Cross-Domain ISR
Maritime Awareness Demonstration

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ISR Cross-Mission Operation

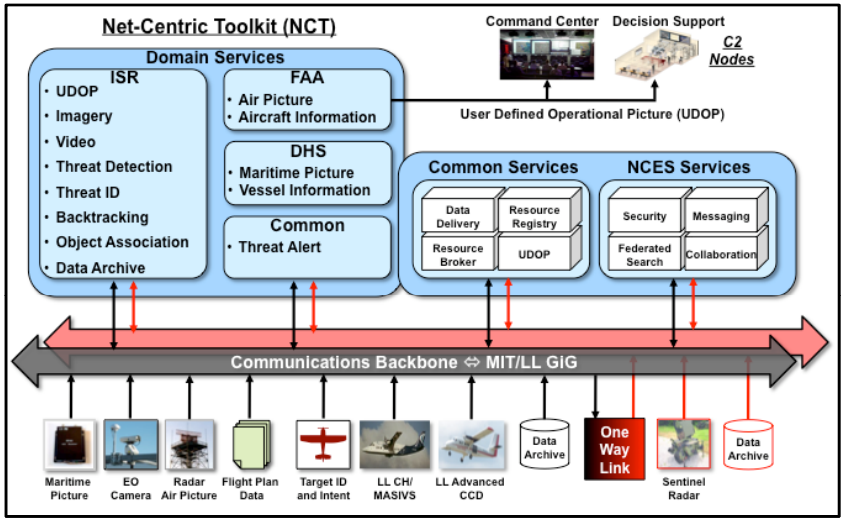
ISR Maritime Domain Awareness Demonstration

- **Cross-Domain ISR Motivation**
- **System Concept Scenario Walk-through**
- **Net-Centric Architecture and Execution**
- **Technical Highlights and Summary**

ISR Capability Development and Demonstration

ISR Operations

ISR Demonstration Architecture

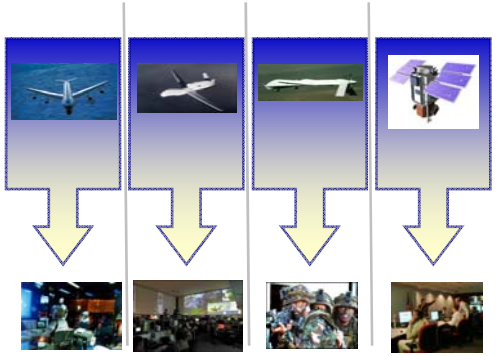


Common Key Capabilities Across ISR Operations

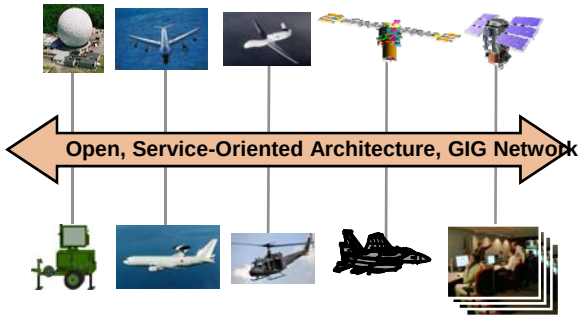
- Dynamic tasking of ISR assets in response to events
- Real-Time interoperation to prosecute ISR engagements
- Automated analysis using software agents

Net-Centricity for ISR

Stovepipe Systems



Sensors on Network



Net-Centric Evolution

Present Conditions

- **Limited information access**
  - Point-to-point connections
- **Expensive integration**
  - Custom proprietary interfaces
- **Predetermined needs**
  - Hardwired functionality
- **Security barriers**
  - Negotiated need to know

Objective Future

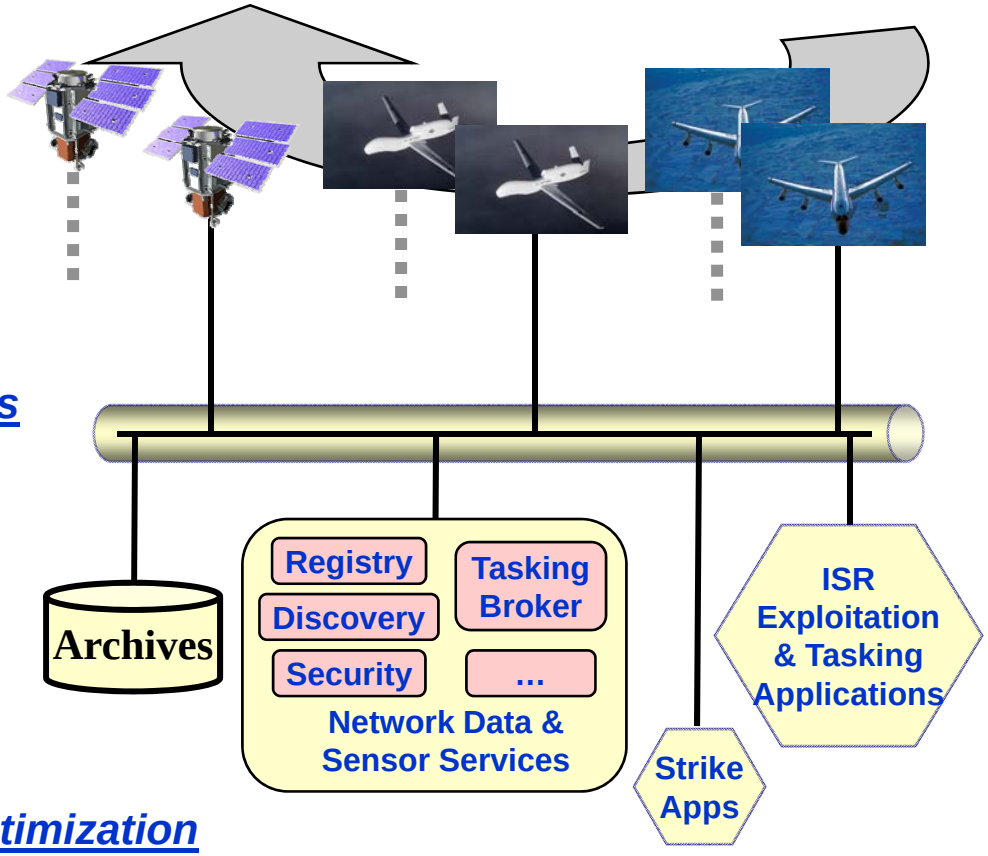
- **Shared authoritative sources**
  - Network search and discovery
- **Interoperability**
  - Fully open standards
- **Unanticipated uses**
  - Dynamically compose-able applications
- **Mandated need to share**
  - Authenticated credentials

