



Discoverer II: Global Precision Surveillance

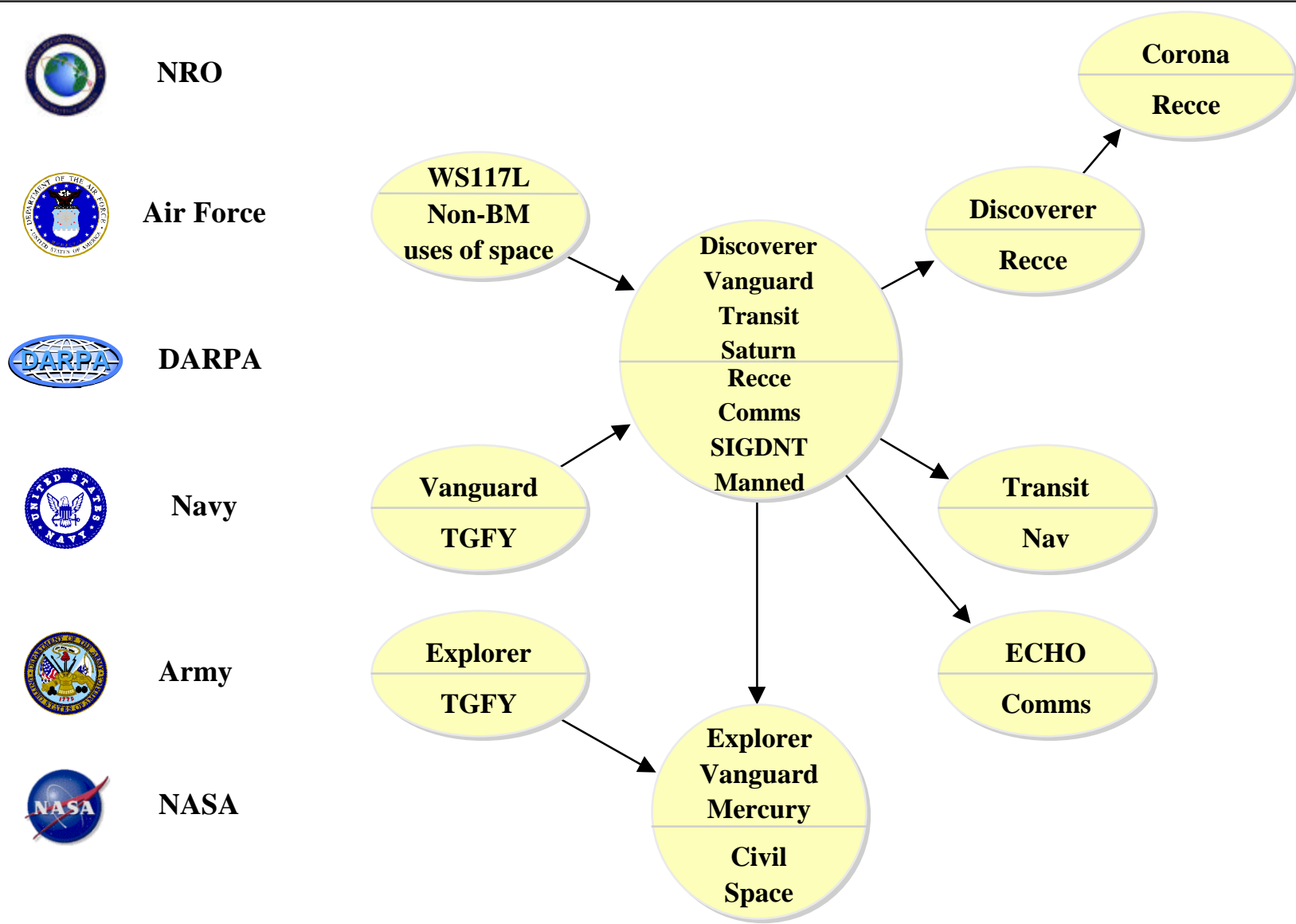
Industry Day Briefing

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DARPA's Space Legacy



-  NRO
-  Air Force
-  DARPA
-  Navy
-  Army
-  NASA

Paradigm Shifts Enabled by Emerging Information Technologies



- **Space-based surveillance**
- **NRT targeting**
- **Global precision DTED**
- **Direct theater control**

A warfighter system designed from the ground-up

Dominant Awareness Problem Statement



■ Warfighter Needs:

— Day/night, all-weather surveillance



Radar [GMTI \hat{U} SAR]

— The right information, at the right time, disseminated to the right user



Theater Control

— Deep, theater-wide, assured access



Space-Based

— “Birth-to-death” tracking to counter “shoot-and-scoot”

