Headquarters U.S. Air Force

Integrity - Service - Excellence

Multi-domain Command & Control

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Why the need to change?

Breaking Barriers ... Since 1947

AS 2030 states "the AF's projected force structure is not capable of fighting and winning against this threat array without a shift in focus to multi-domain capabilities and capacity"

Ground Based Lasers
Light speed Crippling Effects

Co-orbital ASATs
Attack on Demand
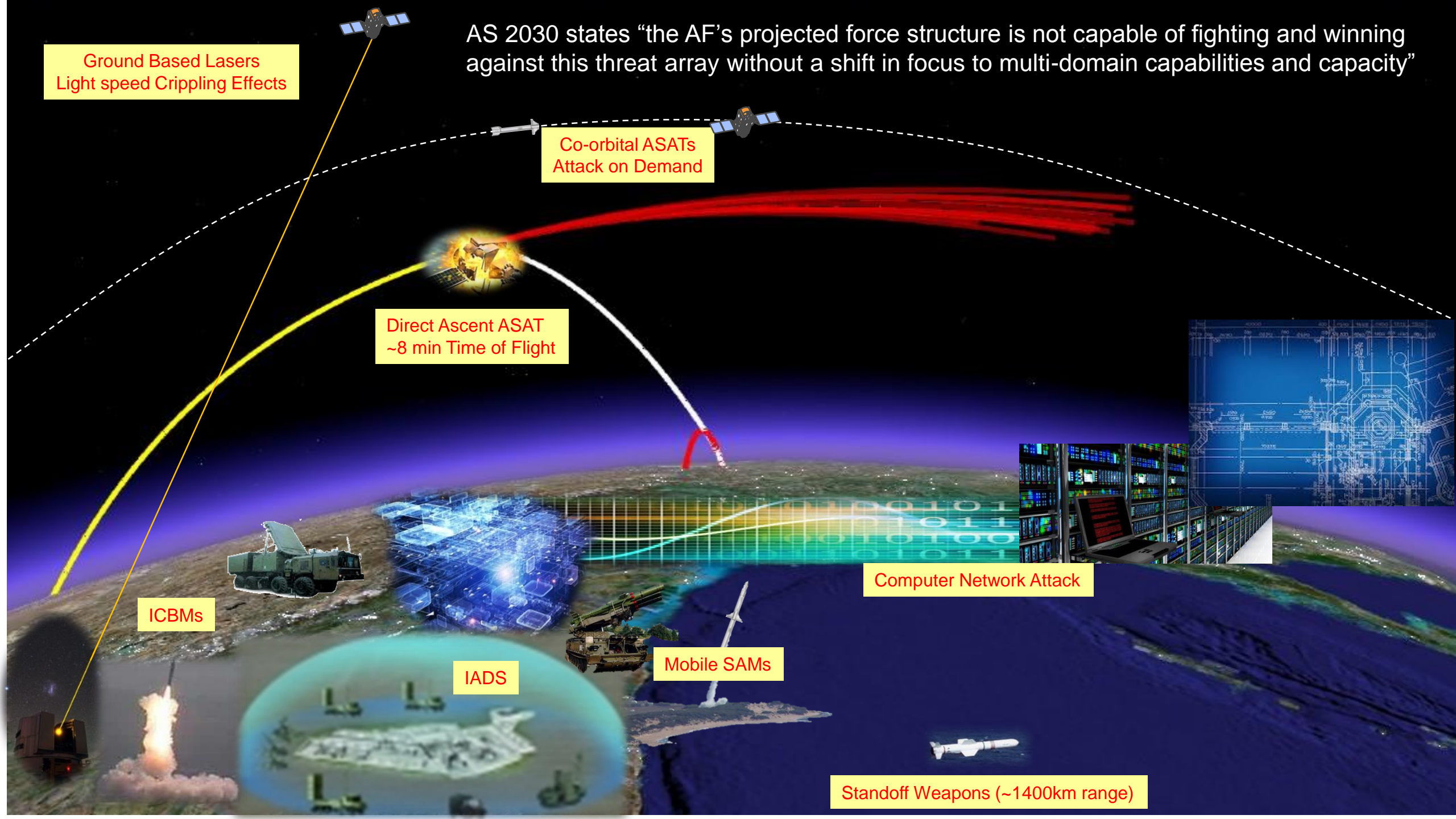
Direct Ascent ASAT
~8 min Time of Flight

Computer Network Attack

ICBMs

Mobile SAMs

IADS

Standoff Weapons (~1400km range)

Future Warfare...and its seams

Cyber

Space

Air

Land

Maritime

Sub-surface

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What needs to change?

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Multi-domain Operations (MDO)

- **MDO is more than operating weapon systems in multiple domains**

- **MDO is more than systems in one domain supporting operations in another domain (necessary but not sufficient)**

- **MDO includes ability to generate offensive & defensive effects from all domains**

- **MDO leverages *seamless, dynamic and continuous* integration of capabilities generating effects in and from all domains.**