Service-Oriented ISR Architecture

Adapts to Changes in Sensor Mix

Sensor-Independent ISR Data Requests (Effects Based Tasking)

- Users can receive requested data types without ID'ing specific sensor sources
- Data request satisfied by any available sensor or archive that can meet user requirements



Tasking Optimization

- Sensor tasking plans visible to user, allows tasking optimization across DoD ISR enterprise
- Prioritized, policy-based multi-user task brokering

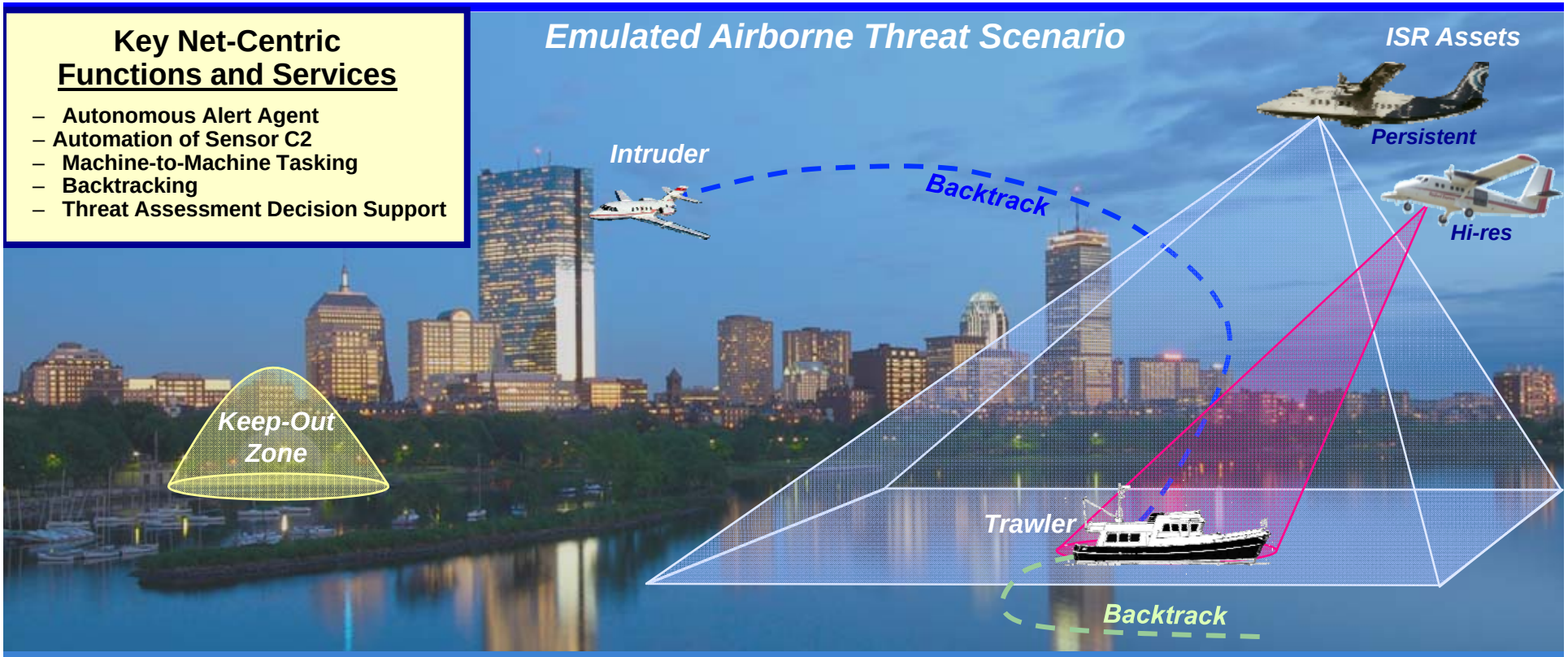
Composable Apps

- Simplified construction of adaptable mission-specific user applications

ISR Identification of Maritime Threat

Key Net-Centric Functions and Services

- Autonomous Alert Agent
- Automation of Sensor C2
- Machine-to-Machine Tasking
- Backtracking
- Threat Assessment Decision Support



Mission Domains	Homeland Defense			Maritime		Intelligence, Surveillance and Reconnaissance	
Sensor	FAA ATC	ERSA* EO	Sentinel	AIS Service	Hawkeye	MIT/LL	Proxy SkyRaider
Info Source	Air Picture	EO ID	Track, RF ID	Ship Tracking, Vessel "ID"	Vessel Registry	Hi-resolution EO CCD Imager	Wide Area Video Camera

