OGC Testbed 12 Aviation Thread Results

Presented to: ATIEC 2016

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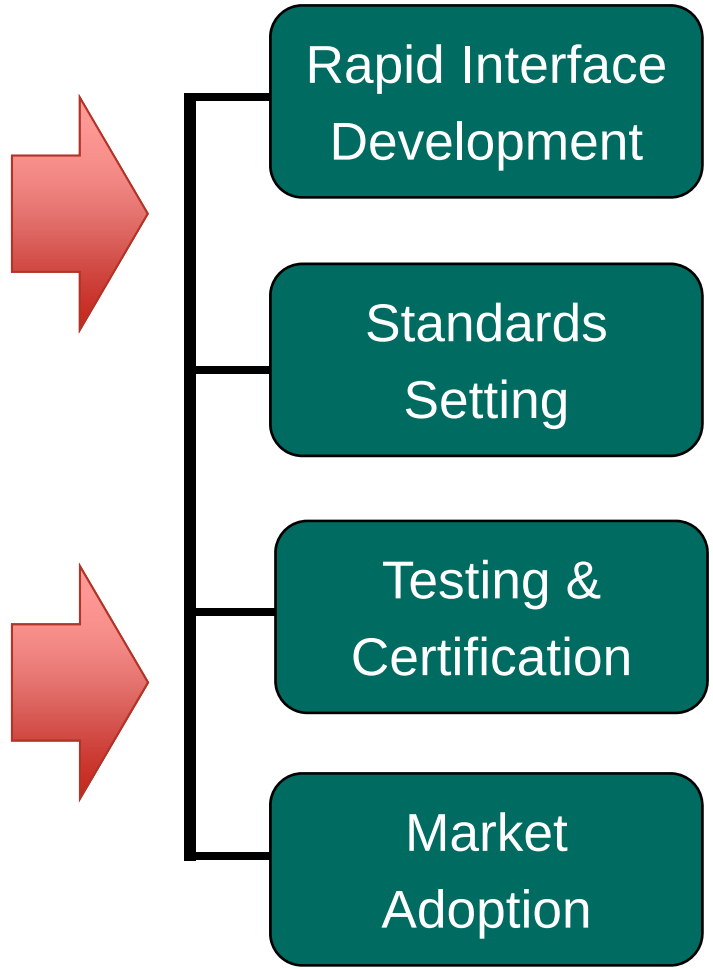
Aviation Information World – Forecasting the Future

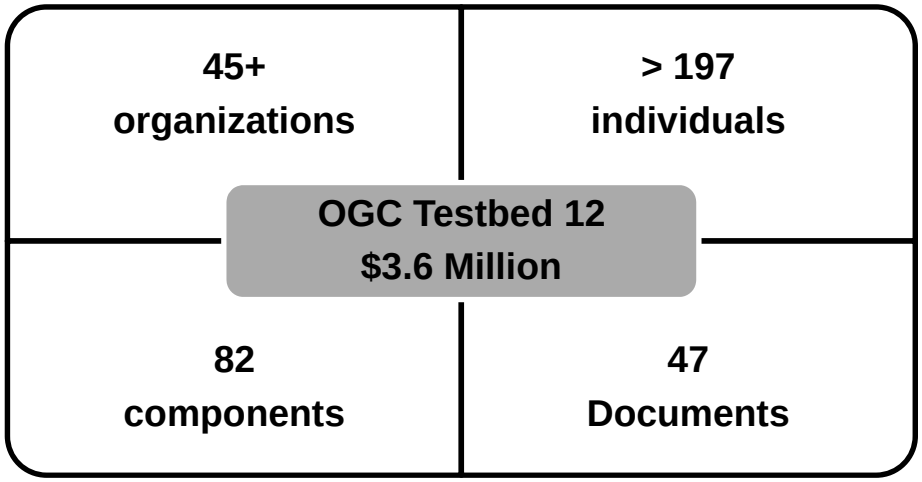
Open Geospatial Consortium

- ***Interoperability Program (IP)*** – a global, innovative, hands-on rapid prototyping and testing program designed to unite users and industry in accelerating interface development and validation, and the delivery of interoperability to the market
- ***Standards Program*** – Consensus standards process similar to other Industry consortia (World Wide Web Consortium, OMA, etc.).
- ***Compliance Testing and Certification Program*** – allows organizations that implement an OGC standard to test their implementations with the mandatory elements of that standard
- ***Communications and Outreach Program*** – education and training, encourage take up of OGC specifications, business development, communications programs



OGC Testbed 12 Overview

OGC Testbeds provide an environment for collaborative, fast-paced, multi-vendor, rapid prototyping efforts to define, design, develop, and test candidate interface and encoding specifications.



Benefits of Involvement

For Participants

Business potentials

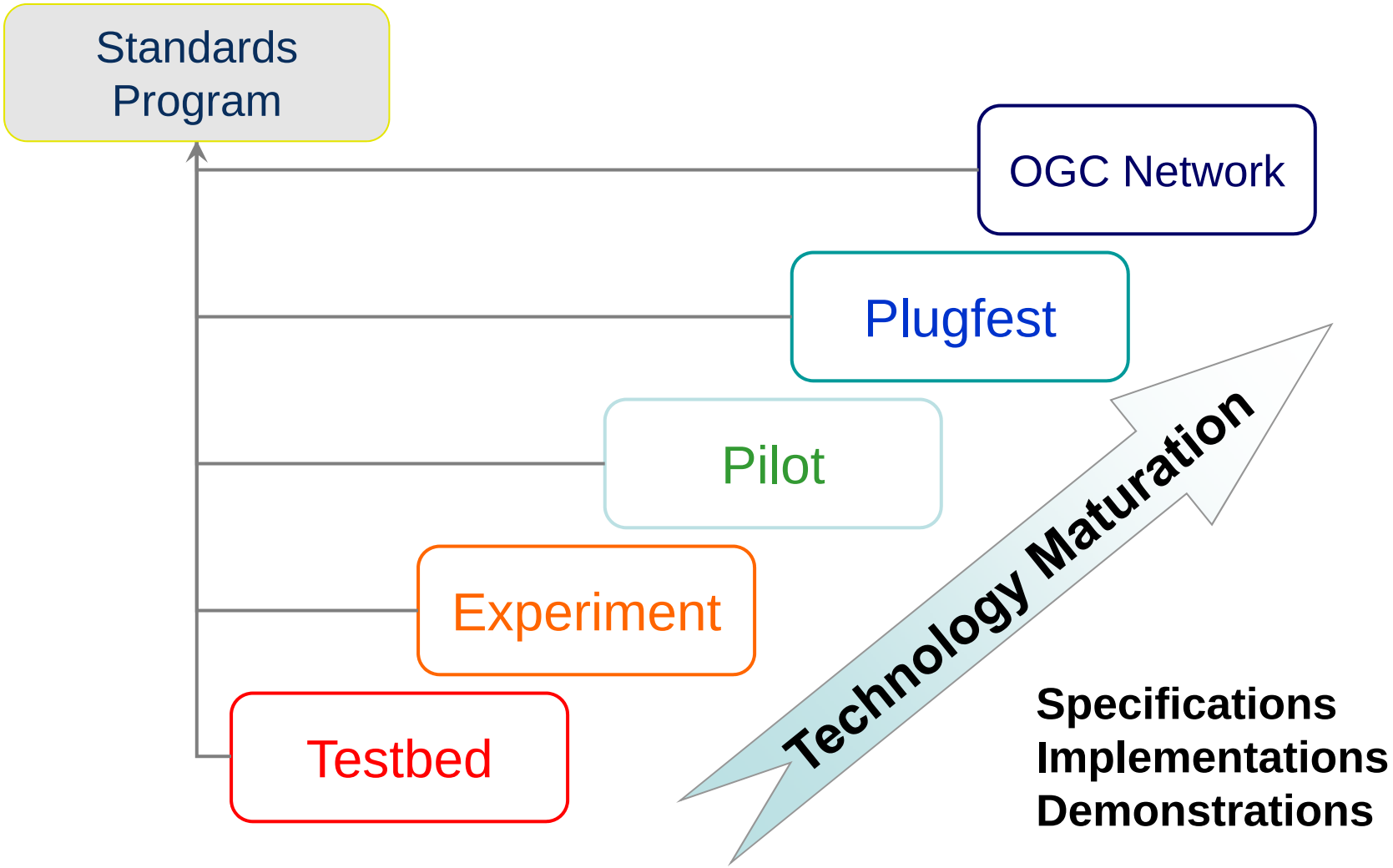
- **Early insights and skill building**
- **Early visibility**
- **Early market deployment**
- **Direct influence**
- **Broaden market reach**

For Sponsors

Significant efficiencies

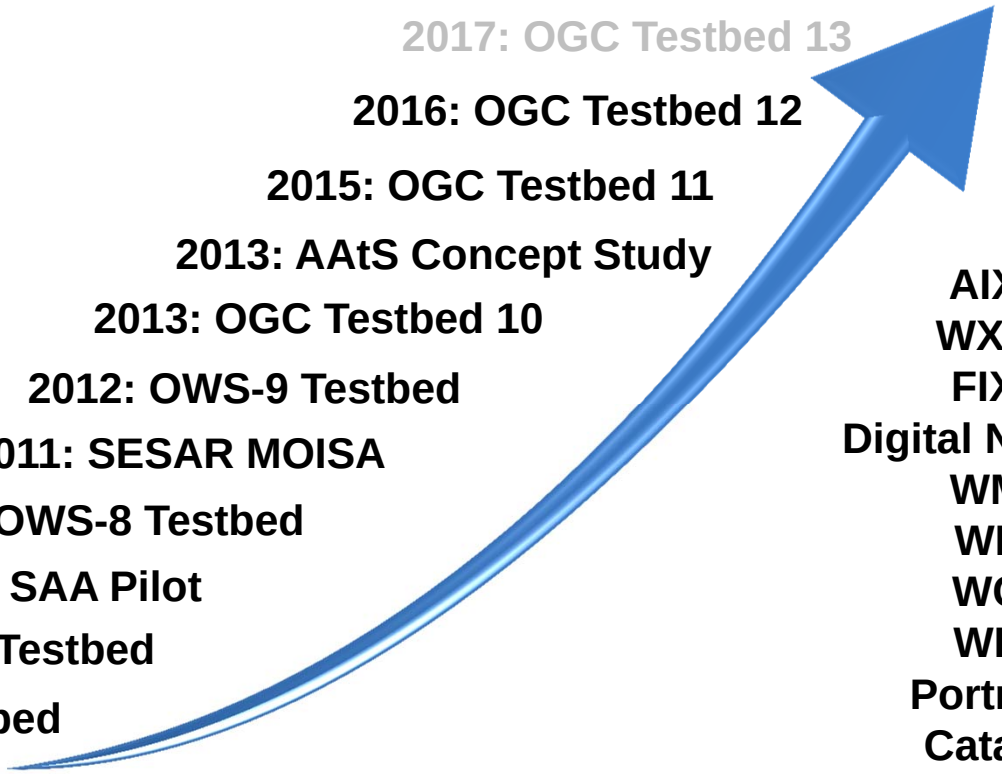
- ***Ability to Determine Market Interest***
- ***Accelerated process - workable interface specifications in 4-6 months***
- ***Vendors test, validate and demonstrate interface integrity – Rapid time to market***
- **Leverage of other sponsor' funding to solve common/similar problems**
- **Collaborative environment with other sponsors and participants**

85+ IP Initiatives Since 1999



OGC Aviation Testbeds

Operational Requirements for OGC Standards in Aviation



2017: OGC Testbed 13

2016: OGC Testbed 12

2015: OGC Testbed 11

2013: AAtS Concept Study

2013: OGC Testbed 10

2012: OWS-9 Testbed

2011: SESAR MOISA

2011: OWS-8 Testbed

2010: FAA SAA Pilot

2010: OWS-7 Testbed

2008: OWS-6 Testbed

2005: AIXM introduced at Technical Committee (TC)

AIXM
WXXM
FIXM
Digital NOTAMs
WMS
WFS
WCS
WPS
Portrayal
Catalog
Pub Sub
EFB
Semantics

OGC Testbed Deliverables

1. Technical Documents

(draft standards, best practices, change requests, etc.)

