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DEFINING THE FUTURE

Rapid Force Structure Analysis

Capability Effectiveness Tool

October 22, 2008

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Overview

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- Large trade spaces limit M&S effectiveness for force structure architecture studies
  - Problem of interest was Layered Intelligence, Surveillance and Reconnaissance (LISR) with Integrated Air and Space
  - Solution spaces ranged from 10,000 to 450,000+ possible architectures
- Historically, addressed with a combination of common sense and expert opinion
  - This in no way guaranteed most cost effective solution was truly identified
- Three-part structured, traceable process was developed to address this limitation
  - Capture commander's intent for a given operation and translate into collection requirements
  - Assess force structure effectiveness as the percentage of collection requirements met and calculate wartime and life-cycle costs
  - Identify highest potential architectures and key elements
- Three tools used to support the upfront process:
  - Collaborative Reasoning Tool (CRT)
  - Capability Effectiveness Tool (CET)
  - Analyst's Workbench

Process Goal: Identify Limited Set of Architectures with the Highest Cost Effectiveness Potential As Starting Point for Detailed Studies

Layered ISR Problem Definition

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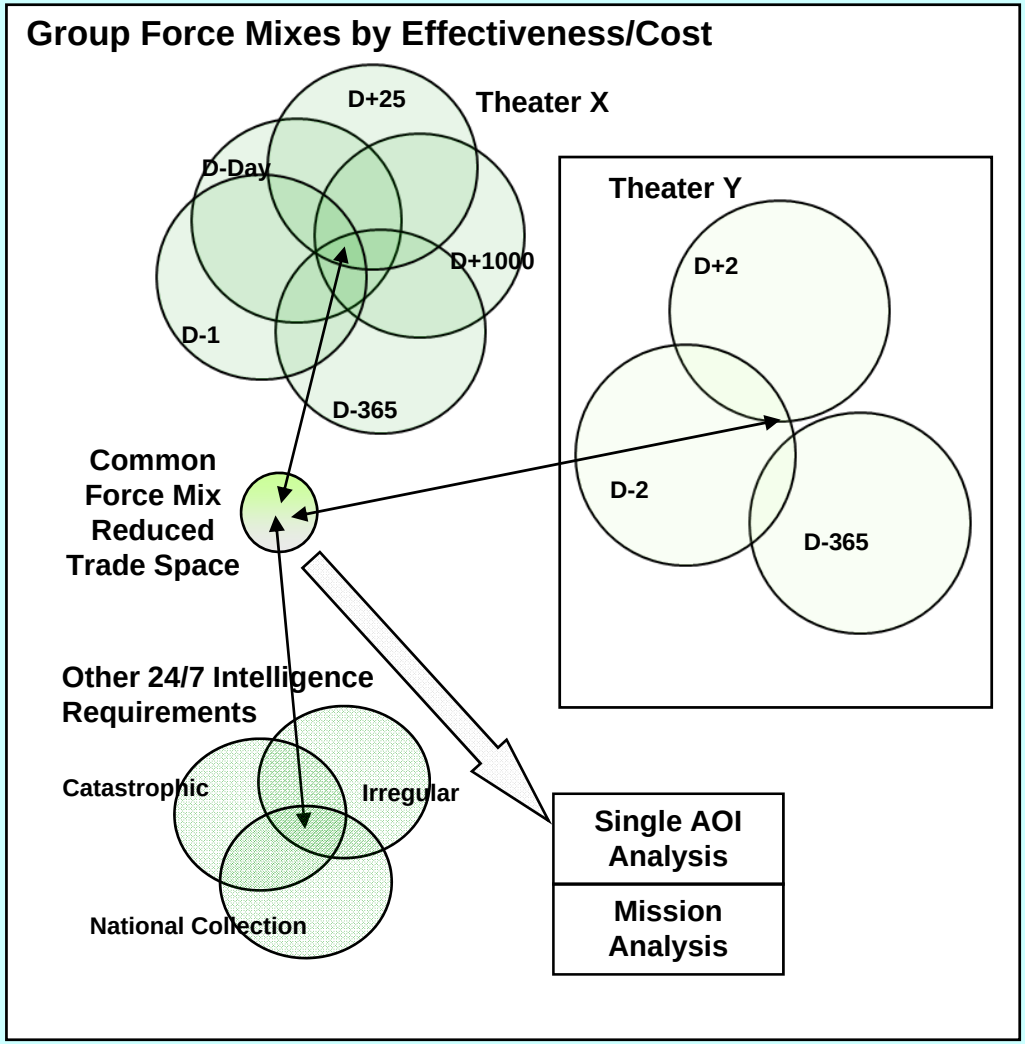
Collection capabilities change with each scenario and phase of war