- **Advanced multi-domain operations are *high velocity, operationally agile* operations that present multiple dilemmas for an adversary at an operational tempo they cannot match.**
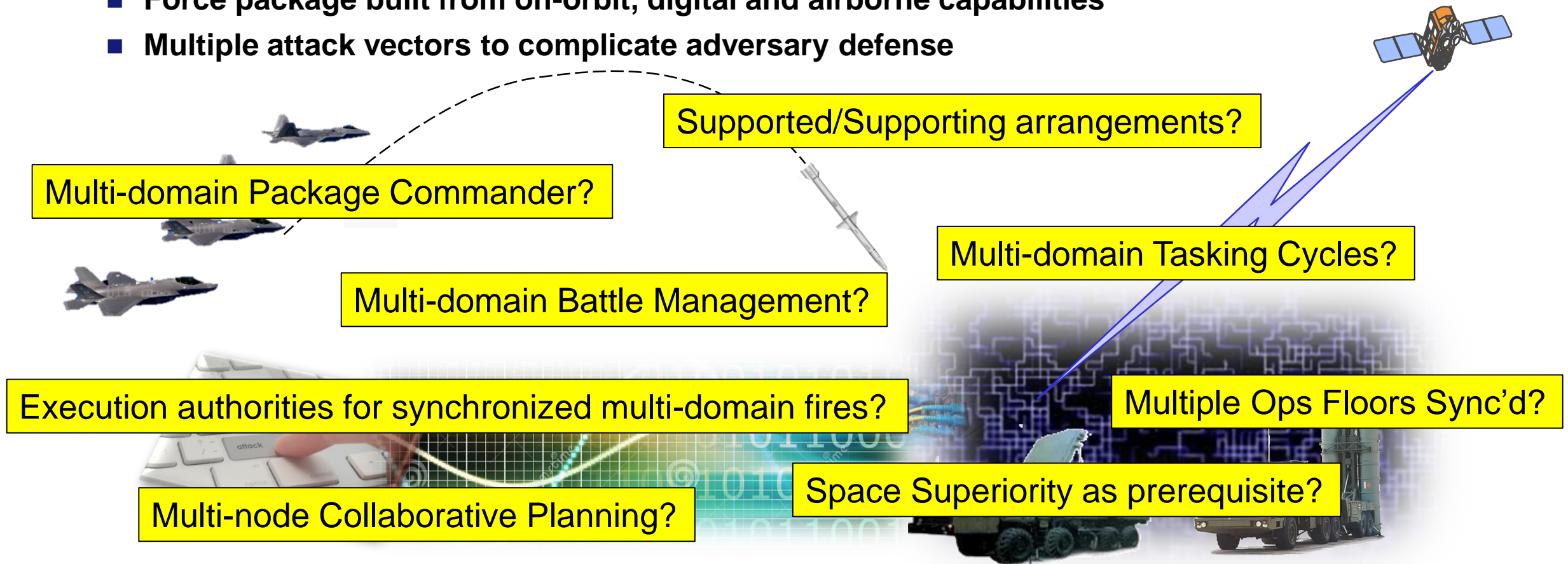
Multi-domain Operations End State

- **Coalition forces have the operational agility to seamlessly shift between levels of war, geographic areas, missions, functions and warfighting domains.**

- **Coalition forces can dynamically create multiple dilemmas for an adversary at an operations tempo they cannot match.**

- **Coalition forces have the support processes and resiliency to conduct sustainable, persistent operations in spite of a contested battlespace.**

Vision of MDO…2030 Vignette

- **Suppression of Enemy Air Defenses in a regional conflict**
  - **Air Force capability to conduct the mission will include air, space and cyber platforms**
  - **Force package built from on-orbit, digital and airborne capabilities**
  - **Multiple attack vectors to complicate adversary defense**

Supported/Supporting arrangements?

Multi-domain Package Commander?

Multi-domain Tasking Cycles?

Multi-domain Battle Management?

Execution authorities for synchronized multi-domain fires?

Multiple Ops Floors Sync'd?

Space Superiority as prerequisite?

Multi-node Collaborative Planning?

Multi-domain Command and Control

DEFINITION: **The coordinated execution of authority and direction to gain, fuse and exploit information from any source in order to integrate planning and synchronize execution of multi-domain operations in time, space and purpose to meet the commander's objectives.**

The MDC2 Campaign Plan is:

"A systematic enhancement of the command and control enterprise in order to accomplish missions in a Digital Age security environment."

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Key Challenges

➢ **C2 Operational Constructs not designed to optimize multi-domain operations**

- ▪ **Space and Cyber warfighting concepts are not as mature as Air warfighting concepts**
- ▪ **AF has missions/capabilities divided between global and regional causing disconnects**
- ▪ **Force Presentation affects multi-domain integration and C2 processes**

➢ **C2 Technology is out of date and less capable of leveraging new technology**

- ▪ **Infrastructure is stovepiped preventing modern IT processes (IA) and rapid integration**
- ▪ **C2 baseline in AOCs is tightly controlled affecting operational performance**
- ▪ **Proprietary data inextricably woven into infrastructure and applications**
- ▪ **New capabilities delivered too slowly to keep pace with technology cycles**
- ▪ **Not able to leverage advanced tech (artificial intelligence, automation, big data analytics, etc.)**

➢ **C2 Supporting Structures not designed for Multi-domain operations**

- ▪ **AF emphasizes Tactical Depth but requires more Multi-domain/Operational Breadth**
- ▪ **Operational-level C2 is only Core Mission mostly done as a "pick-up" game**
- ▪ **Security processes/procedures focused on limiting access to information…not sharing**

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How will we execute the change?

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moon shot /mo͞on ˌSHät/

noun

An ambitious, exploratory and ground-breaking project undertaken without any expectation of near-term benefit and also, perhaps, without a full investigation of potential risks and benefits.

A project or proposal that:

Addresses a huge problem

Proposes a radical solution

Uses breakthrough technology

What did it take to succeed?