2. Prototype Implementations

(services, clients, tools, etc.)

3. Demonstrations

OGC Testbed 12 Sponsors

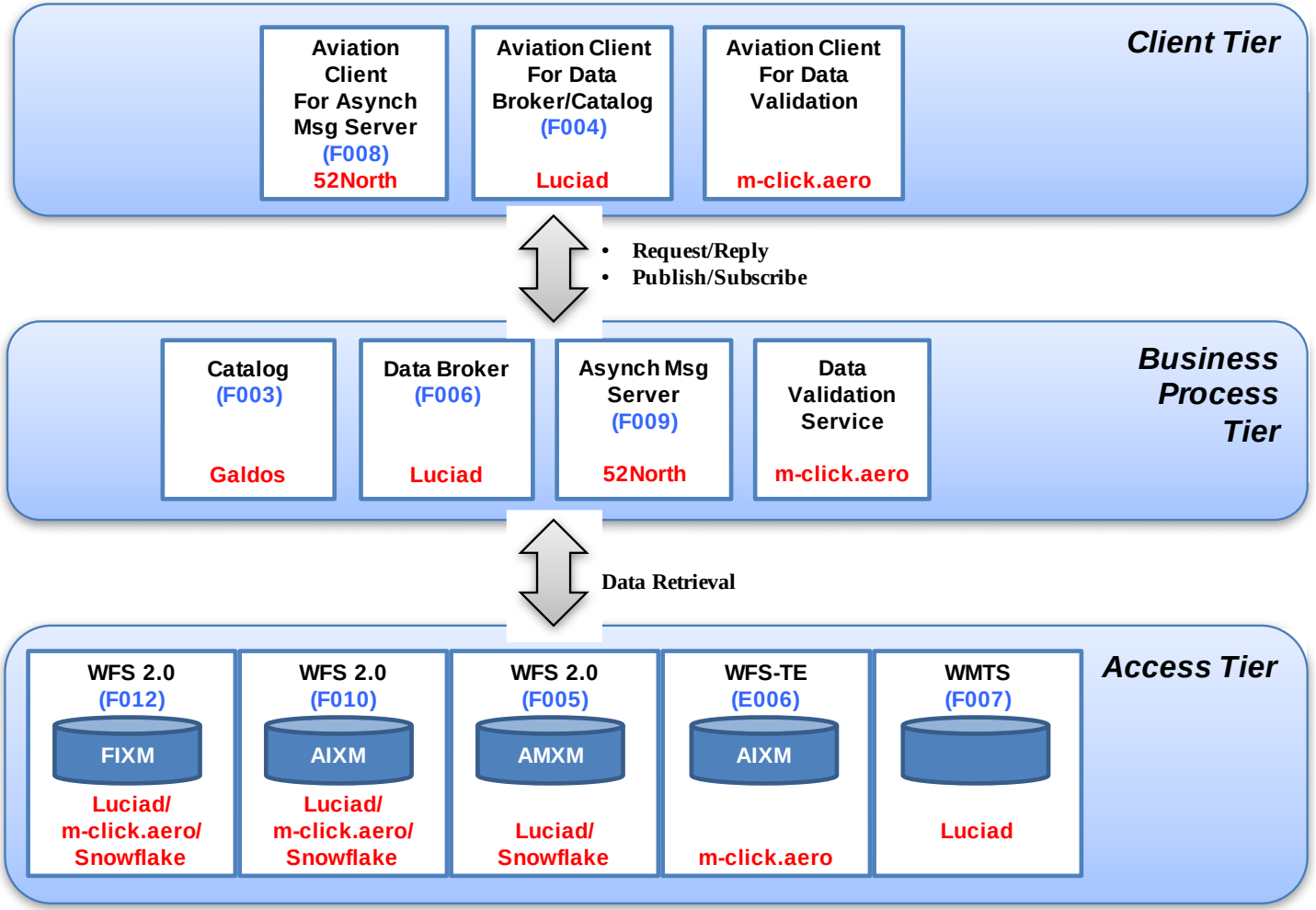
- Digital Global, Inc.
- European Organization for the Safety of Air Transportation (EUROCONTROL)
- National Aeronautics and Space Administration (NASA)
- UK Defense Science and Technology Lab (UK-DSTL)
- US Federal Aviation Administration (FAA)
- US Geological Survey (USGS)
- (Other US Agency)

Aviation Thread Participants

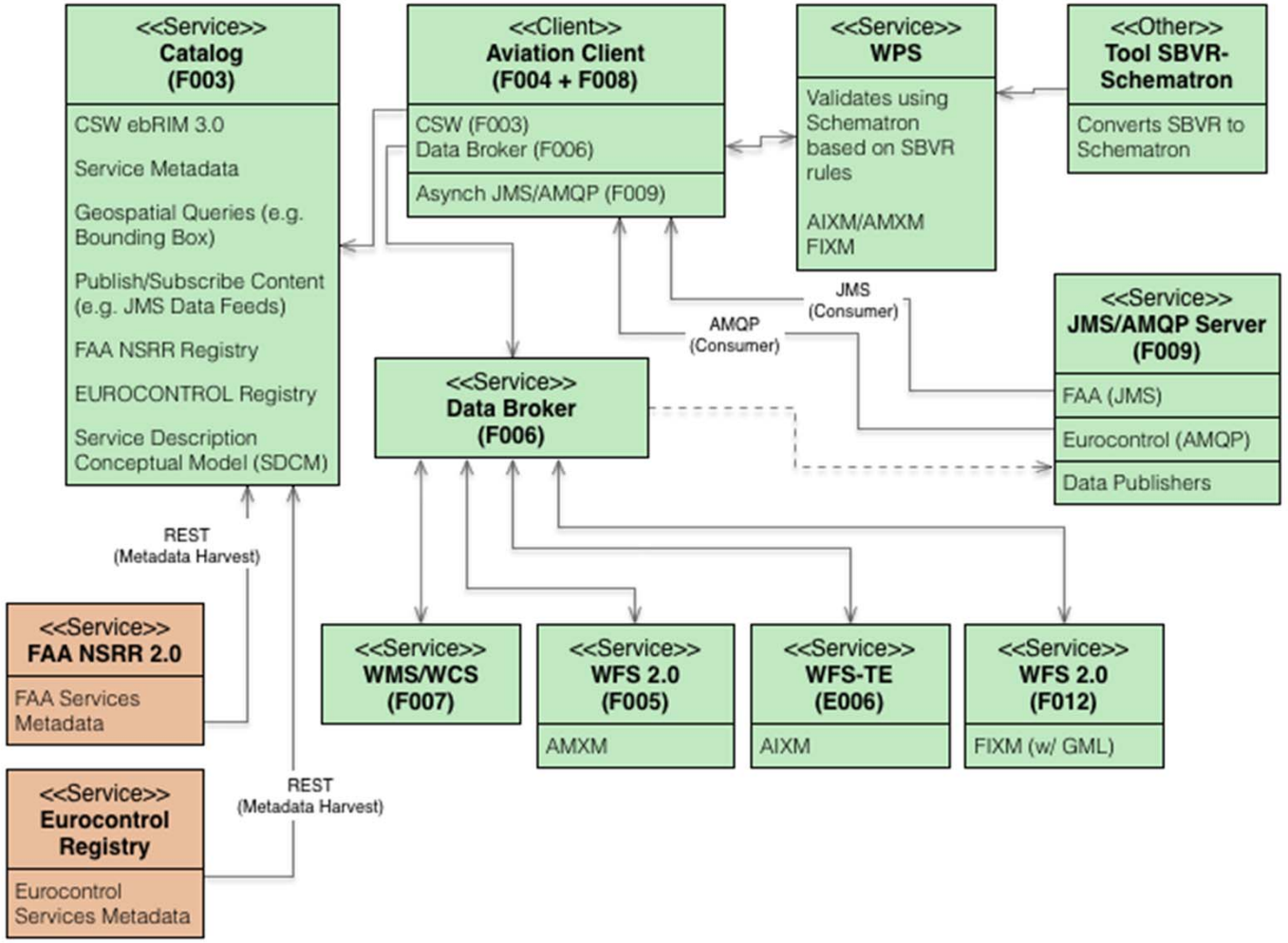
Aviation Thread Topics

- **Semantics**
  - Advance use of Catalog Service for Web
  - Advance use of Semantic Business Vocabulary and Rules (SBVR) for Data Validation
  - Advance use of Data Broker
- **Integration of GML into FIXM**
  - Implementation of FIXM in Web Feature Service (WFS)
- **Asynchronous Messaging for Geospatial Aviation Data**
  - Implementation of prototype using PubSub 1.0 Specification

