Cyberspace: New Frontiers in Technology Insertion

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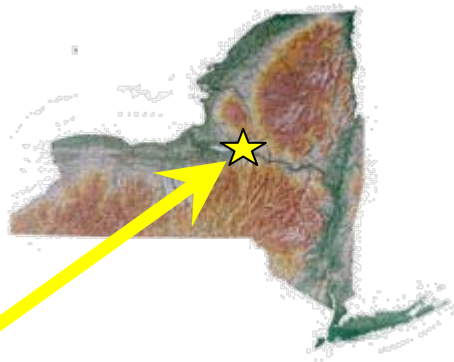
AFRL Structure

AFRL
Maj Gen C Bedke

Staff | **XP**



- **Air Vehicles**
- **Space Vehicles**
- **Information**
- **Munitions**
- **Directed Energy**

- **AFOSR**
- **Materials & Manu-facturing**
- **Sensors**
- **Propulsion**
- **Human Effectiveness**

AFRL/RI
Core Technical Competencies (CTCs)

Information Exploitation

Information Fusion & Understanding

Information Management

Advanced Computing Architectures

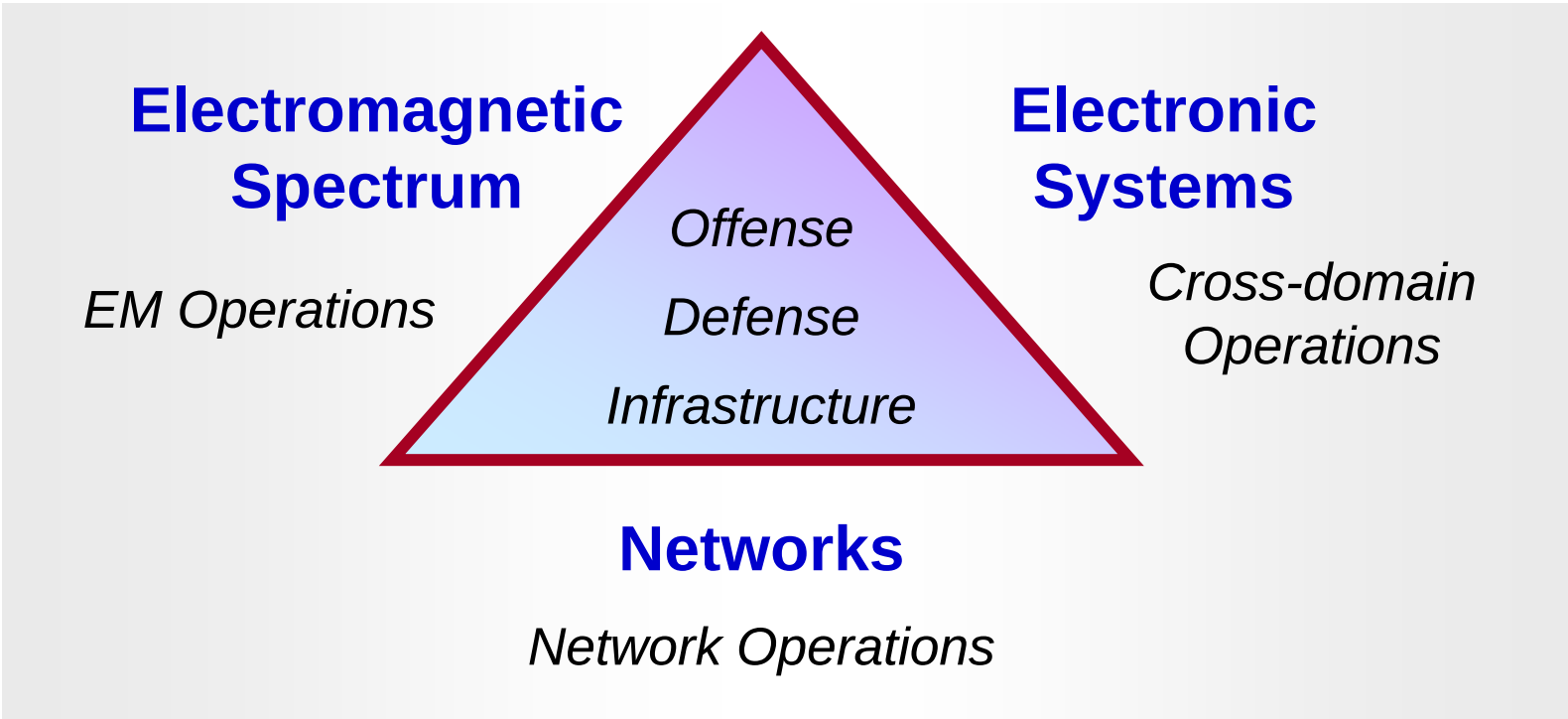
Cyber Operations

Connectivity

Command & Control

CyberSpace Operations

DoD Definition: Cyberspace is a domain characterized by the use of electronics and the electromagnetic spectrum to store, modify, and exchange data via networked systems and associated infrastructures



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Some Important Characteristics of Cyber Operations

- Low cost of entry
  - The enemy can be a disgruntled individual with a cheap computer
- Not characterized by physical or geographic boundaries
  - The enemy can be anywhere and everywhere, outside *and inside*
- R&D and Operations are done in highly classified environment
  - Makes information sharing difficult
- Often relies on exploits that are easily discovered and repaired
  - Sometimes, we only get “one shot”
  - Offense and defense are tightly coupled
  - Technology turnover/refresh

Characteristics of AFCYBER that Catch Our Attention

- Effects, C2, and assessment are to be implemented as integrated capabilities
  - Integrated with other kinetic and non-kinetic capabilities
- The 8th AF capabilities will be organized around an AOC
  - Implies known structure, CONOPs, and doctrine, *but only for air and space domains*
- The executing authority is the COMAFFOR/JFACC
  - Implies known resources, training, responsibilities, *but only for air and space domains*

