Strategy, Technology, and the Next Disruption in Military Affairs

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Final Thoughts
- U.S. military technological advantage not an achieved infallible
- Technology improvements rapidly
- Stagnation and stagnation lead to increased defense
- Tech, domestic, and international
- Geopolitical focus on maintaining U.S. technological edge
- U.S. must avoid becoming dependent on others
- Germany's emphasis on "military self-sufficiency"
- The need for innovation and technological advancement
- The potential for technological stagnation and its implications

Emerging Technologies

Global Context

Domestic Context

Acknowledgments
- This presentation features images from:
  - RAND images
  - U.S. Department of Defense
  - National Aeronautics and Space Administration
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  - National Institute of Standards and Technology
  - Office of Naval Research
  - Department of Energy
  - Department of Homeland Security
  - Defense Advanced Research Projects Agency

Recommendations

Issues for Discussion

Implications for Strategy

Evolution of Guided Munitions and Long-Range Precision Strike

Towards a New Warfighting Environment

Observations on Technology & Defense Strategy
Acknowledgments

- This presentation draws on a recent CNAS report, "Game Changers"
- Many of these ideas have roots with other analysts:
  - Robert Work (CNAS)
  - Peter W. Singer (Brookings)
  - Michael Horowitz (UPenn / OSD)
  - David Kilcullen (Caerus)
  - Ben Fitzgerald (CNAS)
- Any good ideas are theirs
- Bad ideas are mine alone
Domestic Context

U.S. Foreign Policy Goals

Percent saying each should be a very important policy goal:

- Protecting the jobs of American workers: 83%
- Reducing U.S. dependence on foreign oil: 77%
- Preventing the spread of nuclear weapons: 70%
- Combating international terrorism: 70%
- Maintaining a superior military power worldwide: 66%
- Combating poverty and reducing global inequality: 40%
- Combating world hunger: 35%
- Strengthening the United Nations: 32%
- Limiting global climate change: 31%
- Preventing and addressing human rights violations in other countries: 28%
- Helping the world’s democracies form alliances for collective action: 14%

Source: Chicago Council on Global Affairs
PEN Research Center
U.S. Foreign Policy Goals

Percent saying each should be a very important policy goal

Protecting the jobs of American workers: 83%
Reducing U.S. dependence on foreign oil: 77%
Preventing the spread of nuclear weapons: 72%
Combating international terrorism: 64%
Maintaining superior military power worldwide: 53%
Controlling and reducing illegal immigration: 53%
Combating world hunger: 42%
Strengthening the United Nations: 35%
Limiting climate change: 33%
Promoting and defending human rights in other countries: 28%
Helping to bring a democratic form of government to other nations: 14%

Source: Chicago Council on Global Affairs

PEW RESEARCH CENTER
Global Context
Emerging Technologies
Observations on Technology & Defense Strategy

- Technological dominance is a strategic choice.
- We must constantly decide to remain dominant.
- Rising powers & diffusion of technology will erode U.S. position.
- Must take into account that commercial sector is driving most technological innovation.
- Must resist temptation to see investment dollars in defense R&D as bill payments for legacy structure.
- Must be aware of antibodies to change and “bureaucracy doing its thing.”
- But make no mistake – technologies are going to change the game (again).
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Evolution of Guided Munitions and Long-Range Precision Strike

The Unguided Munitions Regime

Alternatives to Unguided Weapons Warfare

Evolution of Guided Weapons Regime

20XX: Long-Range Precision Strike

- Intent was to describe a evolution which provides strike munitions that do not get hurt.
- Includes a series of "20XX" weapons from 1995-2003.
- Aircraft was presumed to have rough guided munitions and battle network parity with U.S. Air Force.
- Guam and 3 radar exercises.
- Defense weapons would continue to make conventional use of the strategic level.
- Offensive weapons would tend to dominate defensive areas.
- Trends would not only remain practical, but be central to survival in a very turbulent battlefield.
- Recent trends have limited these conclusions, but likely have a real impact.
- To achieve this control?
- How's OPR regime affected by global warming, climate change?
- Warhead?
The Unguided Munitions Regime
Distribution of 520 F-86 Pilots by "Weighted Kills" in MiG Alley