T-12 AVI Component Architecture

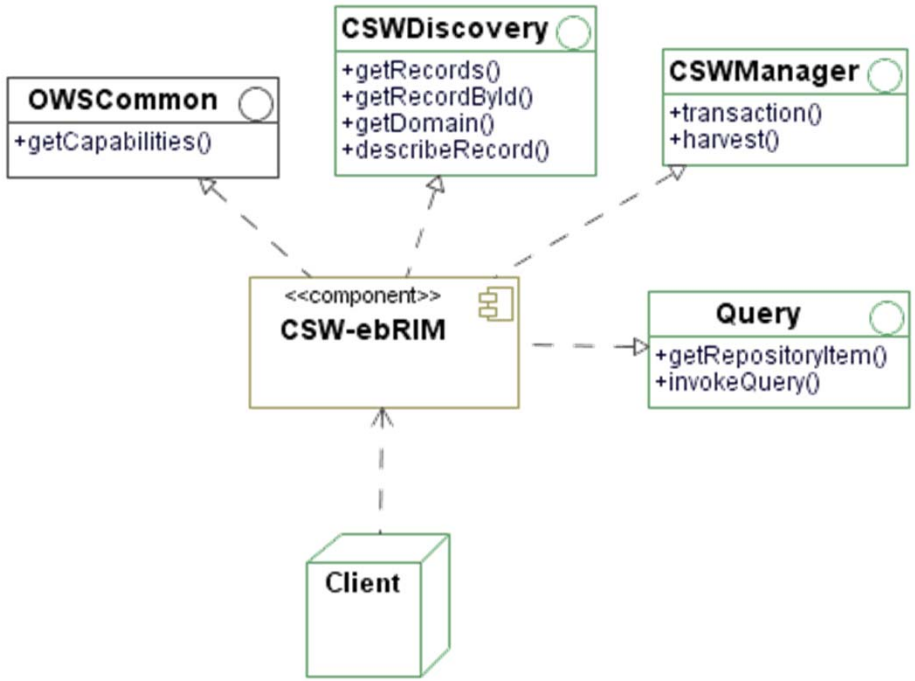


T-12 AVI Service Architecture



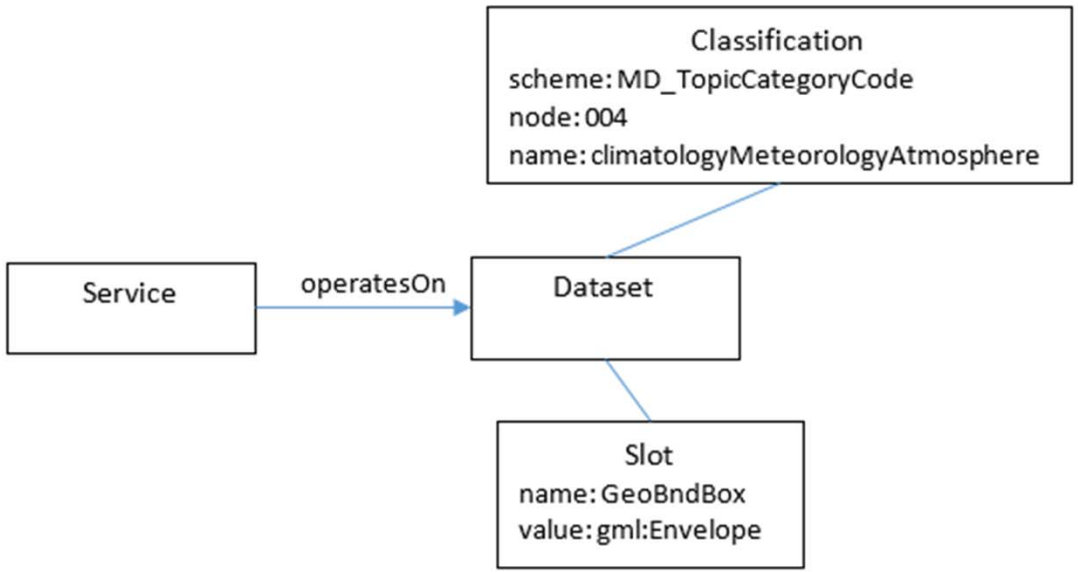
OGC Catalog Service

- The OGC defines the Catalog Service for Web (CSW) interface that is designed to be tailored for particular application domains using a profiling mechanism

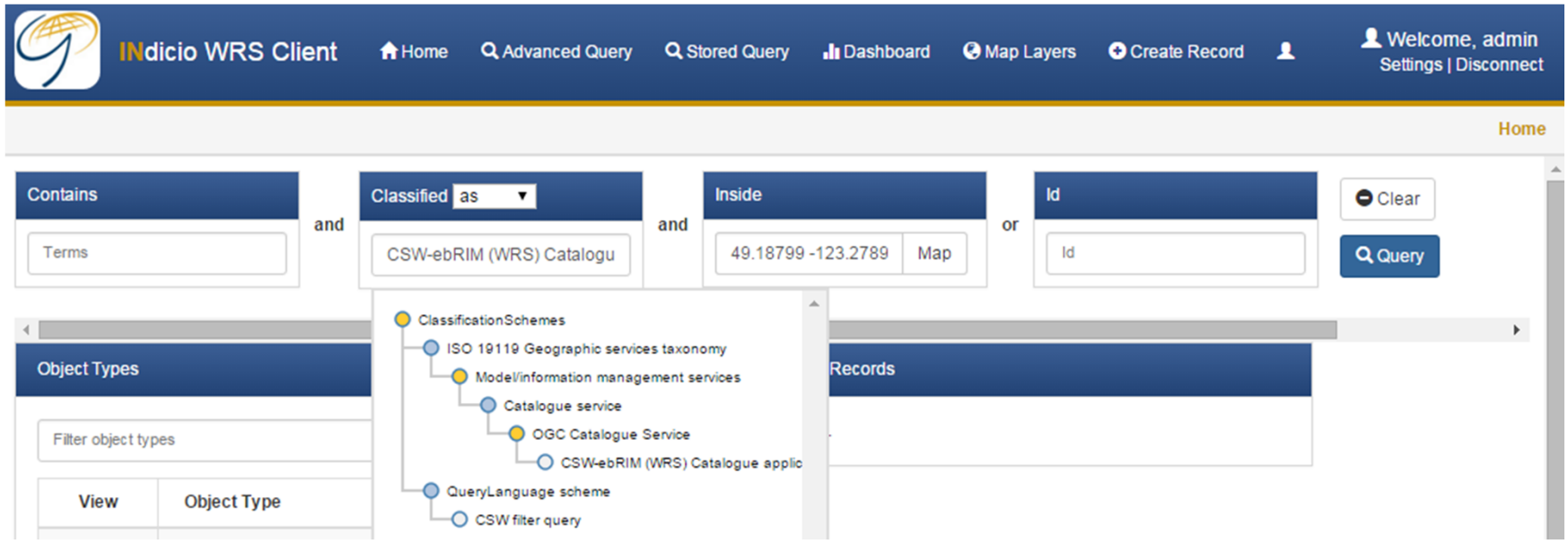


Searching Registry Content

- The registry may be searched using the CSW query interface with filter criteria (spatial and non-spatial predicates)
- **Example**: Find services that offer meteorological data for some area of interest

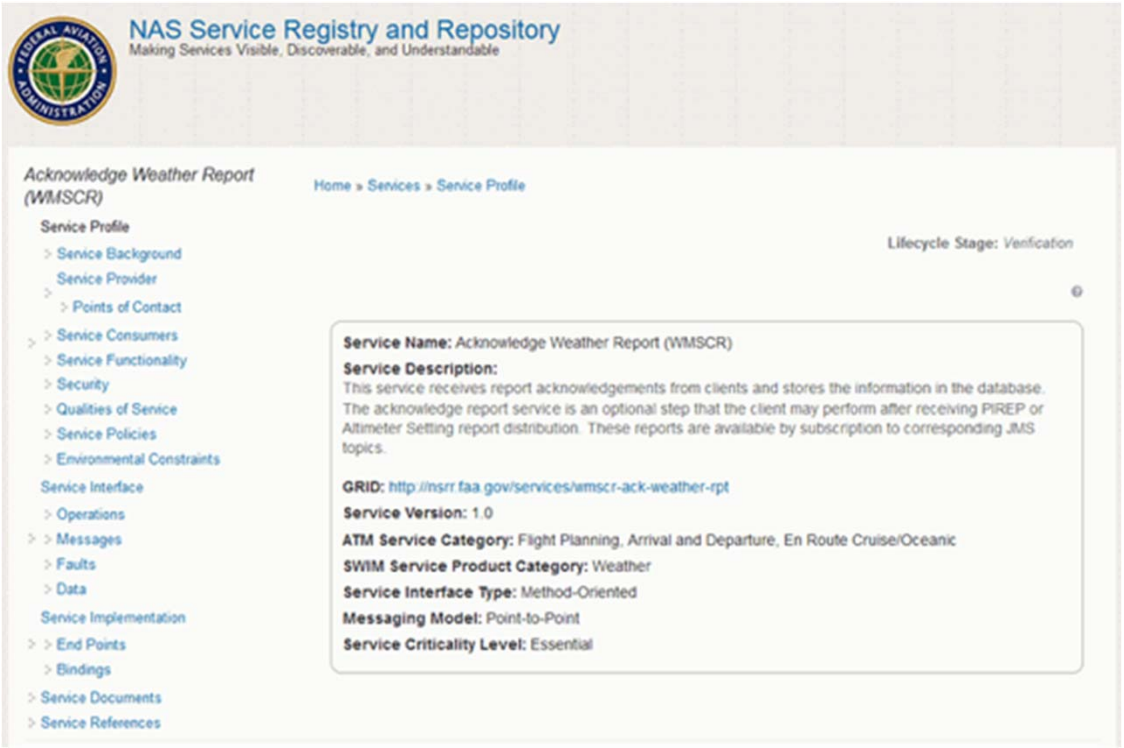


Search interface – Web client



A demo client is available at: http://ows.galdosinc.com/

Recommendations for NSRR v2



1. Implementing the OpenSearch GeoTemporal extensions can enable a spatial search capability for a SWIM registry, but does not conform to OGC standards
2. Implementing a CSW adapter for the SDCM information model permits CSW clients to search SWIM registries.

Data Validation using SBVR

- **SBVR work began in Testbed 11**
  - See ATIEC presentations from ATIEC 2015
- **Testbed 12 continued work in SBVR engineering report**
- **Demonstrated TFR NOTAM validation based on issues raised in the RTCA Graphical TFR Task Group**

Federal Aviation Administration

FAA.gov Home

TFR List | TFR Map | Map Airports | TFR Help | PilotWeb | SUA

NOTAM

Number : **FDC 6/9747 Download shapefiles**

Issue Date :	September 10, 2016 at 1924 UTC
Location :	20 NM SE OF MONTERY, California
Beginning Date and Time :	September 10, 2016 at 1900 UTC
Ending Date and Time :	October 30, 2016 at 0400 UTC
Reason for NOTAM :	TO PROVIDE A SAFE ENVIRONMENT FOR FIRE FIGHTING AIRCRAFT OPERATIONS
Type :	Hazards
Replaced NOTAM(s) :	N/A
Pilots May Contact :	OAKLAND (ZOA) ARTCC, 510-745-3331

Click for Sectional

NOTAM Text

Jump To: Affected Areas | Operating Restrictions and Requirements | Other Information

Affected Area(s) Top

Airspace Definition:
Region bounded by:

	Latitude:	Longitude:	FRD:
From:	36°26'53"N	121°49'12"W	SNS202016.6
To:	36°28'06"N	121°34'33"W	SNS157011.8
To:	36°08'26"N	121°16'01"W	SNS136035.3
To:	35°58'18"N	121°32'54"W	SNS159041.6
To:	36°17'39"N	121°55'42"W	SNS198027.2

Altitude: From the surface up to and including 9000 feet MSL

Effective Date(s):
From September 10, 2016 at 1900 UTC
To October 30, 2016 at 0400 UTC

