



Defense Advanced Research Projects Agency

Cyber Security Research

Dr. Anthony J. Tether
DARPA Director

DARPA Organization



Director, Tony Tether
Deputy Director, Bob Leheny

Information Exploitation
Ted Bially
Stephen Welby/Robert Tenney

Sensors
Exploitation Systems
Command & Control

Tactical Technology
Art Morrish
Gary Graham

Air/Space/Land Platforms
Unmanned Systems
Space Operations
Laser Systems
Future Combat Systems
Planning / Logistics

Special Projects
Amy Alving
Joe Guerci

Chem/Bio Def Systems
Counter Underground Facilities
Space
Sensors/Structures
Navigation/Sensors/Signal Processing

Advanced Technology
Dave Honey
Larry Stotts

Assured C3ISR
Maritime
Early Entry/Special Forces

Joint Unmanned Combat Air Systems
Mike Francis

UCAV(AF)
UCAV(N)
Autonomous Operations

Defense Sciences
Steven Wax
Brett Giroir

Bio Warfare
Defense Technologies
Biology
Materials & Devices
Mathematics

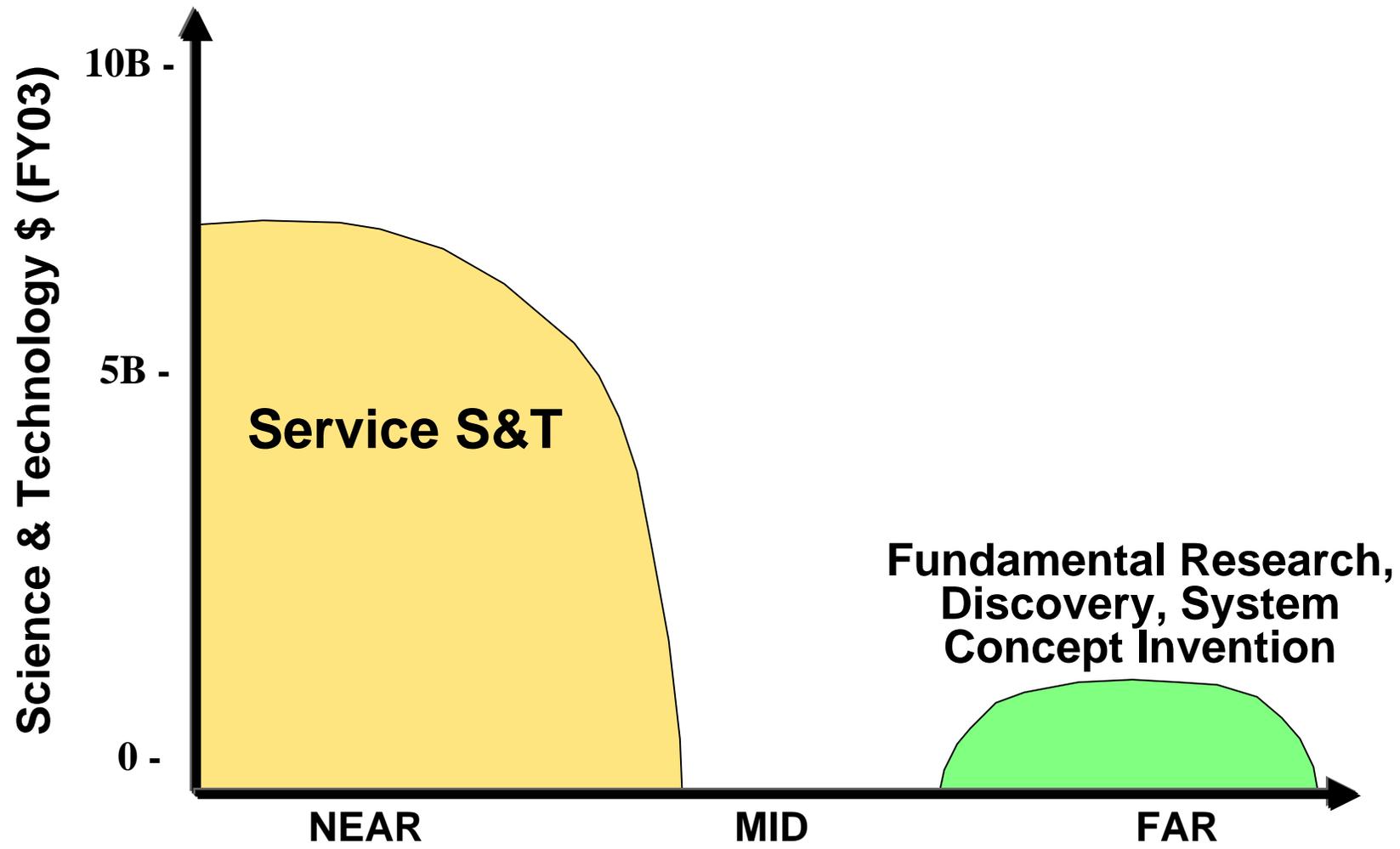
Information Processing Technology
Ron Brachman
Barbara Yoon

