The Cold War and American Science:  
The Military-Industrial-Academic Complex at MIT and Stanford  
Stuart W. Leslie

Introduction

Is Michelangelo less of an artist because he was commissioned to paint the Sistine Chapel? This is the moral dilemma that Stuart Leslie presents in this book. The setting, however, is the Cold War. The story is “big science” and high technology. The actors are the brightest research scientific and engineering minds from MIT and Stanford, the military, and industry. And the drama is the race between two powers for technological and scientific supremacy. One infers from the book’s introduction that the author is a historian and professor at Johns Hopkins University. This book was written with grants from the NSF and NEH. The author’s strong effort towards thorough research is evident from the 1103 footnotes. The history and events are well researched, but the book is also moral history. The author’s message is clear. There is no ambiguity about his position, he writes:

- For better and for worse, the Cold War redefined American Science.
- … the long term costs must be reckoned both in dollars and in sense, in terms of our scientific community’s diminished capacity to comprehend and manipulate the world for other than military ends.
- … we begin to appreciate what was at risk in letting the military play such a crucial role in setting the academic agenda.
- … proved out fears of Cornell (and later MIT) physicist Philip Morrison and others that the military would end up buying American science on the “installment plan.”
- … the Silicon Valleys and Route 128s could not revitalize America’s basic industries and sagging competitiveness.”
- … Stanford’s department fell comfortably into a pattern of appeasement toward military-industrial physics …

The Military-Industrial-Academic Complex

As the name implies, the “Military-Industrial-Academic Complex” is a tri-partite institutional configuration that is mutually beneficial to achieve a super ordinate goal. As all complex systems, this arrangement achieves its goals, but also produces emergent system effects that the author argues are less than desirable. We are running ahead of ourselves at this point, more on this at the end of the report. Below is a simplified sketch to illustrate our interpretation of the structural form of this complex. We have limited the boundaries of this illustration in order to make the illustration is self-explanatory.
Summary of Key Research Programs and Labs

In this section we will present brief sketches of some of the major research programs at MIT and Stanford to illustrate some of the military-industrial-university research programs domains.

MIT (Pentagon East, S. Leslie)

- **Research Laboratory for Electronics (RLE)**
  This lab is significant because it became the model for interdepartmental cooperation, as well as, the template for military-industrial-university research programs.

- **Lincoln Lab (1950)**
  Principally funded by the Air Force it studied the integrated air defense of the US. Produced the concept of a network of ground radar systems, antiaircraft systems all connected to computers. Led to the SAGE (Semiautomatic ground environment) system and DEW line. Industry partner included IBM. It was at the time the largest R&D enterprise since the Manhattan project.

- **Draper Lab (1958)**
  Founded by the Charles Stark Draper Draper. Research included instrumentation, guidance systems, infrared systems, effect of atomic blasts on missiles. Partners included the Navy, and Sperry. Two of its graduates became Air Force Secretaries. General Jimmy Doolittle was another illustrious graduate. In 1969 it had a budget of $54 million, which exceed the Institutes (without Lincoln Lab).
- **Laboratory of Nuclear Science (1946-1950’s)**
  Another one of Slater’s many contributions to MIT. With funding from the AEC and the US Navy to build a nuclear reactor on campus. Rickover needed to shrink the size of a nuclear reactor and new special shielding in order to put them in submarines. With ONR developed the electron synchrotron.

**Stanford** (Pentagon West, S. Leslie)

- **Microwave Lab**
  Supported by the visionary Terman and created by Hansen. Leveraged klystron device and created Varian Associates with Sperry for radar tracking, microwave bombsights, etc. Later missioned to create a linear accelerator of unprecedented scale and to design and build powerful new microwave tubes to drive it. ONR funded.

- **Aeronautical engineering**
  Durand, a naval architect begins research on airplane propeller designs. Builds a wind tunnel. The Missile Gap debate makes Lockheed join the missile club. Wins Polaris contract and moves to Santa Clara to be close to Stanford. Hoff student of von Karman revitalizes Stanford’s aero engineering department. A very productive partnership between government, Stanford and Lockheed develops. Polaris is a success and wins follow on contracts for the Poseidon and Trident submarines. Santa Clara Lockheed personnel skyrocket from 200 in 1956 to 25,000 by 1964. Research expands to include orbital mechanics, space vehicle design, hypersonic structures, and plasma physics. By 1959 Stanford’s aero status is on par with MIT and Caltech.