The parity of Cyber with Air and Space domains suggests parallel concepts in C2, battle management, and intelligence technologies

Cyber Operations Technology Thrusts

1. Access 2. Stealth & Persistence 3. Cyber Intelligence 4. Effects (D5) Deny, Disrupt, Degrade, Deceive & Destroy	CYBER OFFENSE
5. Avoid 6. Defeat 7. Survive 8. Recover	CYBER DEFENSE
9. Situational Awareness 10. Education	CYBER SUPPORT

Warfighting Concepts with a Cyber Twist

- ATR
  - What is a “target” in cyberspace?
  - How do we recognize it when we see it?
- ISR
  - What sensors can we deploy, and how are these assets shared?
- EBO/EBA
  - In cyberspace, the observability of effects is tenuous
  - Second-order effects and cause/effect relationships even more so
- BDA
  - Cyber effects propagate in hard-to-detect ways; including in peoples’ behaviors. What is total effect? Can we determine in real-time?
- AOR
  - Can cyberspace be sensibly decomposed into manageable combatant commands?
- SA and PBA
  - “Situation” is an abstract concept in cyberspace.
  - Visualizations and dynamics (motion, patterns) are ill-defined
- C2 tools
  - Can kinetic and cyber tools be controlled with a single toolset?
  - Can kinetic and cyber tools be integrated/synchronized in a single operation?

AFCYBER Key Areas

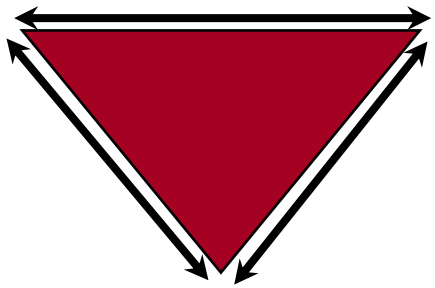
- FY 07
  - Cyber ORM
  - Software Assurance
  - Critical Infrastructure Identification
  - Offensive Cyber Program Research
- FY08
  - Mission Assurance
  - Security Enhancements (Full CAC compliance)
  - Expanded data encryption (at rest and in transit)
  - Sensitive data offline storage
  - Globally Linked AOCs
  - Offensive Cyber Program Development (Integrated with Air and Space C2)
  - DIB IA
- FY09
  - Expeditionary Networks
  - Counter IO: Data protection
  - IP camouflage
  - Active Defense
  - Critical Infrastructure Protect
  - Boundary monitoring
  - Cyber Control
- FY10
  - Network Survivability
  - Cyber Attack
  - Cyber Interdiction
  - Sensor Disruption
  - C2 Disruption
  - Cyber enabled weapons degradation
  - Electronic Sys Attack (w/ DE)