Cognitive Systems
Computational - Perception
Representation & Reasoning
Learning
Natural Communication

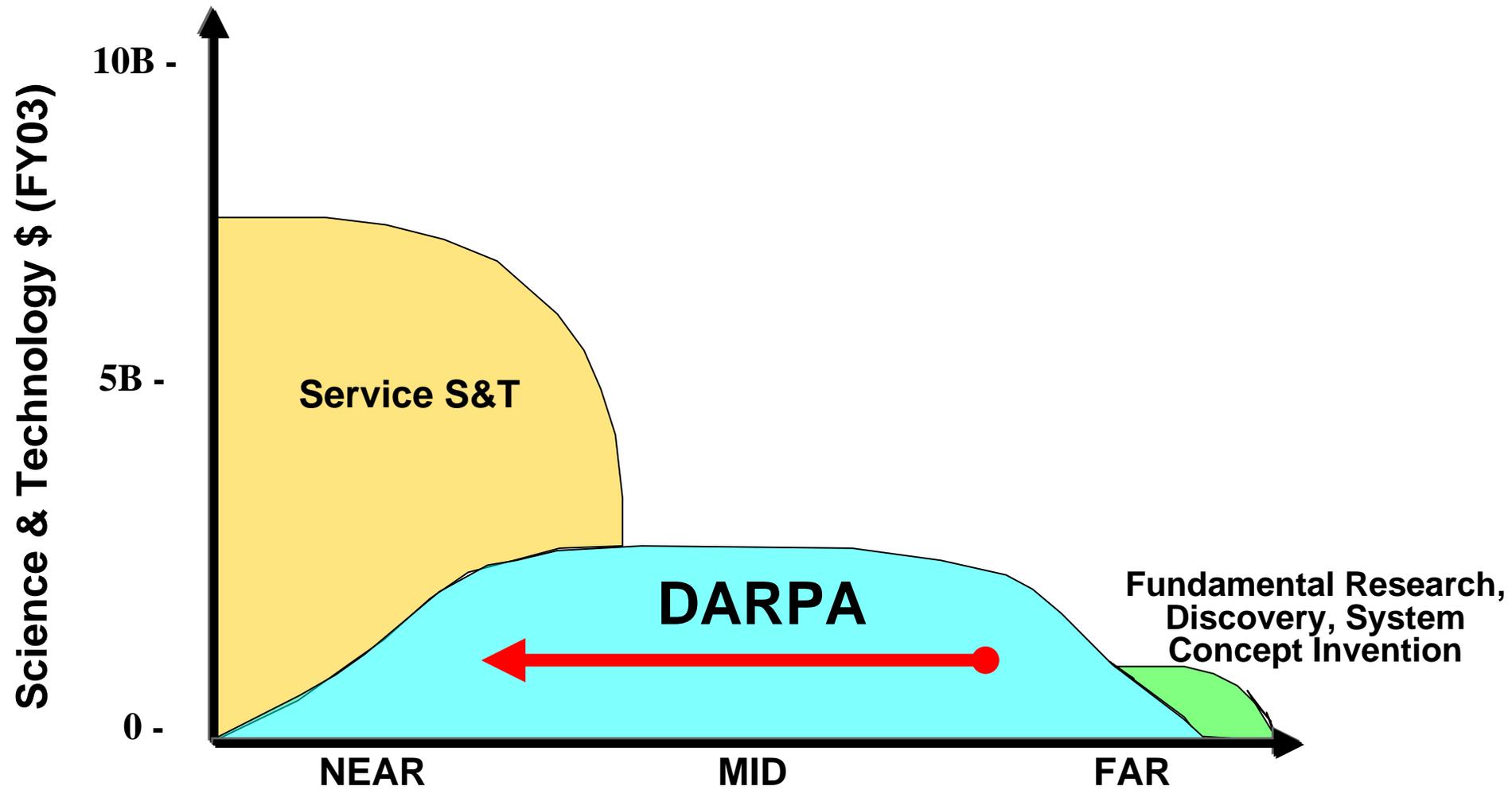
Microsystems Technology
Zach Lemnios
John Zolper