Technology

Project Apollo (1962-1975)
- 17 test & 15 manned flights
- Learned
  - Complex Sys Integration
  - Resolved Tech Issues
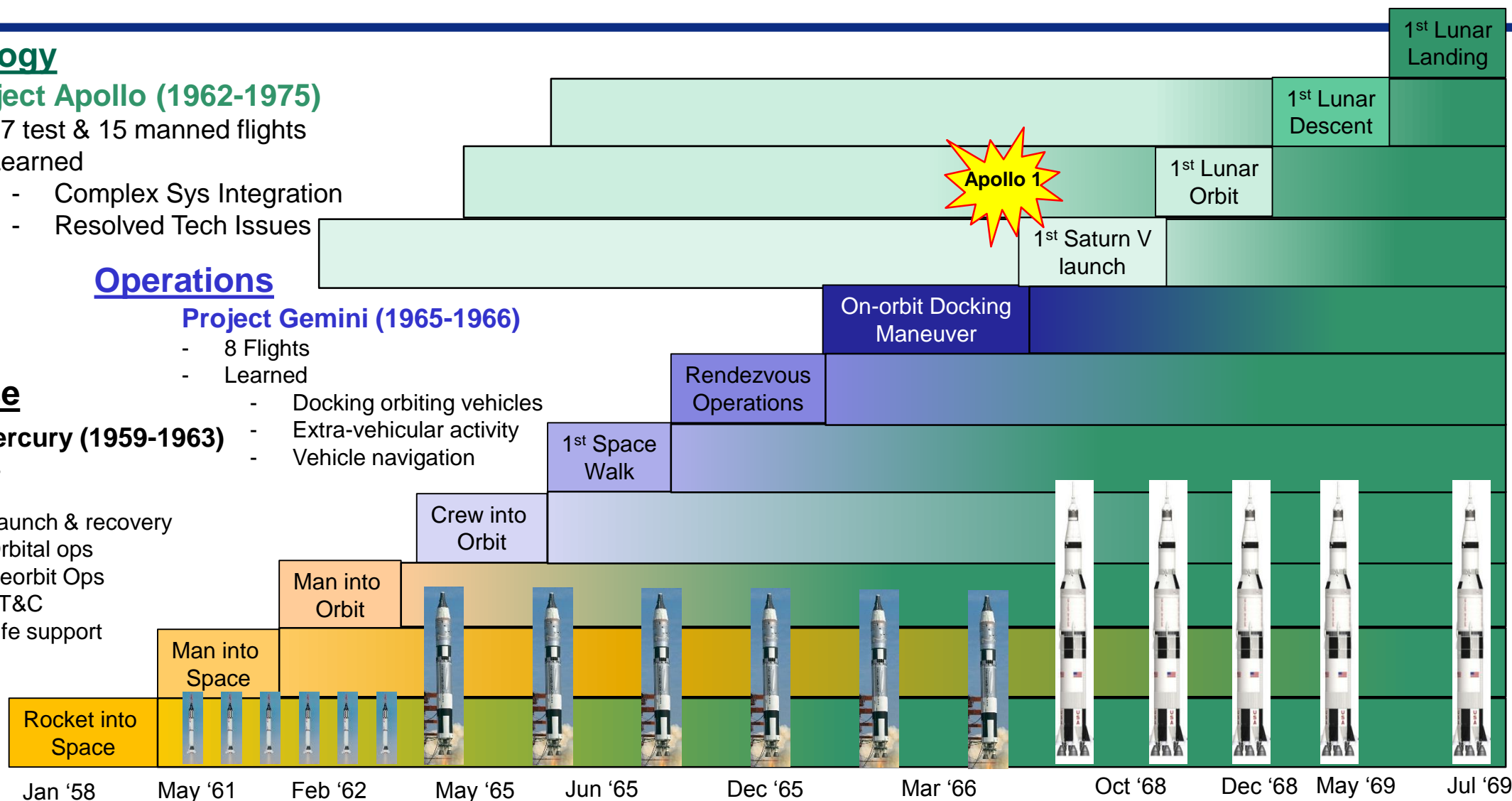
Operations

Project Gemini (1965-1966)
- 8 Flights
- Learned
  - Docking orbiting vehicles
  - Extra-vehicular activity
  - Vehicle navigation

Expertise

Project Mercury (1959-1963)
- 6 Flights
- Learned
  - Launch & recovery
  - Orbital ops
  - Deorbit Ops
  - TT&C
  - Life support

1st Lunar Landing	
1st Lunar Descent	
1st Lunar Orbit	
Apollo 1	1st Saturn V launch
On-orbit Docking Maneuver	
Rendezvous Operations	
1st Space Walk	
Crew into Orbit	
Man into Orbit	
Man into Space	
Rocket into Space	

Timeline: Jan '58 — May '61 — Feb '62 — May '65 — Jun '65 — Dec '65 — Mar '66 — Oct '68 — Dec '68 — May '69 — Jul '69

MDC2 Building Blocks

Technology

- Long-lead infrastructure
- Experimentation
- Data Accessibility

Integrated Ops & Resilient Networks

D2D Expmnts	Assured Comm Network		Full MDO Cloud
Shadow OC	Advanced Tech & Virtualized Mission Data		Next Gen OC
BMC2 NSDC	AOC Pathfinder	Enterprise C2 Apps & Modern IT Infrastructure	Enterprise SOA

