Analysis Protofederation Test Plan

Presented To

High Level Architecture
Architecture Management Group 12

13 June 1996

Topics

- Associated Organizations
- JWARS/RTI Test Concept
- JWARS/RTI Test Objectives
- Requirements Traceability
- JWARS/MIDAS Test Scenario
- JWARS/MIDAS Federation Object Model
- Software Items
- Tests to be Performed
- Data Recording, Reduction, and Analysis
- Test Schedule
- Summary

Associated Organizations

- JWARS Office
- ODPA&E (MIDAS)
- HLA Architecture Management Group
- HLA Technical Support Group
- HLA Performance Working Group
- HLA Test Working Group
- HLA Interface Working Group
- HLA OMT Working Group
- Other HLA Protofederations

JWARS/RTI Test Concept

- **Limited Derived Federation Object Model**
  - **Initial JWARS prototype**
  - **Focus on essential simulation mechanisms**
  - **Simplify instrumentation**
  - **Minimize obfuscating elements**
  - **Minimize data requirements**
- **Cover Wide Range of JWARS/HLA Issues**
- **Lay Foundation For Further Testing And Prototyping**
- **Support Evolution Of JWARS And HLA Requirements**

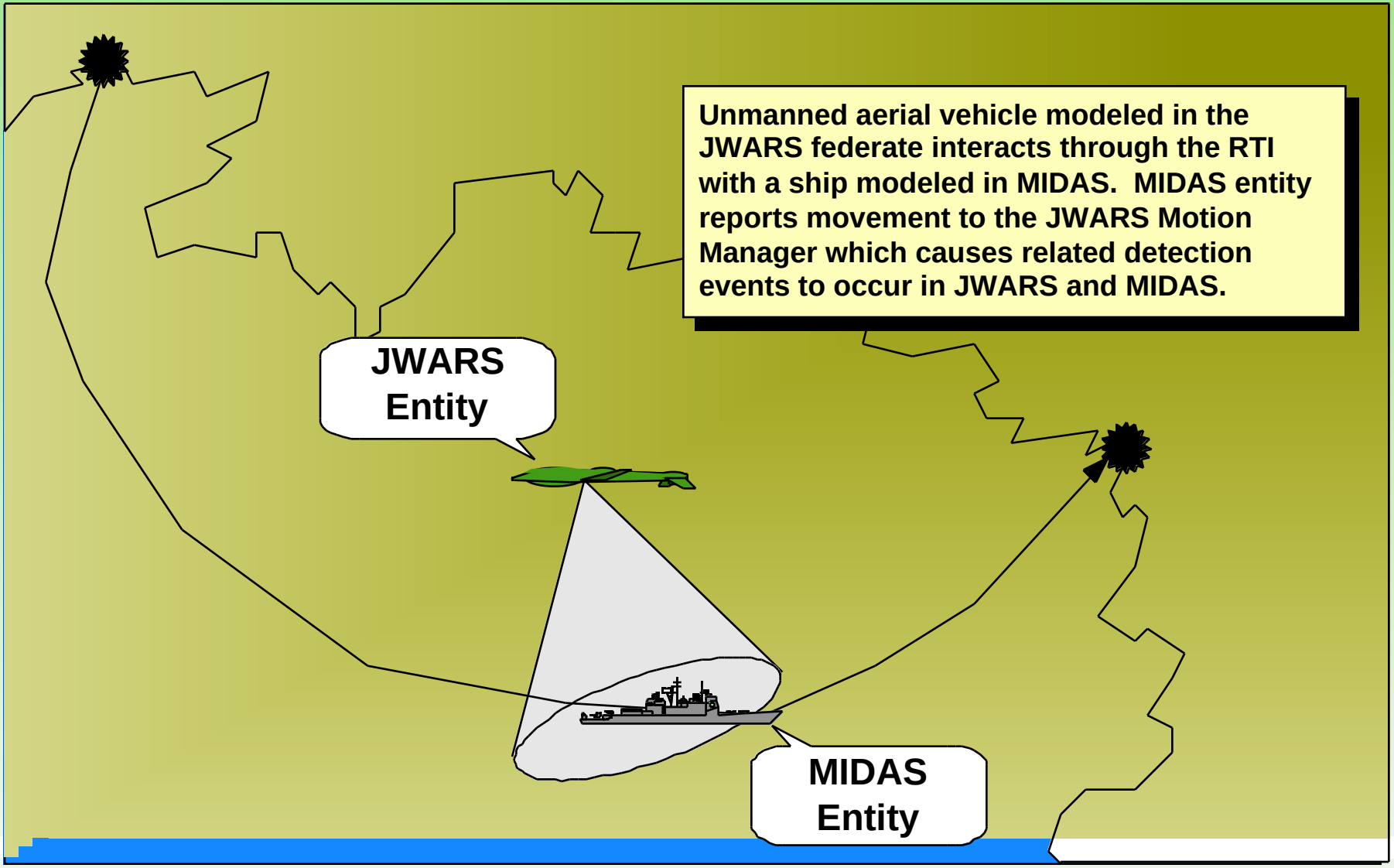
JWARS/RTI Test Objectives

- Contribute to the resolution of HLA Critical Issues
- Verify JWARS implementation of HLA/RTI
- Determine JWARS/HLA performance
- Obtain JWARS/HLA scaling information
- Determine any new HLA requirements

Requirements Traceability

- JWARS Contract, 15 Sep 1995
- JWARS Requirements, J-8/WAD, 14 Dec 1995
- Use Case Scenario, 3 May 1996
- HLA Critical Issues, 1 Apr 1996
- RTI Interface Specification, Ver. 0.32
- OMT, Ver. 0.3
- HLA Rules, Ver. 0.1

JWARS/MIDAS Test Scenario



JWARS/MIDAS Derived Federation Object Model
(Time Stamped Ordering Case)

