

Emerging Technology + International Security

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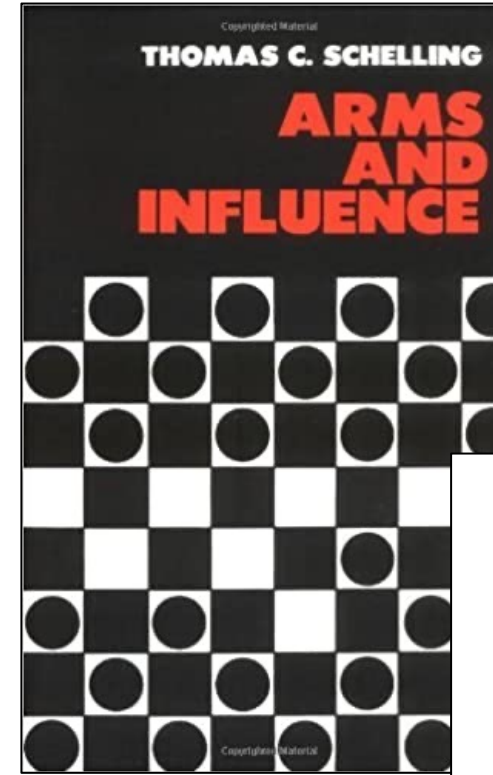
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How to Read

- Read the abstract first
- Read intro and conclusion
- Then, read body



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Why Do States Build Nuclear Weapons?

Scott D. Sagan

Three Models in Search of a Bomb

Why do states build nuclear weapons? Having an accurate answer to this question is critically important both for predicting the long-term future of international security and for current foreign policy efforts to prevent the spread of nuclear weapons. Yet given the importance of this central proliferation puzzle, it is surprising how little sustained attention has been devoted to examining and comparing alternative answers.

This lack of critical attention is not due to a lack of information: there is now a large literature on nuclear decision-making inside the states that have developed nuclear weapons and a smaller, but still significant, set of case studies of states' decisions to refrain from developing nuclear weapons. Instead, the inattention appears to have been caused by the emergence of a near-consensus that the answer is obvious. Many U.S. policymakers and most international relations scholars have a clear and simple answer to the proliferation puzzle: states will seek to develop nuclear weapons when they face a significant military threat to their security that cannot be met through alternative means; if they do not face such threats, they will willingly remain non-nuclear states.¹

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1. Among policymakers, John Deutch presents the most unadorned summary of the basic argument that "the fundamental motivation to seek a weapon is the perception that national security will be improved." John M. Deutch, "The New Nuclear Threat," *Foreign Affairs*, Vol. 71, No. 41 (Fall 1992), pp. 124-125. Also see George Shultz, "Preventing the Proliferation of Nuclear Weapons," *Department of State Bulletin*, Vol. 84, No. 200 (December 1984), pp. 17-21. For examples of the dominant paradigm among scholars, see Michael M. May, "Nuclear Weapons Supply and Demand," *American Scientist*, Vol. 82, No. 6 (November-December 1994), pp. 526-537; Bradley A. Thayer, "The Causes of Nuclear Proliferation and the Nonproliferation Regime," *Security Studies*, Vol. 4, No. 3 (Spring 1995), pp. 463-519; Benjamin Franklin, "The Breeding Shadow: Systemic Incentives and Nuclear Weapons Proliferation," and Richard K. Betts, "Pentagon's Pyramids: The Role of Arms-Transfer Restriction in Proliferation," *Foreign Affairs*, Vol. 71, No. 41 (Fall 1992), pp. 124-125.

Sagan, Scott D. "Why Do States Build Nuclear Weapons?: Three Models in Search of a Bomb." *International Security* 21, no. 3 (1996-1997): 54-86. © The President and Fellows of Harvard College and the Massachusetts Institute of Technology. Used with permission.

