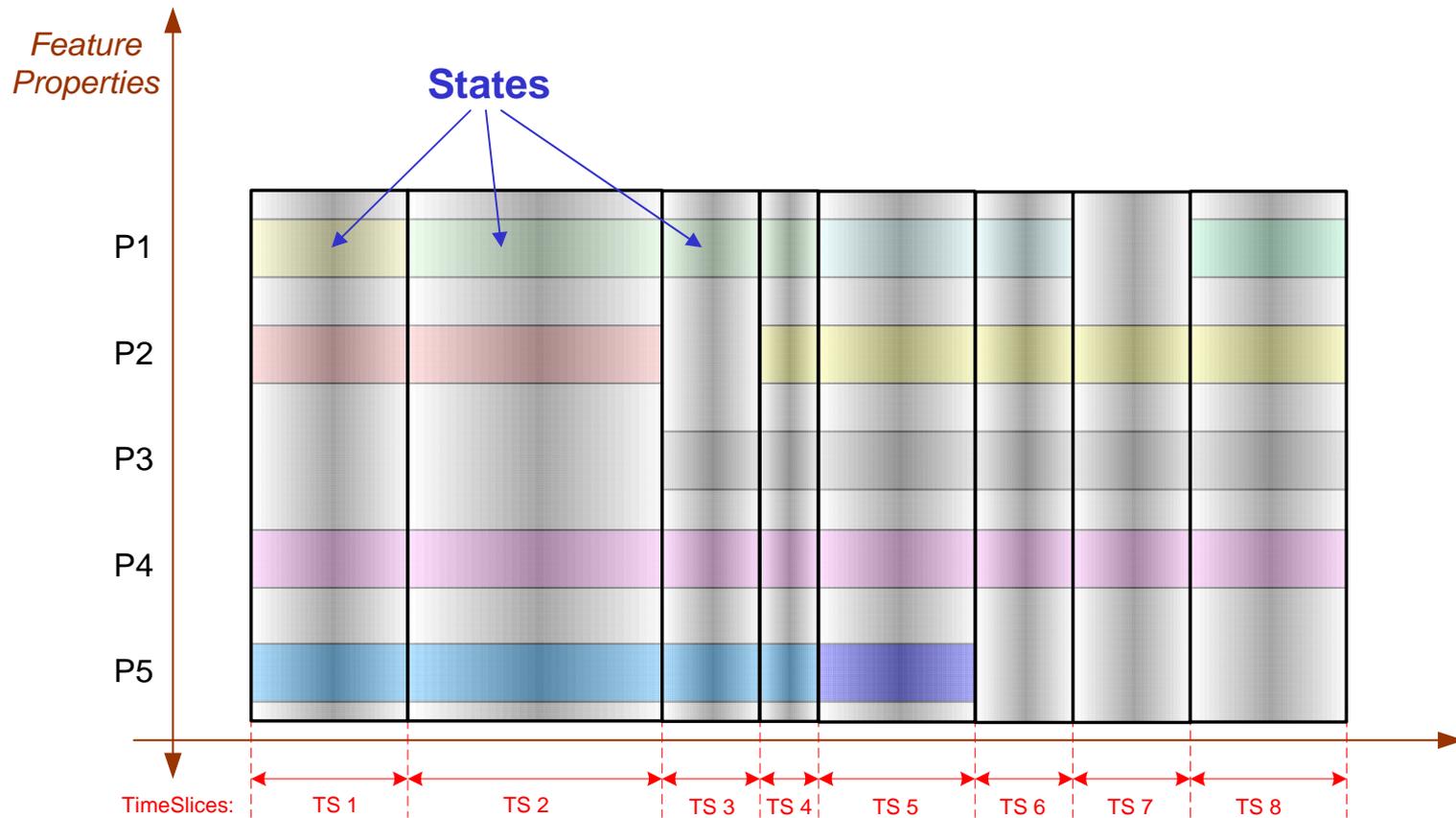
ACY CLSD DUE TO SNOW



# Temporality in AIXM

- **NOTAMs communicate temporary changes to the National Airspace System (NAS)**
- **AIXM can capture these dynamic changes through the use of timeslices**
  - ***BASELINE:***
    - A full set of information for a feature
  - ***PERMDELTA:***
    - Contains only the values that are permanently changing in a feature
  - ***TEMPDELTA:***
    - Contains only the values that are temporarily changing in a feature
    - Used in updates to statuses or schedules
  - ***SNAPSHOT:***
    - Describes a feature in a given moment

