Future Combat Systems

An Army ($509 m)-DARPA ($406 m) Program '01 thru '05

- System of systems
- Not "platform-centric" but "collaborative"
- Two thrust-lines: (1) industry; (2) DARPA
- Early M&S, then field experiments
- 5 DARPA system-components: AFSS, A-160, DRaFT, IUGS and CPOF

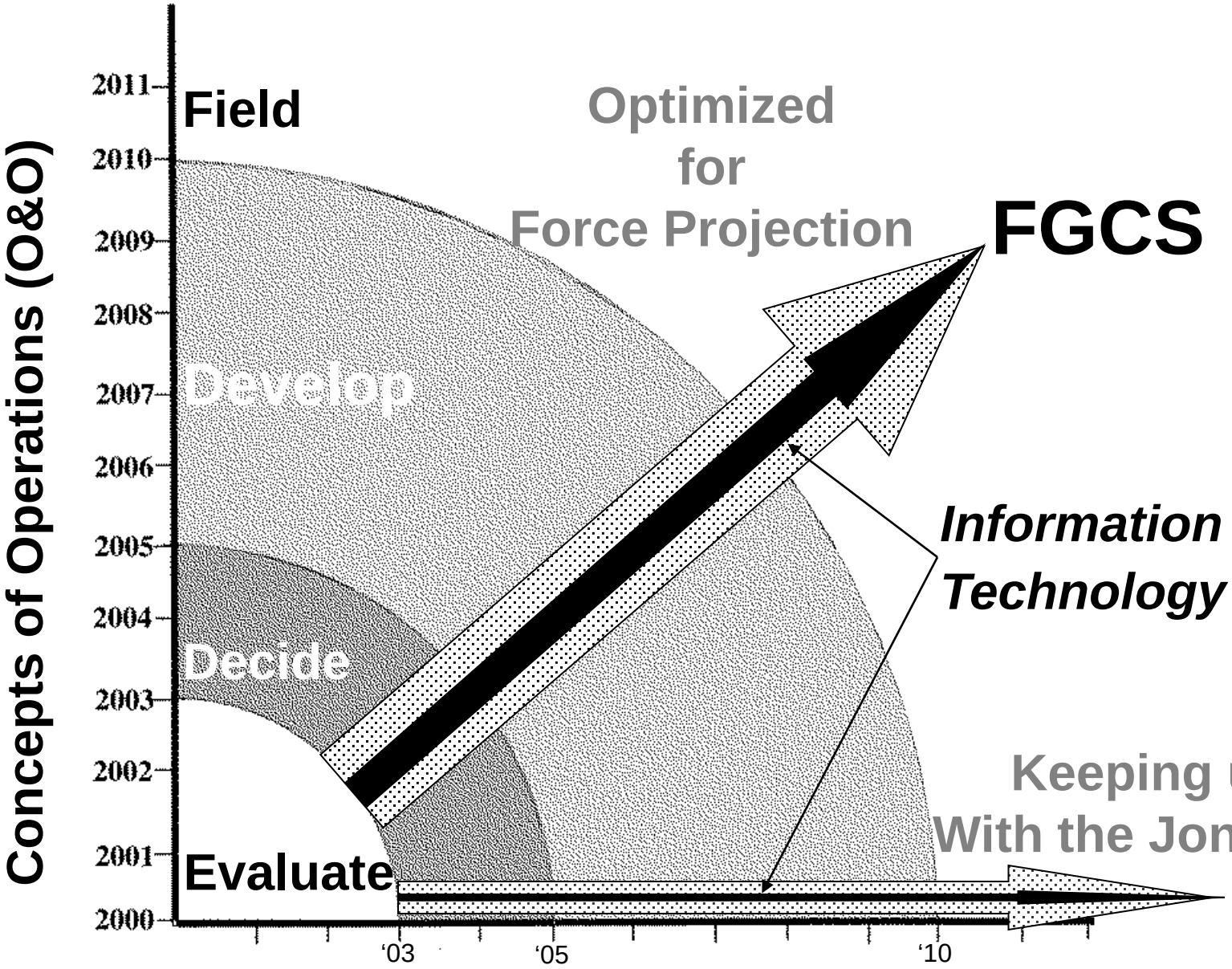
SENIOR ADVISORY GROUP (JUN- SEP 99)

TOR:

- **—Explore innovative technology solutions**
- **—Enable Army to achieve vision of lightweight, lethal, survivable, multi-mission ground combat forces**
- **— Help DARPA and Army determine course of action leading to development of truly innovative future combat systems**

SAG: 2 former Dir DARPA; 3 ASB/DSB; 5 Gen(R)

Toward the Army After 2010



CONOPS (O&O) Enablers

● **Distributed, integrated force of teams with a mix of manned and unmanned systems, light (flattened structure, extensive reach-back, automation, low-weight vehicles, high fuel efficiency), lethal (precision munitions and effective suppressive ordnance), and survivable (teamwork and interactive protective systems).**

● **Organic RSTA at every echelon linked directly to weapons, particularly those enabling engagement beyond line of sight. This must include provision for highly mobile C2, and for elimination of forward TOCs and FDCs.**

● **Highly-automated, self-actualizing C3 system that assures situational understanding and prompt execution of tactical decisions.**

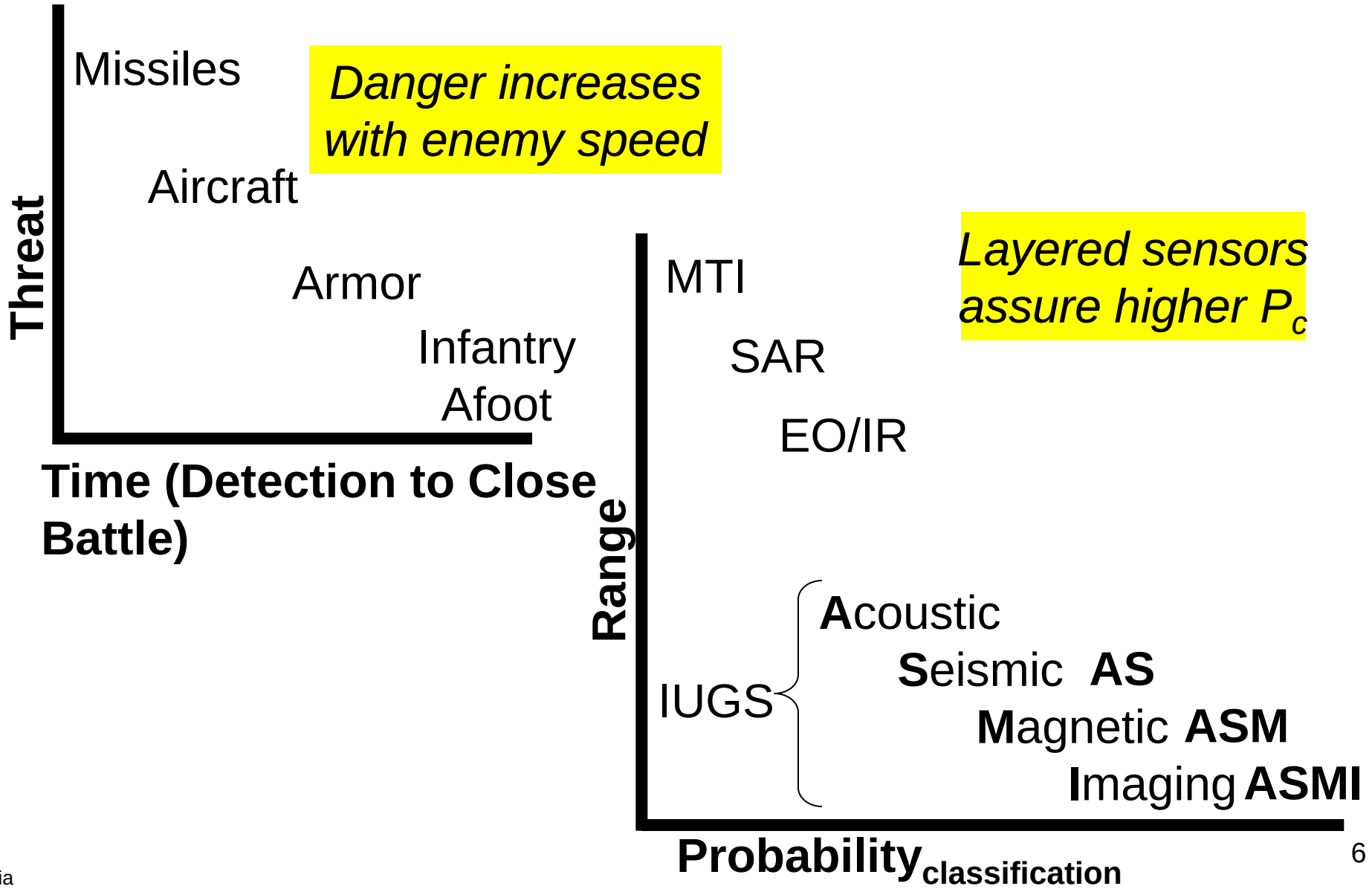
● **Configured for airmobility: moving overseas using commercial transmodal equipment and civil air freighters, and able to be deployed and sustained within the theater by C-130 (or comparable airlifters).**

● **Punch and endurance beyond that of today's heavy-force, capable of forcing entry and of gaining and maintaining operational and tactical initiative.**

