Department of the Navy

Office of Naval Research
Science and Technology Partnership Conference

Hon. Robert O. Work
Under Secretary of The Navy

8 November 2010

Agenda

- A military revolution
- Unguided weapons warfare
- Guided munitions-battle network warfare
- The natural history of innovation
- S&T themes

We find ourselves in the steadily maturing Guided Munitions-Battle Network…with enormous implications for power-projection operations

"…the information age is nothing new…The role of information (scouting) reached fruition in the 1930s with the fusion of air-search and radio communications. Information warfare and operations are indeed evolving with technology, but in most respects they are an extension of the [World War II sensory revolution] with minor changes. ***What we have seen…is a new weapon—the well-aimed long-range missile—to take advantage of sensing and communicating technology, and vice versa."***

Captain Wayne P. Hughes, Jr.

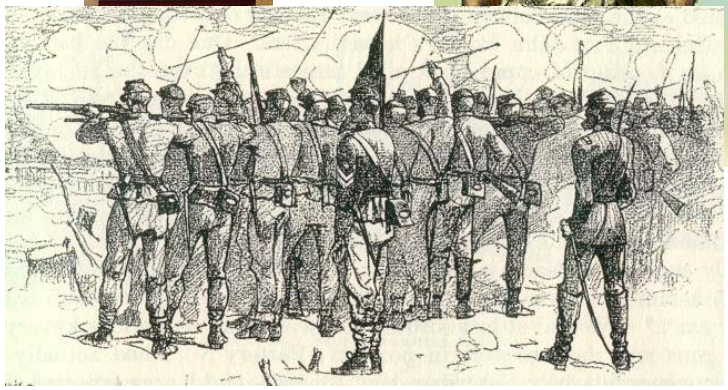
Fleet Tactics and Coastal Combat, p.4

Unguided weapons warfare

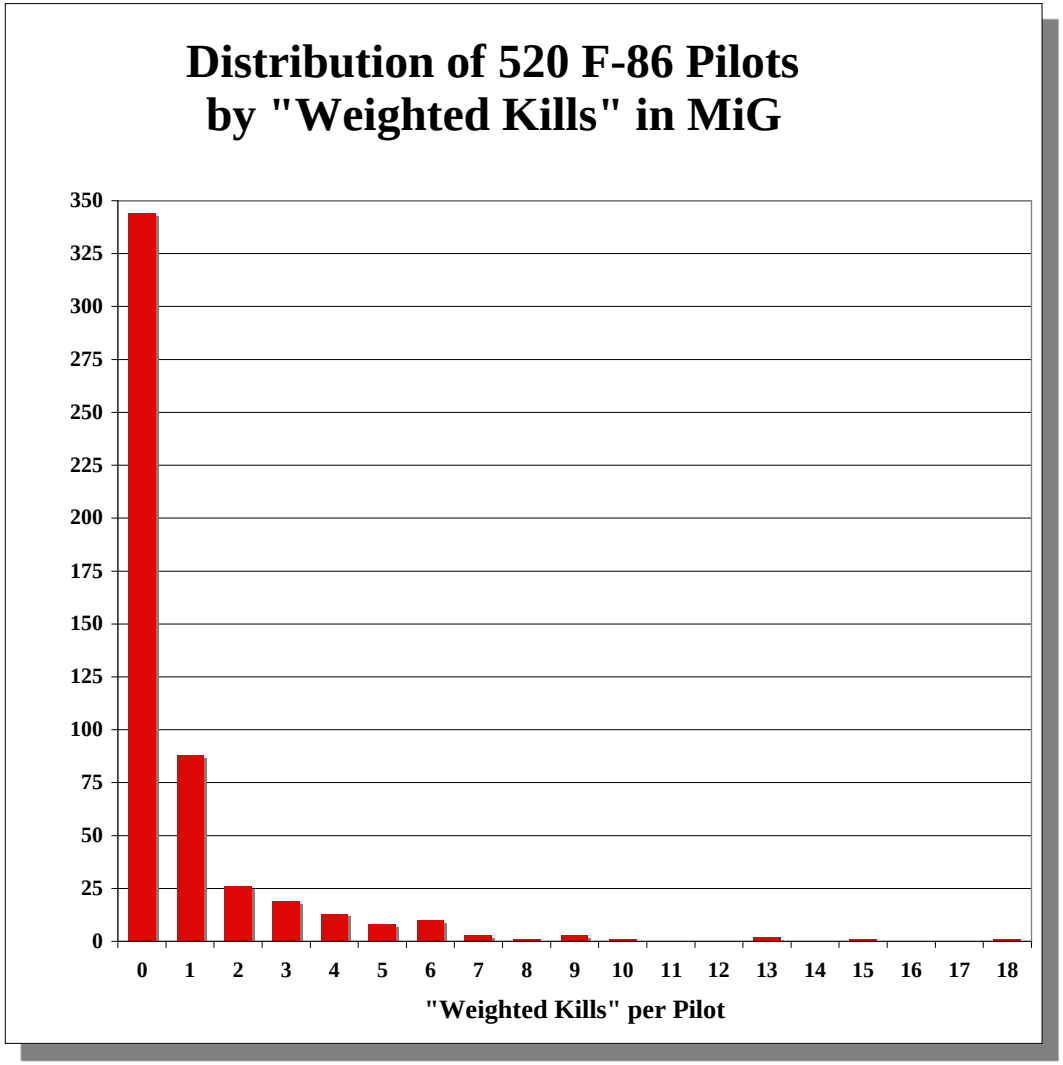
- As soon as rocks and spears were thrown in battle, and particularly once slings and bows and arrows appeared, the contested zone between opposing forces quickly expanded up to hundreds of yards