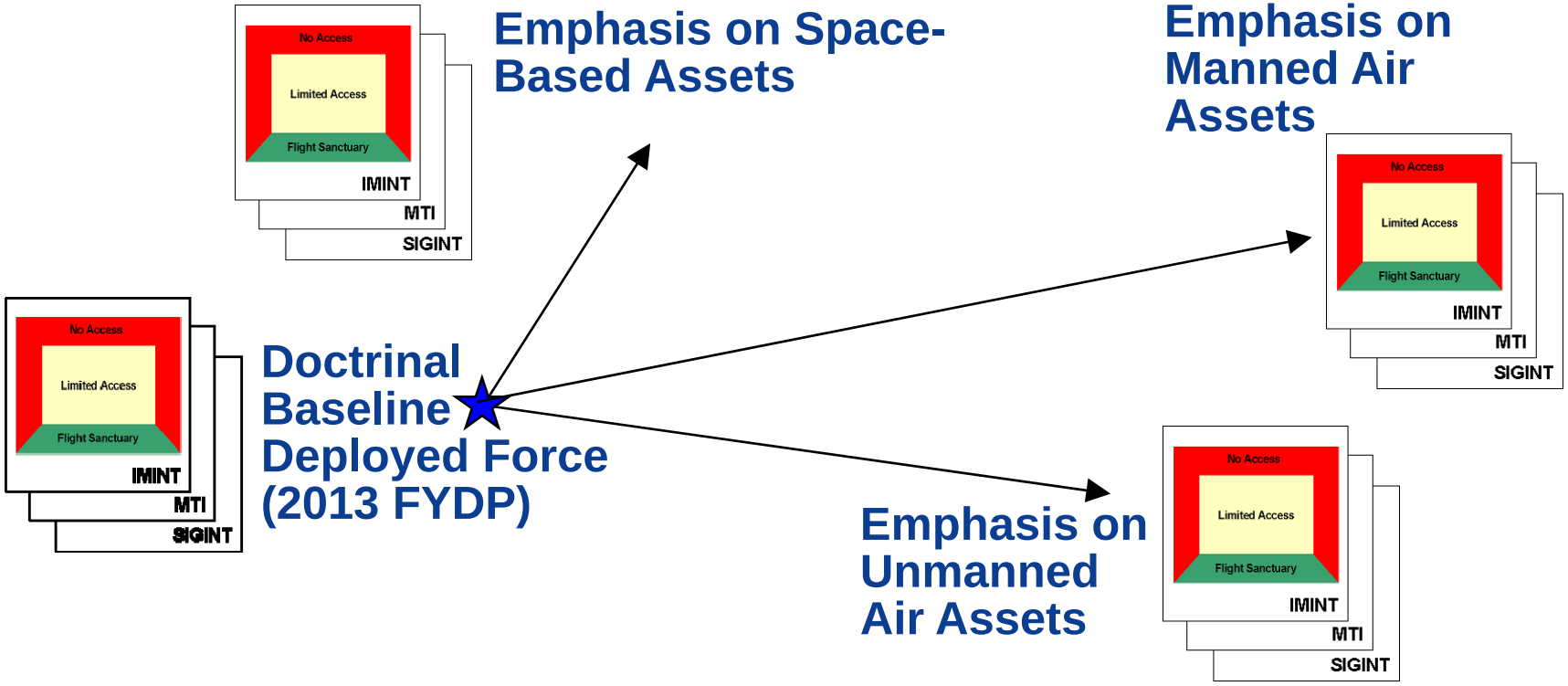
Joint air, space, maritime and ground ISR assets have varied and overlapping capabilities

National leadership must integrate Irregular, Catastrophic and National Collection capabilities to make informed deployment decisions



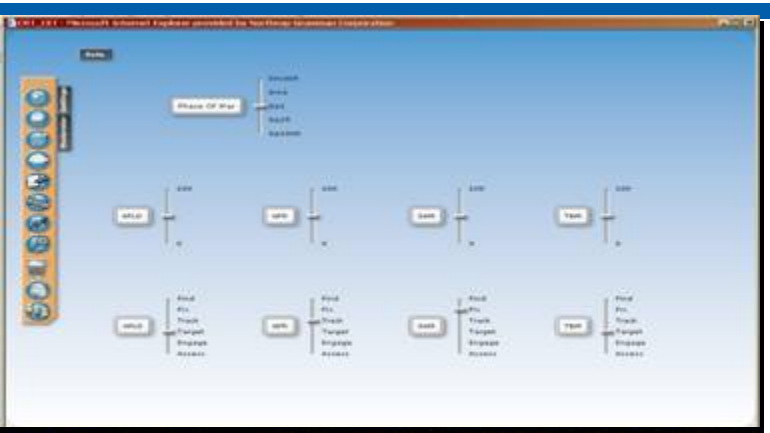
Where We Started

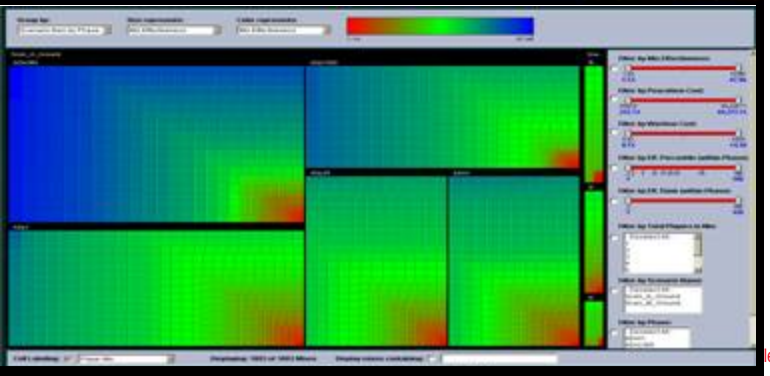
- Investigate Surveillance Capabilities Within 10 Year Horizon That Could Provide Ubiquitous, Near Real Time, Theater-Wide Coverage
  - Consider Manned, Unmanned, Satellites, Ships, Ground Based Systems
  - Multi-Spectral
- What Force Mix Provides Most Cost Effective Means of Accomplishing Goals?