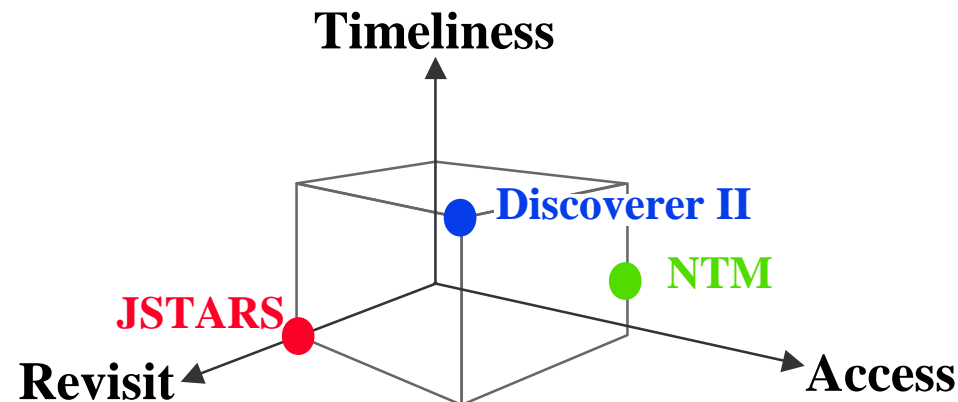


Near-Continuous Dwell

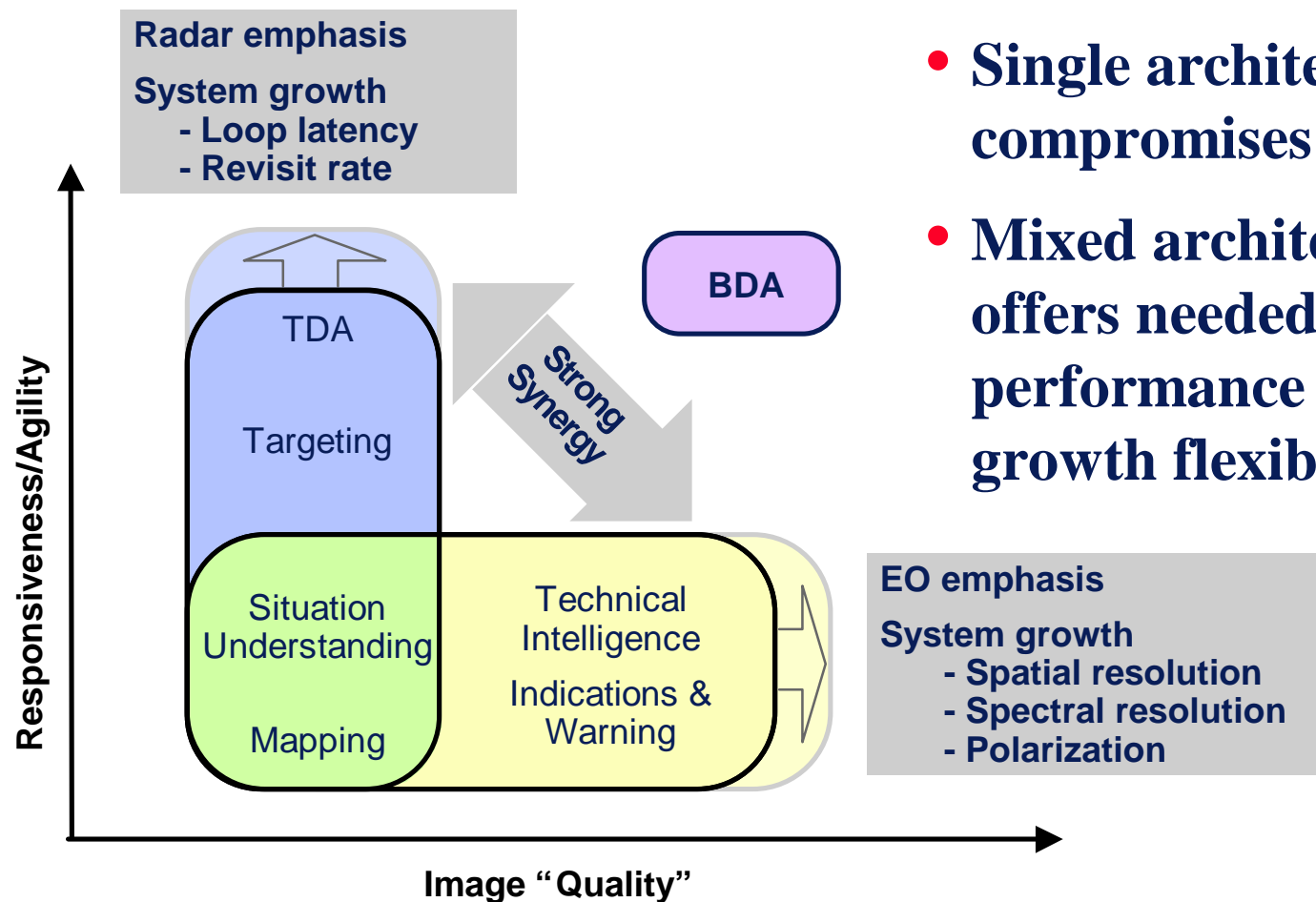
— Elevation accurate to ~1 meter for visualization and precision guided munitions targeting



Digital Terrain Elevation Data (DTED) Level 4-5



Needs Best Addressed By a National Information Architecture (NIA)



- **Overlapping needs**
- **Single architecture compromises both**
- **Mixed architecture offers needed performance plus growth flexibility**

