Beyond the iron triangle : the military-industrial complex as assemblage

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The Military-Industrial Complex as Assemblage

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Abstract

The phrase “military-industrial complex” is at once both widely known and largely vague. Most people with some interest in national security matters will be familiar with the idea of the “iron triangle” — the relations between the three institutions of the military, the government, and industry — and the idea that there is some form of interaction between these three around matters of war and defence. However, there has been little comprehensive work on what the military-industrial complex actually is as a concept — how it should be defined, what its parts are, and how they interact in practice. This dissertation aims to answer these questions and provide both a thorough examination of and a theoretical basis for analysing the workings of the military-industrial complex.

The iron triangle concept as commonly applied implies a rigidity of structure that I argue that the military-industrial complex simply does not display in practice. Rather, it is a fluid and ever-changing system, and neither its parts nor their relations to each other are static over time. Furthermore, this kind of rigidity prevents us from comprehending how the military-industrial complex truly manifests and inhibits our understanding of its effects, making it more difficult to ameliorate the negative outcomes that it can produce for national security. I posit instead that the military-industrial complex is best understood as an assemblage, moving away from the rigidity of commonly held ideas like the iron triangle toward a conceptualisation that brings in the fluidity and change that the military-industrial complex exhibits in practice. I prompt scholars and policymakers to question what they mean by “the military-industrial complex” and offer a fresh and comprehensive way to conceptualise and understand it.

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Beyond the Iron Triangle:

The Military-Industrial Complex as Assemblage

Introduction

"If we didn't have a military-industrial complex, we would have to invent one, for the design and production and maintenance of today's complicated weapons necessarily entails the closest cooperation and communications between the military that requires them and the industry that provides them."[1]

What is the military-industrial complex? The phrase is at once both widely known and largely vague. While most people with some interest in national security matters will know it and have a loose idea of its meaning, when asked to define it their answers will be likely to range over a wide spectrum. Most will be familiar with the idea of the "iron triangle" — in this context, the relations between the three institutions of the military, the government, and industry — and the idea that there is some form of interaction between these three around matters of war and defence. However, there has been little comprehensive work on what the military-industrial complex actually is as a concept — how it should be defined, what its parts are, and how they interact in practice. This dissertation aims to answer these questions and provide both a thorough examination of and a theoretical basis for analysing the workings of the military-industrial complex.

The iron triangle concept as commonly applied implies a rigidity of structure that I will argue that the military-industrial complex simply does not display in practice. Rather, it is a fluid and ever-changing system, and neither its parts nor their relations to each other are static over time. Furthermore, this kind of rigidity prevents us from comprehending how the military-industrial complex truly manifests and inhibits our understanding of its effects, making it more difficult to ameliorate the negative outcomes that it can produce for national security. I posit instead that the military-industrial complex is best understood as an assemblage, moving away from the rigidity of commonly held ideas like the iron triangle toward a conceptualisation that brings in the fluidity and change that the military-industrial complex exhibits in practice.

Neither is the military-industrial complex a deliberately created entity, as some of the more conspiratorially minded often charge — indeed, the waste, inefficiencies, capability gaps, and other problems that are products of the military-industrial complex in its practical workings are evidence of its dysfunction, indicating that there is no deliberate plan behind it. Rather, the effects that the military-industrial complex has on the national security and economy of a state are emergent from the behaviour of the actors within it without being either intended or coordinated. Again, I argue that this is best explained by viewing the military-industrial

[1] Adm. J. M. Lyle (ret.) (1969) *National Security Industrial Association Newsletter*, quoted in Lens, Sidney (1970) *The Military-Industrial Complex* (London: Stanmore Press) p15

complex as an assemblage, as this theoretical basis allows for such emergent qualities to be woven into our understanding.

The fact that the concept of the military-industrial complex has endured for so long shows that there is a real longevity to the unease with which people have viewed the connections between money, military might, and political power. Whilst the form that the military-industrial complex takes has shifted over time, along with the changing contexts of contemporary conflicts and international rivalries, it has remained as an effective framework for exploring and expressing concerns about these connections. Its usefulness is limited, however, by a lack of definitional coherence across the literature, and the lack of a strong theoretical basis underpinning the concept. I argue that simplistic or conspiratorial explanations do not give us sufficient elucidation of how the military-industrial complex manifests, both in theory and in practice, and that an assemblage approach offers both a firmer theoretical foundation and a better way to understand the practical effects of its workings.

I have chosen to explore the military-industrial complex through the prism of its manifestation in the United States for several reasons: the American military-industrial complex is the largest in the world, therefore providing both extensive source material and numerous case studies to illuminate my work; much of the existing literature that touches on various facets of the military-industrial complex centres around the United States rather than any other nation; and the American example offers insight into the military-industrial complexes of other Western liberal-democratic nations. The military-industrial complex described here will not form a perfect depiction of that of, say, the United Kingdom, as many of the actors and incentives are different in the British context, but there remain patterns elucidated by the American example that will offer a framework within which to begin an exploration of the military-industrial complex of a state that shares with the United States the broad commonalities of a democratic government, a capitalist economy, and a civilian-controlled military. There will be material within this dissertation that will be of some help as a starting point for the study of any nation's military-industrial complex, but there will necessarily be far more variation when looking at states that, for example, do not have a democratic government (as much of the political side of a liberal-democratic military-industrial complex is affected by electoral incentives) or that have significant state control of industry (thereby shifting industrial incentives away from the pursuit of profit within a capitalist setting).[2] The intricacies of the structure of an individual state's military-industrial

[2] For an exploration of some of these variations across nations, see DeVore, Marc (2022) "Military-Industrial Complexes and Their Variations" in Thompson, William and Bou Nassif, Hicham (eds.) (2022) *Oxford Encyclopedia of the Military in Politics* (Oxford: Oxford University Press)

complex should be explored separately for a full understanding to be reached, but there will be behaviours, patterns, and incentives that are common across borders.

Firstly, I review the existing literature around the American military-industrial complex and place it within a historical context. The concept of the military-industrial complex has a long historical tail, with some recognition of the interplay between politics, war, and business stretching back as far as ancient Greece, but it coalesced into a recognisably modern form during World War II. The phrase itself was first used by President Dwight D. Eisenhower in 1961, but in coining the term he was drawing upon what was by then a familiar concept to those in national security circles. The literature surrounding the military-industrial complex does not provide a complete theoretical or historical picture — existing works tend to focus on certain facets of it, or how it manifested during particular periods, and the definitions used therein are either assumed or partial.

A common thread throughout the literature is that the term "military-industrial complex" is almost always used in a pejorative manner, either with reference to some form of conspiracy or corruption, or as a way of advancing other concerns — be that around large defence budgets, the influence of the military in politics, or the distortion of the economy via the defence industry. I identify two distinct periods when these critiques coalesce — around the Vietnam War and the Global War on Terror — and argue that wider concerns about American use of force and its domestic effects are reflected in an uptick in contemporary literature on the military-industrial complex, and discussion of the military-industrial complex is used as a vehicle for the expression of these wider concerns rather than as an attempt at dispassionate analysis.

Given the lack of a holistic theoretical explanation of the military-industrial complex in the literature thus far, I then move on to identifying how to achieve this. I explore the traditional iron triangle view of the military-industrial complex, identifying where it falls short in providing a complete understanding of the military-industrial complex. I then look at the scholarly work that does the most to give a better theoretical basis for the military-industrial complex, C. Wright Mills' *The Power Elite* — although Mills was writing before the phrase "military-industrial complex" existed, his identification of elite groups and the relations between them traces much of the ground where the military-industrial complex operates. While he recognises several of the core parts and relations of the military-industrial complex, he misses out some key aspects and his ideas needs updating to the modern context.

There is a shared intuition running through the literature of the military-industrial complex as some form of system, but this idea needs to be more fully developed. I argue that assemblage thinking offers the best path to doing so, drawing on the work of Manuel

DeLanda in bringing the assemblage into the realm of political science. Such a theoretical approach supports a fuller explanation of the intricacies of the military-industrial complex, allows for a less rigid structure than the traditional iron triangle view, and gives a way of explaining emergent behaviours and effects that has thus far been missing. I detail how assemblage thinking maps onto the military-industrial complex, arguing that a methodology based on stripping out the pejorative and focusing on describing the military-industrial complex as it is gives the strongest basis for understanding how it works, how it changes, and how it affects the wider system around it.

Next, I diagram the structure of the American military-industrial complex assemblage through its parts and how they relate to one another. I identify and define four distinct parts — the military, the government, industry, and academia — and show how each of these is itself a smaller assemblage, made up of yet smaller assemblages. I then show how they relate to each other, identifying and defining three types of binary connection: power, money, and the revolving door. In addition to these, I isolate several external motivating factors that shape how the American military-industrial complex works, centred around the electoral incentives that arise when a military-industrial complex exists within a democratic society: the military in politics, public connection with the military, campaign endorsements, veterans in Congress, generals in cabinet, civilian deference to the military, the political nature of the defence budget, and the ratchet effect in military spending.

After having defined and explained the parts and relations of the American military-industrial complex, I move on to exploring how these have shifted over time using case studies and quantitative data. While the amount of material that I could have used here is overwhelming, I draw upon certain examples that illuminate the larger whole of the military-industrial complex, via its parts, their relations to each other, or a particular time period. It is impossible to trace every relation or shift, but using both a qualitative and a quantitative approach to a subsection of these offers a way to elucidate wider trends and patterns, as well as providing a strong evidential basis for my conceptual approach. In addition to case studies and data snapshots, I have performed my own analysis of a portion of U.S. federal government contract data, which gives a helpful window onto a particularly prominent shift within the military-industrial complex over time — the changing nature of defence research and development within the military-industrial complex. I use the results of my quantitative research to frame my historical exploration of the military-industrial complex around three distinct periods in recent American history — the 1980s under the Reagan administration, the 2000s under the Bush administration, and the 2010s under the Obama administration.

In the 1980s, the academia assemblage had relatively more dominance within the military-industrial complex than it has done since, bolstered by high levels of defence spending on the

technologically premature Strategic Defense Initiative. I explore the history of links between academia and the Department of Defense during the early Cold War, spurred by the need for the United States to compete with the Soviet Union through technology, leading into the revitalisation of defence spending under the Reagan administration and the formalisation of the push to cement the American technological edge over its rival. Links between the military and academia were deliberately sought out and encouraged by the federal government during this period, giving universities and other academic institutions (particularly in Silicon Valley and Massachusetts) an unprecedented level of influence within the military-industrial complex. I then dive into the Strategic Defense Initiative as a case study, showing how the project's reliance on early-stage research led to a cementing of the dominance of academia within the space of military research and development.

The 2000s see the growth of the big prime defence contractors and a time of their dominance within the military-industrial complex, buoyed on expensive contracts during the American interventions in Afghanistan and Iraq in the context of the Global War on Terror. I show how the federal government deliberately encouraged the defence industry to consolidate in the 1990s following the end of the Cold War, creating the prime contractors, and explore how the government's response to the 9/11 attacks led to the primes' establishment as a pre-eminent part within the military-industrial complex. I delve into how the rise of the primes manifested within the military-industrial complex through the case studies of the littoral combat ship, the F-22 Raptor, and the Joint Improvised Explosive Device Defeat Organization, all of which show the primes' influence over the government and the military during this period, cementing the dominance of the industry assemblage within the larger whole.

Finally, the 2010s show a shift away from the prime contractors and towards both smaller defence-focused companies and large civilian technology firms due to the rising importance of dual-use technologies, encompassed within the Obama administration's Third Offset Strategy, coupled with a move from technology spin-off to spin-on. I show how, although the primes remain powerhouses in the defence contracting world, the rise of new technologies has changed the nature of demand in military procurement and thereby both the makeup of the industry assemblage and how it interacts with the other parts of the military-industrial complex. Until the 1990s, military technology tended to be more advanced than civilian technology, and the spin-off of such technology to the civilian sector was an important argument for the value of supporting military production. However, the opposite is now the case — in many areas, the military is falling behind in technological innovation, and must therefore procure from non-prime companies that it would not normally do business with, or acquire "commercial off-the-shelf" products from big civilian companies who would not see

themselves as part of the traditional defence industry, which changes the relations between the assemblages of the government, military, and industry within the military-industrial complex. I explore particular facets of this trend through several smaller case studies: the Strategic Computing Program, the JEDI Project, Project Maven, Palantir, and SpaceX.

I then conclude by bringing together my own approach to the military-industrial complex via the lens of assemblage thinking, avoiding the pejorative in favour of the descriptive. While the military-industrial complex as I find it is ever-changing, as evidenced by its shifting manifestations even within the periods I cover in this dissertation, there are commonalities that remain throughout and are useful in pinning down what the military-industrial complex is, how it works, and what its effects may be.

This fresh perspective on the military-industrial complex, and the fuller understanding that I offer, will provide solid foundations for other scholars to build upon, both within the context of the United States and more broadly in other nations. Many academic writers in the field of national security and defence are working from a concept of the military-industrial complex, given that the military-industrial complex is the foundational basis of how military capabilities are procured, how decisions are made as to what programmes to fund for research and manufacture, and how these capabilities fit into what warfighters need in the operational context. However, few of these scholars are explicit in what they view the military-industrial complex to be — indeed, there may often be an assumption on their part that it is unnecessary to elucidate this as a basic shared framework — and we thus cannot know whether those participating in academic debates in related areas are talking past each other due to some misconception of others' understanding of how the military-industrial complex works. I therefore hope to contribute to the facilitation of an academic debate on the military-industrial complex itself, as a building-block upon which to advance wider scholarly exploration of how that impacts on related fields. If we in academia can come to a deeper and more explicit shared understanding of how the military-industrial complex works and how it shapes the defence of a nation, we will be better able to bring that into our work in the national security space.

A more extensive understanding of the military-industrial complex also offers assistance to policymakers. Only through knowledge of how the military-industrial complex works and how its effects manifest can there be efforts to ameliorate the effects that may be detrimental to national defence, such as warping the procurement process, making it more difficult to source the capabilities that the military requires, distorting the wider economy, or conflicting with other policy goals that a government may wish to pursue. Thinking about the military-industrial complex through the framework I offer here gives scope for policymakers to

conceptualise the military-industrial complex in a different manner and identify ways in which to shape it in order to improve its outcomes.

Ultimately, the military-industrial complex has become a phrase that is widely used but narrowly understood. Without an understanding that covers all its parts, interactions, and effects, those who use the phrase may be talking past each other or working from foundations that differ too widely for discussion to be useful. In highlighting this problem and presenting an answer, I prompt scholars and policymakers to question what they mean by "the military-industrial complex" and offer a fresh and comprehensive way to conceptualise and understand it.

CHAPTER ONE

The Military-Industrial Complex: Concept, Context, and Critique

"And he whose occupation is to make or sell spears or shields, and for the sake of improving his trade constantly yells in favour of wars/May he be taken by pirates and eat nothing but barley."

Aristophanes, *Peace*

The term "military-industrial complex" is generally agreed to have first entered the political lexicon when it was used by President Dwight D. Eisenhower in his 1961 *Farewell Address to the American People*.[3] Despite this being the first instance of its use as a phrase *per se*, Eisenhower's speech would not have had the resonance that it did were it not for the fact that the concept of the military-industrial complex commingled several ideas that had promulgated in the United States since the turn of the century, particularly drawing upon the U.S. experience of World War II and the early years of the Cold War.

Since Eisenhower's speech, the phrase "military-industrial complex" has taken on many forms. The context of the Vietnam War added its own colour to the definitions created during and after this period, and the end of the Cold War and the beginning of the "Global War on Terror" gave rise to further shifts in meaning. The term is, however, almost always used pejoratively, and serves as a useful tool for many authors' discussions of wider trends. There are no dispassionate analyses of the military-industrial complex — each treatment of it contains a critique, or a series thereof, and it is through these that we must discern the development of the concept over time.

