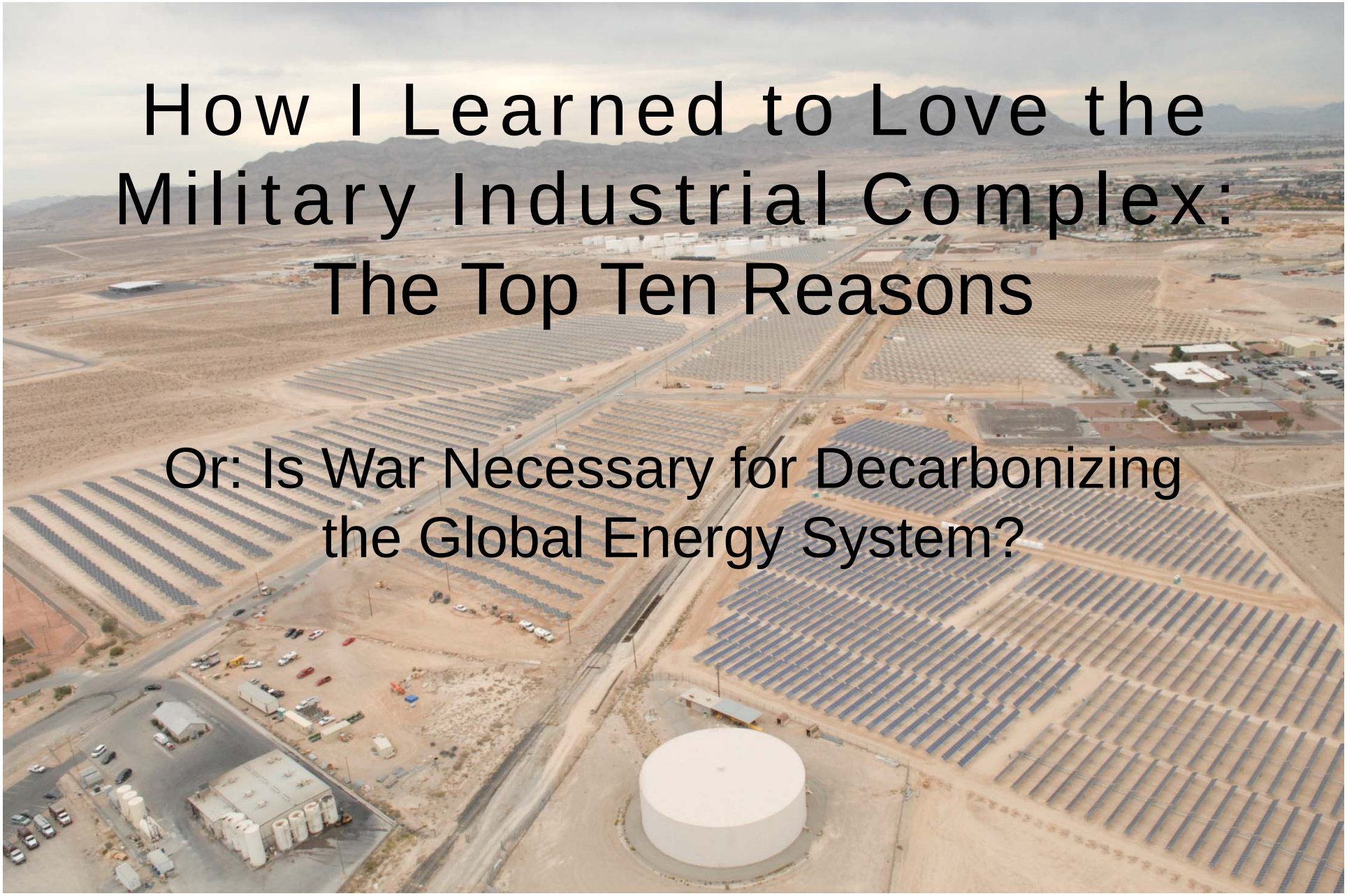
# How I Learned to Love the Military Industrial Complex: The Top Ten Reasons