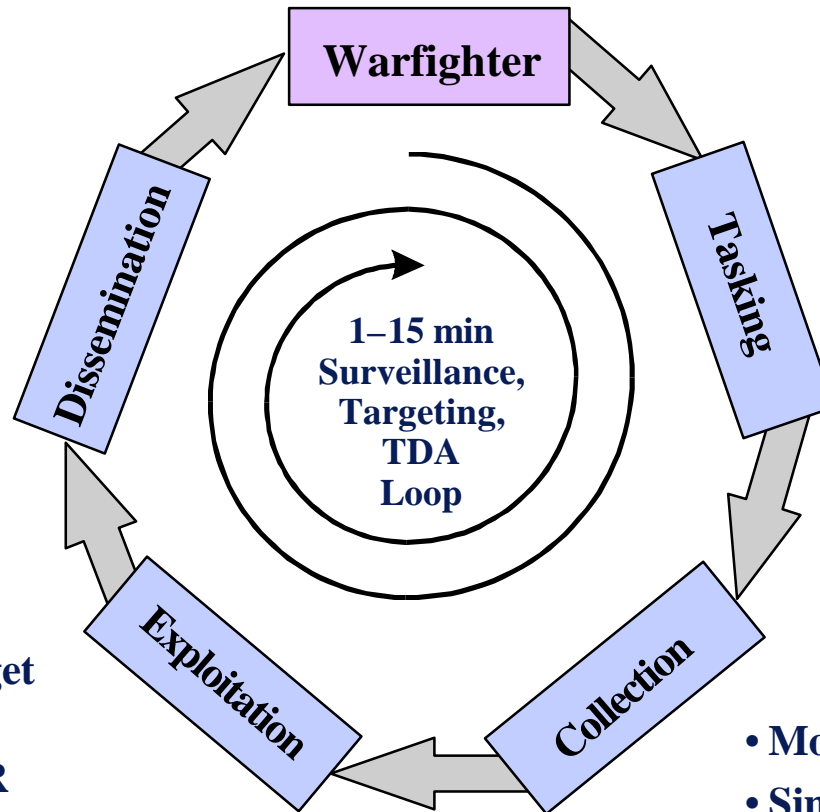
Next-Generation Rapid Targeting



Commander/user in charge

- Common battlespace picture
- Wideband/low latency

Current: verbal - and message-based pull, many bottlenecks
Goal: smart-profile-based push, where needed



- Distributed dynamic multi-asset tasking
- Synchronization of operations and RSTA
- Rapid/low latency

Current: hours
Goal: minutes, dynamic, multiple echelons, automated

- Moving & stationary target exploitation
- Automated GMTI & SAR classification tools
- Recognize force structure
- Rapid report generation

Current: hours to a day
Goal: minutes, dynamic database, semi-automated

- Moving & stationary targets
- Simultaneous SAR/GMTI
- SAR targeting & TDA
- Precision geolocation

Design Philosophy

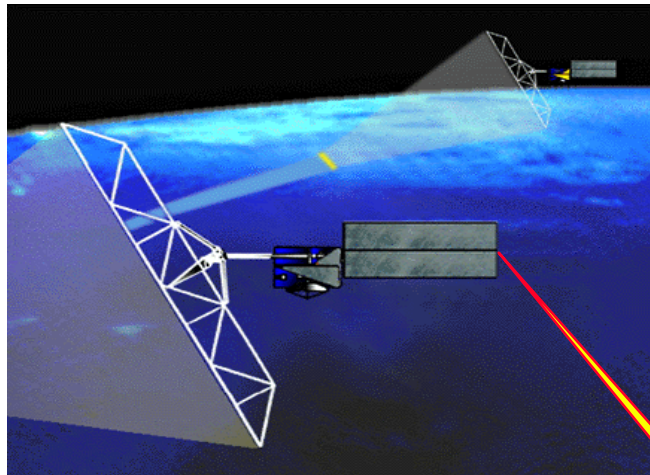


- **Enable future force characteristics**
 - Rapid response
 - Extended reach
 - Precision global strike
 - Sustained operations
 - Lean forces and support
 - Joint/coalition operations

- **Operate in concert with other elements of national security**

- **Capitalize on Allied strengths**
 - Commercial capabilities and know-how
 - High-tech edge

Discoverer II System Concept

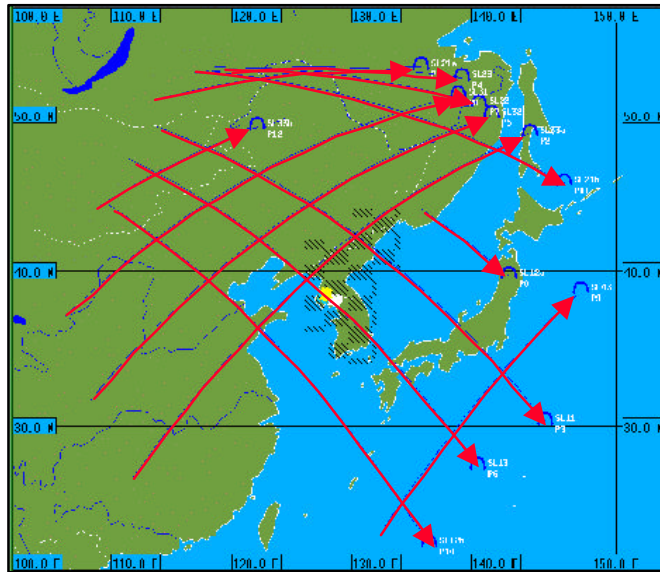


- Large constellation of LEO satellites (24 – 48)
- Leverage ground/surface infrastructure (CIG/SS compliant CARS/ETRAC)
- Employ commercial practices (Iridium, Global Star, etc.)
- Minimal manning in theater and CONUS
- \$100M/bird
- Allied participation