Toward New Team CONOPS (O&O)

	2000	post 2010
Force Structure	“heavy” or “light”	combined arms
Organization	hierarchical	networked
Construct	duel; overmatch	win at extended range
OPTEMPO	diurnal spikes	relentless
Venue	mono-plane	3-dimensional
Close Battle RSTA	“higher”+ eyes	RSTA layered
Indirect Fires	latency	linked sensor-shooter
Manpower	intensive	robot-assisted
AFV	crew + platform	network with robots
C3	TOC	distributed, automated
Mobility: strategic **Mobility: tactical**	DoD lift; RSOI control zone secure LOC	all lift; fight on arrival; control enemy CGs; mass effects; sustain from the air

Sensor-Derived Info



Capabilities Year 2000

IDA Assessment of Current Sensors

Contribution to Force Effectiveness

Sensor System	Detect Locate			ID, Track, Cue, Fuse/Alert			Enable Fires &/or Maneuver		
	Div+	Bde	Bn	Div+	Bde	Bn	Div+	Bde	Bn
JSTARS	5-2*	5-2*	0	3	3	0	2	2	0
DISCOVR II	5-2*	5-2*	0	3	0	0	2	0	0
PREDAT0R	5-2*	5-2*	0	2	2	0	1	1	0
GL0B HAWK	4	0	0	2	0	0	1	0	0
Tactical UAV	1	5-2*	2	3	3	1	2	0	1
UGS	0	0	2	1	2	2	0	0	2

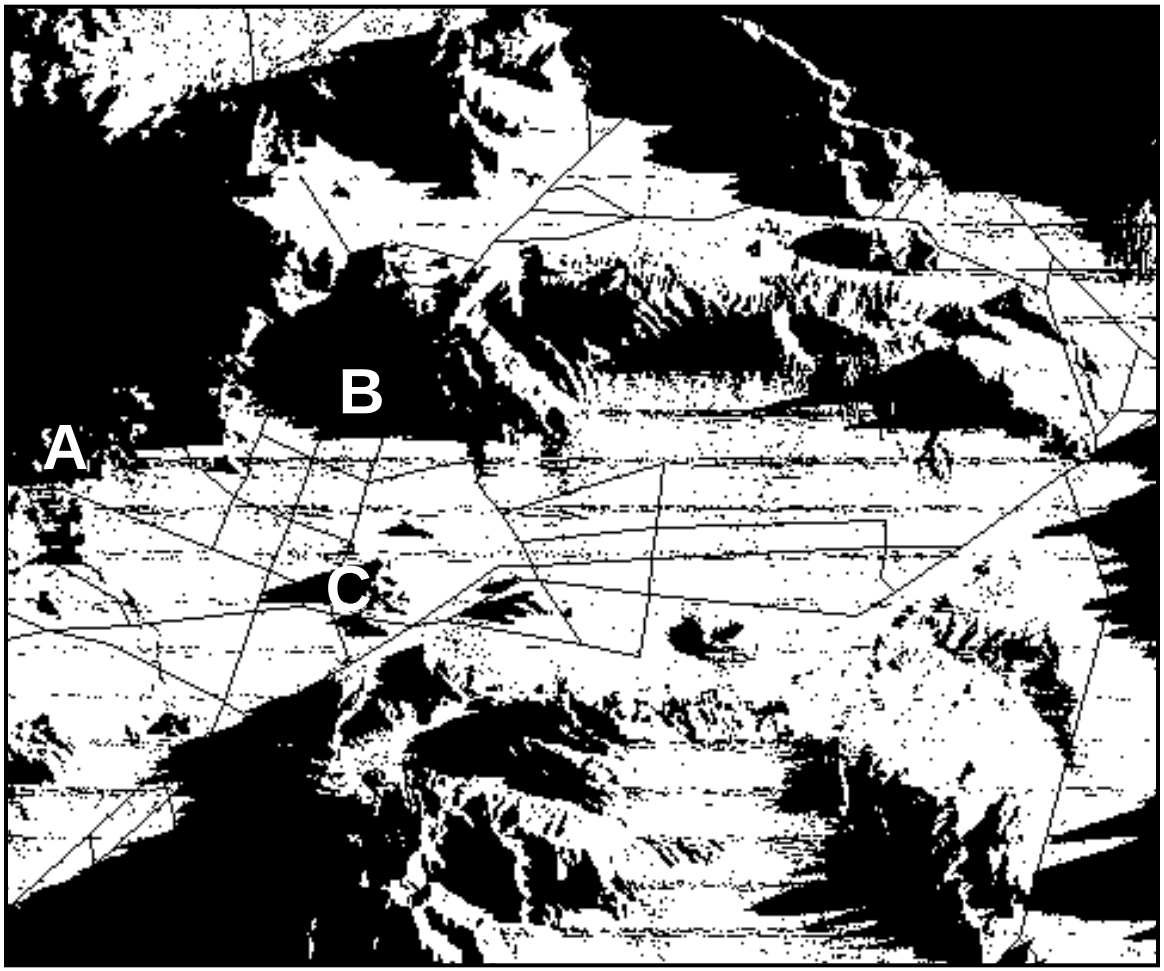
0= No Contribution; 5=Significant Contribution

*** Situationally dependent**

Close Battle is the Payoff

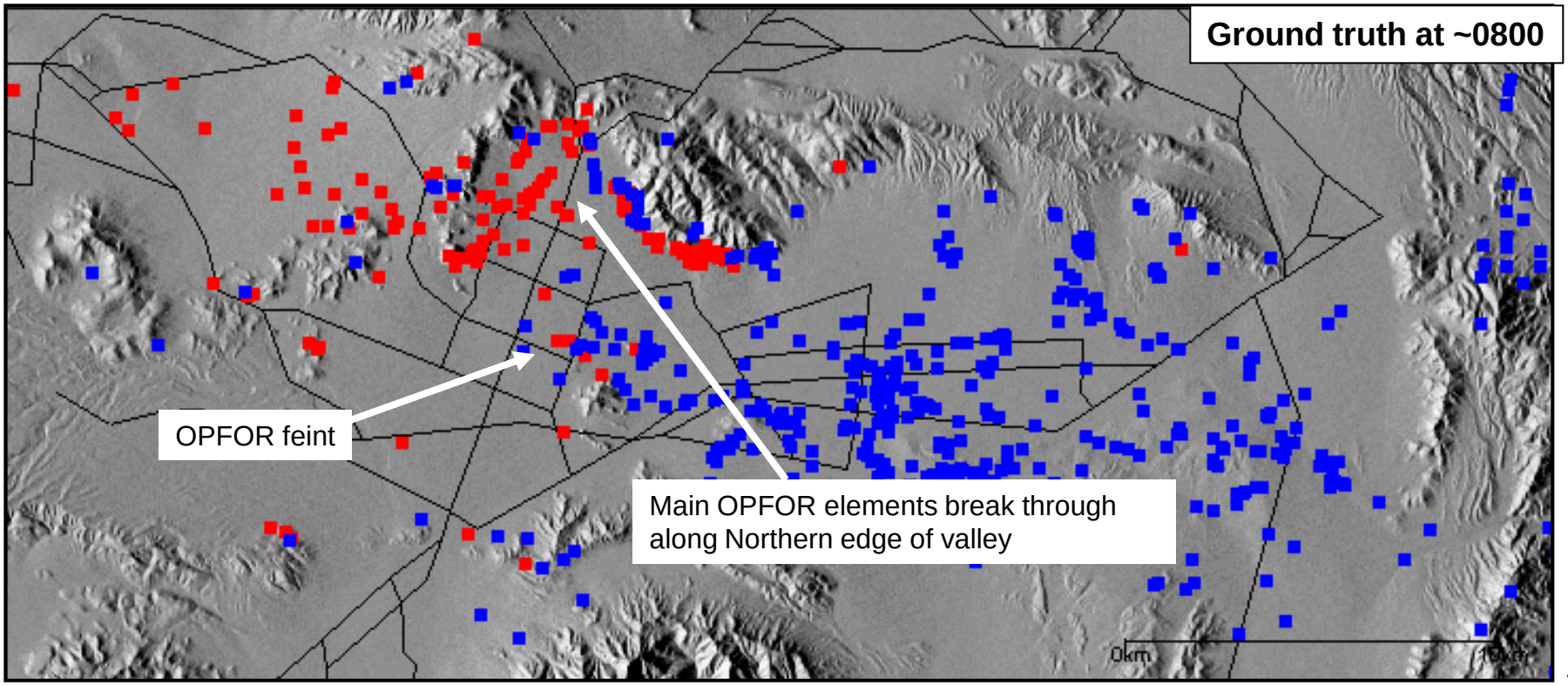
- Target acquisition (TA) for those in close battle is now largely based on (1) eyeballs and oral reports, (2) intel from the rear
- DARPA TTO recently analyzed problem. Method was to examine ground-truth data from Task Force XXI AWE (March 1997) [data from TRAC WSMR]:
  - Successful Red envelopment of Blue due to poor SA
  - Predicated on instrumented histories re behaviors of vehicle types
  - Replay script of AWE maneuvers in Toyon's SLAMEM model
    - Against standoff GMTI radar (JSTARS)
    - Against IUGS fields projected into in key corridors and blind zones
  - Assume IUGS fields communicate directly through battalion's **organic** ground-based air and surface GMTI radars
  - Employ statistics of target detections for analyses