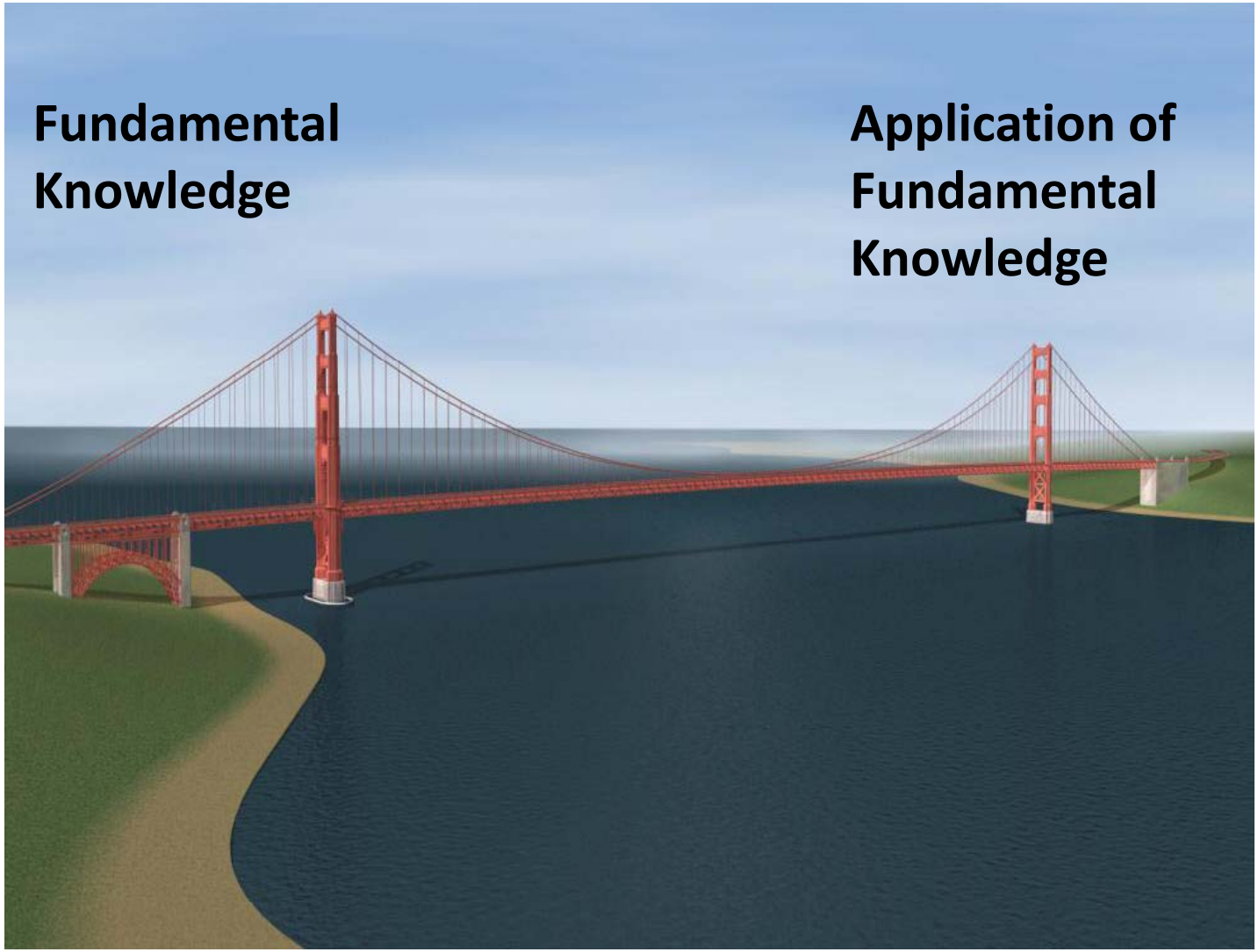
## Or: Is War Necessary for Decarbonizing the Global Energy System?