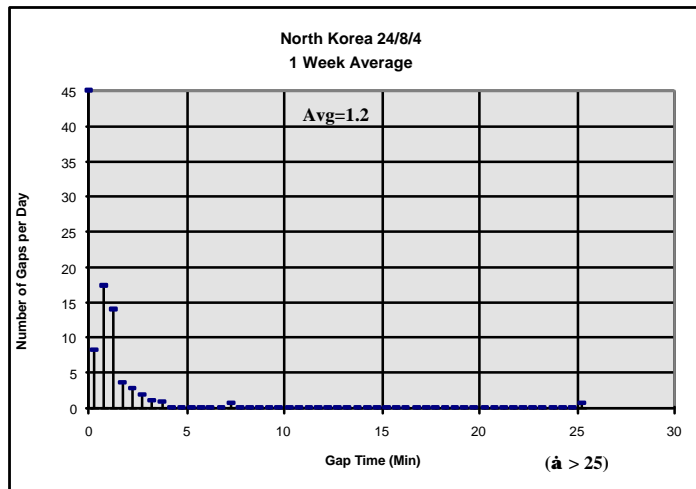
- Theater-wide access
- Day/night, all weather
- Near-continuous surveillance
- Global precision targeting
- High-resolution SAR & moving target exploitation (HR-GMTI)
- Direct theater tasking/downlink
- Worldwide precision DTED collection



Dense LEO Constellation Affords Highly Desired Performance



- **Angle diversity**
 - Mitigate terrain masking
 - Enhanced target recognition
 - Counter CC&D
 - Counter jam

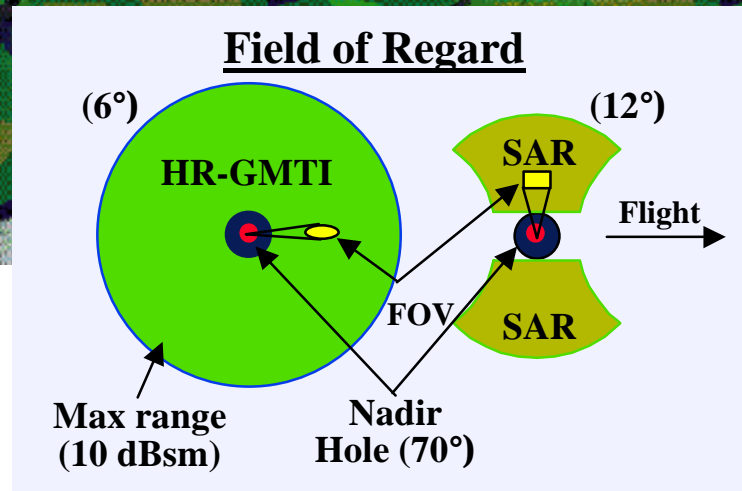
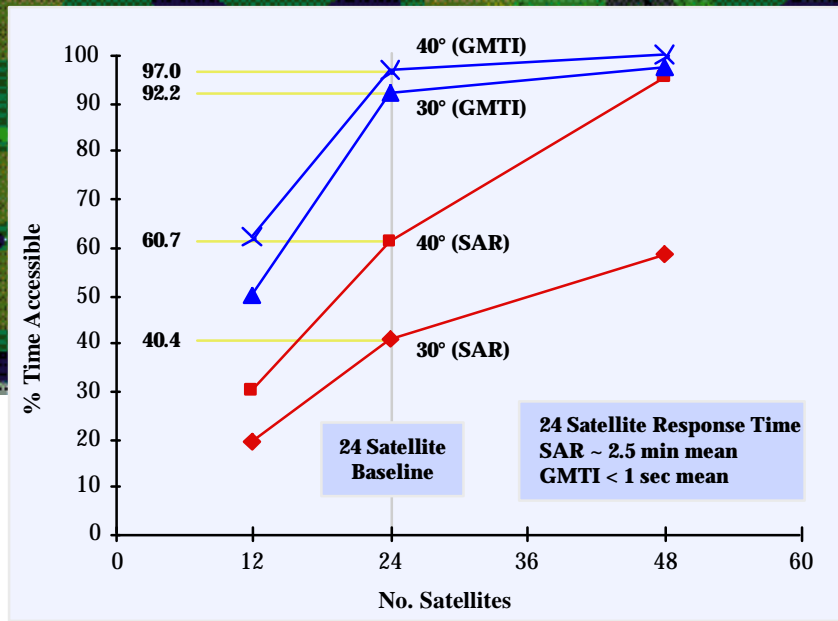
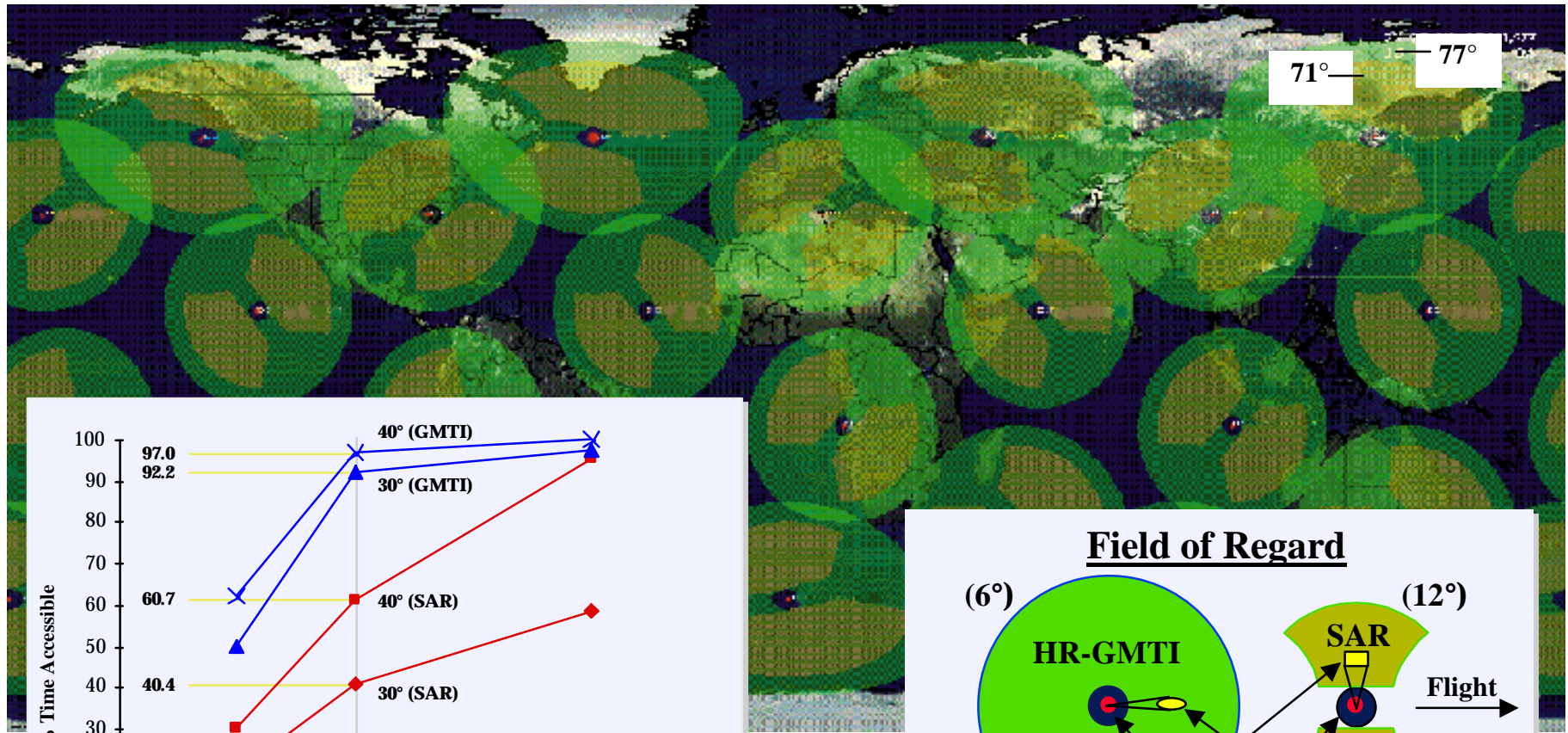