- Indirect fire (artillery and mortars) expanded the zone to tens of miles; air-dropped munitions to hundreds of miles

- The key characteristic of this warfighting regime, which gradually supplanted close-in, hand-to-hand stabbing and chopping combat, was that most munitions that were thrown, propelled, fired, launched, or dropped ultimately missed their targets—often by wide margins, which steadily increased over range



Only a few gifted individuals flourished in line-of-sight, unguided weapon warfare



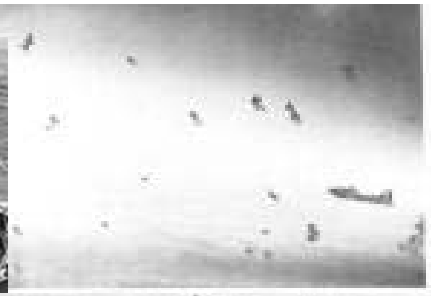
"You can count on about three, if you are lucky, of your pilots in the squadron to possess those things necessary to be exceptional leaders and produce more than an occasional kill or two."

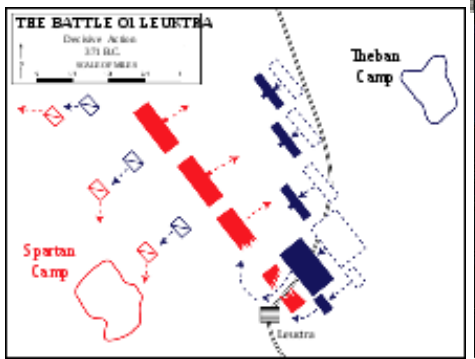
— Major "Boots" Blesse, 1954
No Guts, No Glory

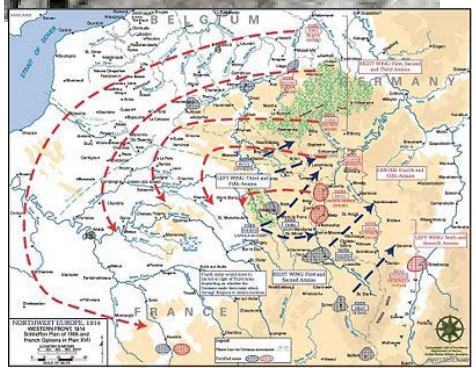
Unguided weapons warfare therefore had an inherent bias towards mass