Operating Restrictions and Requirements Top

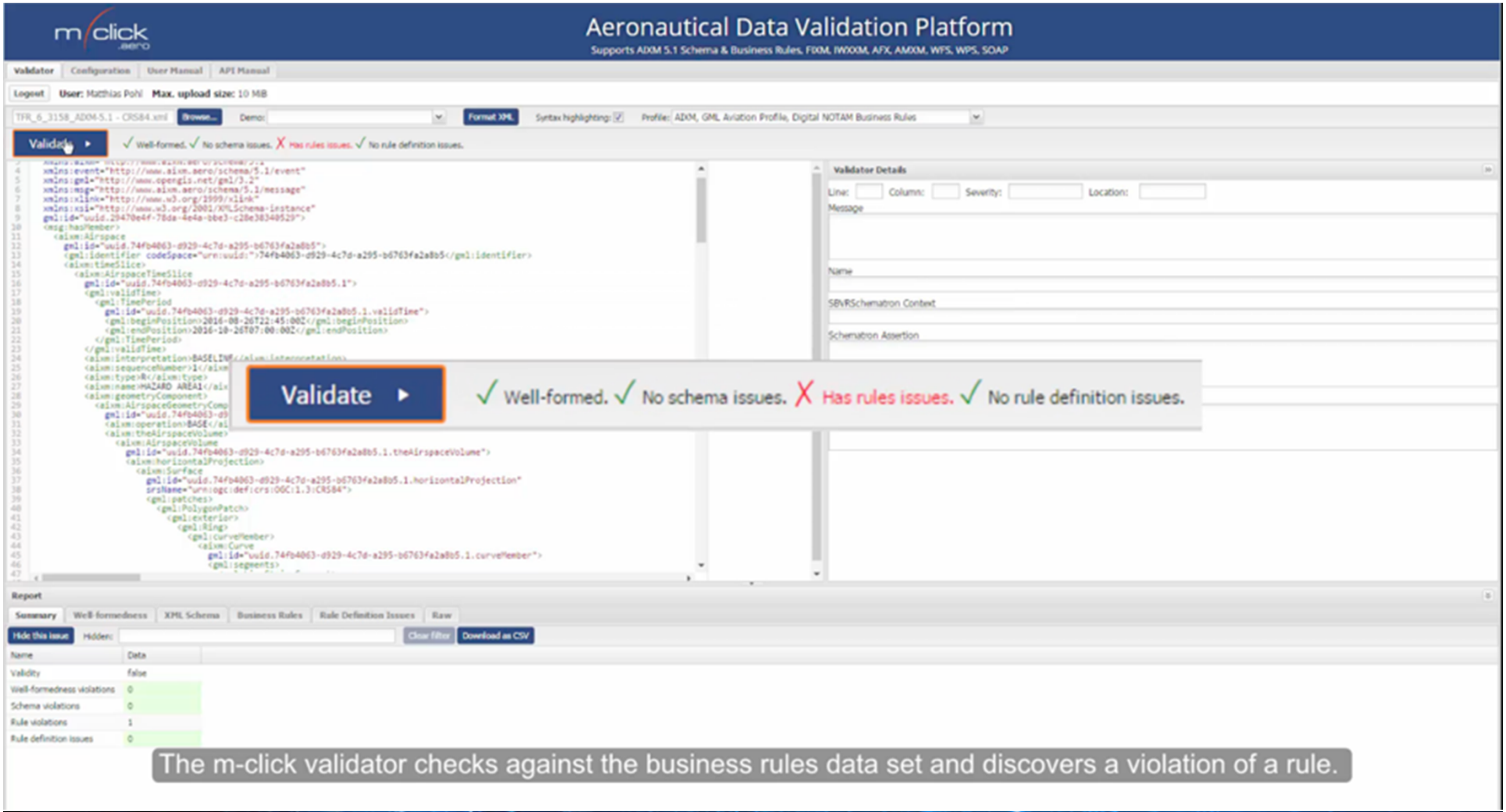
No pilots may operate an aircraft in the areas covered by this NOTAM (except as described).

Other Information: Top

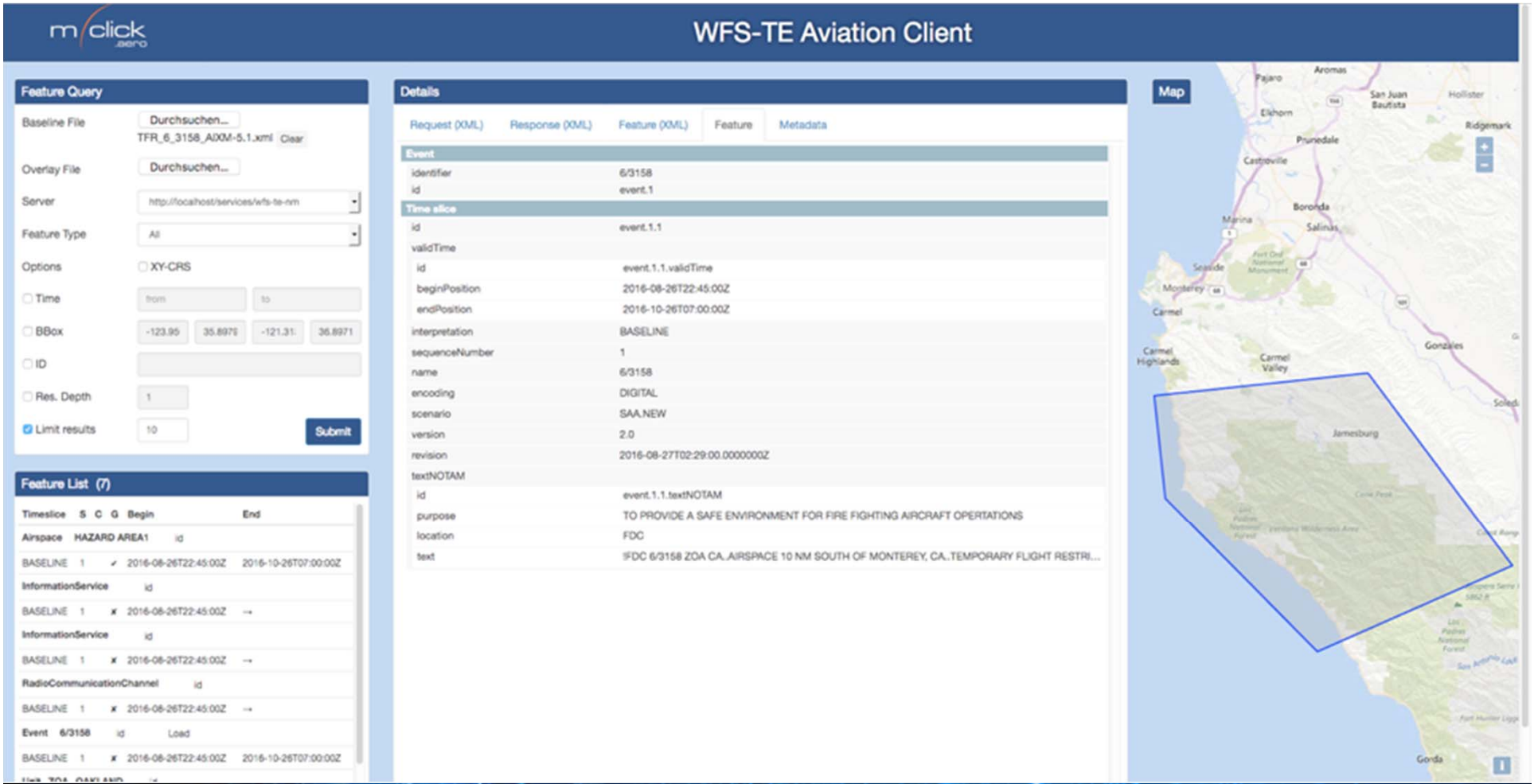
ARTCC:	ZOA - Oakland Center
Point of Contact:	LOS PADRES NATIONAL FOREST Telephone 805-961-5727 Frequency 119.125
Authority:	Title 14 CFR section 91.137(a)(2)

Depicted TFR data may not be a complete listing. Pilots should not use the information on this website for flight planning purposes. For the latest information, call your local Flight Service Station at 1-800-WX-BRIEF.