*Enhanced Regional Situational Awareness System, Deployed by MIT/LL in Washington, D.C. National Capitol Region

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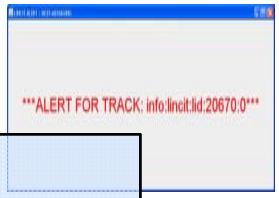
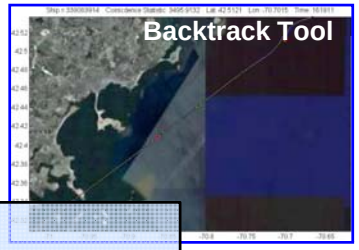
ISR Tactical Engagement Cycle





Alert

- Indications and Warnings
- Mission defined conditions
- Shared notification service

Assess

- Sort threats from false alarms
- Integrate all source information
- Task available resources

Analyze

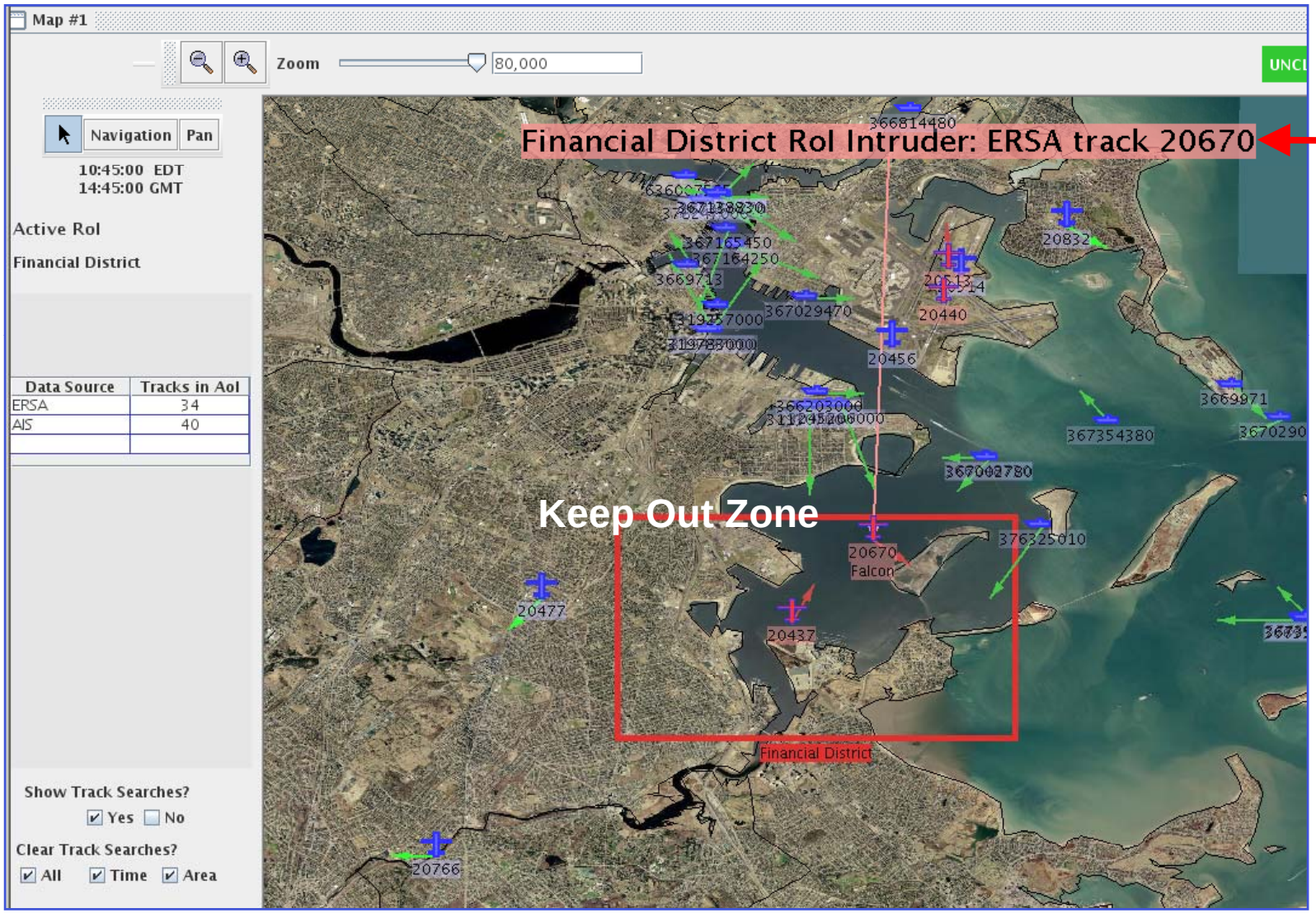
- Determine intent
- Information fusion and inference
- Establish courses of action

Engage

- Command and control
- Monitor successful conclusion

Observe → Orient → Decide → Act

Air and Maritime Picture



Warning Alert

Icons

Normal

Aircraft

Vessel

Threat

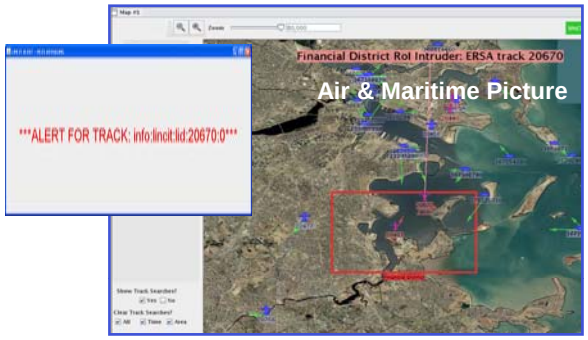
Aircraft

Vessel

Cruise Missile Launch Scenario:

>>Alert: Detect and Notify<<

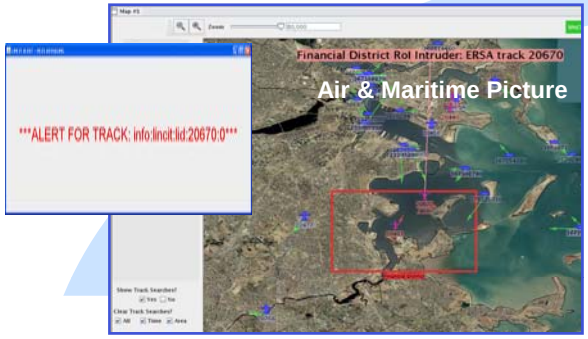
1 **Generate ALERT!**



Cruise Missile Launch Scenario:

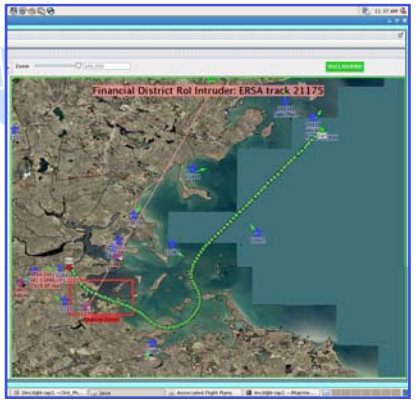
>>Assess: ID and Backtrack<<

1 Generate ALERT!



2 EO Camera ID

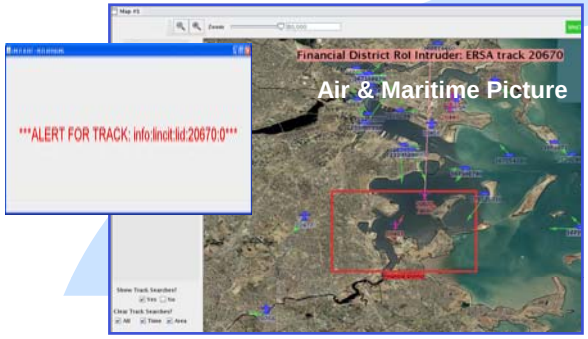
3 Backtrack to Origin



Cruise Missile Launch Scenario:

>>Analyze: Cross Domain Association<<

1 Generate ALERT!



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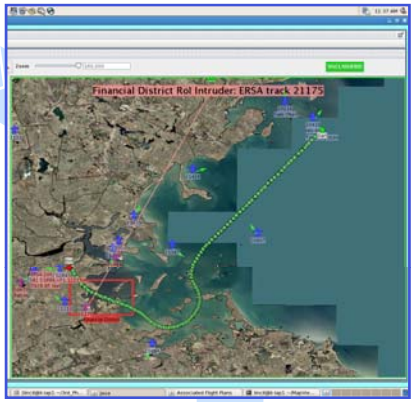
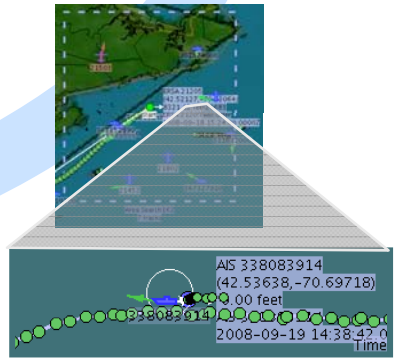
3 Backtrack to Origin



4 Locate Vessel

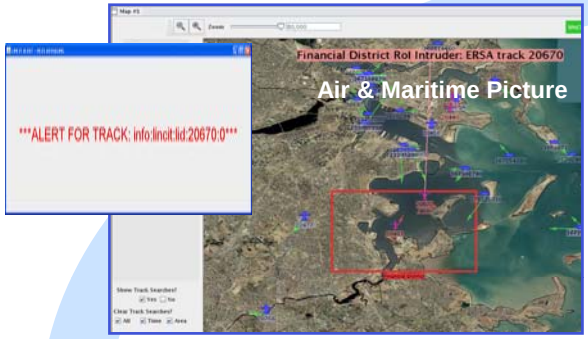


5 Conjunction Analysis

Cruise Missile Launch Scenario:

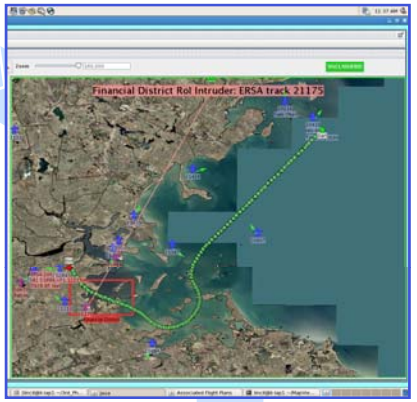
>>Engage: ISR Tasking and Intercept Notification<<

