



Boeing Technology  
Phantom Works

Phantom

# Implementing Geospatially Enabled Aviation WebServices

Authors: Samet Ayhan,  
Paul Comitz, Ron LaMarche

ICNS - May 5 - 7, 2008





- Problem Statement
- Test Case
- Implementation
- Results & Conclusions

# Problem Statement



Boeing Technology | Phantom Works

- Despite the fact that geospatial data is available in existing aviation databases, it is a key factor not being used in retrieving information, causing inability to make time-critical decisions.



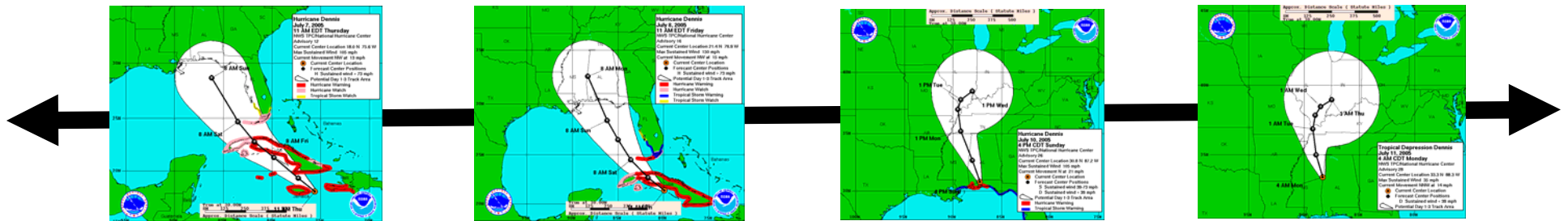
- **NOTAM WebServices** (<https://www.aidaptest.naimes.faa.gov>)
- Currently NOTAM report is provided based on a single airport defined by ICAO, or two ICAOs, each on the other end defining a route
- How do we utilize NOTAM WebServices in a disaster scenario?
- What if we need NOTAM report for a multiple airports inside of a geographic area?
- Searching NOTAM data based on geographic area is a missing component in today's widely used NOTAM Web Services



# Test Case

Boeing Technology | Phantom Works

- Hurricane approaching...



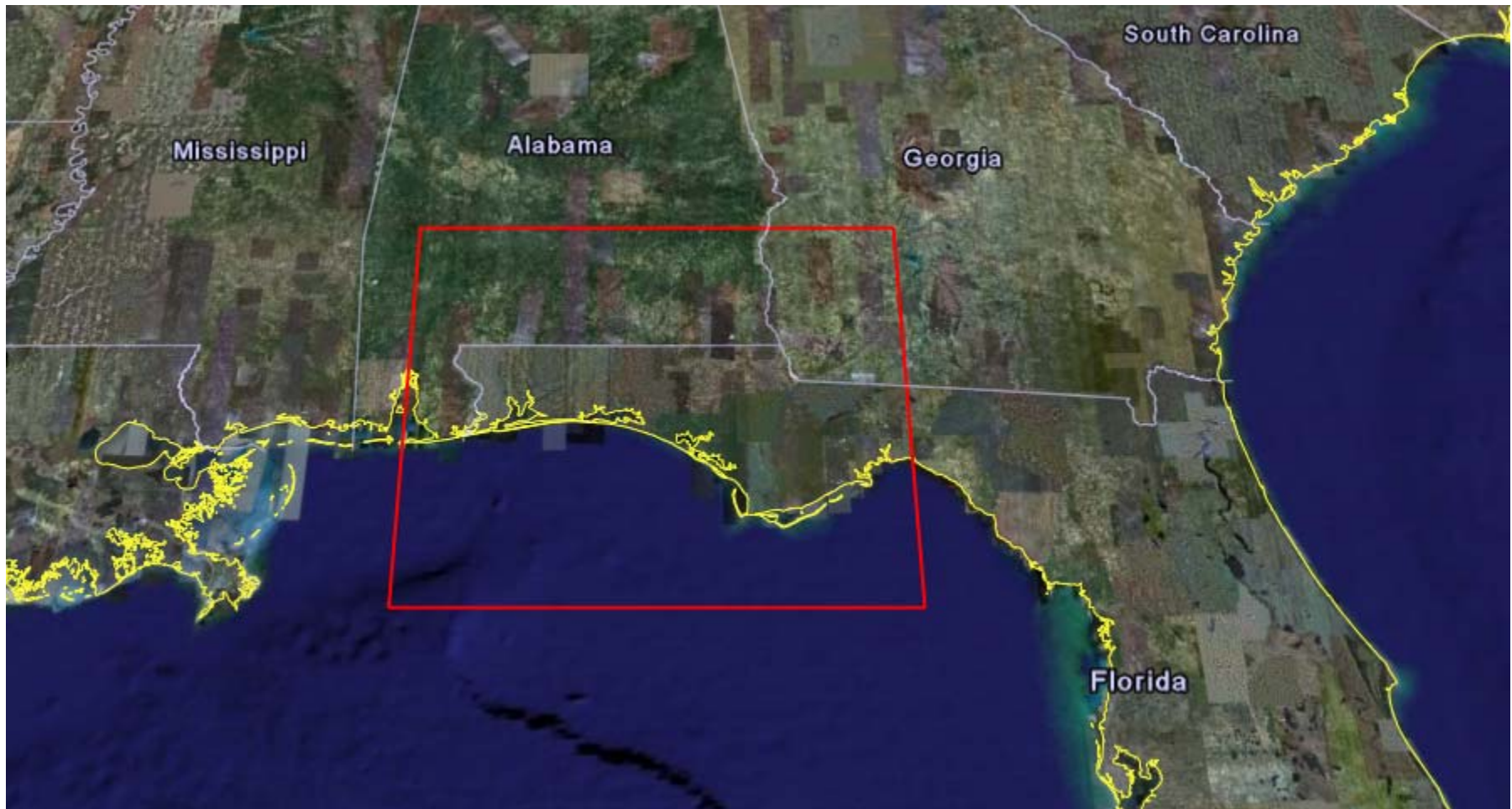
- Need to know about airports in an irregular shaped (polygon) or circular geographic area
  - Before the hurricane for mitigation
  - After the hurricane for damage control
- Can existing NOTAM WebServices help?
  - Yes, BUT ...