The military-industrial complex is, as James Ledbetter puts it, a "rhetorical Rorschach blot — the meaning is in the eye of the beholder."[4] Complicating the picture is the fact that the suffix "-industrial complex" has become a rather overused way of implying that policy in any area has been undermined by profit motivations: in criminal justice, healthcare, and many more.

It is, however, possible to discern the central tenets of the military-industrial complex that run through the varying critiques. Common to all definitions of the military-industrial complex is the identification of network or system of people, institutions, and forces bridging the public and private spheres, combining a capitalist profit motive with the design and

[3] Eisenhower, Dwight D (1961) *Farewell Address to the American People* [broadcast 17 January] (Abilene, Kansas: Eisenhower Presidential Library)
[4] Ledbetter, James (2011) *Unwarranted Influence: Dwight D. Eisenhower and the Military-Industrial Complex* (New Haven: Yale University Press) p5

implementation of defence policy. The core players in the American context are the military itself, the private industry contractors, the executive and legislative branches of federal government (particularly the Department of Defense, Congress, and the White House), and the academics and scientists who provide their skills: military, industry, government, and academia. However, many of those who write about the military-industrial complex identify a substantially differing set of players and connections, from broad to narrow, or focus on one subsection of the complex to the exclusion of a wider conceptual approach.

In this chapter, I will explore the historical context of the development of the military-industrial complex, looking at the key literature that elucidated the concept and its critiques throughout the last century. I will show how these critiques map onto the two largest U.S. overseas conflicts since World War II — Vietnam and Afghanistan/Iraq — and explore how the military-industrial complex became a vehicle for wider critiques of the use of American military force and a way in which to express dissatisfaction with contemporary policy choices. I argue that this context meant that the works discussing the military-industrial complex are often over-reliant on the charge that the state deliberately perpetuated the complex, something that I will go on to explain is simply not the case. Those works that avoid straying into this arena tend rather to be incomplete, identifying some valuable points but not encompassing what I will argue is the true extent of the military-industrial complex.

1.1 Early Roots of the Military-Industrial Complex

The seeds of the military-industrial complex are found throughout the history of warfare since the beginnings of civilisation — as Keith Nelson traces in his work, the constituent traditions of the military-industrial complex, "which hold ruler, soldier, and merchant responsible for war, wind back their separate paths through many centuries."[5] However, we can see the first true roots of the military-industrial complex developing in the United States during the build-up of the military during peacetime in the late 19th and early 20th centuries. Up until this period, the U.S. military machine had been built up during times of war (particularly the War of 1812, the Mexican War, and the Civil War) and demobilised immediately afterwards, while the interbellum periods saw far lower levels of defence spending.

In their excellent analysis of military spending in this period, Ben Baack and Edward Ray argue that a fundamental change took place between 1880 and 1905, when the share of the federal budget spent on the military grew hugely — over this period, the Army budget tripled

[5] Nelson, Keith L (1971) "The 'Warfare' State: History of a Concept" *The Pacific Historical Review* 40 p143

and the Navy budget increased eightfold.[6] They note that this was not simply an increase in manpower, but also an increase in the share of the budget spent on manufactured goods, particularly for the Navy. This gave rise to the first incentives for a commingling of business, military, and political interests in a proto-military-industrial complex — the construction and maintenance of warships necessitated large business investments in shipyards, steel production, and other related industries. Baack and Ray thus identify the roots of the military-industrial complex in the U.S. naval build-up before World War I.[7]

For other authors, the true birth of the military-industrial complex is the crucible of World War II. Paul Dunne and Elisabeth Sköns argue that the shift towards the military-industrial complex came after the New Deal had led to the federal government taking on more responsibility in the 1930s for using national economic planning for economic and military security — the beginning of World War II was the catalyst for truly national defence planning and thereby the dependence of businesses on military spending.[8]

Whilst much of the non-naval arms production for World War I was concentrated in state arsenals, the technological innovations of World War II created huge demand for industry to produce tanks, planes, and artillery. The United States, in common with other world powers at this time, had realised that science and technology were going to be the way to win in the future, and thus began to focus more on research and development, bringing academia into the fold as well:

> As electronics and the atom became instruments of war, the university was co-opted to supply brain power. It was a necessary partnership to win a war and save democracy.[9]

World War II saw the deployment of new and improved technologies such as radar and solid-fuel rockets, and it was ended with the newly invented atomic bomb. These wartime advances had been largely made by civilian scientists working under the umbrella of the Army or Navy directly, the Manhattan Project, or the Office of Scientific Research and Development, the latter of which had not built laboratories of its own but had instead let contracts to academic or industrial institutions.[10] These projects had their funding increased

[6] Baack, Ben and Ray, Edward (1985) "The Political Economy of the Origins of the Military-Industrial Complex in the United States" *The Journal of Economic History* 45:2 p370
[7] Ibid. p375
[8] Dunne, J Paul and Sköns, Elisabeth (2009) "The Military Industrial Complex" *Working Papers 0907* (Department of Accounting, Economics and Finance, Bristol Business School, University of the West of England, Bristol) p5
[9] Lens (1970) p15
[10] Kevles, Daniel (1990) "Cold War and Hot Physics: Science, Security, and the American State, 1945–1956" *Historical Studies in the Physical and Biological Sciences* 20 p239

substantially over the course of the war — in FY1938, the total budget for military research and development was $23 million (roughly $500 million today), but by FY1945 this had jumped to $100 million ($1.7 billion today) for the Office of Scientific Research and Development, $700 million ($11.9 billion today) for the Army and Navy, and more than $800 million ($13.5 billion today) for the Manhattan Project.[11] The biggest of the academic institutions, the Radiation Laboratory at the Massachusetts Institute of Technology, had a staff of 4,000 in 1945 and a total accumulated expenditure of $80 million ($1.35 billion today) from Office of Scientific Research and Development coffers.[12] Following the end of the war, new military entities like the Office of Naval Research came into the fray — by the time this organisation officially received legislative authorisation to begin its work in August 1946, it had already entered into contracts for 602 academic projects employing over 4,000 scientists.[13]

The war-winning achievements of the Office of Scientific Research and Development and, in particular, the Manhattan Project showed U.S. policymakers that the nation's security depended on technological superiority, which could be built on research into the pure sciences. The military advances that gave the United States the edge in World War II, particularly the atomic bomb and radar, had been based upon pure scientific research, and the Office of Scientific Research and Development model showed that this did not need to be done in government laboratories. This is where we see the U.S. government entrenching its support for civilian science and becoming the principal patron of research and development through a variety of institutions — in addition to those mentioned above, the Atomic Energy Commission was created in 1946, and the National Science Foundation in 1950. However, despite this deep-pocketed support, some scientists worried that the military focus of federal funding would mean that the purer sciences would fall by the wayside in favour of engineering technologies more immediately fruitful for military purposes.[14] In 1949, Lee DuBridge, who had been the head of the Radiation Laboratory during the war, warned:

> When science is allowed to exist merely from the crumbs that fall from the table of a weapons development program, then science is headed into the stifling atmosphere of 'mobilised secrecy' and it is surely doomed — even though the crumbs themselves should provide more than adequate nourishment.[15]

[11] Forman, Paul (1987) "Behind Quantum Electronics: National Security as Basis for Physical Research in the United States, 1940-1960" *Historical Studies in the Physical and Biological Sciences* 18:1 p152
[12] Kevles (1990) p239
[13] Turse, Nick (2008) *The Complex: How the Military Invades Our Everyday Lives* (London: Faber & Faber) p34
[14] Hounshell, David A (2001) "Rethinking the Cold War; Rethinking Science and Technology in the Cold War; Rethinking the Social Study of Science and Technology" *Social Studies of Science* 31 p290
[15] Quoted in Kevles (1990) p241

These newly funded research and development efforts, with aircraft and electronics given priority, led to patents, which were then granted to companies. For the first time, any cuts in federal defence research and development spending would have a major effect on the profits of private businesses, and the emerging defence industry responded by starting to lobby the federal government for increased budgets.[16]

The immediate post-war period is also where we begin to see the first overt criticisms of what would eventually be called the military-industrial complex. Sidney Lens quotes from an early example of such criticism: a December 1947 article for *Harper's* entitled "The Military Moves In" by the well-known military correspondent Hanson W. Baldwin:

> Some wise man once wrote that each victorious war costs us a few more of our liberties. Not only does the Government, like an octopus, draw to itself during war extensive new powers, many of which are not repealed when peace comes, but the great emotional upsurge of victory inevitably has the double effect of carrying to new positions of authority the military architects of victory, and encouraging in the rest of us dreams of an expanded 'manifest destiny' for our country.[17]

Although this does not yet identify the military-industrial complex fully, this critique highlights the growing concern about the accumulation of power by a conglomerate of elite interests in government and the military. These early critiques tended to coalesce into two main categories: economic (that the interdependence of the state and the arms industry would distort both the wider economy and the U.S. government's spending priorities) and militarist (that these trends could only lead down a path towards fuller military control of the state and wider society).

1.2 Eisenhower and Unwarranted Influence

Eisenhower's *Farewell Address to the American People*, broadcast to the nation in January 1961, marks the first use of the phrase "military-industrial complex," and an entire section of his remarks are devoted to explaining it and warning of its dangers. He began by outlining the conjunction of the military and the defence industry following World War II:

> Until the latest of our world conflicts, the United States had no armaments industry. American makers of plowshares could, with time and as required, make swords as well. But now we can no longer risk emergency improvisation of national defense; we have been compelled to create a permanent armaments industry of vast proportions. Added to this, three and a half million men and women are directly engaged in the

[16] Dunne & Sköns (2009) p5
[17] Lens (1970) p17

> defense establishment. We annually spend on military security more than the net income of all United States corporations. This conjunction of an immense military establishment and a large arms industry is new in the American experience. The total influence — economic, political, even spiritual — is felt in every city, every State house, every office of the Federal government. We recognize the imperative need for this development. Yet we must not fail to comprehend its grave implications.[18]

He went on to counsel vigilance against the military-industrial complex's dangers:

> In the councils of government, we must guard against the acquisition of unwarranted influence, whether sought or unsought, by the military-industrial complex. The potential for the disastrous rise of misplaced power exists and will persist. We must never let the weight of this combination endanger our liberties or democratic processes.[19]

One would not expect Eisenhower to be the president who criticised the "unwarranted influence" of the military-industrial complex so openly.[20] His acclaimed career in the U.S. military, as a five-star general and Supreme Commander of the Allied Expeditionary Forces in Europe during World War II, was a key part of his appeal to both the Republican party and the American electorate. His administration maintained a high level of defence spending throughout his tenure in the White House — the annual military budget ranged from $42 billion to $49 billion, three to four times higher than spending during the brief period of post-war demobilisation.[21] He presided over U.S. interventions in coups in Guatemala and Iran, and held to a doctrine of massive nuclear retaliation against the Soviet Union.

However, it was precisely this record that gave such authority to his warning of the dangers of the military-industrial complex. His experience as a president and commander-in-chief dealing with the prospect of mutually destructive nuclear war had, by the end of his two terms in office, shaken his faith in the ability of a free and democratic United States to come through the Cold War unscathed. His horror of nuclear war led him to advise publicly in 1959 that if war with the Soviet Union came, "you might as well go out and shoot everyone you see, and then shoot yourself."[22]

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[18] Eisenhower (1961) part IV
[19] Ibid.
[20] Janiewski, Dolores E (2011) "Eisenhower's Paradoxical Relationship with the 'Military-Industrial Complex'" *Presidential Studies Quarterly* 41:4 p672
[21] Härtung, William D (2001) "Eisenhower's Warning: The Military-Industrial Complex Forty Years Later" *World Policy Journal* 18:1
[22] Engel, Jeffrey A (2011) "Not Yet A Garrison State: Reconsidering Eisenhower's Military-Industrial Complex" *Enterprise & Society* 12:1 p190

Eisenhower's warnings about the military-industrial complex must be read in this context — as he prepared to leave office, he feared that those who stood to benefit most from the continuation of the Cold War were only becoming more entrenched, and more emboldened. The loss of military contracts during the years of peace and demobilisation from 1946–1948 had hit the defence industries hard, particularly in aviation, and their profits had only picked up again with the increasing tensions of the Cold War. Eisenhower had noted that any willingness from Congress to increase budgets was almost exclusively related to countering the Soviet Union, and that officials from the executive branch regularly deployed the spectre of communism as a persuasive measure when congressional votes wavered on foreign policy or defence matters. This point was compounded in the penultimate draft of the speech, which extended Eisenhower's reprimand to the "military-industrial-congressional" complex, although he ultimately decided to forgo the final element to avoid the appearance of the executive branch overtly chastising the legislature.[23]

Eisenhower also drew on technological changes in military affairs to identify the fourth corner of the military-industrial complex: academia. He warned of the distorting of academic research by the lure of government funding and the restrictions of federal grants:

> Akin to, and largely responsible for the sweeping changes in our industrial-military posture, has been the technological revolution during recent decades. In this revolution, research has become central; it also becomes more formalized, complex, and costly. A steadily increasing share is conducted for, by, or at the direction of, the Federal government [...] The prospect of domination of the nation's scholars by Federal employment, project allocations, and the power of money is ever present — and is gravely to be regarded.[24]

By bringing in academia as a part of the military-industrial complex, Eisenhower recognised that the need for research and development work to maintain the momentum of technological progress within the military context would mean that the distortions created by the military-industrial complex would impact more widely than solely within the national security space, moving out into the world of universities and laboratories.

Ultimately, Eisenhower reasoned that the defence industry would view any steps towards peaceful détente as an unacceptable threat to their business — they would do whatever they could to ensure that the United States did not rethink the expensive and expanding list of military capabilities deemed necessary to counter the Soviet Union. If the American people were not careful, national security policy would thus be determined not by the needs of the

[23] Ibid. p192
[24] Eisenhower (1961) part IV

country, but by the siren call of profit. This would not only threaten the survival of democracy, by undermining the ability of the electorate to direct their representatives' actions, but would also threaten the survival of the nation itself if the artificially inflated tensions of the Cold War ever culminated in nuclear warfare. Eisenhower warned that only a vigorously engaged electorate could ensure that the country did not fall into this trap:

> We should take nothing for granted. Only an alert and knowledgeable citizenry can compel the proper meshing of the huge industrial and military machinery of defense with our peaceful methods and goals, so that security and liberty may prosper together.[25]

He further advised that only a wise statesman should be entrusted with the role of president:

> It is the task of statesmanship to mold, to balance, and to integrate these and other forces, new and old, within the principles of our democratic system — ever aiming toward the supreme goals of our free society.[26]

For Eisenhower, putting businessmen in charge could only ever lead to ruin, as the impulse to enable perpetual war for the sake of perpetual profit was simply too appealing to avoid. His counsel was thus that the electorate and the president must both work to restrain the influence of the military-industrial complex as the joint guardians of the national interest.