- **Near continuous coverage**
 - GMTI track association
 - Long-dwell imaging
 - Counter activity scheduling

GMTI/SAR Coverage



24 Satellite Coverage



HR-GMTI and SAR Collection Rates 24 Satellite Constellation



Iran
1,643,000 km²



Libya
1,757,000 km²



Iraq
435,000 km²



N. Korea
122,000 km²

- **HR-GMTI**
 - MDV = 4 kph, max V = 100 kph
 - 2,000,000 km²/hr — 600 km²/sec

- **STRIP SAR/GMTI**
 - 3-m IPR
 - 700,000 km²/hr

- **SCAN SAR**
 - 1-m IPR
 - 100,000 km²/hr

- **SPOT SAR**
 - 0.3-m IPR
 - 150 X 16 km²-areas/hr
 - 3,600 X 16 km²-areas/day

Mobile Ground Target Tracking



Features

- **Wide area search**
- **Near continuous coverage**
- **Target-feature extraction**
- **NRT information**
- **Cross-cuing with other collectors**

Capabilities

- **Birth to death tracking**
- **Situation understanding**
- **Counter CC&D**
- **Agile targeting**

Why Digital Terrain Elevation Data?



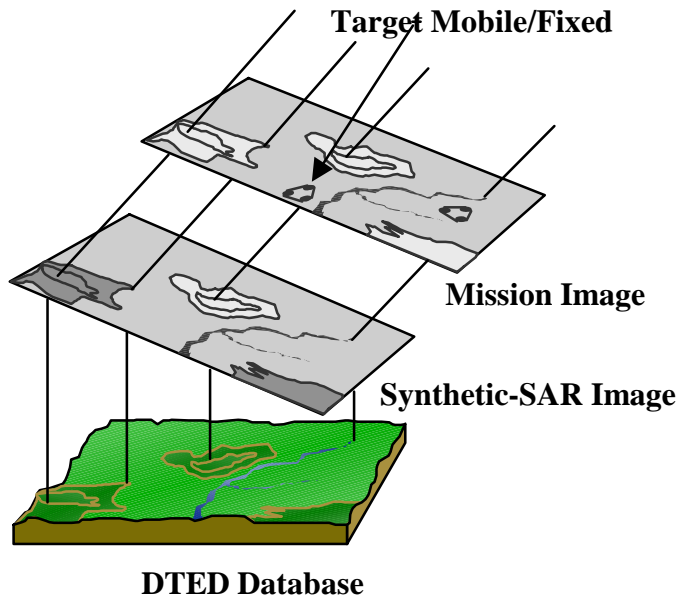
DTED Accuracy Requirements

DTED Level	Post Spacing (approx) (m)	CE (absolute)* (m)	LE (absolute)* (m)	CE (relative)* (m)	LE (relative)* (m)	Current Global Coverage
1	100	50/25	30/10	¼ / 15	¾ / 10	60%
2	30	50/15	30/10	¼ / 10	¾ / 7	5%
3	10	10	10	3	2	Bosnia
4	3	10	5	2	0.8	¼
5	1	5	5	0.5	0.33	¼

