JWARS Space Strategic Partner (JSSPAR) Progress Report
Space Users Group (SPUG) Meeting
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• JSSPAR task
• Significant activities
• Workshop results
• Space representation status
• Remaining activities
• Future plans
JSSPAR Task Overview

- Assess current space functionality representation in JWARS
- Identify shortfalls and prioritize requirements
- Develop space representation improvement plan
- Begin implementation as resources permit
Significant Activities

• Conducted joint workshop with JWARS (modeling) and US Space Command (operations)
  - Collaboration on the future functionality in JWARS to adequately reflect how space is used by the warfighter
  - 1-3 April in Washington DC

• Accomplishments
  - Coordinated space functionality assessments
  - Finalized requirements and functionality diagrams
  - Coordinated improvement plan
  - Identified data requirements
  - Established priorities
Workshop Results

• Developed 4 products for each space system
  - Current JWARS functionality (what exists) and shortfalls
  - Functional diagram (what should be)
  - Current enhancement plans (what is planned)
  - Development and data requirements (what is needed)

• Prioritized systems for improvement
Component area assessments are rolled up into overall Space Mission Area assessments.
Priorities for space representation in JWARS include:

- DSP
- ISR
- GPS
- SATCOM (relates to other space functional areas)
- Space launch/Space Ops (implicitly through satellite ops in other functionalities)
- BFT (JWARS assumes perfect SA of blue forces)
- CNO (can be modeled similar to SATCOM)
Current Functionality:
- Single (vs. stereo) satellite detection vs missile type
- Pd based on ECA and MDS
- DSP detection provides cue to TBMD forces for intercept (active, passive, attack ops)

Shortfalls:
- Only mono satellite (vs. stereo) coverage and Pd considered
- Missile classification not considered (missile typing)
- Cloud cover not considered
- DSP battlespace characterization mission not modeled
- Ground station (Comm path) not modeled

Remedy:
- Incorporate stereo detection
- Include missile classification (SCUD-B vs SCUD-C, etc.)
- Calculate cloud cover based on LOS
- Include battlespace characterization mission
- Add ground station (comm path) to model
DSP “Warning” - fx Diagram

System outputs are shown above, Not current model outputs. SPACECOM / JSSPAR will determine model MOEs
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DSP - Current Enhancement Plans

- Implement stereo detection
- Utilize cloud data based on cloud height along line-of-sight from DSP to launch site
DSP - Development and Data Needs

• [Deleted]
• [Deleted]
• DSP satellite locations
• DSP satellite reliability by satellite ID
• Min and max processing time by satellite ID
• [Deleted]
• [Deleted]
Current Functionality
- Space-based ISR is aggregated into generic satellite platforms
- Orbits modeled as number passes per day and time per pass
- Dynamic collection plan with user defined planning cycles reacts to changes and new facts from knowledge database

Shortfalls
- Model requires accredited data to support ISR functionality
- Collection planning based on targeting is limited
- Limited Denial & Deception modeled (decoy yes, camo no)

Remedies
• SPACECOM working with JWARS JDS for data “points” for extrapolation
• NRO providing some data
• Tie targeting system to ISR system (reverse is already true)
• Incorporate D&D into SPACECOM ISR study to quantify
• JWARS Office will identify the data required for D&D
System outputs are shown above, Not current model outputs. SPACECOM / JSSPAR will determine model MOEs.
• Implement staggered observation period function
  - Provides more realistic satellite coverage for LEO and MEO orbits
• Implementing consolidated GUI utility to manage satellite assets within the scenario
• Implementing camouflage, denial and deception for ISR targets
 ISR - Development and Data Needs

Analyses:
- Resolution requirements for adequate target ID
  - NIIRS levels needed for count vs identify
- Data processing rates as related to satellite scheduling
- Determination of how much aggregation is right to represent ISR
  - MOPs that adequately define satellite footprints for coverage

Data Resources:
- Collateral data set for testing and general (Non-IC) analysis
  - Has to provide “good enough” ISR performance to not invalidate other non-IC analysis efforts
  - Coordination with NRO not yet yielding results
Current Functionality:
- JWARS currently assumes perfect GPS system accuracy

Shortfalls:
- Lack of the ability to represent navigational errors
- Inability to modify the Pk of GPS guided weapons in a countermeasures environment
  - Degradation to GPS information
  - Denial of GPS information
- Inability to model the weapons selection of GPS guided munitions
- Inability to model GPS derived timing inputs required for secure communications (freq hopping radios)

Remedies:
- Quantify data for GPS effects on specific “conventional” systems
- Implement GPS-caused degraded navigational performance
- Model jamming assets, deployments, and subsequent effects
- Increase situational awareness of hostile forces based on secure communications (freq hopping radios) degrades of friendly forces
System outputs are shown above, Not current model outputs. SPACECOM / JSSPAR will determine model MOEs.
GPS - Current Enhancement Plans

GPS Munitions Effectiveness:
- Representation of ground based jammer operations and tactics
- Implementation of degraded damage performance of GPS-dependent air-to-ground munitions
- Inclusion of long-range cruise missile and indirect fire operational degrades

Terrestrial Navigation:
- Model representation of navigational delays of terrestrial combat systems in low feature terrain environments
- Implementation of jammer effectiveness zones produced by hostile countermeasures systems
- Identification of ground maneuver susceptibility to GPS navigation degradation

Secure Communications Degradation:
- Identification of combat communications systems and nets requiring synchronization
- Implementation of non-secure backup modes of operation
- Modification of enemy situational awareness resulting from non-secure communications modes
Analyses:
- Space implementations in similar campaign warfare modeling tools
- Measures of effectiveness employed in lower level models
  - Critical to the determination of relevant JWARS input data
  - germane to the proper representation of higher fidelity GPS effects
- Access to mission and campaign level studies of GPS criticality to force enhancement operations