# Test Case



Boeing Technology | Phantom Works

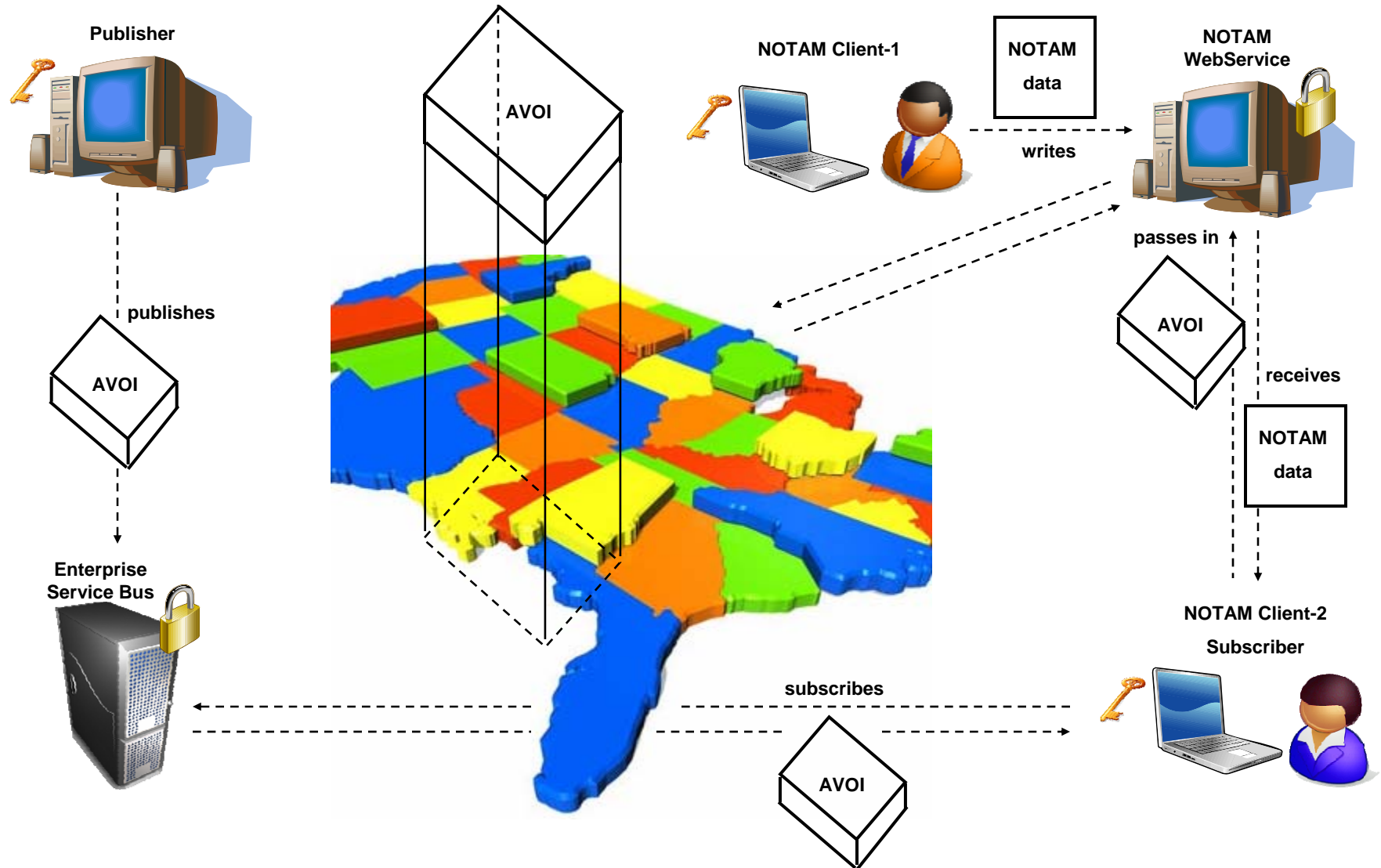
- Area of Interest – JOA (Joint Operations Area)