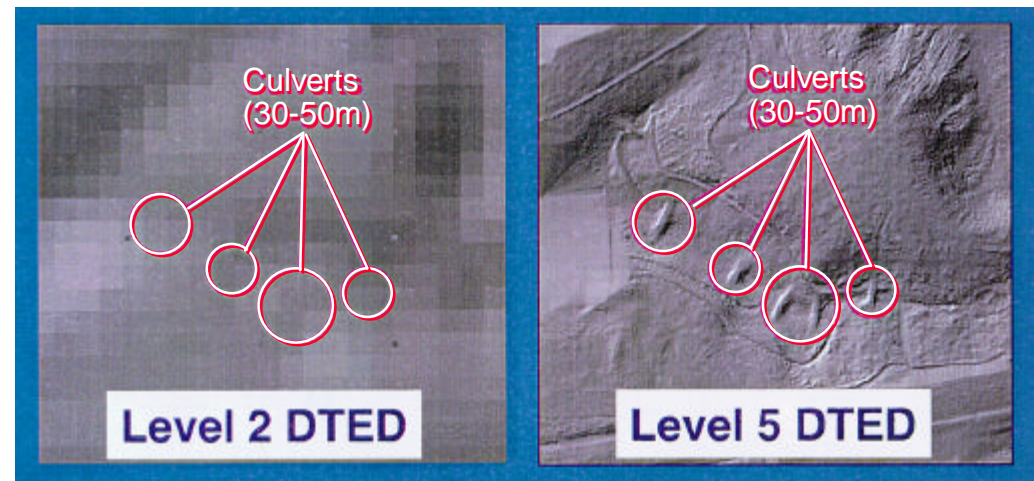
Timeliness (DTED 3, 4, 5)

Area (km ²)	Hours
20 x 20	18
90 x 90	72 (3 days)
300 x 300	288 (12 days)

* x/y : Current requirement/Evolving Requirement



Battlefield Visualization

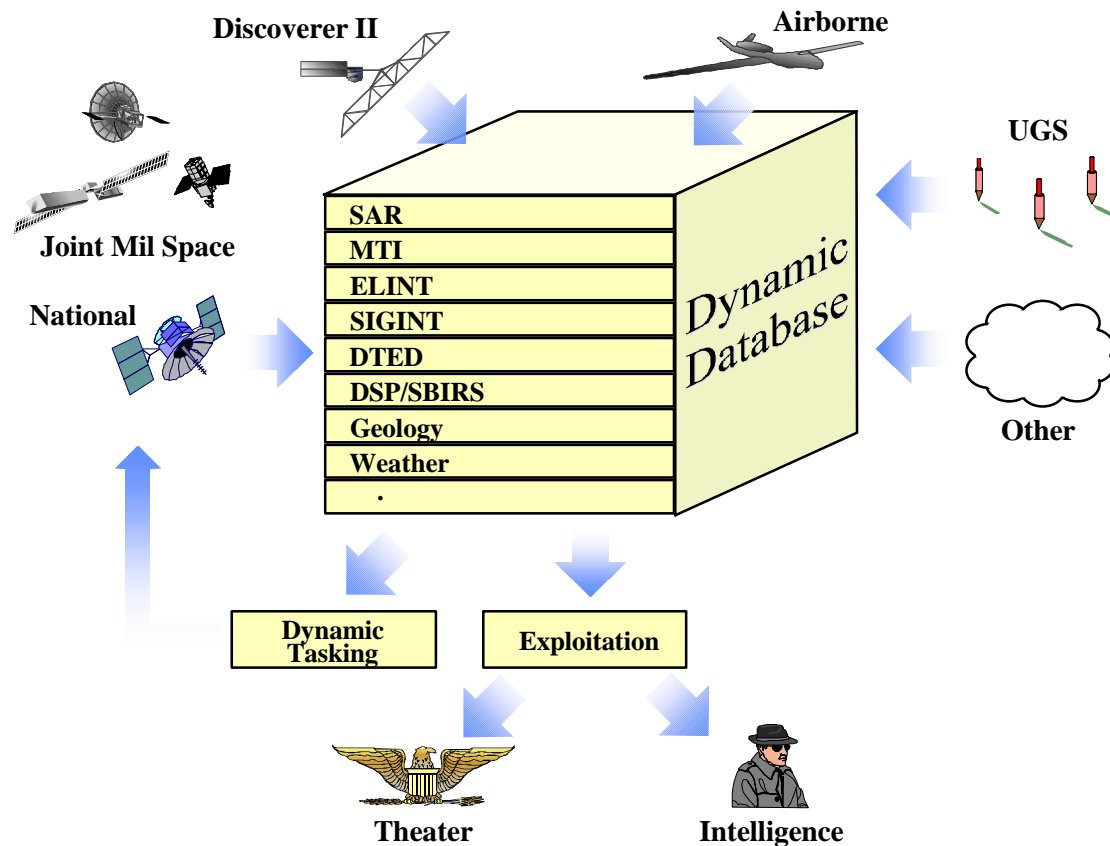


Why Direct To Theater?



