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Taking the Next Step:
From “Unmanned” to True Autonomy

Topic 7:
Architectures, Technologies, and Tools

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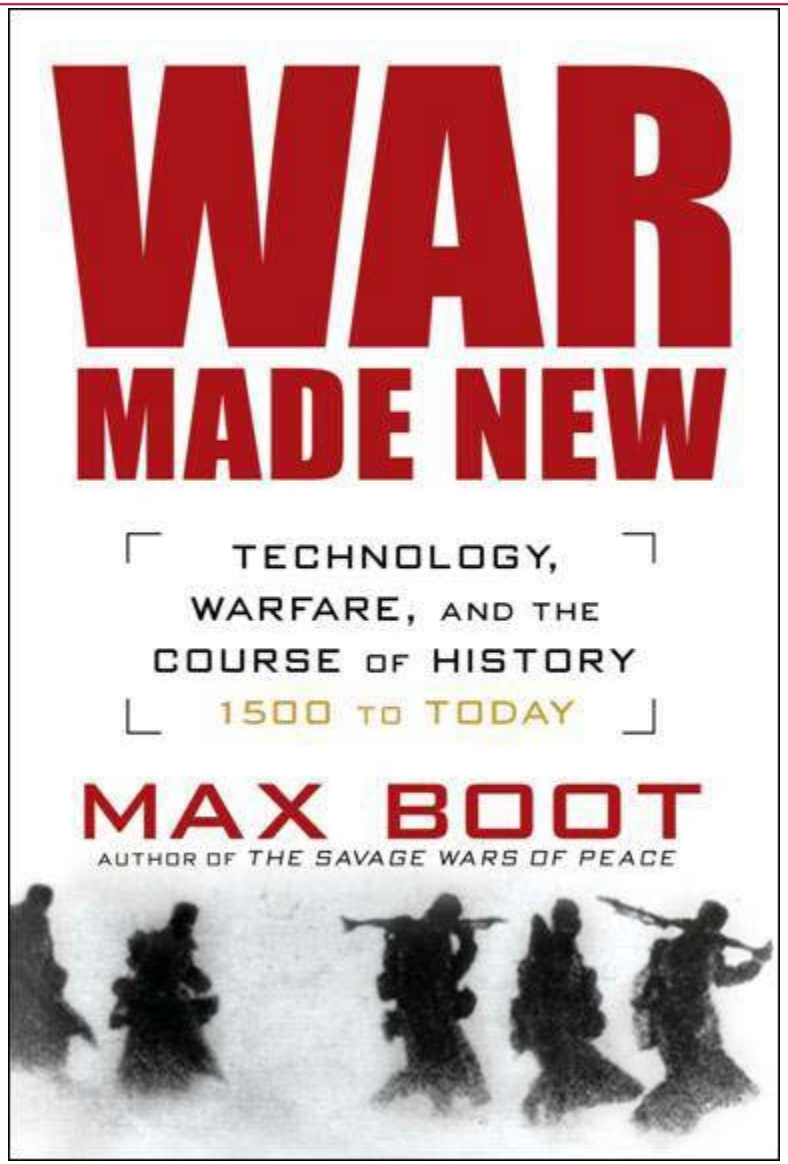

"My view is that technology sets the parameters of the possible; it creates the potential for a military revolution."

Max Boot

War Made New

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Outline

- The Plan
- The Challenge
- C4ISR Innovation As the Answer
- Into the Future

“Creation of substantive autonomous systems/platforms within each domain will create resourcing and leadership challenges .... Trust of unmanned systems is still in its infancy in ground and maritime systems ... Unmanned systems are still a relatively new concept ... As a result, there is a fear of new and unproven technology.”

FY 2009-2034 Unmanned Systems Integrated Roadmap

“The combat potential of UV’s (unmanned vehicles) is virtually unlimited. ... There is no question that the Fleet/Force of the future will be heavily dependent upon UVs.”

Naval Research Advisory Committee (NRAC)

Roles of Unmanned Vehicles, March 2003

DoD envisions the continued expansion of unmanned systems in the future force structure … expanding into new mission areas not currently covered. … As DoD defines a path towards this vision, a common set of challenges is apparent that cuts across all military Services, budgets, and all three domains … .”

FY 2011-2036 Unmanned Systems Integrated Roadmap

“The National Defense Authorization Act for FY2007 … called for the DoD to establish a policy … on unmanned systems, some key points of which included identifying a preference for unmanned systems in acquisitions of new systems.”