Electronics
Optoelectronics
MEMS
Combined Microsystems

DARPA Role in Science and Technology



DARPA Role in Science and Technology



DARPA Accomplishments



Saturn



M-16 Rifle



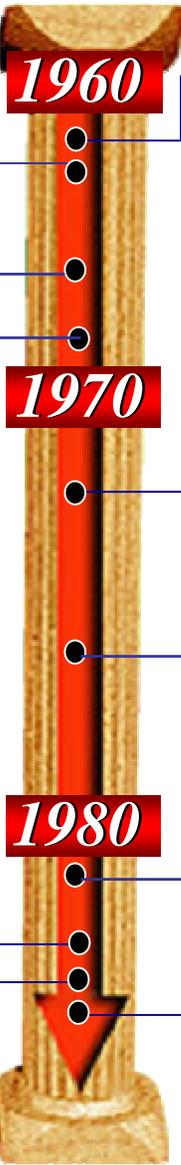
Ground Surveillance Radar



Stealth Fighter



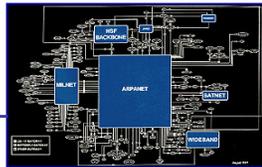
Sea Shadow



Vela Hotel



ATACMS



Arpanet



JSTARS



GPS



J-UCAS



TMR



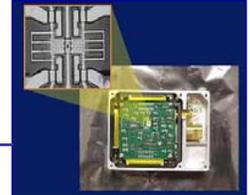
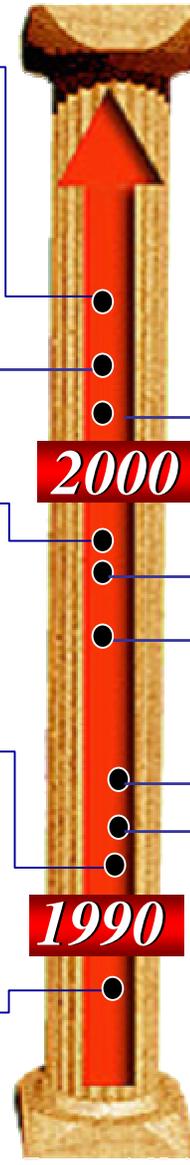
JSF



Uncooled IR



Taurus Launch Vehicle



MEMS



MALD



Global Hawk



Predator



BAT

DARPA's Strategic Thrusts



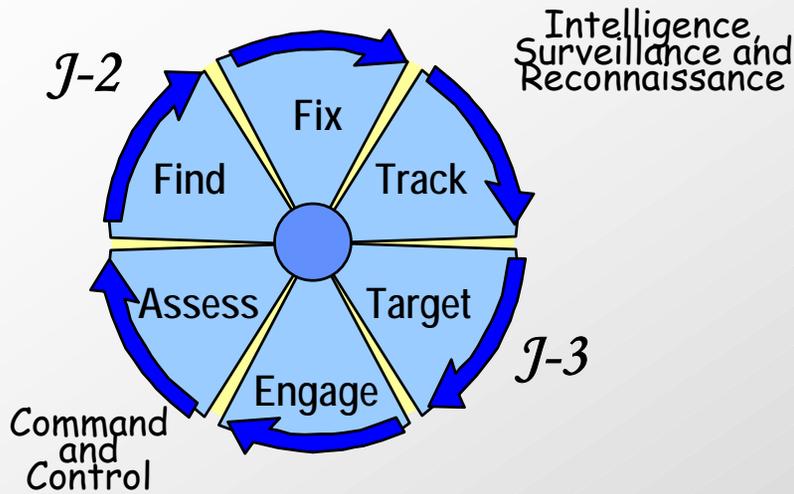
Investments Today for Future Capabilities

- **Detection, Precision ID, Tracking, and Destruction of Elusive Surface Targets**
- **Characterization of Underground Structures**
- **Force Multipliers for Urban Area Operations**
- **Networked Manned & Unmanned Systems**
- **Robust, Secure Self-Forming Tactical Networks**
- **Cognitive Systems**
- **Assured Use of Space**
- **Bio Revolution**

