Program Executive Office for
Simulation, Training & Instrumentation

Army Training with Distributed Networked Systems

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Approved for Public Release.
Security and OPSEC Review Completed: No Issues.

Leadership is Essential

"A nation which depends upon others for its new basic scientific knowledge will be slow in its industrial progress and weak in its competitive position in world trade."

Vannevar Bush
Science, The Endless Frontier, 1944

Current Battlefield Networks

MSE

NTDR

Division TOC

Brigade TOC

Brigade TOC

Upper Echelon

Battalion TOC

Brigade TOC

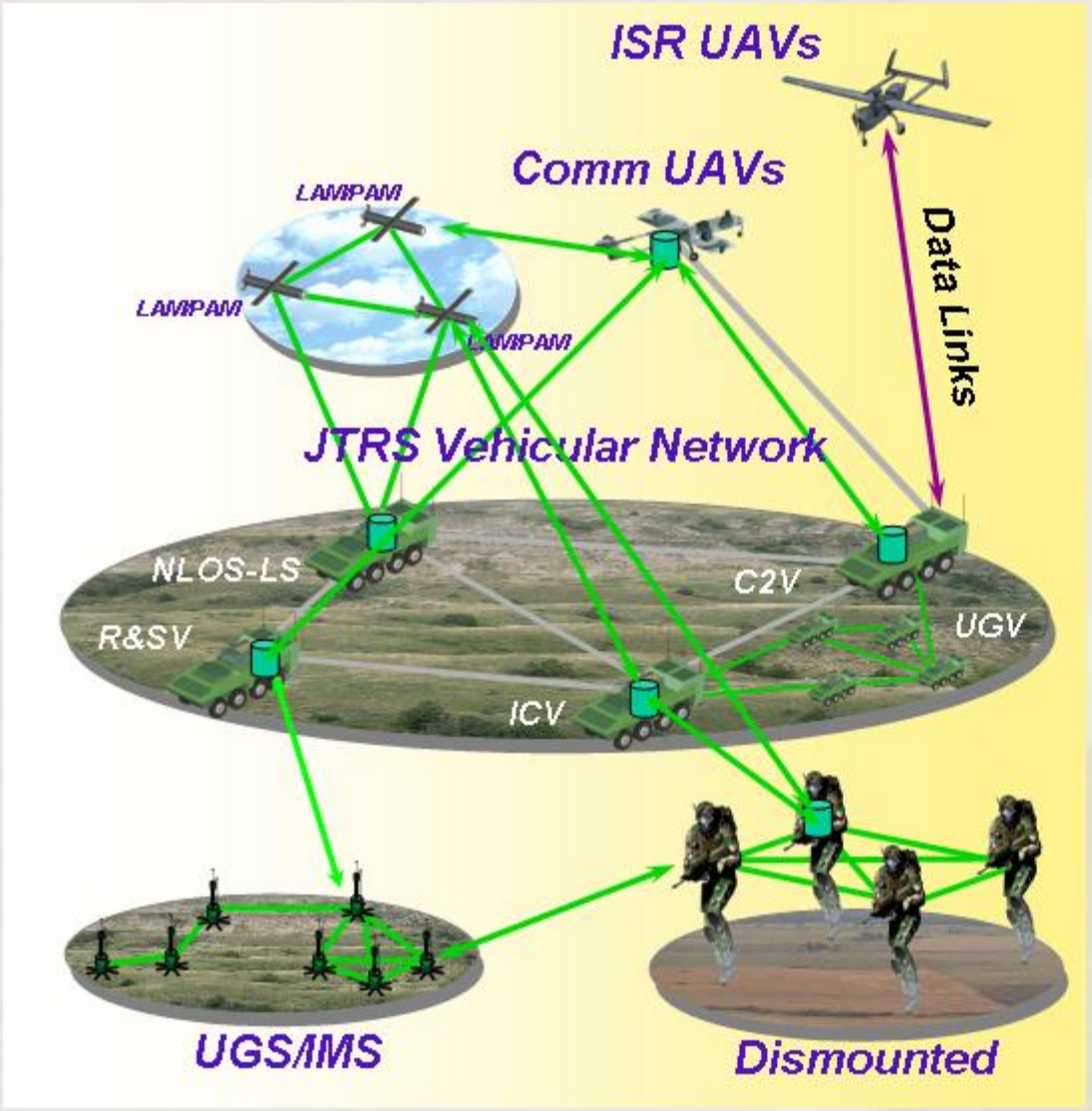
Battalion TOC

Battalion TOC

EPLRS (Enhanced Position Location Reporting System)

SINCGARS (Single Channel Ground and Airborne System)

Emerging FCS Communications



- UofA vehicular-based backbone services
- Soldier Radio Waveform provides similar services to attached networks
  - Dismounted Soldier – Objective Force Warrior
  - Unattended Ground Sensors – UGS
  - UGV (SUGV) / UAV (Class I and II)
- JTRS Cluster 1 radios on vehicles simultaneously support both WNW and SRW for seamless access and operation

Live Training Environment
Digital Tactical Monitoring
AAR
System
Tech
Monitoring
Observer Controllers
Training
Analyst
EXCON
FTI
Training IED
Player Units
Targets

Beyond Industry Boundaries

"Innovation requires building a community of like-minded and wholly committed individuals who see their shared future in the success of the emerging technologies and industries."

- Andrew Hargadon, Univ of California

"Moving among industries frees you from the dogma of any one industry and their firm belief in the links between problems and solutions."