Aeronautical Data Validation Service



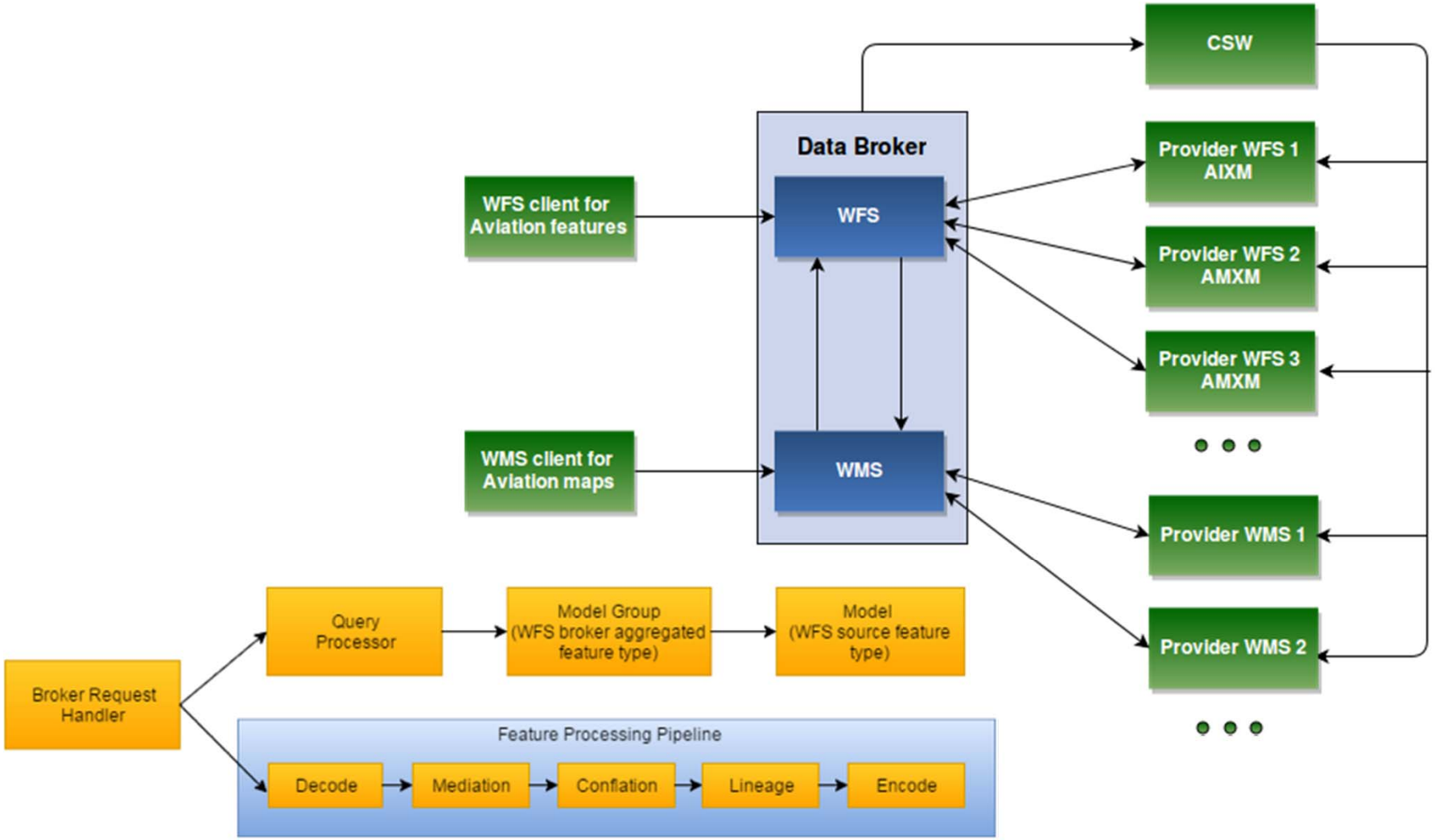
TFR NOTAM Graphical Verification



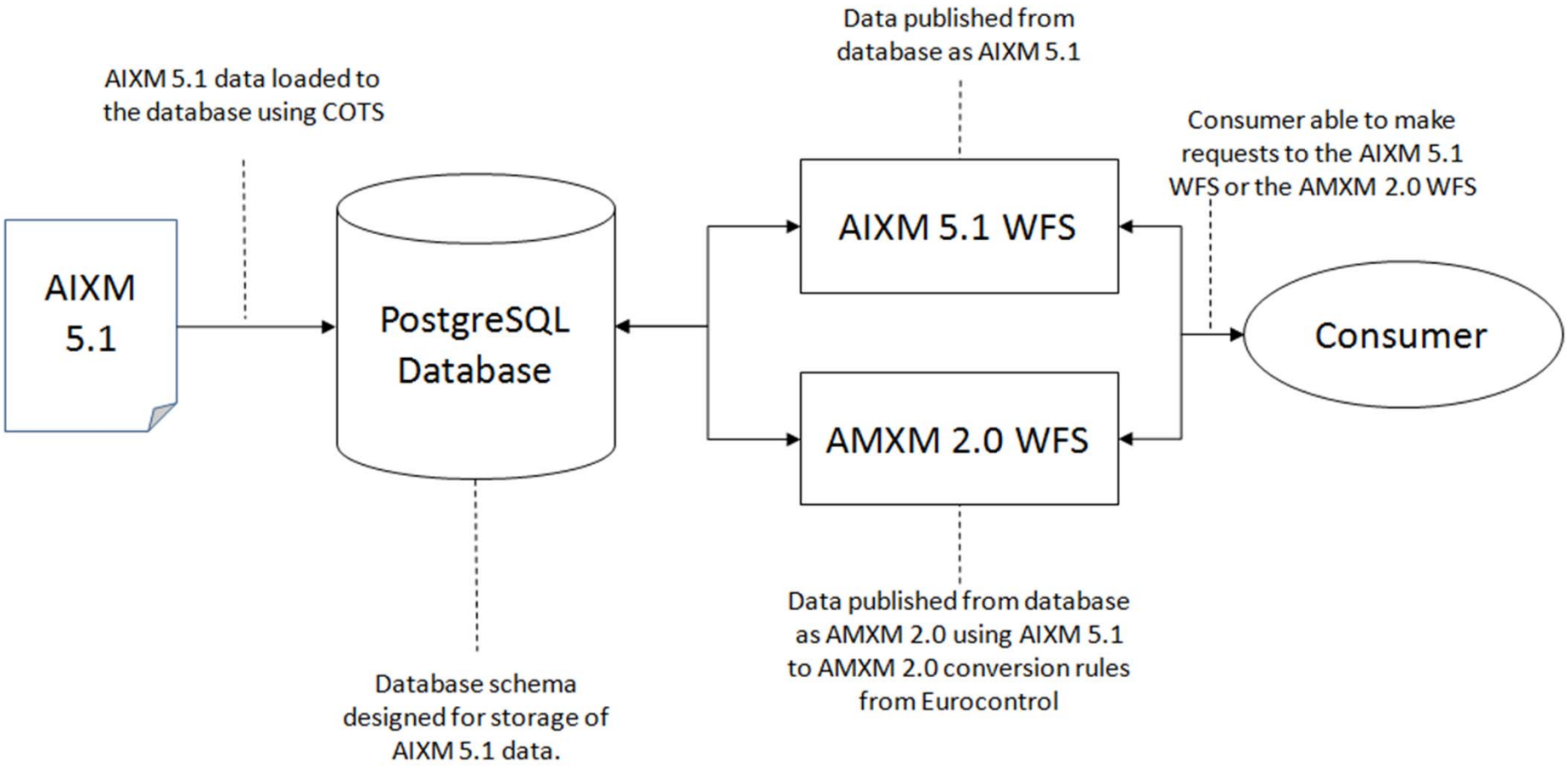
Data Broker Concept

- Support for brokering of OGC WFS data sources
  - Complies with WFS 1.1.0/2.0.0
  - Supports AIXM 5.1 and AMXM 2.0.
- Automated data source discovery via OGC CSW
- Conflation of data based on unique identifiers
- Aggregation of similar features types from different WFS data sources in to one feature type
- Semantic mediation between AIXM 5.1 and AMXM 2.0 feature data
- Addition of provenance by integrating lineage information by adding ISO 19115-based lineage metadata to AIXM 5 features