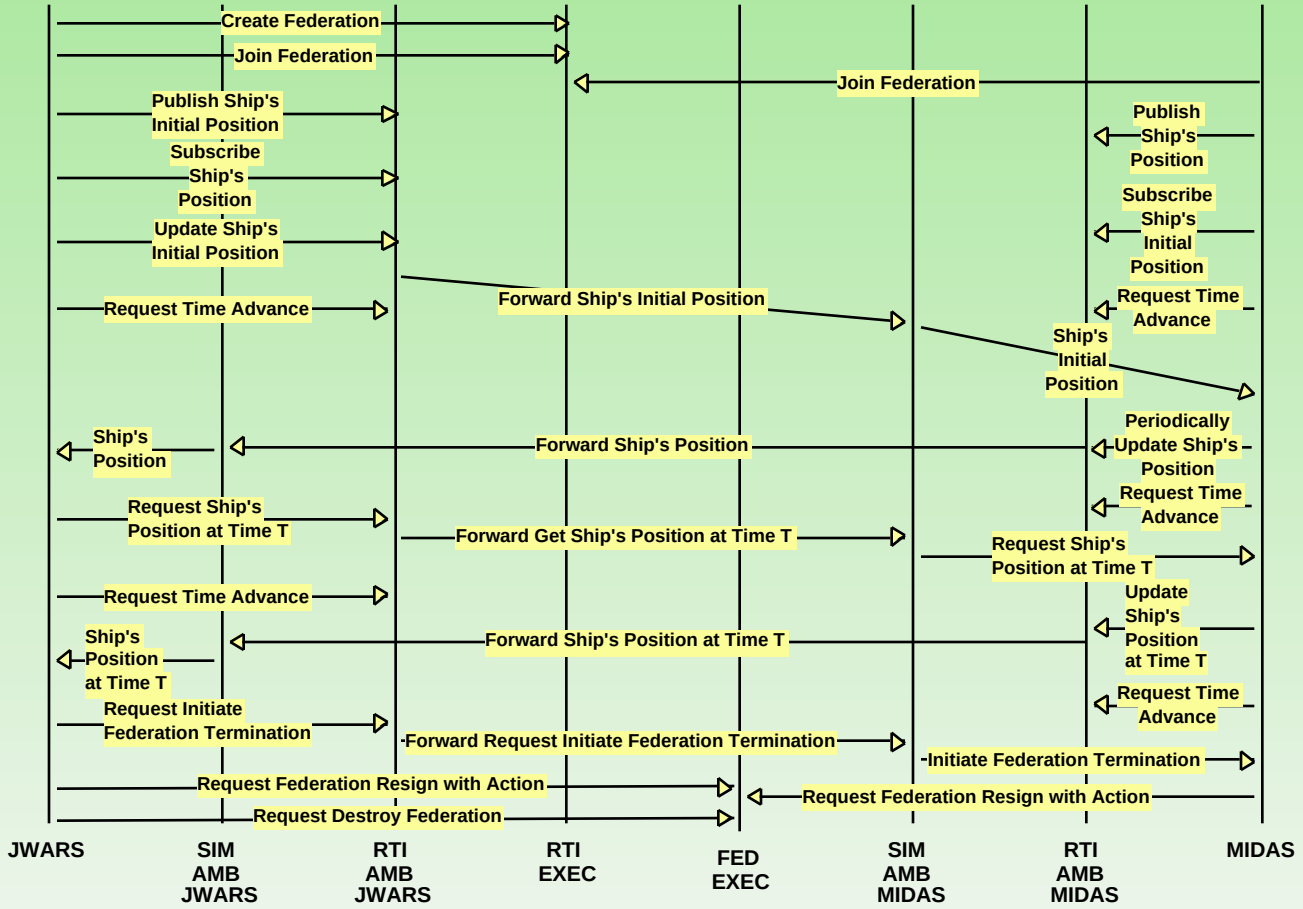
```
(

;; object, class, and attribute definitions follow:  They utilize timestamp order messages

(dfom

 (objects
   (class jwars_event_manager
     (attribute object_name RID_SERVICE_TYPE_RELIABLE RID_ORDERING_TIMESTAMP)
     (attribute event_name RID_SERVICE_TYPE_RELIABLE RID_ORDERING_ TIMESTAMP)
     (attribute current_time RID_SERVICE_TYPE_RELIABLE RID_ORDERING_ TIMESTAMP)
     (attribute parameter_list RID_SERVICE_TYPE_RELIABLE RID_ORDERING_ TIMESTAMP)
   )
   (class midas_event_manager
     (attribute object_name RID_SERVICE_TYPE_RELIABLE RID_ORDERING_ TIMESTAMP)
     (attribute event_name RID_SERVICE_TYPE_RELIABLE RID_ORDERING_ TIMESTAMP)
     (attribute current_time RID_SERVICE_TYPE_RELIABLE RID_ORDERING_ TIMESTAMP)
     (attribute parameter_list RID_SERVICE_TYPE_RELIABLE RID_ORDERING_ TIMESTAMP)
   )
 )
)
)
```