MDO CONOPS
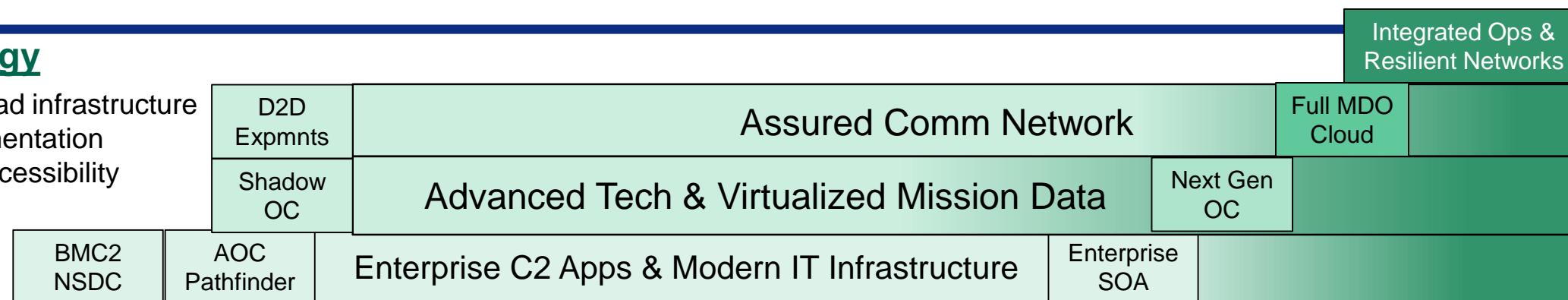
Operations

- Processes/Procedures
- Multi-node synchronization
- C2 Integration
- MDC2 Ops

MDO Force Package

MDO Battle Mgmnt

Multi-node Planning
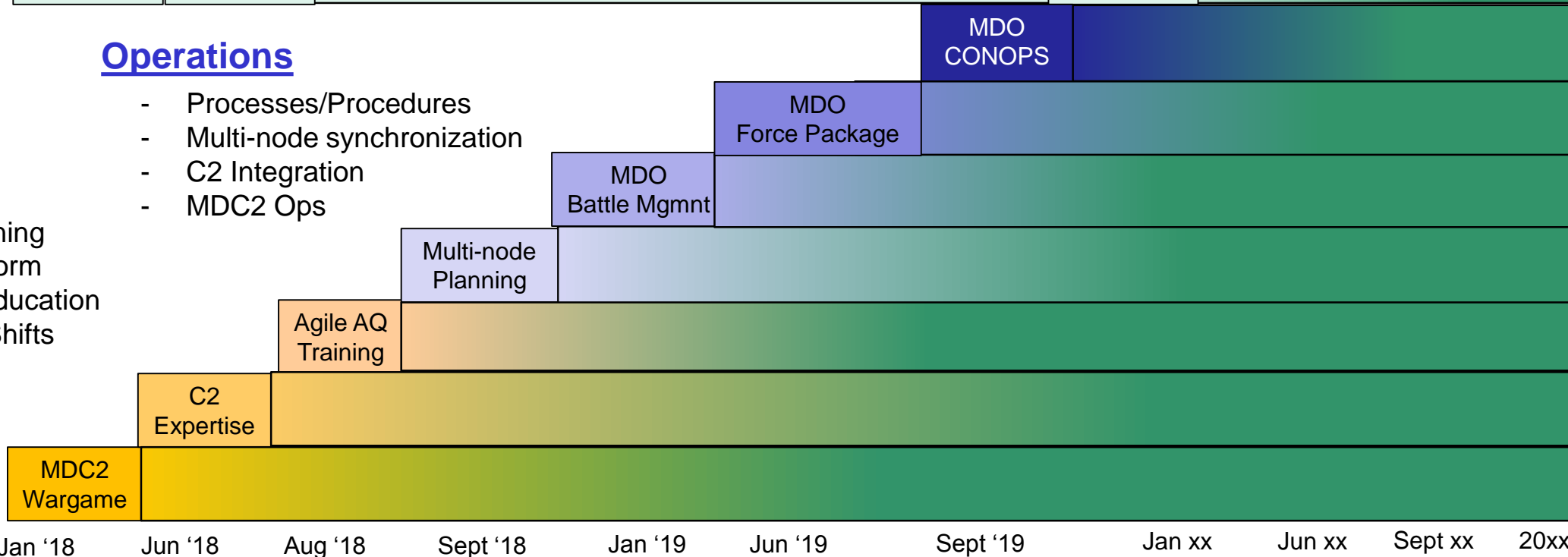
Expertise

- C2 Training
- AQ Reform
- MDO Education
- Policy Shifts

Agile AQ Training

C2 Expertise

MDC2 Wargame

| Jan '18 | Jun '18 | Aug '18 | Sept '18 | Jan '19 | Jun '19 | Sept '19 | Jan xx | Jun xx | Sept xx | 20xx |