- Gian Zaccai, CEO of Design Continuum

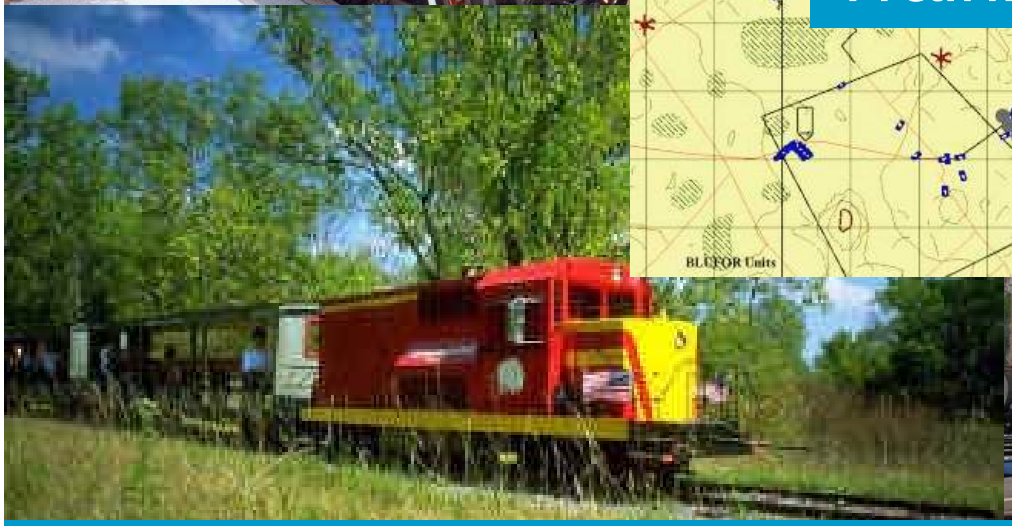
Hargadon, A. (2003). *How breakthroughs happen: The Surprising truth about how companies innovate*. Harvard Business School Press.