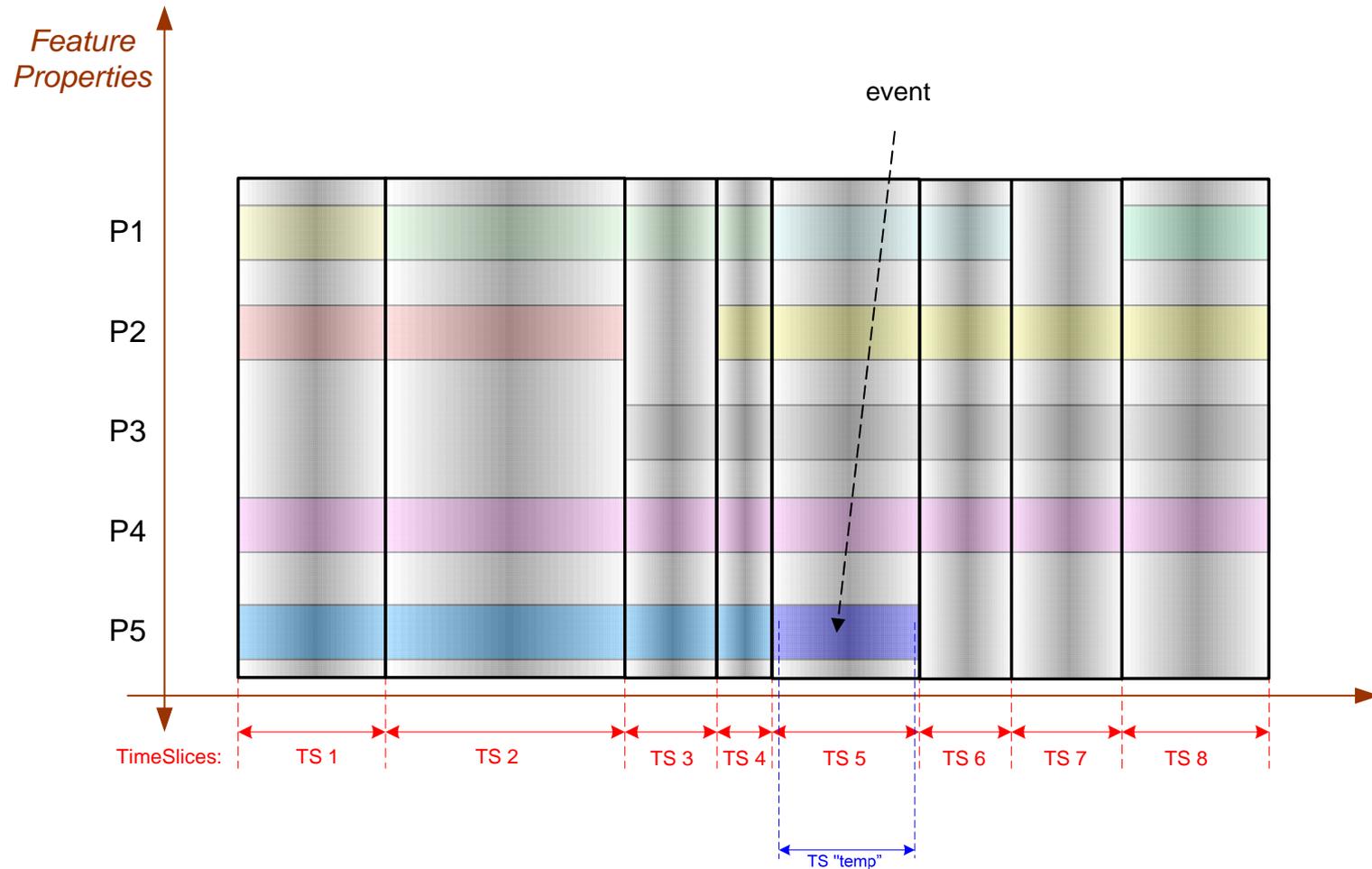
# Basic Timeslice Model



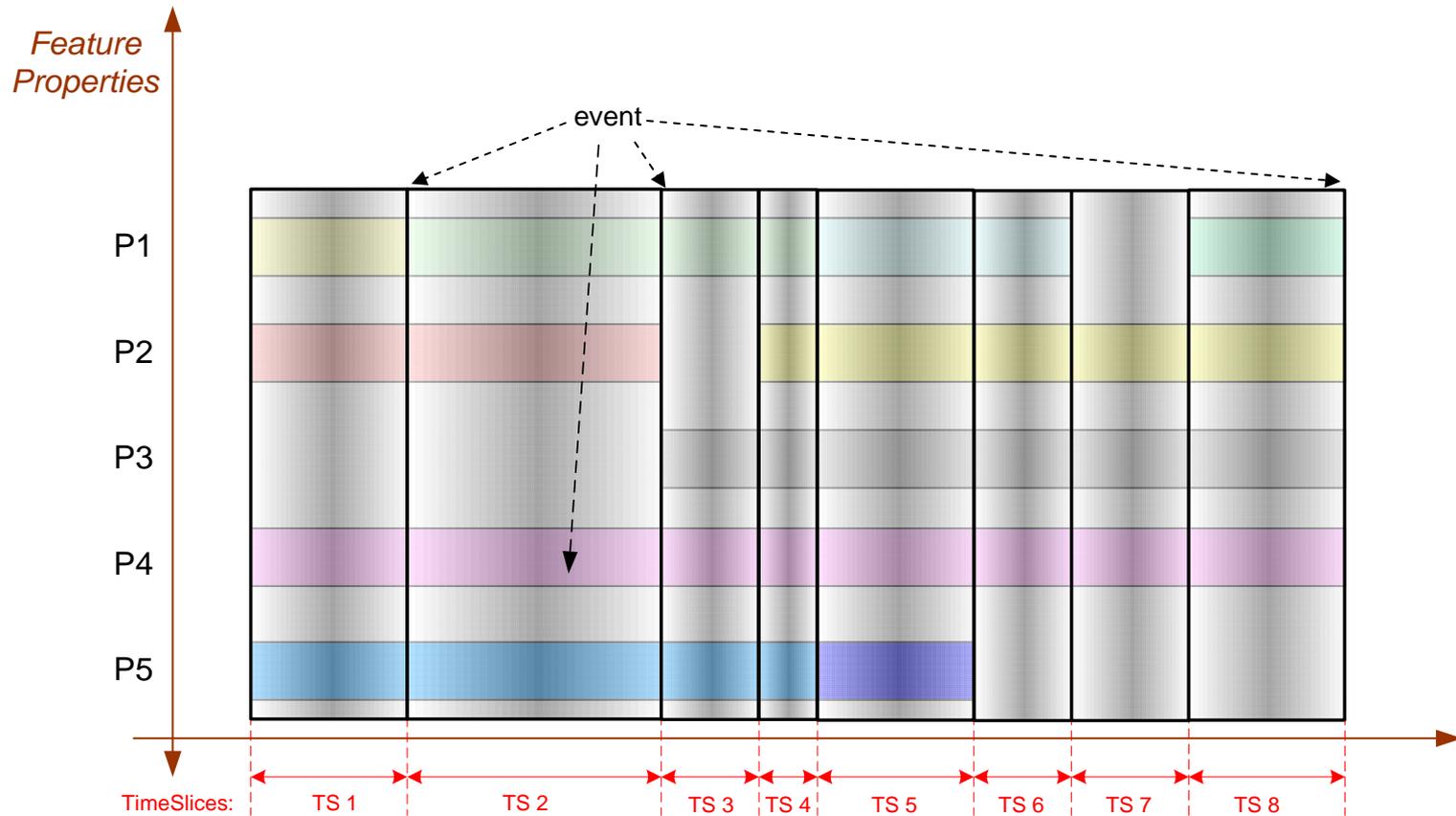
- **Features have time varying properties**

- There can be multiple PERMDDELTA and TEMPDELTA timeslices that overlap with each other