FY 2009-2034 Unmanned Systems Integrated Roadmap

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The Plan

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"The Department of Defense's vision for unmanned systems is the seamless integration of diverse unmanned capabilities … DoD envisions unmanned systems seamlessly operating with manned systems while gradually reducing the degree of human control and decision making required."

FY 2011-2036 Unmanned Systems Integrated Roadmap

Unmanned Aircraft Systems

Mission Areas

2011 — Increasing Reach, C2, Autonomy, & Complexity — 2035+

Increasing Performance, Payload, & Vehicle Size

ISR / Data Relay Platforms

Strike Capable

Long Endurance

Group 5
- > 1320 lbs
- > FL180

Air Force MQ-9 Reaper

Air Force RQ-4 Global Hawk
Navy MQ-4 BAMS

Air Force MQ-La/b

Air Force MQ-X

Air Force MQ-Lc

Persistent

Group 4
- > 1320 lbs
- < FL180

Army MQ-5 Hunter

Army MQ-1C Gray Eagle

Air Force MQ-1 Predator

Navy MQ-8 Fire Scout

Army / Navy / USMC VTOL

Navy UCAS-D

Navy UCLASS

Navy MRMUAS

Navy UCAS FAA-XX

Tactical

Group 3
- < 1320 lbs
- < FL180
- < 250 kts

Army / USMC / SOCOM RQ-7 Shadow

SOCOM EUAS (VTOL)

SOCOM EUAS (FW)