Recap

- Brute force vs. coercive force ("power to hurt")
 - Deterrence vs. compellence
 - Effectiveness
- Levels of analysis
- Realist assumptions (3)
- Security dilemma
- Biases and heuristics

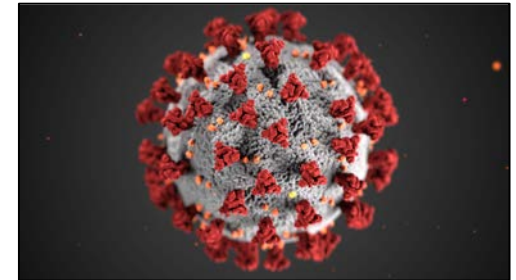
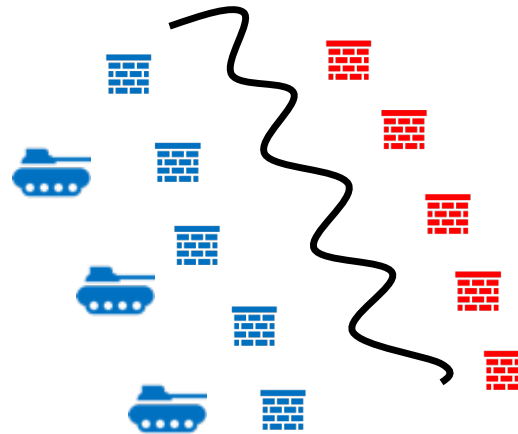


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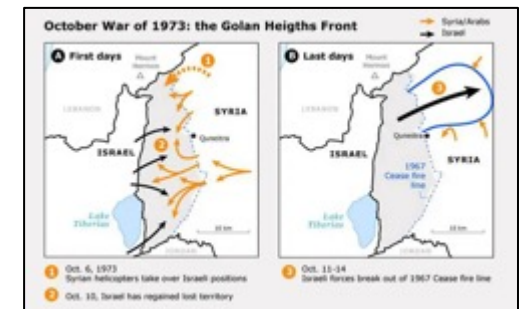


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What is technology?

Technology

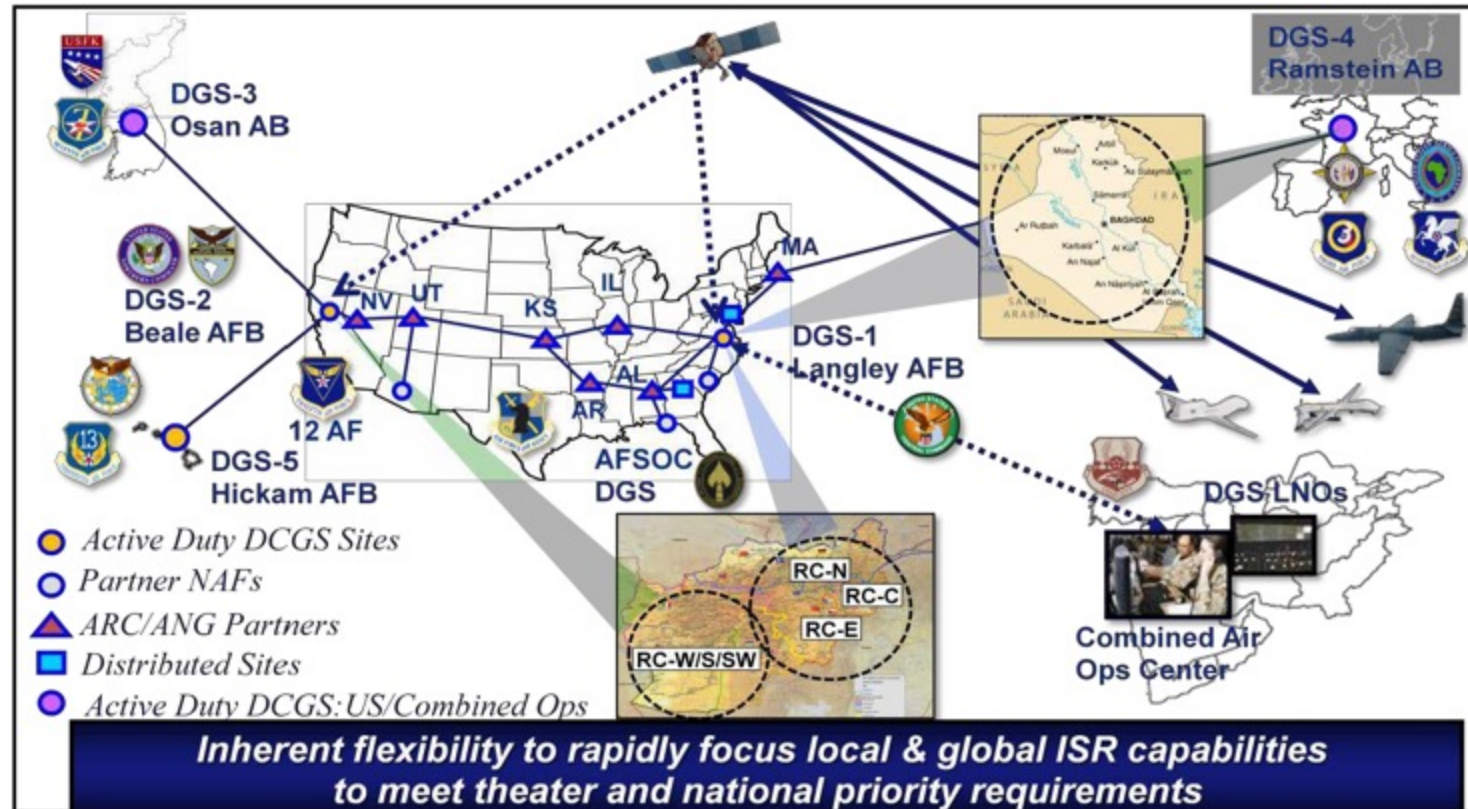
- Two critical components
 - Hardware
 - Software