Technology Enabled C4KISR: Paradigm Shift



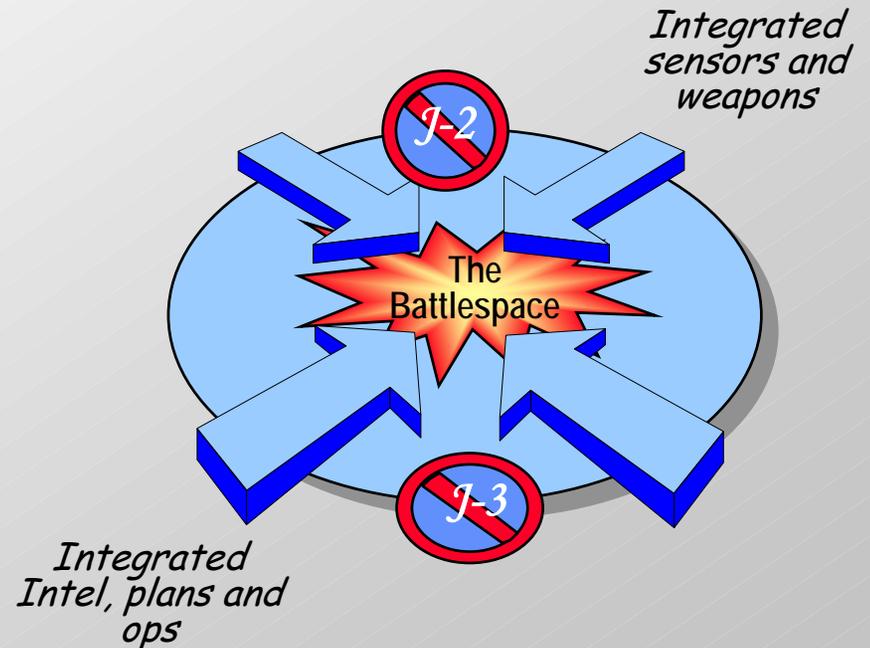
Current Paradigm



Sequential
Static

Disjoint
Rigid

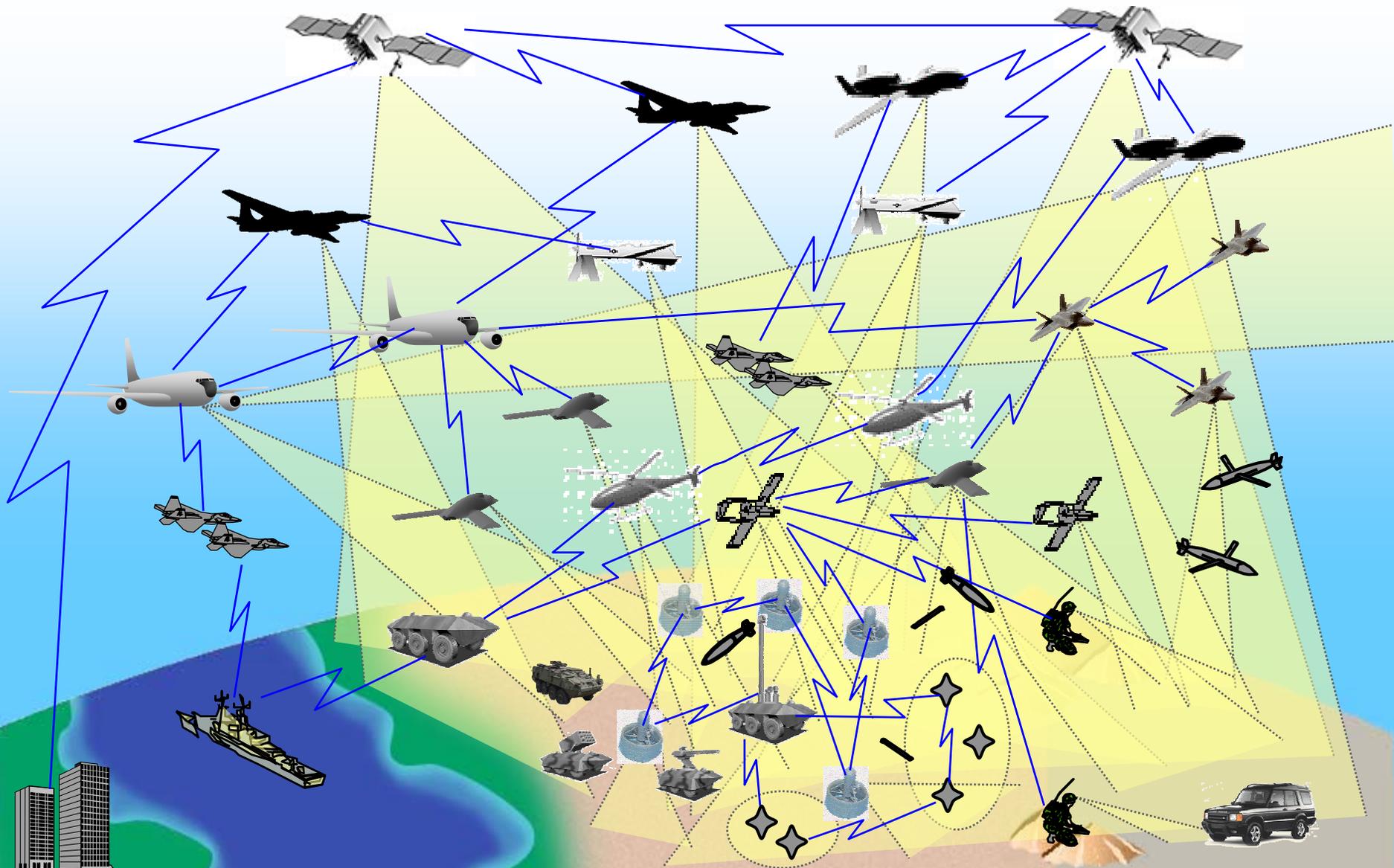
New Paradigm



Uninterrupted
Dynamic

Continuous
Adaptive

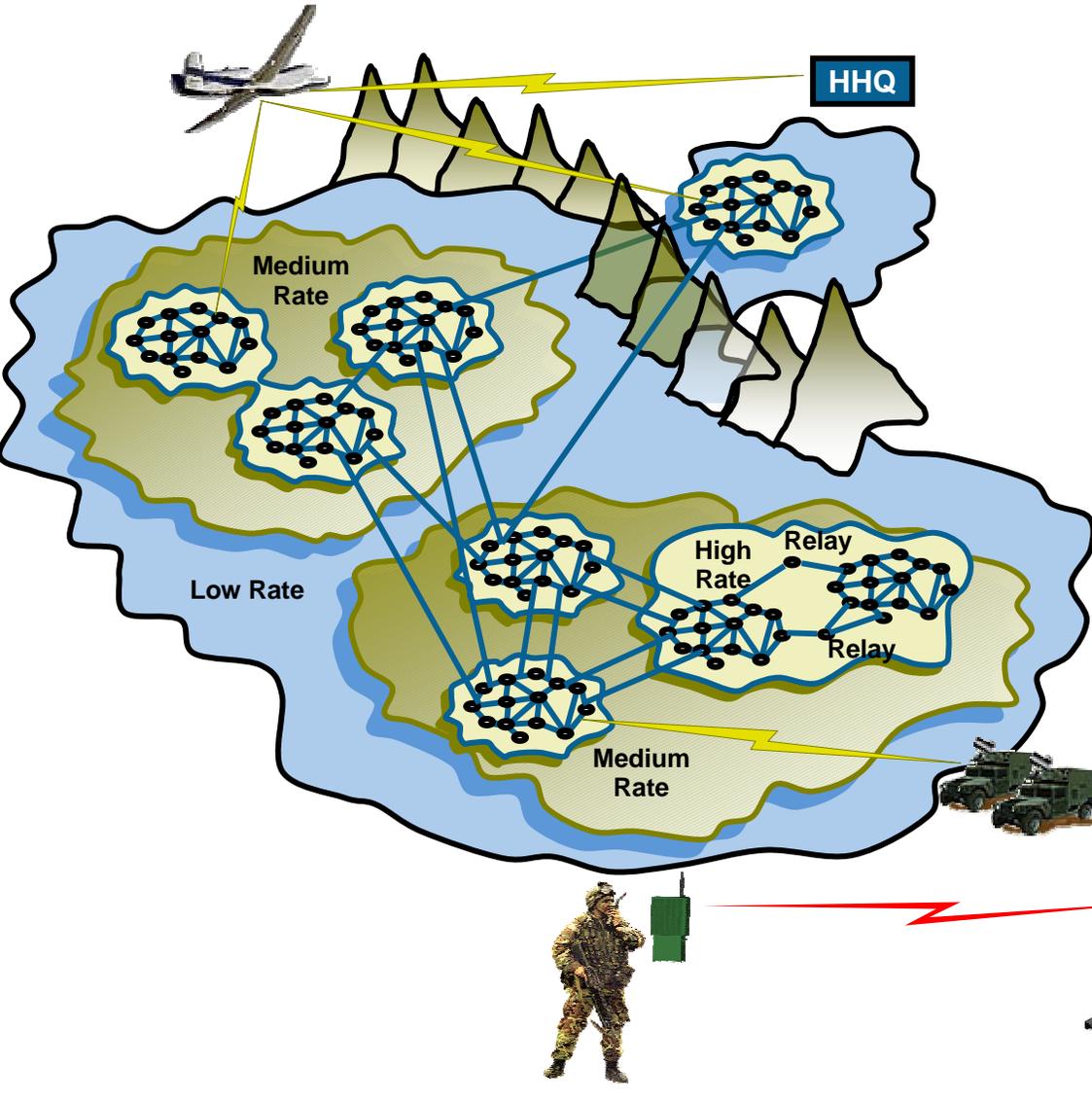
Networked Operations



Self Forming Networks