Nellis AFB PV Array

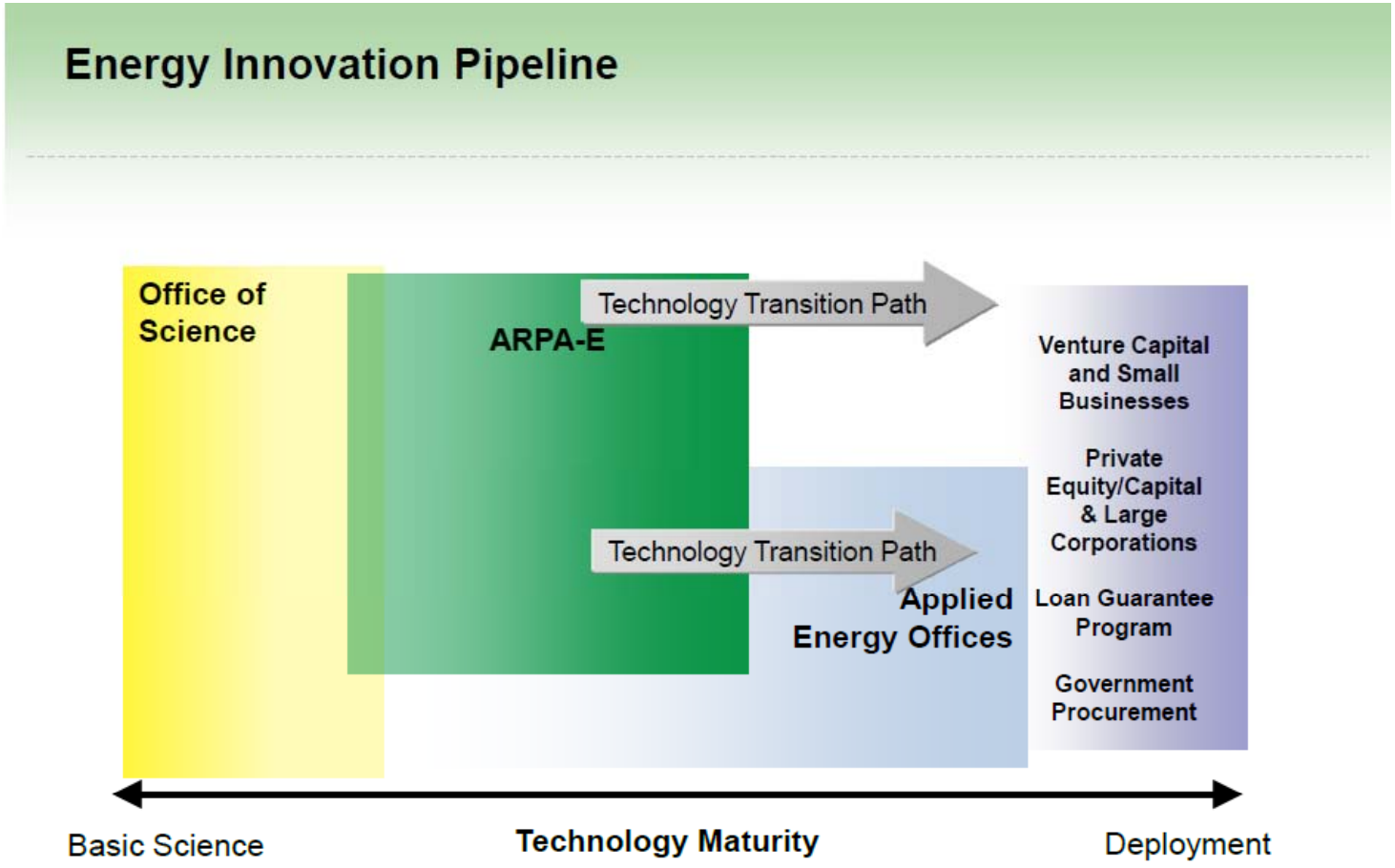
Daniel Sarewitz
Professor and CSPO co-director