Terrain Masking of JSTARS at NTC



Hypothesis: Blue Needed Organic Sensors

- Red envelops N flank because of flawed Blue Situational Awareness
- Blue battalion could have defeated Red with better SA from from IUGS, and an MTI system of its own, with DRaFT on Blue AFV



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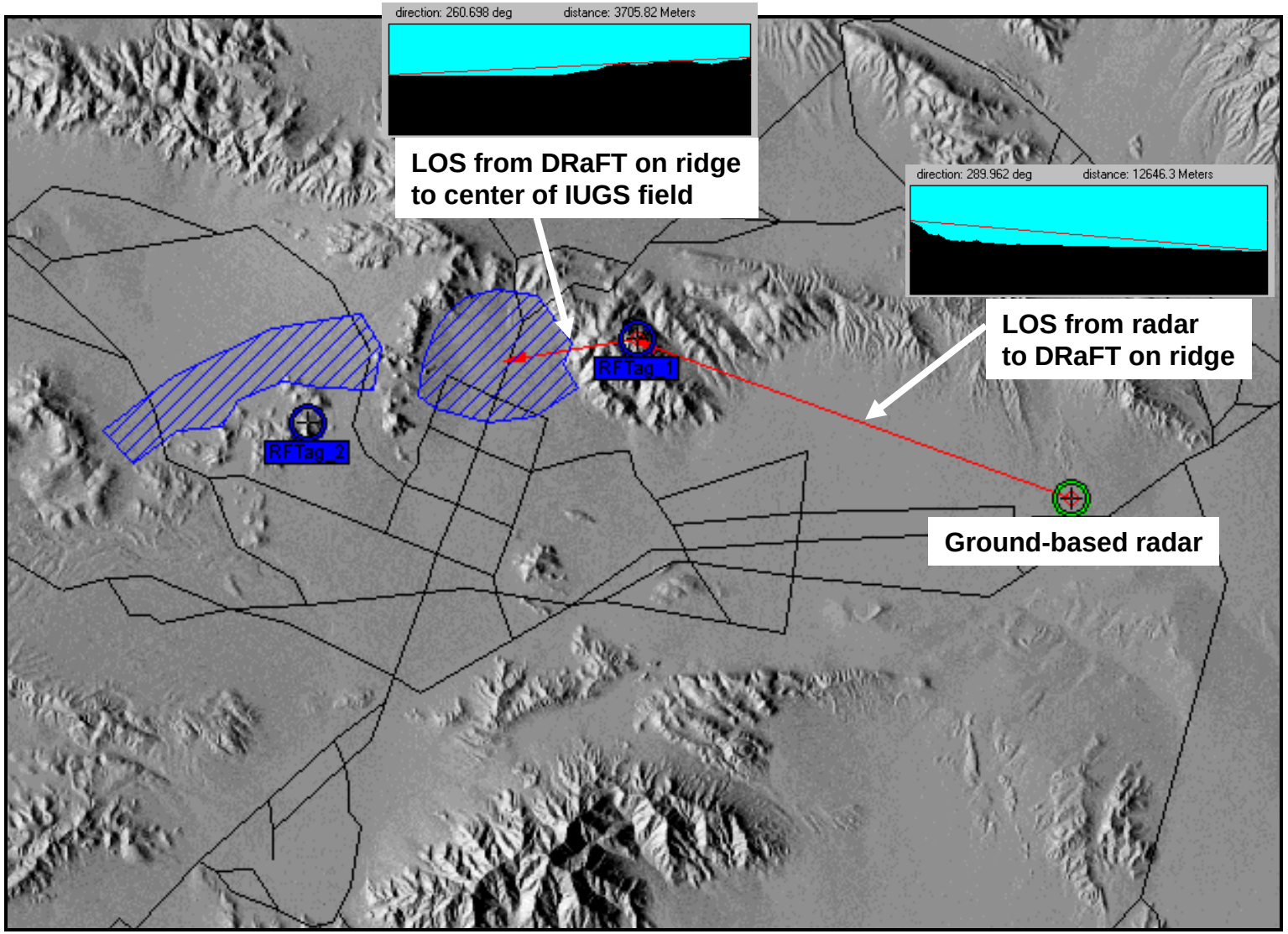
IUGS, DRaFT Simulated w/ 97 AWE Data



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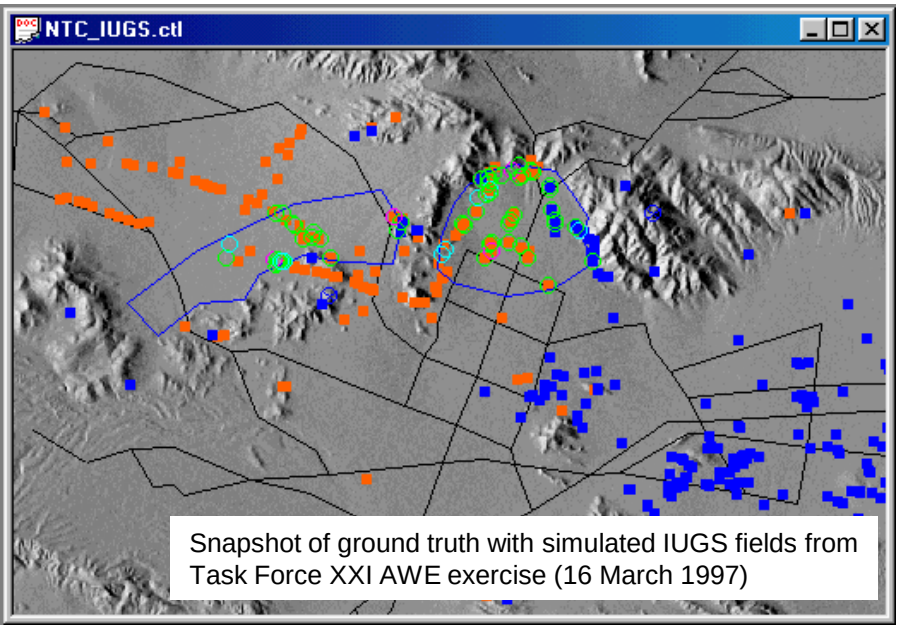
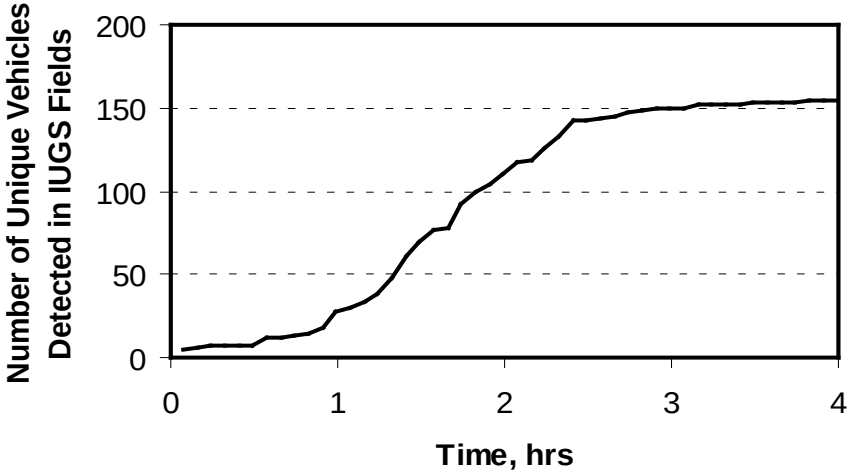
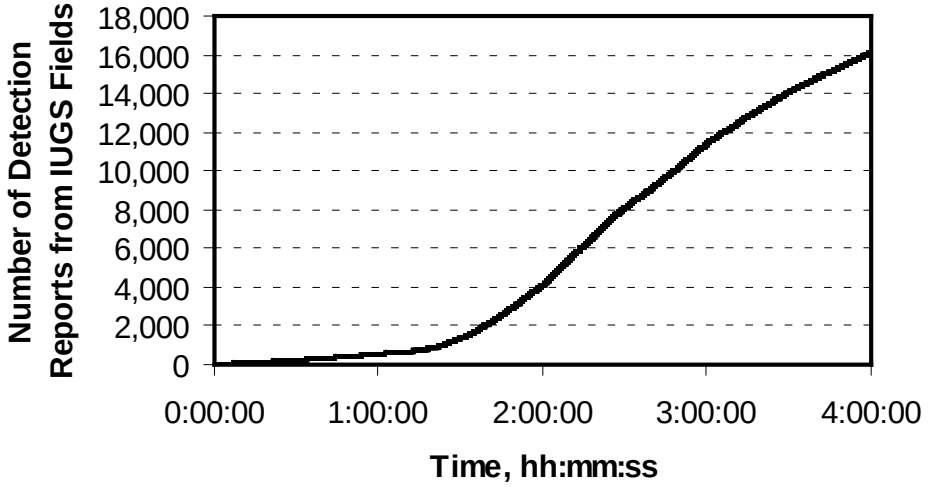
Radar-read IUGS Can Plot Red AFV



Snapshot of ground truth with simulated IUGS fields from Task Force XXI AWE exercise (16 March 1997)

IUGS linked by DRaFT to battalion radar(s) provide Red awareness not available from theater-level sensors