“Traditional” AFRL Transition

- **6.1 → 6.2 → 6.3, Critical Experiments and Advanced Technology Demonstrations**
- **Advanced Technology Council**

Lab (☆☆)

- Identify ATD Candidates
- Budget for Technology Programs
- Develop Transitionable Technologies



User (☆☆☆)

- Define Requirements
- Budget Transition Funds

Center (☆☆☆)

- Interpret Requirements
- Build Transition Program
- Integrate Into Systems

POM-Oriented Transition

ATD Categories

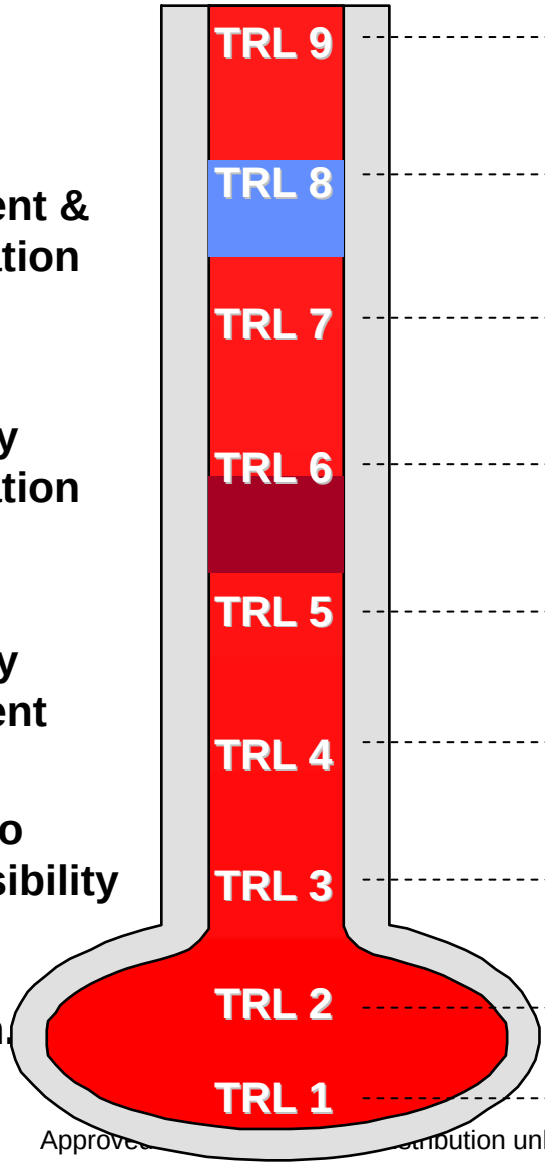
- *Category 1:* MAJCOM or Agency supports and has programmed required funding for transition within the FYDP
- *Category 2A:* MAJCOM or Agency supports and is committed to identify transition funding in the next Program Objective Memorandum (POM) cycle or Amended POM
- *Category 2B:* MAJCOM or Agency supports but is not currently able to program for transition funding

Traditional Acquisition

Traditional acquisition practices support the development, deployment, and sustainment of long term, highly capable systems

- **Focus on minimum risk**
- **Stable requirements (or a known roadmap)**
- **Dedicated development and test cycles**
- **Refined over years based on large body of experience**
- **10 year cycle typical for development to transition & Integration**