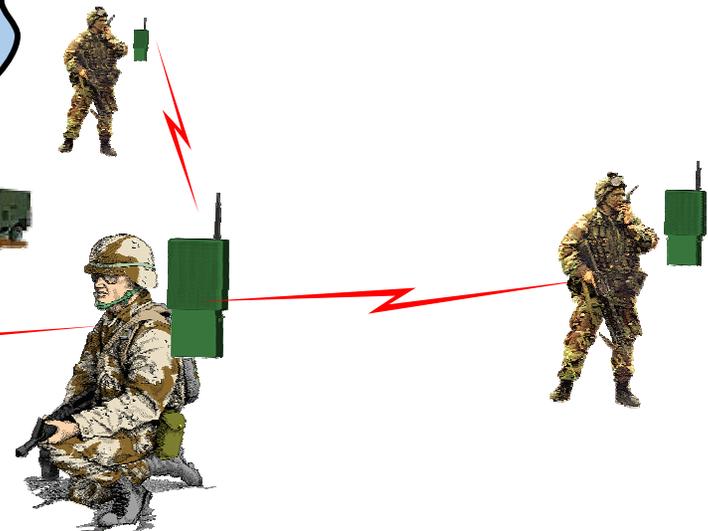


Airborne Communications Node



Unparalleled Communications

- Connectivity guaranteed in any environment at distances, data rates, and level of LPD never before available
- Hierarchical structure scalable to 10,000 nodes
- No fixed infrastructure, all ad hoc peer to peer networking