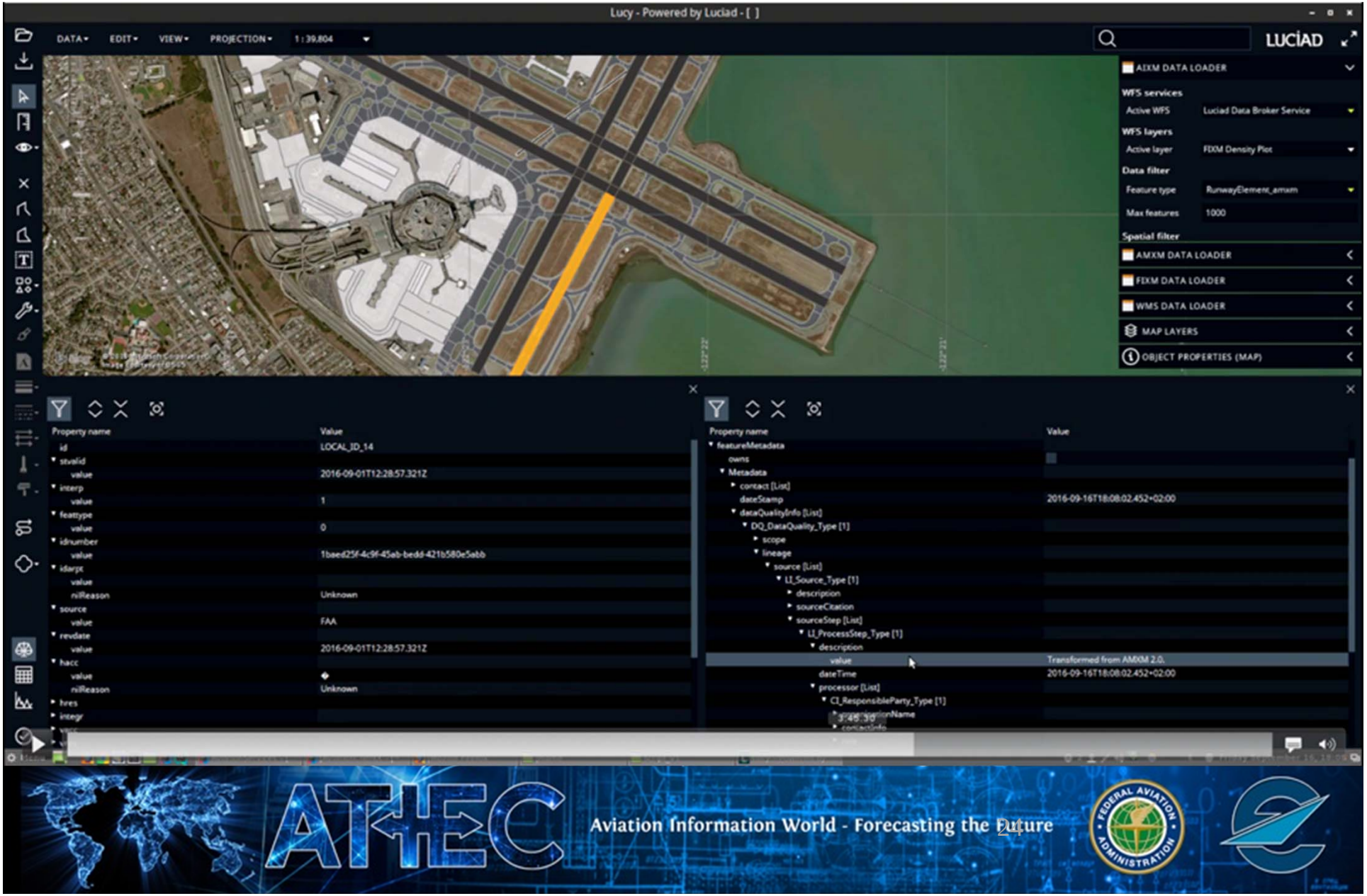
Data Broker Architecture



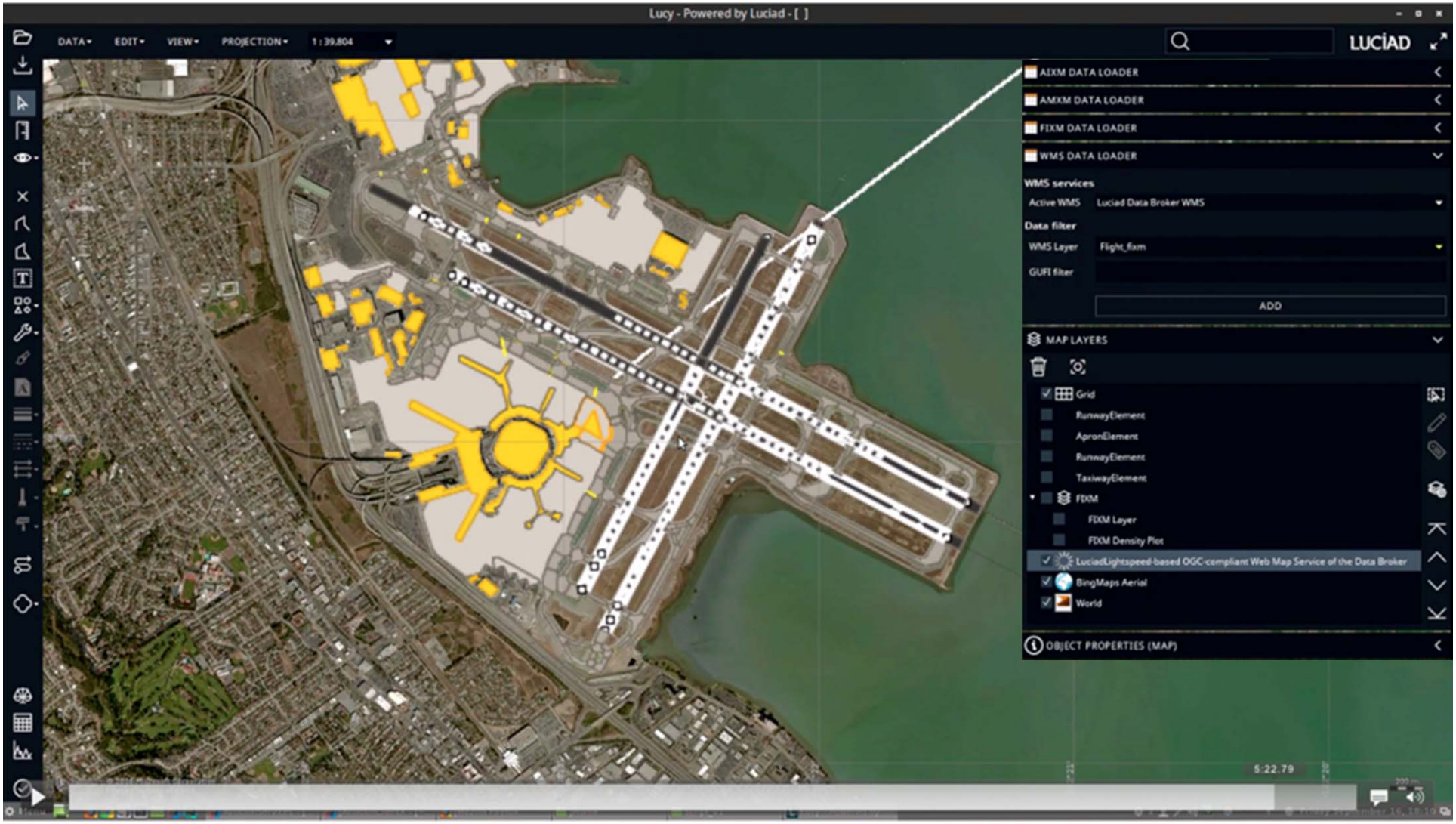
AMXM 2.0 to AIXM 5.1 Mediation



Mediation of AMXM 2.0 to AIXM 5.1



Data Broker Orchestration WFS → WMS



FIXM-GML in OGC Testbed 10

- **Testbed 10: Issues with “bloating” of XML due to object property model**

```
...
<route routeText="KATL.PNUTT7.MCN..AMG.J45.OMN..KDAB">
    <segment airway="S1">
        <routePoint>
            <point xsi:type="base:LocationPointType">
                <location srsName="urn:ogc:def:crs:EPSG::4326">
                    <pos>33.63333333 -84.41666667</pos>
                </location>
            </point>
        </routePoint>
    </segment>
    ...
</route>
...
```

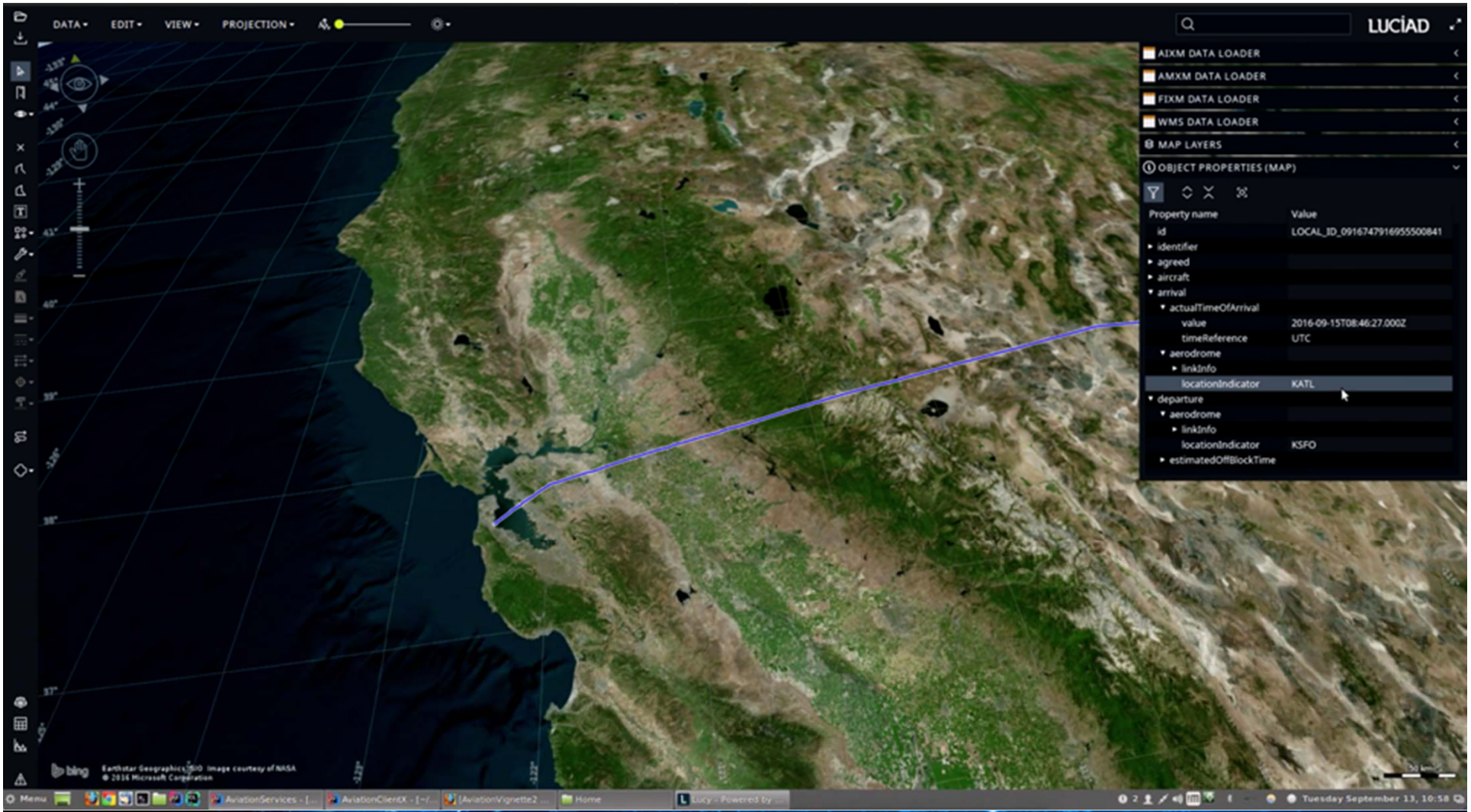
```
...
<route>
    <Route routeText="KATL.PNUTT7.MCN..AMG.J45.OMN..KDAB">
        <segment>
            <RouteSegment airway="S1">
                <routePoint>
                    <RoutePoint>
                        <point>
                            <fb:LocationPoint>
                                <fb:location>
                                    <gml:Point gml:id=
"KATL.PNUTT7.MCN..AMG.J45.OMN..KDAB..S1" srsName="urn:ogc:def:crs:EPSG::4326">
                                        <gml:pos>33.63333333 -84.41666667</gml:pos>
                                    </gml:Point>
                                </fb:location>
                            </fb:LocationPoint>
                        </point>
                    </RoutePoint>
                </routePoint>
            </RouteSegment>
        </segment>
        ...
    </Route>
</route>
...
```

FIXM-GML in OGC Testbed 12

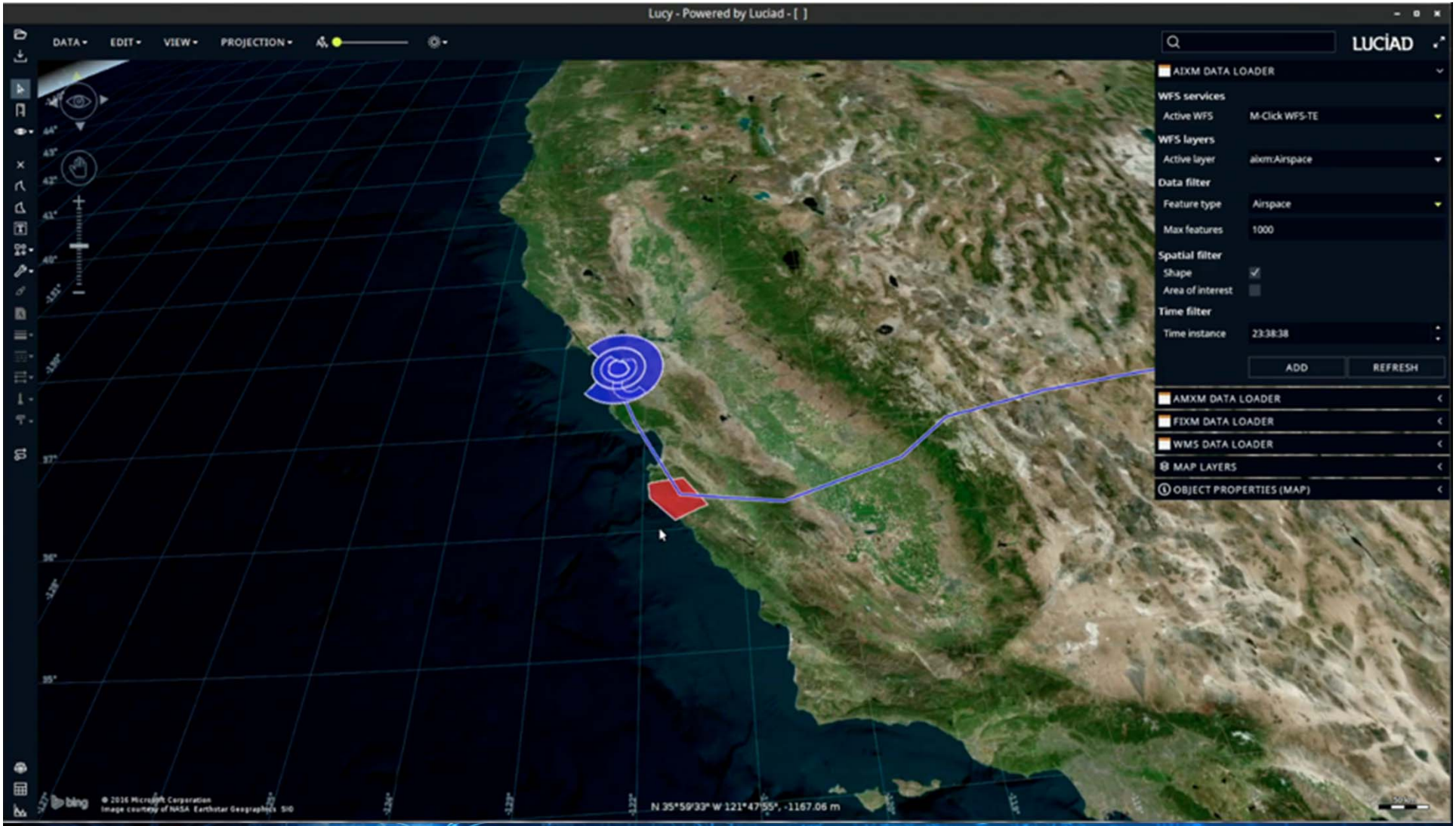
- **Testbed 12 FIXM ER provides observations and recommendations on**
  - Use of Object-Property Model (Keep, Modify, or Discard)
  - GML Abstract Feature (WFS-compatible)
  - Use of gml:id Attribute
  - Use of <gml:identifier> element
  - Temporal Values (such as xs:dateTime)
  - Use of xsi:type
  - Referencing using Xlink (e.g. Reference to AIXM elements)
  - Removing restrictions on Natural Keys and Coordinates
  - Reducing the FIXM XML file size
  - **Ten** Change Requests (CR) to send to FIXM CCB