Technology Readiness Levels



System Development & Demonstration

Technology Demonstration

Technology Development

Research to Prove Feasibility

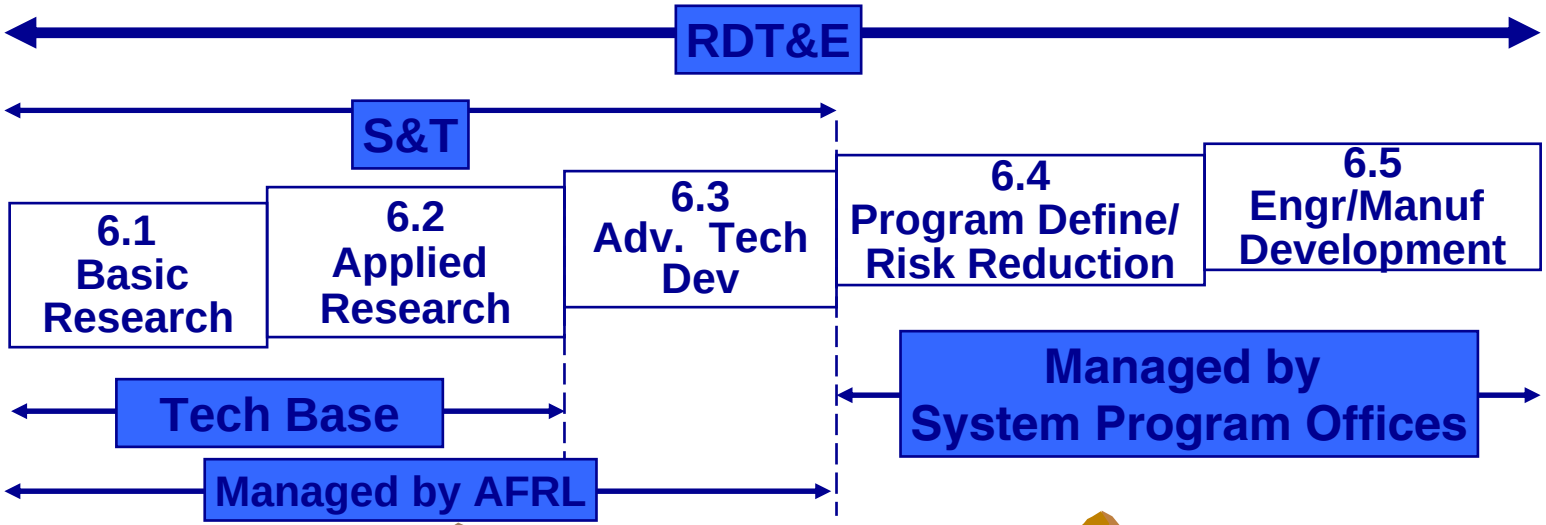
Basic Tech. Research

- **TRL 9:** Actual system "Flight Proven" through successful mission operations
- **TRL 8:** Actual system completed and "flight qualified" through test and demonstration
- **TRL 7:** System prototype demonstration in an operational environment
- **TRL 6:** System/subsystem model or prototype demonstration in a relevant environment
- **TRL 5:** Component and/or breadboard validation in a relevant environment - environment can be simulated
- **TRL 4:** Component and/or breadboard validation in a laboratory environment
- **TRL 3:** Analytical & experimental critical function and/or characteristic proof-of-concept
- **TRL 2:** Technology concept and/or application formulated
- **TRL 1:** Basic principles observed and reported

The Current Landscape

Bridging The Technology Transition Gap

Source: AFC2ISRC GCIC AFISR ATC



Applied Technology Council

Means for Tech Transition

- Advanced Technology Demo (ATD)
- Advanced Concept Tech Demo (ACTD)
- Technology Planning IPT
- Technical Events (JEFX, CWID etc.)
- SPD Initiative
- Industry Initiative
- Senior Leader Initiative

Tech Transition "Seam"

Emphasis is Necessary on Technology Transition

- Sustained Senior Leader Emphasis
- Continuous Communication
- Integrated Process
- Budget For Production Incorporation

The S&T Transition Struggle

Technology Standards

Acquisition Standards

New Ideas

Tech. Push

Strategic

- Meets Planners Projections
  - General Technology
  - Future Capability
- General Applicability
  - Enhances Performance
  - Foundation (i.e. Open Syst.)
  - Lead Industry
- Expandability – General
- Flexibility – General

Transition Gap

Tactical

- Meets User Need
  - Specific Capability
- GOTS/COTS Avail.
- TRL Level Validated
- Production Capable
- Allows COTS Prod. Integration