- **Understand enemy deployment and dynamics in detail — responsive to tactics and mobility**
- **Target precisely and rapidly — decisive action whenever required**
- **Track from birth to death — continuous operation from peacetime through wartime**
- **Enable increased ops tempo**

Space-Time Dynamic Targeting

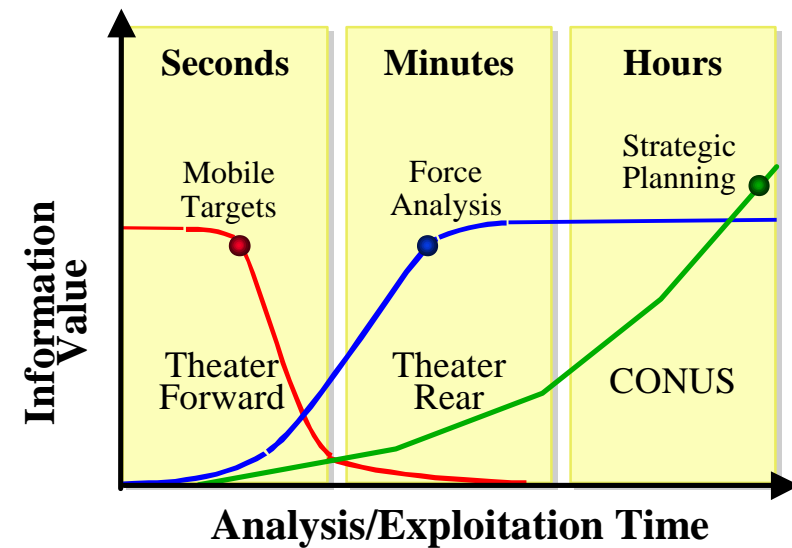
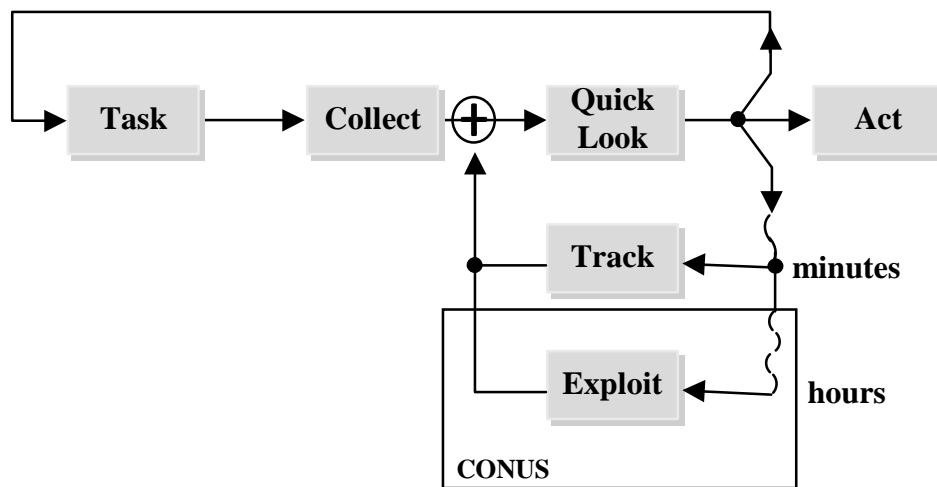


- Comprehensive dynamic database
- Search agents/data mining
- Anomaly detection
- Correlation detection
- Step toward situational understanding

A New Exploitation Concept: 3-Stage Pipeline with Feedback



	Stage 1	Stage 2	Stage 3
Location	Theater Forward	Theater Rear	CONUS
Emphasis	Quick Look	Track	Exploit
Time Frame	Seconds	Minutes	Hours

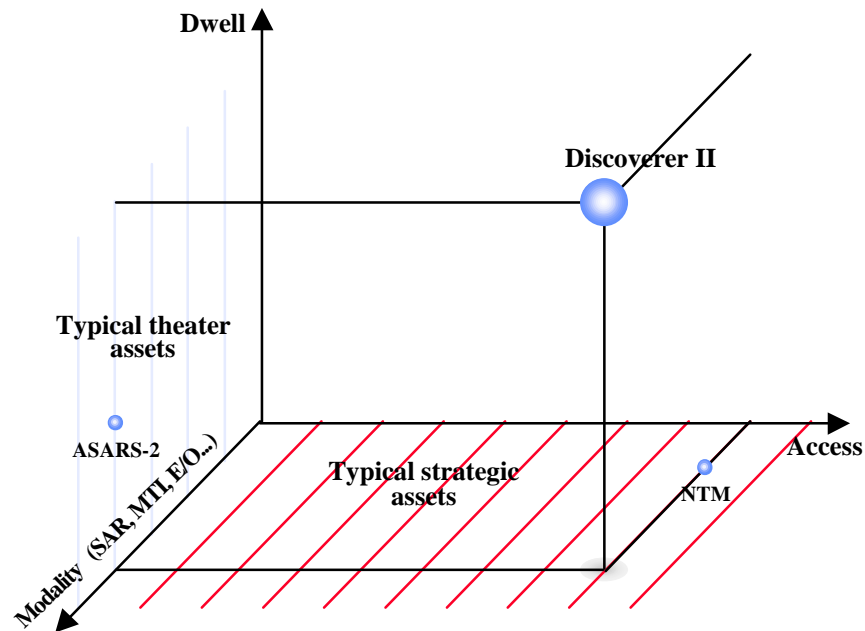


CINCs Maintain Operational Priority



- **Peacetime** — shared use with emphasis on stage 2 and 3 exploitation — populate DDB
- **Pre-hostilities** — greater emphasis given to relevant CINC's — Buildup precision DTED
- **Wartime** — controlling emphasis given to relevant Theater Commander(s) — continuous surveillance and near real-time targeting