Waves of Change are Building

IT Services

Game Tech

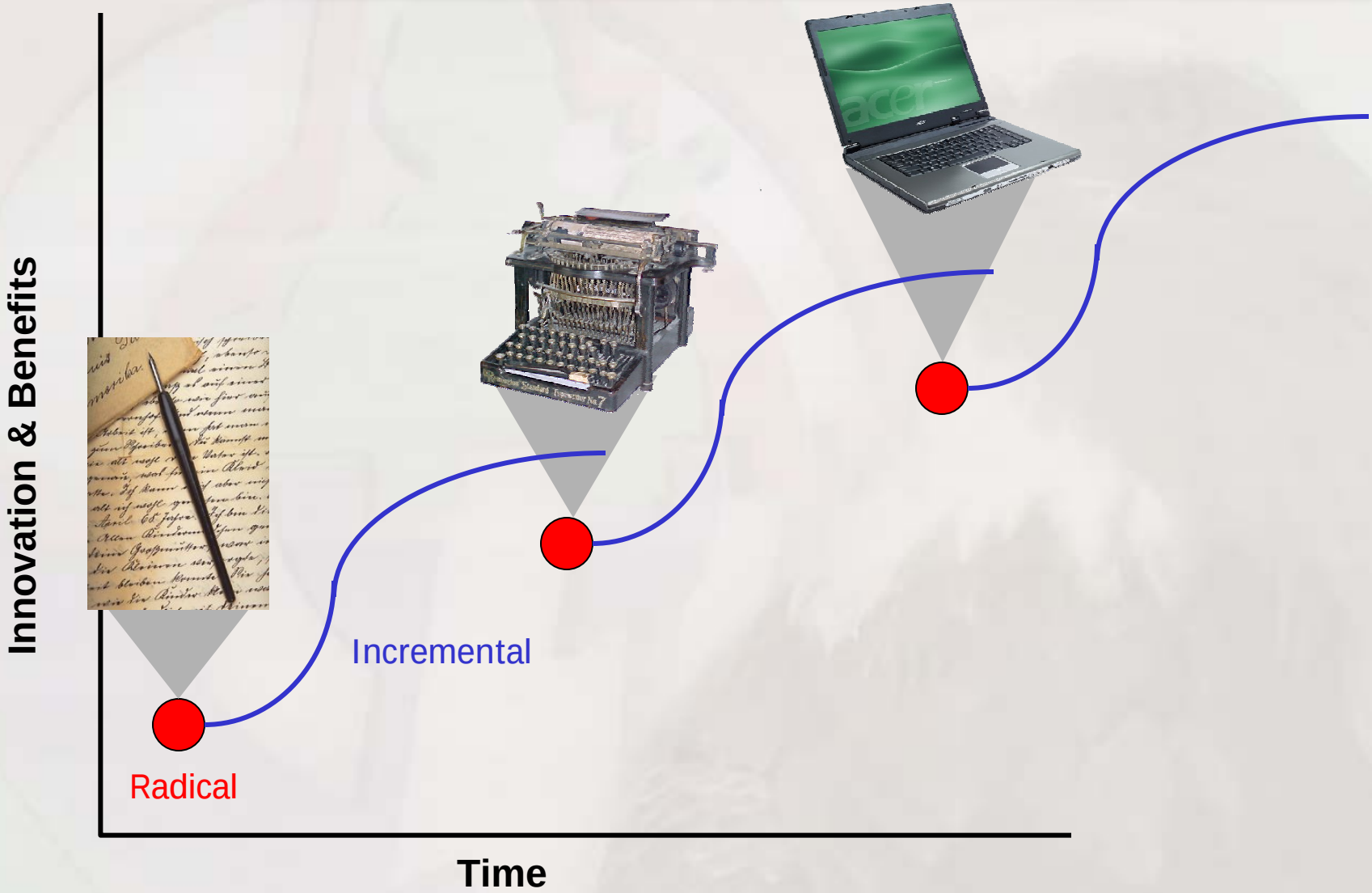
Military Training



Computer Performance

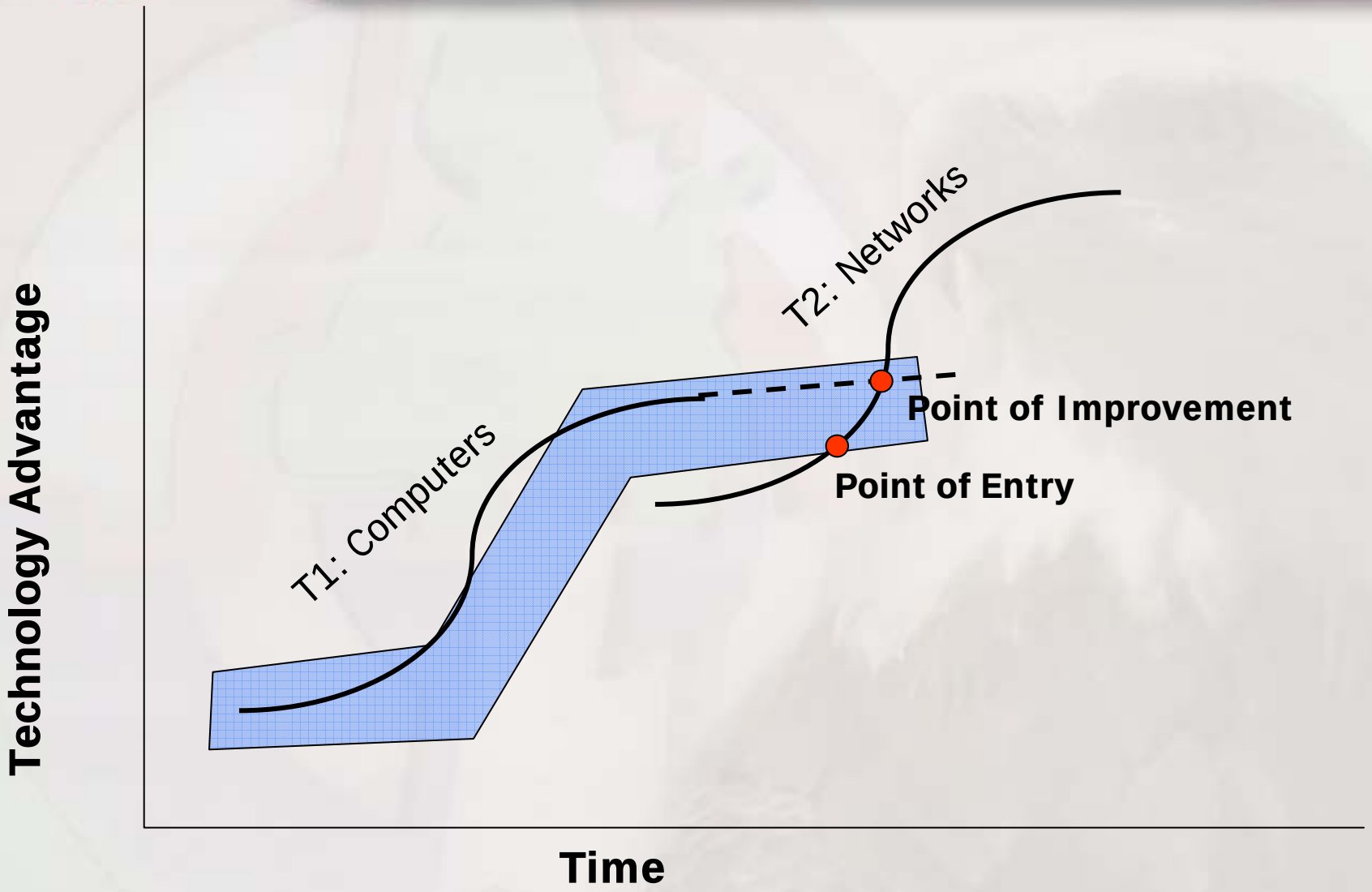
Networking

Radical and Incremental Waves



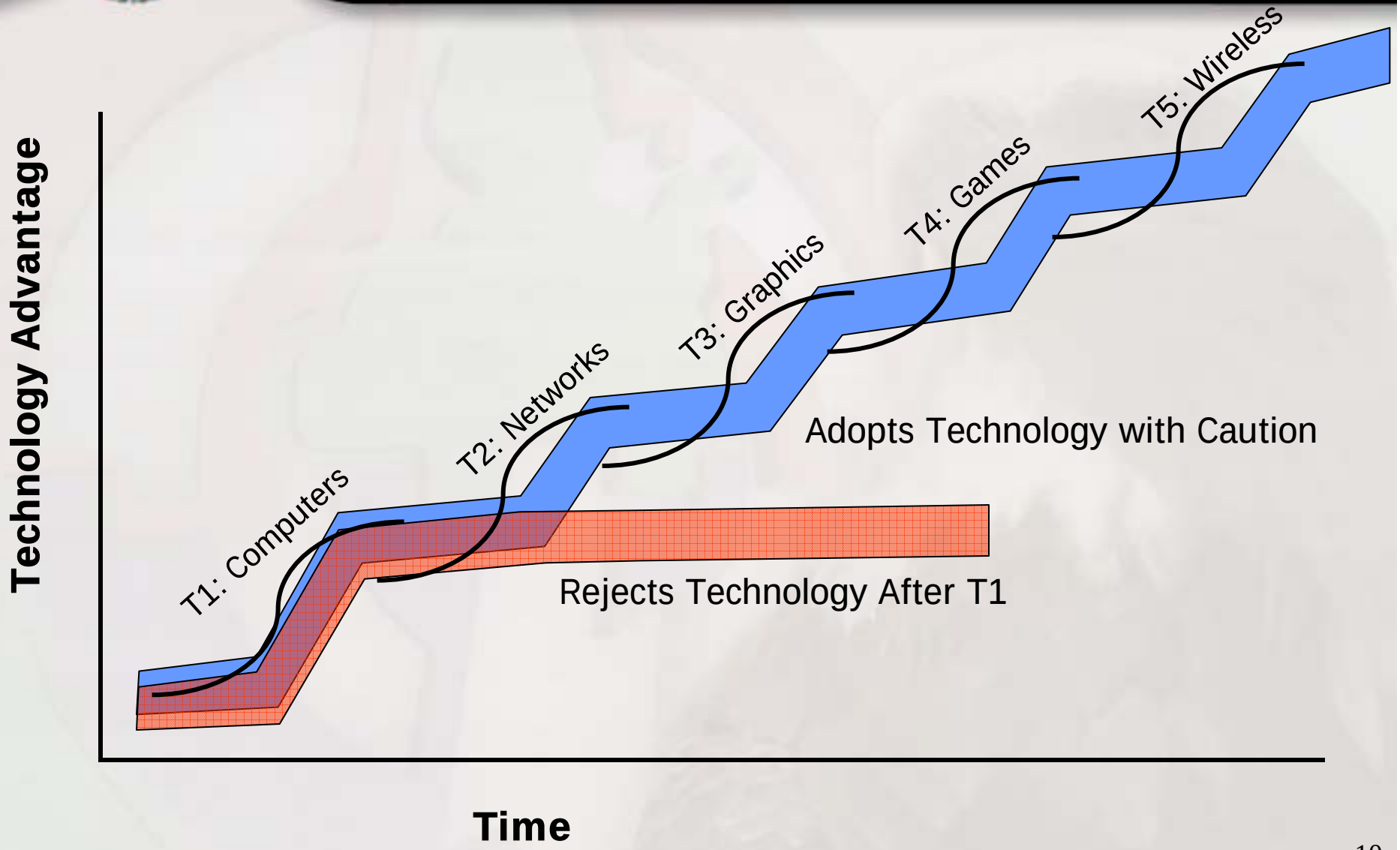
Dewar, R.D., & Dutton, J.E. (November, 1986). The adoption of radical and incremental innovations: An empirical analysis. *Management Science*, 32(11), 1422-1433.