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Technology

- Two critical components
 - Hardware
 - Software



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Technology

- Two critical components
 - Hardware
 - Software



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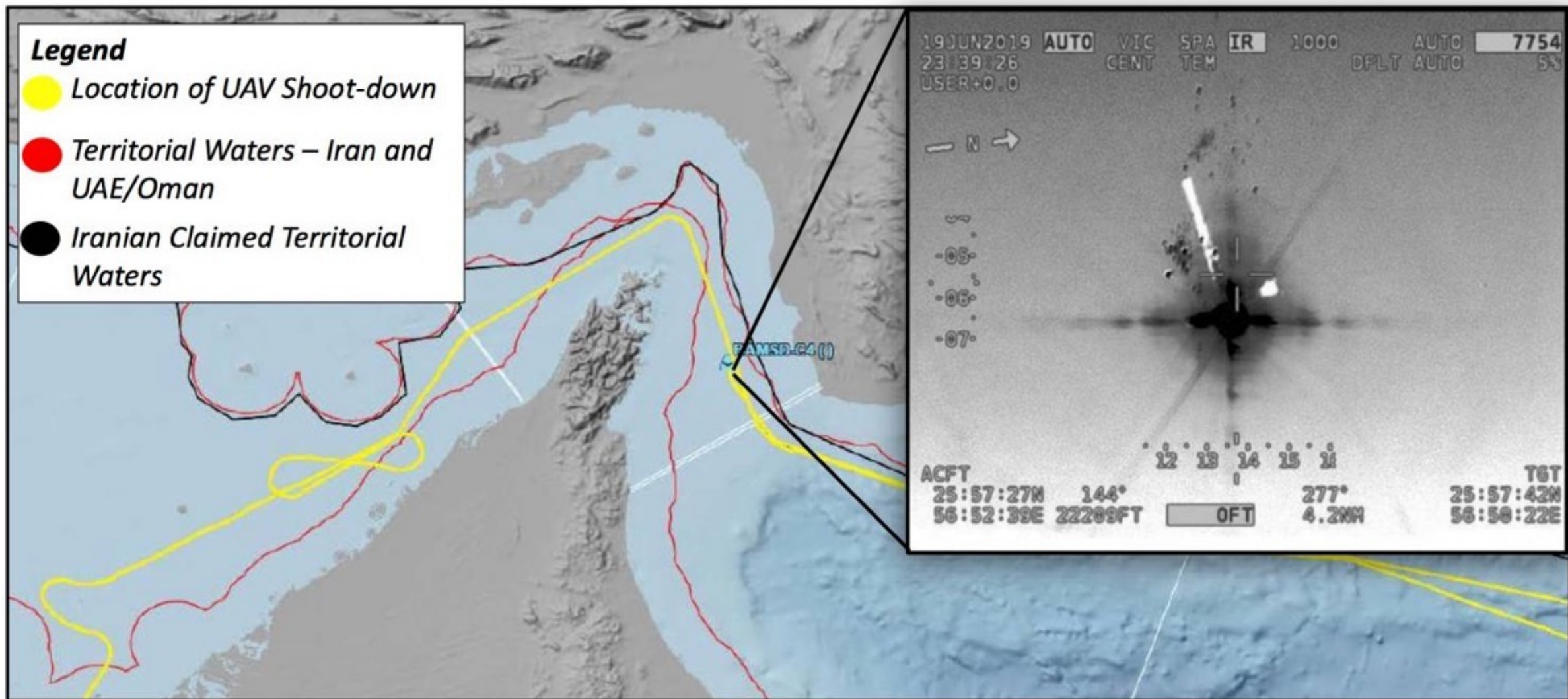
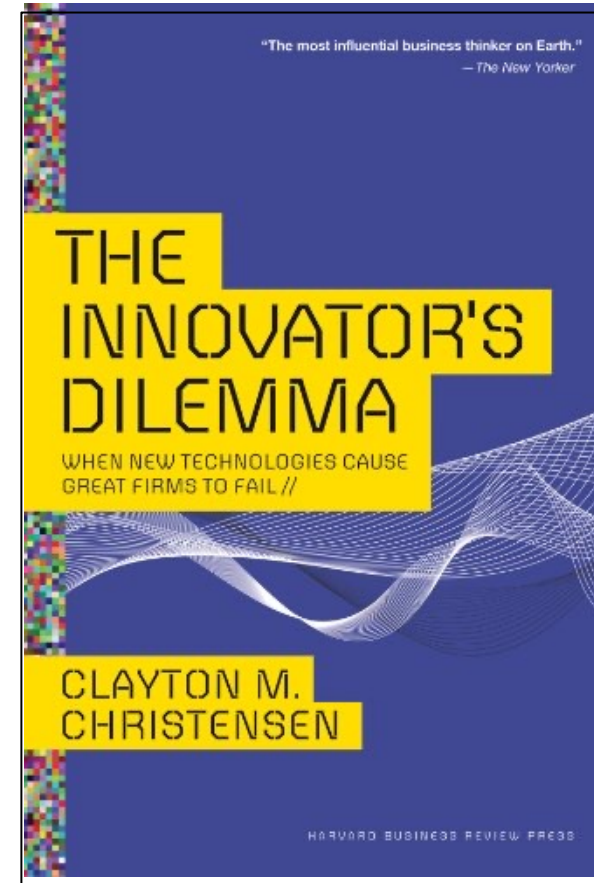