JWARS/MIDAS Event Trace



Test Configuration

CS4SRV

SUN SOLARIS 2.4

ORBIX 1.3.5

RTI - IDL 0.32

JWARS

LAN

SACPF1

SUN SOLARIS 2.4

ORBIX 1.3.5

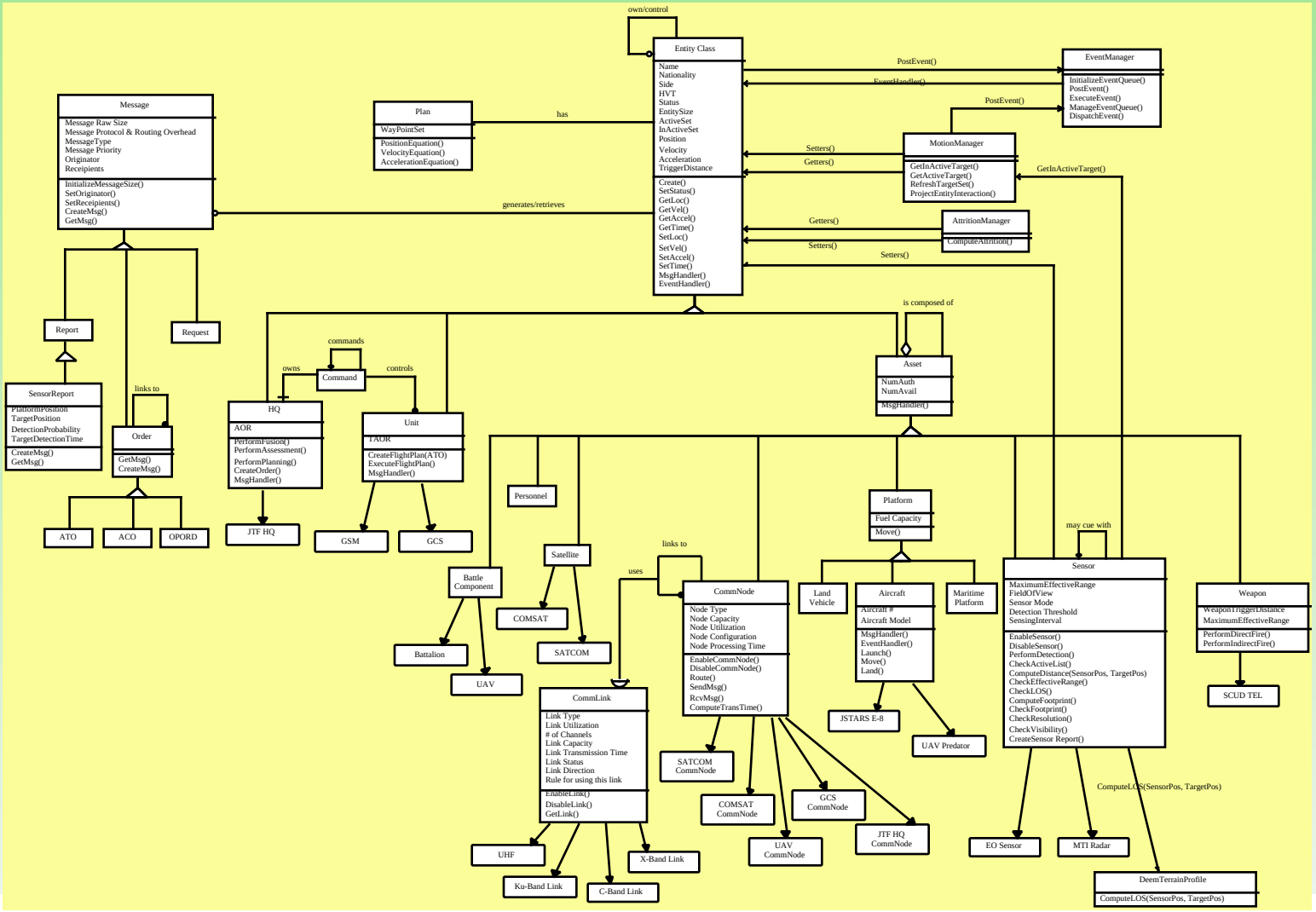
RTI - IDL 0.32

MIDAS

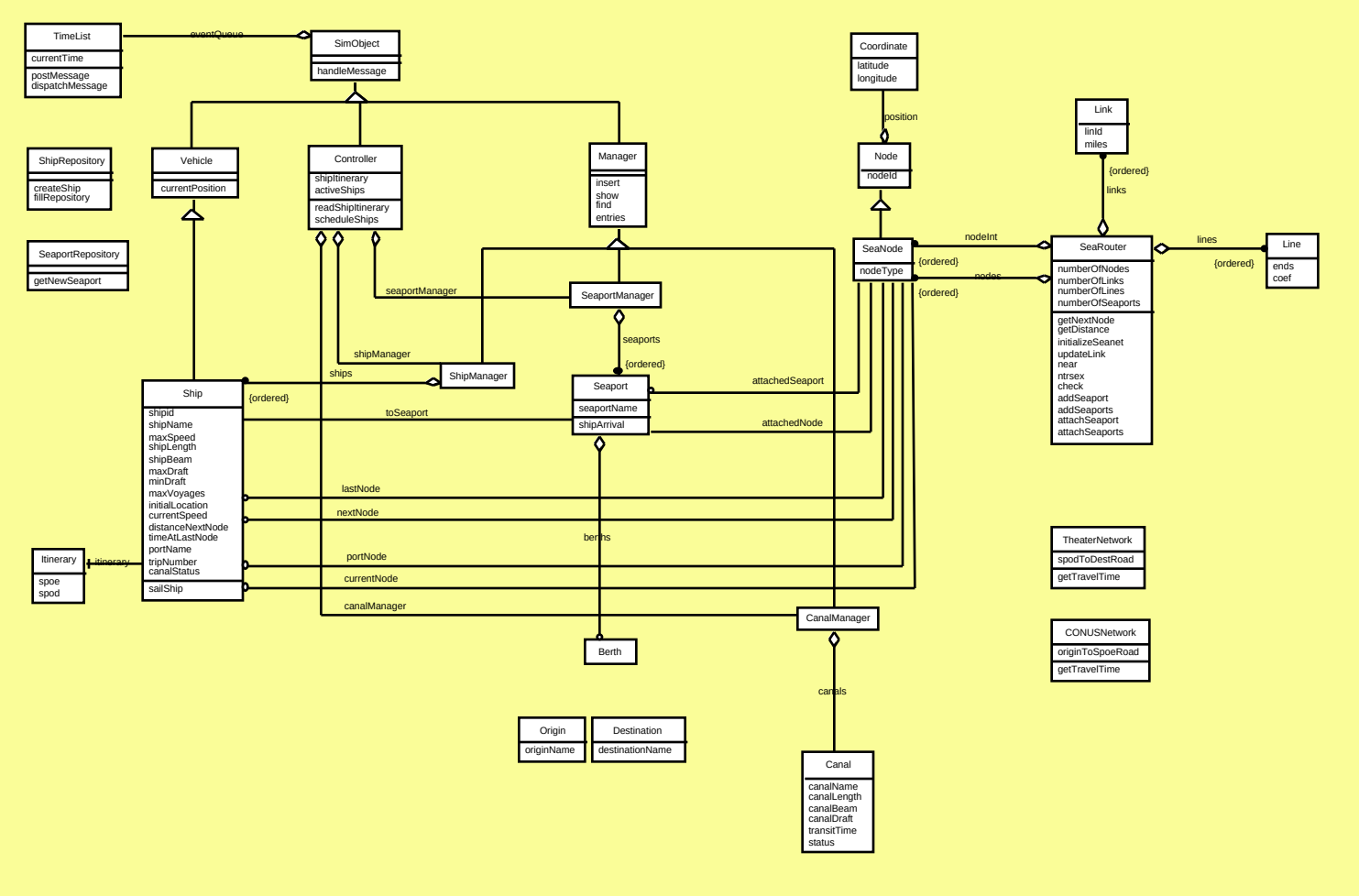
Software Items

- **JWARS Prototype Initial Build**
  - **Motion Manager**
  - **UAV Entity Model**
  - **Map Manager**
  - **Display Manager**
  - **Study Manager**
- **MIDAS**
  - **Sea Route Manager**
  - **Ship Entity Model**
- **Additions To JWARS/MIDAS For RTI Integration**
  - **Sim Ambassador**
  - **JWARS FOM Event Manager**
  - **MIDAS FOM Event Manager**

JWARS Simulation Object Model



MIDAS Simulation Object Model



Planned Tests