Technology Adoption



Smith, R. (2007). “Game impact theory: Five forces that are driving the adoption of game technologies within multiple established industries”. *Games and Society* (under review).

Successive Waves of Adoption



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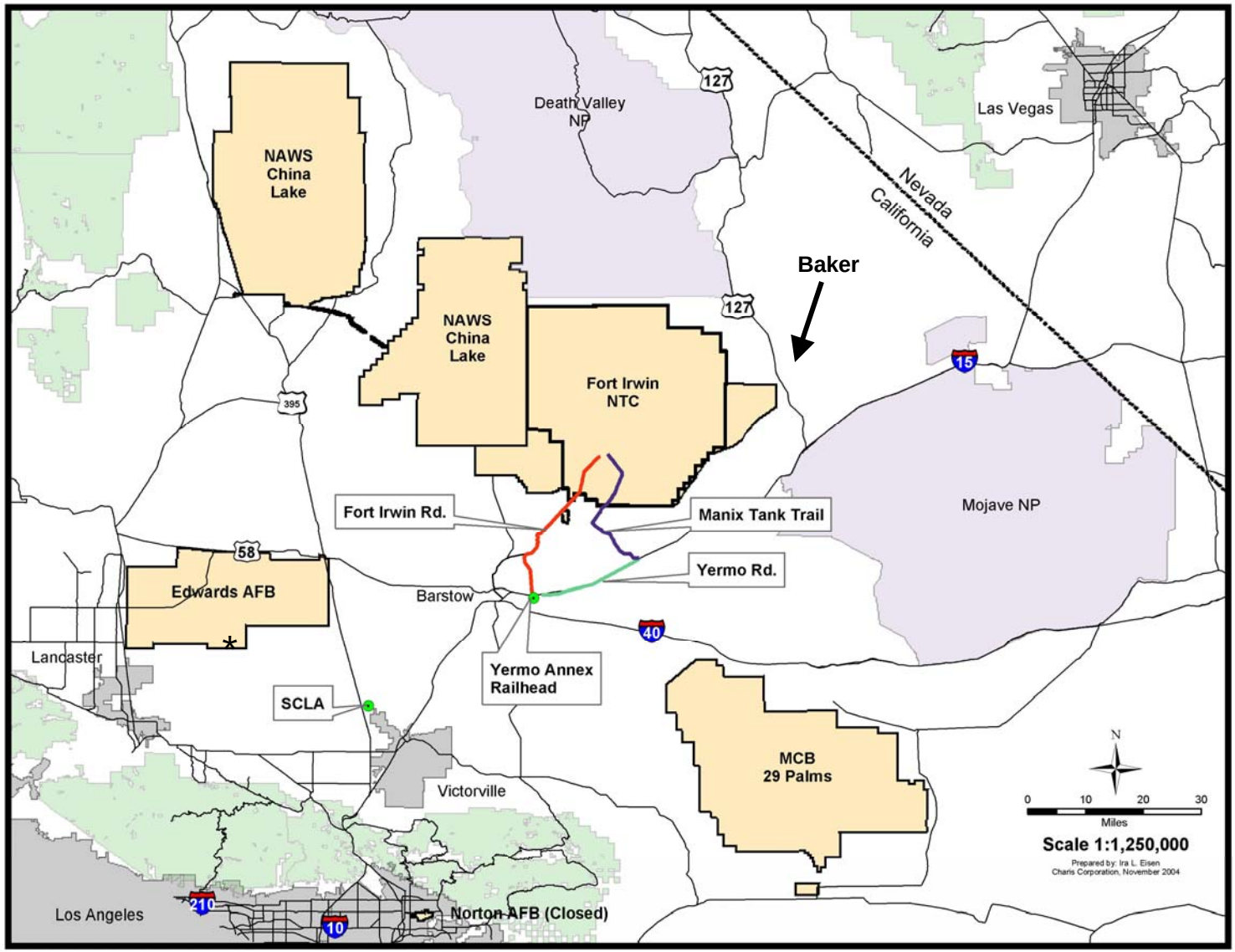
National Training Center

