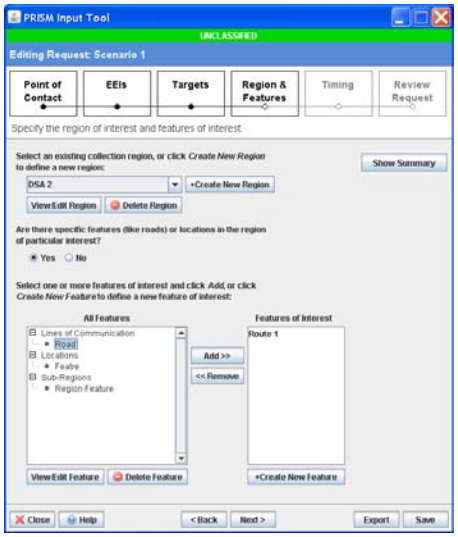


# Ground Moving Target Indicator (GMTI) Utility Analysis for Airborne Assets

## A mission-based framework for requesting and planning GMTI support

**Mr. Craig Bonaceto, Dr. Edith Mooers, Mr. Stephen Theophanis, Dr. Varley Wrick**

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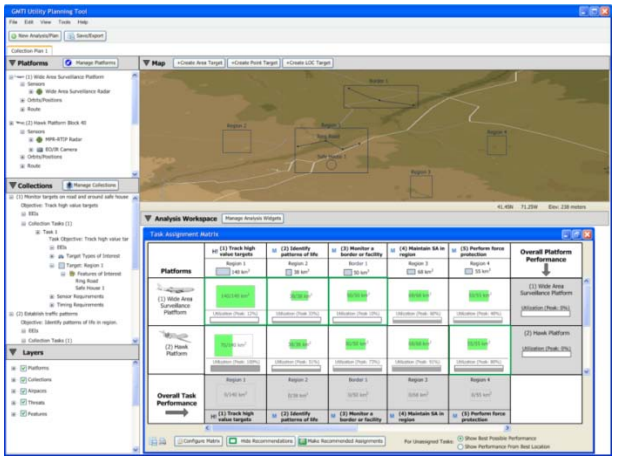
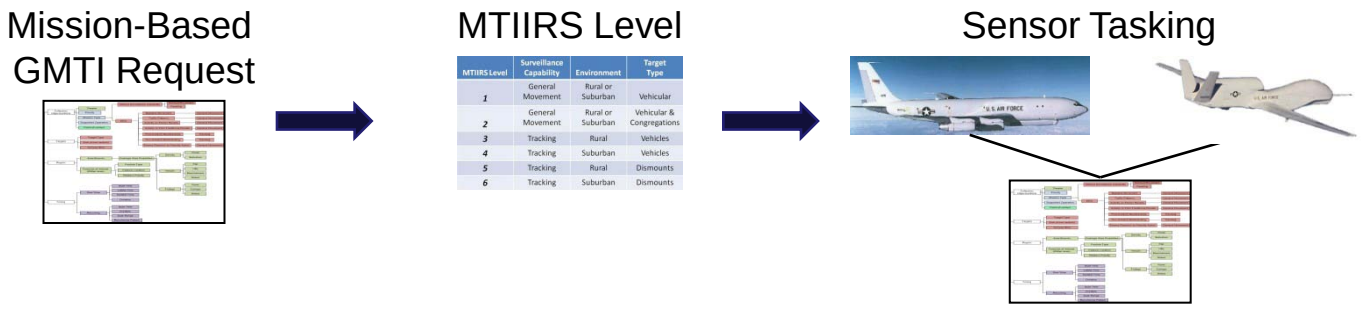