Assessed 57 Cases Out of ~450,000 Possibilities

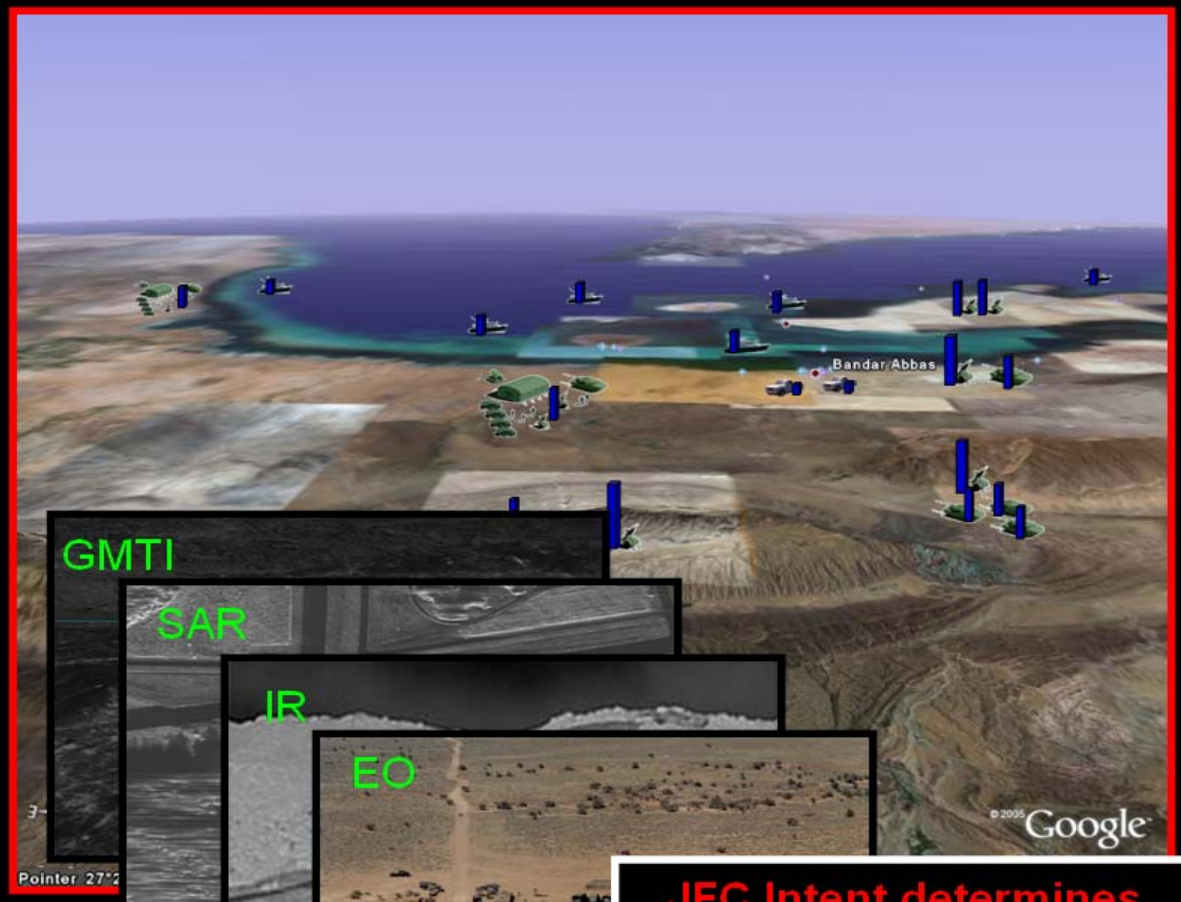
Developed Toolset to Address Solution Space Size





- Collaborative Reasoning Tool
  - Means to easily capture commander's intent for each phase of an operation
  - Single Joint Forces Commander (JFC), or consensus of a group
  - Distributed Capability
- Capability Effectiveness Tool
  - Assess alternative force structure options in terms of potential effectiveness and cost
  - Graphical User Interface (GUI)
- Analyst Workbench
  - Means to quickly review and understand a large database
  - Filters, tagging and other tools to support data analysis