# Test Case - Overview

Boeing Technology | Phantom Works

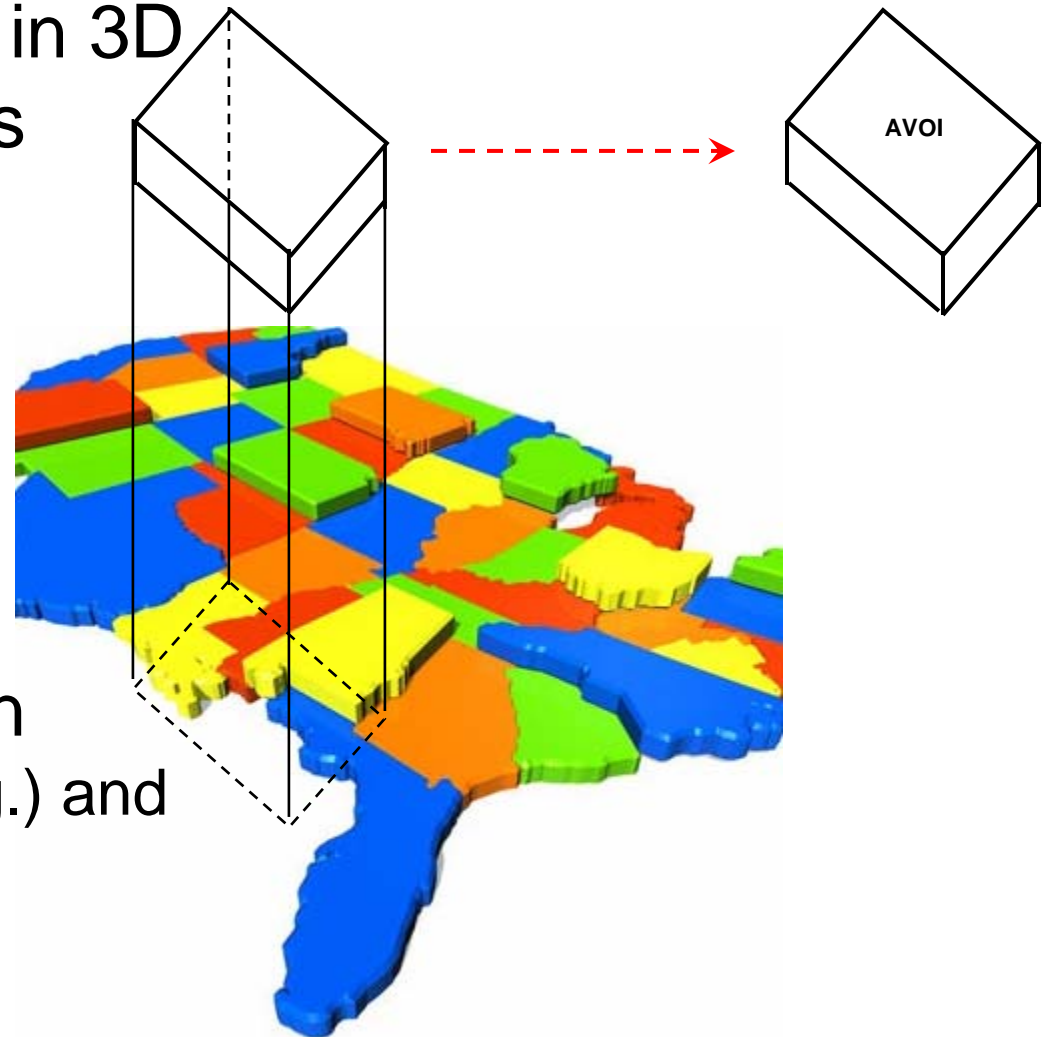




# Test Case - AVOI

Boeing Technology | Phantom Works

- AVOI – Airspace Volume of Interest
  - Defining airspace in 3D
  - In different shapes
    - Point
    - Polygon
    - Cylinder
  - In XML form
  - Specific schema
  - Polygon defined in
    - A set of (lat., long.) and
    - altitude

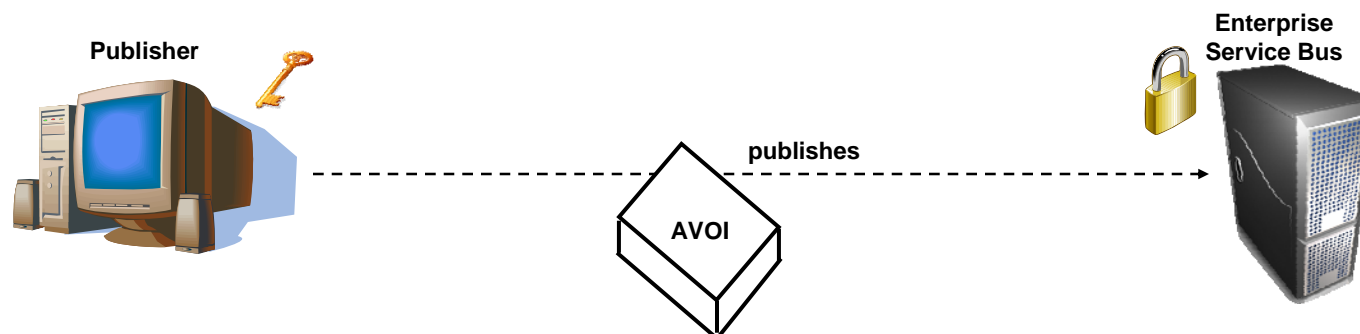