MITRE

# Outline

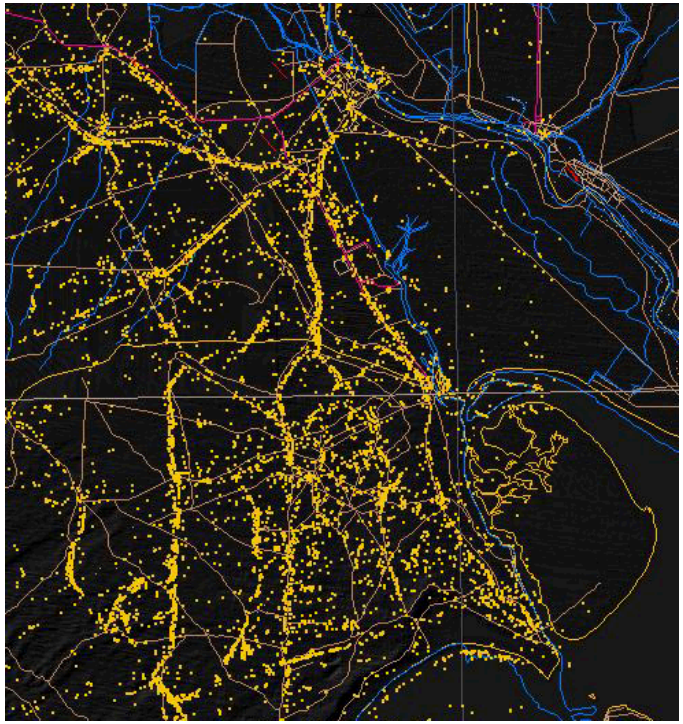
- Introduction to GMTI and Planning Challenges
- Mission-Based Approach to GMTI Planning
- Moving Target Indicator Interpretability Rating Scale (MTIIRS): Assessing required GMTI data fidelity to support the mission
- Decision Support Applications
  - PRISM Input Tool© (PIT): Requesting GTMI support
  - GMTI Planning Tool© (GPT): Planning GMTI collections




| MTIIRS Level | Surveillance Capability | Environment | Target Type |
|---|---|---|---|
| 1 | General Movement | Rural or Suburban | Vehicular |
| 2 | General Movement | Rural or Suburban | Vehicular & Congregations |
| 3 | Tracking | Rural | Vehicles |
| 4 | Tracking | Suburban | Vehicles |
| 5 | Tracking | Rural | Dismounts |
| 6 | Tracking | Suburban | Dismounts |

# Introduction – What is GMTI?

- GMTI = Ground Moving Target Indicator
  - An INT type that detects and tracks moving surface objects in an area of interest
  - Detections can be associated to form tracks, or used for situational awareness
  - Traditionally radar-based, but can be from other sources such as video and SIGINT
- Typical uses of GMTI
  - Discover and characterize lines of communication
  - Monitor borders
  - Track high value targets



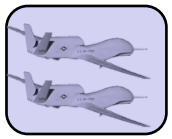
# GMTI Planning Challenges

- GMTI data collection is complex and multi-dimensional, involving detection across time and space
- GMTI planning today is based on implicit assumptions about the effectiveness of GMTI sensing strategies in meeting operational objectives.
- Collaboration and planning suffers from inconsistencies in these assumptions between humans and machines, as well as between humans in different echelons, locations, and organizations. [Hence lots of chat.]
- Standardized mission types and model-driven mission planning tools are needed to provide potential sensing strategies spanning multiple GMTI sensors/platforms that satisfy end-user operational objectives.

# Mission-Based GMTI Planning Process

## GMTI Requesters

## GMTI Planners



**Current Process**

"I need a JSTARS with a 10 second revisit rate." Lack tools to structure requests in mission-centric terms.

→

"Hands tied" to requested revisit rates. Requests often lack needed information.
Lack systems to evaluate mission satisfaction and plan multi-platform collects.

---

**Improved Process**

Mission: "I need to identify traffic patterns along a road."

→

Provide decision support tools to evaluate tasking requirements and plan GMTI collections based on mission needs and area characteristics.