Navy /USMC RQ-21A STUAS

Black: Programs of Record
Red: Future concepts

Small Tactical

Group 2
- 21-55 lbs
- < 3500 AGL
- < 250 kts

Navy / USMC/ Air Force / SOCOM ScanEagle

Micro/Mini Tactical

Group 1
- 0-20 lbs
- < 1200 AGL
- < 100 kts

Army / Navy / USMC/ SOCOM RQ-11 Raven

SOCOM Puma

Navy / Air Force / SOCOM Wasp

Army gMAV
Navy T-Hawk

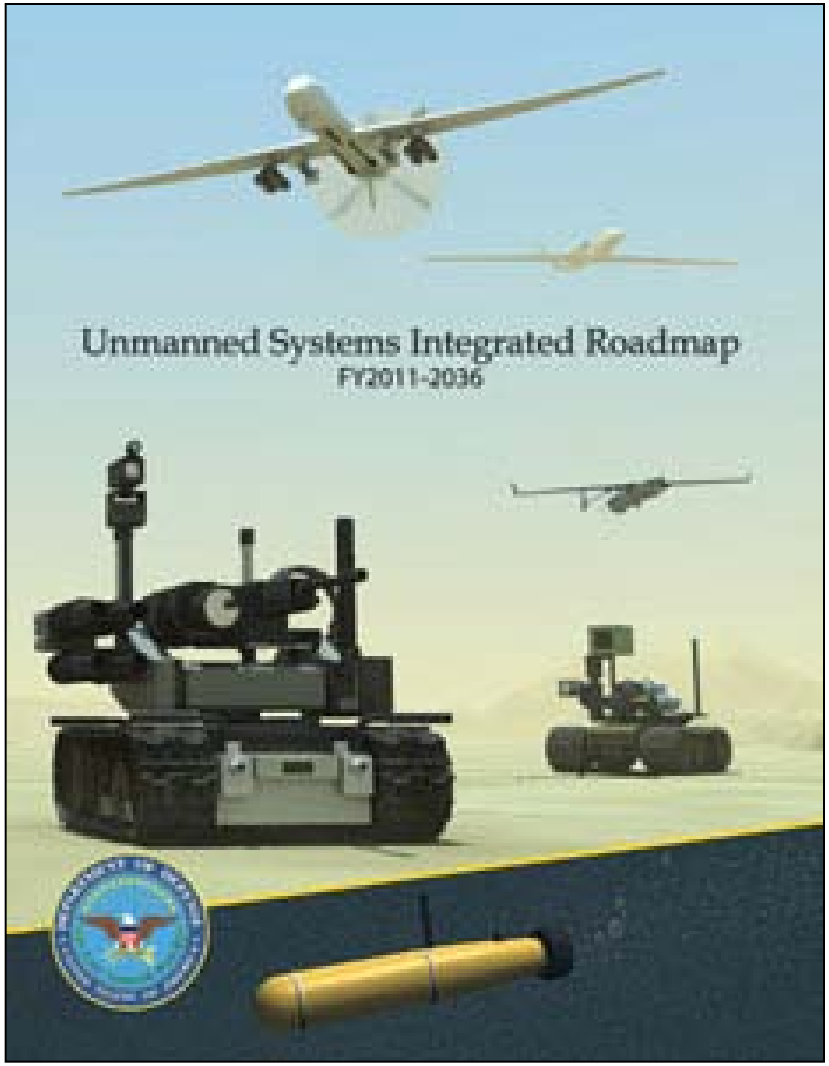
Small Family of Systems

Nano UAS

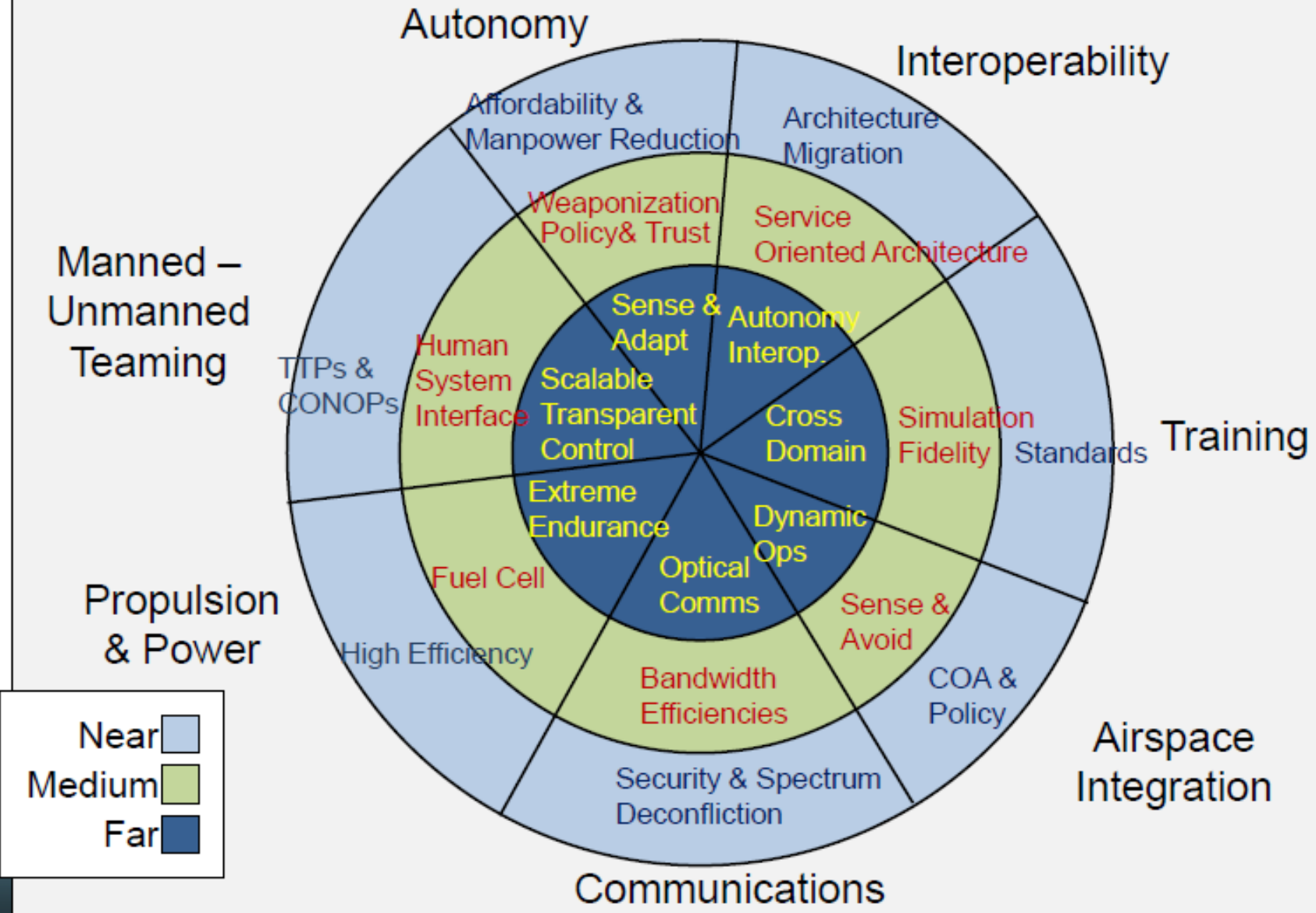
DoD Guidance

Key Challenges

- Interoperability
- Autonomy
- Airspace Integration
- Communications
- Training
- Propulsion and Power
- Manned-Unmanned Teaming