# Test Case – Step #1

Boeing Technology | Phantom Works

- Publisher publishes AVOI data on a topic on the Enterprise Service Bus (ESB)
- employing PKI

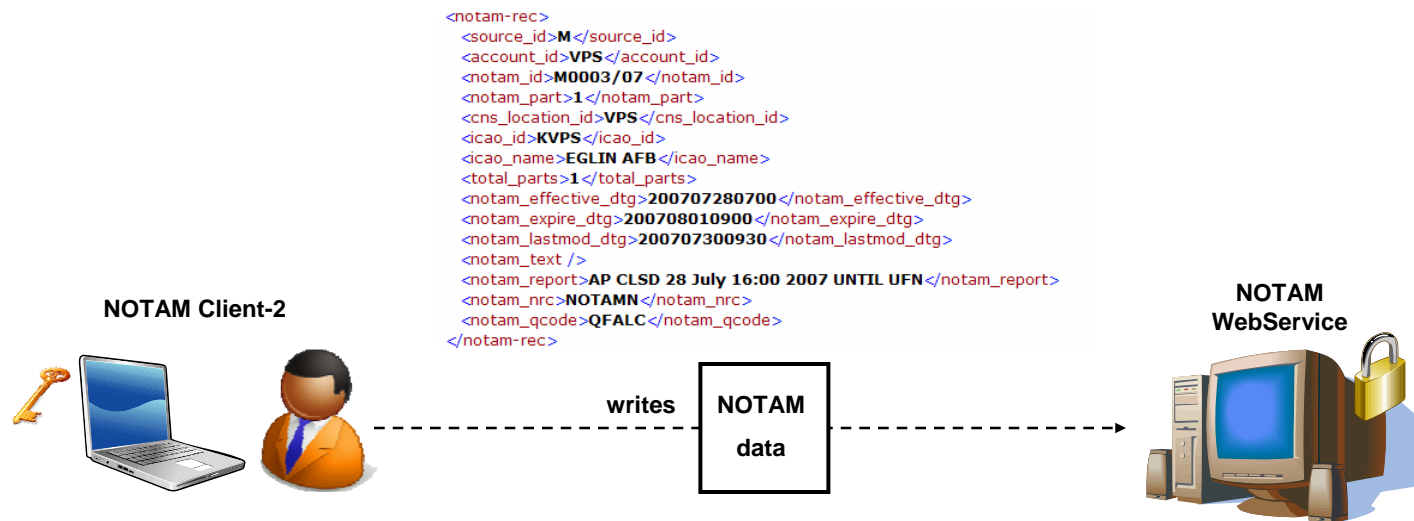




# Test Case – Step #2

Boeing Technology | Phantom Works

- A Privileged user enters NOTAM data
- about the airports under hurricane risk
- using his credentials
- over the secure NOTAM WebService
- SAML token employed