- **First implementation of an OGC conforming WFS serving FIXM 4.0(draft) with minimal GML elements**
  - Maintains ”compactness” of FIXM

FIXM Flight Plan using WFS



Query on WFS-TE with FIXM Route



OGC PubSub 1.0 Specification

Publications

- Identify which kind of data is provided
  - US Airspace
  - AIXM, FIXM

Delivery Methods

- How data is delivered via asynchronous messaging patterns
  - AMQP 1.0
  - JMS
  - → NEMS

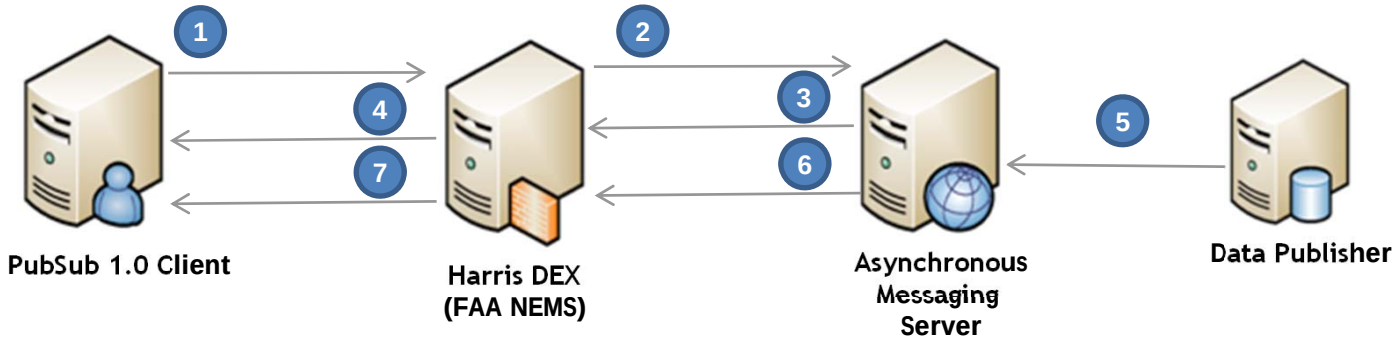
Filtering Capabilities

- Sub-setting of data
  - Spatial Filter (using Airspace extents)
  - Specific Flight (GUFI filter)

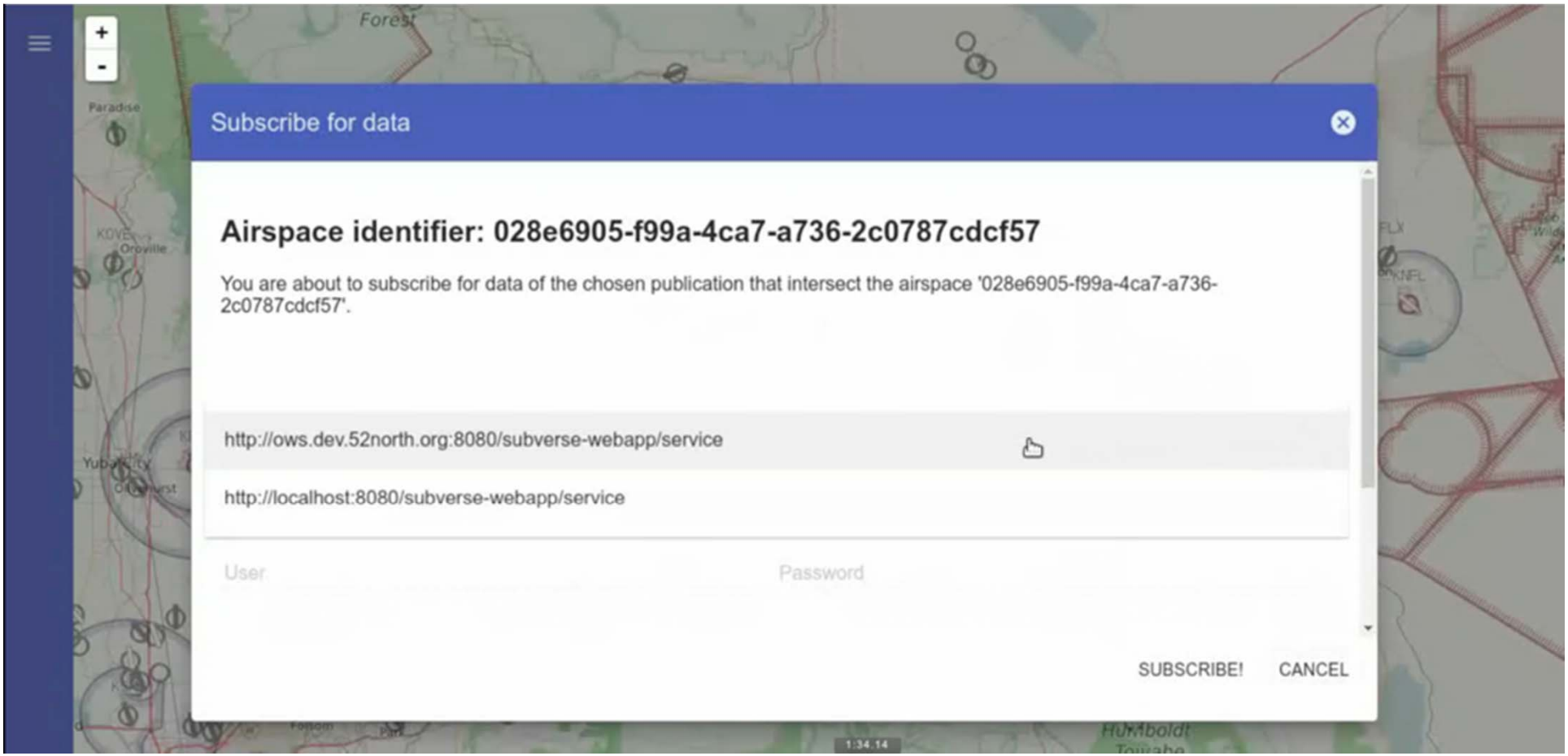
52North provides an Open Source implementation for OGC Testbed 12

Request/Reply vs Publish/Subscribe

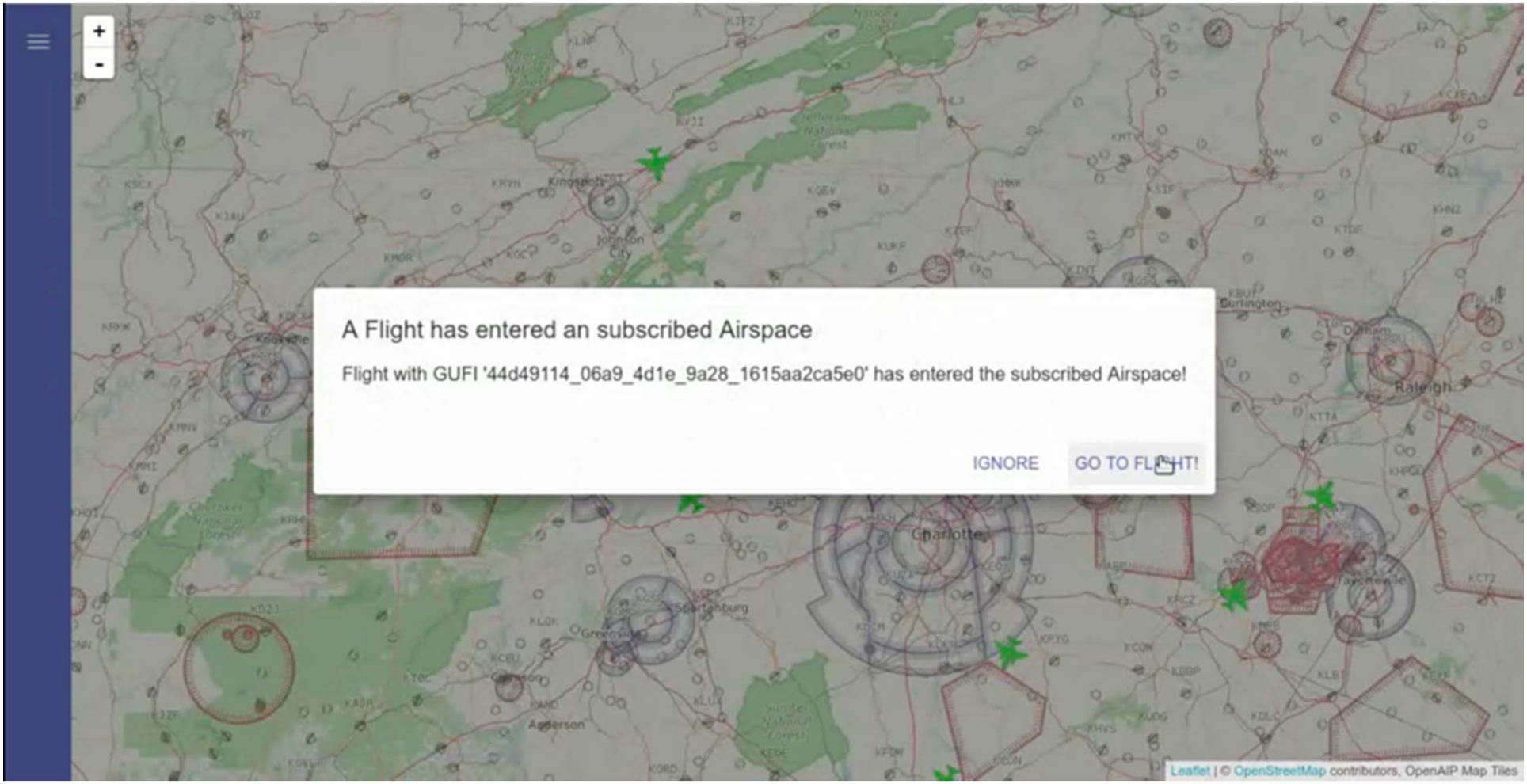
- **OGC Web Services (WFS, WMS, WCS, WPS, etc.) use request/reply “synchronous” messaging patterns**
- **OGC PubSub Standard Working Group (SWG) developed the PubSub 1.0 Specification for subscription-based messaging**
- **OGC Testbed 12 implements a PubSub 1.0 service prototype with integration to Harris DEX™ (i.e. FAA NEMS)**
  - Conforms with FAA SWIM B-12 Dynamic Subscription service