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What is an innovation?

Innovation

- Innovation is multifaceted
 - Technology, processes, etc.
- Innovation often framed as a good thing
- Innovation need not always be better
 - Innovations can fail
 - Innovations can have narrow use cases



Christensen, Clayton M. *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*. HarperCollins, 2011. © HarperCollins. All rights reserved. This content is excluded from our Creative Commons license. For more information, see <https://ocw.mit.edu/help/faq-fair-use/>.

Innovation: Innovator's Dilemma

- Sustaining technologies
 - Improved product performance
 - More of the same
 - Can exceed requirements
- Disruptive technologies
 - New value proposition
 - Initially suboptimal
 - Little mainstream interest



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Innovation: Innovator's Dilemma

- What's the dilemma?
- Companies respond to customer demand
 - Sustaining tech → thought to improve customer experience
- Disruptive tech initially of interest to niche markets
 - Future need
- First mover advantage
 - Incumbent firms struggle/fail to catch up

Innovation: Innovator's Dilemma

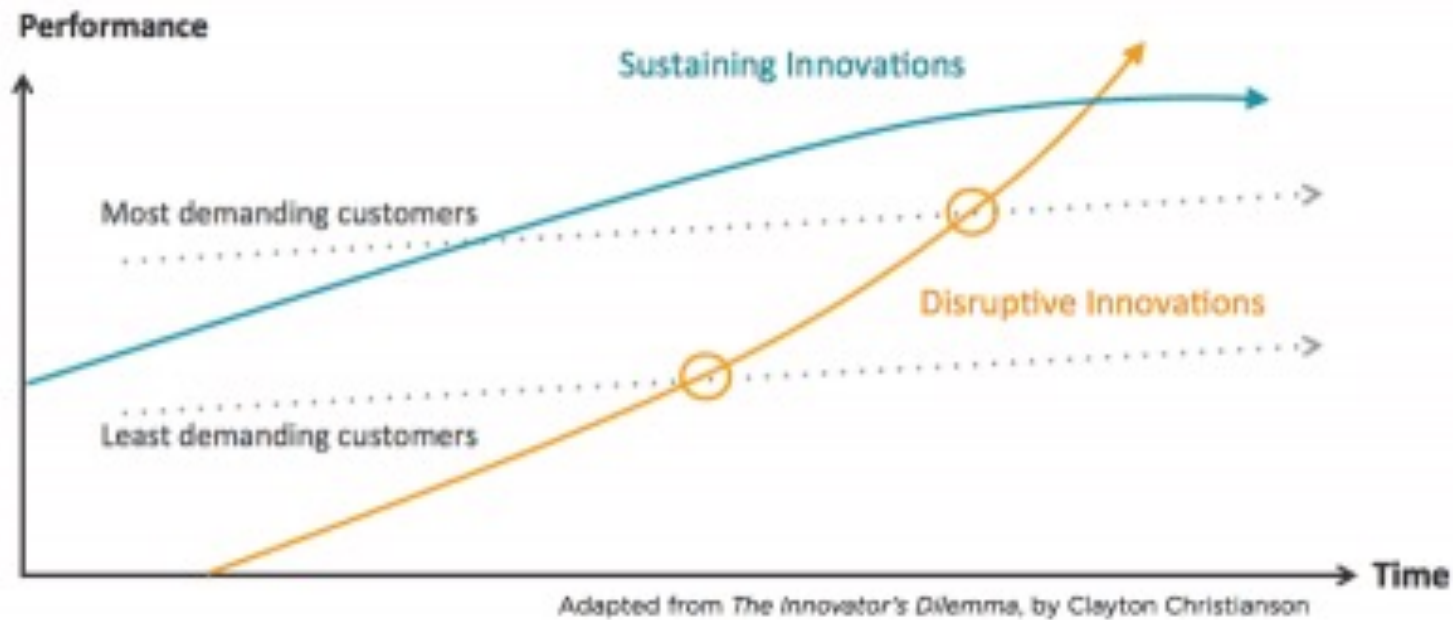


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Innovation: Innovator's Dilemma



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1979



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Innovation: Innovator's Dilemma



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1826-~2020



Image courtesy of [Kmart](#). Source: Wikimedia Commons. This image is in the public domain.