![Bar graph showing the distribution of "Weighted Kills" per pilot among 520 F-86 pilots in MiG Alley. The graph has a y-axis labeled "Number of Pilots" and an x-axis labeled "Weighted Kills per Pilot." The bars indicate that the majority of pilots have 0 or 1 "Weighted Kills."}
Alternatives to Unguided Weapons Warfare
Evolution of Guided Weapons Regime

In the unguided weapons regime, massive salvos were needed to achieve a single target hit. In the guided weapons regime, a salvo only had to be dense enough to saturate an opponent's defenses; any "leaker" would likely hit the target, with devastating results.

Implications of Guided Munitions Warfare

<table>
<thead>
<tr>
<th>Unguided Munitions</th>
<th>Guided Munitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Munitions fired are much, much smaller; one bomb is equivalent to an entire salvo.</td>
<td></td>
</tr>
<tr>
<td>Munitions have a greater chance of hitting their targets, regardless of the accuracy of their aim.</td>
<td></td>
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<tr>
<td>Munitions cost is a small fraction of the cost of a guided system; the cost of accuracy is much lower.</td>
<td></td>
</tr>
<tr>
<td>Munitions are easier to produce and maintain.</td>
<td></td>
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</tbody>
</table>

Consolidation into AirLand Battle

1978, Assistant Secretary of Defense
- Demonstrations in early 1980s confirmed the technical feasibility of wide area Air Force missions using multiple deliveries of guided munitions against targets on Soviet battlefield
- Becomes the basis for AirLand Battle and Follow on Force Attack (FOA)
- Also spurred the development of non-FOA, and a billion dollar guided munitions

1982, Congress
- Stays to begin building a more flexible, more effective force
- Congress provides substantial funding for guided munitions

1984, Secretary of Defense
- "Motorola MiG"... "no one can see the microwaves..."
- "Guided weapons, guided munitions, automated G2"

By 1984, General W. W. Jorden, directed the development of the guided munitions program; it was the program that achieved effects approaching that of tactical nuclear weapons.

Qualitative leap forward: a decisive military edge over rivals.
In the unguided weapons regime, massive salvos were needed to achieve a single target hit. In the guided weapons regime, a salvo only had to be dense enough to saturate an opponent’s defenses; any “leaker” would likely hit the target, with devastating results.
Implications of Guided Munitions Warfare

**Unguided munitions warfare:**

- Most projectiles that are thrown, shot, fired, or dropped miss their targets (increasingly so as range increases)
- Rate-of-fire far more important than munitions range
- Munitions range is dependent on cost; lack of accuracy means the cost premium for long range munitions was rarely worth it
- Collateral damage an accepted fact of life
- Operator skill paramount

**Guided munitions warfare:**

- Munitions have a good chance of hitting their targets; accuracy is independent of range
- Maximum effective range and weapon Pk are more important than rate-of-fire or density of barrage
- Range is still dependent on cost (and costs for guided munitions are uniformly higher than for unguided weapons), but operational ROI much higher
- Over time, collateral damage far less acceptable
- Operator skill no longer so important; weapon does much of the work
Consolidation into AirLand Battle

1978: Assault Breaker Program
Demonstrations in early 1980s confirmed the technical feasibility of wide-area Air Force sensors cueing missile-delivered guided submunitions against follow-on Soviet echelons

Became the basis for AirLand Battle and Follow-on Forces Attack (FOFA)
Also spurred the development of new ATGMs and artillery-delivered guided munitions

Late 70s: US work spurred the Soviets to begin talking of a third Military Technical Revolution
First revolution: tank, aircraft, radio...leads to blitzkrieg and deep battle
Second revolution: atomic weapons
Third revolution: wide area sensors, guided munitions, automated C2

By 1984, Marshal N.V. Ogarkov concluded that automated “reconnaissance-strike complexes” (RUKs) employing conventional guided munitions could achieve effects approaching that of tactical nuclear weapons