# Innovation Policy: It's not a bridge…




**FY 2012 NIH Budget Roll-out:** http://www.nih.gov/about/director/index.htm

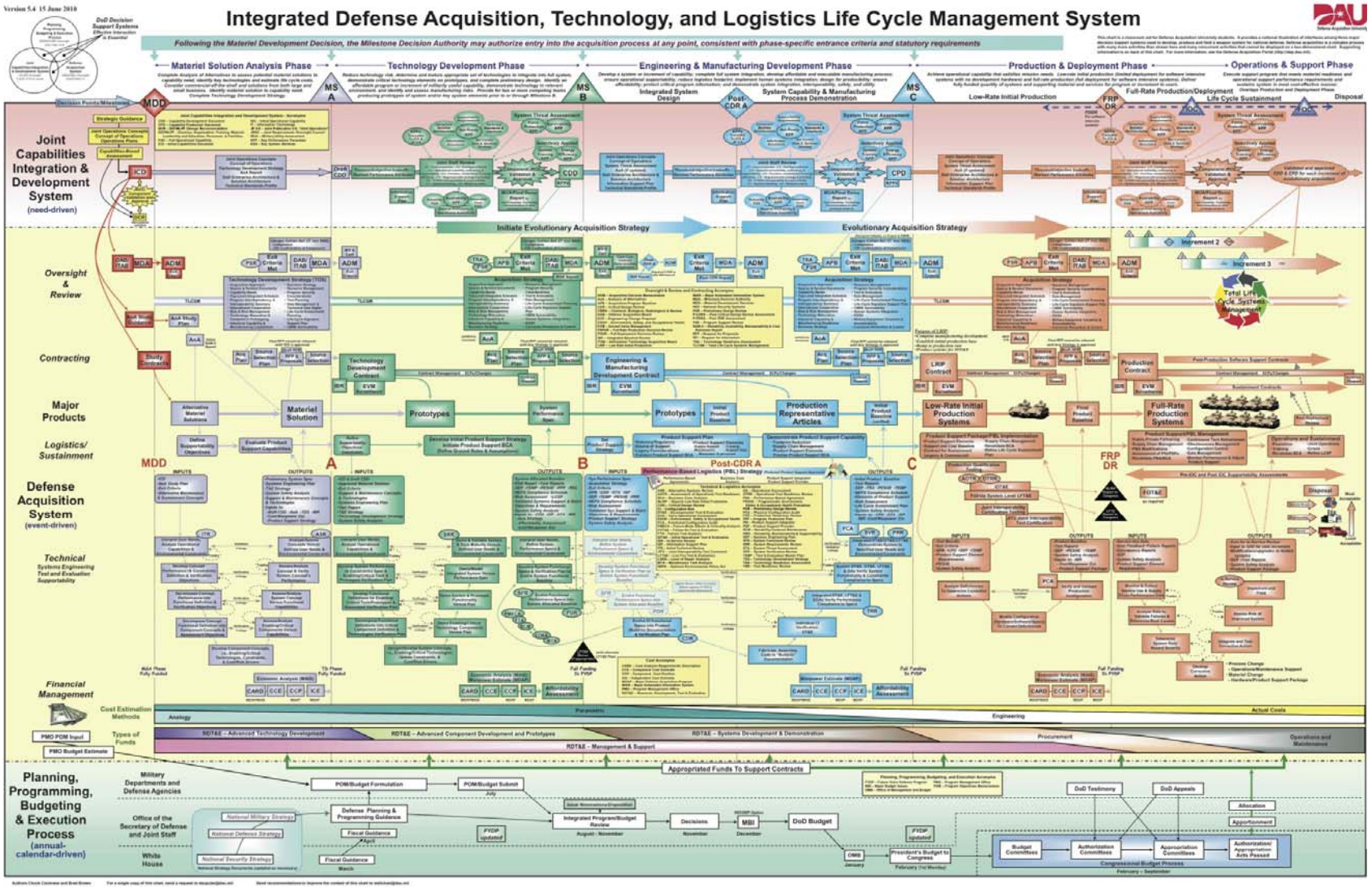
# or a pipeline…






**ARPA-E 2011 Energy Innovation Summit:** http://arpa-e.energy.gov

# it's a complex ecosystem.




**Integrated Defense AT&L Life Cycle Management Chart:** https://ilc.dau.mil/

# 10. Huge R&D capacity

- 30,000 scientists and engineers
- 2010 RDT&E budget over $80 billion
  - Basic Research: $1.8 billion
  - Applied Research: $5.0 billion
- Around 66 military labs

**Defense Laboratory Enterprise:** http://www.acq.osd.mil/rd/laboratories

# 9. Strong and enduring ties to academia

- In late 1940's Office of Naval Research built R&D capacity across U.S. universities
- DOD developed key academic fields like computer science ,material science, applied physics, etc.