- Unguided weapons warfare:
  - Most projectiles that are thrown, shot, fired, or dropped *miss their targets* (increasingly so as range increases)
  - Munitions range is dependent on cost; lack of accuracy means the cost premium for long range is rarely worth it
  - **Rate-of-fire** was thus more important than munitions range

- Maneuver in the unguided weapons warfare regime sought to gain a local advantage in mass

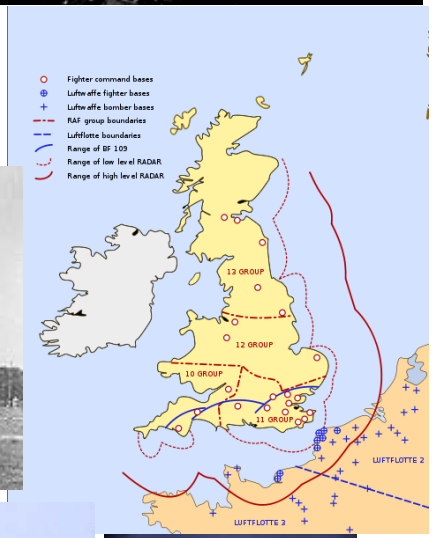






A major change to the unguided weapons regime occurred during WWII, when the first modern battle networks appeared

- **Battle Network:** Three vertically-linked grids which operate together as a single cooperative and adaptive fighting network:
  - Sensor grid (*common battle network picture)*
  - C3I grid
  - Effects grid (control effectors)



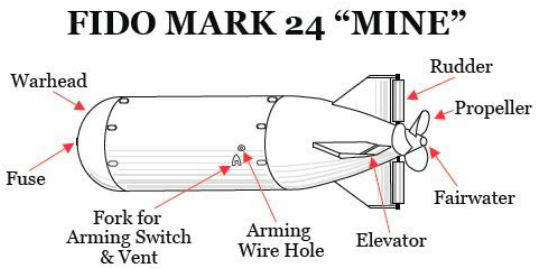
- First came **tactical battle networks** which engaged specific targets in discrete operating domains
  - British IADS
  - German IADS
  - US Fleet Air Defense Network

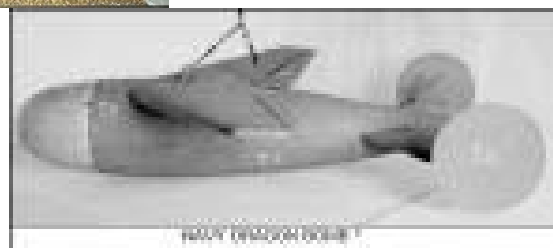
- Helped take surprise out of enemy attacks; however, with unguided weapons, mass v mass engagements was still the norm

WWII also saw two alternatives to unguided weapons: atomic bombs and guided conventional munitions

Guided munitions are projectiles, bombs, missiles, torpedoes and other weapons that actively correct for individual-aiming or subsequent errors while homing on their targets or aim-points after being fired, released, or launched

- Guided munitions warfare:
  - Munitions have a good chance of hitting their targets; ***and this accuracy is independent of range***
  - Operator skill no longer so important; weapon does much of the work
  - Maximum effective range and Pk more important than rate-of-fire
  - Range is still dependent on cost (and individual munition costs are uniformly higher than unguided weapons)





The battle for Okinawa (1945) saw a mature unguided munitions-battle network take on massed guided munition salvos

- The result was sobering:

  "Approximately 2,800 *Kamikaze* attackers sunk 34 Navy ships, damaged 368 others, killed 4,900 sailors, and wounded over 4,800. Despite radar detection and cuing, airborne interception and attrition, and massive anti-aircraft barrages, a distressing 14 percent of *Kamikazes* survived to score a hit on a ship; nearly 8.5 percent of all ships hit by *Kamikazes* sank."