# Temporary Change (TEMPDELTA)



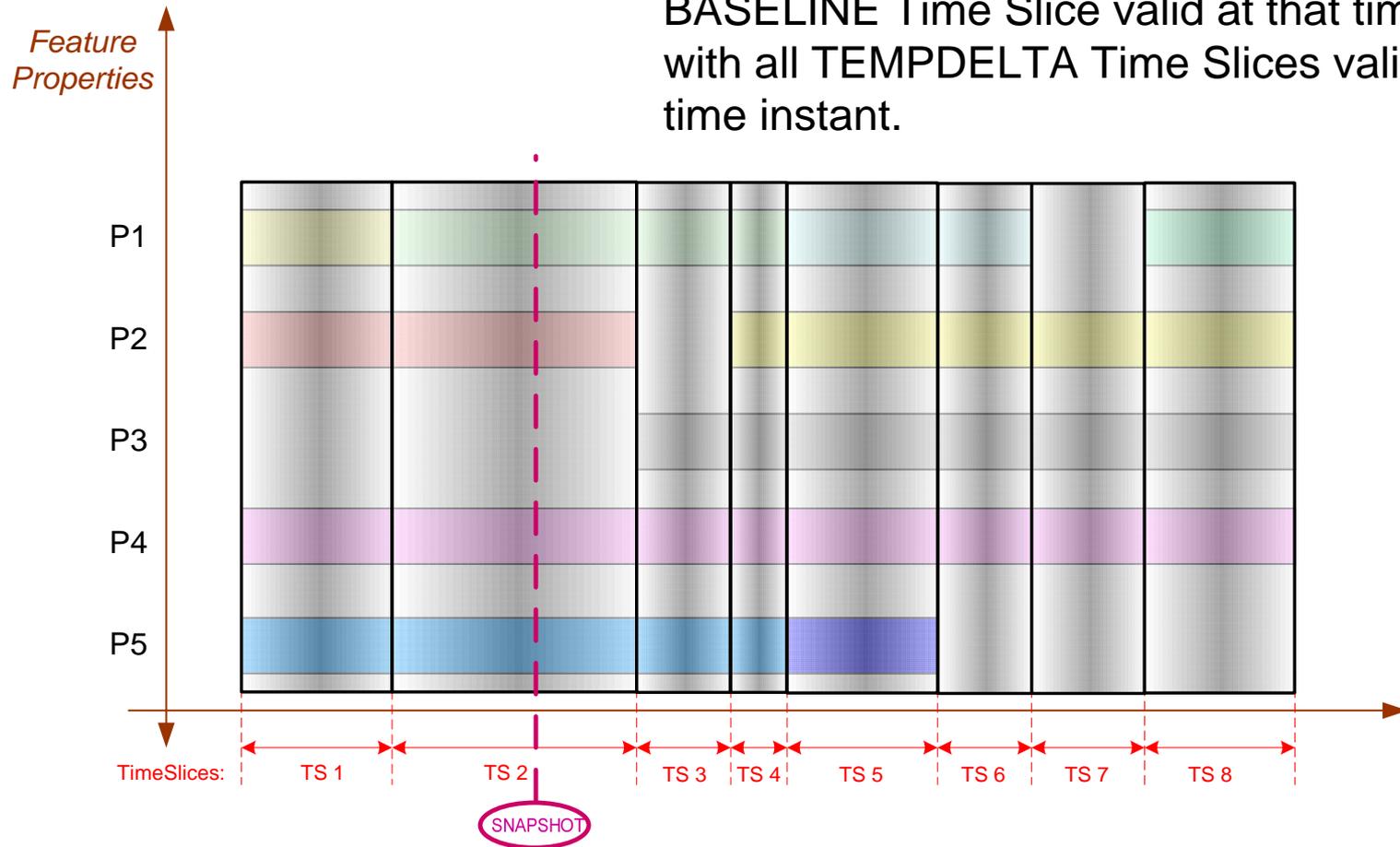
# Permanent Change (PERMDELTA)



**PERMDELTA** describes the change in a feature state as result of a permanent change.

# Snapshot

**SNAPSHOT** describes the state of a feature at a time instant, as result of combining the actual BASELINE Time Slice valid at that time instant with all TEMPDELTA Time Slices valid at that time instant.



# Application of AIXM for Digital NOTAMs

- **TEMPDELTA**
  - For Temporary Situations or changes of a limited duration
  - When the TEMPDELTA ends, revert back to permanent feature state
- **PERMDELTA**
  - For Permanent Changes
  - Two timeslices are created
    - PERMDELTA contains just the values of the merged properties
    - BASELINE contains the result of merging the changes with the existing BASELINE
- **BASELINE**
  - For “transient” features
  - Example: Temporary obstacle that did not exist before and does not have baseline data (BASELINE with end-of-life)
- **SNAPSHOT**
  - For transmitting of information in the Digital Message which is to be captured by UUIDs in the future