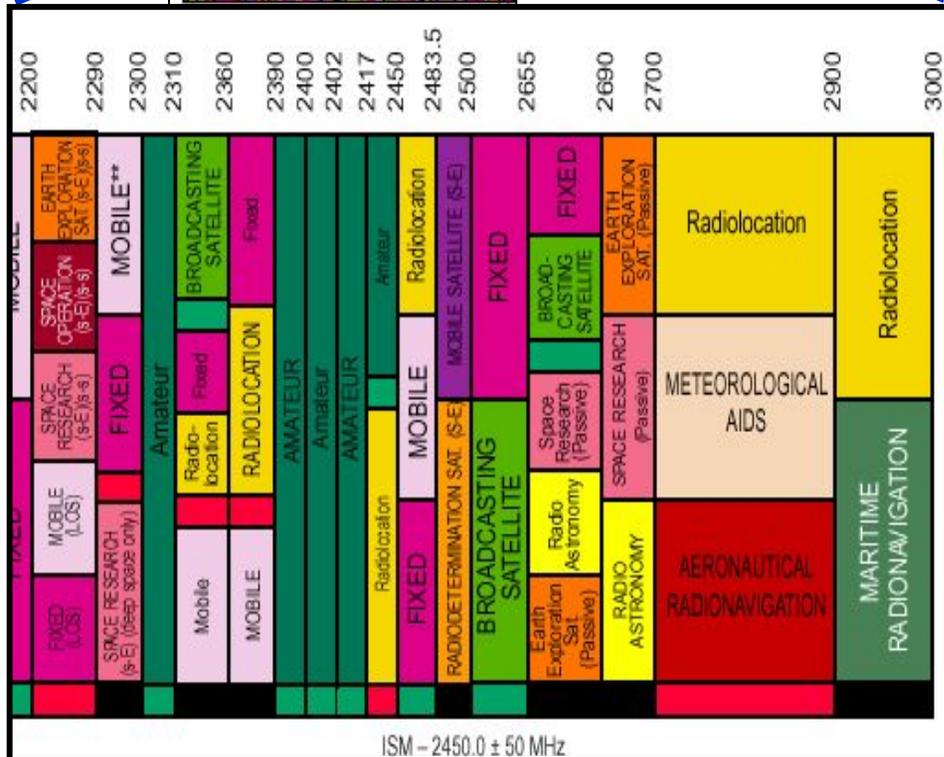
neXt Generation (XG) Communication



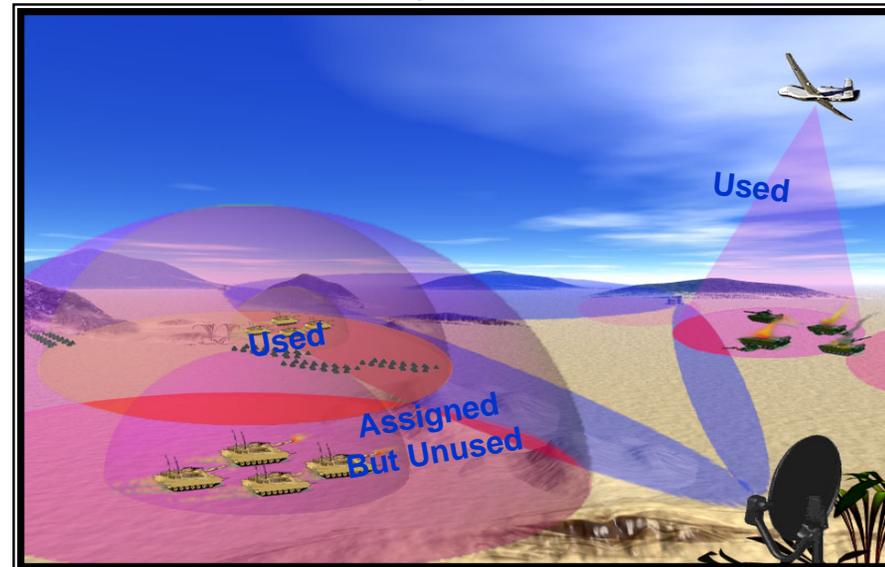
TODAY: Spectrum statically allocated