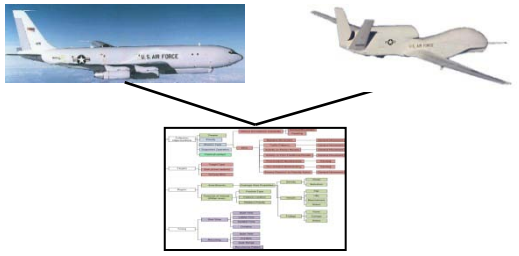
Mission-Based GMTI Request

→

MTIIRS Level

| MTIIRS Level | Surveillance Capability | Environment | Target Type |
|---|---|---|---|
| 1 | General Movement | Rural or Suburban | Vehicular |
| 2 | General Movement | Rural or Suburban | Vehicular & Congregations |
| 3 | Tracking | Rural | Vehicles |
| 4 | Tracking | Suburban | Vehicles |
| 5 | Tracking | Rural | Dismounts |
| 6 | Tracking | Suburban | Dismounts |

→



**PRISM Input Tool©**

**GMTI Planning Tool©**

# GMTI Mission Types and Essential Elements of Information (EEIs)

- Mission Types:
  - Track high value targets
  - Monitor a border, facility, or other area of interest
  - Perform force protection or convoy over-watch
  - Maintain situation awareness in a region
  - Identify patterns of activity in a region

- EEIs
  - Characterize baseline movement
  - Establish traffic patterns
  - Identify activity on established routes
  - Identify activity on non-traditional routes
  - Perform incident backtracking (forensics)
  - Identify enemy reactions to friendly actions
  - Identify milling activity


# The Moving Target Indicator Interpretability Rating Scale (MTIIRS)

- Previous efforts to define GMTI fidelity based on the analogy to imagery: National Imagery Intelligence Interpretability Rating Scale (NIIRS)
  - Imperfect analogy: GMTI data is <u>not</u> imagery
  - **GMTI data fidelity is the degree to which targets are unambiguously distinguished**
- Current approach: "GMTI Units" based on area scanned per hour is insufficient as it does not consider update rate
- MTIIRS Approach:
  - Characterize required GMTI data fidelity given mission requirements
  - Enable collection planners to bin requests by difficulty
  - Characterize fidelity of previously collected GMTI data
- MTIIRS is currently is linear scale comprised of 6 levels in increasing order of fidelity
- MTIIRS levels are derived from the triad of mission type, target types of interest, and area characteristics

# Current MTIIRS Levels

| MTIIRS Level | Surveillance Capability | Environment | Target Type |
|---|---|---|---|
| *1* | General Movement | Rural or Suburban | Vehicular |
| *2* | General Movement | Rural or Suburban | Vehicular & Congregations |
| *3* | Tracking | Rural | Vehicles |
| *4* | Tracking | Suburban | Vehicles |
| *5* | Tracking | Rural | Dismounts |
| *6* | Tracking | Suburban | Dismounts |

| MTIIRS Levels | Rural | Suburban | Rural | Suburban |
|---|---|---|---|---|
| | Vehicles | Vehicles | Dismounts | Dismounts |
| Wide Area Surveillance / Situation Awareness | *1* | *1* | *2* | *2* |
| Tracking | *3* | *4* | *5* | *6* |