- **Compatibility with RTI interface**
  - **Federation Management**
  - **Declaration Management**
  - **Object Management**
  - **Ownership Management**
  - **Time Management**
- **Performance**
- **Scaleability**
- **Specific Tests**
  - **Event Synchronization**
  - **Object Interaction Control Across Federation**
  - **Event Retraction**
  - **Attribute/Data Synchronization**

Test Specification

- Test Objective
- Unit Under Test (UUT) Configuration
- Evaluation Criteria
- Analysis Plan
- Test Scenario
- Test Data Set
- Approach

Test Specification
(Example)

Test Requirement:

JWARS/RTI Performance

- **Test Objective: Measure the time required to execute each element in the test suite including each JWARS/ MIDAS object and the RTI**
- **Unit Under Test (UUT) Configuration: JWARS/MIDAS baseline configuration, RTI Version .32**
- **Evaluation Criteria: TBD**
- **Analysis Plan: TBD**
- **Test Scenario: UAV/Ship reference scenario**
- **Test Data Set: TBD**
- **Approach: TBD**

JWARS/RTI Compatibility Testing

- For each RTI service JWARS compatibility will be demonstrated by verifying the expected RTI responses or outcomes are obtained when the service is properly requested by the JWARS/MIDAS federates.
- Verify that each RTI-initiated service is properly recognized.
- Documented RTI exceptions will be tested using off-nominal behavior
- Other exceptions will be investigated.