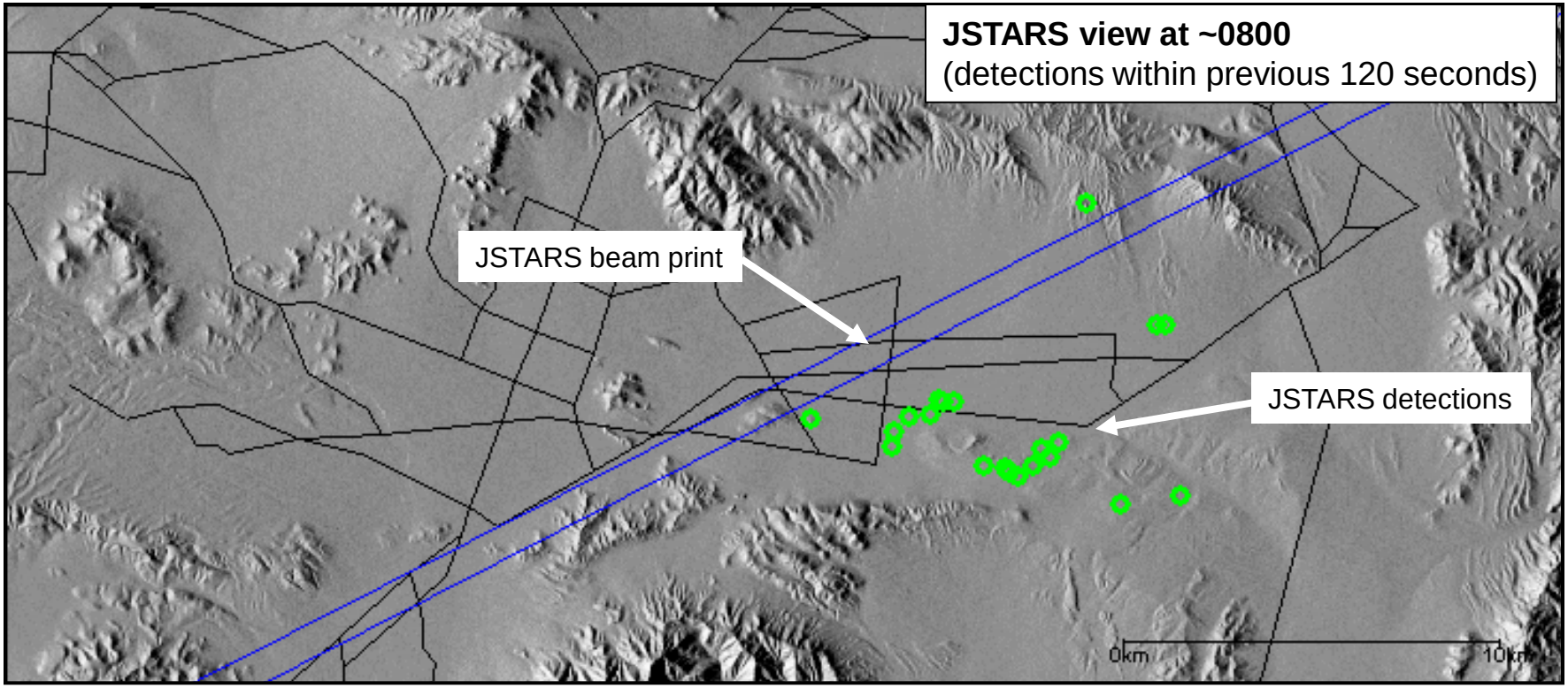


Assumes 30 second updates for detected targets in IUGS fields

Theater-level MTI Limited to Macro-detail

Negligible contribution to Blue situational awareness

- Can only detect movers in MTI mode
- Majority of movers are masked by terrain
- Cannot distinguish Blue from Red
- Information has significant latencies



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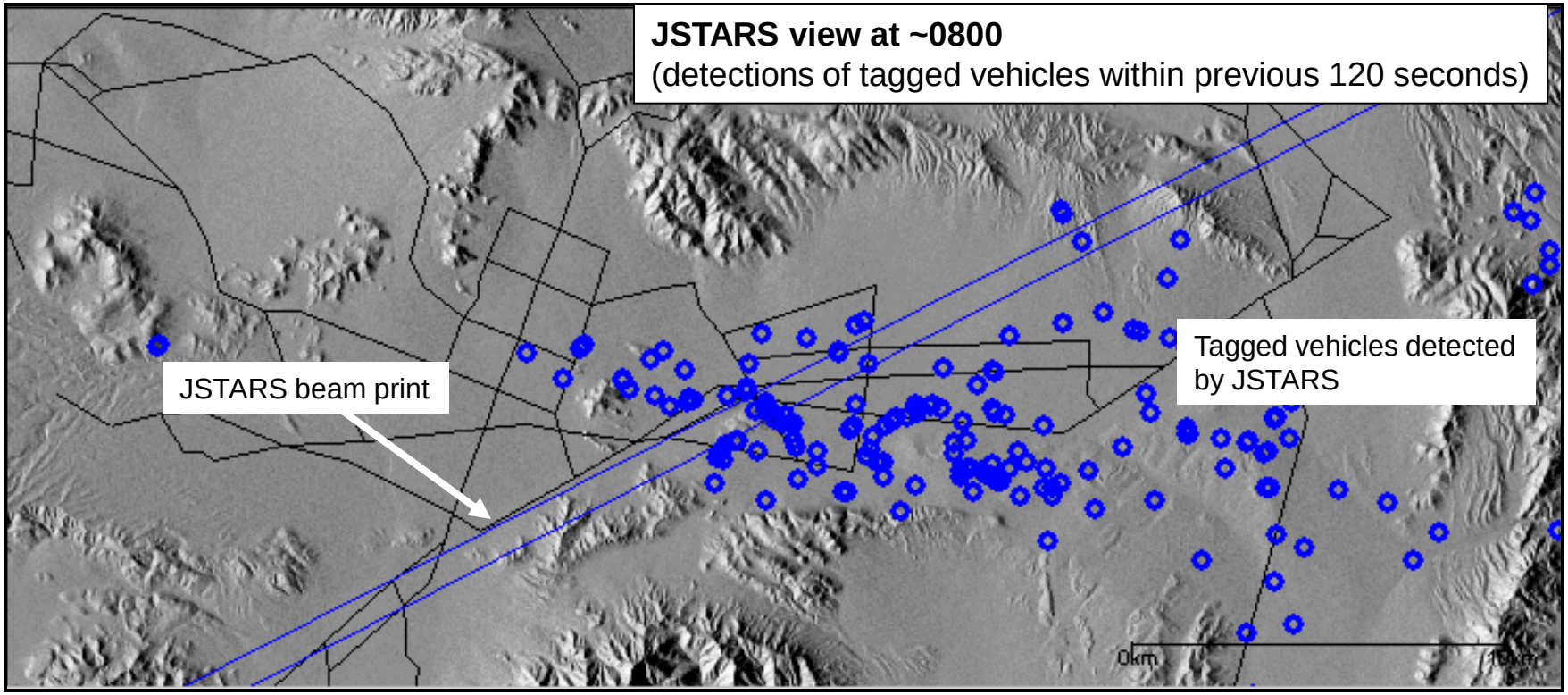
JSTARS+DRaFT Improves Blue Data

Blue-side awareness at the Theater level is significantly better

- **Movers and tagged stationary vehicles are located; DRaFT discriminates Blue from Red**
- **Many targets (including the main Red force) are masked by terrain**
- **Latencies may limit the value of the information forward of brigade**