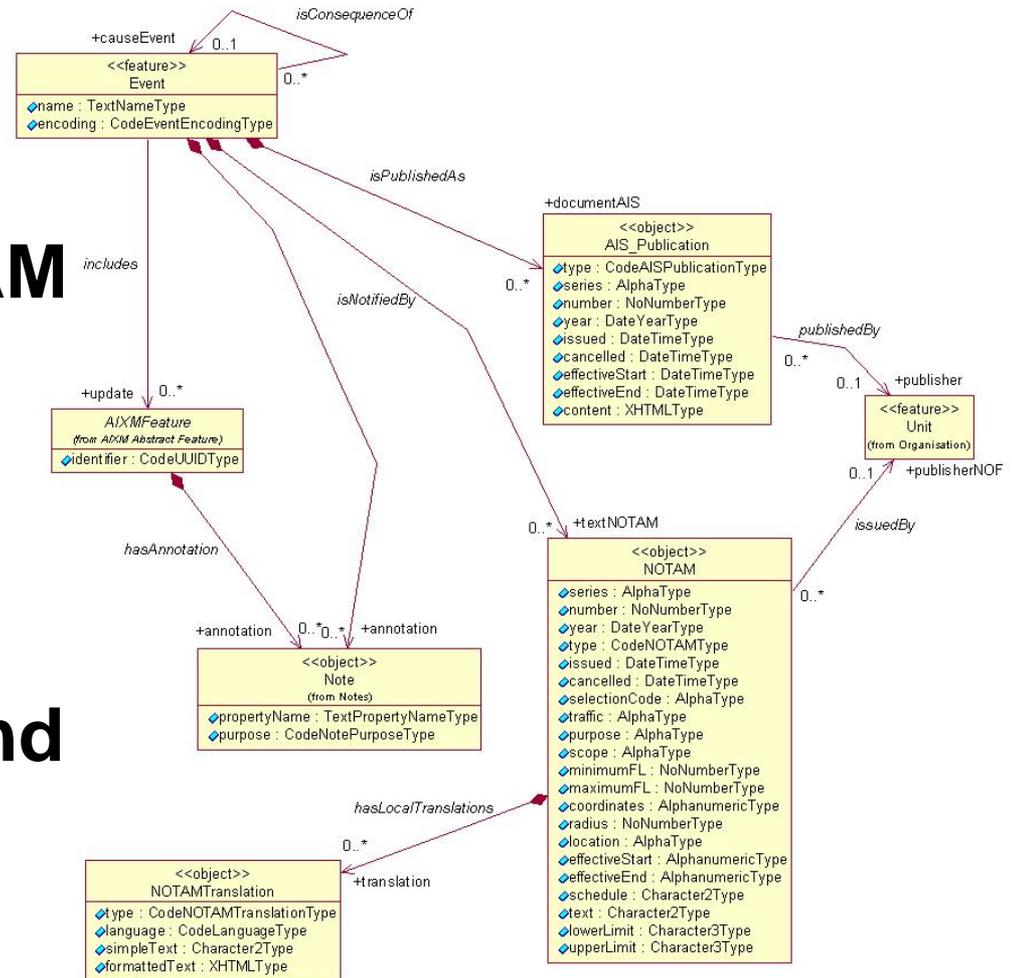
# Digital NOTAM Messages

- Messages are composed of any number of specified features and objects
- The message is used to convey information between systems
- Goal is to use the same structure and format for the digital messages as Eurocontrol
  - Jennifer Bewley will provide additional information on these efforts



# Digital NOTAM Messages

- Provides structure for the digital NOTAM message
- Samples of digital messages that comply with this schema can be found at: [aixm.aero](http://aixm.aero)



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# Scenarios/Event Specifications

- **What is a scenario?**

- A scenario describes the NOTAM condition or event that is being reported
- A scenario is applied to a feature
- The purpose is to capture the rules that are specific to each category of aeronautical information events

# Components of Scenarios

- **Each scenario documents the following:**
  - Identification of the individual elements of the NOTAM
  - Mapping of each element to AIXM
  - Translations between the digital encoding to FAA legacy, ICAO, and Plain Language
  - Business Rules
    - Template Business Rules
    - Policy Business Rules
    - Digital Encoding Business Rules
  - Sample AIXM Messages

# Use of Scenarios

- **Guidance for creating templates for entry of Digital NOTAMs**
- **Provide guidelines for validating messages transmitted to FNS**

US Digital NOTAM System - Mozilla Firefox

http://notandemo.aim.nas.faa.gov/dnotamtest/

US Digital NOTAM System

Federal Aviation Administration Test System

NOTAM Manager | Feature Manager | User Administration | My Profile | Preferences | Feedback | Help | Logout

Digital - AIM | NOTAM - Manager

Jocelyn Cox | OCT 1 2010 FRI 1341 UTC

New Cancel NOTAM Replace Copy Edit Delete Error Check Save as Draft View Change Log Submit Refresh

Filters

NOTAM Summary

Keyword Designator Condition Number Start Date UTC End Date UTC Status

NOTAM Editor - TWY A Scenario: Lighted Sign Status

Properties Prior Permission Comments Contact Info

Sign: -Select Value-

Status: -Select Value-

Description:

Direction: -Select Value-

Location

Between: -Select Value- and -Select Value-

For: -Select Value-

Period of Validity

Domestic ICAO Plain Language

ACY XXXXX ACY TWY A

Active filters: Keywords = ALL, Status = All [29 Records]

Connected to NOTAM Manager | Page 1 of 1

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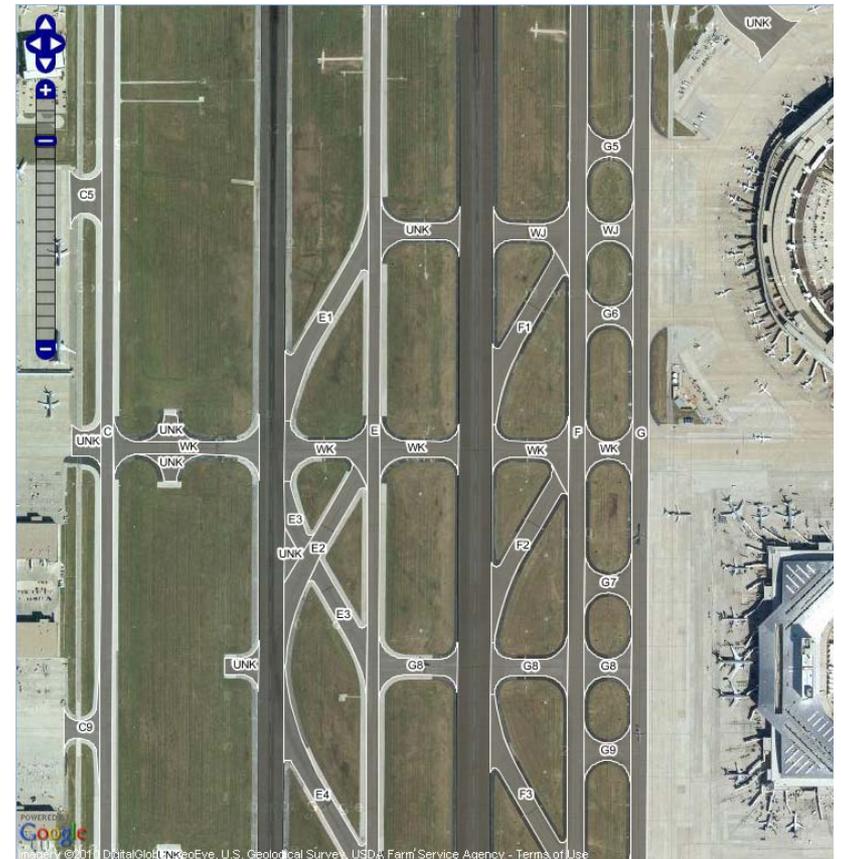


# Verification of Baseline Data

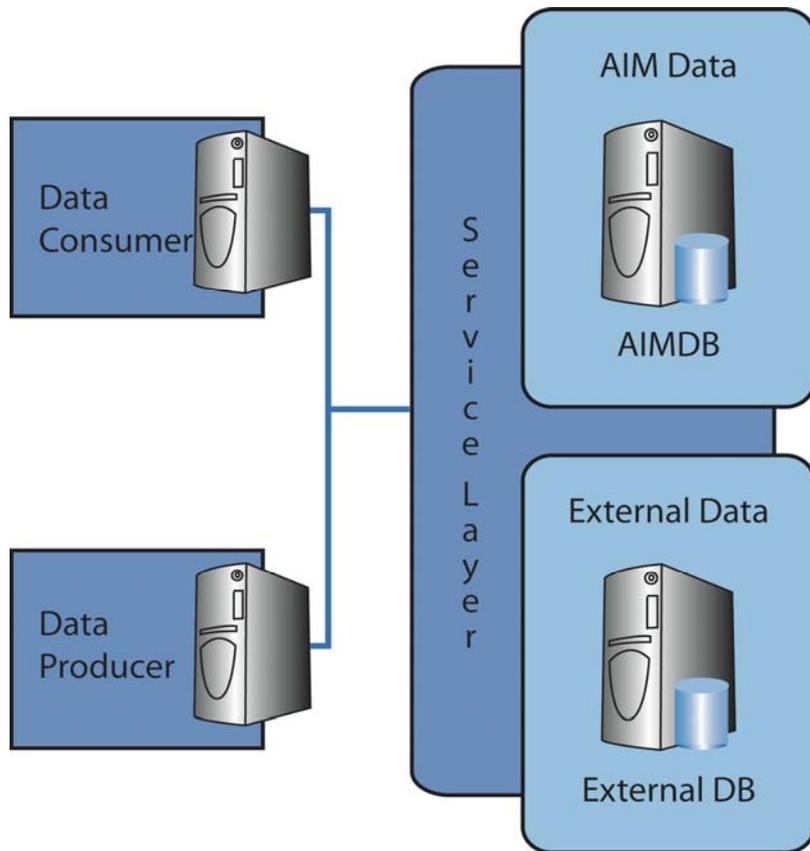
- **Key objective of FNS is to ensure that NOTAMs can be validated against baseline data**
  - Airports – AIMDB (future)
  - TLO – OE/AAA, DOF, FCC
  - OCC – FSEP
  - SAA – NASR
  - etc.
- **Need to ensure that the data is validated against the authoritative source**