Whilst he remained supportive of a large military to protect the interests and freedoms of the United States ("our arms must be mighty, ready for instant action, so that no potential aggressor may be tempted to risk his own destruction"), Eisenhower charged the electorate with ensuring that their representatives had the ability to balance this need with the consistent profiteering of the defence industry. In a rather less carefully crafted set of comments at a press conference shortly after he delivered the speech, this paradox of simultaneous defence and critique appears more clearly: he stressed the need for the military-industrial complex to "protect the great values in which we believe," whilst warning against its "insidious penetration of our own minds."[27]

1.3 The Early Cold War and the Vietnam Era

The outbreak of Cold War had reinforced the concept of national security being equated with a U.S. lead in nuclear weaponry, and this period forged an affinity between technological superiority in the arms race and in the other arenas in which the United States sought to

[25] Ibid.
[26] Ibid.
[27] Quoted in Janiewski (2011) p685

present itself as superior to the Soviet Union.[28] The Korean War in 1950–53 and the Soviet launch of Sputnik in 1957 showed that the United States could not afford to be complacent about national security, which remained closely linked to technological and scientific superiority.[29] Throughout the 1950s, over half of all funds for unclassified basic research in university physics departments came from the Department of Defense or the Atomic Energy Commission, including funding to build particle accelerators.[30] A few years after Eisenhower's speech, Sen. J. William Fulbright spoke out against the militarisation of academia, warning that, "in lending itself too much to the purposes of government, a university fails its higher purposes" — he called this the military-industrial-academic complex.[31]

Between the end of Eisenhower's tenure as president and the beginning of extensive U.S. involvement in the Vietnam War, the concept of the military-industrial complex resonated among those worried about the threat of an enhanced military establishment. This is clearly illustrated by the robust conversations taking place in the early 1960s within the growing counterculture movement about the impact of the military-industrial complex elites. The manifesto of the Students for a Democratic Society group, for example, identifies "the dominating complex of corporate, military, and political power" as the reason for the perpetuation of the Cold War, as well as the alienation, apathy, and false consciousness that went along with it — political participation by the individual was without meaning if the ends of the military, political, and industrial elites were going to be fulfilled without question or hope of change.[32] However, U.S. engagement in Vietnam was the primary context for discussions of the military-industrial complex during this period, as James Fallows summarises:

> When people warned about the influence of the military-industrial complex in the 1960s, they usually were talking about an increased risk of actually going to war [...] During the Vietnam era, the military-industrial complex was a shorthand reference to the interests that presumably kept profiting from the war.[33]

The Vietnam War gave rise to a large network of anti-war activists, who built upon the earlier counterculture movements and seized upon Eisenhower's warning to support their own

[28] Ungar, Sheldon (1990) "Moral Panics and the Military-Industrial Complex, and the Arms Race" *Sociological Quarterly* 31:2 p166
[29] Lassman, Thomas C (2015) "Putting the Military Back into the History of the Military-Industrial Complex: The Management of Technological Innovation in the U.S. Army, 1945–1960" *Isis* 106:1 pp95-96
[30] Forman (1987) p194, Kevles (1990) pp261-262
[31] Quoted in Turse (2008) p32
[32] Students for a Democratic Society (1962) *Port Huron Statement*
[33] Fallows, James (2002) "The Military-Industrial Complex" *Foreign Policy* 133 p46

critiques of the national security state,[34] describing the entrenchment of a corrupt and dysfunctional "government-industry establishment that was insulated from both democratic politics and competitive capitalism."[35] Ledbetter identifies the 1966 protests against the work of Dow Chemical on napalm production as a central example:

> This is what, for many, the military-industrial complex had come to mean: that industry was synonymous with militarism, that industry supported the military, and that to work for or buy from industry was to be complicit in an unjust war.[36]

There were protests throughout 1966 and 1967 on university campuses all over the country, with students railing against their institutions' research work into herbicides, tear gas, chemical weapons, and bacterial agents. For example, pressure from students and faculty led the University of Pennsylvania to reject two million-dollar Department of Defense contracts in early 1967 for classified research into chemical and biological warfare.[37]

The military-industrial complex became a rallying point for the left as an explanation for the interminable, pointless, and unjust war in which the United States was engaged in Vietnam. This is therefore a period that gave rise to a profusion of critiques of the military-industrial complex, often with deep and specific focus on one of its facets (particularly Congress, the Department of Defense, and industry lobbyists), and references to some form of militarism. There was also increasing concern about the effect of the military-industrial complex on the civilian economy, with a particular emphasis on the role of large industrial corporations and their partnership with the Department of Defense — the military-industrial complex became understood as a method of privatising profit while socialising risk, all whilst entrenching industry influence over the political sphere.[38] However, as I will now explore, the Vietnam context inescapably colours many of the works produced during this time period, and the charge of some kind of conspiracy or deliberate perpetuation by the state often undermines the place of these works in the search for dispassionate analysis of the military-industrial complex.

1.4 Cook and the Warfare State

In his 1964 piece *The Warfare State*,[39] Fred Cook fleshed out Eisenhower's warning about the military-industrial complex into his own concept, which he christened the "warfare state"

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[34] Härtung (2001)
[35] Bernstein, Michael A and Wilson, Mark R (2011) "New Perspectives on the History of the Military-Industrial Complex" *Enterprise & Society* 12:1 p2
[36] Ledbetter (2011) p166
[37] Ibid. p183
[38] Bernstein & Wilson (2011) p2
[39] Cook, Fred J (1964) "The Warfare State" *Annals of the American Academy of Political and Social Science* 351

and situated within the post-World War II context. He argued that the military-industrial complex formed the basis for the perpetuation for the two "myths" sustaining the warfare state: that safety can only be achieved through power, and that economic prosperity depends upon the pump-priming of the domestic economy through high military spending.

Cook identified the growth of the warfare state in the remaking of the U.S. military during World War II. The advanced technology of modern warfare now called for complicated planning and constant development, and this age of the atom bomb and the long-range missile gave rise to what he called the need for a "force in being."[40] He also linked the war with the health of the U.S. economy, highlighting that many saw the war as the only reason that the United States had managed to pull itself out of the trauma of the Great Depression, using as its lifeline the employment and prosperity brought by the vast military expenditures needed to arm the nation for a conflict fought around the globe. The combination of these two produces a change in the structure of power:

> All pressures, then, combined to one end — the creation, for the first time in American history, of a powerful militaristic class allied to powerful business interests. With inconceivable billions of dollars at their disposal, this combine possessed a lever on the entire economy of the nation. Economic self-interest became chained to the maintenance of the military budget at unprecedented levels — a performance that could be justified and maintained only by an ever-present menace.[41]

Cook argued that the massive sums of money involved had made large parts of the U.S. economy completely dependent upon the military budget, and this effectively bound the self-interest of millions of people to the perpetuation of the warfare state. He used as an example the U.S. stockpile of nuclear weapons, the "crowning folly" of the warfare state — no particular amount of these weapons can ever be considered by the warfare state to make the nation truly safe, because once the nation no longer needs more missiles, the warfare state can no longer perpetuate itself through the requisite spending. Every member of Congress is subjected to the outcry of constituents seeking a slice of the pie, abetted by the powerful lobby groups linked to the defence industry. This is the crux of Cook's critique of the military-industrial complex: "the billions spent create enormous complexes that perpetuate themselves only through the expenditure of more billions."[42]

While Cook identifies several of the key players within the military-industrial complex, his approach is overly coloured by his intimation of conspiracy — his language implies that there

[40] Ibid. p103
[41] Ibid. p104
[42] Ibid. p105

is deliberate perpetuation of war in order to feed the complex, which I will argue is simply not the case, and the value of his work is undermined by his focus on such a conspiratorial underpinning.

1.5 Adams and the New Industrial State

Walter Adams continued the trend of looking at the military-industrial complex from an economic perspective, and he coupled the concept with his exploration of what he calls the "new industrial state" in 1968. He identified the grounding of the "new power configurations" of the military-industrial complex within the unique buyer-seller relationship between the state (in which term he elides the military and the government) and business, a relationship that he argued "defies analysis by conventional economic tools."[43]

Adams began with the scenario of large defence budgets creating demand for the development and production of sophisticated weaponry, which cannot be produced by the U.S. state itself due to a lack of appropriate government-owned arsenals. The state thus becomes a monopsonist buyer of weaponry and related products, purchasing these at prices without yardsticks based on precedent or competition, and dealing with private contractors whose business model is often entirely reliant on supplying the state's defence needs. The controlling variable in the defence market is not price, but technical capability. Adams argued that the state thus confronts a powerful defence oligopoly in an uncompetitive market, without the ability to shore up its own position with the capability to produce in-house. He reiterated this economic analysis in a number of later works focusing on the market structure of defence industry.[44]

The military-industrial complex, for Adams, was a "natural coalition" of defence stakeholders, each with a political, professional, or economic interest in the perpetuation of the status quo. He argued that this was not, however, an inevitable consequence of either the 1960s national security context or the inexorable march of technology — although he did not view the military-industrial complex as a "conspiracy," he did argue that it was created and preserved by the state. He highlighted the blending of public political power and private economic power, which he called "private socialism" or social planning, and castigated the result as:

> … reminiscent of the Elizabethan monopoly system and its abuse, corruption, favouritism, waste, and inefficiency — an *imperium in imperio*, without

[43] Adams, Walter (1968) "The Military-Industrial Complex and the New Industrial State" *The American Economic Review* 58:2 p655

[44] See, for example, Adams, Walter and Adams, William J (1972) "The Military-Industrial Complex: A Market Structure Analysis" *American Economic Review* 62

> demonstrable public benefits, and without any built-in safeguards for the public interest.[45]

Given that he saw the military-industrial complex as the creation of the political state, rather than being the product of evolution, he contended that there was nothing inevitable about its survival, or the survival of the public policies that sprang from it. As with Cook's work, although Adams is careful to avoid overt charges of conspiracy, this emphasis on the deliberate creation and perpetuation of the military-industrial complex is unhelpful and undermines the value of the economic analysis he provides.

1.6 Melman and Pentagon Capitalism

A stronger economic analysis came in 1970 with Seymour Melman's landmark book *Pentagon Capitalism: The Political Economy of War*. Melman had worked on the economic impact of the military for some time prior, but his pessimism over the Vietnam War made this work particularly scathing of the U.S. state's reliance on its war economy. He noted that Eisenhower had not defined the military-industrial complex in his speech, but he argued that it was possible to infer a good definition from the context:

> Military-industrial complex means a loose, informally-defined collection of firms producing military products, senior military officers, and members of the executive and legislative branches of the federal government — all of them limited by the market relations of the military products network and having a common ideology as to the importance of maintaining or enlarging the armed forces of the United States and their role in American politics.[46]

Melman clearly drew on previous definitions here, particularly in his identification of the relationships between the main parts of the structure — but he saw the military-industrial complex as being an interplay of the interests of the elite groups involved, causing them to move together with a mutually reinforcing effect, without the existence of any formal organisation or direction. He viewed private business as a "ruling elite," using the political power of the government to extend and maintain their own power.[47]

Melman agreed with Eisenhower's warning, but saw the decade since the speech as one of true formalisation of the structures that made up the military-industrial complex, primarily through the new institution of "state-managerial control." He argued that the loose collaboration of interests that had characterised Eisenhower's time had been replaced by a

[45] Adams (1968) p656
[46] Melman, Seymour (1970) *Pentagon Capitalism: The Political Economy of War* (New York: McGraw-Hill) p10
[47] Ibid. p7

formal centralised management of the military-industrial relationship, under the direction of President John F. Kennedy's secretary of defense, Robert McNamara. Government no longer regulated business, or even served business — government and business had merged in the form of "state capitalism."[48]

This military state capitalism, for Melman, was based upon the funnelling of tax revenue and manpower into military production, which he viewed as parasitic upon the U.S. economy — these products did not contribute to either the general standard of living or further economic production. He argued that the prioritisation of military goals had a large opportunity cost, both in human and economic terms, as resources could not be used elsewhere in the U.S. economy:

> The true cost is measured by what has been foregone, by the accumulated deterioration in many facets of life, by the inability to alleviate human wretchedness of long duration [...] The human cost of military priority is paralleled by the industrial-technological depletion caused by the concentration of technical manpower and capital on military technology and in military industry.[49]

He built on this in a later paper titled "Ten Propositions on the War Economy," in which he outlined a series of effects that this parasite of military capitalism had on the U.S. economy. On the micro level, he argued that the war economy had undermined the operation of the self-correcting mechanisms of normally cost-minimising industrial firms. On the macro level, it had become a generator of industrial depletion, and thereby unemployment of both labour and capital.[50]

Melman added to his critique by drawing on aspects of militarism, although he did not use this terminology. He wrote of the "untouchable" and "sacred cow" quality bestowed on the military by its interplay with the state. The military's position as the defender of the nation meant that it could not be criticised, with an aura of mystery built up around military technology in particular. He argued that this meant that only those with advanced technical knowledge or access to secret information are seen as being capable of understanding the military sphere, thereby removing the ability of the public to seek to develop informed opinions and hold their government to account on related policies.[51]

As with Cook and Adams, Melman's work is inescapably coloured by his views on the Vietnam War. He initially moves beyond their work by identifying the basis of the military-

[48] Ibid. pp1-2
[49] Ibid. p3
[50] Melman, Seymour (1972) "Ten Propositions on the War Economy" *The American Economic Review* 62:1/2 pp317-318
[51] Melman (1970) p26

industrial complex as an interplay of interests rather than a creation or conspiracy, but his criticism of McNamara through the prism of centralised management moves him back into the conspiratorial field once again.

1.7 Lens and the Military Syndrome

The militarist critique was most clearly advanced by Sidney Lens in his book *The Military-Industrial Complex*, which was published in the same year as Melman's work. Lens defined the military-industrial complex as a pyramid of influential groups, including Congress, corporate contractors, military organisations, and the academic community, with elites from each of these sectors acting as "a select group who know each other well and tend to shuttle back and forth from one milieu to another."[52]

Lens' key contribution, however, was his development of an exploration of the militarist basis of the military-industrial complex, which he called the "military syndrome." He contended that the tradition of the military being subservient to civilian political control had been fatally undermined, and that the "pitiless logic" of militarism joined with the newly global outlook of the United States after World War II to give rise to the "monolithic state" that was the subject of Eisenhower's warning.[53] The Cold War global imperialism of the United States demanded the maintenance of a large peacetime military establishment, and Lens viewed this as the catalyst for the welding together of the domestic elites with a stake in militarism into the military-industrial complex. This military-industrial complex survives, in turn, by perpetuating this militarist outlook:

> The destiny of that complex, if it is to survive, depends on whether it can mobilise public acceptance of its aims and can fashion a national spirit of discipline and conformity similar to what governments impose, through persuasion and compulsion, in wartime. The result is therefore a specific military syndrome.[54]

Lens went on to highlight the military-industrial complex's reliance on the American public's fear of communism, manufactured through the withholding or spinning of information in critical situations. The public find it impossible to make an intelligent assessment of the government's policies, and therefore rely on their political masters to do what is necessary to deal with the ever-present danger of the Soviet Union. This excludes the populace from the political process, and reserves the decision-making power for the elites, thus prolonging the political monopoly of the military-industrial complex. Lens also argued that militarism perpetuates itself by creating its own momentum towards war — by consistently demanding

[52] Lens (1970) pp39-40
[53] Ibid. p34 and p60
[54] Ibid. pp99-100

the advancement of military technology, the availability of a wide range of weapons capabilities, and the creation of plans for every contingency, the establishment both justifies its existence and promotes its expansion.

Lens adds considerable value here with his identification of a far broader set of actors within the military-industrial complex than is evident from prior works, but again his language strays too far into the conspiratorial to be truly useful for dispassionate analysis.

1.8 Proxmire and Congressional Oversight

Lens recognised the usefulness of the Vietnam War in exposing the U.S. military establishment to criticism, pointing out that the Department of Defense's views on procurement were "accepted like a message from Mount Sinai" until the war proved to be an unwinnable quagmire.[55] He reserved significant praise for Sen. William Proxmire and his Subcommittee on Economy in Government, which began from late 1968 to reveal the "miasma of waste, inefficiency, and probably corruption"[56] hidden by the previously sacrosanct nature of military spending. The results of this work were collected by Proxmire into a book entitled *Report from Wasteland: America's Military-Industrial Complex*, also published in 1970.