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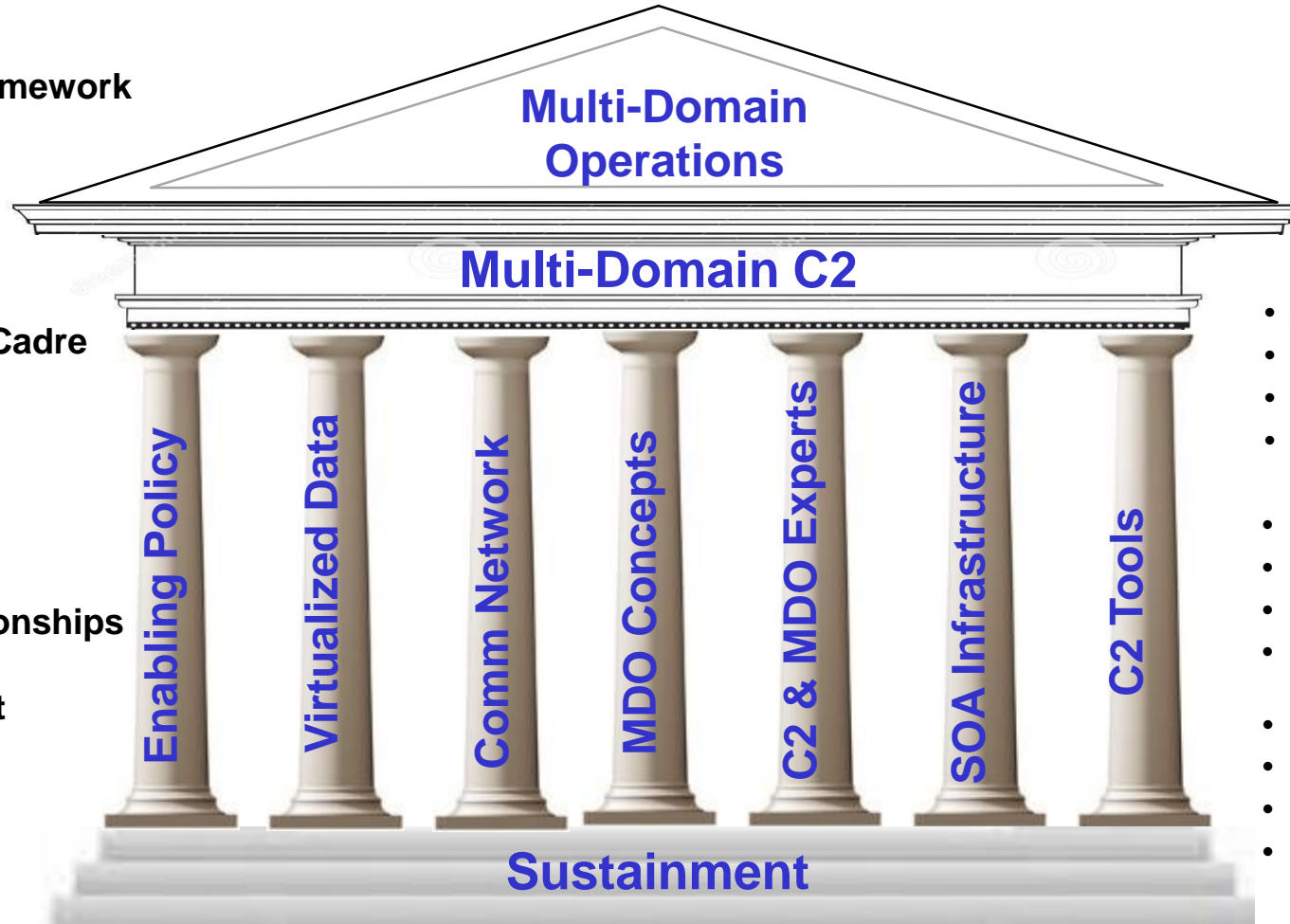
Foundation for Effective MDO

Multi-Domain Operations

Multi-Domain C2

- Effective Security Risk Framework
- Auth to Operate Process
- Rapid Testing Process

- Formal C2 Cadre Training
- Force Development of C2 Cadre
- JOPP expertise
- MDO experience
- Assured Comm
- Tactical Data Links

- Effective Command Relationships
- Collaborative Planning
- Multi-domain Battle Mgmt
- MDO Force Packaging

Pillars:
- Enabling Policy
- Virtualized Data
- Comm Network
- MDO Concepts
- C2 & MDO Experts
- SOA Infrastructure
- C2 Tools

Sustainment

- Virtualized Data
- Common Interface
- Common data standards
- Service-oriented architecture

- Algorithms separated from data
- Tailored mission applications
- Multi-node COP sharing
- Decision support

- Rapid Tech Refresh Cycle
- C2 Exercises & Experiments
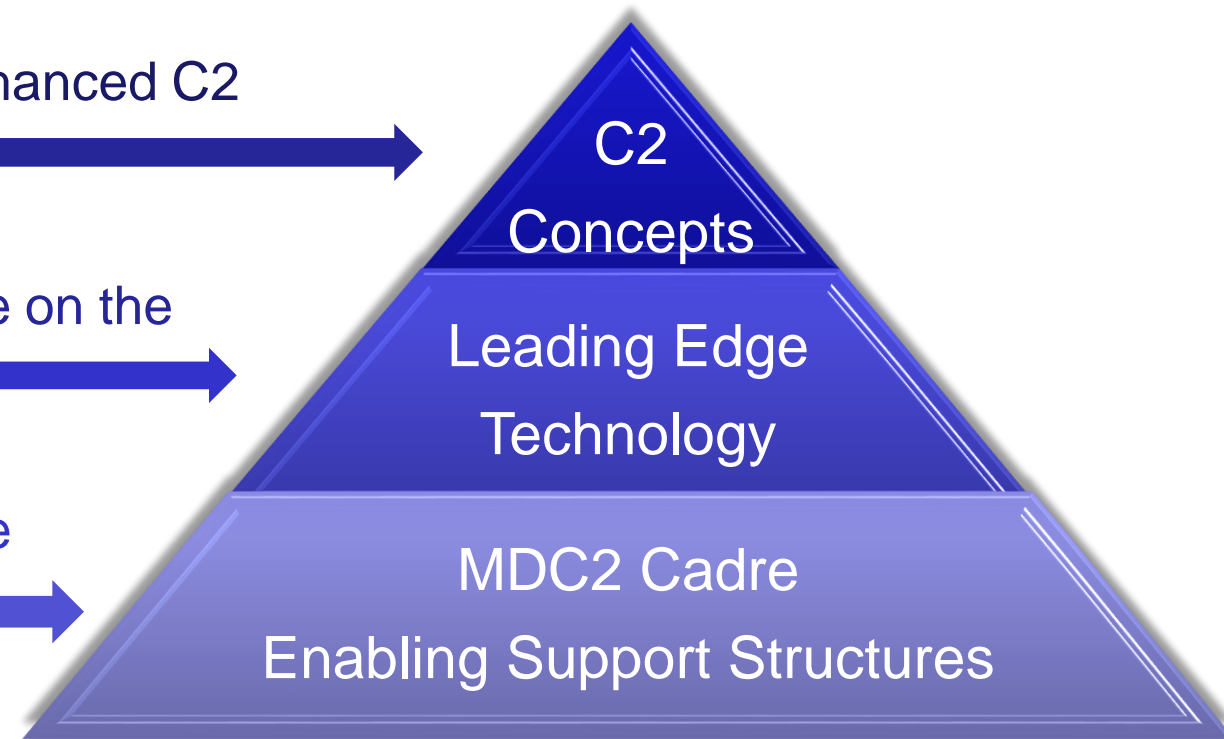- Training, Education & Experience
- Force Development