**4 Army Collaborative Technology Alliances**
5-8 years $3-$8 million/yr, e.g. ASU:

**10 Army and Navy University Affiliated Research Centers**
e.g. MIT: 5-10 years, $10 million/yr

INSTITUTE FOR SOLDIER NANOTECHNOLOGIES
Enhancing Soldier Survivability

# 8. Diversity of roles and approaches to RD&D

**Defense Advance Research Projects Agency**

high-risk—high-payoff

**Service Labs**

downstream, incremental performance improvement

**Other labs and centers**

e.g. Tank Automotive RD&E Center

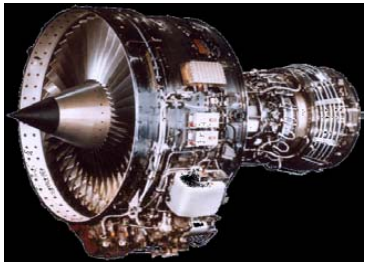
# 7. Unique role and scale as a test bed

- <u>DOD infrastructure</u> captures the diversity of building types and climates in the U.S.
  - 500+ facilities, 300,000 buildings, over 2.2 billion sq. ft., consumed over 209 trillion BTU's in 2009
  - 160,000 non-tactical vehicles
- <u>Military operations</u> are a test bed for a myriad of dual-use technologies, from advanced batteries to synthetic fuels
  - $10 billion / year on liquid fuels

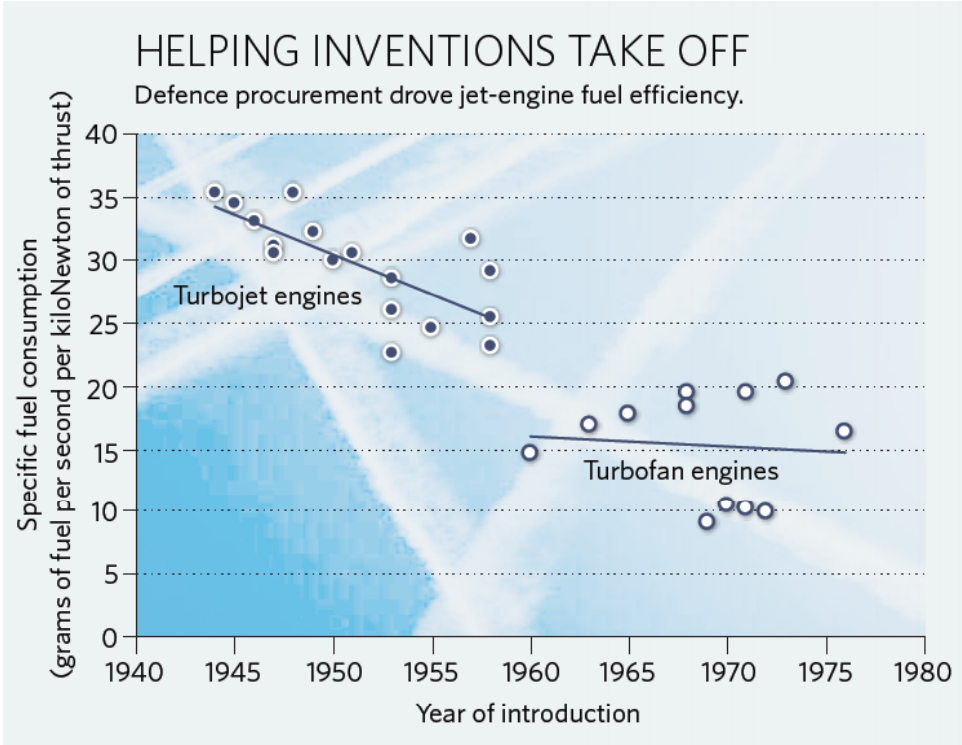

# 6. Persistent commitment to performance improvement

- Long-term programs aimed at continued improvement for mission critical systems, for example:

  **Gas Turbine Engines**





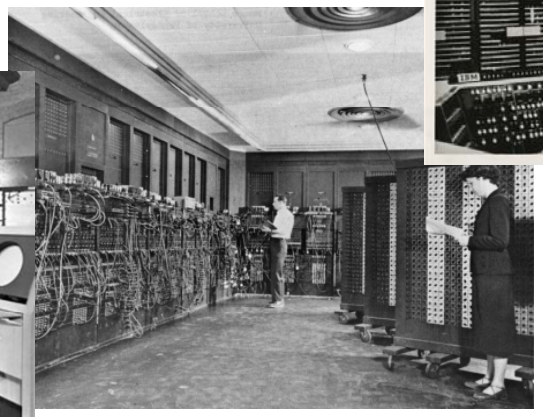



A new strategy for energy innovation: Alic, John et al., Nature, Vol. 446,15 July 2010

# 5. High price point for technology that advances the mission

- The fully burdened cost of fuel in Afghanistan can exceeded **$200 per gallon**

- The military's **first computers cost millions:**
  - ENIAC $750,000
  - Whirlwind $4,000,000
  - NORC $2,500,000



# 4. Strong and enduring ties to firms


NORTHROP GRUMMAN

SAIC
From Science to Solutions

United Technologies

OSHKOSH

SEMATECH

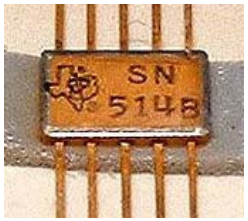
LOCKHEED MARTIN
We never forget who we're working for™

BOEING

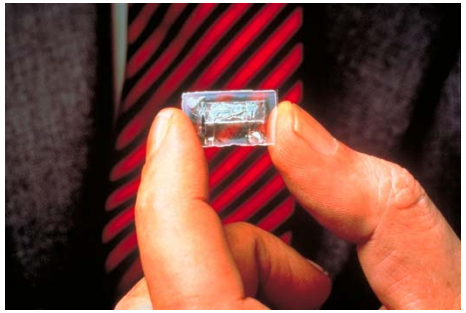
# 3. Role as a rich customer and discerning user

- Procurement **($105 Billion**), not just for weapon systems
- Integrated circuit chips, and satellite imagery and communications in the 1960s