1 Generate ALERT!



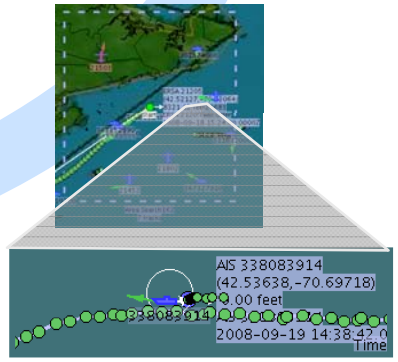
2 EO Camera ID

3 Backtrack to Origin



ISR products pushed to operator display

4 Locate Vessel



5 Conjunction Analysis

6 Task ISR Collection

7 Intercept

ISR Demonstrator Test Scenarios

Scenario	Description	Location	Runs
Emulated Airborne Threat	Emulated airborne threat launched from vessel to trigger alert in Boston ADIZ	Financial District	3
Homeland Protection			
False Alarm	Visual ID confirms no threat to Hanscom	HAFB	3
VIP Event	Aircraft intrudes in FRZ for special event	MIT	3
9-11	Plane departing Boston for London breaks from flight plan and heads back to Boston	Logan Outbound	3
Maritime Security			
Fishing Zone	Vessel illegally enters restricted fishing zone	Cape Ann	3
Protected Vessel	Dynamically entered ROI to protect vessel delivering valuable material to Marblehead	Moving Vessel	1
Environmental Enforcement			
Coastal Surveillance	Image coastal areas for environmental enforcement and targets of opportunity in Boston Harbor	As Tasked	15

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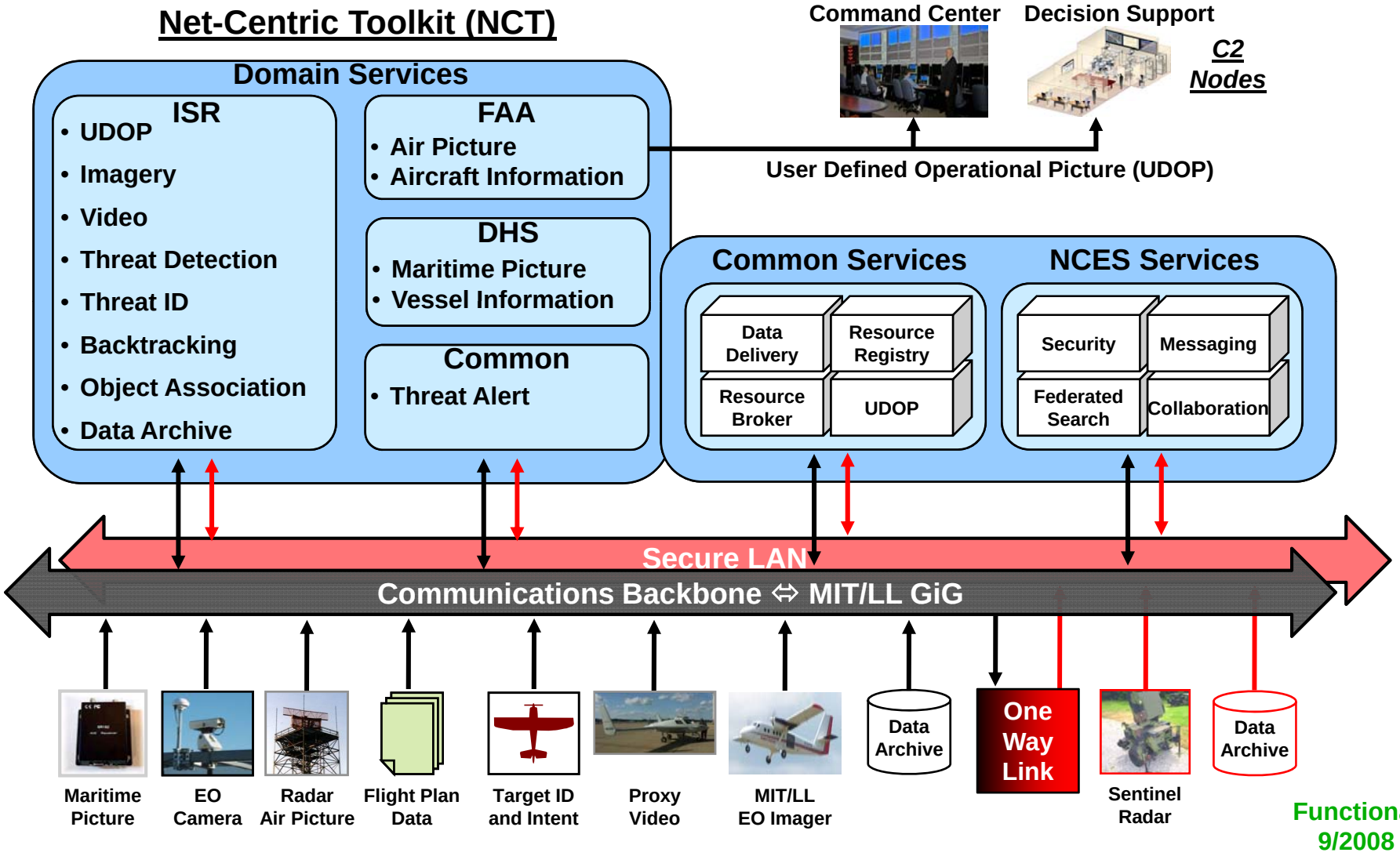
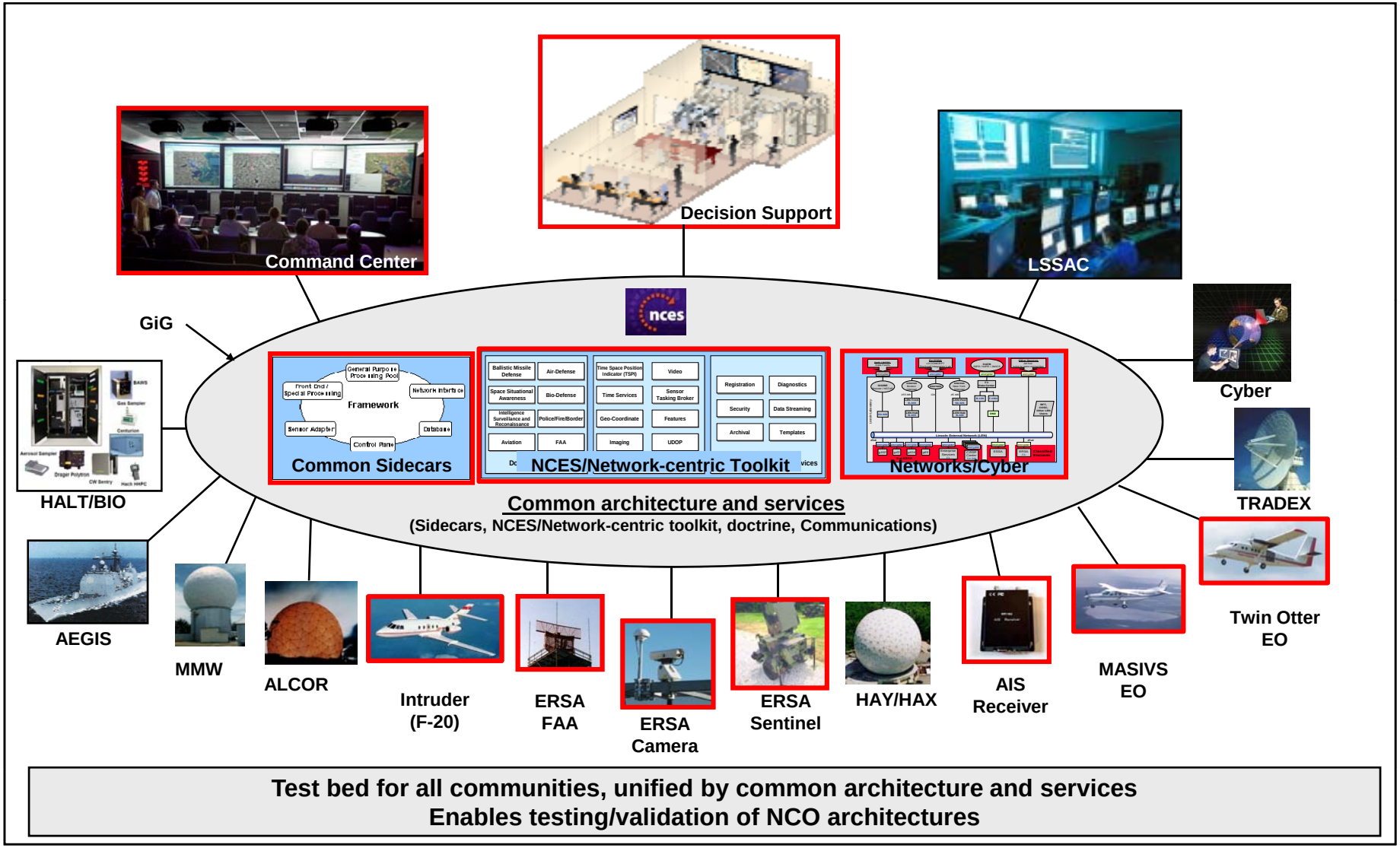
ISR Demonstration Components and Architecture