Meeting the Challenges
Unmanned System Roadmap



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Navy's AISR&T "Family of Systems"

- Broad Area Maritime Surveillance (BAMS)
  - Long-endurance remotely operated signals intelligence
  - Airborne support for MDA and battlespace preparation
- Unmanned Carrier Launched Airborne Surveillance and Strike (UCLASS)
  - Carrier-based intelligence and precision strike
- MQ-8B FireScout
  - Real-time ISR, battle management and target classification
- P-8A Poseidon
  - Maritime patrol ASW, ASUW and armed ISR capability
- H-60 Helicopter
  - Will be equipped with additional sensors
- E-2D Advanced Hawkeye
  - Carrier-based Airborne Early Warning and Battle Management Command & Control

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The Challenge

"Today's unmanned systems require significant human interaction to operate. As these systems continue to demonstrate their military utility and are fielded in greater numbers, the manpower burden will continue to grow … [this] is occurring at a time when constrained budgets are limiting growth in Service manpower authorizations."

FY 2011-2036 Unmanned Systems Integrated Roadmap

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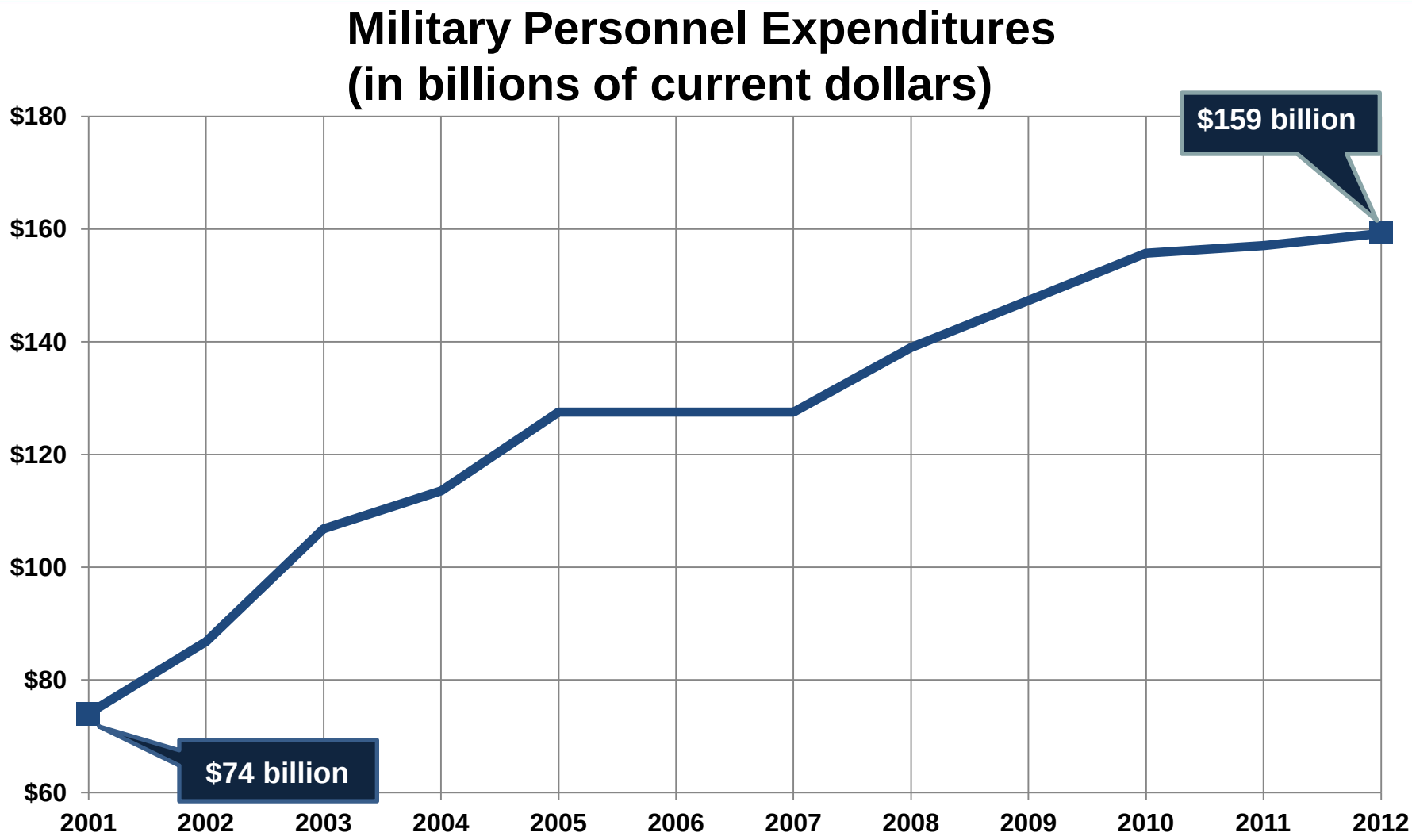
The Total Ownership Cost Challenge