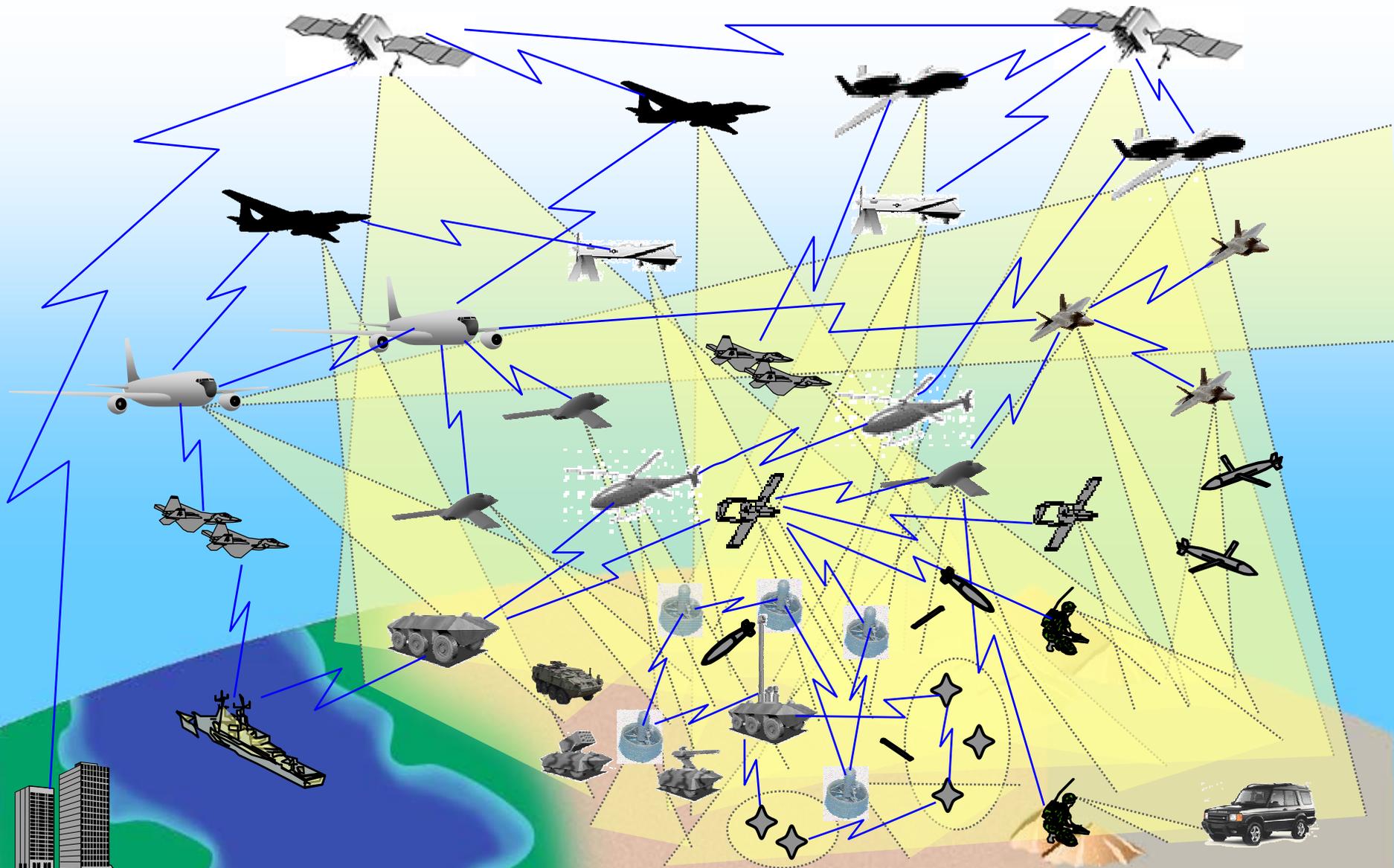
FUTURE: Dynamically allocating spectrum in frequency, space, and time may improve utilization by a factor of 10