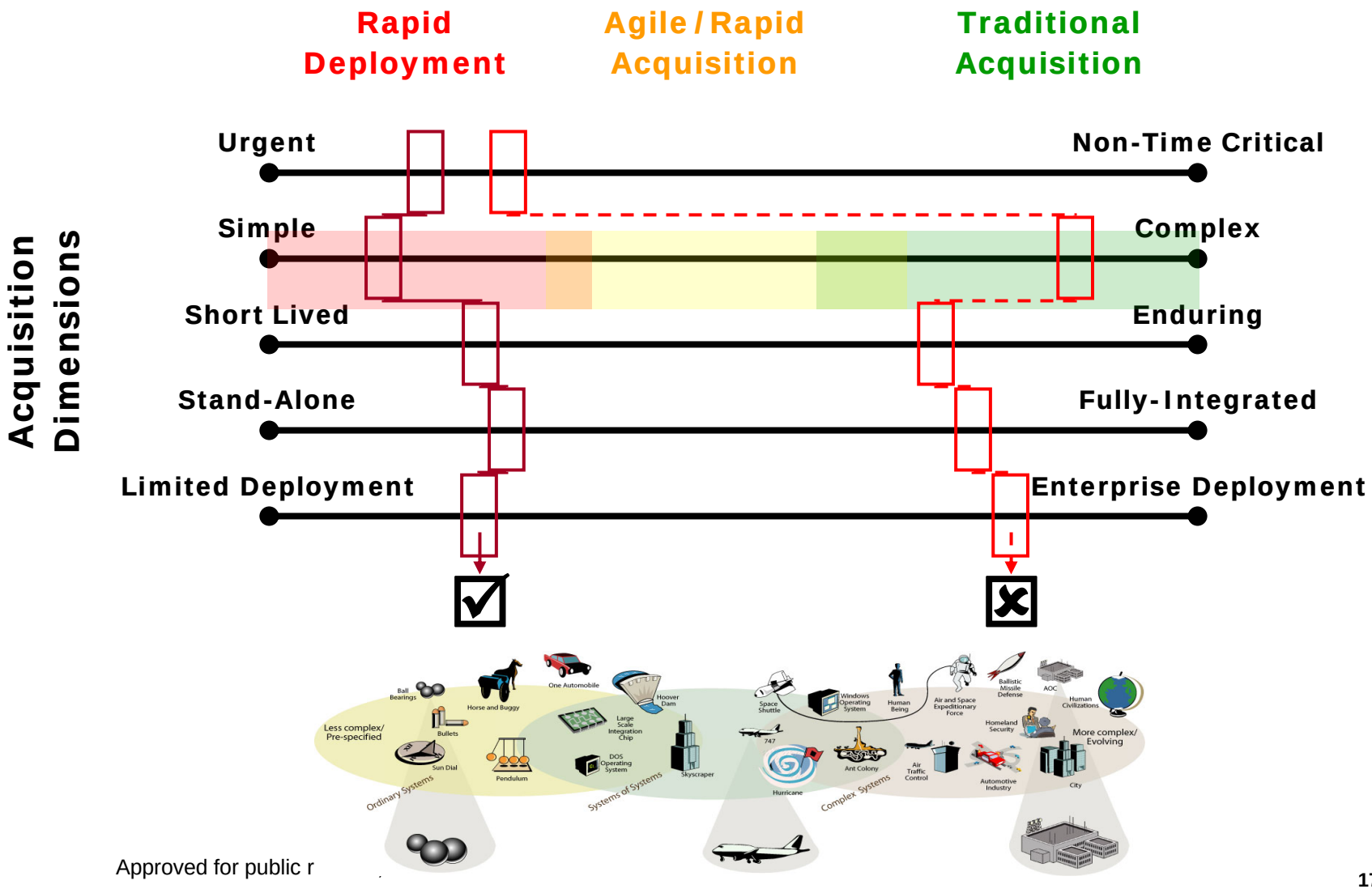
Reg Pull

Current Needs

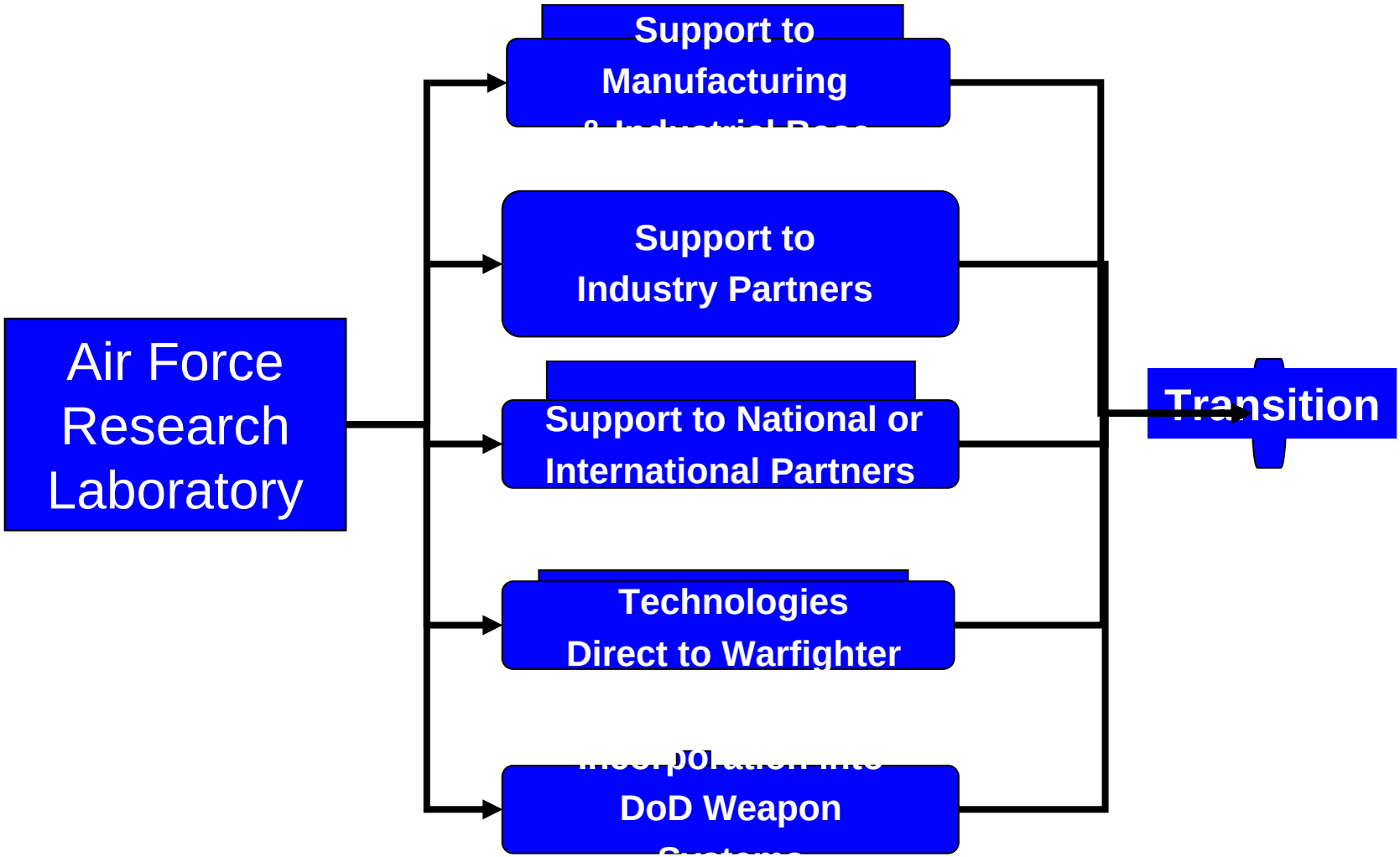
CYBER Transition Requires new Acquisition Processes

- **Cyber Acquisitions may require:**
  - **Very rapid, urgent fielding needs (days to weeks)**
  - **Agile development and fielding (months)**
  - **Traditional development, fielding, and sustainment (months to years) with regular capability "releases" or spirals**
- **Application to very short cycle times requires alternative approaches**
  - **Decreased research & development time**
  - **Limited test and verification**
  - **"Short tail" logistics**
- **Strategies to continually innovate and assess**
  - **threats and emerging technology,**
  - **Rapid prototyping**
  - **Supporting AFCYBER stated capability needs**
  - **Develop key partnerships**
- **Migration of some development and assessment efforts to "pre-need" phase**
  - **Emerging threat R&D strategy to complement reactive acquisition strategy**