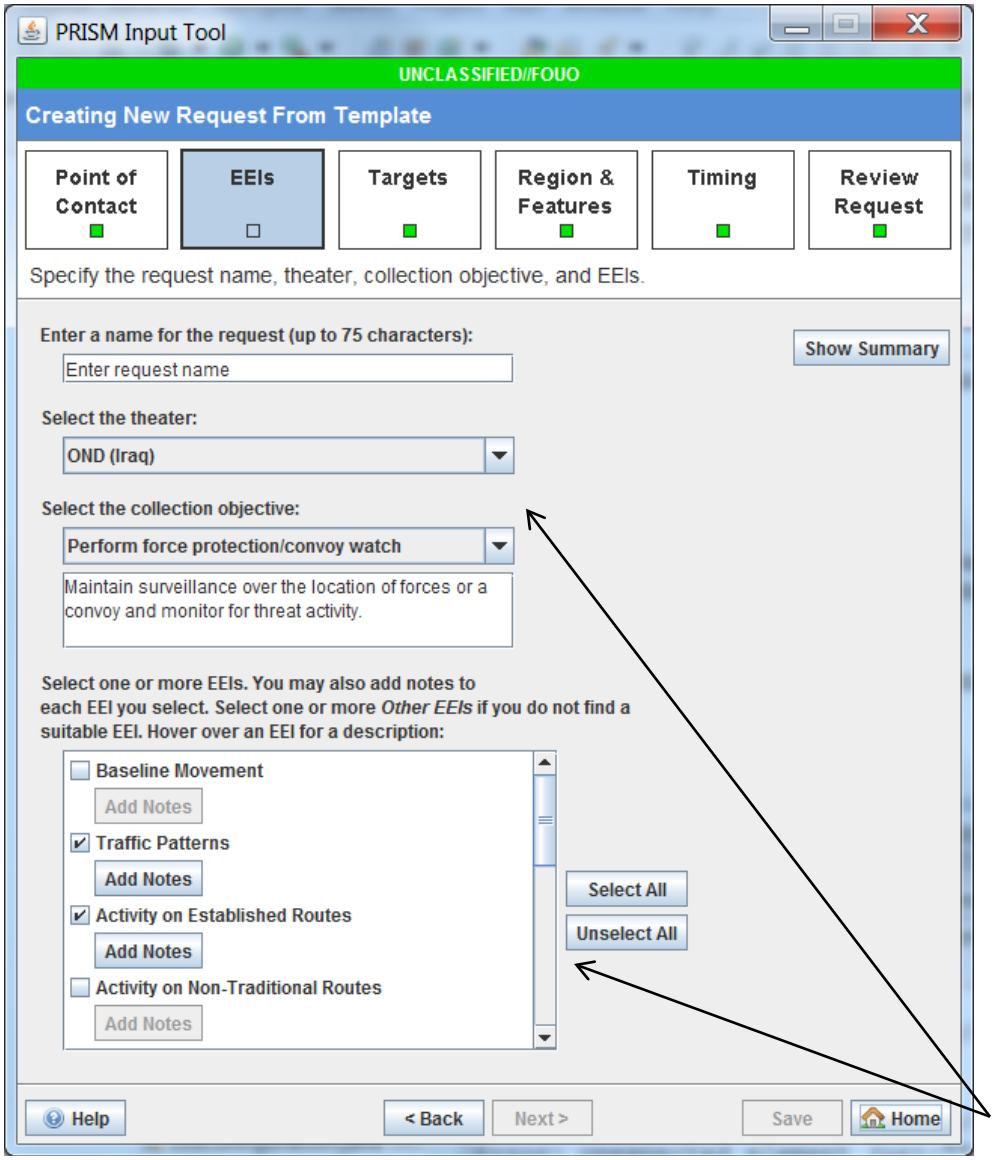
# PRISM Input Tool©

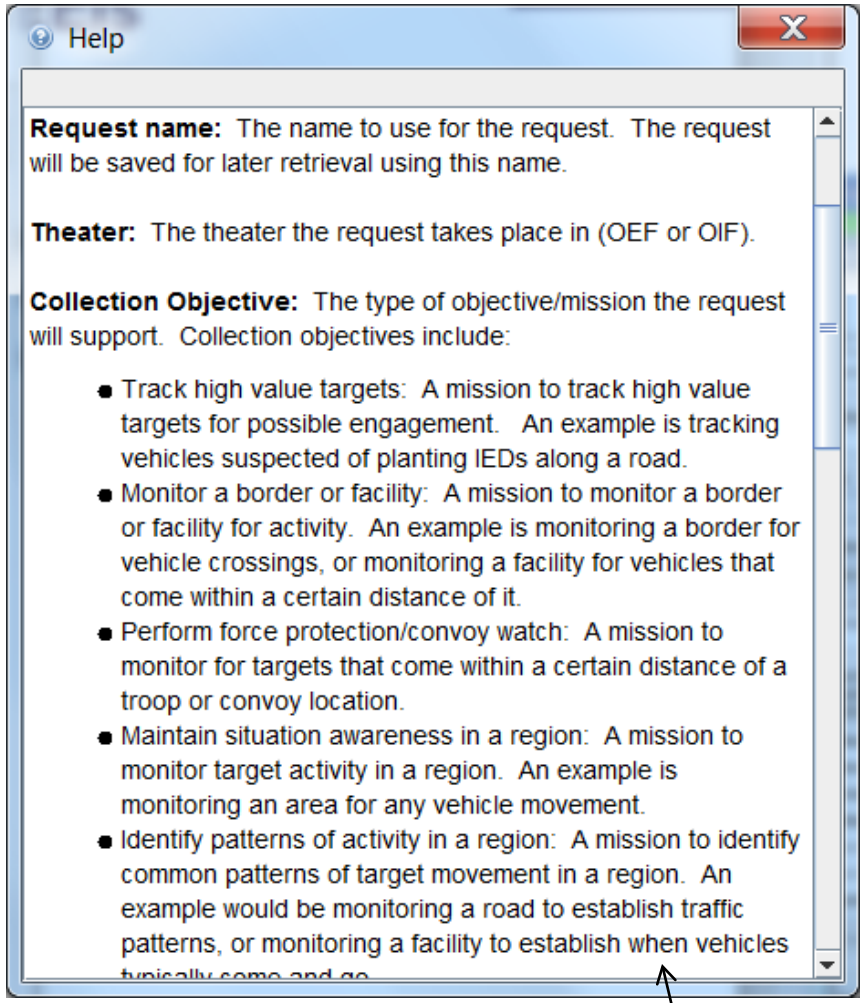
## Structuring GMTI Requests

- **Goal: Develop a software tool to:**
  - Assist in requesting GMTI support in mission-centric terms
    - Old Way: "I need a JSTARS with a 30 second revisit rate"
    - New Way: "I need to identify traffic patterns along a road"
  - Add structure to the GMTI request process
  - Be "Turbo Tax" easy-to-use
  - Compute an MTIIRS level based on request
  - Export requests as formatted text and XML to PRISM

- **Needs Addressed:**
  - GMTI requests are currently poorly structured and not reproducible
  - GMTI is not a well understood INT type by end-users
  - Structuring requests will:
    - Standardize the process and avoid confusion
    - Help requesters understand GMTI a
    - Help planners better manage and utilize GMTI assets