Qualitative approach had (at least for a time) a decisive edge over mass.
Historical PGM Analysis

Increasing Precision of Air-Dropped Munitions

- PGMs (% of Total)
- Circle Error Probability (CEP)

1945 1955 1965 1975 '85 '89 '91 '93 '95 '97

CEP (in ft)

% of total munitions

100 75 50 25 0

No use of guided munitions
CEP at 3,300 feet gravity bombs

Vietnam
Almost no use of guided munitions
CEP down to 400 feet gravity bombs

Gulf War
9% PGM bombs
weather problem for LGBs
CEP less than 300 feet for gravity bombs and radar assisted aircraft

Bosnia
69% PGMs
GPS-assisted bombs
GPS reduces CEP for gravity bombs to 90 feet

Future
Rely on PGMs
CEP down to 45 feet
(F-16, gravity bombs, and GPS)
B-2 <20 ft GATS/GAM)
20XX: Long-Range Precision Strike

  - Intent was to describe a world in which precision strike munitions had fully proliferated
- Adversary was presumed to have rough guided munitions and battle network parity with U.S. Joint Force.
- Games had 3 main conclusions:
  • Nuclear weapons would continue to truncate conventional war at the strategic level;
  • Offensive capabilities would tend to dominate defensive ones;
  • Stealth would not only remain practical, but would be central to survive in a very transparent battlespace
- Recent history has largely borne these conclusions out, but likely time for a re-look at key assumptions
  • Is stealth still central?
  • Is offense still dominant?
  • How is LRPS regime affected by global trends (e.g. urban / littoral theater)?
Toward a New Warfighting Regime?

Three key trends will irreversibly shape future defense:

1. Access will be far more difficult to create and sustain.
2. Increasing lethality of operations.
3. Increasing cost of military personnel.

These trends will inevitably push force designers toward greater use of unmanned systems—which now remain largely in their operational infancy.

Advances in technology—driven mostly by the commercial sector—will back this trend as unmanned systems increasingly capable and connected.

20YY: Moving Toward a New Warfighting Regime
Three Key Trends Will Inevitably Shape Force Design:

First: Access Will be Far More Difficult to Create and Sustain

- Short-warning aggression, political/geographical access constraints, and long-range area denial threats require **GLOBAL RANGE**
- Advanced integrated air defenses require broad-band/all-aspect **LOW-OBSERVABILITY**
- Large numbers of distributed time-sensitive targets require **BROAD-AREA PERSISTENCE**
Second: Increasing Lethality of Operations

G-RAMM is coming to a theater near you
Third: Increasing Cost of Military Personnel
These trends will inevitably push force designers toward greater use of unmanned systems -- which now remain largely in their operational infancy.
Advances in technology — driven mostly by the commercial sector — will both make these unmanned systems increasingly capable and accelerate the drive towards them.
20YY: Moving Toward a New Warfighting Regime
Implications for Strategy?

OFFENSE VS. DEFENSE
• Game-changing technologies will alter relationship between offense and defense.
• U.S. has enjoyed monopoly on offensive-dominant precision strike regime.
• That monopoly is eroding.
• Other actors are investing in capabilities that encourage offensive dominance.
• Several game-changing technologies may alter the offensive bias of military competitions (e.g., directed energy, UAVs).

QUANTITY OVER QUALITY?
• The precision-strike regime tends to bias toward quality over quantity.
• Range, precision, stealth, speed are more important than mass.
• Emerging technologies may change this dynamic.
• Proliferation of smaller, cheaper UAVs could help redress disadvantages (e.g., could swarm advanced defensive systems).
• Mass may reemerge as a prominent feature of future conflict.

A NEW ESCALATION LADDER?
• The relationship between emerging technologies and deterrence/crisis stability is under-explored.
• Different actors will employ and value systems differently.
• Adversaries will not fully understand thresholds for use of force in a largely unmanned and autonomous regime.
• It will be difficult to maintain crisis stability and prevent escalation.