Operational Approach

- **In order to keep MDC2 perpetually optimized to provide <u>high velocity</u>, <u>operationally agile operations</u>, the Air Force will:**

  - Exploit purpose-built opportunities to explore enhanced C2 processes and concepts

  - Provide them the tools, data and IT infrastructure on the leading edge of technology
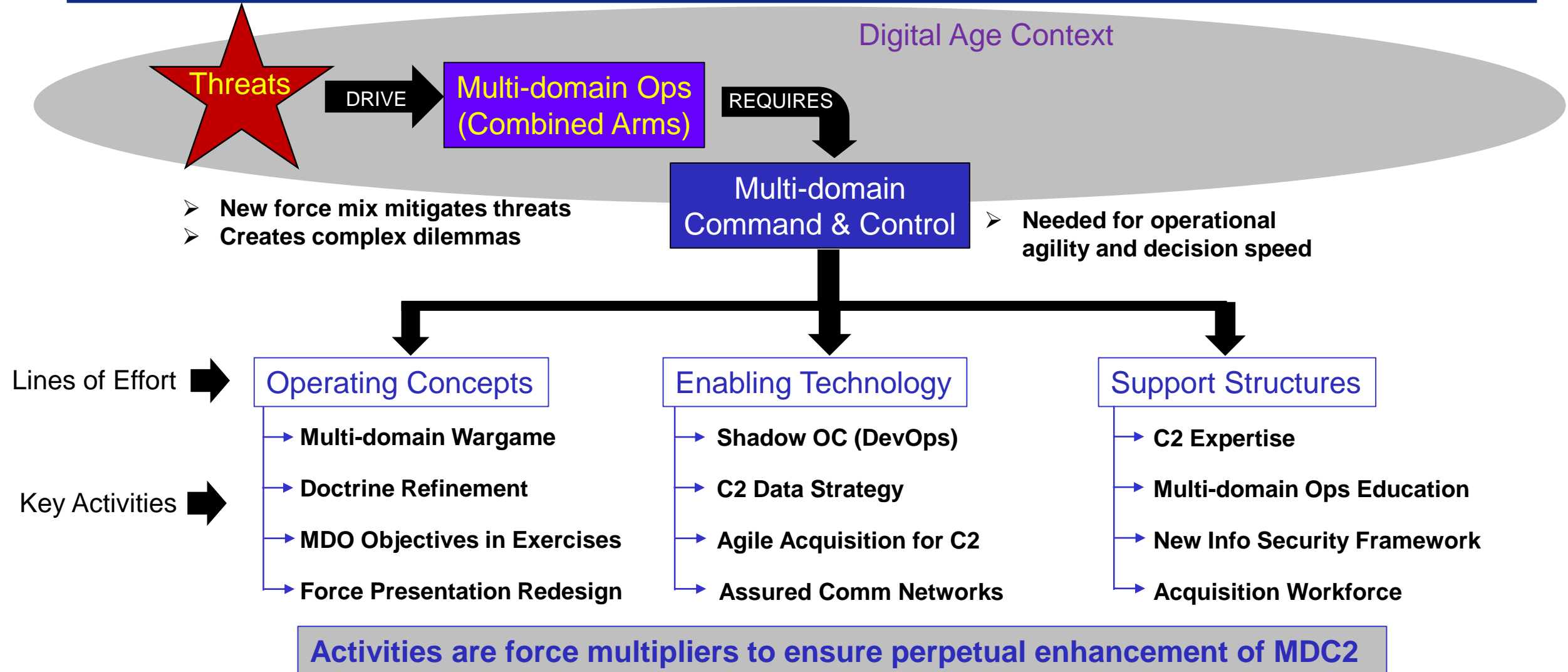
  - Develop a continuum of learning for C2 expertise and key support structures