Enabling New Sources and Methods



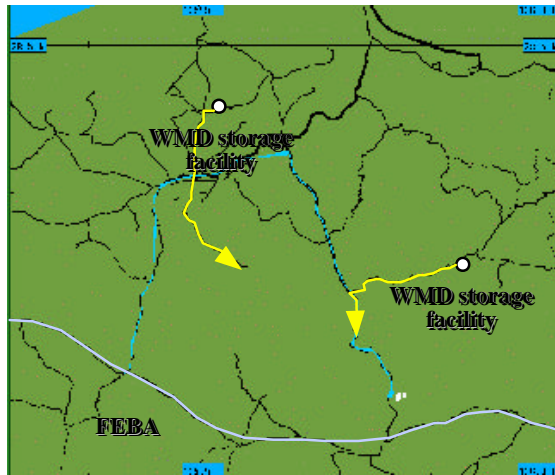
- Theater-wide near-continuous dwell
- Breadth of available mode selection:
 - High rate HR-GMTI 3M SAR/GMTI 0.3M SAR
- Rapid revisit of widely separated regions
- High coverage rates, rapid angle diversity
- First warfighter control of a theater wide, near instant observation asset for battlefield awareness and precision targeting
- Rapid high quality DTED generation
- NRT exploitation and dynamic retasking

Unique attributes lead to new and enhanced warfighter capability

New Capabilities

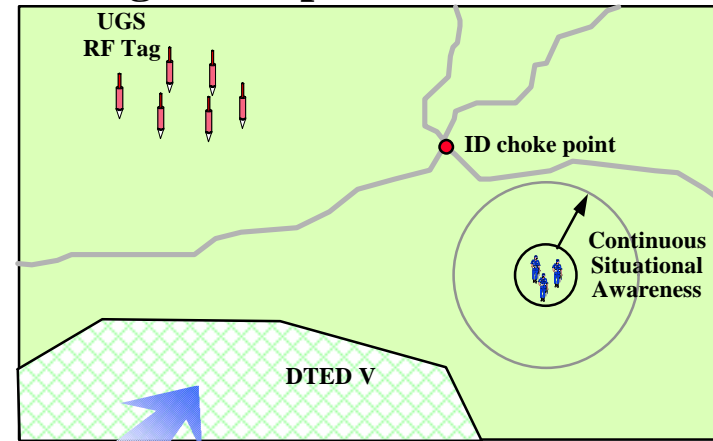


Indications & Warning

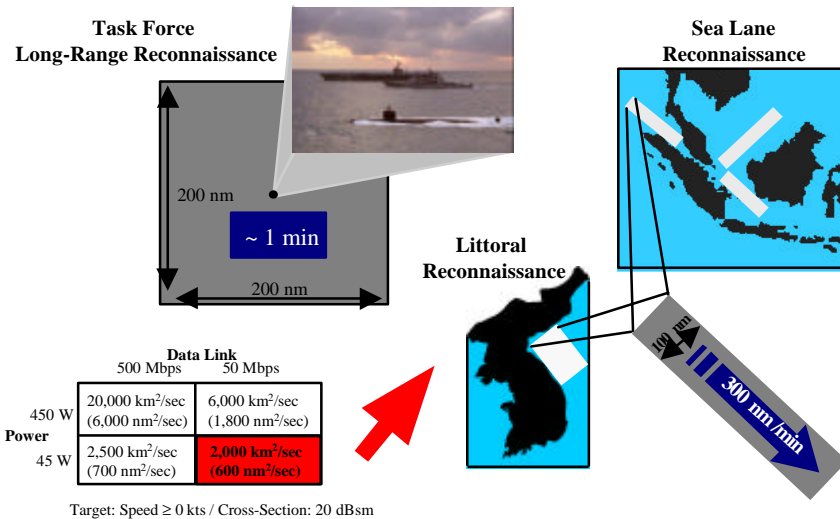


- Trigger on movement anomalous compared to baseline
- Track convoys moving WMD to the border

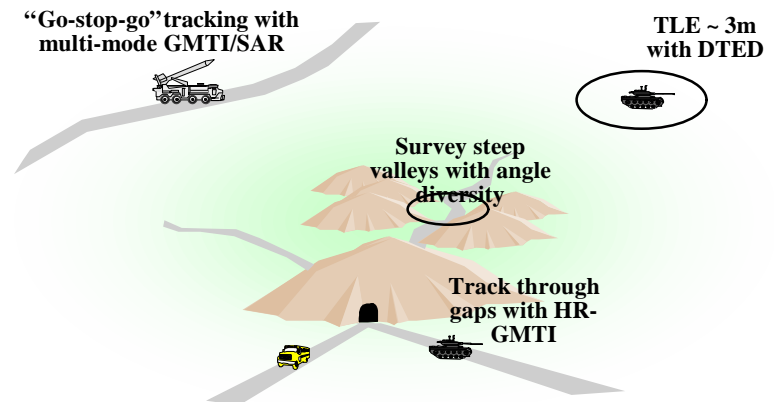
Intelligent Preparation of Battlefield



Ocean Reconnaissance



Precision Engagement



Discoverer II Presents Opportunities, e.g., Combining ESM With SAR/GMTI