# PIT: Specifying Mission Type and EEIs

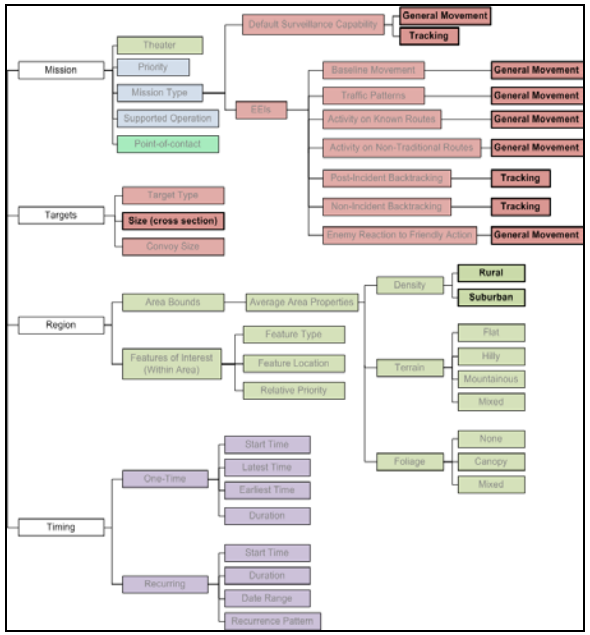


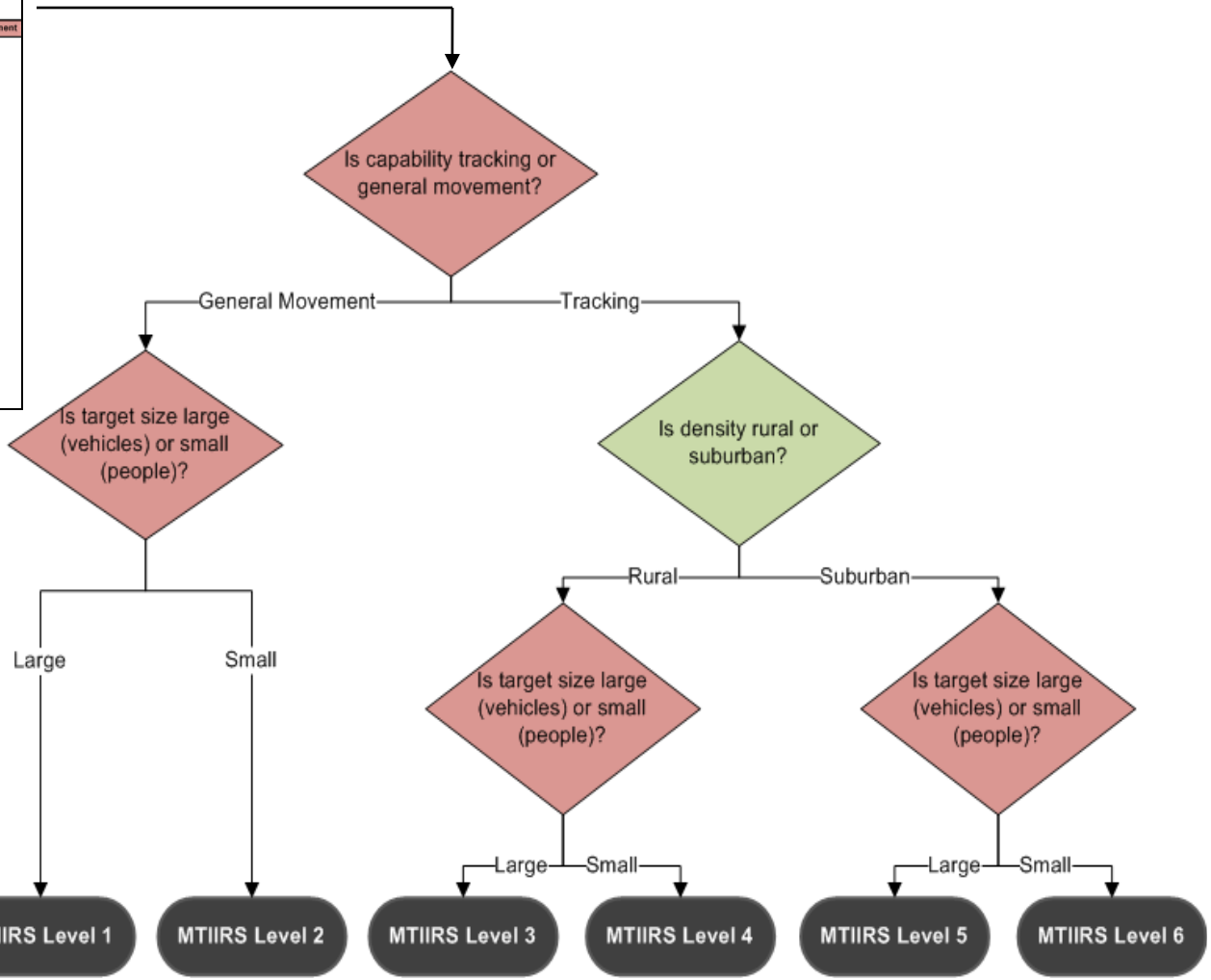




EEIs enabled for selection are specific to the mission type

Context-sensitive help

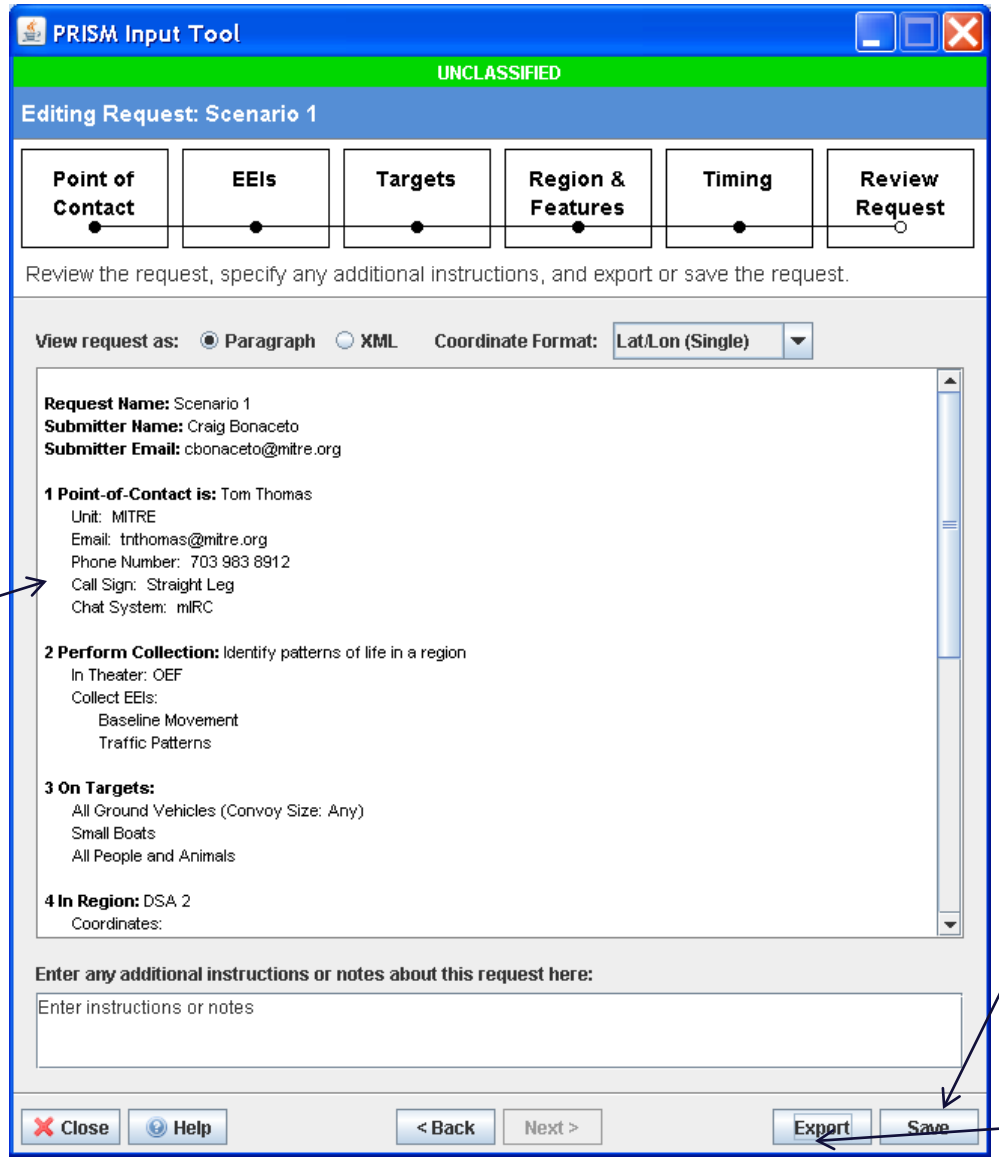
# MTIIRS Calculation



# PIT: Request Summary

Formatted summary paragraph of request




"Save" when inputs are complete

"Export" provides a text file that can be copied to PRISM

# GMTI Planning Tool©

## GMTI Platform Planning and Optimization

- **Goal: Develop a decision support capability to:**
  - Provide a structure to allow a non-expert to determine radar tasking requirements based on mission needs, target type and area conditions
  - Evaluate which and how many GMTI platforms are required to satisfy requests
  - Determine placement and orbit of platforms to maximize collection effectiveness
  - Predict and visualize performance based on platform placement and orbits