JWARS/RTI Compatibility Testing

- RTI Service
- Interface Specification Reference
- Supplied Parameters
- Returned Parameters
- Pre Conditions
- Post Conditions
- Exceptions

Tests to be Performed

RTI Compatibility

- **Federation Management**
  - Create Federation Execution
  - Destroy Federation Execution
  - Join Federation Execution
  - Resign Federation Execution
  - Submit Query
  - Query
  - Query Result
- **Declaration Management**
  - Publish/Subscribe Object Class
  - Publish/Subscribe Interaction Class
  - Control Updates
  - Control Interactions

Tests to be Performed

RTI Compatibility

- **Object Management**
  - ID Request
  - Instantiate Object
  - Instantiate Discovered Object
  - Delete Object
  - Remove Object
  - Update Attribute Values
  - Reflect Attribute Values
  - Send Interaction
  - Receive Interaction
  - Cancel Object Attribute Values
  - Obtain Attribute Values
  - Provide Attribute Values

Tests to be Performed

RTI Compatibility

- **Ownership Management**
  - Request Attribute Ownership Divestiture
  - Unconditional Attribute Ownership Divestiture
  - Attribute Ownership Divestiture Notification
  - Request Attribute Ownership Assumption
  - Request Attribute Ownership Acquisition
  - Attribute Ownership Acquisition Notification
  - Request Attribute Ownership Release
  - Query Attribute Ownership
  - Request Delete Privilege Acquisition
  - Request Delete Privilege Release
  - Delete Privilege Notification
- **Time Management**
  - Time Advance Request
  - Next Event Request
  - Time Advance Grant

Tests to be Performed

RTI Performance

- **RTI Overhead**
  - Function Timings
  - Size Dependencies
  - Surrogate Related
- **Message Transfer Rate**
  - Message Size
  - Message Send Rate
  - Numbers of Objects

Performance

- Time Management (Time Tagged operation only)
  - Event Timing
  - Event Ordering
    - Verify causal relationships
    - Verify repeatability of results
    - Examine minimum time increments for maintaining causality
- Latency
- Throughput

Data Recording, Reduction, and Analysis

- **Data recording will be specified using the JWARS Testbed services**
  - **Audit Manager**
  - **Data Prep Manager**
- **Data reduction will be accomplished using off the shelf products**
  - **Mathematica**
  - **Excel**

HLA Critical Issues

- RTI Feasibility
- RTI Implementation Variations
- Impact of HLA Rules
- HLA Compliance
- Range of Functionality
- Performance
- Scaleability

Test Schedule

• JWARS/MIDAS DFOM	Complete
• Test Scenario	Complete
• RTI V 0.3 Installation/Checkout	Complete
• JWARS SW Installation	28 June
• MIDAS SW Installation	28 June
• Federation Integration	12 July
• Test Data Available	12 July
• Complete Testing	31 July
• Complete Analysis	2 September
• Report To AMG	September Meeting

Summary

- The Analysis Protofederation Testbed Test Plan uses a focused configuration to address a range of JWARS and HLA issues
- A goal of the Test Plan is to support the evolution of JWARS and HLA requirements
- Another goal is to collect data for planning JWARS prototypes
- The Analysis Protofederation test program will be completed in July
- Results will be shared with the HLA community

HLA Issues

Range of Functionality

- **Scaleability**
- **Repeatability**
- **ISR**

HLA Issues

RTI Feasibility

- **Interfacing Cost**
- **Performance Cost**
-

HLA Issues

RTI Implementation Variations

HLA Issues

Impact of HLA Rules

HLA Issues

HLA Compliance

Scaleability