  Dr. Richard P. Hallion,
  "Precision Weapons, Power-Projection, and the Revolution in Military Affairs"

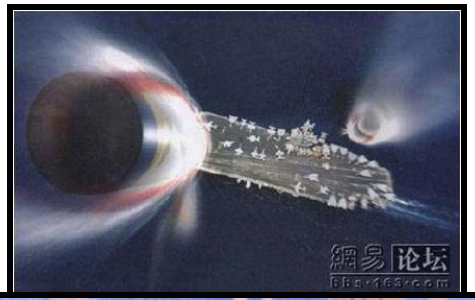
The implications of the confrontation were quite clear

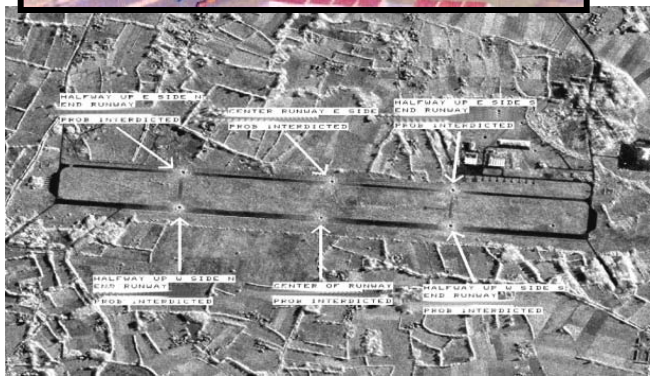
- In the unguided weapons regime, massive salvos were needed to achieve a target hit. In the guided weapons regime, the **salvo only had to be dense enough to saturate an opponents defenses; any leaker would likely hit the target**

- Burden on defenses would therefore be very high

- **It would take a guided munitions-battle network to fight off a determined guided weapons attack**

Operating in an A2/AD environment will demand new ways of (networked) thinking





Anti-access: prevent operational freedom of action

G-RAMM

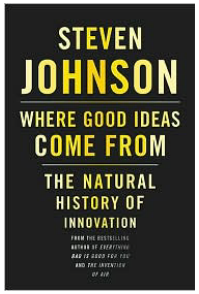
Guided Rockets, Artillery, Mortars, and Missiles