1962-Present

Founded earlier as Kresge stores, but
became a "big box store" in the 1960s



Image courtesy of [Amazon.com, Inc.](#) Source: Wikimedia Commons.
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1994-Present

Innovation: Innovator's Dilemma



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Innovation: Innovator's Dilemma

- What causes the dilemma? What are barriers to innovation?
- Limited strategic thinking (foresight)
 - Heuristics (from last class)?
 - Lack of information
- Customer demand influences resourcing
- Organizational characteristics
 - Bureaucratic politics?

Innovation: Innovator's Dilemma

- How do we overcome barriers?



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Global Trends 2030: Alternative Worlds. National Intelligence Council, 2012. This image is in the public domain.

Innovation: Open vs. Closed

- Two models (Cronin 2020)
 - Open: Accessible, collaborative
 - Closed: Restricted, secretive
- Who:
 - Can use it the innovations?
 - Directs the innovations?
- Focus of most IR scholarship? Why?

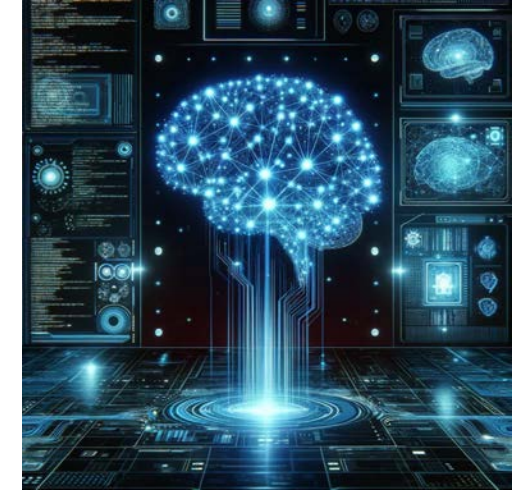


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Patterns of Military Innovation

What is a military innovation?

Major military innovation:

Change that forces one of the primary combat arms of a service to alter its concept of operations. Leads to a new way of war.

Major military innovation

**Dependent
Variable**

**Independent
Variable**

Major military innovation

**Dependent
Variable**

**Independent
Variable**

When do militaries innovate?