Proxmire situated his work directly within the warning of Eisenhower's speech and claimed that the unwarranted influence cited therein had resulted in government spending that prioritised the military budget over any other threat to the nation's security, taking needed funds away from addressing domestic social and environmental problems. He extended the definition of the military-industrial complex far beyond that used in previous works, encompassing within its bounds not only the traditional facets of the military services, the legislative and executive branches of government, the defence industries, and academia, but also a long list of other groups such as lobbyists, trade associations, and research organisations:

> The complex has more tentacles than an octopus. Its dimensions are almost infinite. It is a military-industrial-bureaucratic-trade-association-labor-union-intellectual-technical-academic-service-club-political complex whose pervasiveness touches nearly every citizen.[57]

In common with previous writers, Proxmire identified the roots of the military-industrial complex within the need for specialist military production capacity following the end of

[55] Ibid. p1
[56] Ibid. pp3-4
[57] Proxmire, William (1970) *Report from Wasteland: America's Military-Industrial Complex* (New York: Praeger) pp8-9

World War II, which gave rise to the big defence industrial contractors. He argued that the lack of civilian markets for these companies' goods meant that they became dependent on military contracts, unable to convert their production into consumer items. A concentration of technologically sophisticated companies thus developed, and the U.S. government and military become dependent on this limited pool of contractors for their defence requirements. The companies need the Department of Defense, and the Department of Defense needs the companies — both are on what Proxmire described as "a military-contract treadmill."[58] His approach is far less reliant on overly conspiratorial language, and his work identifies several of the patterns that I elucidate below, but much of what he touches on is theoretically underdeveloped — which is understandable given that his purpose was to argue in favour of tackling waste and corruption within the defence procurement system rather than to offer a deeply developed theory of the military-industrial complex.

1.9 Smith, Smith, and Military-Industrial Symbiosis

In their 1983 book *The Economics of Militarism*, Ron Smith and Dan Smith looked at how a state determines its military expenditure. They highlighted that the orthodox account, which imagines a state conducting a cost-benefit analysis as a rational actor, is undermined by domestic forces that affect decisions, notably industrial interests and the operation of military bureaucracies. They argued that the most influential grouping is the military-industrial complex, which they defined as "that confluence of interests between arms manufacturers and the military establishment."[59] The military-industrial complex is not a homogeneous bloc, and comes with its own set of competing interests and constraints, but it is a key determinant of military spending within a state.

Their military-industrial complex was not based on conspiracy or corruption, likely because the world had moved on from the miasma of Vietnam, but rather on the development of mutual interests given the structural pairing of the military and industry. This is constructed upon the many smaller relationships built between corporations and parts of the military bureaucracy on specific projects over time, and both come to find mutual benefits in pushing for higher military spending. Smith and Smith posited that this symbiosis has at its roots two fundamental and self-reinforcing politico-strategic assumptions: firstly, that state security requires national self-sufficiency in weapons production; and secondly, that state security also requires advanced and advancing technology. This leads to industry having influence

[58] Ibid. pp16-17
[59] Smith, Ron & Smith, Dan (1983) *The Economics of Militarism* (London: Pluto Press) p41

over how the military budget is spent, and how large it is to begin with — this influence works through direct contacts with the military, and indirectly through the political arena.[60]

Smith and Smith were the first authors to identify explicitly the role of technological momentum in perpetuating the military-industrial complex, and to argue that this momentum is not a natural law but a product of human choice. Both the military and the corporations constantly look ahead — the military because they always want improvements to their equipment, and the corporations because they need to secure production contracts into the future. The result of this is that "'solutions' emerge before anybody has identified the 'problems' they can solve." Smith and Smith summarised this as a definite philosophy of technology in three parts: "all problems have technological solutions; the best solution is the most complex one; if it *can* be done, it *ought* to be done."[61] This is a valuable exposition of several of the parts and connections of the military-industrial complex, and safely avoids the conspiratorial underpinnings of earlier works, but the explicitly economic and technological focus of their work leaves considerable gaps to be filled before a full exposition of the complex can be reached.

1.10 Brunton and the Constellation of Institutions

In his 1988 paper "Institutional Origins of the Military-Industrial Complex," Bruce Brunton offered a new institutionalist perspective on the military-industrial complex. He argued that the traditional way of looking at the military-industrial complex, with its focus on its group composition, was incomplete — defining it instead as an evolving system of institutions enabled a better identification of specific historical patterns. Using Thorsten Veblen's definition of an institution as a way of thinking or behaving that has become habituated in human culture, as well as Common's definition of an institution as a going concern, Brunton defined the military-industrial complex as a "constellation of institutions."

In a departure from earlier authors, Brunton argued that the military-industrial complex first began to coalesce during the pre-World War II period. He highlighted that most major "latecomer nations," including the United States, sought to catch up to Britain from the late 19th century onwards by directly stimulating the development of their strategic industries, such as metals, machinery, and transport equipment. This behaviour was the result of each state's reaction to its perception that technical gaps existed between its capabilities and those of its rivals, and such an environment of international rivalry created a basis for an "intimate interrelationship" between military spending and industrial development. He argued that new institutions commonly arise from changes in production relationships, and the

[60] Ibid. pp74-75
[61] Ibid. pp76-77

perceived need for the United States to catch up with Britain provided a fertile spawning ground for the emergence of institutions that would both facilitate and legitimate the federal government's role in this catching-up process.[62] Brunton built on this by arguing that this period was one of transition from liberal to advanced capitalism, in which the state took on new functions and thus needed to create a legitimation system for these — a set of "normative values, policies, and institutions that elicit mass loyalty." The patriotism and nationalism that could be easily engendered through the institutions of the military-industrial complex provided just such a legitimation for the newly extended role of the state in the advanced capitalist economy of the United States from this period onwards.[63]

The nexus of Brunton's military-industrial complex is the institution that "military procurement in peacetime is largely through private contractors," which encompasses the historical shift from public to private production of armaments. This institution spawns and is sustained by a transactional network of groups that benefit from the flow of defence spending from the U.S. government — here he brought in the traditional groups of the military-industrial complex, namely military personnel, government officials, congressmen, and private firms. To this core institution, he added others: the "revolving door," or flow of personnel between the core groups; the "preparedness ethos," which maintains that the nation must be constantly prepared for war even during times of peace; and defence "pressure groups," within which he categorises lobbying organisations and trade associations.[64]

Building on prior analysis of defence market structure, Brunton also added the institution of "state support of strategic industry," which he defined as the idea that the state should maintain a base of private firms with defence production capability in order to augment its readiness for war. He argued that the rapid pace of technological change in the modern world constantly threatened to disrupt the balance of power, and that a state must therefore act to support its domestic industries and research and development in the face of its rivals doing the same.[65] This is where he situated the interrelationship between military and industrial development, established in the late 19th century and echoing down to the current period.

While Brunton's approach is perhaps the best at spotting the broadness of the set of actors and connections within the military-industrial complex, and the network that exists between

[62] Brunton, Bruce G (1988) "Institutional Origins of the Military-Industrial Complex" *Journal of Economic Issues* 22:2 pp603-604
[63] Ibid. p605
[64] Ibid. pp600-601
[65] Ibid. pp600-601 and p604

them, once again his explanation relies too heavily on the deliberate perpetuation of the complex by the state.

1.11 From Cold War to War on Terror

Following the U.S. withdrawal from Vietnam, discussions of the military-industrial complex began to tail off, and little new ground was broken as the Cold War came to its end. The context provided to the military-industrial complex by the Cold War changed little up until the fall of the Soviet Union, and the academic work in this area during the late 1980s and 1990s tended simply to spin out the same strands:[66] the monopsonist nature of the U.S. state within the market, the technological and scientific arms race with the Soviet Union, and the revolving door of personnel between the main groups of the military-industrial complex.[67] There was also increased focus on domestic spending within the U.S. political landscape, a trend that had begun towards the end of the 1970s — coupled with the end of the draft, this transformation made the military establishment appear to be less of a threat to social welfare.[68]

World military expenditures peaked in the late 1980s, fell gradually between 1989 and 1990 with improving East-West relations, then dropped sharply after the disintegration of the Soviet Union. Procurement of weapons also fell sharply, with SIPRI estimating that arms production (domestic demand plus exports minus imports) in 1997 was 56 percent of its 1987 level in the United States, 78 percent in France, and 90 percent in the United Kingdom.[69] These changes not only had a direct impact on the demand for the products of the military-industrial complex, but also called into question the need for governments to maintain a comprehensive domestic defence industrial base. However, this trend was reversed in the United States towards the turn of the millennium — while there was an initial period of military expenditure cuts after the end of the Cold War, spending began to grow again in 1999 and increased rapidly after 2001 due to the "global war on terror" and the U.S. interventions in Afghanistan and Iraq.[70] This increase in spending, coupled with a level of unease about U.S. overseas interventions not seen since the Vietnam War, led to renewed interest in and critique of the military-industrial complex.

Fallows summed up the status of the "war on terror"-era military-industrial complex, arguing that Eisenhower's warning of economic, political, and spiritual influence held true:

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[66] Ledbetter (2011) pp188-189
[67] Dunne & Sköns (2009) p6
[68] Bernstein & Wilson (2011) pp2-3
[69] Sköns, Elisabeth & Weidacher, Reinhilde (2000) 'Arms production' in *SIPRI Yearbook 2000* (Oxford, Oxford University Press)
[70] Dunne & Sköns (2009) p7

> The economic problem is that the federal government no longer has enough money to throw around without a plan. The political problem is the distortion of the process of public choice [...] The most profound source of concern may be what Eisenhower called spiritual: the corrupting effect on the uniformed military by their alliance with contractors.[71]

In common with many others writing during this period, Fallows reserved a great deal of scorn for the actions of members of Congress. He described how defence companies parcel out subcontracts to the districts of as many influential House members and senators as they can, dealing them into the arrangements and putting pressure on them to acquiesce to major spending on these contracts lest they lose out on jobs in their constituencies and bring down upon themselves the wrath of their electorate. Unlike other government programmes, whose impact tends to be more dispersed, military contracts generate jobs in identifiable locations that can be directly linked to decisions taken by the relevant elected representatives.[72] As Nick Turse pithily summarises, "it's America's legislative representatives who pump up the pork in Washington in order to bring home the bacon for their districts."[73]

The modern concern about the military-industrial complex is perhaps best summarised by William Pfaff, writing in 2010, who argued that the military-industrial complex of Eisenhower's warning was alive and well in the modern United States. Drawing on militarist theory, Pfaff argues that the defence and security industries are positioned to use their corporate interests to "dominate Congress, as well as an inexperienced administration" with a focus on expensive and over-designed weapons platforms that are not built to be useful in modern counterinsurgency warfare. He describes the United States as "a state owned by its army."[74] In a speech that same year, Rep. Ron Paul railed against "blank checks to the military-industrial complex" that, he argued, does little to defend against authentic threats.[75] These works and comments are very focused on the political aspect of the military-industrial complex, adding to the more economic focus of the Vietnam-era critiques, but in themselves they do not provide a holistic analysis of the military-industrial complex. Much of the literature written in the last decade or so is of a historical nature, exploring how particular facets of the military-industrial complex changed and grew during the 20th century, but not

[71] Fallows (2002) pp47-48
[72] Härtung, William D (2011) *Prophets of War: Lockheed Martin and the Making of the Military-Industrial Complex* (New York: Nation Books) p3
[73] Turse (2008) pp27-28
[74] Pfaff, William (2010) "Manufacturing Insecurity: How Militarism Endangers America" *Foreign Affairs* 89:6 p140
[75] Quoted in Dunlap, Charles J (2011) "The Military-Industrial Complex" *Daedalus* 140:3 p136

offering any deeper analysis of what the military-industrial complex is from a conceptual standpoint.

There are also some authors who have used the concept of the military-industrial complex as a prism through which to view other modern developments. Particular highlights include: James Der Derian's exploration of the "military-industrial-media-entertainment network"[76] as a way to find "new demarcations of power and identity, reality and virtuality"; Turse's rather expansive view of the military-industrial complex as a series of "iron myriagons"[77] encompassing a huge range of industries outside the defence and technology worlds; Shane Harris' overview of his conception of the "military-internet complex"[78] and its interplay with cyberwarfare; and Tim Lenoir and Luke Caldwell's fascinating exploration of the "military-entertainment complex"[79] and the spread of militarism into the world of gaming. These works move in interesting directions, but they draw too far away from the historic thread of the military-industrial complex concept to be of use for my purposes here. There is also a significant subgenre of overtly polemical work on the left of the political spectrum that uses reference to the military-industrial complex as part of a toolset to criticise American imperialism more broadly — however, these works tend to veer sharply too far towards the conspiracy theory to be of use in picking out the concept of the military-industrial complex.

The most recent exploration of the American military-industrial complex comes from Alex Roland.[80] His mission in writing his latest book, and its predecessor that this serves to update, was to assess whether and how the military-industrial complex of the Cold War has endured into the modern day. His historical narrative is sound and he provides some interesting vignettes into various procurement programmes and government decisions, but the short theoretical section of the book is sadly rather muddy. He identifies five institutions (the state, strategy, the military, industry, and contracts) and four themes (technological determinism, economic impact, statism, and collusion) that make up the military-industrial complex,[81] but he does not clarify how strategy and contracts can be institutions in the same vein as the traditional three of state, military, and industry, and his themes appear to elide factors *affecting* the military-industrial complex with criticisms *of* the military-industrial complex. He also does not build on this section throughout the rest of the book, nor in its

[76] Der Derian, James (2001*) Virtuous War: Mapping the Military-Industrial-Media-Entertainment Complex* (Colorado: Westview Press) pxx
[77] Turse (2008) pp30-31
[78] Harris, Shane (2014) *@War: The Rise of Cyber Warfare* (London: Headline) pp218-219
[79] Lenoir, Tim and Caldwell, Luke (2018) *The Military-Entertainment Complex* (Cambridge, MA: Harvard University Press)
[80] Roland, Alex (2021) *Delta of Power: The Military-Industrial Complex* (Baltimore: Johns Hopkins University Press)
[81] Roland (2021) pp4-11

conclusion, so it feels rather like a distracting addendum to what is otherwise an interesting historical work.

1.12 Conclusions

The difficulty of conceptualising the military-industrial complex was recognised by Carroll W. Pursell, who was writing in 1972 when the Vietnam War-era critiques of the military-industrial complex were coming to the fore.[82] He noted that these critics were handicapped in their efforts by their inability to identify a theoretical framework underpinning the military-industrial complex, and their work tended to do no more than identify "a handful of interconnections which seem inappropriate" and implying misdeeds or conspiracy that they could not prove. Indeed, he admitted in the preface to his book on the military-industrial complex that his work, and the essays included therein,[83] were "both incomplete and tentative" as an attempt to provide an answer. He highlighted that this lack of a theoretical framework not only hampered the military-industrial complex's critics, but also enabled its defenders to easily dismiss critique: without this underpinning, the military-industrial complex "is usually translated to mean "conspiracy," and great sport is made of people who are still so naïve as to believe in devils."[84] This tendency to stray into the conspiratorial is reflected throughout the literature I have explored above, as is the lack of a comprehensive theoretical basis for analysis of the military-industrial complex.

However, what Pursell does identify, even if only briefly and without developing the thought further, is that a theoretical framework should begin with an appreciation of the military-industrial complex as a system: "The key to understanding the complex is to see it as a system, and to realize that it is only as a part of this system that the individual examples of its operations make any sense at all."[85] This thought is echoed to some extent throughout much of the literature on the military-industrial complex, and many writers use some form of system or network as their foundation (whether explicitly or implicitly), but this is rather loosely done and none explore more deeply how to define and conceptualise such a framework. I will explore the possibilities for such a theoretical framework and put forward my own.

[82] Pursell Jr., Carroll W. (1972) *The Military-Industrial Complex* (New York: Harper & Row)
[83] These mainly comprise partial reprints of works I examine in this chapter.
[84] Ibid. p13
[85] Ibid. p13

CHAPTER TWO

The Military-Industrial Complex as Assemblage

When analysing the military-industrial complex, two large-scale questions arise: how do we best conceptualise the players in the military-industrial complex, and how do we best conceptualise how they interact with each other? Much of the existing academic work that covers the military-industrial complex discussed in the previous chapter either provides a short definition, assumes knowledge of a definition on the part of the reader, or focuses on certain parts of the military-industrial complex to the exclusion of others, forming an incomplete picture. There is often an assumption, whether latent or explicit, underlying discussion of the military-industrial complex that relies on the traditional "iron triangle" formulation, which I argue is both too rigid and too incomplete to be so great an influence on how we talk about and understand the military-industrial complex.