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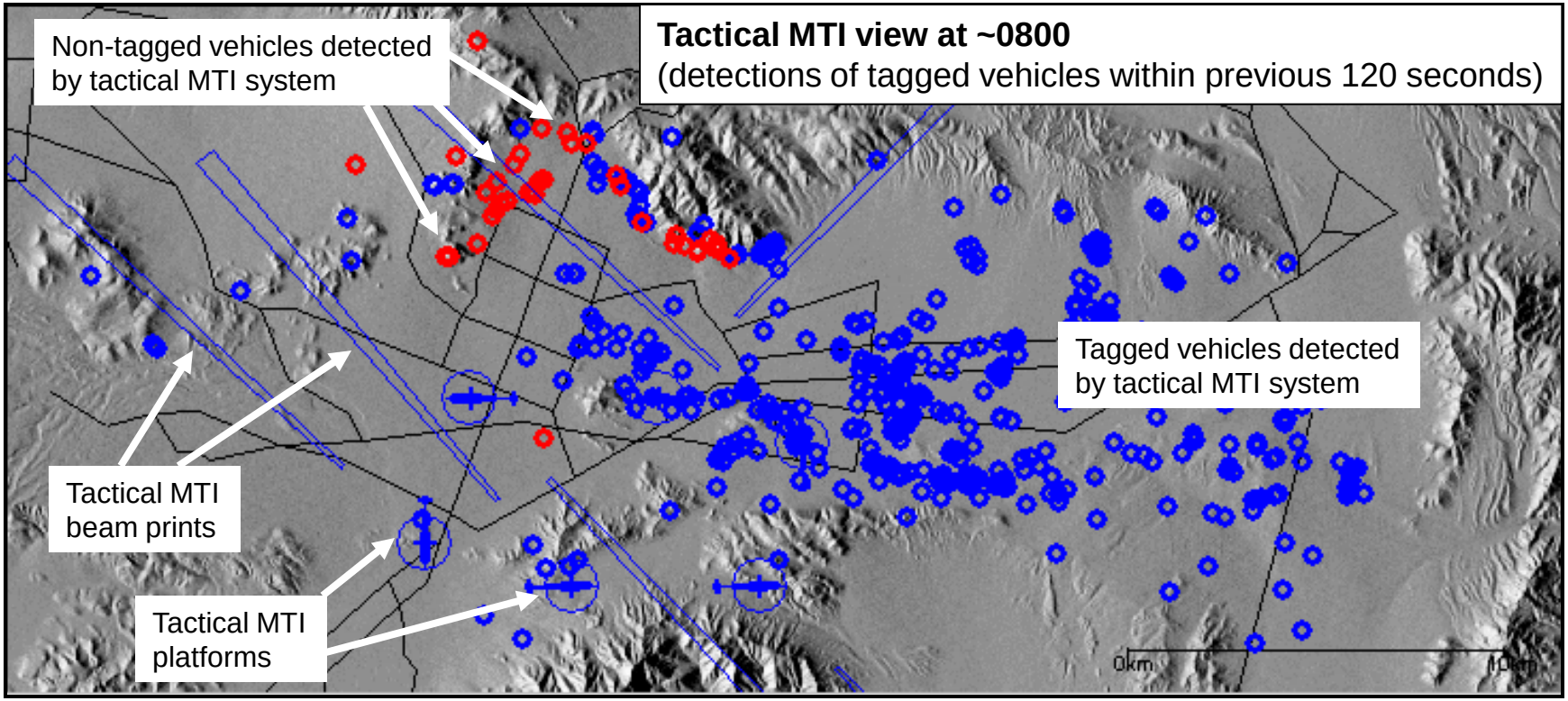
Tactical GMTI+DRaFT = Reliable SA

Airborne GMTI for Blue, and DRaFT for all Blue vehicles provides timely, unambiguous Blue and Red SA:

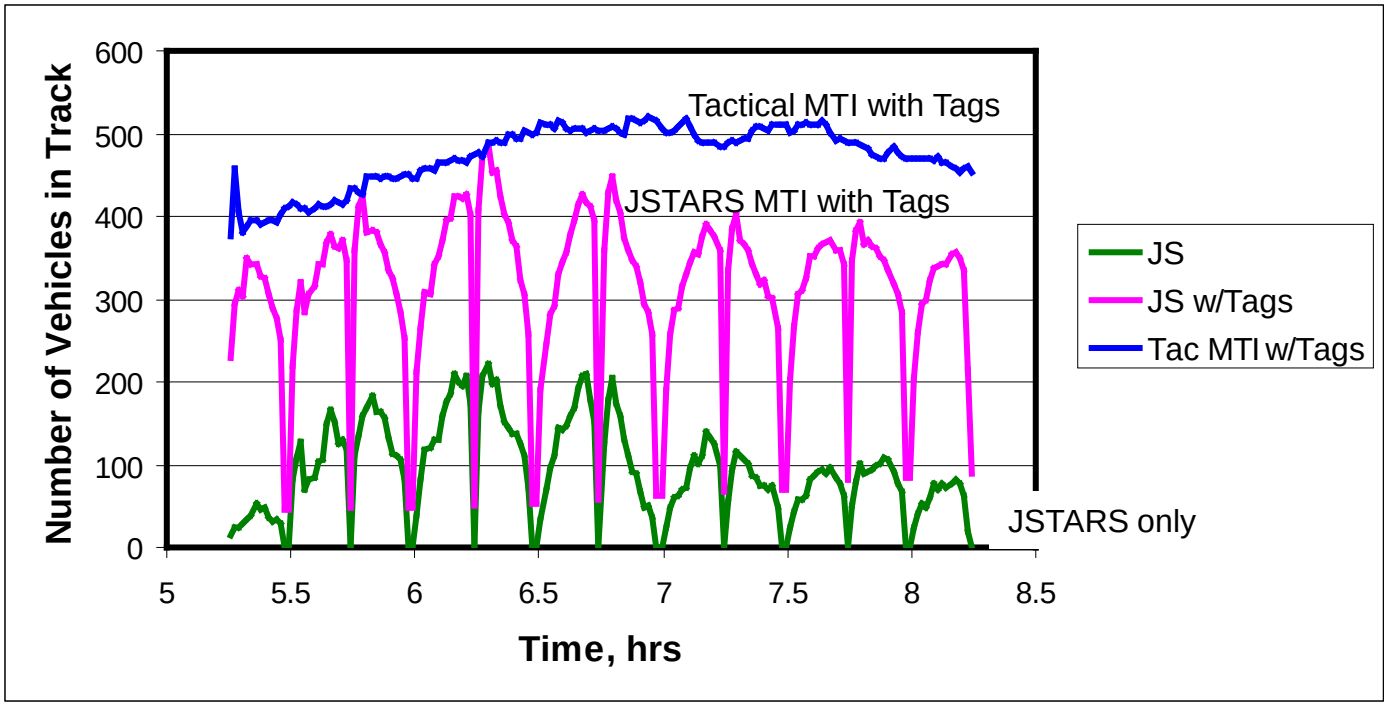
- **GMTI assumptions: six platforms at 5 km altitude; 15 km MTI range; interacts with DRaFT**
- **Blue vehicles stationary or moving can be detected and identified**



Blue-Force SA -- Options Compared

Tactical GMTI with RF Tags provides best awareness

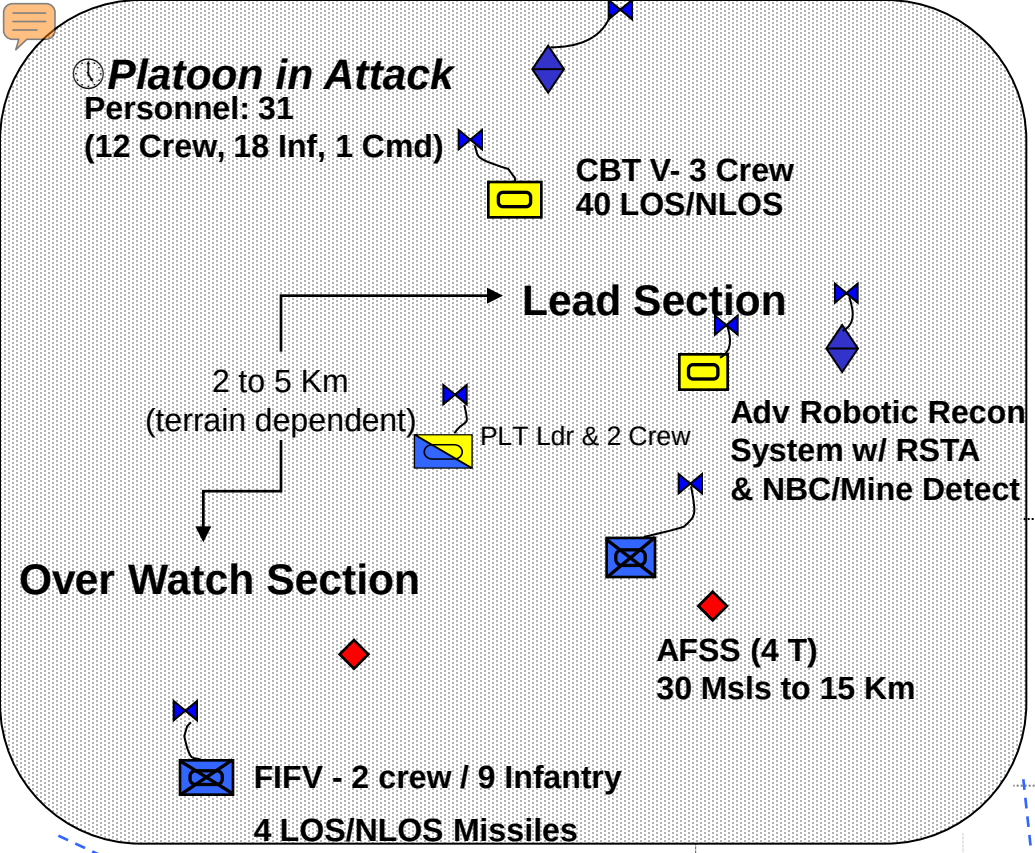
- Sees most of the Blue AFV (not terrain masked; sees stationary tagged vehicles)
- Sees advancing Red AFV inaccessible to standoff GMTI
- Has high refresh rate and no outages due to turns