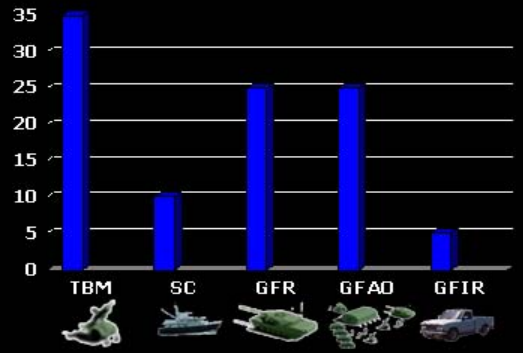
Capability Effectiveness Tool



JFC Intent determines type and quality of required sensor information by target

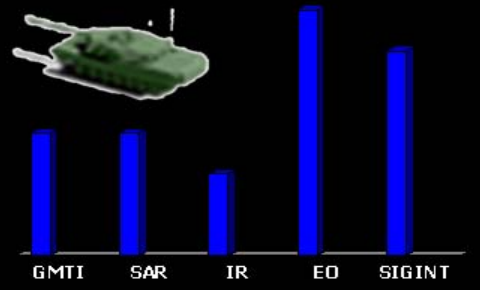
Commander's Intent

Joint Target Prioritization by Phase

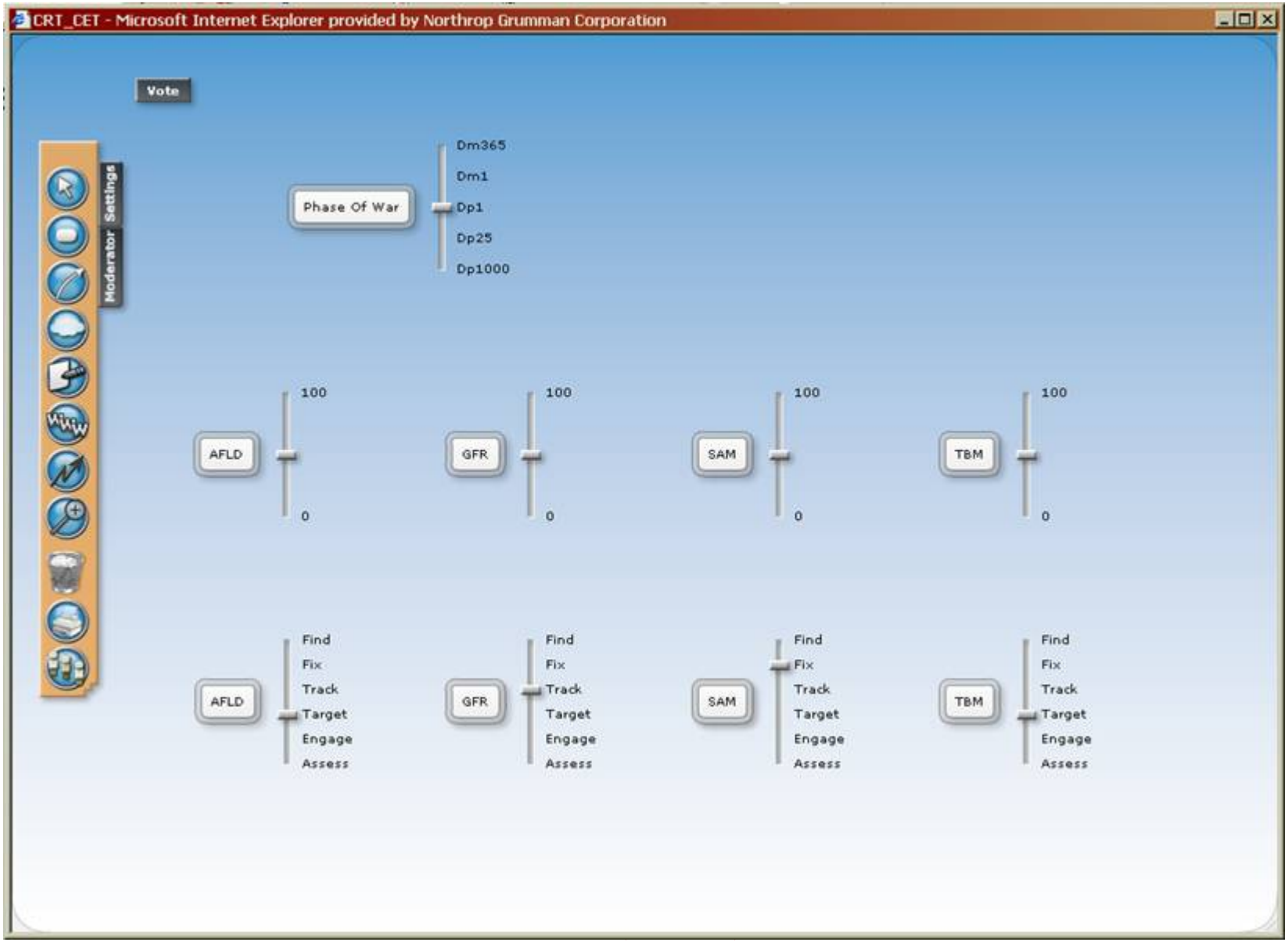


Determine JFC Intent by Target

FIND		●			
FIX					
TRACK				●	
TARGET			●		
ENGAGE	●				●
ASSESS					



Collaborative Reasoning Tool



CET Model

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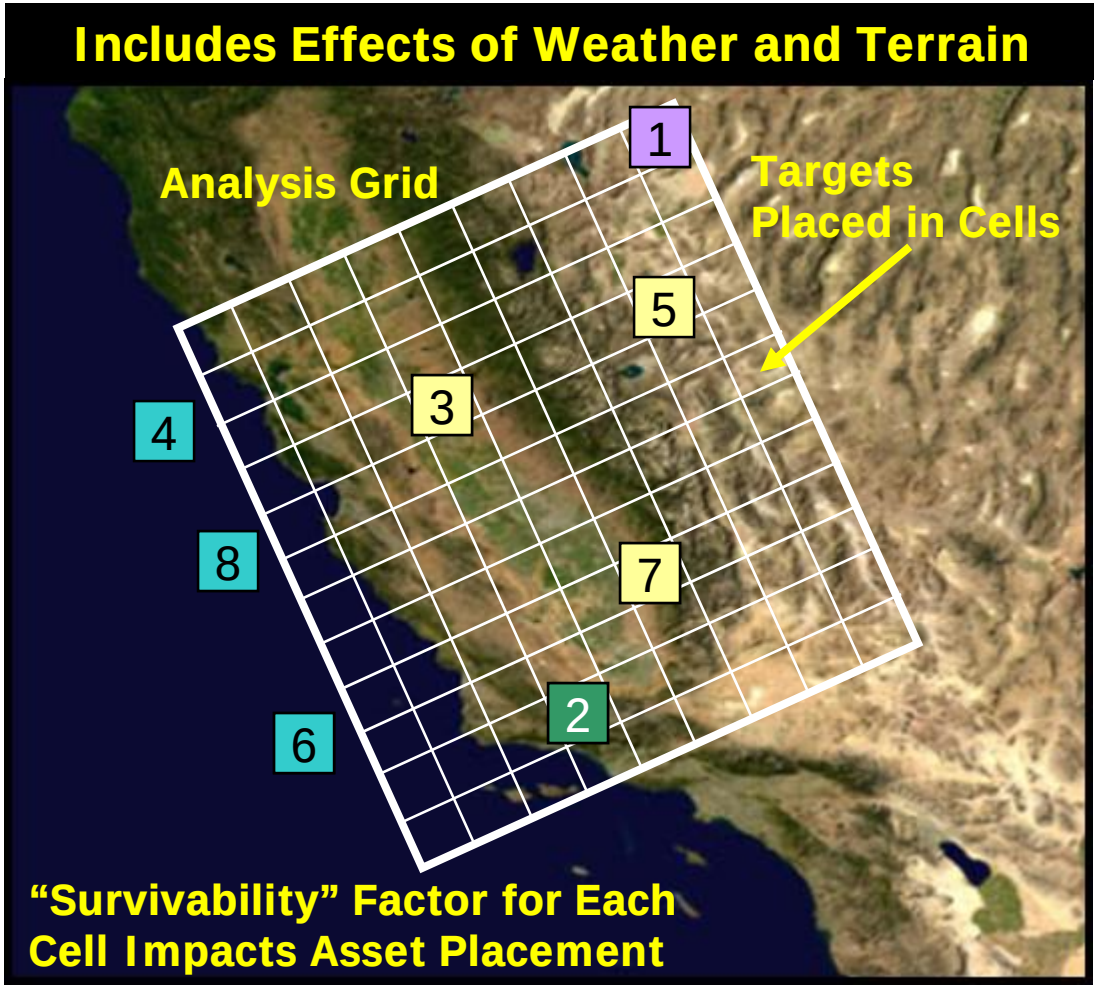
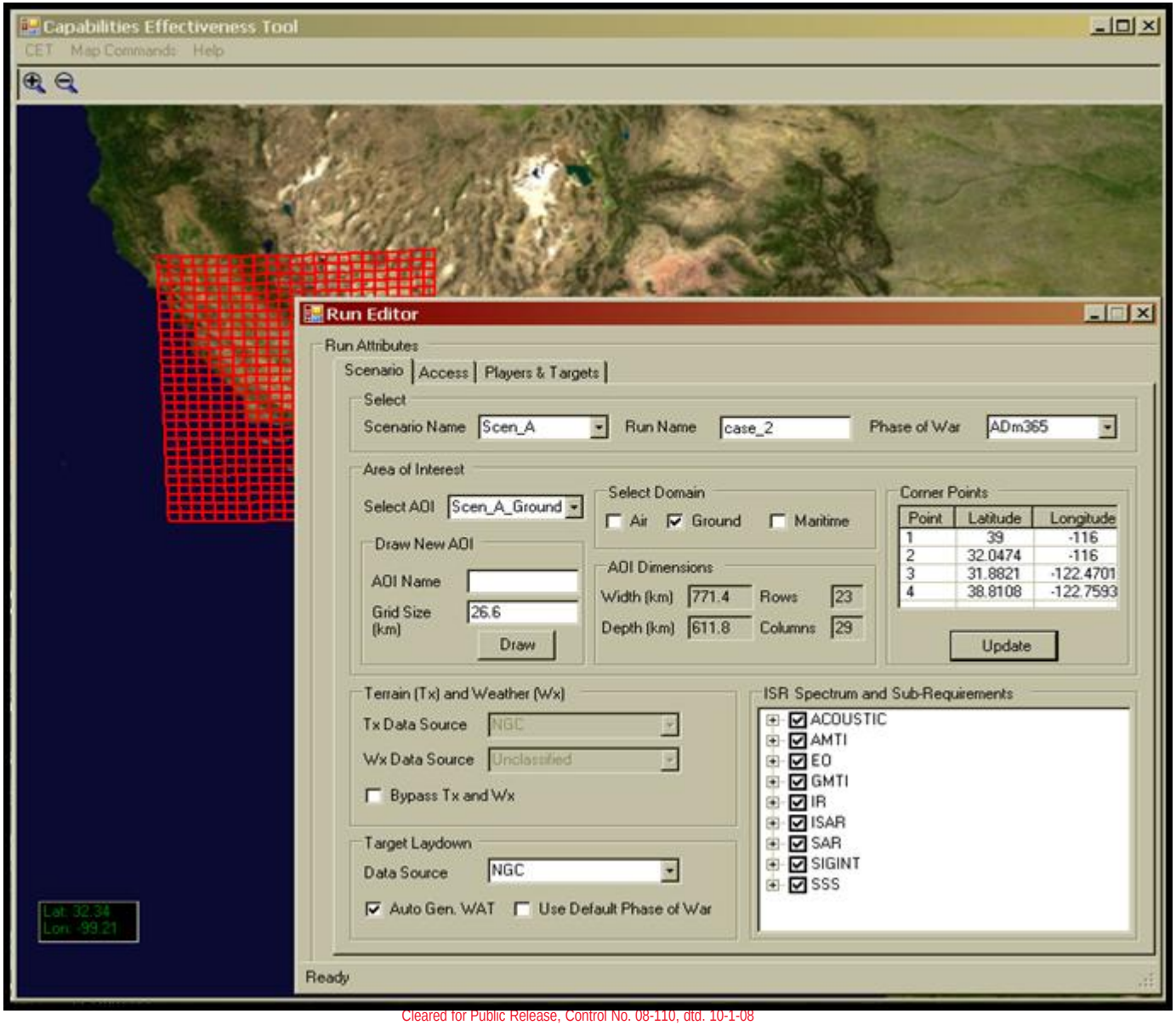