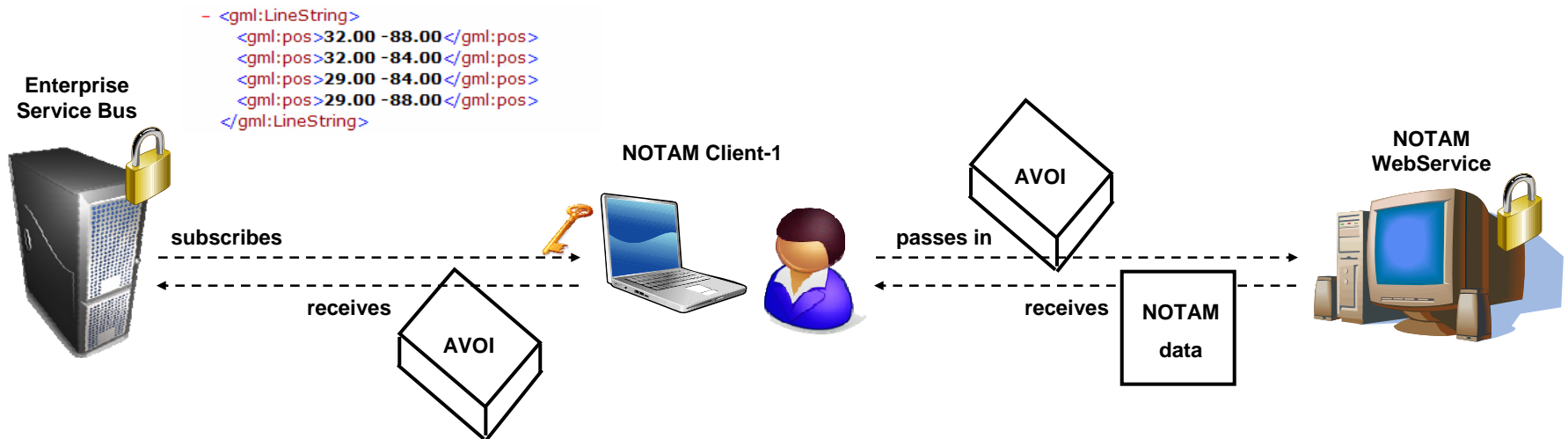




# Test Case – Step #3

Boeing Technology | Phantom Works

- A decision maker queries NOTAM
- for airports at risk
- by providing AVOI defining an area
- NOTAM WS returns airports at risk