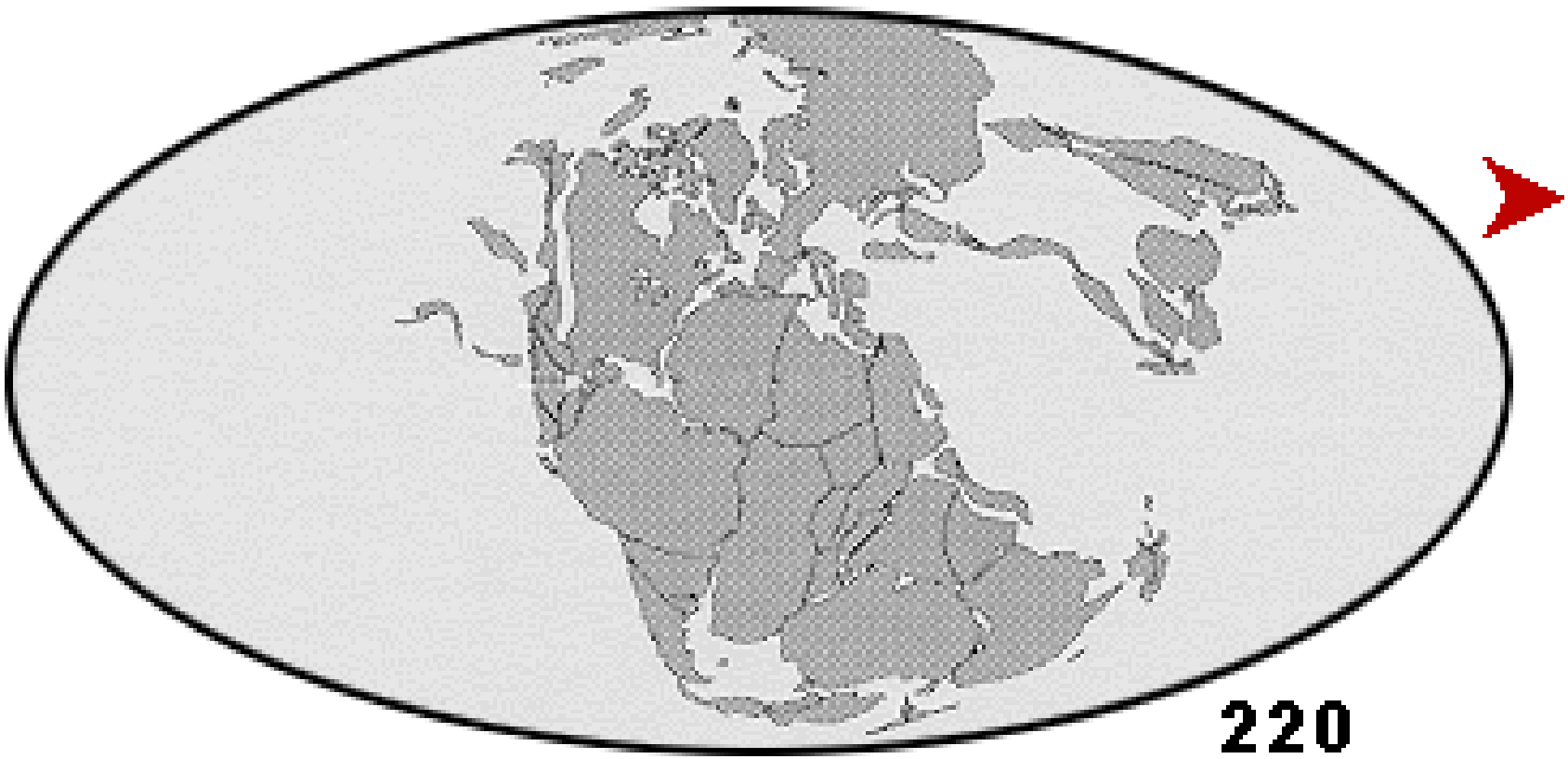
Full Spectrum Acquisition



Alternative Transition Paths



Conclusions: The Changing Battlefield of CyberSpace



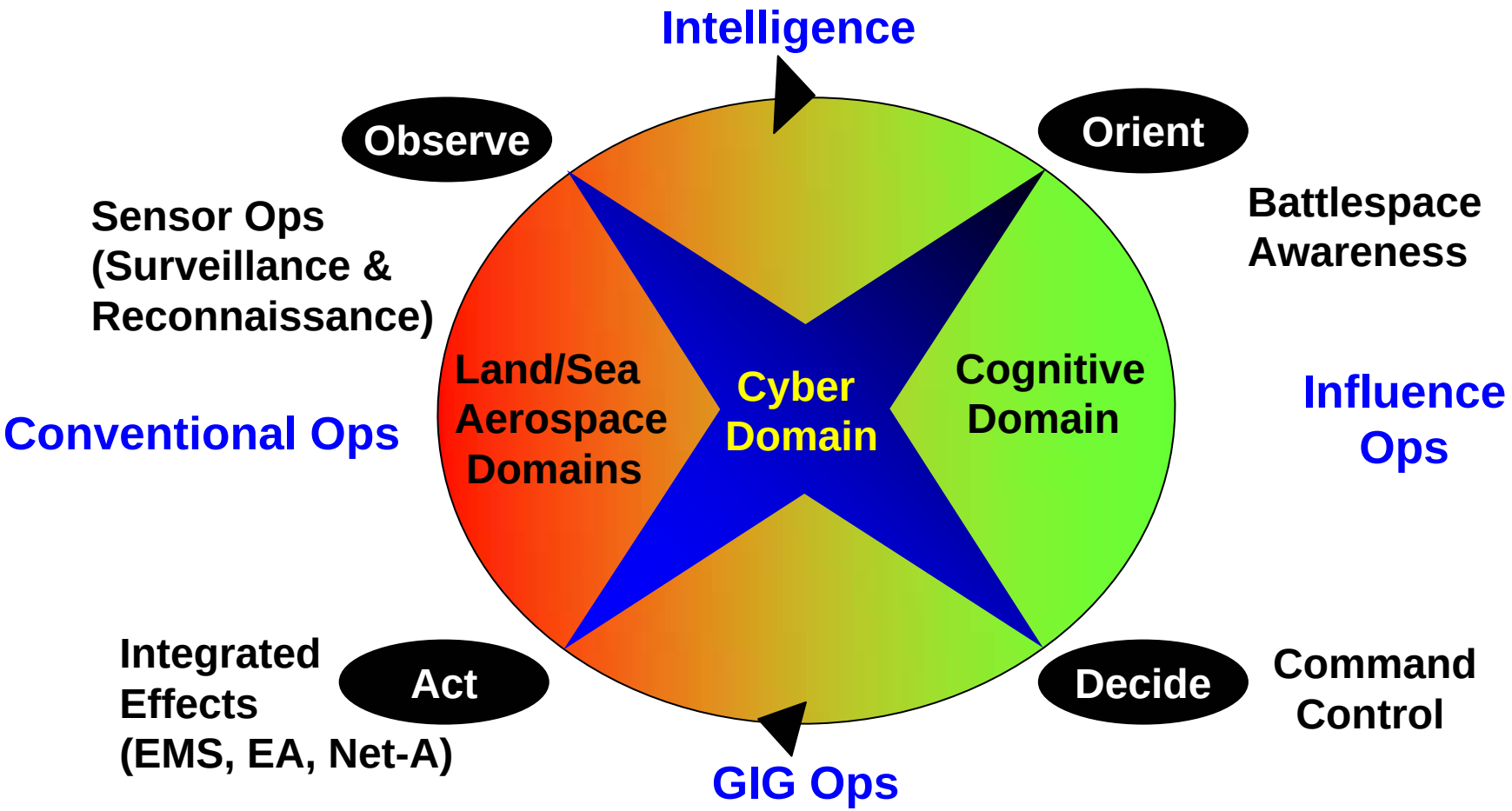
"Transition to WHAT?"

Summary

- **Rapid research & development strategies**
- **Constant reassessment of changing landscape resulting in short duration R&D efforts and rapid technology transition**
- **New acquisition strategies required**
- **New relationship between research and acquisition**
- **Innovative challenges/opportunities for community to develop a responsive cyber research and development strategy to work with a full spectrum acquisition capability**
- **AFRL/RI to lead R&D for the cyber big “A” team**

Questions?

The Battle in Cyberspace



Offense, Defense, Infrastructure Elements

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