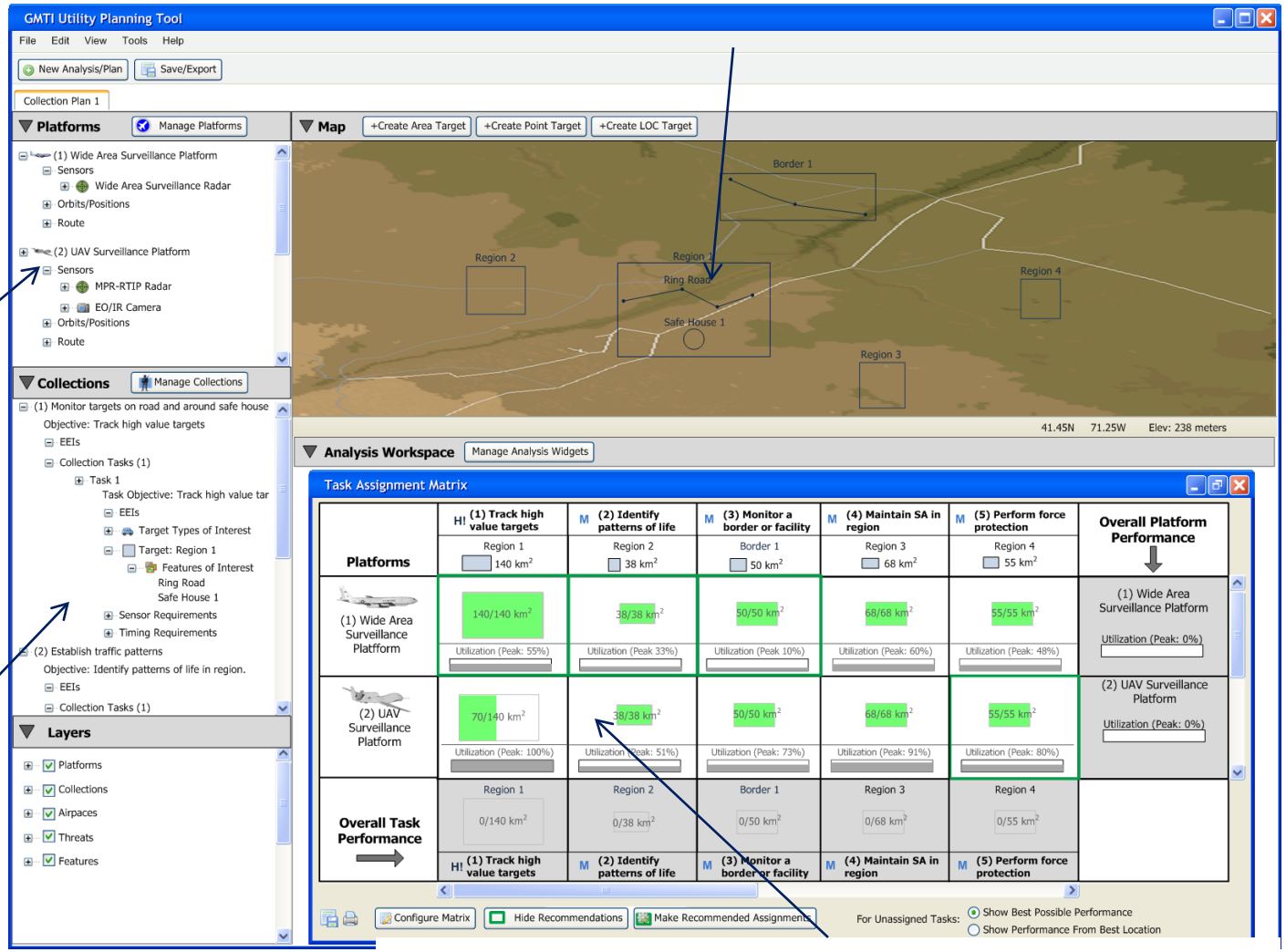
- **Needs Addressed:**
  - Current systems for tasking GMTI collections do not provide adequate feed back as to whether they satisfy mission needs
  - No systems exist to plan multi-platform GMTI missions
  - Improve GMTI platform utilization (reduce/eliminate incorrect tasking)

# GPT: Overall Tool Layout

The interactive map shows areas requiring GMTI coverage.

The platforms browser enables planners to add, edit, and remove GMTI platforms.

The collections browser allows planners to add, edit, and remove GMTI collections.




The analysis area contains an interactive assignment matrix that shows the expected performance of each platform against each collection.

# Summary and Future Directions

- Our aim is to standardize the process of requesting GMTI support and tasking GMTI platforms with a mission-based framework
- We demonstrated a framework for requesting support based on mission needs, a new MTIIRS metric to assess required fidelity, and a planning tool to relate requests to platform tasking
- We intend to next investigate extending this methodology by understanding how GMTI can be combined with other INT types
- We also intend to validate our utility models using theater GMTI data collects

Mission-Based GMTI Request

MTIIRS Level

| MTIIRS Level | Surveillance Capability | Environment | Target Type |
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Sensor Tasking