C2 Concepts

Leading Edge Technology
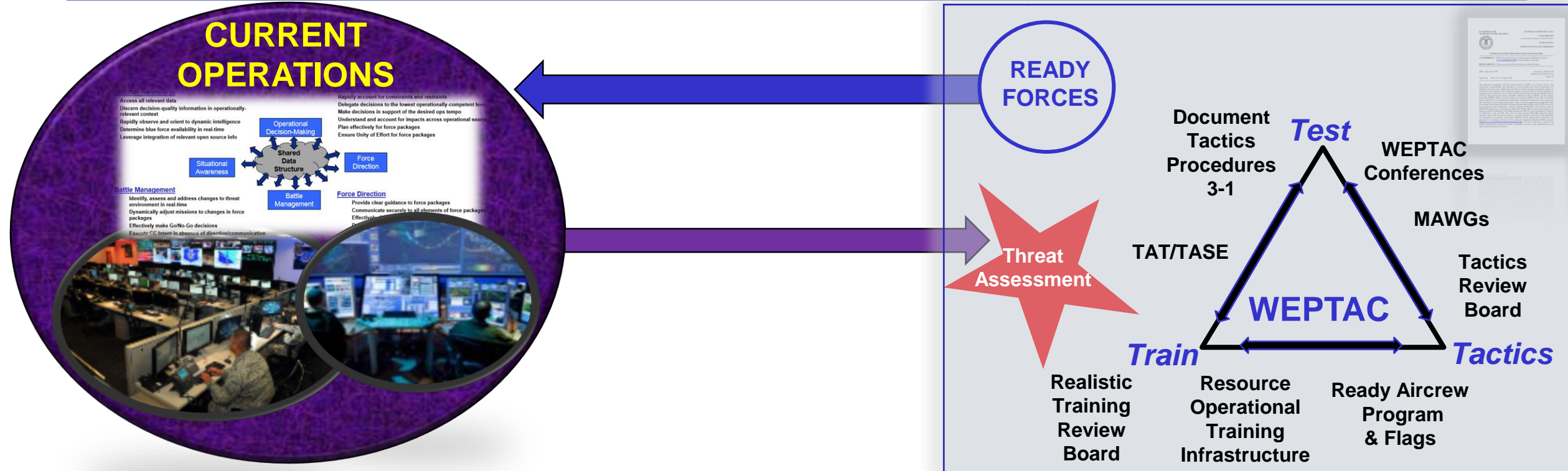
MDC2 Cadre Enabling Support Structures

Success is about processes not products

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Connecting Need for MDO to Key Activities

Digital Age Context

Threats → DRIVE → **Multi-domain Ops (Combined Arms)** → REQUIRES → **Multi-domain Command & Control**

➤ **New force mix mitigates threats**
➤ **Creates complex dilemmas**

➤ **Needed for operational agility and decision speed**

Lines of Effort →

Key Activities →

Operating Concepts	Enabling Technology	Support Structures
→ **Multi-domain Wargame**	→ **Shadow OC (DevOps)**	→ **C2 Expertise**
→ **Doctrine Refinement**	→ **C2 Data Strategy**	→ **Multi-domain Ops Education**
→ **MDO Objectives in Exercises**	→ **Agile Acquisition for C2**	→ **New Info Security Framework**
→ **Force Presentation Redesign**	→ **Assured Comm Networks**	→ **Acquisition Workforce**

Activities are force multipliers to ensure perpetual enhancement of MDC2

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Weapons & Tactics (WEPTAC) Model

CURRENT OPERATIONS

READY FORCES

Threat Assessment

Test

Document Tactics Procedures 3-1

WEPTAC Conferences

MAWGs

TAT/TASE

WEPTAC

Tactics Review Board

Train

Tactics

Realistic Training Review Board

Resource Operational Training Infrastructure

Ready Aircrew Program & Flags

Tactics Improvement Process

Air Force has leveraged the WEPTAC Model:

➢ Continuous enhancement of weapons and tactics
➢ Disciplined processes, forums, mechanisms for improvement
➢ Weapons Officers serve as "keepers" of the WEPTAC model
➢ Ensures highest state of readiness for forces

MDC2 Continuous Enhancement Cycle

AFWerX

AQ Program Offices

S&T

Industry

Tech Development

CURRENT OPERATIONS

Info Sharing Security Environment

Virtualized Data

Innovate

Mission Needs

Validated C2 Tech & TTPs

C2 OPS

Validate

Train

Wargames/Exercises

C2 Expertise

How do we get started?

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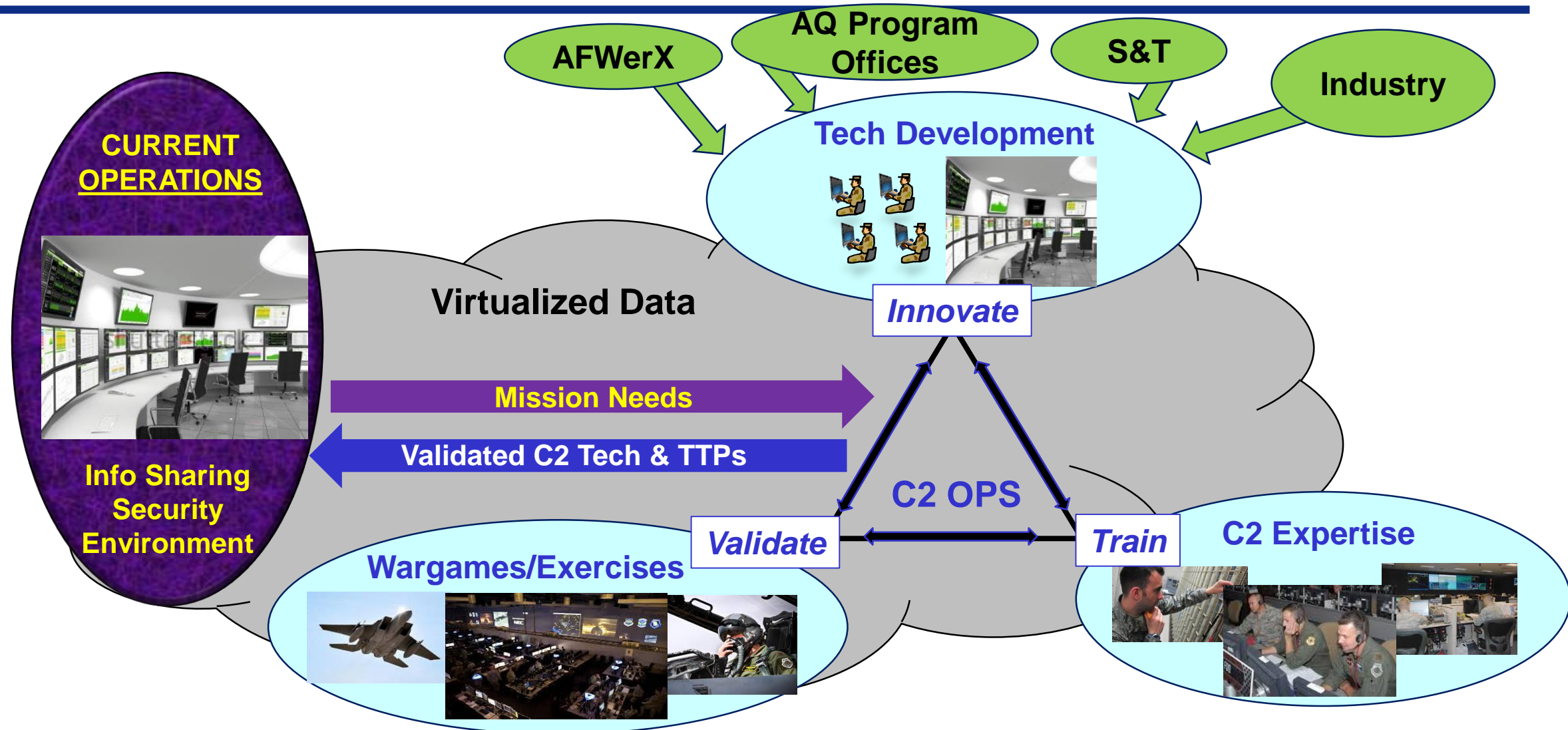
Multi-domain Wargame Series