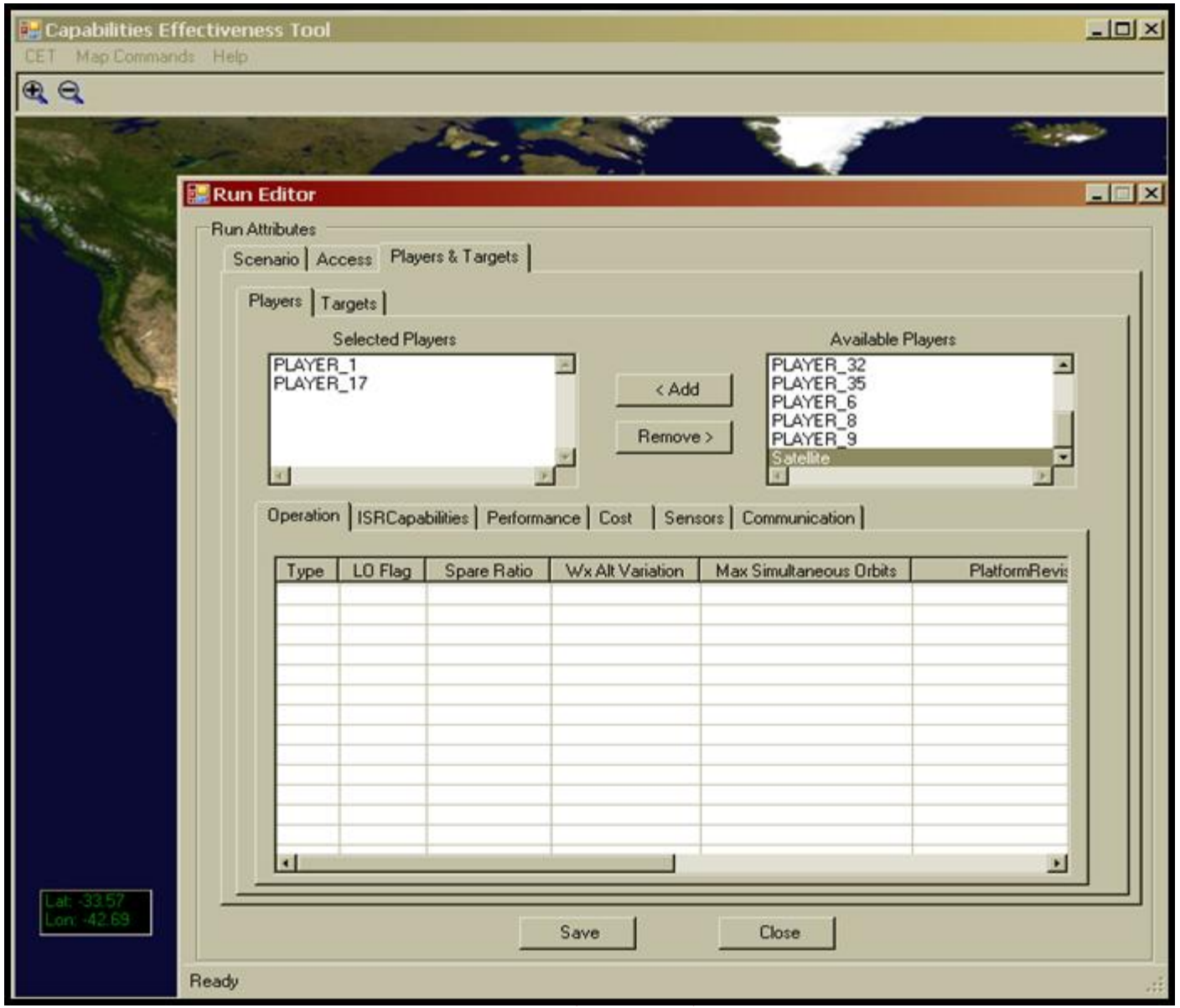
- Assesses the ability of alternate force structures to achieve the commander's intent
- Static assessment of potential capability over 12 hr or 24 hr period
- ISR force mix effectiveness defined as percent of commander's collection priorities achieved
- Exhaustive assessment, or greedy algorithm
- Also provides
  - Relative contribution of each potential element
  - Collection gaps by sensor and by target
  - Comms throughput and reach-back
  - Wartime operating costs
  - Peacetime life cycle costs