# Connect to AIMDB for Airport Data

- **Provides static airport configuration information to support operations**
  - Airport/runway configurations
  - Taxiway routing
  - Airport base data for moving map displays



# Data Distribution using OGC Web Services



- **Data Layer**
  - AIM database and external databases
- **Service Layer**
  - Java-based GeoServer platform
  - Strictly adheres to OGC standards (e.g., WMS, WFS, WCS, KML)
- **Data Users**
  - Data consumers/producers
  - Data stewardship
  - Custom adapters to support legacy systems

# AIXM Web Services



- **Web services**
  - WSDL (Web Service Description Language)
  - REST (Representative State Transfer)
- **Currently, airport data is provided as AIXM 5.1**
  - Approximately 800 airports –National Geospatial-Intelligence Agency (NGA)
  - NASR data
  - Convert 3D to 2.5D
  - Simplified XLink –internally refer to gml:id
- **In the future, airport data will be provided through WFS (WFS 2.0)**
  - Survey data will be integrated with NGA baseline data

# For Additional Information on AIMDB

- **Contact Information**

- Joseph Norton
  - joseph.ctr.norton@faa.gov
- Marcus Rouhani
  - Marcus.Rouhani@faa.gov

- **Airports GIS**

- **Web Application – <http://airports-gis.faa.gov>**
- **Web Services – <https://agisdemo.faa.gov/airportsgis/services>**

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# Digital Message

- AIXM Message – XML
- AIXM Temporality
  - Timeslice: SNAPSHOT
    - RWY 13
    - TDZ Lights
  - Timeslice: TEMPDELTA
    - OTS

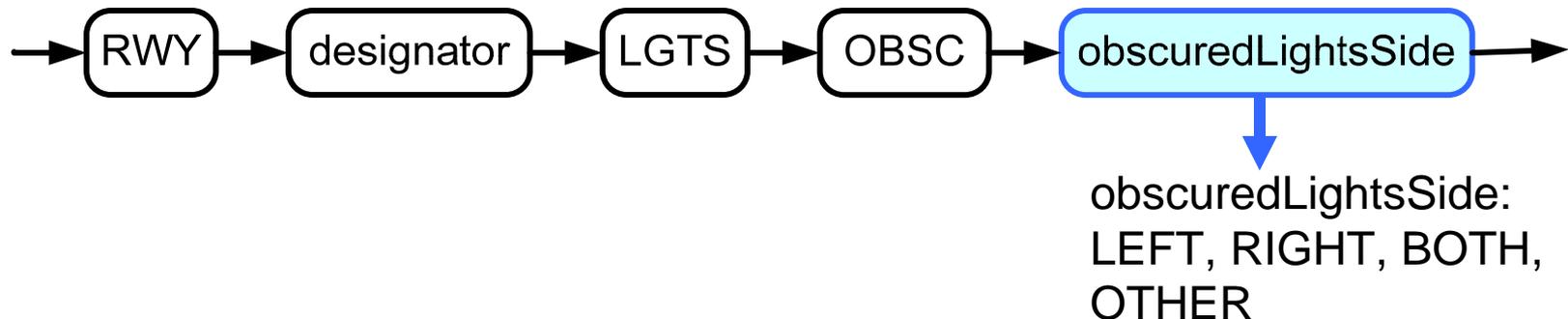
```
<interpretation>SNAPSHOT</interpretation>
<position>TDZ</position>
<associatedRunwayDirection xlink:href="#RWYDIR01"/>
</RunwayDirectionLightSystemTimeSlice>
</timeSlice>
<timeSlice>
<RunwayDirectionLightSystemTimeSlice gml:id="RWYDIRLGTSYS01_TS02">
<gml:validTime>
<gml:TimePeriod gml:id="RWYDIRLGTSYS01_TS02_TP01">
<gml:beginPosition></gml:beginPosition>
<gml:endPosition></gml:endPosition>
</gml:TimePeriod>
</gml:validTime>
<interpretation>TEMPDELTA</interpretation>
<sequenceNumber>16</sequenceNumber>
<availability>
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<operationalStatus>INSERVICEABLE</operationalStatus>
</GroundLightingAvailability>
</availability>
</RunwayDirectionLightSystemTimeSlice>
</timeSlice>
</RunwayDirectionLightSystem>
</notamMessage:hasMember>
<notamMessage:hasMember>
<RunwayDirection gml:id="RWYDIR01">
<timeSlice>
<RunwayDirectionTimeSlice gml:id="RWYDIR01_TS01">
<gml:validTime>
<gml:TimeInstant gml:id="RWYDIR01_TS01_TI01">
<gml:timePosition>2010-04-07T09:00:00</gml:timePosition>
</gml:TimeInstant>
</gml:validTime>
<interpretation>SNAPSHOT</interpretation>
<designator>13</designator>
<usedRunway xlink:href="#RWY01"/>
```