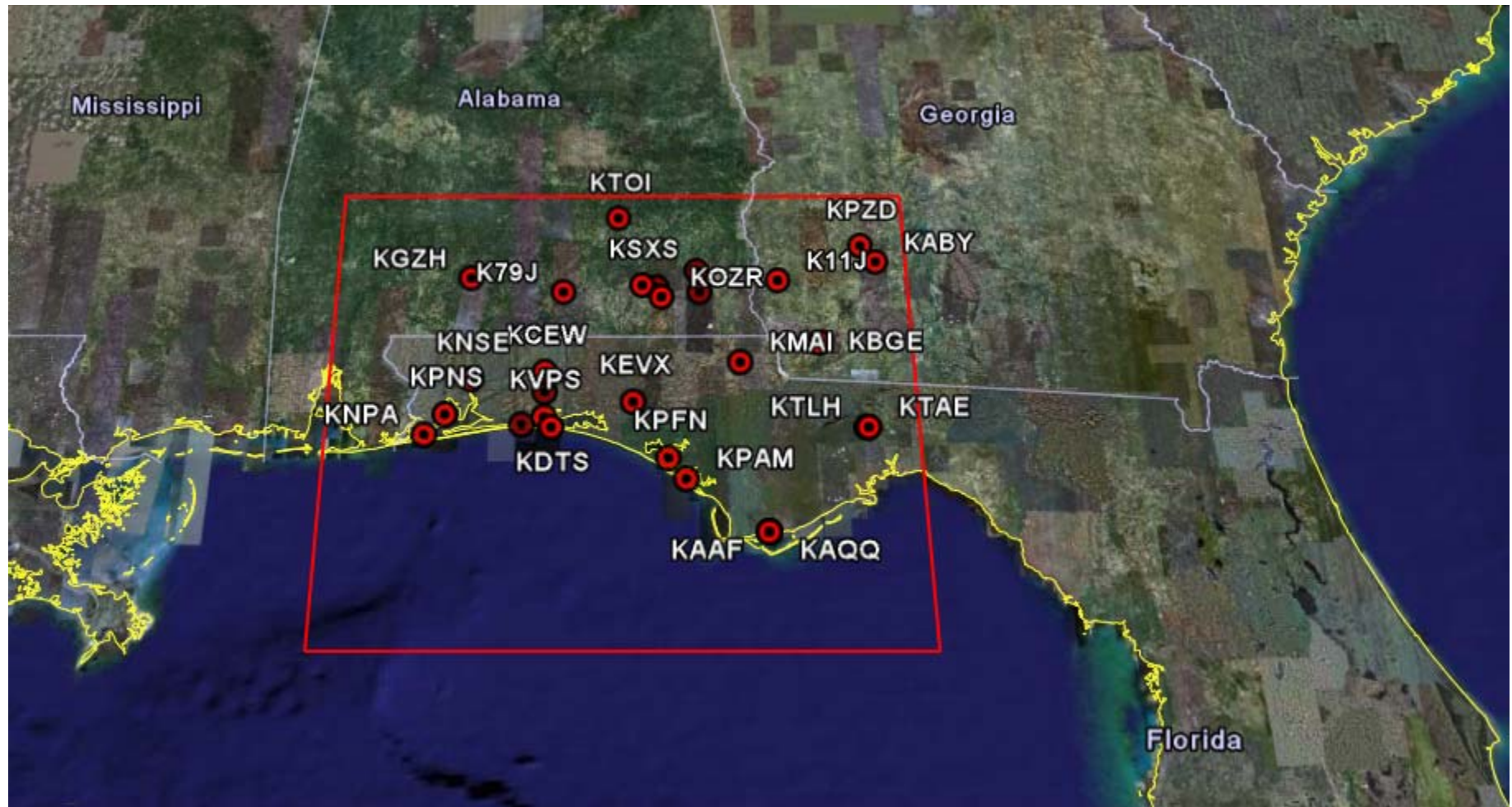




# Test Case – Step #3 Result

Boeing Technology | Phantom Works

- Airports at risk

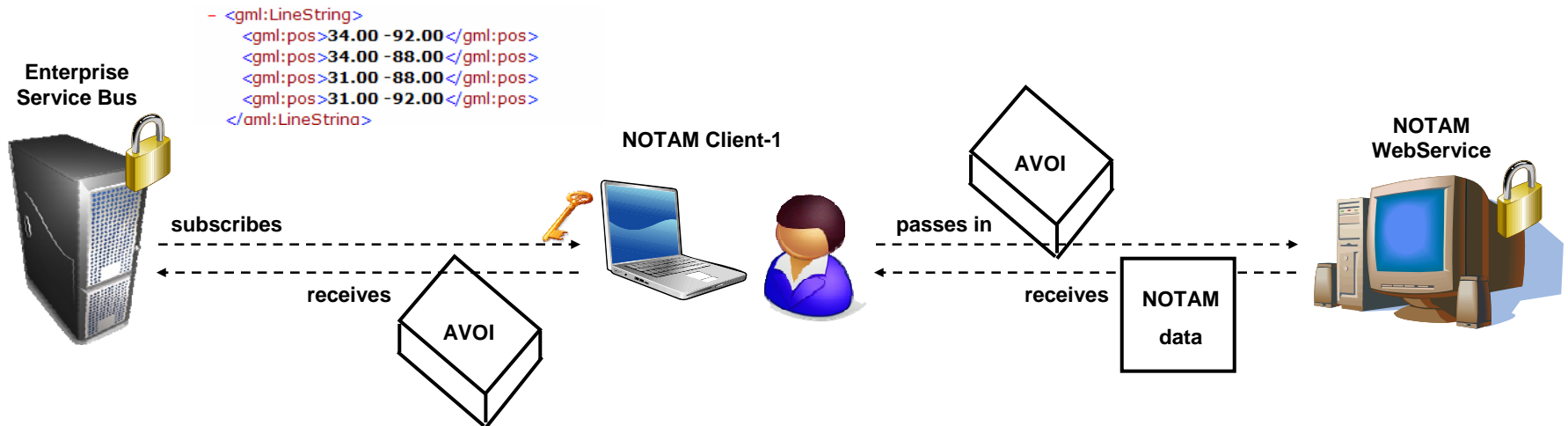




# Test Case – Step #4

Boeing Technology | Phantom Works

- A decision queries NOTAM
- for reliever airports (safe heavens)
- by providing AVOI defining an adjacent area
- NOTAM WS returns airports for reliever efforts