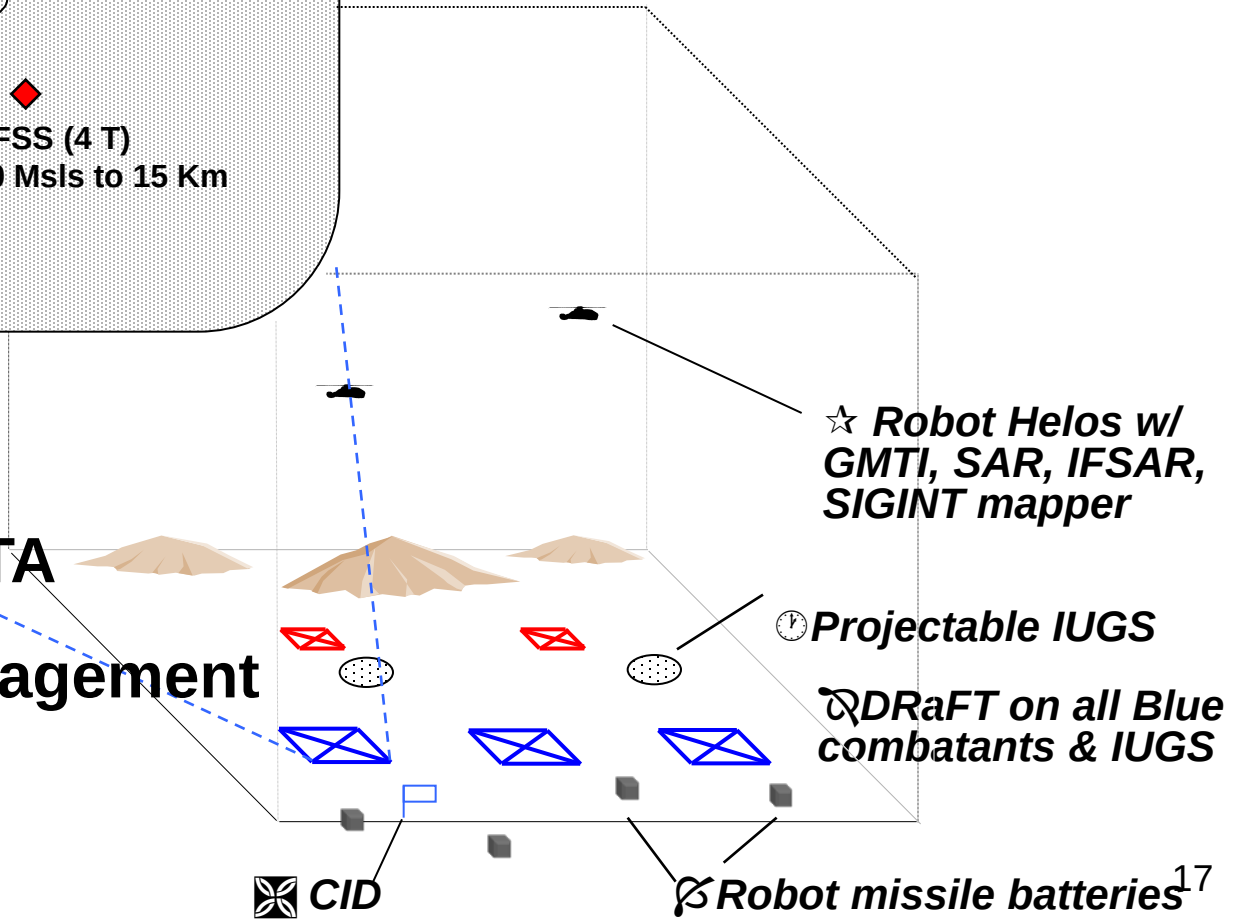
Notes

- *Vehicle counted as in track if it was detected in the previous 120 seconds*
- *Plot does not distinguish between Blue and Red vehicles*
- *20 km range for tactical MTI*
- *30 seconds to sweep 360 degree field-of-regard*

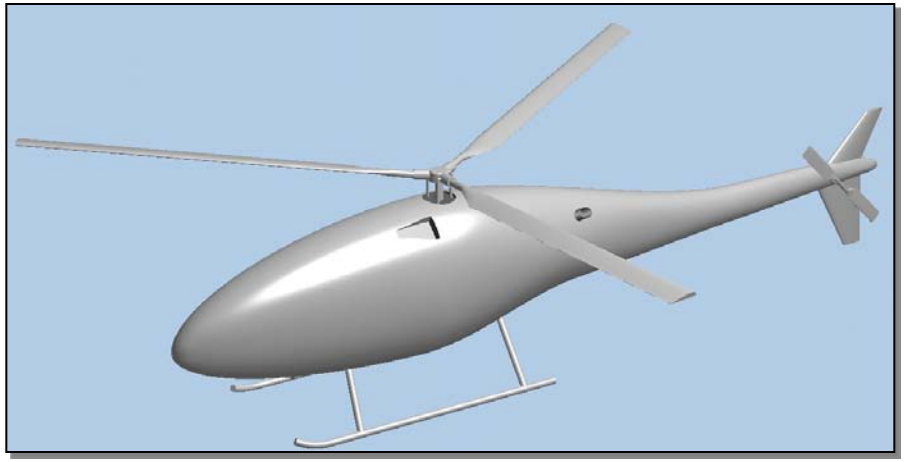
Combined Arms Team



- **Integrated robotics**
- **Network-centric RSTA**
- **Extended range engagement**
- **Strat/tac air mobility**

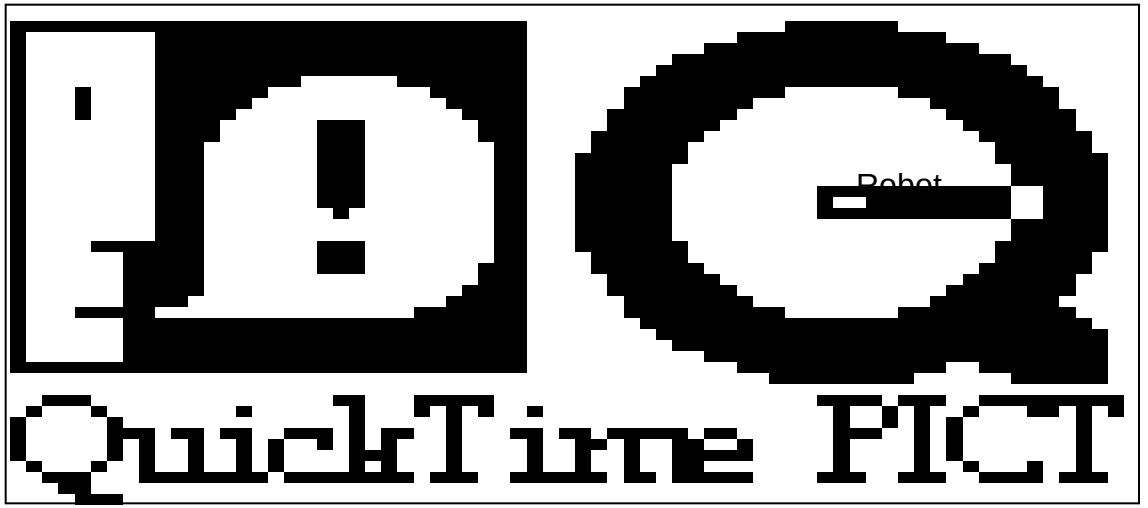


Candidates for Layered RSTA⇔DRaFT



A-160 unmanned VTOL
- **40+ hrs endurance**
- **max speed 140 kts**
- **ceiling 30k ft**
- **payload 300#**
- **low signature**

Tethered electric robot
- **30” X 45”**
- **30 lbs. gross**
- **15lbs 45 MHz GMTI**
- **max alt 300 ft**