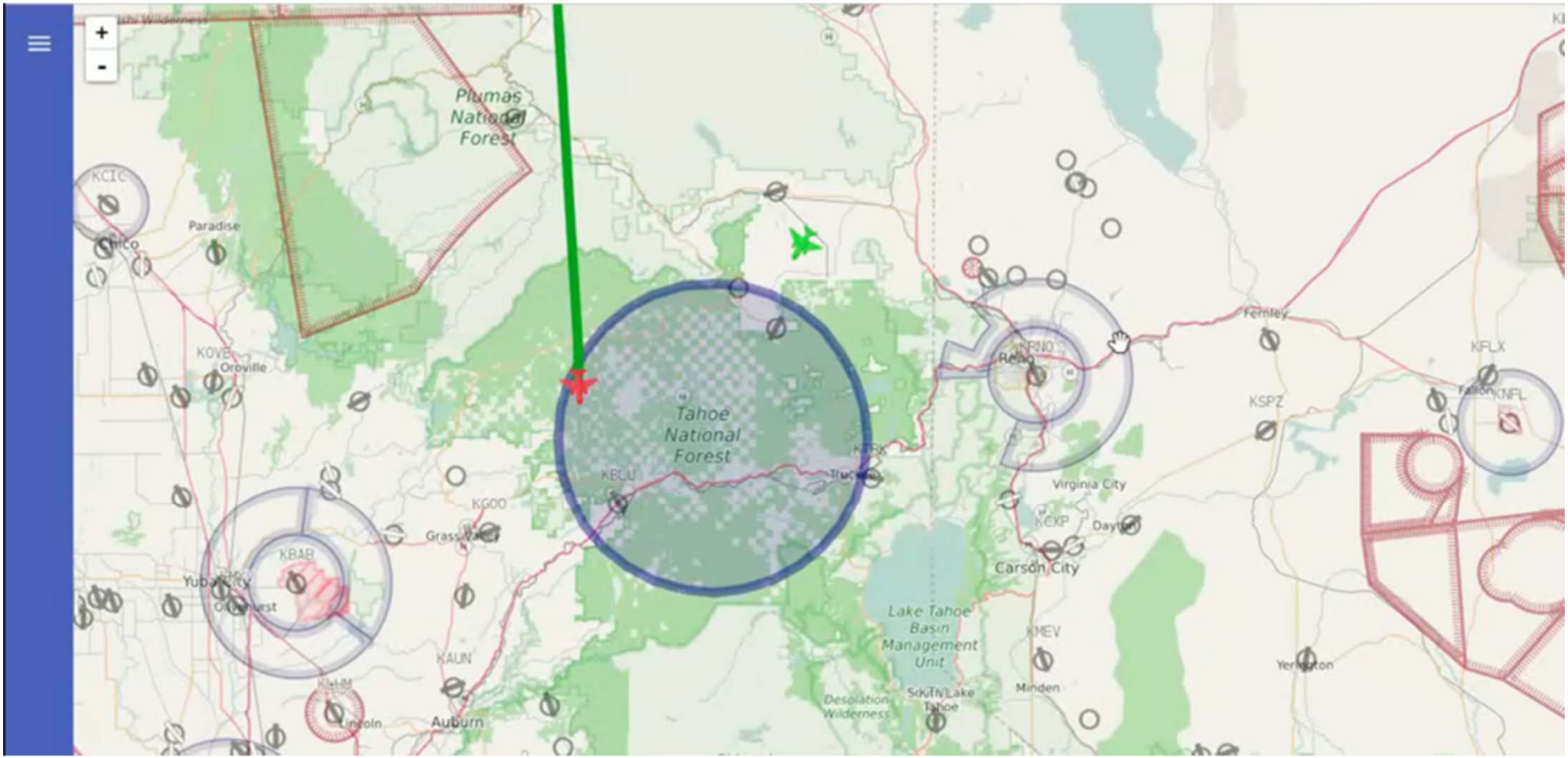
PubSub 1.0 Demo (1/3)



PubSub 1.0 Demo (2/3)



PubSub 1.0 Demo (3/3)

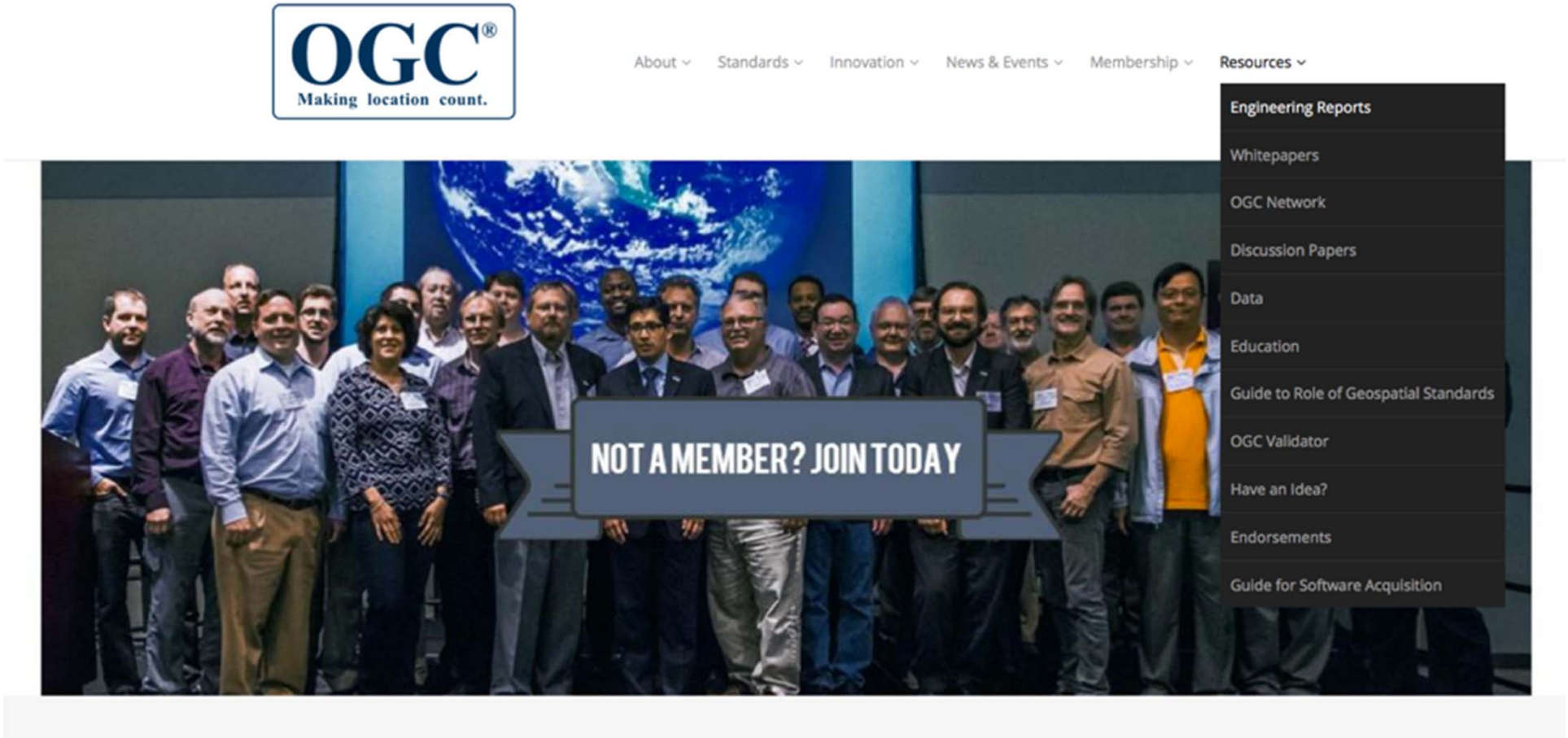


Aviation Engineering Reports

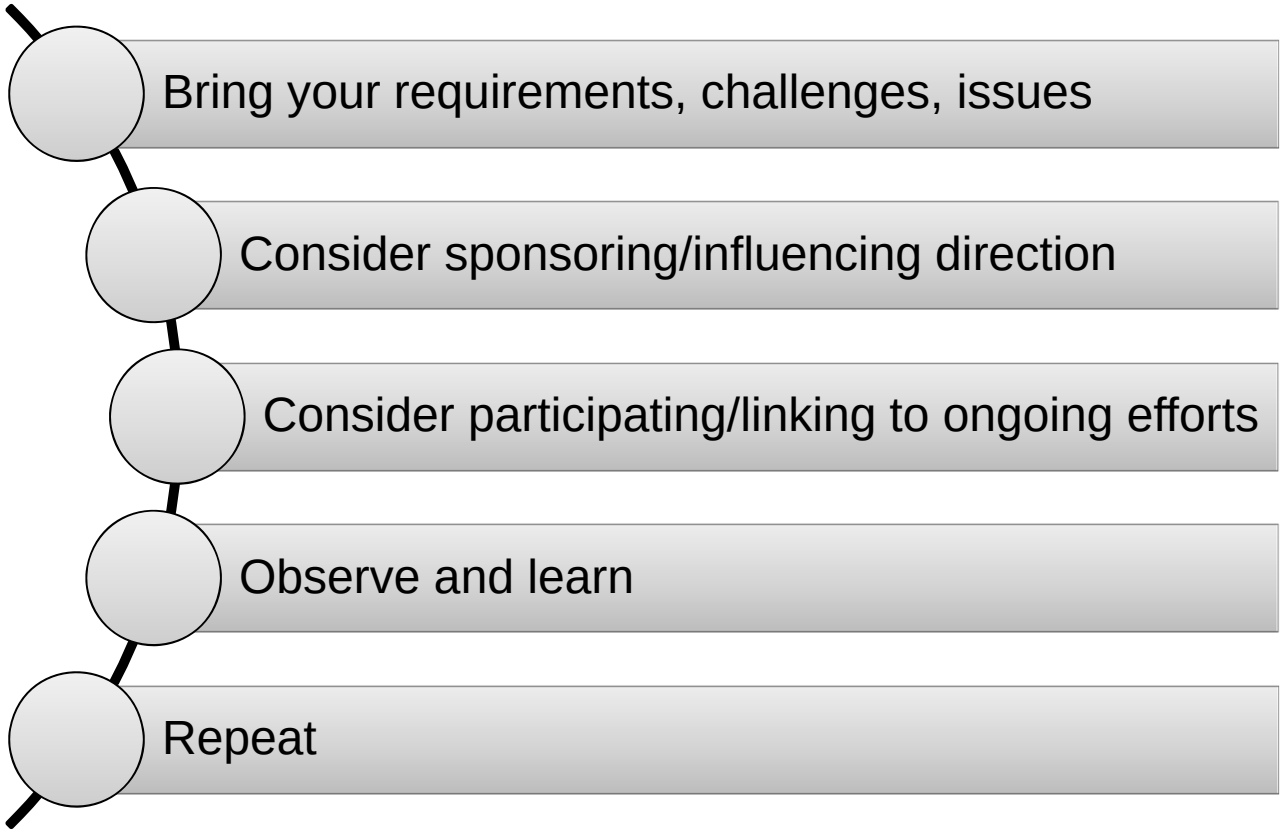
- **16-018 Testbed-12 Aviation Architecture ER**
- **16-024 Testbed-12 Catalog ER**
- **16-045 Testbed-12 Data Broker ER**
- **16-017 Testbed-12 Asynchronous Messaging ER**
- **16-061 Testbed-12 SBVR ER**
- **16-040 Testbed-12 Aviation Security ER**
- **16-059 Testbed-12 Aviation Semantics ER**
- **16-028 Testbed-12 FIXM GML ER**

- **Drafts available at docs.opengeospatial.org/per/**

http://www.opengeospatial.org/docs/er



OGC Testbed 13 – Bring your ideas!



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