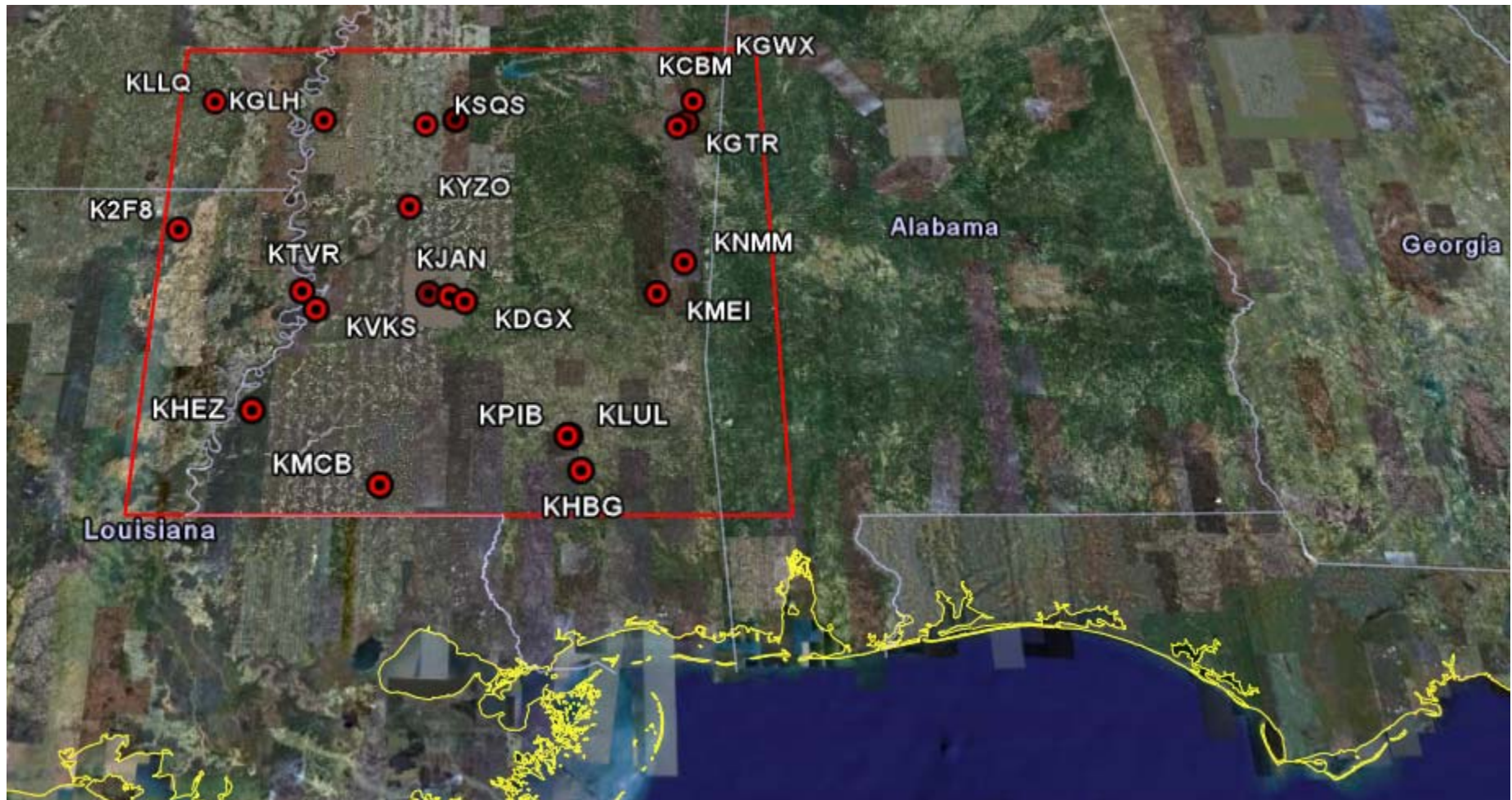




# Test Case – Step #4 Result

Boeing Technology | Phantom Works

- Reliever airports





# Test Case – Final Step

Boeing Technology | Phantom Works

- Now, decision maker is able to determine
- what airports are at risk
- and what the reliever airports are
- based on the area s/he queried

```
airportsAtRisk.txt - Notepad
File Edit Format View Help
K11J, -84.9 31.4
K79J, -86.4 31.31666667
KAAF, -85.03333333 29.73333333
KABY, -84.2 31.53333333
KAAQ, -85.03333333 29.73333333
KBGE, -84.63333333 30.96666667
KCEW, -86.51666667 30.76666667
KDHN, -85.45 31.31666667
KDTS, -86.46666667 30.4
KEGI, -86.51666667 30.63333333
KEOX, -85.46666667 31.46666667
KEVX, -85.91666667 30.56666667
KGZH, -87.05 31.41666667
KHRT, -86.66666667 30.41666667
KLOR, -85.75 31.35
KMAI, -85.18333333 30.83333333
KNPA, -87.31666667 30.35
KNSE, -87.01666667 30.71666667
KOZR, -85.71666667 31.28333333
KPAM, -85.56666667 30.06666667
KPFN, -85.68333333 30.2
KPNS, -87.18333333 30.48333333
KPZD, -84.3 31.65
KSXS, -85.85 31.36666667
KTAE, -84.33333333 30.4
KTLH, -84.35 30.4
KTOI, -86.01666667 31.85
KVPS, -86.51666667 30.46666667
```

```
relieverAirports.txt - Notepad
File Edit Format View Help
K2F8, -91.88333333 32.75
KCBM, -88.45 33.63333333
KDGX, -89.98333333 32.28333333
KGLH, -90.98333333 33.5
KGRW, -90.08333333 33.5
KGTR, -88.56666667 33.45
KGWO, -90.08333333 33.5
KGWX, -88.33333333 33.9
KHBG, -89.25 31.26666667
KHEZ, -91.28333333 31.61666667
KHKS, -90.21666667 32.33333333
KIGB, -88.5 33.48333333
KJAN, -90.08333333 32.31666667
KLLQ, -91.75 33.63333333
KLUL, -89.33333333 31.46666667
KMCB, -90.46666667 31.18333333
KMEI, -88.75 32.33333333
KNMM, -88.56666667 32.53333333
KPIB, -89.31666667 31.46666667
KSQS, -90.28333333 33.46666667
KTVR, -91.03333333 32.35
KVKS, -90.93333333 32.23333333
KYZO, -90.36666667 32.9
```



- Geospatial methods implemented
  - parseAVOI() – extract a or set of lat., long values
  - pointInPolygon() – what airports are inside polygon