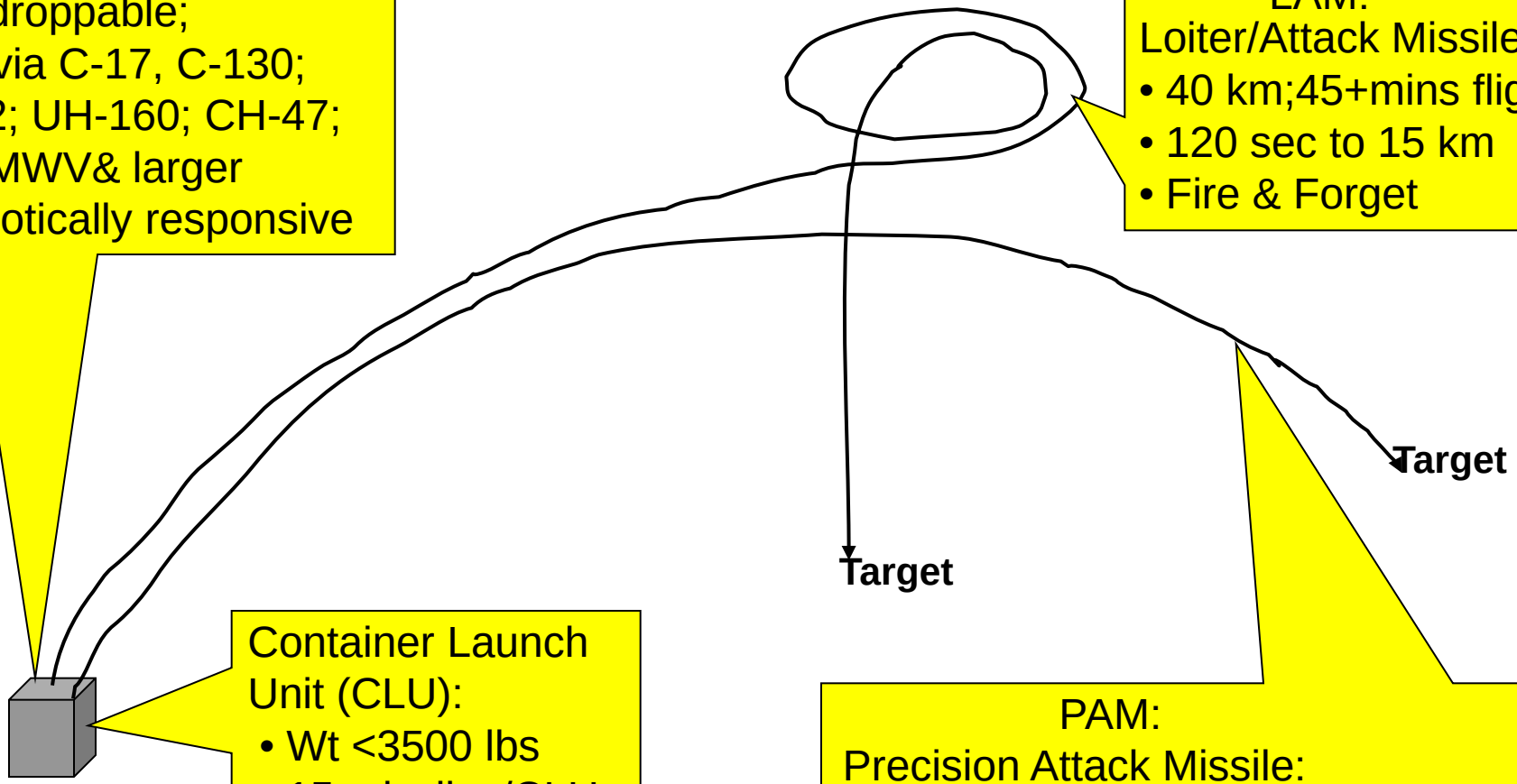


"NetFires"

Advanced Fire Support System (AFSS)

- Air-droppable;
- Lift via C-17, C-130; V-22; UH-160; CH-47; HMMWV& larger
- Robotically responsive

LAM:
Loiter/Attack Missile:
- 40 km;45+mins flight
- 120 sec to 15 km
- Fire & Forget



Container Launch Unit (CLU):
- Wt <3500 lbs
- 15 missiles/CLU
- + Computer & Comm Sys (CCS)

PAM:
Precision Attack Missile:
- Multi-mode warhead
- Range 0.5-90 km
  - Virtual direct fire <40 km
  - Glide trajectory <90 km
- Fire and Forget (GPS+INS+seeker)

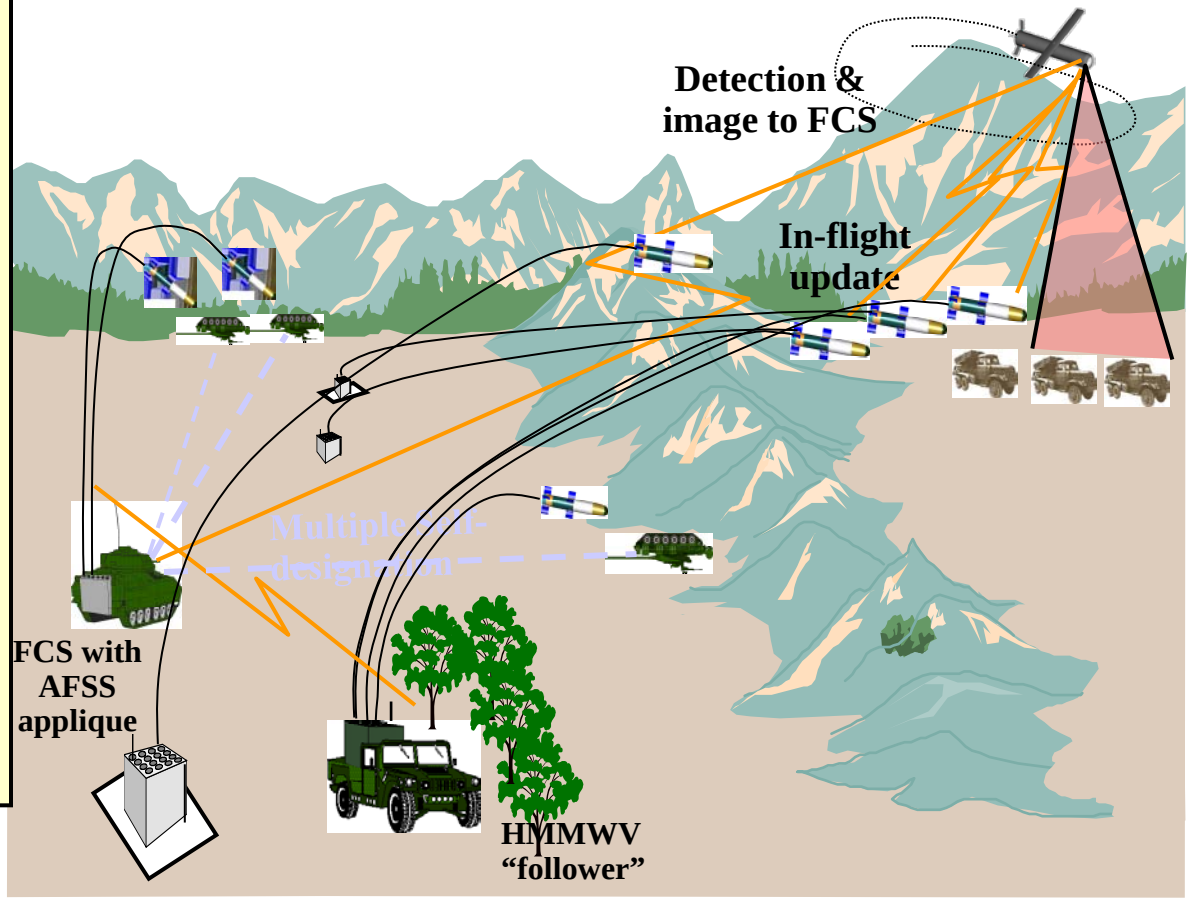
NetFires will provide for FCS

NetFires goals

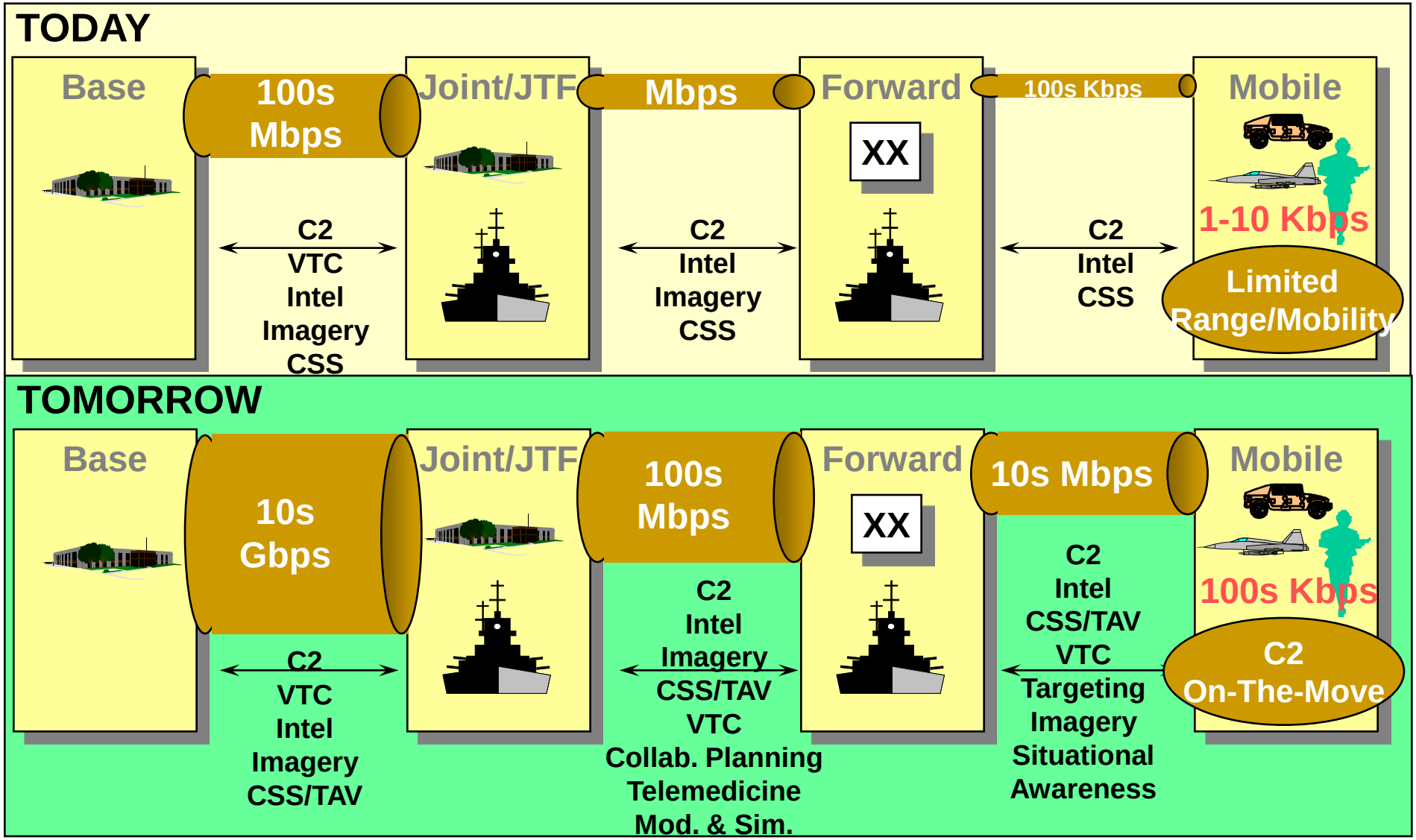
Potentially reengineers close combat.