National Training Center



Collaboration in the Mojave Desert

Each range or agency has its own mission objectives

Scientific Research

NASA/Goldstone
NASA/Drydent FTC
JPL/Pasadena

Training

NTC - FT. Irwin
Nellis AFB
NAS Fallon

Testing and Development

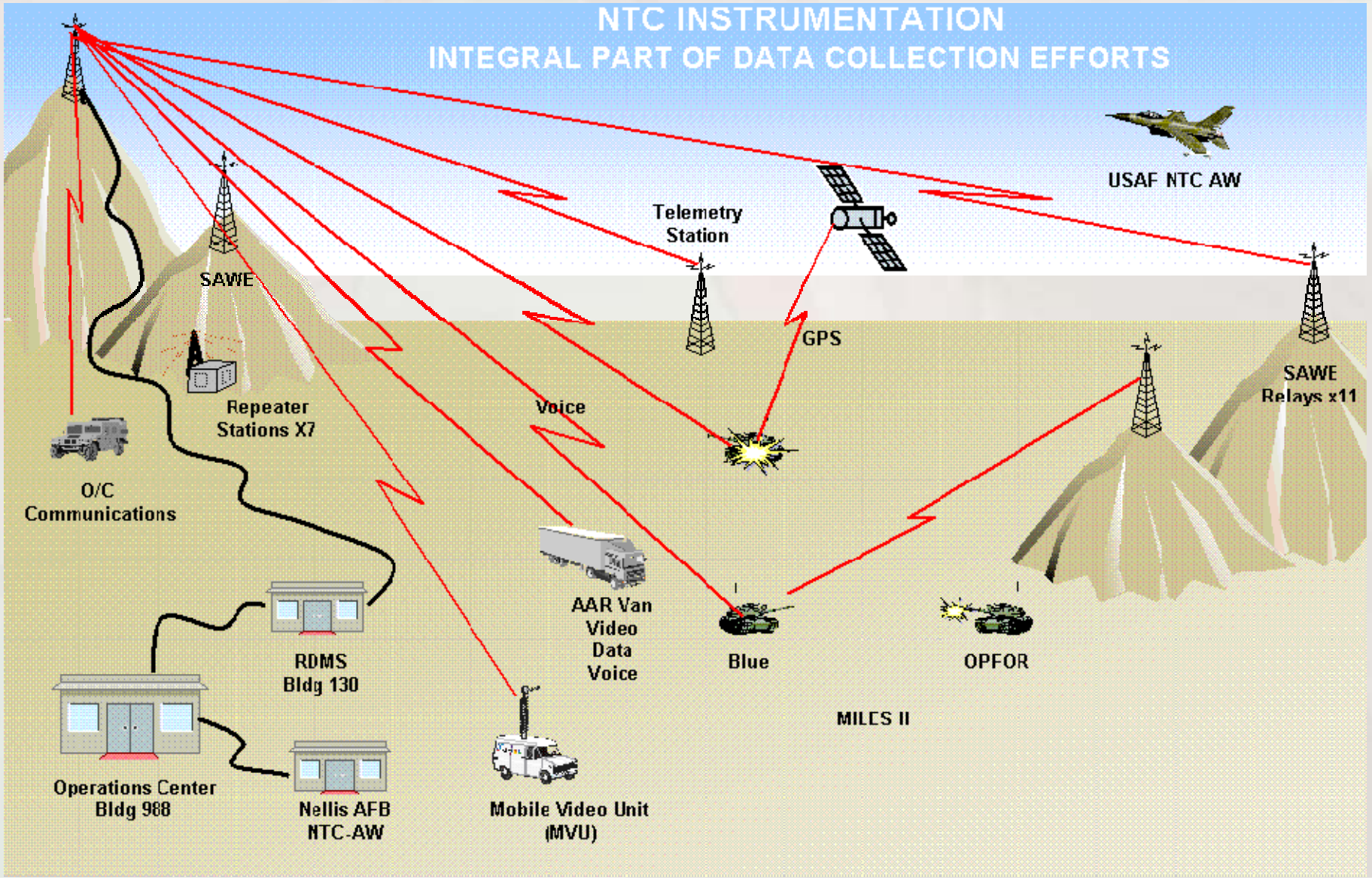
Edwards AFB
China Lake
Nellis FTC
NAS Fallon
Pt. Mugu