GUI Interface: Scenario and Spectrum



GUI Interface: Platforms



LISR CET Typical Products

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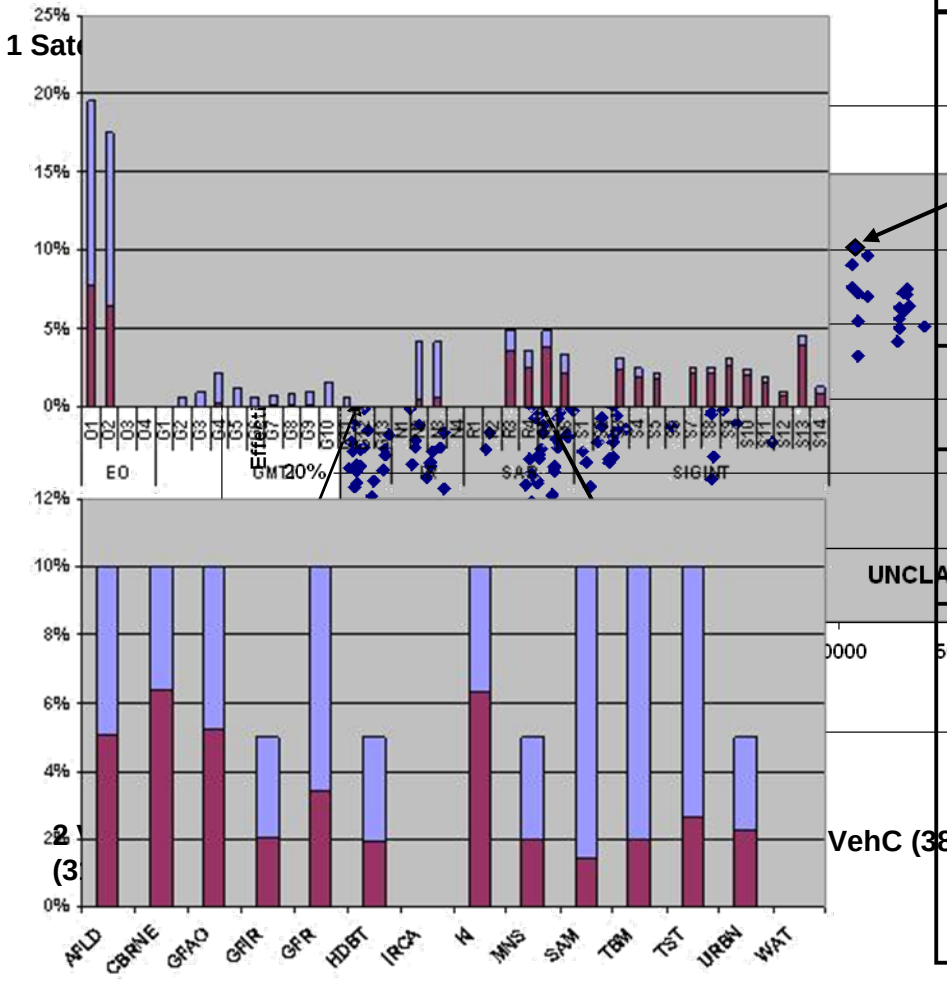
NOTIONAL RESULTS