The only work that potentially gives a theoretical perspective is that of C. Wright Mills in his sociological exploration of power elites — while he was writing before the phrase "military-industrial complex" existed in common parlance, his work highlights the same power relations and connections that would come to be recognised as the complex. However, I argue that while his theory is useful in conceptualising some of the larger-scale components of the military-industrial complex and their interactions, its focus remains too centred on the traditional iron triangle and therefore it does not provide us with a full picture of the military-industrial complex, missing some vital parts that need to be recognised in order to properly describe and conceptualise it.

Given the lack of explicit theoretical exploration of the military-industrial complex thus far, I must look to other theories outside of specific work on the military-industrial complex in order to construct a new theoretical edifice, building on the intuition explored in the previous chapter of the military-industrial complex as some form of system. I argue that the best candidate for this is Manual DeLanda's expansion of assemblage thinking into the sociopolitical world. DeLanda does not specifically attempt to address the military-industrial complex in his work, but his translation and expansion of the work of Gilles Deleuze on assemblage thinking into the realm of sociology and politics provides a valuable framework for the development of a conceptual ontology of the military-industrial complex.

2.1 The Iron Triangle

The traditional lens through which to view the military-industrial complex has been via some form of employment of the "iron triangle" concept. At its core, this brings together an elected legislature, a bureaucracy, and one or more interest groups to show how the three together

consolidate their own power bases, gain from each other, and ensure that policy is directed in their own interests. While iterations of iron triangles are used in many different settings, in the context of the military-industrial complex the three corners of the triangle are Congress (the elected legislature corner), the federal government and military (the bureaucracy corner), and the defence industry (the interest group corner).

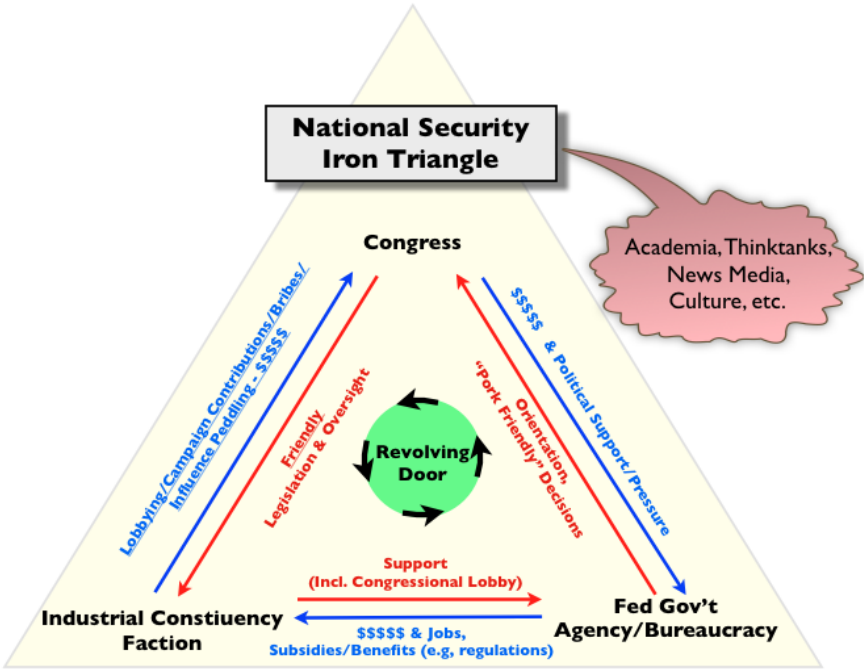
This concept is most clearly elucidated in the work of Gordon Adams, who attempted in 1981 to describe how the iron triangle functioned in the United States during the 1960s and 1970s. He argued that national security policymaking had become dominated by powerful corporate interests (which he identified as the defence primes) and that this had created a "policy sub-government," removed from the normal policymaking process, in the form of the iron triangle. He charged that the three corners of the triangle (the defence bureaucracy, Congress, and private industry) had worked together to build it and continue to actively collaborate to maintain it as economic circumstances change:

> Once molded, the triangle is set with the rigidity of iron. The three participants exert strenuous efforts to keep it isolated and protected from outside points of view. In time they become unwitting victims of their own isolation, convinced that they are acting not only in their own but in the public interest.[86]

Chuck Spinney also draws upon the iron triangle concept in his exploration of what he calls the "military-industrial-congressional complex" using the following diagram:[87]

[86] Adams, Gordon (1981) The Politics of Defense Contracting: The Iron Triangle (Council on Economic Priorities) p25

[87] Spinney, Franklin C. (2015) *The Defense Death Spiral: Why the Defense Budget Is Always Underfunded*



Military - Industrial - Congressional Complex (MICC)

Spinney does not accompany this diagram with deeper definitions of any of these facets, but he is clearly assuming knowledge on the part of his readers of this as the military-industrial complex. In using this type of diagram, he is drawing upon what he feels to be the accepted and obvious definition of the military-industrial complex, based on what he calls the "iron-triangle culture of the Pentagon." There are other similar diagrams floating around the internet that, while unsourced to a particular work, clearly build upon the same underlying intuition of the military-industrial complex as an iron triangle, with some iteration of the same three corners and interplay between each.

While this is a compelling picture, and tempting to maintain as a simple yet *prima facie* persuasive model, it does not fully reflect how the military-industrial complex manifests in practice. Firstly, the choice of the three corners — always some iteration of bureaucracy, Congress, and industry — leaves out other institutions that have a place within the military-industrial complex. Spinney touches on this with his addition of academia, think tanks, and the media in a bubble in his diagram — clearly he believes they have a role to play, but he does not explain why they do not warrant their own corners or why they are different to the core three. Secondly, even the core three institutions are not single actors. Different parts of the bureaucracy, the defence industry, and the elected legislature act differently in certain situations or at particular periods, and eliding them together as the immovable corners of the iron triangle does not allow us to analyse how and when this occurs. When analysing the ways in which power and money move within the military-industrial complex, we must be able to identify the different ways in which smaller-scale parts of those institutions act, and

the differing motives and limitations that constrain or shape those actions. An examination of the government's role in the military-industrial complex, for example, is too broad-brushed unless we can investigate how the executive branch, the legislative branch, and the bureaucracy interact with each other as well as with entities outside of the government. Thirdly, there is no ability to assess how external factors affect the workings of the military-industrial complex. While Spinney goes further than Adams in explaining how the three interact with each other, through the use of the sides of the triangle, there is still no recognition of how these interactions may shift when the wider environment does or what factors may change parts of how the military-industrial complex manifests — the sides of the triangle are just as rigid as the corners.

I argue that a proper understanding of the military-industrial complex requires moving away from the rigidity inherent within the iron triangle concept. In order to be able to see the full scope of the military-industrial complex and how it behaves, we must be able to add in more actors than the core three, recognise that these actors are themselves made up of different parts that may operate differently, and appreciate the fluidity of their interactions over time. While the iron triangle concept is compelling, it is insufficient in both mapping and understanding how the military-industrial complex manifests in practice, and we must look to other theories for a stronger framework.

2.2 Power Elites

When Mills wrote his seminal 1956 work *The Power Elite*, the phrase "military-industrial complex" had not yet been brought into being. However, his work draws out many of the connections and themes that would later be named as such, and a closer look at the concepts he elucidates is an important step in progressing towards a theoretical framework for the military-industrial complex.

The building blocks of Mills' power elite are individuals: the people whose position in society, at the top of major organisations and hierarchies, gives them the chance and ability to make decisions that have major consequences. While they do not exercise their power alone, being at the centre of a milieu of advisors and other subordinates, these people "occupy the strategic command posts of the social structure"[88] around which power is concentrated. However, Mills was careful to clarify that these individuals are not the means of power, and neither are the events that these individuals react to. What is behind both and links both are the major institutions of modern society, and Mills identified three of these: state, corporation, and army. These represent the three main parts of what we would now call the military-industrial complex in its traditional iron triangle form: government,

[88] Wright Mills, C (1956) *The Power Elite* (New York: Oxford University Press) pp3-4

industry, and military. The individuals of the power elite sit at the top of these three hierarchies and wield their institutional power.

Why these three? Why not the many other types of institution that existed in the United States when Mills was writing, and still exist today? While Mills spoke of others, such as the family, religion, and educational institutions, he argued that these are not by themselves centres of national power, and are in fact subordinate to the power of the three main hierarchies:

> Families and churches and schools adapt to modern life; governments and armies and corporations shape it; and, as they do so, they turn these lesser institutions into means for their ends.[89]

Furthermore, Mills highlighted that the big three have changed over time, becoming larger, more administrative, and more centralised. The American economy of Mills' day had shifted from a scattered collection of small productive units with a web of links between them to a larger domain ruled over by a few hundred corporations. The political realm had changed from a decentralised grouping of states within a weak federation to the heft of the modern United States of America, with its centralised and powerful federal government drawing many powers to it that had once been the purview of the individual states. And the post-World War II military, which has once been an institution distrusted in favour of state militias to the extent of this wariness penetrating the very fabric of the U.S. constitution, had become both the largest and the most expensive arm of the federation with a sprawling bureaucracy of its own. All three of these institutions share three common trends: the means of power available to their elites have increased, their central executive powers have been enhanced, and their working has been made more efficient through modern administrative and bureaucratic methods.[90]

Not only does this shift mean that the government, industry, and the military have become larger and more centralised, Mills argued, but it also means that the consequences of their actions become more far-reaching and interrelated with each other. While the military and the government have always been somewhat intertwined given the fact that the political class funds and directs the nation's armed forces, Mills highlighted that this interplay has only become greater over time as both institutions grew in scope and power. When we bring the economy into the mix, the connections increase exponentially, with political decisions impacting corporations and military decisions having grave consequences for the economy. Mills argued that this is "an ever-increasing interlocking of economic, political, and military

[89] Ibid. p6
[90] Ibid. p7

structures" with intervention and influence running between all three as a "triangle of power"[91] — what we would now call the iron triangle.

What do these enlarged and centralised institutions mean for the individuals who Mills identified as the power elite? Each of the three central hierarchies has at its summit such an elite (whom he calls the warlords, the corporation chieftains, and the political directorate) and the people who make up these elites can be taken together to form the ultimate power elite of the United States, the top social stratum or higher circle. Mills noted that the people of this elite know one another, socialise with one another, and take each other into account when making decisions, placing them within a series of overlapping "crowds" or "cliques" — although this social entity often only becomes fully defined when externally challenged:

> There is a kind of mutual attraction among those who 'sit on the same terrace' — although this often becomes clear to them, as well as to others, only at the point at which they feel the need to draw the line; only when, in their common defense, they come to understand what they have in common, and so close their ranks against outsiders.[92]

This is not to say, however, that every member of the three big institutions has the same level of power. They are, after all, hierarchies, and as such their members sit within a gradation of power. Mills noted that one of the problems in defining the power elite comes when attempting to draw a line — what amount of power does an individual need to have in order to be a member of the elite? To take an example from the military side, the chairman of the Joint Chiefs of Staff would definitely be part of the power elite, and a private in an army unit definitely would not be, but at what point along the chain does one gain one's membership into the higher circle? Drawing the line too high or too low means defining the power elite as either so small or so large as to make the concept useless. Mills split the difference, and his ultimate definition of the power elite is "those political, economic, and military circles which as an intricate set of overlapping cliques share decisions having at least national consequences."[93]

Mills also identified what he called the "military ascendancy," whereby the military has an increasingly large role in government, and posited that the government has a similarly increasing role in the economy. He identified this as a recent phenomenon — before World War II, the military had only entered into the higher political and economic circles temporarily during times of crisis, but the nature of modern warfare had meant that the

[91] Ibid. p8
[92] Ibid. p11
[93] Ibid. p18

three had by necessity moved closer together, with the military, political, and corporate elites working together to plan and implement war production programmes. He also noted how scientific research had shifted from its seat within the civilian economy to become part of the military order — the direction and the funding for research came increasingly from military sources.[94]

The structural basis for the military ascendancy was, for Mills, the shift of the U.S. capitalist system towards a permanent war economy — he noted that the United States became both one of the world's leading industrial societies and one of the leading military states within the span of a generation. He argued that military institutions were beginning definitively to shape the economic life of the United States, despite economists usually considering the military to be parasitic on the means of production, and were becoming ever more dependent on an industrial economy due to the military's development as "an army of machines."[95] This shaping of the economy required the shaping of political decisions — the military was moving away from its constitutionally subordinate role as advisor and servant to political authority towards a new place within the political higher circles, where a higher military figure could influence decisions "by his definitions of reality."[96]

It is here that we find Mills' fundamental critique of this military ascendancy, centred on the concept of militarism. He defined this as "a case of the dominance of means over ends for the purpose of heightening the prestige and increasing the power of the military"[97] — those in the military are not satisfied to remain the means of accomplishing objectives set by their political masters, but rather wish to identify and pursue ends of their own, and shape other institutional areas into means for accomplishing these, while increasing their status. Mills argued that the pursuit of status is no threat whilst it remains contained within the military hierarchy, but it becomes a threat once it is claimed outside the military circle, and when it becomes the basis for influencing wider policy. He pointed out that status is predicated on power, or the perception thereof, which is always relative — the power of one person is the weakness of another. In the iron triangle of military, government, and industry, therefore, the military can only gain power (and thereby status) by weakening the other two. He described the military position thus:

> American 'militarism', accordingly, involves the attempt of military men to increase their powers, and hence their status, in comparison with businessmen and politicians […] their ends must be identified with the ends as well as the honour of the nation;

[94] Ibid. p216
[95] Ibid. p222
[96] Ibid. p223
[97] Ibid. p222

> the economy must be their servant; politics an instrument by which, in the name of the state, the family, and God, they manage the nation in modern war.[98]

Mills argued that the military ascendancy and the centrality of military capitalism to the U.S. economy proves that the military has succeeded in its appropriation of power, and has created a "seemingly permanent military threat" to justify this — all political and economic actions are "now judged in terms of military definitions of reality."[99] His power elite is shaped by the coincidence of interests between "those who control the major means of production and those who control the newly enlarged means of violence," operating in a "weakened and formal democratic system"[100] — this interplay is, in essence if not in name, the military-industrial complex.

The value of Mills' work when looking at the military-industrial complex lies in his identification of three of its main components — the government, the military, and industry — and his exploration of their interactions. He was the first to explicitly identify the interactions between these three, and the concept of elites at the top of each hierarchy is a valuable way of visualising the interplay between those individuals in positions of power. Mills also usefully explored the centralisation of power within the three main authority structures, showing the consolidation of influence within the military-industrial complex — a trend that only continued after he was writing.

However, there are limitations to the power elite model when developing a holistic ontology of the military-industrial complex. Although he did not name it as such, Mills identified and relied upon an iron triangle of government, military, and industry — as detailed in the previous section, I do not believe this to be a sufficiently comprehensive way in which to view the military-industrial complex in its entirety and to fully appreciate how it works. Mills also placed too much emphasis on the power of the military within the military-industrial complex, particularly during his critique of the "military ascendancy" in the United States. He argued that the democratic system has been weakened and the economy militarised, privileging the power of the military over the power of both the government and industry. While the military at his time of writing was significantly larger and more influential than it had been before World War II, I would not agree that this has persisted since, and to keep this 1950s perspective would risk undervaluing the role of the non-military parts of the military-industrial complex in later decades. While Mills' work is a solid basis from which to

[98] Ibid. p223
[99] Ibid. p275
[100] Ibid. p276

begin, and contains valuable insights, it is not sufficient as an ontology of the military-industrial complex.

2.3 The Complex as Assemblage

When considering the intuition examined above, of the military-industrial complex as some form of system, a natural place to look for a theoretical framework is assemblage thinking. Although not created with this context in mind, it has developed into a theory that has made its way into political science, and I argue that it offers a solid basis for understanding the military-industrial complex.