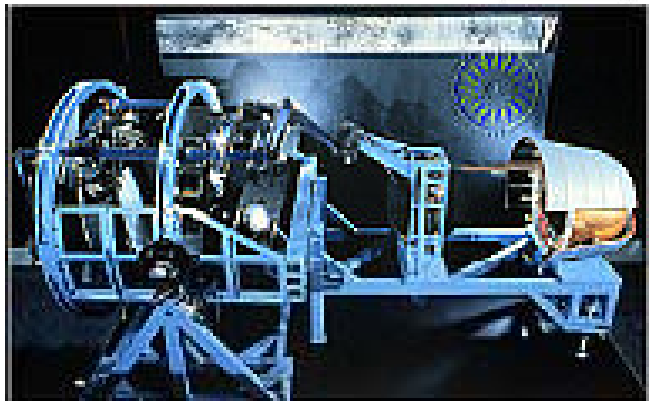
TEXAS INSTRUMENTS




FAIRCHILD
SEMICONDUCTOR®

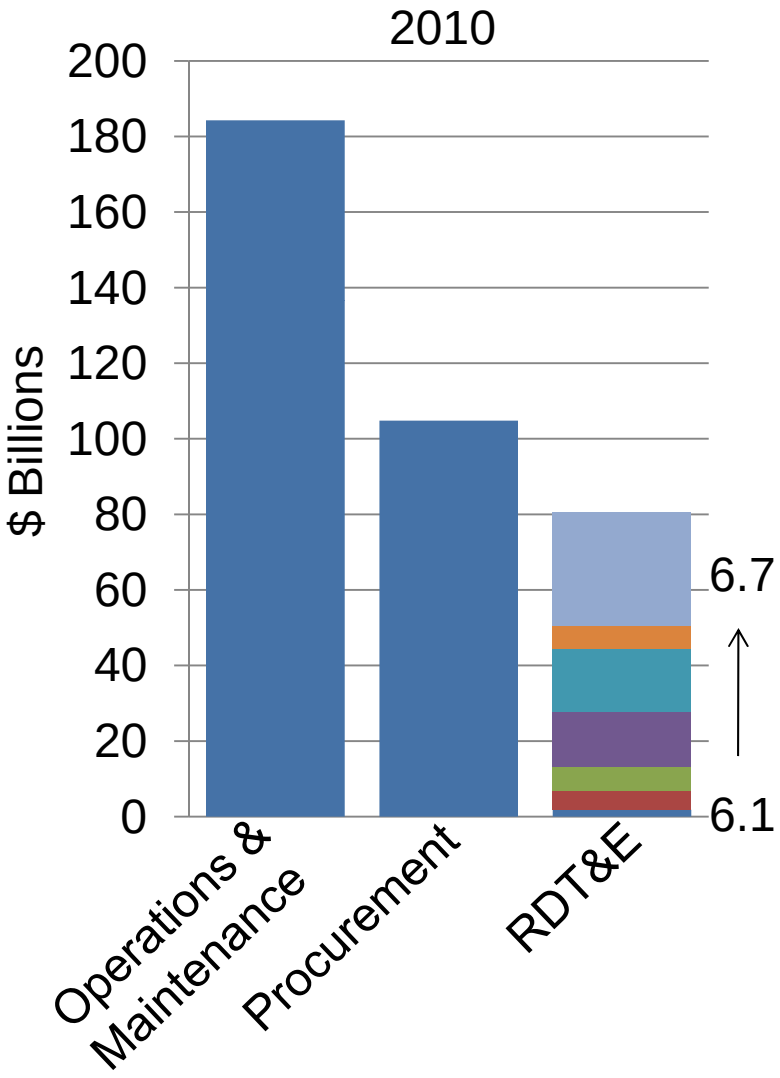


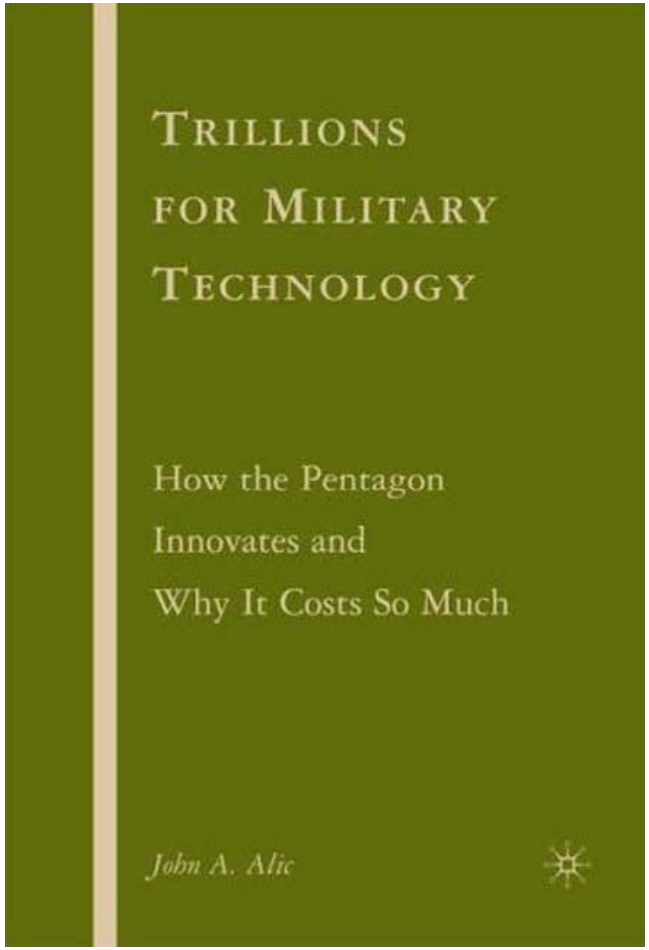
Itek



Corona KH-4B satellite camera by Itek, and imagery

# 2. Trillions of dollars



# 1. National security mission with broad public support