Threats
F-22
Global Hawk
33 UAV programs
Joint Exercises
Top Gun

Trident II Launch Evaluation
Cruise Missile
Deep Space Tracking
Space Exploration (SOHO)
10 Army Rotations a year

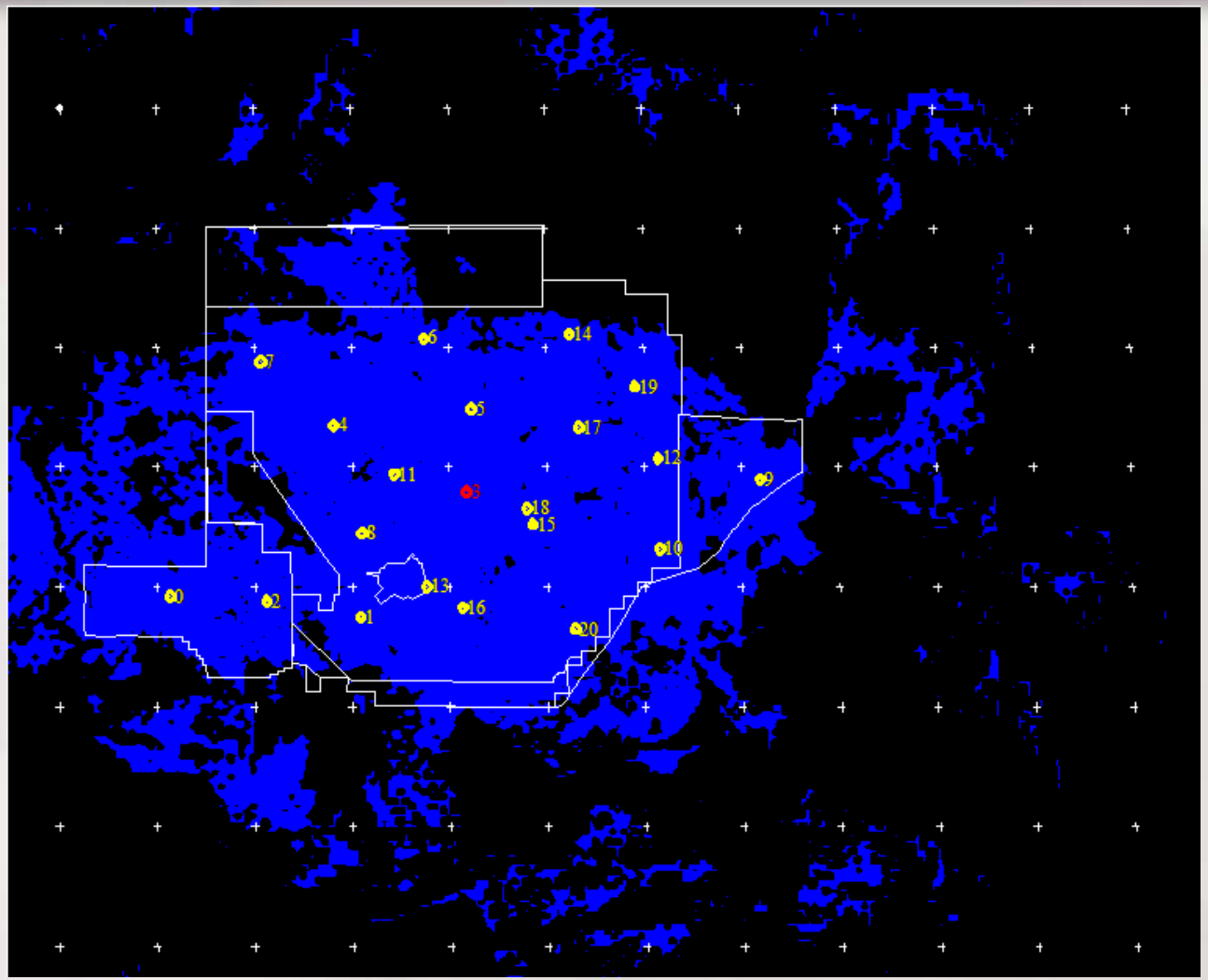
Scientific, training and tactical spectrum needs must be accommodated without conflict