When defining an assemblage[101] at the basic level, we must look to Gilles Deleuze as the father of the term. While an assemblage can be prosaically defined from its conceptual refinement in his work with Felix Guattari, *A Thousand Plateaus*, as a number of disparate and heterogenous elements that are convoked into a single formation,[102] Deleuze described the concept most beautifully in a later work:

> What is an assemblage? It is a multiplicity which is made up of heterogeneous terms [...] the assemblage's only unity is that of co-functioning: it is a symbiosis, a 'sympathy.' It is never filiations that are important, but alliances, alloys.[103]

Deleuze drew upon a range of contemporaneously maturing concepts within the realm of the non-linear sciences, such as emergence, complexity, and open systems.[104] The different elements that compose an assemblage (all of which have the same ontological status, be they people, objects, or whatever else) form a network as opposed to a structure — the parts have an independent existence aside from their relations within the assemblage, rather than being bounded within a closed totality.[105] This is described through the metaphor of comparing a tree's root system to a rhizome. A root system may become multiple, but it remains a system in which there exists a central higher unity. A rhizome, on the other hand, has no such core,

[101] The English term "assemblage" encapsulates the concept of multiple, heterogenous parts forming a whole, but Martin Muller notes that it misses some of the nuance of the original French word, *agencement*, which connotes "an arrangement that creates agency." See Muller, Martin (2015) "Assemblages and Actor-networks: Rethinking Socio-material Power, Politics and Space" *Geography Compass* 9:1 p28

[102] Deleuze, Gilles and Guattari, Felix (1987) *A Thousand Plateaus* (Minneapolis, MN: University of Minnesota Press) p327 and pp503-504

[103] Deleuze, Gilles and Parnet, Claire (2002) *Dialogues II* (London: Continuum) p69

[104] Acuto, Michele and Curtis, Simon "Assemblage Thinking and International Relations" in Acuto, Michele and Curtis, Simon, ed. (2014) *Reassembling International Theory: Assemblage Thinking and International Relations* (London: Palgrave) p4

[105] Bousquet, Antoine "Welcome to the Machine: Rethinking Technology and Society through Assemblage Theory" in Acuto, Michele and Curtis, Simon, ed. (2014) *Reassembling International Theory: Assemblage Thinking and International Relations* (London: Palgrave) p94

but rather grows in many directions simultaneously with "no beginning or end, only a middle, from where it expands and overspills."[106]

Deleuze also used the language of machinery to explain his concept of assemblages, arguing that we should replace questions about what something means with questions about how it is built, what it does or can do, and what its gears are.[107] This machinic concept allowed for a true interchangeability of parts, moving away from the concept of an organic unity, as machines are manufactured from disparate parts that come together in work but can be replaced or used in another machine. Jay Conway notes that the machinic concept is a key unpinning of assemblage, in that the term "lends itself to a distinction between what is arranged and how these various items are arranged."[108] The Deleuzian assemblage also encompasses the concept of emergence — its properties are not part of or predictable from those of any of its parts considered in isolation, but instead only discernible as the result of the intersection and interaction of those parts.[109]

For Deleuze and those following after him, assemblage thought does not mean finding assemblages in a plethora of non-assemblages — rather, the assemblage is the fundamental subject of any investigation, the "minimal real unit" of the world.[110] It is not intended to be a theory, based on a system of ideas that moves towards the explanation of its object, but rather an analytical tool to be used in the exploration of systems.[111] Not only is the assemblage a useful way of describing social systems and their flows, but it does so while also weaving in the concept of agency: "It is not just the patterning of the flight of the bumblebee but also an effect of human decisions."[112] It also encapsulates a reflexivity that can make it harder to get one's head around, as Conway highlights:

> Deleuze and Guattari's concept of assemblage can be difficult to grasp, not because it is abstruse, but because it is itself an assemblage — an intricate, detailed arrangement.[113]

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[106] Bleiker, Roland "Visual Assemblages: From Causality to Conditions of Possibility" in Acuto, Michele and Curtis, Simon, ed. (2014) *Reassembling International Theory: Assemblage Thinking and International Relations* (London: Palgrave) p79
[107] Deleuze, Gilles (2000) *Proust and Signs* (Minneapolis, MN: University of Minnesota Press) pp145-146
[108] Conway, Jay "Deleuze, Guattari, and the concept of social assemblage" in Delanty, Gerard and Turner, Stephen P., ed. (2022) *The Routledge International Handbook of Contemporary Social and Political Theory, second edition* (Oxford: Routledge) p233
[109] Marcus, George and Saka, Erkin (2006) "Assemblage" *Theory, Culture, & Society* 23(2-3) p103
[110] Deleuze & Parnet (2002) p38
[111] Muller (2015) p28
[112] "The Carpenter and the Bricoleur: A Conversation with Saskia Sassen and Aihwa Ong" in Acuto, Michele and Curtis, Simon, ed. (2014) *Reassembling International Theory: Assemblage Thinking and International Relations* (London: Palgrave) p19
[113] Conway (2022) p232

The literature on assemblage thinking manifests a variety of styles, and it does not hang together as a theory so much as a "way of reframing our inquiry,"[114] a "repository of methods and ontological stances."[115] As Christian Bueger argues, assemblage thinking is not meant to be evaluated on the basis of whether it gives us an internally coherent theoretical apparatus, but rather on how it creates new spaces and opens up new ways of studying things. He notes the paradox that the abstract and complicated philosophical arguments used by Deleuze in his work on assemblages were in fact intended to argue against abstraction and in favour of empirical study. As he summarises, "Assemblage thinking is an invitation for empirical work, not for contemplating ontological concepts and metaphors."[116] He warns that scholars should beware of anything that appears to be a coherent whole, as one could argue of the military-industrial complex: such wholes are "puzzles for research and are not to be taken for granted."[117]

George Marcus and Erkin Saka agree, arguing that the concept of assemblage is a way in which one can marry the apparently competing concepts of the structural and the ephemeral in social science. Assemblages seem to be structural in their materiality, but in fact are inherently and constantly changing. As such, they undermine traditional concepts of structure and instead give rise to puzzles about relationships and processes. Marcus and Saka posit that assemblage thinking can be used to explore "objective relations, a material, structure-like formation, a describable product of emergent social conditions, a configuration of relationships among diverse sites and things"[118] — precisely how one could describe the military-industrial complex.

Conway highlights that assemblages are internally diverse and are not intended to be used to draw down first principles like other forms of philosophical inquiry. Although different assemblages may share an approach, an explanation of one assemblage will not be an explanation of another, even if the two are closely related.[119] He defines assemblage thought as "identifying the precise and varied lines of influence" running between the component parts of an assemblage, be they material or immaterial, which exist in a combination that "possesses areas of stability and instability, rigidity and becoming, unification and lines of flight."[120]

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[114] "The Carpenter and the Bricoleur" p19
[115] Acuto & Curtis (2014) p3
[116] Bueger, Christian "Thinking Assemblages Methodologically: Some Rules of Thumb" in Acuto, Michele and Curtis, Simon, ed. (2014) Reassembling International Theory: Assemblage Thinking and International Relations (London: Palgrave) pp64-65
[117] Ibid. p65
[118] Marcus & Saka (2006) p102
[119] Conway (2022) p234
[120] Ibid. pp236-238

Michele Acuto and Simon Curtis argue that assemblage thinking brings us out of the habit of relying on categories and concepts that are often utilised as abstractions and reifications without deeper exploration, such as "state" or "society," and challenges us to move away from totalising systems of thought. Such an approach also places the human as a component in common with other actors, shifting away from anthropocentrism and "replacing it with a form of materialism that lays emphasis upon the creative capacities of matter and energy, and the processes that instantiate them in their great variety of forms."[121] It does not value either the material or the social, instead bringing both together in one holistic approach while recognising the provisional nature of that which is being analysed, "things that are always in the midst of unfolding."[122]

Martin Muller highlights that assemblage thinking is a valuable resource for exploring power, because it is "concerned with why orders emerge in particular ways, how they hold together, somewhat precariously, how they reach across or mould space and how they fall apart."[123] He also notes that an assemblage approach helps us to decentre reified totalities, leading us instead to questioning the processes of political systems and interrogating the *a priori* concepts that so often underpin explanations thereof.[124] Being able to explore how power arises through the making and maintenance of connections is, he notes, an important rejoinder to Marxist ideas of power: one shows how power actually works, rather than "assuming it on the basis of uneven structural relations."[125]

Glenn Savage argues that assemblages are not only a generative method for probing the limits of established concepts and debate in the political realm, but also a corrective to accounts of process that lean too heavily on concepts like the state and institutions. He identifies three core foundations of an assemblage approach to policy processes (relations of exteriority, heterogeneity and flux, and attention to power and agency) and posits that using an assemblage approach to policy research allows these processes to be explained in new and valuable ways. He particularly identifies the value of relations of exteriority, an idiosyncratic way of looking at the relationship between wholes and their parts, in understanding how both policies and political systems are formed and perpetuate.[126] Like Muller, he argues that assemblage thinking is important in analysing power, bringing out a view of it as "as immanent, capillary-like and relational in nature"[127] — it does not exist within one or several fixed places, but is instead everywhere, flowing unevenly throughout a system and its

[121] Acuto & Curtis (2014) p2
[122] "The Carpenter and the Bricoleur" p19
[123] Muller (2015) p27
[124] Ibid. p28
[125] Ibid. p33
[126] Savage, Glenn C. (2020) "What is policy assemblage?" *Territory, Politics, Governance* 8:3 pp320-321
[127] Ibid. p328

multiple nodes. Particular actors may direct, wield, or influence power within the assemblage that they are part of, but they do not have an absolute monopoly on it.

Manuel DeLanda takes the concept in a new direction. His book *A New Philosophy of Society: Assemblage Theory and Social Complexity* builds upon the work of Deleuze on assemblage thinking, which he reworks to relate it directly to the sociopolitical realm. While DeLanda does not mention the military-industrial complex in his work, the framework he constructs is a valuable one for analysing it: assemblage thinking applies to wholes built from heterogenous parts, precisely as the military-industrial complex is built, and the sociopolitical lens that DeLanda brings to the theory makes it directly applicable.

DeLanda's work uses the concept of assemblage to form what Conway calls a type of anti-essentialist "social realism,"[128] criticising the reification of generalities such as the individual, the nation, and society itself. He argues that such reification, which overlooks any inquiry into how these things emerge and are maintained, leads to a view of them as static and transhistorical, when they are in fact dynamic and mutable. In providing an alternative to such conceptions, DeLanda gives us a way of describing all of these as assemblages, at different scales, and thus an alternative to social reductionism focused on any of these scales. He replaces the individual, society as a whole, or any praxis in between with the "minimal real unit" of the social assemblage.

DeLanda begins by highlighting that previous work has viewed the problem of linking the micro and macro levels of society in reductionist terms, in three ways.[129] The first of these he terms "micro-reductionist," work that focuses too heavily on individualism. Microeconomics reduces matters to the level of individual rationality, in which the only significance falls to individual persons making rational decisions in isolation from one another. Social constructivism, while moving away from the rationality of the individual person, nevertheless has the same problem because it is established around the categories and routines that structure the experience of those individuals. While neither theory denies the existence of a larger entity — "society" or something similar — this is conceptualised not as a whole but rather as an aggregate. The second kind, "macro-reductionist" work, goes to the opposite extreme by positing that people are mere products of the society in which they are born and raised. Individuals are comprehensively socialised by their upbringing into entirely internalising the values of their society or class, to the extent that their micro-level choices are seen as a simple epiphenomenon. The third type, "meso-reductionist" work, tries to

[128] Conway (2022) p239
[129] DeLanda, Manuel (2006) *A New Philosophy of Society: Assemblage Theory and Social Complexity* (London: Bloomsbury) pp4-5

square the circle by choosing a social entity at an intermediate level to be the real core of society, with both social structures and individual choices becoming by-products thereof.

Each of these three kinds of reductionist theory can provide a lens through which to view the military-industrial complex, but none by itself can give us the whole picture. Micro-reductionist theories would place too much emphasis on the decisions made by individual people, be they military leaders, industrial executives, or political representatives. While these decisions do have an effect to a greater or lesser extent on the military-industrial complex, both individually and in aggregate, they are insufficient in themselves to explain the entire emergent whole. Macro-reductionist theories would over-emphasise the impact of macro-level structures such as capitalism in explaining how the military-industrial complex is shaped, with no appreciation of the impact of smaller-scale choices. A meso-reductionist theory may attempt to explain the military-industrial complex entirely through one of its parts, such as arguing that the military is the cause and prime mover of the whole, but again this is insufficient. What assemblage thinking does, particularly in DeLanda's capable hands, is provide a framework within which every one of these theories can be located, whether based on individual interpersonal networks, intermediate social entities, or wide-lens societal structures. As Bueger puts it, this focus on multiplicity provides a corrective to both universalist and pluralist extremes: "Neither should the world be understood as one coherent whole, nor as an atomized system of particulars."[130] The military-industrial complex can be best conceptualised as a whole whose properties emerge from the interactions between its parts: an assemblage.

Assemblage thinking also provides an alternative to the metaphor of an entity as an organism. This idea views the relationship between a whole and its component parts as a seamless totality via what DeLanda calls "relations of interiority."[131] As the parts are constituted by the relations they have to other parts within the whole, a part cannot be detached from the whole without ceasing to be. An entity in this instance is a whole whose parts have strict reciprocal determination, and thereby an inextricable unity like that of a living organism. While this is a tempting prospect given our familiarity with such organisms, a whole whose parts form a seamless web removes the prospect of complex interactions between the constituent parts of different wholes, something that is vital when looking at emergent properties. Allowing for this possibility requires recognising that parts must also be defined by their capacities to interact with others, or "relations of exteriority," and that such capacities are by their very nature an open list given that there is no way to predict in what way a particular part may affect or be affected by any other entity. In this view, a part

[130] Bueger (2014) p61
[131] DeLanda (2006) p10

exercises its capacities by being part of a whole but this is not a constitutive property, so a part can be detached from a whole while retaining its identity, and plugged into a different whole within which its interactions may be different.

This is the core of assemblage thinking, as an alternative to the organic totality, in which the properties of a whole are not merely an aggregate of its parts. Deleuze illustrated this by moving away from the organism as metaphor to the organic system as metaphor, using the example of the symbiosis of an orchid and its wasp pollinator. The relations between the wasp and the orchid as self-subsistent parts of a greater whole are not solely interior relations that are logically necessary to forming a seamless whole: they are exterior relations that are contingently obligatory, and have only become so due to the coevolutionary history of the two species.[132] The ecosystem as a whole could exist without either wasp or orchid, and both wasp and orchid can conceivably become part of a different whole while keeping their identity.

Again, looking at the military-industrial complex in this way proves to be helpful. The military-industrial complex cannot be viewed as an organic totality because its parts can and do exist independently of it for multiple purposes. Congress, for example, is a part of the military-industrial complex, but nobody would be so extreme as to argue that this is its only proper context within the American political realm. The political representatives in the House of Representatives and Senate have exterior relations with the military-industrial complex, contingently obligatory rather than logically necessary, and they do not lose their identity when interacting with sociopolitical entities that are not included within the military-industrial complex.

Viewing social entities as assemblages gives a deeper understanding of causality within the sociopolitical realm. DeLanda notes that explanations of activities normally involve the matching of means with ends, labelled as "rational" actions, but that this process does not take into account the involvement of other mental faculties in problem-solving beyond solely rationality. While the calculations that an individual actor makes in their head are important in explaining how that actor solves a problem, there are other nonlinear causal events that must be considered, such as that individual's interactions with the means of achieving a chosen goal. The same external cause may also affect one individual actor differently than it would affect another. Causality is not strictly linear, but rather probabilistic or statistical, and this becomes even more important to consider when we are looking at populations of actors. While individuals of course remain able to make intentional choices, it is vital to also understand that "the synthesis of larger social assemblages is many times achieved as the

[132] Ibid. pp11-12

collective unintended consequence of intentional action, that is, as a kind of statistical result."[133]

This is perhaps the best explanation of why the military-industrial complex is not a conspiracy. There is a tendency in some of the wilder critiques of the military-industrial complex to assume that it is a deliberate construction, a product of the proverbial men in smoke-filled rooms creating plans to enrich themselves by perpetuating the war economy and pulling the wool over the eyes of the public. However tempted one might be by such notions, this is simply not the case. The military-industrial complex is the collective unintended consequence of the actions and choices of all of its constituent parts together: actors on the micro-level make their choices based on their beliefs, resources, and so on, but the existence of the military-industrial complex on the macro-level does not mean that any of those choices were made with the motive of creating or sustaining it. The military-industrial complex is the product of its parts, but is not a deliberate one.