Demonstrate two LOS/NLOS weapons

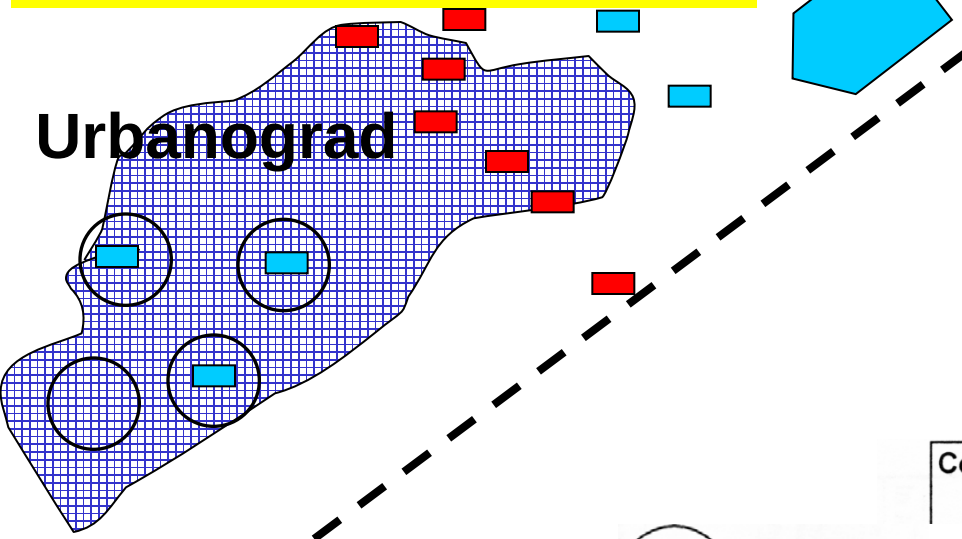
- Rapid Response PAM
  - Short time of flight (100s/25km)
  - Multimode terminal guidance
  - Low cost configuration
  - LOAL
- Hunter Killer LAM
  - 3-D ladar seeker w/ATR, TERCOM
  - Significant loiter
  - Multi-mission including BDA
- PAM/LAM
  - GPS/INS guidance
  - Variable propulsion
  - Terminal guidance (end game)
  - Midcourse update through networked 2-way data link
- Platform independent launcher
- Container command and control



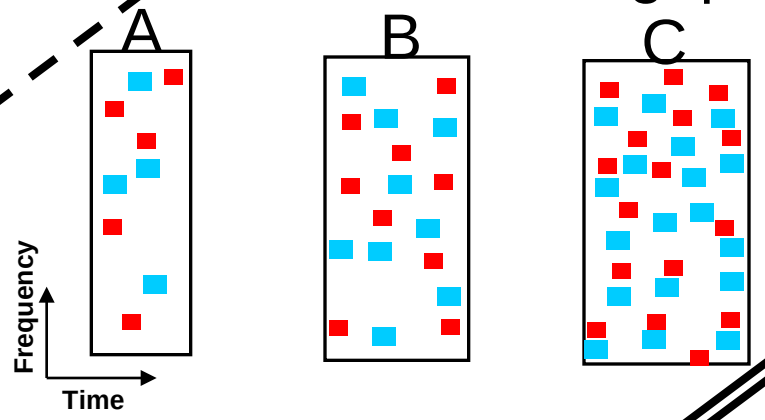
Broadband Communications for Close Battle

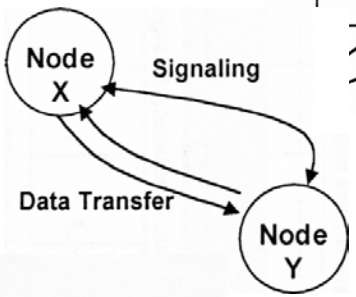


Ultra Wide Band (UWB)
Wire Scavengers
60 GHz links



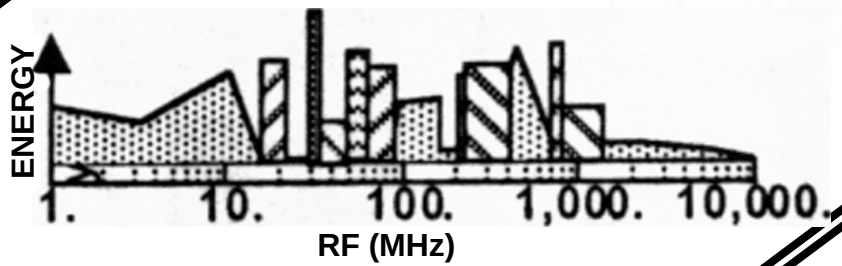
The more enemy/ neutral use, the more throughput





Common Signaling Function: provides a means for nodes to establish initial contact

All nodes sense spectrum



All-terrain (incl. Urban) wideband waveforms

Autonomous Adaptive networking

Continuous POS/NAV D-GPS + INS + TA

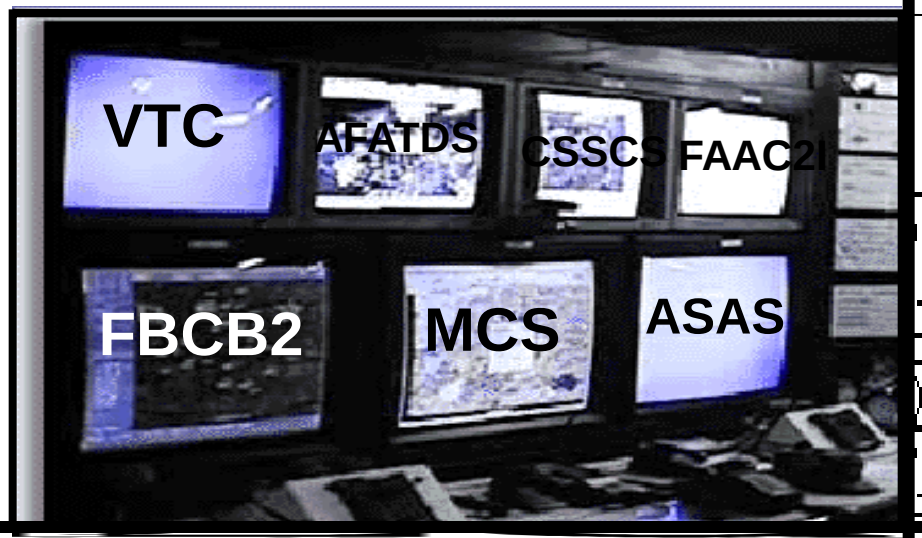
Distributed Information Management

Opportunistic Spectrum Use

SUO SAS

Not This

Stovepiped C2



TOC

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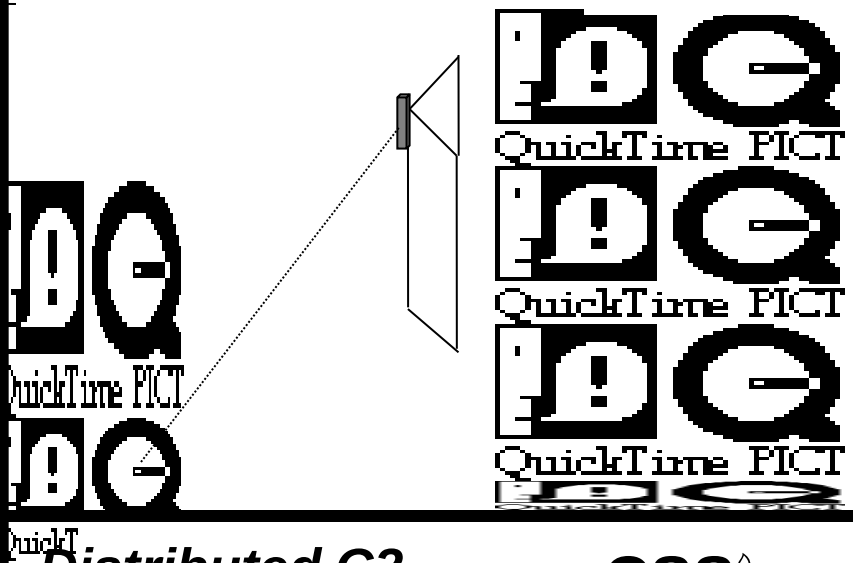
Target Of Choice

But This

Platform Independent

Command-on-the-move



Distributed C2

CSS

Intel

Ops

FS

Avn,AD

• Bn Cdr

50 km

SU Cdr•

• Bn Cdr

SU Cdr•

• Bn Cdr

SU Cdr•

FCS: Future Covering Force

- **Strategic Precursor for arrival of "heavier" forces**
  - Superior strategic mobility
  - Seize and defend strategic access facilities
  - Forestall enemy positional advantage
  - Set conditions for operational initiatives
- **Enabler of surprise reversal of regional force balance**
  - Deter
  - Be demonstrably lethal and survivable
  - Deny enemy Kosovo-like "hide" options
  - Act as force multiplier for follow-on forces
    - … Protect RSOI and rapid advance
    - … Exploit superior operational, tactical maneuver
    - … Extend range of conventional DS fires
    - … Shape decisive engagements