Current NTC Instrumentation



RF Terrain Masking at NTC

- OIS Receiver Threshold -86 dBm
- 20 Tower Sites
- 470 MHz



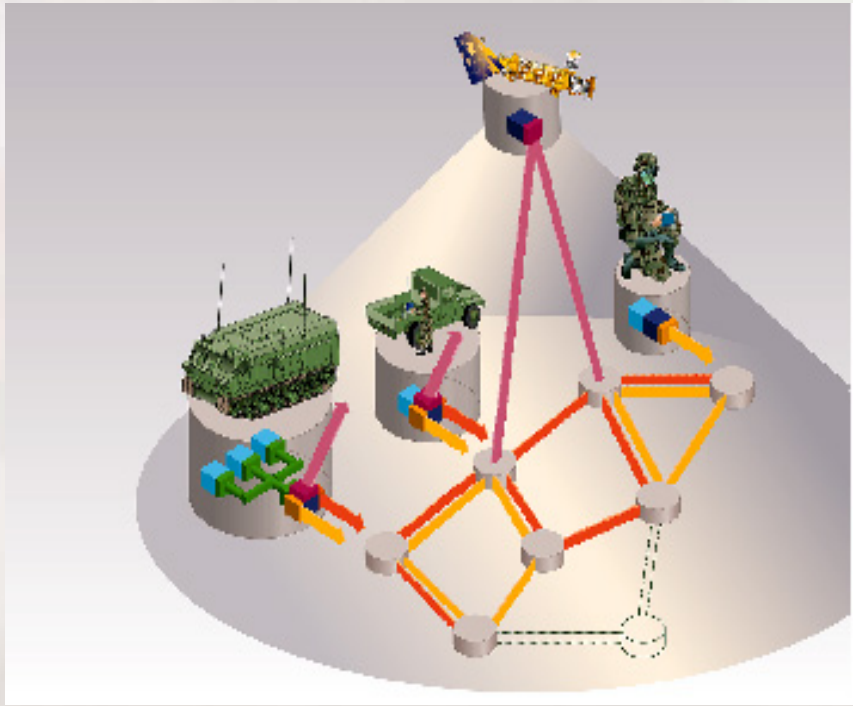
Ad hoc Wireless Network

- Ad hoc -> Created for a particular purpose
- Wireless -> Mobile hosts
- Network -> Information sharing

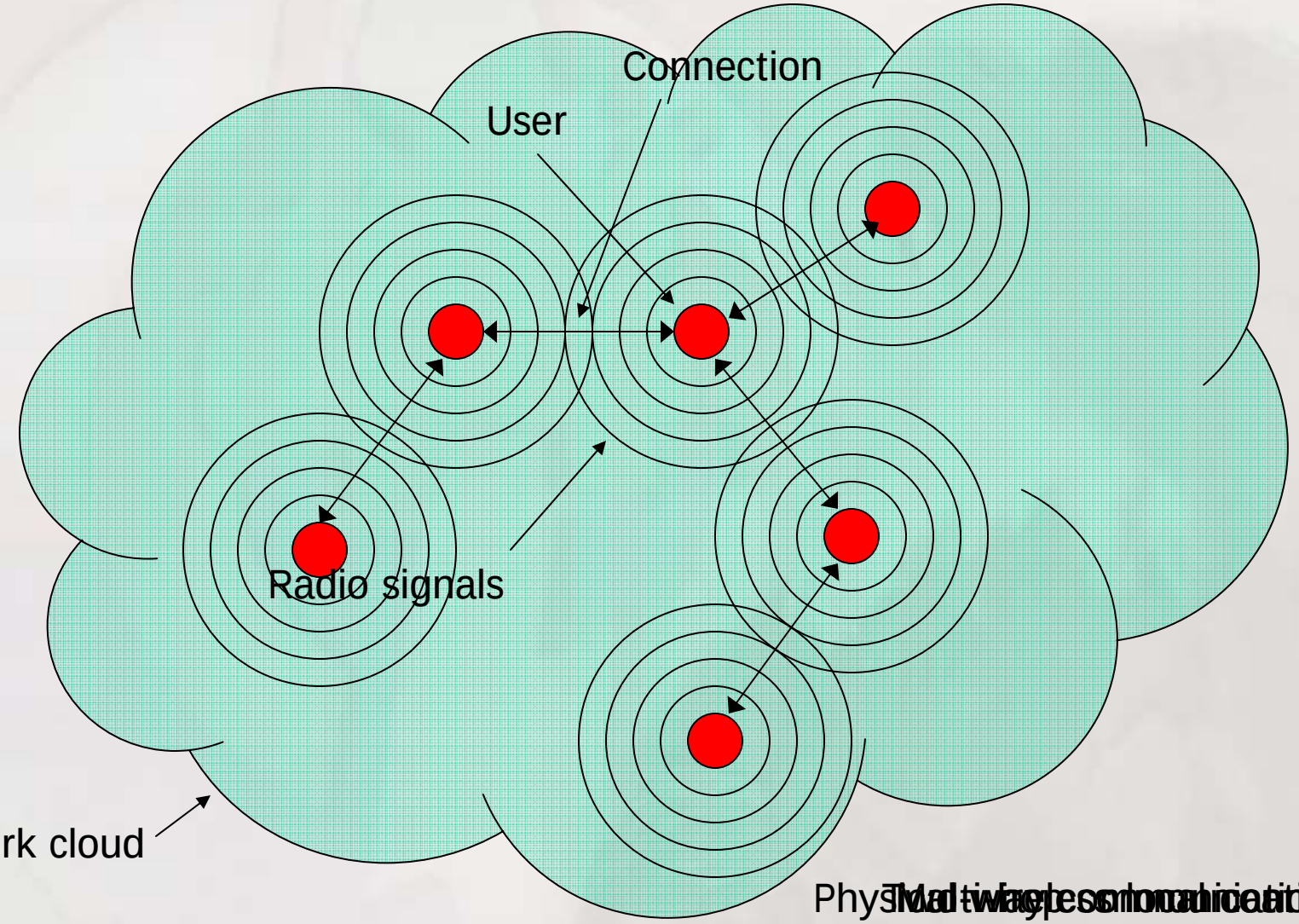
- Ad hoc wireless network:
  - Information sharing between mobile hosts for a particular purpose
- A.K.A. Mobile Ad hoc NETwork (MANET)