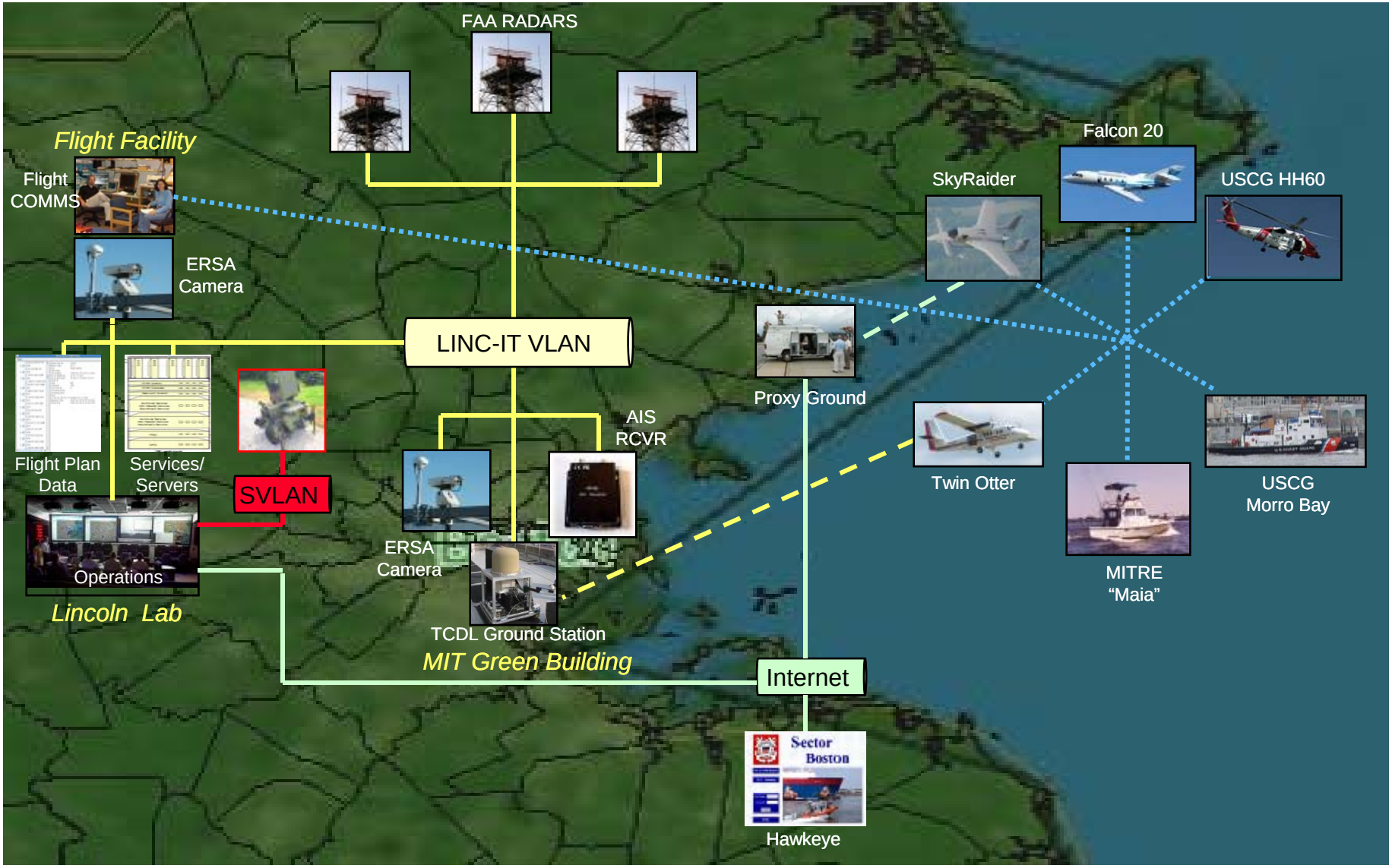


Lincoln Net-Centric Test Bed



Test bed for all communities, unified by common architecture and services
Enables testing/validation of NCO architectures

ISR Demonstration Deployment



ISR Demonstration Execution Schedule

Kickoff: 8 Feb 08

FY08 | FY09

Jan Feb Mar | Apr May Jun | Jul Aug Sep | Future

PHASE I
5 Apr 08

Alert

Intruder (Sim)

ERSA FAA

Trigger alert from airspace intrusion

▲ **Demo in every Phase**

PHASE II
A: 2 Jun 08
B: 23 Jul 08

Task, ID, Notify

AIS Receiver

ERSA Sentinel

ERSA Camera (FF)

HawkEye Database

Task sensor, visual ID, backtrack intruder, and associate with maritime vessel

Live Fly: 10-19 Sep 08

PHASE III
10 Sep 08

Assess, Engage

RF ID, ISR collect on candidate launch vessels

ERSA Camera (GB)

Intruder (F-20)

MIT/LL Hi-Res EO

SkyRaider

Launch Vessel (MITRE)

PHASE III+

Interceptors (USCG)

Confirm

Metrics and Assessments In FY'09

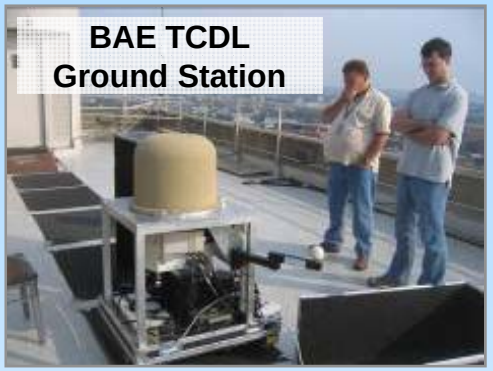
MASIVS EO

HAX SATB

Intercept (G-II)

From 0 to Live Fly in 7 Months!

External Collaborators



MITRE

Walter Kuklinski
Stephen Theophanis
Anthony Lawrence

USCG

LCDR Chris Kluckhuhn
CDR Stephen Torpey
LT Brendan Blain
LT Bennie Wenban
Crew of Morro Bay

Proxy Aviation

Jim Carter
Gus McLeoad
Mike Meador
Larry Belella
Bob Arseneault

BAE Systems

Arie Kronfeld
Greg Couch
Andre De Liso
Charles Yee
John Santillo
John Parkes

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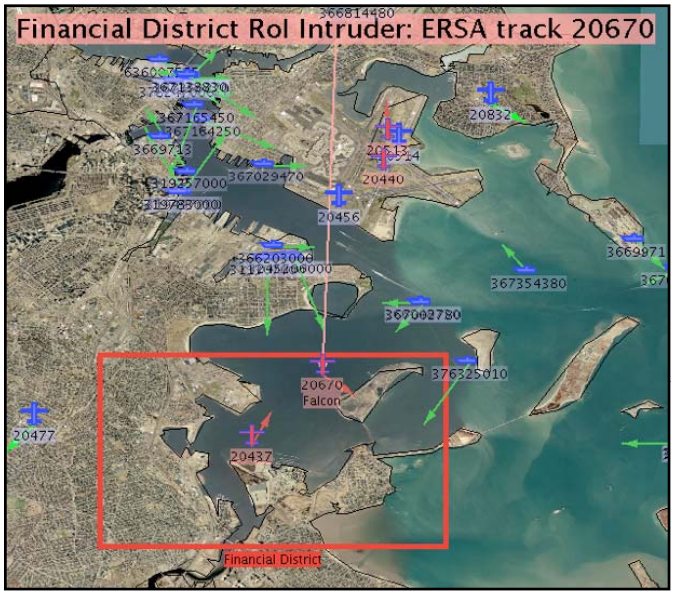
Machine-to-Machine Automation Demonstration