Each component part within an assemblage can contribute to stabilising or destabilising the identity of that assemblage, through acting to change the sharpness of its boundaries or its level of internal homogeneity, through processes referred to respectively as territorialisation and deterritorialisation.[134] A single assemblage may have parts that are doing each of these, some acting to stabilise its identity while others are forcing it to transform, and an individual part may do both at the same time by employing its various capacities. The identity of any assemblage of whatever size is thus both the product of a process and precarious, as another process can destabilise it. DeLanda argues that this means the assemblages are always unique individuals, ontologically speaking, and that a world of assemblages is thus made up of "differently scaled individual singularities."[135] People are therefore not the only individuals taking part in social mechanisms: there are individual organisations, individual institutions, individual nation-states, and so on. If we look at this through the prism of what Deleuze called a "diagram" (a plan of the individual singularities of an assemblage that shows the space of possibilities associated with it), we can see that while each person, organisation, and institution may be an individual singularity within a larger assemblage, each is also associated with its own space of possibilities and set of universal singularities, forming its own assemblage with its own diagram. Each unit bears a relation of part-to-whole to a larger one, and of whole-to-part with smaller ones.[136] It is, as one might say,

[133] Ibid. p25
[134] Ibid. pp12-13
[135] Ibid. p29
[136] Ibid. pp30-31

assemblages all the way down.[137] Although the theory applies equally well to larger entities as it does to smaller ones, as they are displaying similar properties at different scales, DeLanda does note that the larger the entity, the more problematic it can become for collective intentional actions to be taken efficiently, meaning that larger-scale entities exhibit more extensive unintended consequences.[138]

Each part of the military-industrial complex is indeed its own assemblage. If we look at the four main parts that I have identified (government, military, industry, academia) we can see the assemblage of each, and indeed that the parts of each of those assemblages are themselves smaller assemblages. To take one example, the government is made up of the executive and legislative branches; the legislative branch is a smaller assemblage containing the House of Representatives and the Senate; the House of Representatives is a smaller assemblage made up of the elected representatives, staff, committees, and so on. This pattern can be replicated for each of the component parts of the military-industrial complex as the macro-whole.

A whole emerges from the interactions between its component parts, but it may also affect those parts itself. What DeLanda calls the micro-macro mechanisms that give rise to the emergence of the whole are not the only story: there are also macro-micro mechanisms, or ways in which a whole enables its parts' actions through providing resources or places limitations on their actions via constraints.[139] Wholes also have their own causal capacities when they interact with each other, causing the emergence of larger-scale assemblages, and these wholes may be enabled or constrained by that larger assemblage that they are part of. In the case of the military-industrial complex, being part of it may provide an organisation with resources and/or political legitimacy, but may also constrain it to act in ways pursuant to goals agreed on a higher level. For example, a company will receive contracts and thus profit if it is part of the defence industrial base, but it will be constrained into producing only those goods that the military requires as part of those contracts, which are decided upon elsewhere in the wider structure. A sub-office of the Department of Defense will similarly receive resources via budgetary funding, but will be constrained to operate within the legal and bureaucratic confines of the government in which it sits.

When we look at how assemblages made up of people interact with each other, it can be difficult to ascertain whether the causal actor in a particular event is the macro-whole, or the

[137] This reflects the "system of systems" concept seen in, among other examples, the work of Murray Gell-Mann on complex adaptive systems. See Gell-Mann, Murray (1994) "Complex Adaptive Systems" in Cowan, G., Pines, D. and Meltzer, D. (1994) *Complexity: Metaphors, Models, and Reality* (SFI Studies in the Science of Complexity, Proc. Vol. XIX) p24
[138] DeLanda (2006) p74
[139] Ibid. p35

micro-parts — is an action happening because of the assemblage or because of the actions of the individual people therein? DeLanda solves this problem with the concept of redundant causality, which allows for larger entities to have their own causal capacities while accepting that assemblages made up of people must, of course, interact through the activity of people. Redundant causality removes the difficulty of identifying the causal actor if there exist many equivalent micro-level explanations of the process in question. Under this viewpoint, we can justifiably explain a particular event as being caused by macro-level interactions if an explanation of the lower-scale details is redundant because several combinations of micro-level causes would have led to the same outcome. This thinking also allows us to identify a large organisation as a causal actor in a process if the individual people performing specific roles within its structure could be replaced by other qualified individuals without change: if the emergent properties and capacities of an organisation are unchanged by the substitution of individuals, and the outcomes of interactions between that organisation and others are not significantly affected either, then it would be redundant to say that those individuals are the causal actors in a particular interorganisational process.[140]

Redundant causality is useful for explaining the outcomes of the interactions between the component parts of the military-industrial complex. Each of the large organisations that make up the military-industrial complex are of the nature described by DeLanda, in that the substitution of qualified individuals within them would not meaningfully affect their capacities or their emergent properties. The substitution of one qualified bureaucrat, business manager, or military servicemember in place of another is not something that will substantively change what that organisation does or does not do, so the organisation itself can be identified as the causal actor when we are looking at the macro-level interactions between the larger-scale parts of the military-industrial complex.

Why is it possible to do this? DeLanda is careful to clarify that large-scale sociopolitical assemblages only truly make sense when we are looking at polities that are predominantly established on a rational-legal system. This term comes from the work of Max Weber, who identified three extreme forms (or ideal types) of authority structure based on the source of their legitimacy.[141] "Rational-legal" is a type of bureaucracy in which each office or position is entirely separate from the individual occupying it, each incumbent operates within a clearly defined sphere of competence (often bounded by written codes), and the hierarchy of all positions is defined by some kind of legal regulation. Obedience within this kind of system is owed to the order itself, not to any particular person, and its legitimacy is established on

[140] Ibid. pp37-38
[141] Weber, Max (1964) *The Theory of Social and Economic Organization* (New York: Free Press of Glencoe) pp328-359

both its legal foundation and its technical competence. The second extreme form, which Weber calls "traditional," gives submission not to an impersonal legal order but to a sacred tradition, such as we see in a monarchy or theocracy. The authority vested in a particular position is justified wholly in terms of traditional and sacred rules and ceremonies, past precedent rather than function. A position of power is not separated from its occupant, with that individual leader retaining an extensive prerogative to give orders. The third form is "charismatic," wherein leaders derive their legitimacy from their personal charisma, rather than from either legal structures or traditional precedent, and the office of leader does not exist outside of the person of its incumbent.

It is important to note that these are ideal types, and no society will fit exactly within any one of these. Not only is this classification intended to elucidate a continuum of authority structures between the three extremes, with most sitting somewhere in the middle, but it is also not meant to exclude the possibility of organisations within the same polity exhibiting tendencies towards different forms. Weber highlights these kinds of mixtures in complicated modern organisations, such as a rational-legal bureaucracy filled with technical officeholders who are ultimately led by a person elected on the basis of something closer to sacred precedent or personal charisma. DeLanda also notes that rational-legal bureaucracies tend to shift their procedures into forming some kind of sacred precedent in themselves,[142] moving from matching means to ends to viewing means as ends through a "ceremonial adherence" to the rules: how things have always been done.

Despite this mixing, the rational-legal archetype dominates most modern nation-states, and thus the military-industrial complex of those states — if not in its pure form, then at least in mixtures in which the rational-legal model is the prevalent ingredient. DeLanda argues that this fact makes assemblage thinking particularly important in expanding our understanding of our modern polities. In doing so he directly reflects the work of Deleuze and Guattari, who described the state thus:

> … a phenomenon of intraconsistency. It makes points resonate together […] very diverse points of order, geographic, ethnic, linguistic, moral, economic, technological particularities.[143]

An assemblage of a predominantly rational-legal type has its relations (both interior and exterior) defined by legal and contractual means, under which individuals transfer some measure of authority over their actions to other entities, and the separation of position from incumbent means that organisational resources are associated with the office, not with the

[142] DeLanda (2006) pp68-69, Weber (1964) p382
[143] Deleuze & Guattari (1987) p433

person occupying it. An entity of this kind has clear emergent properties and can be easily defined as an individual actor, with its own goals and motives separate from the people comprising it. An explanation of the actions of that organisation does not require exploration of those of its component individuals — causal redundancy in evidence.[144] This kind of entity is evident throughout the military-industrial complex, from the government to the military to industry. Although the elected representatives of the American political system arguably have some mixing with the more charismatic form, given their need to persuade voters to elect or re-elect them at regular intervals, once they are in office the rational-legal part of the mixture is clearly in evidence.

Sociopolitical entities, as assemblages, are subject to forces of territorialisation and deterritorialisation, or what Muller characterises as making diverse elements hold together versus the continuous centrifugal forces acting upon them:

> After all, spatial state power neither exists a priori nor is it evenly distributed in space: it runs up against obstacles, works better in some places than in others, is more contested here and is less contested there.[145]

Authority structures may not have physical boundaries, but they do have jurisdictions, the stability of which is derived from their rational-legal legitimacy and the quality of their enforcement. Destabilisation of an organisation's identity can thus occur when its jurisdiction is challenged or undermined, or when it does not have access to the resources required to enforce its claims of jurisdiction.[146] DeLanda highlights that these resources (whether legal, economic, or military) are not a given, and acquiring them can easily put an organisation in a position of dependence in relation to another entity.[147] Furthermore, the stability of an organisation can be affected by the strength of its group beliefs: a strongly coherent set of such beliefs, in the form of a consensus or established discourse, is an emergent property that can be bolstered or destabilised by individual members.[148]

These factors are evident in the military-industrial complex: issues of jurisdiction and access to resources form the crux of many of the interactions between the military-industrial complex's component parts. There is also evidence of group beliefs, particularly around what Ron Smith calls the "conspiracy of optimism"[149] — the actors in the military-industrial complex have strong incentives to be optimistic about new acquisition programmes (whether

[144] DeLanda (2006) p69
[145] Muller (2015) p32
[146] DeLanda (2006) p72
[147] Ibid. p74
[148] Ibid. p73
[149] Smith, Ron P. (2022) Defence Acquisition and Procurement (Cambridge: Cambridge University Press) pp4-5

in service of a lucrative contract for industry, a new weapon for the military, or a popular announcement for elected officials) and these beliefs reinforce each other. Smith notes that this is a particularly strong effect if there are long lead times involved, as by the time that a decision is proved to have been a poor one, new individuals will be in post and there will be little or no institutional learning.

Assemblage thinking, therefore, appears to be a solid basis for building a new way of understanding the military-industrial complex.

2.4 Why Assemblage?

When assemblage thinking is used in other subfields, this tends to be driven by a frustration or disappointment with the extant or dominant ontologies within that field. For example, Acuto and Curtis explore the use of assemblage thinking within international relations and find it useful in moving away from the traditional emphasis on simple closed systems and the over-reliance on reifications of elements like the state.[150] This speaks to my own dissatisfaction with existing theories of the military-industrial complex. Although such theories are sparse, and tend to focus on subsections rather than the whole, they share the tendency to reify abstractions and hold fast to broad categories that offer little in the way of fine-grained analysis.

In his exploration of the application of assemblage thinking to policy, Savage provides an excellent argument that also applies to the military-industrial complex (not least because of the central role of policy within it). Rather than trying to understand a policy in a reified manner, an assemblage approach stresses the importance of understanding the nature of the interactions between components and their capacities, along with the processes of their arrangement and the power relations that arise from this:

> The particular ways in which components are brought together will determine the properties and effects of any given policy or agenda; and if the very same components were to be arranged differently, or new components were introduced or excluded, then different properties and effects would be produced.[151]

He also argues that the shift away from micro-macro reductionism allows scholars to rethink the structure/agency binary and look more closely at how we understand the power of actors within the policy world, how they shape individuals and are shaped by them, and how different actors contribute to wider-scale trends and formations as they evolve. When understood in this way, a policy or political system is shown to never be truly static. This

[150] Acuto & Curtis (2014) pp6-7
[151] Savage (2020) p322

does not mean that policies are not formed or that they never exhibit periods of stability, but instead recognises that they are constantly subjected to disruption, challenge, and interpretation, in ways that are not predictable at the outset and that often cause a policy to be reformed or repealed.[152] Savage argues that an assemblage approach to this process means "seeing the relations established between policy components as just as (if not more) fundamental to understanding policies as the components themselves."[153] Therefore, assemblage thinking offers "both highly complex yet potentially very productive ways of understanding power, politics and agency; and the context-dependent ways these forces result from, and contribute to, the making of policy."[154]

What an assemblage approach offers, therefore, is a way to delve into the heterogeneous elements, processes, and mechanisms that make the military-industrial complex what it is and give it its emergent capabilities. Additionally, assemblage thinking allows for a shift away from reductionism, be that micro, meso, or macro, instead working from a flat ontology of individuals to trace the connections that exist between them, with a nested web of parts and wholes that can form parts of other wholes and so on. This permits us to see how causality and agency work within the military-industrial complex, both from the top down and the bottom up, while also encompassing the possibility of emergent behaviour and unintended consequences. This inherent non-linearity means that assemblage thinking is "comfortable with modelling structures while seeking to undermine structuralism."[155]

Assemblage thinking can, like any approach, be pushed too far. As Marcus and Saka are careful to highlight, if one insists upon it too literally, beyond a helpful allusion, "assemblage rapidly becomes a dead metaphor in one's work." Instead, they argue, one should extract the concept and take it for "an evocation of emergence and heterogeneity" that helps us to move away from reification and take account of the shifting nature of relations between actors.[156] Using an assemblage approach in this way means that I am able to unpick the dominant assumptions underlying the military-industrial complex while taking full account of the messiness, contingency, and intricacy that comes along with any such structure as it exists in the real world — both stability and fluidity.

It is important to understand, as Bueger notes, that in representing an assemblage "the scholar is inevitably entailed in the enactment of an assemblage."[157] However, thinking with assemblages also allows one to more easily take account of the biases that every writer brings

[152] Ibid. pp323-326
[153] Ibid. p327
[154] Ibid. p328
[155] Ibid. p8
[156] Marcus & Saka (2006) p106
[157] Bueger (2014) p65

to an account — these are part of the assemblage that is the individual. The ways in which I characterise and describe the various parts and processes of the military-industrial complex will be shaped by my position as a scholar, my particular viewpoints as a British civilian with a background in democratic politics, and the intellectual pathways I tend to default to given my academic journey thus far. My own assemblage affects how I see other assemblages, and that should not be forgotten by those reading this dissertation.