Multi-Domain Force Mix Gap Analysis

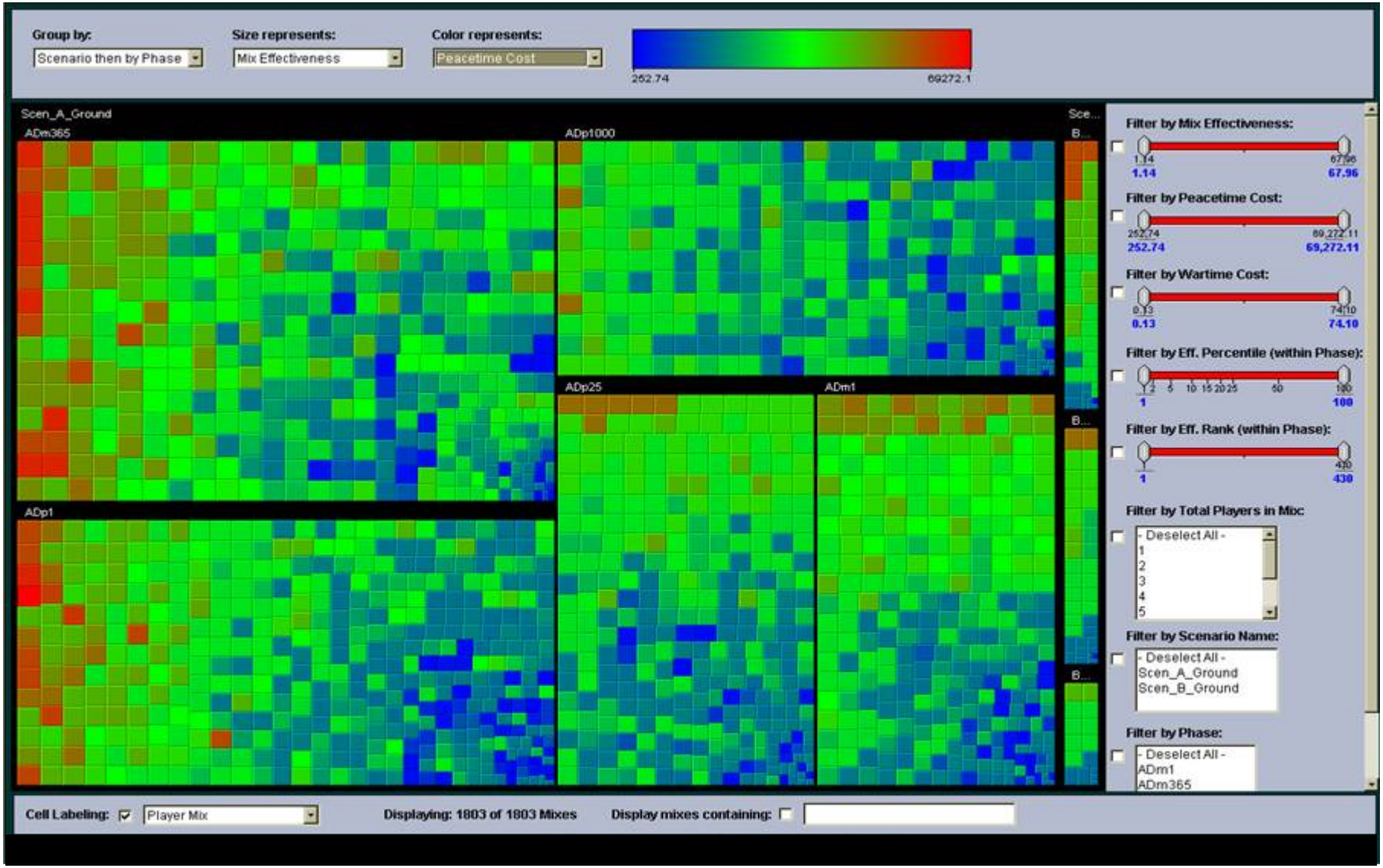
Cost Effectiveness

1 Satellite_A; 1 Satellite_B; 3 VehA; 1 VehB

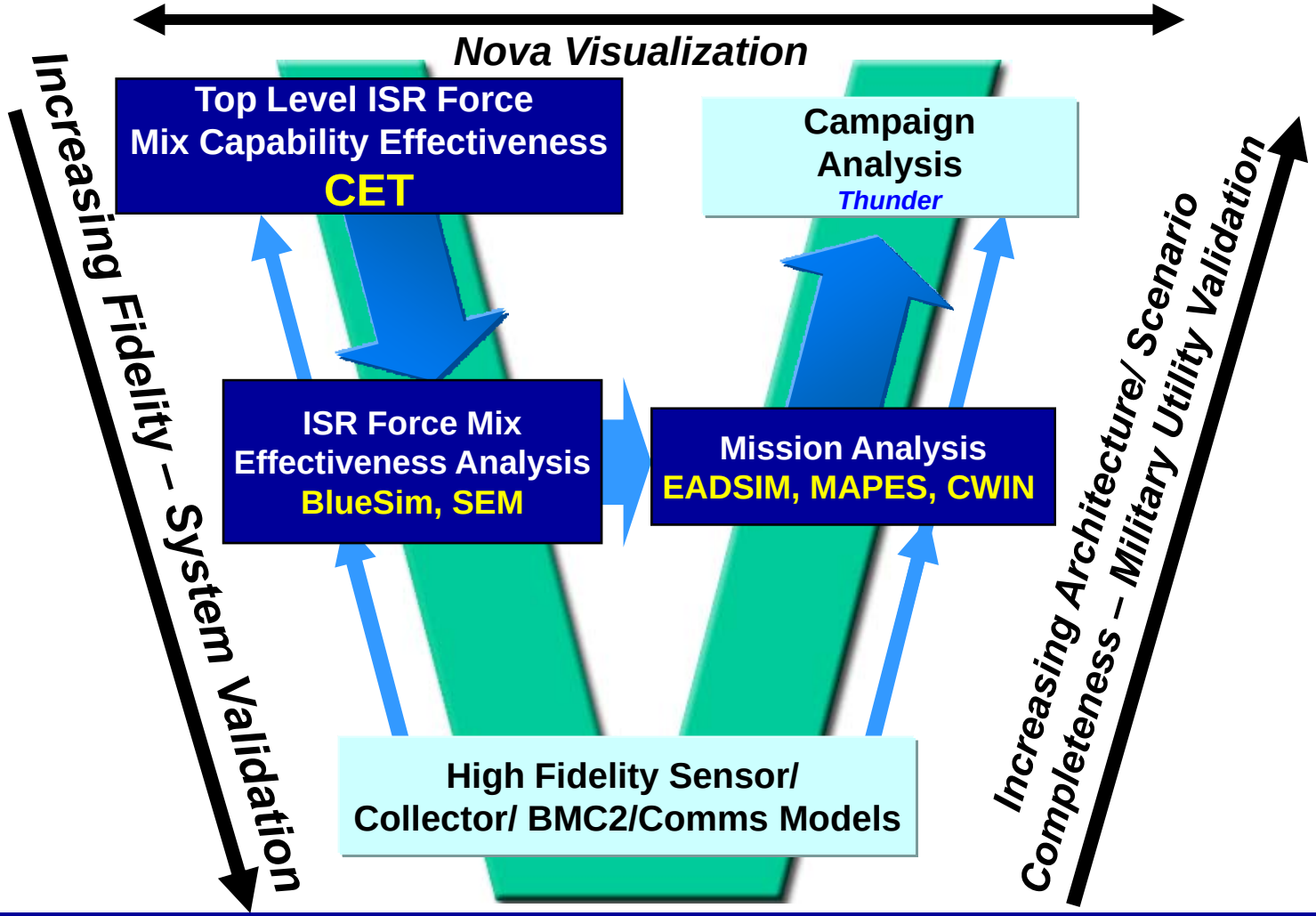


Label	Spectrum	Requirement
O1	EO	EO_GEO_LOC_ACCURACY
O2		EO_NIIRS
O3		HAS_EO
O4		PLATFORM_REVISIT
G1	GMTI	GMTI_DETECTIONS
G2		GMTI_ELECTRONICALLY_SCANNED_ARRAY
G3		GMTI_GEO_LOC_ACCURACY
G4		GMTI_LONG_TERM_TRACKS
G5		GMTI_MIN_DETECTABLE_VELOCITY
G6		GMTI_MTI_HRR
G7		GMTI_NEAR_SIMO_MTI_HRR
G8		GMTI_NEAR_SIMO_SAR_GMTI
G9		GMTI_RESOLUTION
G10		GMTI_SENSOR_ONLY_REVISIT_RATE
G11		HAS_GMTI
G12		PLATFORM_REVISIT
G13		
N1	IR	HAS_IR
N2		IR_GEO_LOC_ACCURACY
N3		IR_NIIRS
N4		PLATFORM_REVISIT
R1	SAR	HAS_SAR
R2		PLATFORM_REVISIT
R3		SAR_ELECTRONICALLY_SCANNED_ARRAY
R4		SAR_GEO_LOC_ACCURACY
R5		SAR_RESOLUTION
R6		SAR_SIMO_SAR_GMTI
S1	SIGINT	HAS_SIGINT
S2		PLATFORM_REVISIT
S3		SIGINT_COMINT_GEO_LOC_ACCURACY
S4		SIGINT_COMMERCIAL_COMINT
S5		SIGINT_CONVENTIONAL_COMINT
S6		SIGINT_DETECTIONS
S7		SIGINT_ELINT_AGILE
S8		SIGINT_ELINT_ANALYSIS
S9		SIGINT_ELINT_GEO_LOC_ACCURACY
S10		SIGINT_ELINT_SIMPLE
S11		SIGINT_FREQ_RANGE
S12		SIGINT_LPI
S13		SIGINT_MILITARY_COMINT
S14		SIGINT_UEE

Analyst Workbench



CET Results Feed Into Detailed Analysis



CET Does Not Optimize – It Assesses All Force Mixes to Feed Physics Based Analysis…

Force Structure Validation: CWIN, A Distributed/Collaborative Virtual M&S Enterprise