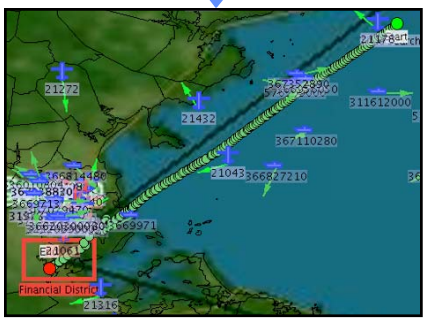


Alert

- Auto-generated requests
- Human authorization
- Provides basis for future choreography of composed services

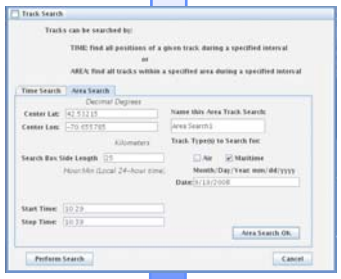
>>3-Click Tasking<<

Click-1: **Backtrack**



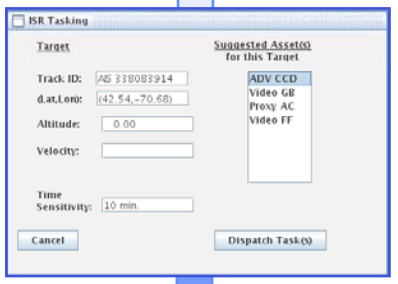
Track History

Click-2: **Area Search**



Association

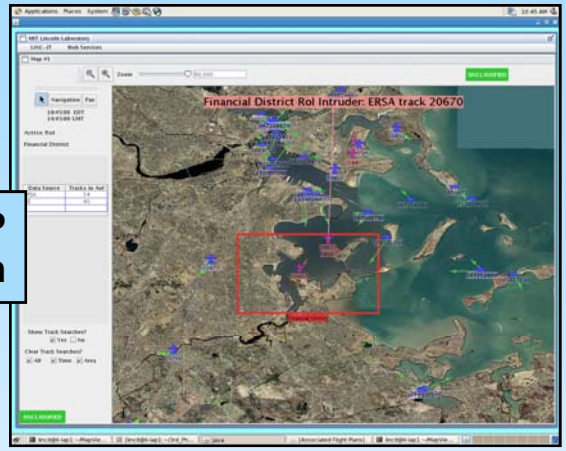
Click-3: **Collection**



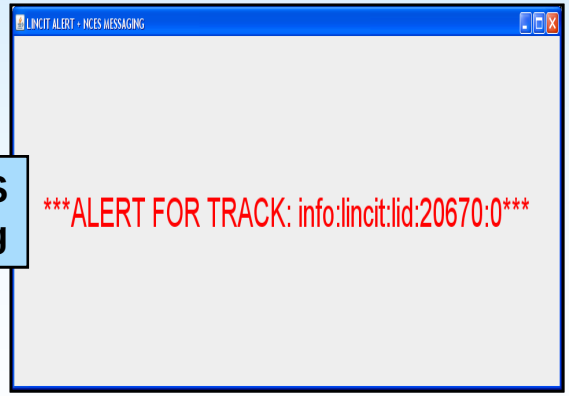
Imagery

Application Specific Service Implementations

Alert Service



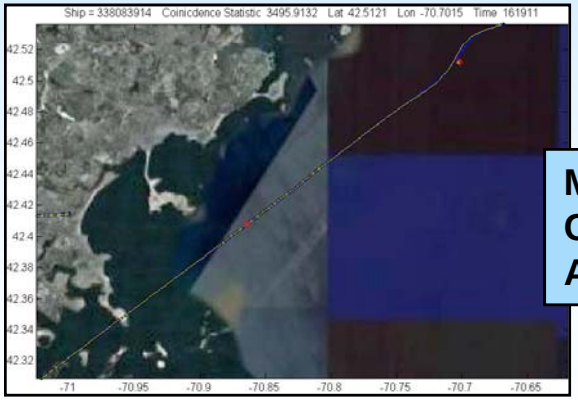
UDOP Application



NCES Messaging

Association Service

Geo-Temporal Search



MITRE Conjunction Analysis Tool

Demonstrates Key Feature of Service Oriented Architecture:
Rapid composability due to loosely coupled, well defined interfaces

Automated Resource Brokering Demonstration

Early validation of Resource Broker Tasking Interface

Architectural Principles Validated

- **Technology growth continues to lower barriers to net-centric performance and interoperability**
  - **Network bandwidth, latency improvements enable tactical uses of commercial standards**
    - **XML messaging**
    - **Web Services**
- **Service Oriented Architecture simplifies system integration, upgrade and extension at low cost and on short time-scale**
- **Standard formats and service interfaces facilitate uniform tasking and data access**

Summary

- **Demonstrated Technical Accomplishments**
  - Integrated Air, Maritime, and ISR situational awareness services using XML messaging with latencies supporting tactical operation
  - Uniform ISR sensor tasking interface for dissimilar systems
  - Machine generated requests with human authorization for execution
- **Advanced Lincoln Net-Centric Vision**
  - Implemented Service Oriented ISR sidecars for legacy systems and SOA network adaptors for new systems
  - Initial demonstration of laboratory Test Bed with potential future extension to regional, and national activities
- **Successful Program Execution**
  - Demonstrated ability to integrate new capabilities on very short time-scale