Data Resources:
- Approved suites of modeling tools used to represent GPS performance in benign and hostile battlefield environments
- Potential countermeasures system performance and operational tactics
- Data on terrestrial navigation delays and mission failure scenarios resulting from degraded GPS performance
- GPS guided weapons performance and alternate guidance methodologies
Current Functionality:
  - Deployment of blue communications assets via TPFDD
  - Attrition of communications capability
  - Models throughput (bandwidth)
  - Control over message routing
  - Includes functionality such as jamming, deception, encryption, and interception

Shortfalls:
  - Susceptibilities specific to SATCOM assets
  - No automatic redeployment / reallocation of SATCOM assets
  - Does not include EMCON or “minimize” procedures

Remedies:
  • Include space-based vulnerabilities
  • Include SATCOM resource management
  • Include EMCON and “minimize” procedures
Outputs shown above are current model outputs. SPACECOM / JSSPAR will determine additional model MOEs.
Candidates for Enhancement

- Simulate dynamic bandwidth (capacity) **load changes** due to demands of:
  - force deployment
  - intelligence
  - combat demands
- Simulate dynamic **management** of satellite resources
  - UHF and SHF bandwidth allocation
  - Simulate employment DSCS & commercial satellites
  - Based on traffic patterns
  - Accommodate changing traffic patterns caused by arrivals of units and attrition
SATCOM - Development and Data Needs

• Information on functions that cause large increases in satellite message traffic and bandwidth consumers
  – Real time video imagery, satellite snapshot imagery
  – Targeting BDA, intelligence imagery
  – Force deployment, combat phases

• Information of satellite management strategy alternatives
Current Functionality:
- No current JWARS functionality for space-based BFT

Shortfalls:
- JWARS assumes perfect blue force situational awareness
- JWARS assumes perfect blue force combat identification
- Absence of performance effects and the ramifications of degraded operations

Remedies:
- Determine the impact of time delayed reporting on accurate unit location
- Determine the effect of varying error ellipses and element misidentifications as well as false alarms
- Determine the applicability of BFT to sensor and weapons employment (vs. GPS for example)
- Quantify the mission-level impact of having combat identification to military forces
- Implement higher fidelity/dynamic combat resource allocation (AD)
- Perform sensitivity analysis in JWARS
System outputs are shown above, Not current model outputs. SPACECOM / JSSPAR will determine model MOEs
BFT - Current Enhancement Plans

Implementation of an enhanced “IFF/SIF type” infrastructure:
- Representation of interrogator/response elements on combat entities
- Develop a coupled sensor network to detect and track force changes in disposition
- Construction of communications and data networks to manage situational awareness
- Development of backup modes of operations in degraded countermeasures conditions
- Development of the ability to easily construct and modify BFT networks in order to perform trade-off analyses

Development of improved weapons employment zones:
- Implement a higher fidelity representation of weapons allocation
- Induce variations in blue force situational awareness in order to drive force employment and redirection
Analyses:
- Mission scope, purpose, objective and responsibilities of Blue Force Tracking
- Space operations contribution to the BFT network
- Candidate MOEs/MOPs that will permit proper evaluation of effects
- A complete listing of analyses, reports and white papers that outline the details of the concept

Data Resources:
- Performance and architectures of candidate networks
- Approved metrics to evaluate system performance
- Characterization of space based elements (sensors, relays)
- Characterization of battlefield elements and allocations
- Network command hierarchy and the scope of force redirection
Functionality:
- Space Warfare (Force Application), Other Space System Applications, Space Control, and CNO to be considered later
- Space Wx and and Space-derived Wx may not be sufficient to model

Shortfalls:
- Lacks ability to control the availability of satellites
  - Move, Launch
  - Outage / Anomaly due to other events (space Wx)
  - Countermeasures
- BDA Issue: Damaged/destroyed BSEs removed from play

Remedies:
- Include ability to control the availability of satellites
- Define MOEs for Space MS&A
  - Mission-level and Campaign-level analysis
- Leave damaged/destroyed BSEs where they fall
- Identify sources of data
Generic - Status

• Currently no modeling of any of these systems in JWARS
  – Space Warfare (Force Application), Other Space System Applications, Space Control, and CNO
• Scope of representation needs is far more than just “assessment and improvement”
• Further analysis deferred to follow-on effort
• Will develop space requirements and design
  – Joint effort with JWARS and US Space Command
Summary

- Space modeling assessment completed
- Requirements and functional flows developed to reflect warfighter usage of space
- Ready for coordinated approval from Space Users Group (SPUG)
- Ready to begin implementation in JWARS
Remaining Activities

- Current period of performance ends 1 August
  - Complete implementation of DSP model enhancements
  - Coordinate DSP data gathering
- Incremental extension to 31 Oct to align with Government fiscal year
  - Work ISR modeling improvements and data gathering with NRO
  - Begin design of GPS modifications
Planned Activities for FY03

- Coordinate across the space community (Army, Navy, other agencies)
- Refine data requirements details, facilitate data collection
- Validation and assessment of DSP model
- Implement additional space systems in priority order
- Determine how to best model Space Surveillance effects in JWARS
- Programmatic activities
1. SPACECOM
   • Provide access to SMEs to facilitate design of tables that capture sufficient satellite operational parameters for campaign analysis

2. JSSPAR
   • Work with JWARS and SPACECOM to define data tables needed for accurate space representation

3. JWARS
   • Code JWARS to read from tables in advance of actual data

4. SPACECOM
   • Populate data tables with probabilities

5. JWARS
   • Provide data formats to SPACECOM

6. Define follow-on efforts for SOW?
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