**!ACY 03/020 ACY RWY 13 TDZ LGTS OTS**

# FNS AIXM Extensions

- **Identify any gaps in the core AIXM model**
  - Gap analysis will lead to an extension to the core AIXM Model
- **Runway Lights Obscured**

!SVA 02/001 SVA RWY 5/23 LGTS OBSC **SOUTH SIDE** WEF  
0902062026



However, FAA uses cardinal direction (NORTH, SOUTH, EAST, WEST, etc.)

# Extensions and Unified AIM Database

- **Goal is to consolidate extensions across all AIM projects to create one AIXM extension**
  - Help ensure unified approach for extensions within AIM
  - Increases interoperability between different projects/programs

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# Digital Encoding Business Rules

- **Define the rules for encoding the NOTAM information in AIXM**
  - Ex: Runway Closure
    - If the runway is closed without any exceptions and without a schedule, then the operationalStatus attribute shall get the value CLOSED
    - If the runway is closed for specified operations, flights and/or aircraft, the operationalStatus attribute shall get the value LIMITED
    - If the runway is closed with an associated schedule, then the operationalStatus attribute shall get the value LIMITED
    - If the runway is closed except for specified operations, flight and/or aircraft, the operationalStatus attribute shall get the value RESERV and the type of usage shall be CONDITIONAL

# Policy Business Rules

- **Define policy/policies that dictate the rules implemented by the system**
  - Ex: Runway Lights Obscured
    - FAA Order JO 7930.2, paragraph 5-2-2d4(c)
      - Lights that are partially obscured should not be reported
      - The reason for obscuration should not be reported
- **Purpose is to separate business rules that potentially can change as the policy is updated**

# Template Business Rules

- **Define the business rules associated with the NOTAM entry template**
  - Identify required and optional fields
  - Ex: Runway Closure
    - Runway Designator is Required
    - Operational Status (CLOSED) is required
    - Specific Operations/Aircraft are Optional
      - BUT the user cannot select the same restriction more than once
      - If closing only a Runway Direction – the user has to select a reason
  - Ex: TLO
    - NOTAM duration cannot last more than 15 days

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# Questions

- **Contact Information**

- Jocelyn Cox
  - [jocelyn.ctr.cox@faa.gov](mailto:jocelyn.ctr.cox@faa.gov)
- Jennifer Bewley
  - [jennifer.ctr.bewley@faa.gov](mailto:jennifer.ctr.bewley@faa.gov)
- Vinod Vallikat
  - [vvallikat@cghtech.com](mailto:vvallikat@cghtech.com)



- **FNS Website**

- <http://notams.aim.faa.gov>

# Features

**A feature is a representation of an entity in the real world**

E.g., Nav aids, Airports, Airspace

**Features have a lifetime**

They have a beginning of life, end of life and can change properties throughout

**They are related to other features but independent of them**

# Objects

**An object is structured data that is generally (but not always) contained within a feature**

**An object, on its own, does not represent a real entity with its own timeline**

**Objects contained within a feature inherit that feature's timeline**

# Messages

**A message is composed of any number of specified features, objects or properties**

**A message is the entity used to convey information between systems**

It is the element most tied to the actual implementation of the system