- The irony of “unmanned” systems
- TOC issue intensified by increasing manpower costs, ongoing budget crisis
- Data overload exacerbates the challenge
- C4 technological innovation a prerequisite for success

Manpower Costs Have Reached An All-Time High



Data from: Office of Management and Budget, *Budget of the U.S. Government, FY 2012, Historical Tables*

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C4ISR Innovation As the Answer

"We will win – or lose – the next series of wars in our nation's laboratories."

Admiral James Stavridis
SOUTHCOM Commander
"Deconstructing War"
U.S. Naval Institute Proceedings
December 2005

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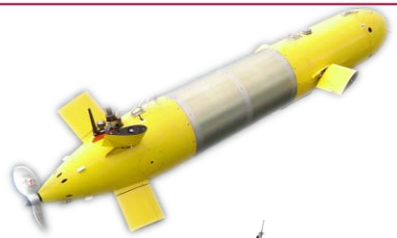
Making UxV Smarter

- Automated TCPED processes
- Ability to sense and adapt to the environment
- Autonomous collaboration
- One operator, multiple UxV

Multi-Robot Operator Control Unit (MOCU)



MOCU is a flexible software framework capable of monitoring and controlling unmanned systems across multiple domains.

- Modular, open architecture
- Government developed and owned
- Widely adopted

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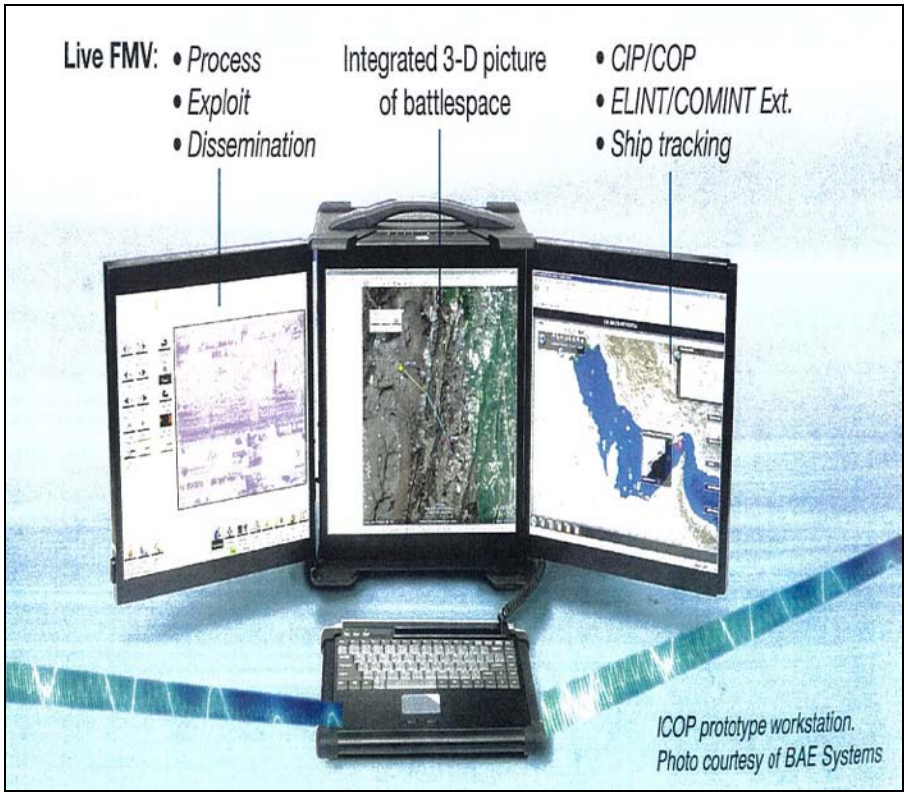
Intel Carry-On Program



- A portable, robust suite of ISR PED capabilities for unit-level platforms
- Allows operators to exploit data & video from multiple UAS simultaneously
- Demonstrated in exercises such as Trident Warrior 2011

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UCAS-D

- Conceived as operating in swarms, using state-based control
- Operators would collectively task and communicate with the swarm
- Autonomy and manning challenges must still be overcome

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Into the Future

"To change anything in the Navy is like punching a feather bed. You punch it with your right and you punch it with your left until you are finally exhausted, and then you find the damn bed just as it was before you started punching."