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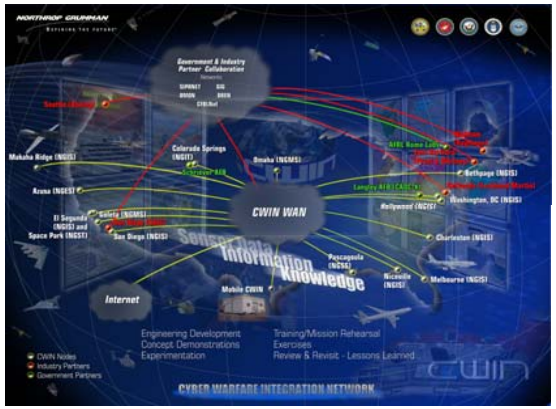
CWIN Washington Node
Rosslyn, VA

CWIN Western Region
El Segundo, CA

CWIN Eastern Region
Bethpage, NY



CWIN Western Region
Rancho Bernardo, CA

CWIN Eastern Region
Melbourne, FL

Deployable Mobile CWIN Services & Systems

Expanded CET Applications

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- CET has been adopted by USSTRATCOM
- Other CET applications under consideration:

DIA/STRATCOM Joint Functional Component Command ISR - Assessment Tool for Theater Apportionment

NRO: Integrating CET with Northrop Grumman Corporation ISR Test Bed Incorporate National Intel Priority Framework

J-2 and OSD: Capabilities Assessment Tool for Battlespace Awareness Functional Capabilities Board Program Objective Memorandum Decisions

USSTRATCOM: ISR Global Force Management/ Global Force Posture

Summary

- Means to rapidly identify high potential solutions within a large problem set
- Provides understanding of the contribution of each potential element
- Provides understanding of the capability gaps
- Effective use of analyst time and simulation resources

Structured, traceable process providing the means to support LISR force structure architecture studies:

Stand-alone and as a lead-in to detailed work

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