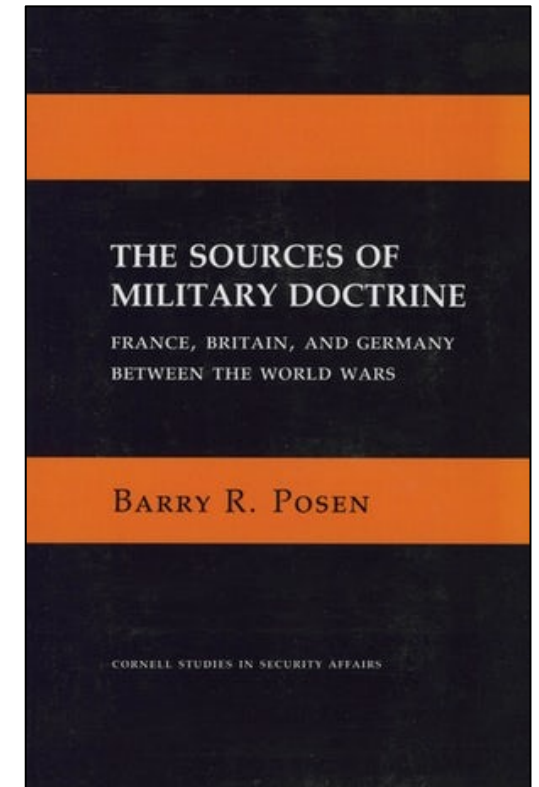
Who “drives” military innovation?

Patterns of Military Innovation

- Multiple competing (and complementary) theories
- Peacetime or wartime?
- After victory or defeat?
- External pressure or internal drivers?

Patterns of Military Innovation

- *Sources of Military Doctrine* (Posen 1984)
- Interwar innovation
- “Mavericks” + Civilian intervention
 - Someone the military has overlooked
- Foil for Rosen (1988)



Posen, Barry R. *The Sources of Military Doctrine: France, Britain, and Germany Between the World Wars*. Cornell University Press, 1984. © Cornell University Press. All rights reserved. This content is excluded from our Creative Commons license. For more information, see <https://ocw.mit.edu/help/faq-fair-use/>.

Patterns of Military Innovation

- Militaries are resistant to innovation
 - Sticky "organizational essence"
 - Fixed cultures, professional incentives
- Interwar innovation
- "Mavericks" try to generate change
- Civilian elites pressure military

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Patterns of Military Innovation

- Posen: Civilian intervention is crucial
- RAF focused on strategic bombing
- Mavericks + civilian intervention forces attention to RAF Fighter Command
- Rosen disagrees; raises questions



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Patterns of Military Innovation

- Rosen's alternate argument:
 - Civilian intervention is not the driver
 - Senior officers: "intellectual redefinition"
 - Civilians support senior officers
 - Departures from traditional way of war
- Militaries are not monolithic
 - Look at communities within military



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Patterns of Military Innovation: Carriers



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Patterns of Military Innovation: Carriers

What are common (but according to Rosen, incorrect) explanations for the development of aircraft carriers in the U.S. Navy?

Patterns of Military Innovation: Carriers



Pearl Harbor, 1941

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Ostfriesland, 1921

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Patterns of Military Innovation: Carriers

- Navy requested carriers in 1919
- Senior Navy leaders drove innovation
 - Rear Admiral William Moffett
 - Not a maverick
- “Negotiations” with battleship admirals
 - Missions
 - Promotion patterns (e.g., 1926 naval aviator law)
- Created space for organizational change
 - Aviators in senior Pacific Fleet leadership (1943)
 - Carrier centered doctrine (PAC-10)

Photo # NH 47725 Rear Admiral William A. Moffett, USN



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Patterns of Military Innovation: Carriers