HUMANS IN THE LOOP?
• Technologies often compress time available for decision (e.g., nuclear, cyber).
• There are incentives to take humans out of certain levels of decision-making.
• Humans should remain the ultimate arbiters of using force, even if this poses a level of risk.
• Policymakers need to dedicate time to participate in exercises and simulations to show how technology best enables and complicates decision making.
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Recommendations

CONGRESS SHOULD:

- Require DOD to issue annual reports on state of defense research and development;
- Form temporary or permanent subcommittees of SASC/HASC to provide dedicated oversight of defense R&D spending;
- Think Congressional Military Reform Caucus from 1970s

SECRETARY OF DEFENSE SHOULD:

- Task Deputy Secretary to create standing next-generation technology task force;
- Task OSD (Policy) to ensure defense planning scenarios take full account of emerging and technologies;
- Initiate a series of war games exploring impact of technology on regional/military competitions;
- Commission studies on technology and decision-making during crises;
- Ask Chairman to ensure Services and GoD/DoD leverage emerging technology in exercises, experiments, and planning.

WHITE HOUSE SHOULD:

- Create standing IPC to examine state of national security R&D priorities, policies, and funding;
- Establish White House driven forum to increase private-public partnerships to apply advanced technology to national security challenges.

ANALYTIC RESEARCH COMMUNITY SHOULD:

- Act in collaboration and/or research agenda that applies DoD/Interagy forces to:
  - Strategy
    - Fiscal outlook in 2017
    - Alliances and partnerships
  - Operational Concepts
    - Theater warfare in 2017
    - Air dominance in the uncertain era
    - Sea control in the uncertain era
  - Weaponing Systems
    - Anti-ship systems, UCAV, EDMS, more UAVs
    - Sea lift, LHDs, carrier groups (light & heavy)
    - Unmanned UCAV, more-vabbreviated airframes, sensors
    - Ground and air-ground control systems
  - Beating techniques
    - Protected communications
    - Integrated autonomy
    - Impediments to transformation
      - Cultural (e.g., MCB in Pacific, NAVY and Marine Corps)
      - Legal
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• Ask Chairman to ensure Services and COCOMs leverage emerging technology in exercises, experiments, and planning.
ANALYTIC / RESEARCH COMMUNITY SHOULD:

• Active collaborate on an research agenda that applies 20YY-type frame to:
  • Strategy
    • Force posture in 20YY
    • Alliances and partnerships
  • Operational Concepts
    • Theater warfare in 20YY
    • Air dominance in the unmanned era
    • Sea control in the unmanned era
  • Warfighting Systems
    • Air: LRPS systems, UAVs, UCAS, micro-UAVs
    • Sea: USVs ,USV carriers (amphibs and LCS to start)
    • Undersea: LDUUVs, mine warfare UUVs, sensors
    • Ground: unmanned ground combat systems
  • Enabling Technologies
    • Protected communications
    • Protected autonomy
  • Impediments to Transition
    • Cultural (e.g. UCAS vs. F/A XX; BAMS and Maritime Patrol/Recon)
    • Legal
Final Thoughts

- U.S. military-technical advantage not an inherent right.
- Disruptive technologies are rapidly complicating the security environment
- Executive, Congress, and Research Community must focus on maintaining U.S. technological edge.
- R&D and S&T must not be bill payers.
- Need to understand warfighting implications of 20YY regime
- Need to focus on connecting technology and policy-making.
- Time is not on our side.
- Decisions in next 24-36 months will greatly influence whether U.S. retains technological edge out to 20YY.
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• Decisions in next 24-36 months will greatly influence whether U.S. retains technological edge out to 20YY.
Issues for Discussion

- What signposts should we watch for to determine if we are / are not risking U.S. technological edge?
- What capabilities should we consider the "crown jewels" for the 20YY regime?
- What "tribes" in DOD understand the need to leverage disruptive capabilities -- which do not?
- What should we watch for in QDR & FY15 budget to gauge OSD willingness to move to 20YY regime?
- Which technologies are most disruptive to U.S. defense strategy and policy?
- How can we as a community push DOD to adapt more rapidly to secure the future?
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