ISM - 2450.0 ± 50 MHz

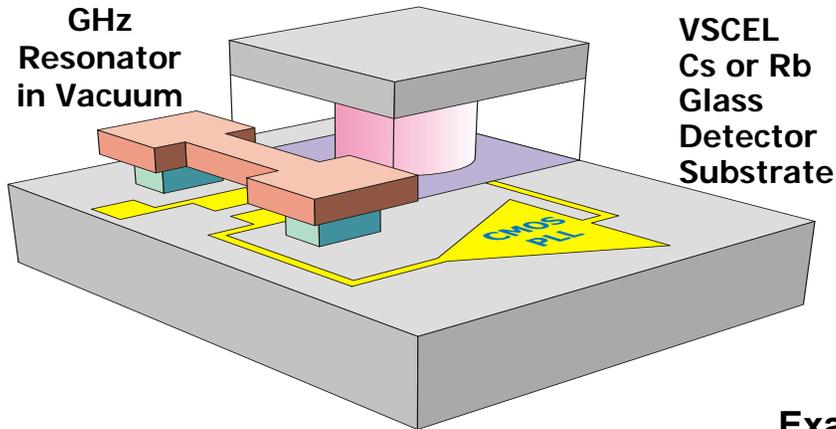


Networked Operations



Chip-Scale Atomic Clock

Ultra-miniaturized, low-power, atomic time and frequency reference units

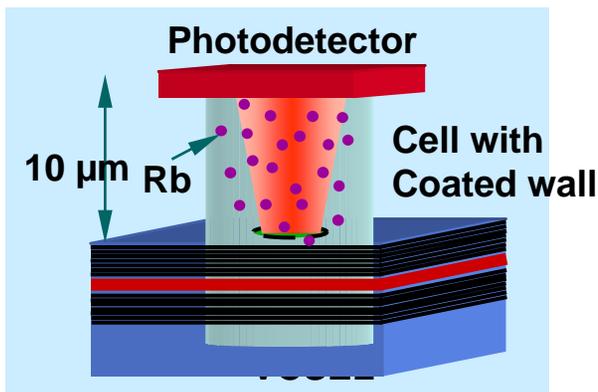


>200X reduction in size

>300X reduction in power

($\pm 1 \times 10^{-11}$ accuracy \Rightarrow $< 1 \mu\text{s/day}$)

Example of Use: Radio System (SINGARS)



Atomic Absorption Cell



Clock accuracy of $1 \times 10^{-11} \Rightarrow$ 16-hour resynch interval or radio silence

Cyber Security Research Programs

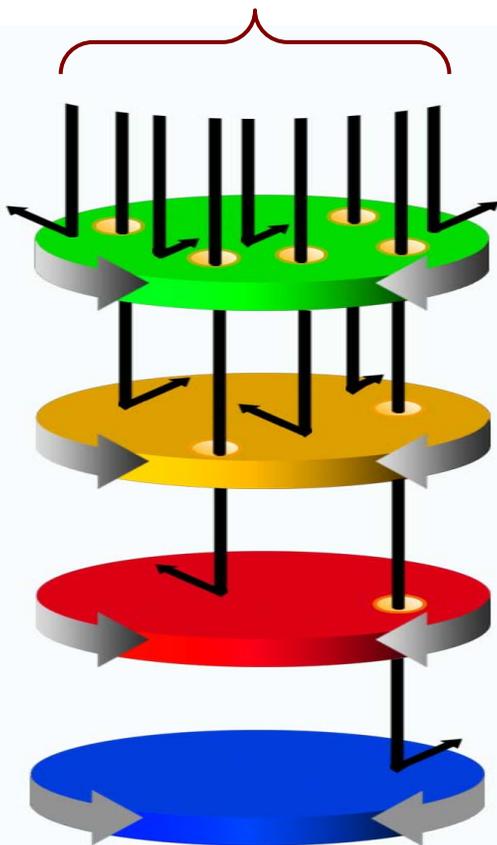


Layered Defense

Thrust Areas:

- Protect against denial of service attacks
- Protect against jamming / denial
- Detect and contain malicious code
- Detect and respond to intrusion

Attacks



Prevent:

All that can be prevented

Respond:

To attacks that can not be prevented

Survivability:

Architect systems to be capable of operating through the worst attacks

Programs:

Portfolio of classified and unclassified programs

Cyber Security Projects



- **Statistical Packet Anomaly Detection Engine (SPADE)**
 - Uncovering stealthy aggressors
- **Operating System Wrappers**
 - Thwarting new forms of malicious code
- **Autonomic Distributed Firewalls**
 - Providing firewalls in network interface cards
- **Composable High Assurance Trusted Systems**
 - Make info security an integral part of open source operating systems
- **Fault Tolerant Networks**
 - Allow network operation under partially successful attacks
- **Cyber Panel**
 - Detect attacks and manage mission critical systems
- **Shapes Vector**
 - Network monitor



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