- **Purpose-build annual event focused on MDC2 Operational Concepts**
  - Command Relationships
  - Authorities
  - C2 Procedures for critical functions
  - Employment considerations (Force packaging)
  - Force Presentation considerations

- **First event – Fall 2018** (planning conferences beginning in Feb 2018)

- **Location –** Hurlburt AFB, FL

- **Players –** mixed team of C2 SMEs from 505th , joint/coalition and AU students (AWC and ACSC)

- **Initial Desired Learning Objectives:**
  - Are adjustments to command relationships/authorities needed to effectively C2 multi-domain forces?
  - What are the key considerations for force presentation that affect MDC2?
  - What Operational-level TTPs should be employed to optimize MDC2?
  - What are the key considerations for effective execution of multi-node collaboration?

Shadow Ops Center
(Nellis, Schriever, ADF-E, Langley, Hurlburt)

➢ **Multi-node, C2 Enterprise Experimentation**

- ■ Leverage live data (virtualized for ready access)
- ■ Set up a DevOps Environment (modern IT infrastructure)
- ■ Rapid Prototyping with Minimum Viable Product early to operators
- ■ Ability to test and rapidly promote new Apps, networks, tech to Operations

➢ **ShadowOC Objectives:**

Phase 1: Procure cloud computing capability & platform

- ■ Virtualize data with 'cloud-like' storage and processing
- ■ Procure programming platform (software design)

Phase 2: Agile Acquisition for new mission apps/technology

- ■ Employ/Demo all Agile Acquisition Principles
- ■ COTS software modified by AF-organic teams of programmers
- ■ Multi-domain tools experimentation

Phase 3: Experiment with AI, machine learning, automation

- ■ Live fly feedback on how best to leverage technology

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Summary

- **MDC2 is the Air Force approach to:**
  - **Executing operationally agile and high velocity operations**
  - **Creating dilemmas for an adversary from multiple domains**
  - **At an operations tempo they cannot match**

- **Air Force intends to enhance its MDC2 capabilities across 3 Lines of Efforts**
  - **Operational Concepts**
  - **Enabling Technology**
  - **Supporting Structures**

- **Initial Activities**
  - **Conduct Multi-domain C2 Wargame Series**
  - **Standup a DevOps environment for C2 experimentation (ShadowOC)**
  - **Formalize and develop a continuum of learning for operational-level C2**

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Discussion

Transition to "New – New" is difficult

New - Old	New - New

■ Processes and org structures are in place to support
   ■ Industrial support
   ■ CONOPS in place
   ■ Expertise based on SOP
	■ Processes and org structures are not designed to support
	   ■ Industrial support limited (TRL low)
	   ■ No CONOPS (detail low)
	   ■ Very limited expertise (training low)

Seen as low risk but enhancing capability	Seen as high risk & uncertain impacts on capability
Clear linkages to our way of doing business	Less clear how links to our way of doing business
Powerful cultural & institutional inertia	Small group of advocates battling status quo
Seems like responsible use of funding	Seems entrepreneurial & less responsible

Improvement (New-Old) should not be confused with Innovation (New-New)

Points to Ponder...

"New truths begin as heresies. A heretic is someone who sees a truth that contradicts the conventional wisdom of the institution—and remains loyal to both entities, to the institution and the new truth."

"Heretics are not apostates. They do not want to leave the 'church.' Instead, they want the 'church' to change, to meet the truths that they have seen halfway."

"Modern heretics are not burned at the stake. They are relegated to backwaters or pressured to resign. They see their points of view ignored or their efforts undermined."

- "The Age of Heretics" by Art Kleiner

Point to Ponder…

"A complex system that works is invariably found to have evolved from a simple system that worked.

The inverse proposition also appears to be true: A complex system designed from scratch never works and cannot be made to work. You have to start over, beginning with a working simple system."

- John Gall, Systems Theorist
General Systematics, 1975