  - pointInCircle() – what airports are inside circle
  - arePointsSame() – what airport matches the point
  - getNotamData() – retrieve NOTAM for those airports
- Client displays data in XML form
  - all airports with NOTAM data (at risk)
  - all airports (reliever)
- Client displays data graphically



- Security implemented
  - WS-Security using SAML token
  - Topic Security using PKI
  - RBAC implemented
- NOTAM reports can be generated
  - Online by privileged users
- NOTAM reports can be retrieved
  - Based on a geographic area (in any shape)
  - In a timely manner



- A better way - MASHUP
  - The ideal way of emergency planning using geospatially enabled web services and web applications would utilize Mashup Technology
  - Add more capabilities
    - Not only airports with NOTAM data inside of AVOI
    - But also runways (width, length, material)
  - We'd benefit from a capability retrieving data for a query such that
    - What airports are available in user-defined geographic area, with a runway length of certain length and width that is in the proximity of radius of certain miles?



# Conclusions

Boeing Technology | Phantom Works

### Boeing Usable Airports Search

Go to View Search All

Tools Content Feeds Tools Boeing Favorites Collaboration

#### Boeing Search Form

Enter airport search criteria: **NEO**

City:

State:

Radius (in miles):

Min. Runway Length:

Show all airports

#### Generic Map

#### Open Airports

Airport Name	ICAO	Airport Id
BALTIMORE WASHINGTON INTL	KBWI	US94057
MARTIN STATE	KMTN	US88631

#### Airport Details

Airport Name	ICAO	Latitude	Longitude	Elevation
BALTIMORE WASHINGTON INTL KBWI		39.175361	-76.668333	146

#### Runway Details

Length	Width	Surface type
10502	200	ASP
5000	100	ASP
6005	150	ASP
9519	150	ASP

#### NOTAM Messages

Source_id	Account_id	Area_description	Note
D	BWI	KBWI, BALTO/WASH INTL, MD, US , (390959N, 0764100W)	[BWI] 04/03
D	BWI	KBWI, BALTO/WASH INTL, MD, US , (390959N, 0764100W)	[BWI] 02/02