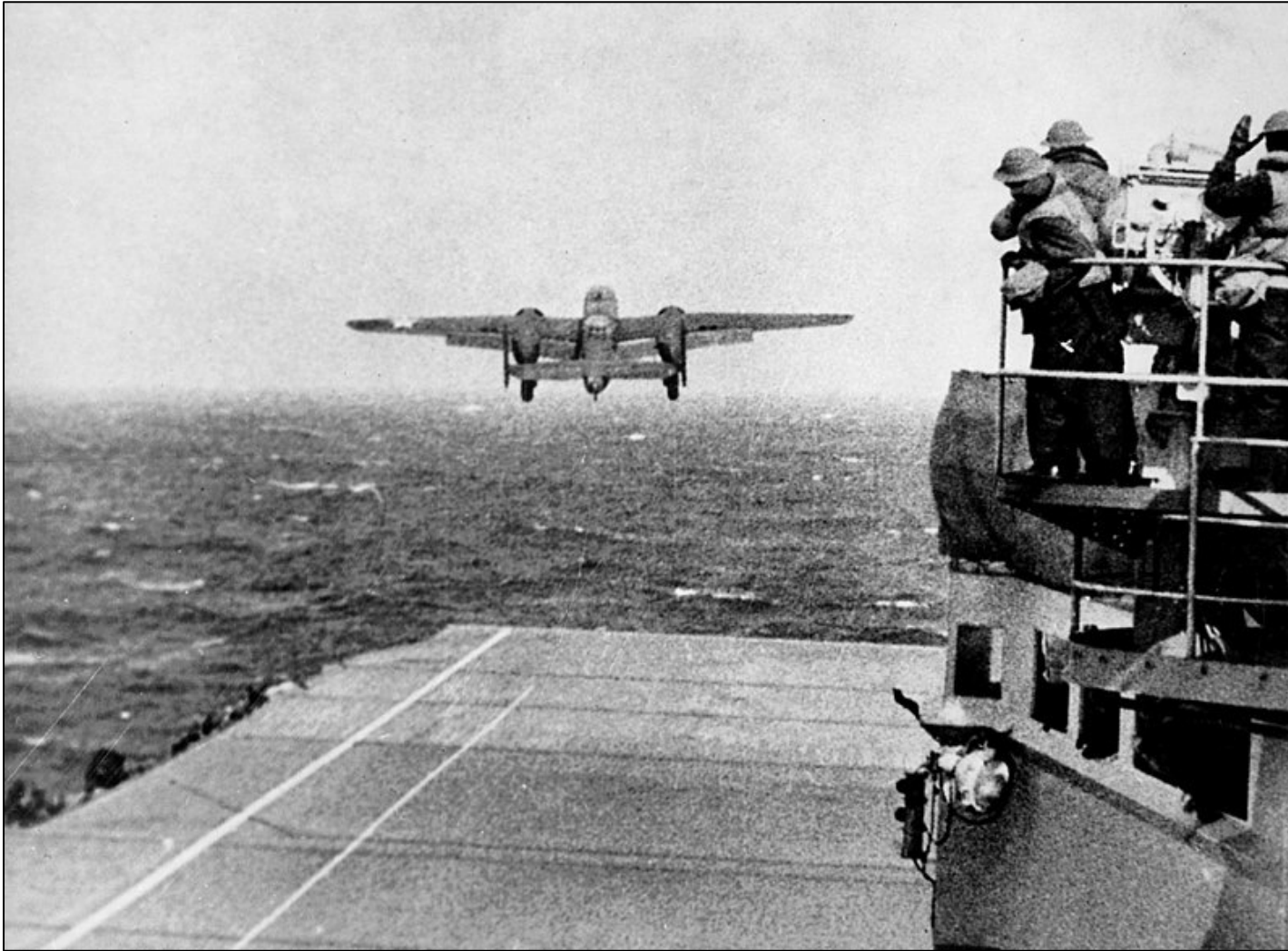


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Patterns of Military Innovation: Carriers



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Patterns of Military Innovation



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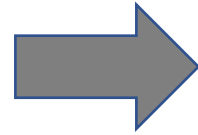


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Hinote, Clinton. From "US military must develop radically new ideas to win the next big war," *The Hill*, February 19, 2021. © Nextstar Media Group, Inc. All rights reserved. This content is excluded from our Creative Commons license. For more information, see <https://ocw.mit.edu/help/faq-fair-use/>.

The stark reality is that change is badly needed or we will experience a crisis that similarly exposes our shortcomings. In the past two decades, we have seen the rise of formidable rivals and the erosion of the technology advantage that emerged in Desert Storm. It's not hard to foresee scenarios where we might lose, or worse, become irrelevant. Just as we did after Vietnam, it's time to bring together a diverse team to re-think and rebuild national defense.

Lt Gen Clint Hinote

HAF/A5

Feb 19, 2021



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What “disruptive” technology exists today?

What is technology?

What is innovation?

When do militaries innovate?

Who drives it?

Patterns of military innovation (aircraft carriers)

Looking Ahead

- Determinants of Innovation Success
 - Culture
 - Adoption-Capacity Theory
- Please remember to complete response papers!

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