Mobile Ad hoc Networking

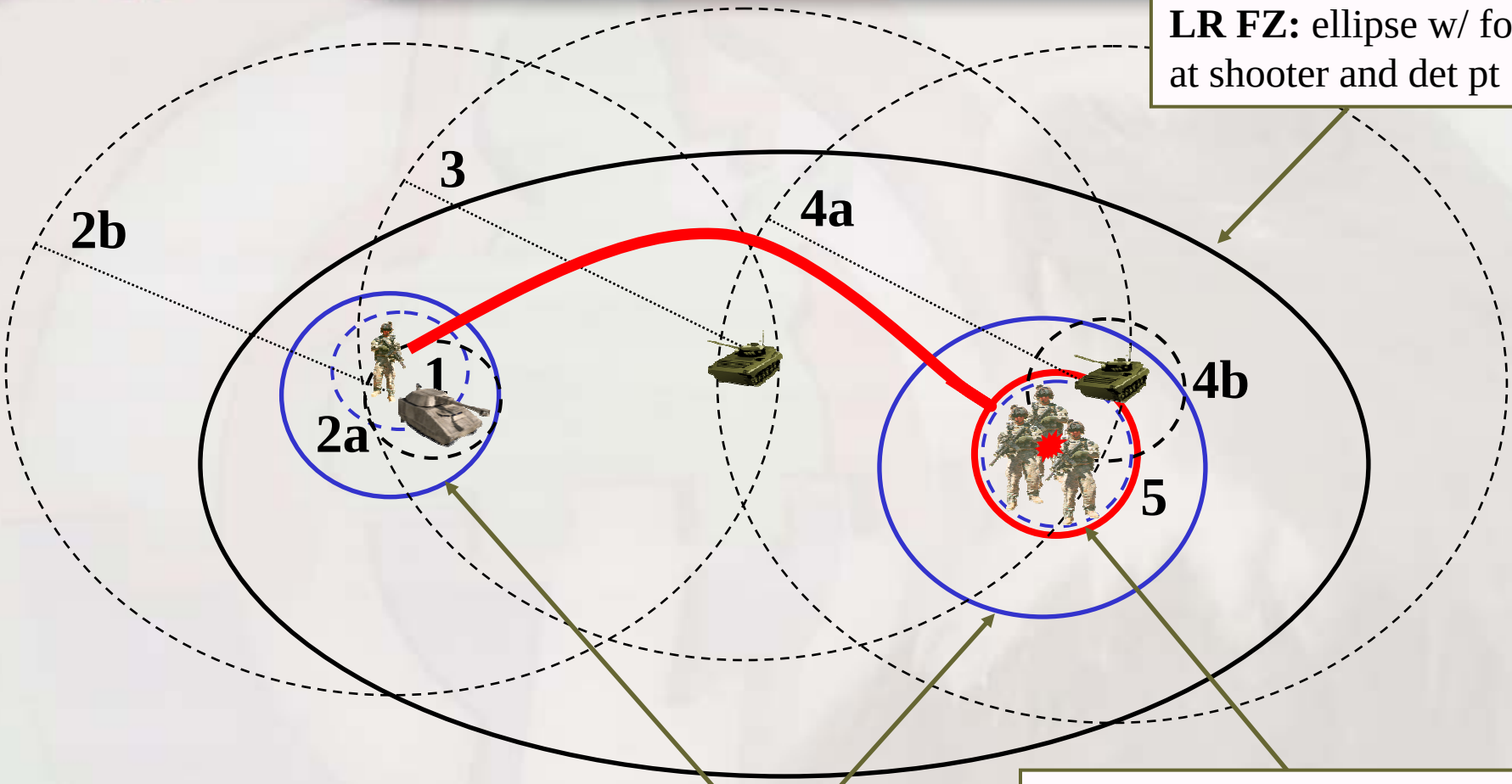
- MANET: Peer-to-peer wireless networking
  - Mobile nodes relay each others' packets
  - No designated base stations (not hub-and-spoke)
- Advantages
  - No infrastructure necessary
  - Dynamic topologies
  - Can operate with short radio ranges to save power
  - Can extend coverage/connectivity (e.g. around obstacles)
- Drawbacks
  - Scaling is problematic, especially for non-local communication patterns
  - Paths break frequently $\Rightarrow$ excessive routing overhead
  - Energy constrained



MANET Concept



MANET At Work



LR FZ: ellipse w/ foci at shooter and det pt

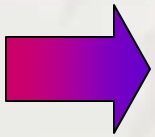
Geocast Region: Effect Circle

SR Forwarding Zone: two circles

Red = Objective Connection
Blue = Short Range Tier
Black = Long Range Tier

From Big to Open Systems

- Design Big Systems
- Build Big Systems
- Run Big Events



- Design Open Systems
- Build Open Systems
- Run Open Events

Central Control → Shared Control

Resources Must Be:

- Abundant
- Reliable/Robust
- Trusted/Secure

Conclusion

- Computing, communications, and distributed systems are evolving quickly.
  - Large and Monolithic are being replaced with Open and Flexible
- Commercial industries are driving many of the technologies for products like
  - Cellular communications, IT services, Multiplayer games,
- DOD training is in a position to significantly leverage commercial advances in these areas
  - e.g. MANET, MMOG

Presenter Info

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