**Success Factors**

From the reading, we find that the productivity and efficacy of the military-industrial-university research model can be attributed to six dominant factors:

**Exogenous historical conditions.** The Cold War began after WWII as a result of a realignment of the balance of power. The Soviet Union, a former ally became an adversary that was able to build nuclear weapons with unanticipated speed. The Korean War fomented by the Soviet Union quickly followed in the early 1950s. In 1957, they shocked the world by launching the first man-made satellite, Sputnik. American policy makers became convinced that the US could not afford to lose the technological race.

**Far-sighted leaders.** Vannevar Bush set the example as chief architect of wartime science policy and strong advocate of university research. He was convinced that “the nation was not prepared for the scientific challenges of any coming war and that even the military’s own laboratories were not up to the job.” He convinced Roosevelt to put him charge of the Office of Scientific Research and Development (OSRD). OSRD spent $450 million on research and made many scientific breakthroughs during the war. Slater, MIT physics professor, not only elevated the physics depart to one of the best research departments in the US, but was the guiding hand in key MIT research laboratories. Draper professor of Aero and Astro built a research organization of such stature that its
research budget rivaled MIT itself (minus Lincoln Lab). Stanford’s Panofsky had a vision of building a 50 billion ev linear accelerator. Terman of Stanford transformed its engineering school to an outstanding one by methodically building faculty and judiciously targeting areas of research.

New model of Research and Funding. The military-industrial-university research model is shown in the previous page. Its salient features go beyond the obvious partnership among the three parties. The armed forces and business became researchers and developers of scientific and engineering solutions at the universities. For example in 1964, the MIT nuclear engineering graduated 192 students. 46 were from the military, 115 from the Navy’s contractors. Lockheed was not only a source of adjunct faculty for Stanford, but of students (up to 50 a year) and an employer of its graduates. The organizational model was elastic. While MIT adopted the Laboratory model for its research, Stanford often opted to have its faculty run their own teams without necessarily creating a new organization. Another key reason for the productive nature of the relationship was that the research was mission oriented. The problems to be solved had well defined goals.

Interdisciplinary research. Stanford’s Center for Material Research emphasized its strong ties with research programs in aeronautics and electronics. In the same manner, at MIT, the Center for Material Science and Engineering combined the domain disciplines of metallurgy, ceramics, solid-state physics, chemistry and electrical engineering. Stovepipe research could not compete with this interdisciplinary approach to big problems. The DOD-University Forum initiative spend $125 million aimed at stimulating interdisciplinary research.

An unambiguous visible hand. In the reading, we can find no case where the government organization is vague or ambiguous about the problem they want to solve. The problems are mission oriented: e.g., need to address air defense that culminated in SAGE at MIT, extreme precise and accurate inertial navigational systems, behavior of materials at hypersonic speeds, shrinking nuclear reactors for submarines, microwave counter measures, propeller designs for new aircraft, relativity gyroscopes capable of measuring relativistic precessions, etc.

Money and lots of it. The government spent prodigious sums of money. For example, in 1940, the MIT Radiation Lab (later became the Research Lab of Electronics) had more people working there than the Manhattan project. The SAGE program cost the US government $8 B over a decade. The Air Force spent $1 B to develop a nuclear airplane. The bill to upgrade Stanford’s superconductor accelerator: $22 M.

Opinions

The title of the book is “The Cold War and American Science: The Military-Industrial-Academic Complex at MIT and Stanford.” A more appropriate title would have been: “The Military-Industrial-Academic Complex at MIT and Stanford during the Cold War.” The work done at MIT and Stanford is well researched and the emergent undesirable emergent behavior of this complex system is passionately argued. Unfortunately, the author barely discusses the historical context that motivated the formulation of American technology policies that encouraged universities and brilliant scientists and engineers like Slater and Terman to partner with industry. For example, the issues of national survival and hegemonic ambitions of America’s rivals and adversaries are barely visible. We believe
that these conditions exerted a powerful influence in the formation of national technology policy, but Leslie sheds no light on this subject.

The book is prone to sermonizing. Every chapter ends with a little editorial often using the voice of others by quoting them. To make sure the readers get the point, the last chapter is titled: “The Days of Reckoning: March 4 and April 3.” (The year is 1969 at the height of the Vietnam war and student antiwar demonstrations in the US.) The following are examples:

- But it cost them something too-if not their self-image, then their independence.
- …their very success raised troubling, and enduring questions about the extent to which the military establishment set the rules and determined how the game would be played.”
- … perhaps there should be envisioned an aeronautical industry without a military object.
- The question arises, therefore, whether the restrictions imposed upon research sponsored by government or industry is likely to lead to a loss of our academic ideals?
- Though bigness is of the essence of the research organizations, the thoughts they produce fall into various small corners of the universities’ range of knowledge.

These are noble sentiments. We agree and respect them. But the author offers no alternatives. We think that this is a serious omission.