President Franklin Delano Roosevelt

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Into The Future

- UxVs' ability to deliver revolutionary change is real …
- … but to be realized, this vision must be supported by commitment at the top levels of naval leadership, and by leadership and stewardship at the programmatic level
- A way ahead: operationalize the mandate of the Department of Defense *Unmanned Systems Integrated Roadmap* to "expedite the transition of unmanned technologies from research and development activities into the hands of the Warfighter."

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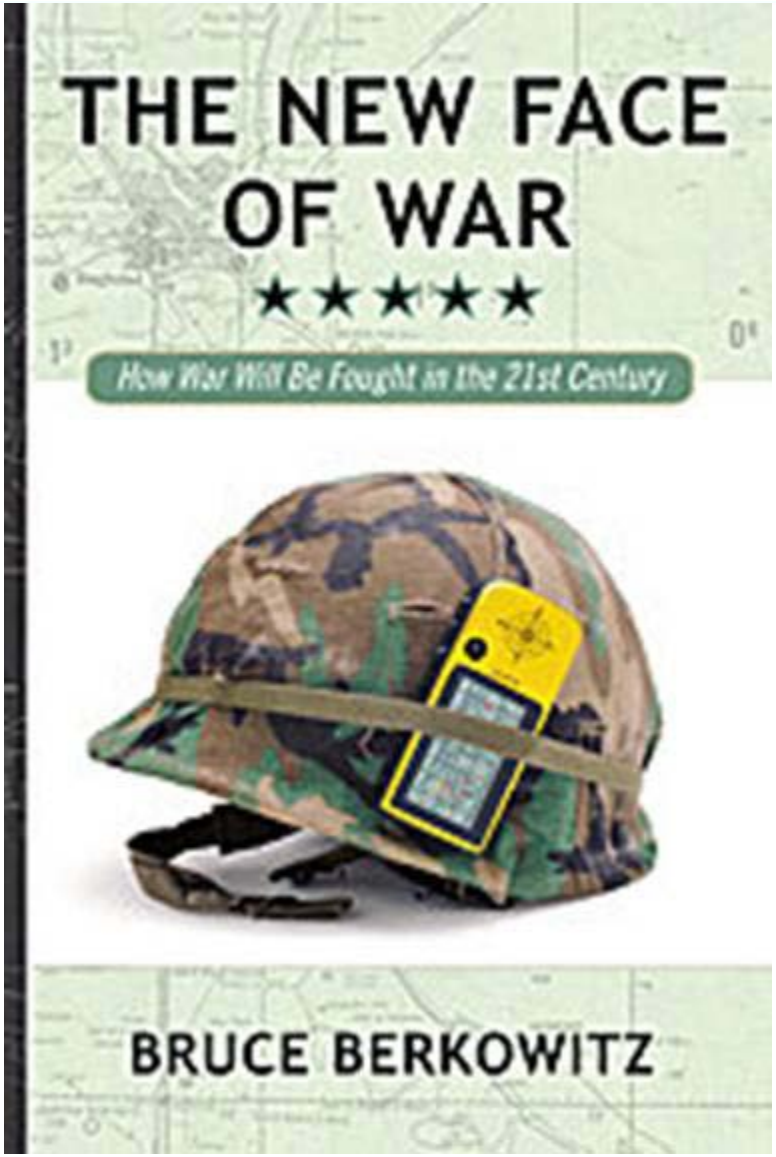

Recent experience suggests that the **right technology, used intelligently, makes sheer numbers irrelevant.** The tipping point was the Gulf War in 1991. When the war was over, the **United States and its coalition partners had lost just 240 people. Iraq suffered about 10,000 battle deaths**, although no one will ever really be sure. The difference was that the Americans could **see at night, drive through the featureless desert without getting lost, and put a single smart bomb on target** with a 90 percent probability."

Bruce Berkowitz

The New Face of War

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Questions?