Area-denial: prevent tactical freedom of action

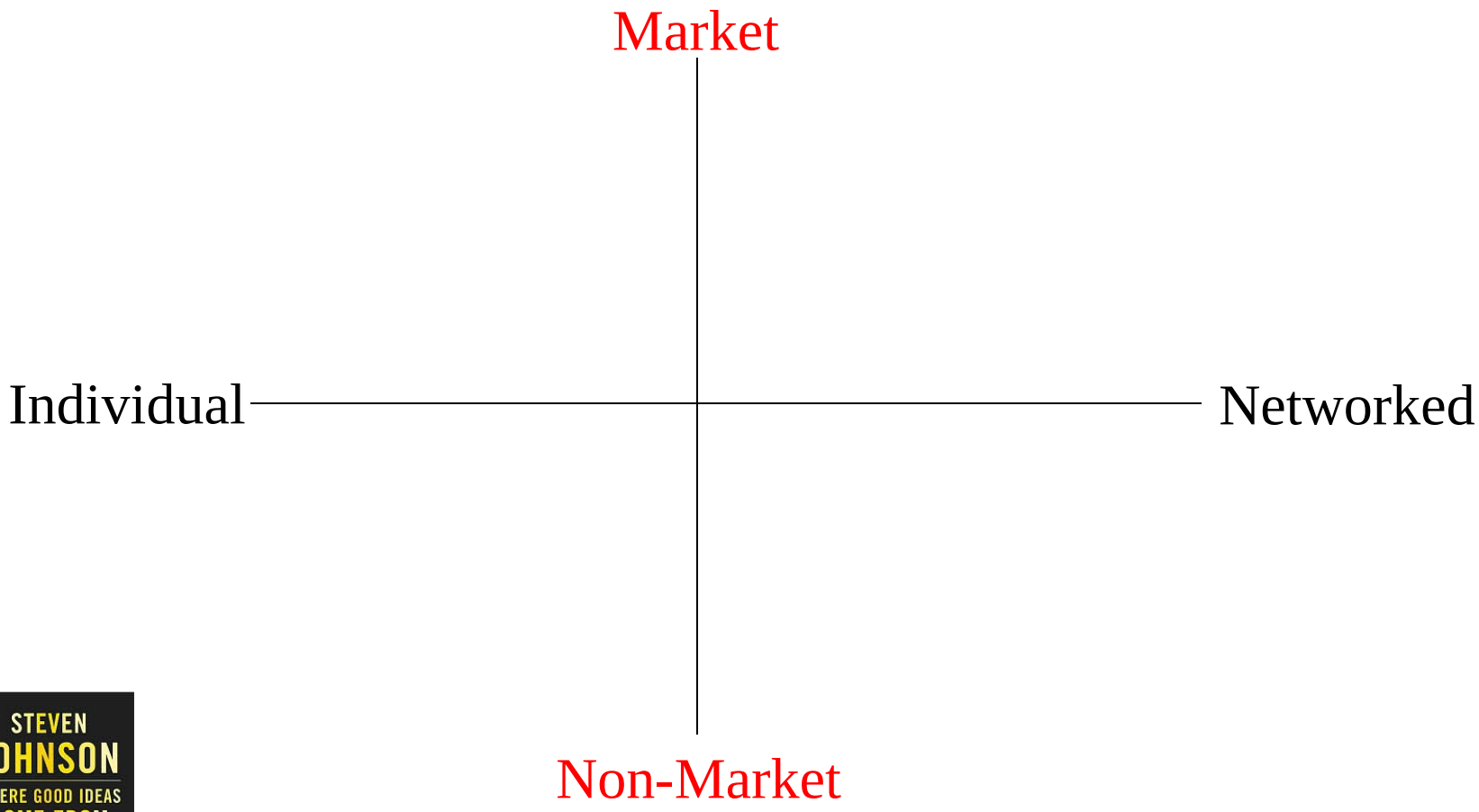
Open Source Materials

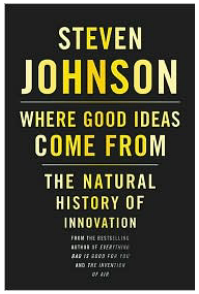
Environments for innovation

Individual — Networked

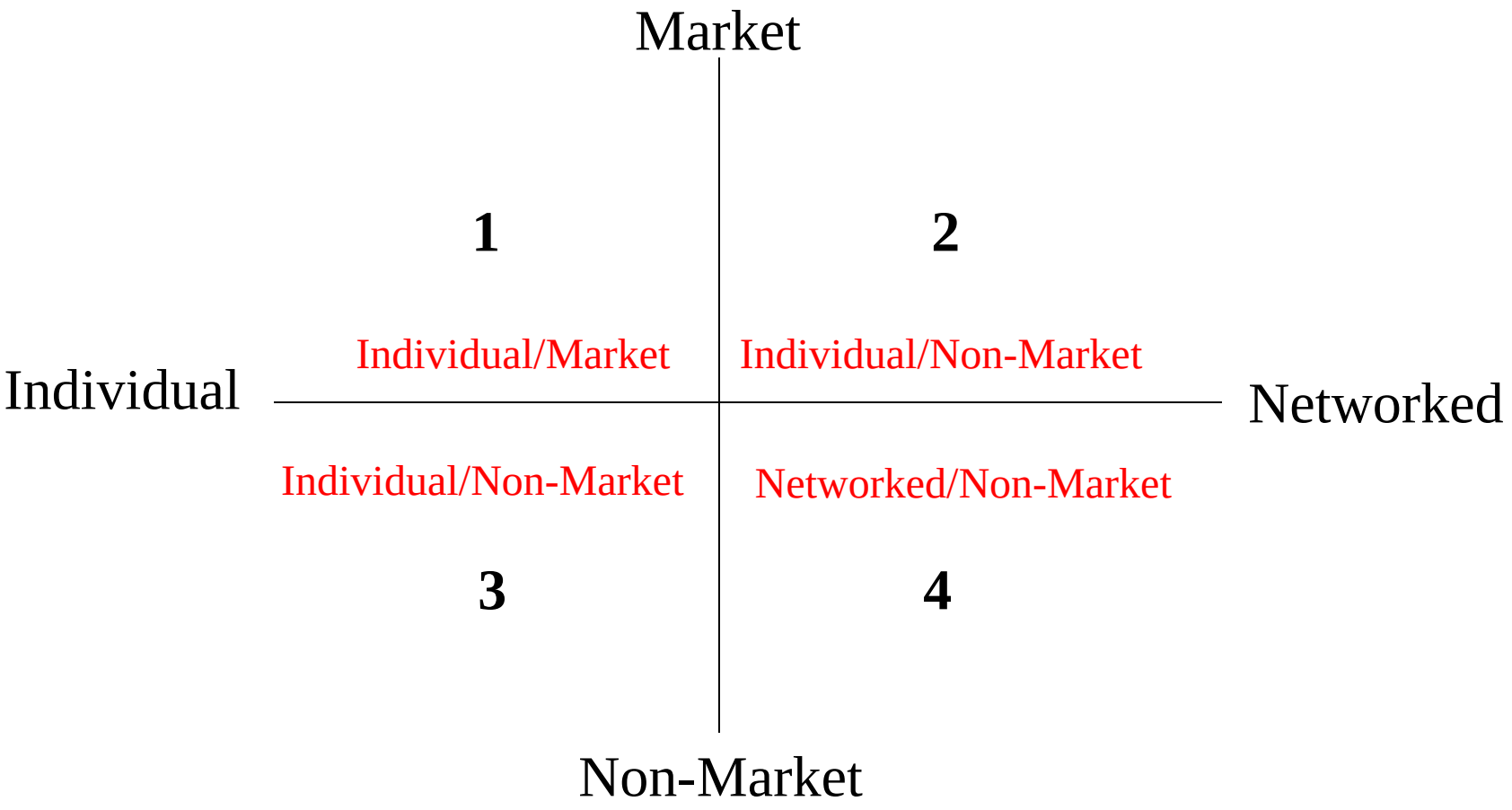


Environments for innovation





Environments for innovation



The Natural History of Innovation

Market

1

Individual/Market

2

Individual/Non-Market

Individual

Networked

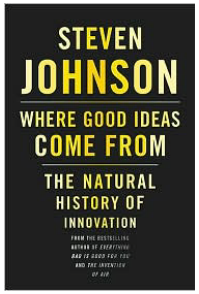
Individual/Non-Market

3

Networked/Non-Market

4

Non-Market



1400-1600: Renaissance

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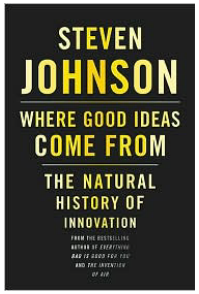

1600-1800: Enlightenment

The Natural History of Innovation

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Individual

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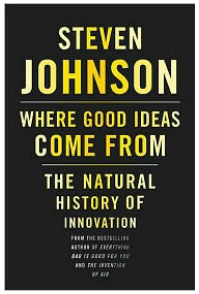

1800-present: Industrial Revolution and Info Age

S&T Themes

- Unmanned and autonomous systems
- Energy/power systems
- Directed energy
- Network (information) dominance
- Irregular and expeditionary warfare

STEM

- The foundational partnership

Thank You!