Debbie Lisle notes that assemblage thinking is not often considered when looking for a methodology, and argues that it is often "cast as deviant because it exceeds, disrupts and reworks established methodological rules and conventions."[158] Here I rely, as she does, on the work of John Law on non-coherent methods, which foregrounds the messiness of the subjects of study. Law argues that the world is complicated, unclear, and often unknowable, and that traditional methods fail properly to capture "the ephemeral, the indefinite and the irregular" due to their underlying assumptions that the world is formed of a set of "fairly specific, determinate, and more or less identifiable processes."[159] We therefore need to identify new ways of studying our subjects that acknowledge and address these complexities, which Law calls "method assemblages" — these do not produce neat or definite accounts because they recognise that the realities they are describing are neither neat nor definite.[160] As Lisle aptly summarises, the point is to "rejuvenate and keep open the debates on method [...] by demanding a place for the disruptive, troublesome and unruly character of assemblage thinking."[161]

The power of description as a means of analysis is also prevalent in the work of Bruno Latour, who prioritises it over explanation. Latour argues that description gives space for the actors within a given subject to play out their roles and define their social realm themselves, rather than having an outside analyst impose explanations in a search for order:

> ... to regain some sense of order, the best solution is to trace connections between the controversies themselves rather than try to decide how to settle any given controversy [...] the actors are allowed to unfold their own differing cosmos, no matter how counter-intuitive they appear.[162]

Latour also maintains that the dichotomy between description and explanation is a false one:

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[158] Lisle (2014) p71
[159] Law, John (2004) *After Method: Mess in Social Science Research* (London: Routledge) pp4-7
[160] Ibid. p14
[161] Lisle (2014) p71
[162] Latour, Bruno (2005) *Reassembling the Social: An Introduction to Actor-Network-Theory* (Oxford: Oxford University Press) p23

> … we worry that by sticking to description there may be something missing, since we have not "added to it" something else that is often called an "explanation." And yet the opposition between description and explanation is another of those false dichotomies that should be put to rest […] Either the networks that make possible a state of affairs are fully deployed — and then adding an explanation will be superfluous — or we "add an explanation" stating that some other actor or factor should be taken into account, so it is the description that should be extended one step further. If a description remains in need of an explanation, it means that it is a bad description.[163]

The goal is thus not to explain, but instead to look closely at the subject and provide the fullest description possible of what is happening. As Lisle articulates, "it is only by slowing down that you will be able to identify the multiple human and non-human actors involved in an assemblage and let them articulate themselves in whatever way they can."[164] Assemblage thinking allows us to afford agency to all actors or parts, whether they are human or non-human, and to describe the relationships between them that cause them to act in the way that they do — thereby permitting a fuller understanding.

The complicated and messy world of the military-industrial complex is a prime candidate for such an approach, being composed of multiple parts and relationships that interact and produce emergent effects — looking at these parts as assemblages, and working towards a solid description of them and their interactions, gives the best hope of a fuller understanding of how the military-industrial complex works.

[163] Latour (2005) pp136-137

[164] Lisle, Debbie "Energizing the International" in Acuto, Michele and Curtis, Simon, ed. (2014) *Reassembling International Theory: Assemblage Thinking and International Relations* (London: Palgrave) pp71-72

CHAPTER THREE

Connections: How the U.S. Military-Industrial Complex Fits Together

Understanding the U.S. military-industrial complex as an assemblage requires the exploration of its diagram, the Deleuzian term for a plan of an assemblage that shows each actor and its associated space of possibilities. Diagramming the military-industrial complex allows us to see more clearly how these actors fit within it and also how each actor is itself an assemblage, with whole-to-part and part-to-whole relations moving up and down with scale. Mapping out the military-industrial complex in this way also permits its fuller description, contributing thus to a better understanding of how it manifests and its effects.

I argue that the assemblage of the military-industrial complex in the United States is made up of four distinct parts: the military, the government, industry, and academia. Each of the four parts is itself an assemblage whose parts interact with each of the others, and so on down the scale, and this chapter will explore how these connections manifest and are maintained. Some of these lower-level assemblages interact in slightly different ways to their fellows and it is important to treat each separately within the larger whole.

While the binary connections between the actors within the military-industrial complex do not wholly submit to clear demarcation, there are three main types. The first type is the most obvious: **money**. These connections come in the form of direct transfers of cash (such as in funding agreements or donations to political campaigns) or the giving of the chance to make profit via the awarding of contracts. The second type is **influence**, a form of power that gives one the ability to affect decisions made by another party. This can blur into money, as the influence desired may be over the financial transactions described above, but the decisions one can have influence over may also be more abstract, such as the direction of policy or operational posture. The final type has elements of both money and influence, but is a separate type: the **revolving door**, whereby individuals within all parts of the military-industrial complex can change roles to be employed by a different part thereof. This may manifest as someone from one part bringing its influence into a new job in another part, or as an individual modifying their decisions in an existing role to improve their chances of employment elsewhere in the future.

A complete picture of the military-industrial complex cannot be formed without also developing an understanding of the shaping political forces that do not fit neatly within the binary interactions between its individual parts and assemblages. While these political forces do draw upon the key factors of money and influence, they sit apart from the binary relations described above and must therefore be considered separately. The two central subjects are the interplay between the military and the political ecosystem, and the political motivations

that arise from and shape the defence budget itself. Both bring out themes of **electoral incentives**, whereby the behaviour of the elected politicians involved is shaped, either consciously or unconsciously, by thoughts of how their actions will affect their own election campaigns.

While there are connections of some kind between all of the assemblages within the broader military-industrial complex assemblage, certain links are stronger and more consequential than others, and the nature of these connections in particular tells us a great deal about the nature of the military-industrial complex.

3.1 Defining the Parts

I identify four key sub-assemblages within the military-industrial complex assemblage, as illustrated in the diagram below:

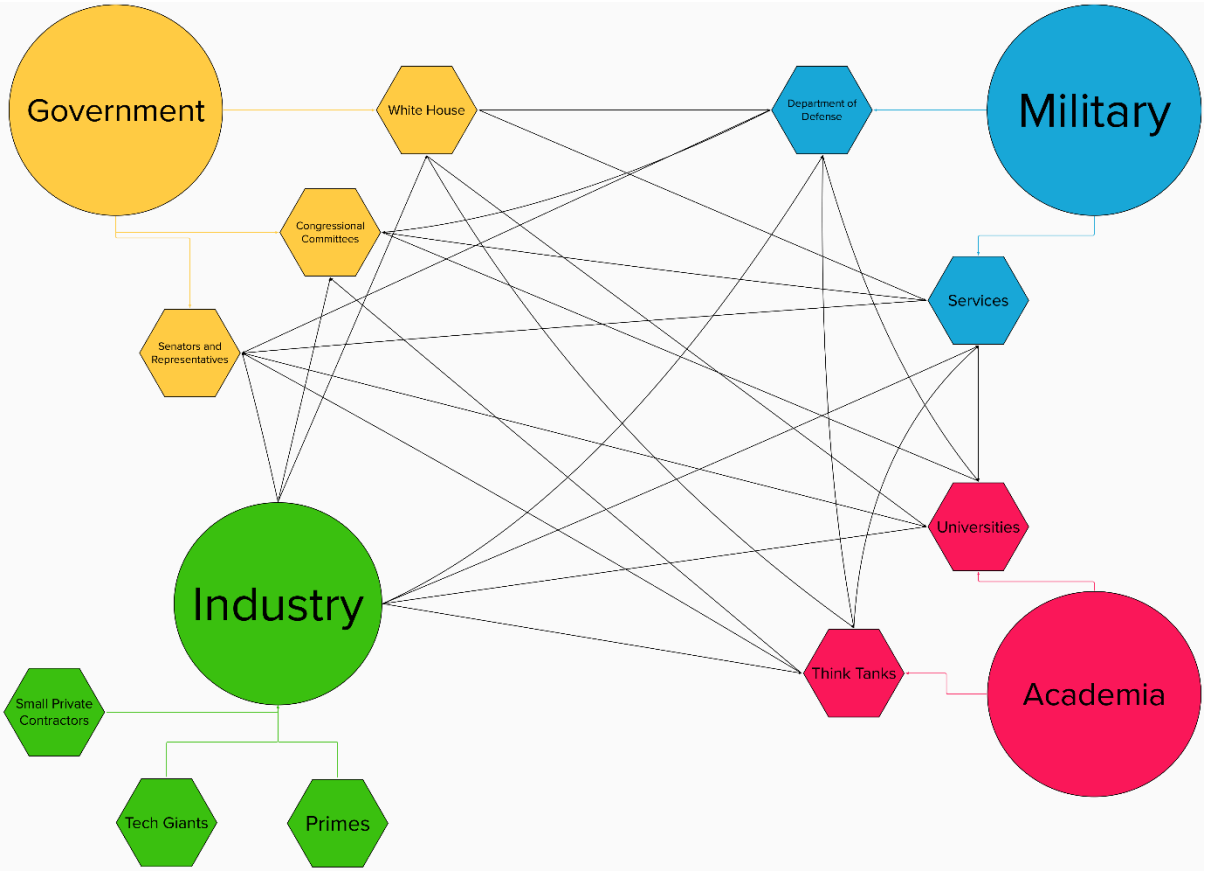


Fig 1: The major assemblages and connections of the U.S. military-industrial complex

It is important to note that the U.S. military-industrial complex itself sits within other large-scale assemblages, connecting both within the United States and internationally. Such connecting assemblages in a domestic context include, for example, the media, other non-defence parts of the state and federal bureaucracy, and civil society — and each of these plus the U.S. military-industrial complex itself has an analogue within other nations that also

connects across borders, with differing contexts and levels of interconnectedness around allied nations, partner nations, adversaries, and neutral nations, in addition to the further assemblages centred around international institutions. Any assemblage approach necessarily requires some form of delineation, given that at root everything connects to everything else. My focus here is on the U.S. military-industrial complex, so I have chosen to exclude these broader external connections in my diagram, but this should not be read as non-recognition of their interplay with what I explore here. These connections could also form the basis of further research.

Each of the nodes shown in my diagram is also an assemblage, made up of even smaller assemblages, and to delve down too far would be impossible in the space I have here. I therefore take the four main assemblages (military, industry, government, and academia) and their largest sub-assemblages as the key areas to explore.

3.1.1 The Military Assemblage

The **Department of Defense** is part of the executive branch of the U.S. federal government, tasked with coordinating and supervising all functions relating to the armed forces and national security. The department is headed by the secretary of defense, a civilian who is appointed by the president and is a member of the cabinet. Within the Department of Defense sit a number of subordinate entities that coordinate various areas, all of which ultimately report to the secretary of defense: the three military departments (for the Army, the Navy (plus the Marine Corps), and the Air Force), the Joint Chiefs of Staff, 19 defence agencies, 8 field agencies, and 10 unified combatant commands.

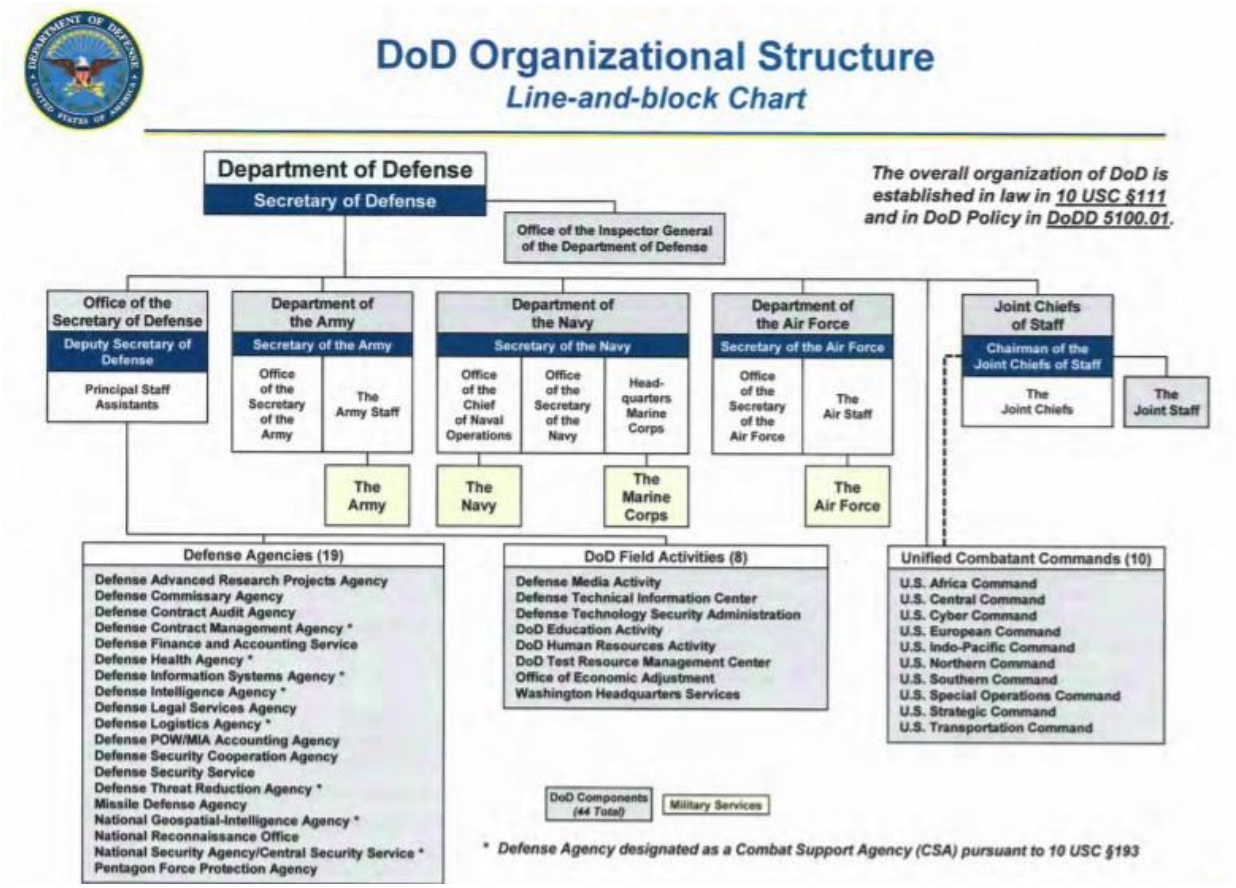


Fig. 2: The assemblage of the Department of Defense[165]

The three military departments are each headed by a civilian secretary, who is appointed by the president. The highest-ranking military official in each is the chief of staff, each of whom is also a member of the Joint Chiefs of Staff. Following the Goldwater-Nichols Act in 1986, the Joint Chiefs of Staff have a solely advisory role and do not have operational command authority: the chain of command goes from the president to the secretary of defense, and then down to the 10 combatant commanders.

There are four **uniformed military services** that come directly within the purview of Department of Defense:[166] the U.S. Army, the U.S. Navy, the U.S. Air Force, and the U.S. Marine Corps.[167] Since 1973, all of those serving do so on a voluntary basis rather than via

[165] Department of Defense (2019) *Organization and Management of the Department of Defense* [Washington DC: Department of Defense] p6

[166] The U.S. Coast Guard is a uniformed military service, but comes under the command of the Department of Homeland Security unless the president directs it to operate under the Department of the Navy during a time of war.

[167] The U.S. Space Force was created in December 2019 as a fifth uniformed military service, under the Department of the Air Force. Given that it was created after the period covered by this research, I will not be including it directly. However, the similarities in structure and organisation mean that it will likely behave similarly to its sister services within the military-industrial complex in future years.

conscription. As of October 2019, there were 1,337,005 servicemembers (officers and enlisted) in the regular armed forces.[168]

3.1.2 The Government Assemblage

The **White House** represents the seat of the executive branch of the U.S. government, under the leadership of the president, who appoints the cabinet and sets the policy direction of the wider administration. This includes appointing the secretary of defense and other subordinate civilian officials within the Department of Defense, and establishing national security and military priorities. The president is also the commander-in-chief of the armed forces, and thus has ultimate control over the military.

Senators and Representatives are elected by their constituents to sit in the Senate (the upper house of Congress) and the House of Representatives (the lower house of Congress) respectively, making up the legislative branch of the U.S. government. Each American state has two senators for a total of 100, ensuring that each state has the same amount of representation within the Senate no matter its geographical and population size. Representatives are elected by districts based on population within states, so larger states have more representatives than their smaller fellows: California has the largest group, with 53, while seven of the smallest states only have one.[169] There are 435 Representatives, each covering a district of around 711,000 people, plus a non-voting delegate from each of the five inhabited U.S. territories[170] and one from the federal district of Washington, D.C.

Congressional committees are formed within the Senate and the House of Representatives as legislative sub-organisations that perform specific duties. Standing committees are permanent organisations, unaffected by the two-year cycle of Congress, with both legislative jurisdiction (considering bills and recommending measures for the wider legislature to consider) and oversight authority (monitoring agencies, programmes, and activities within their jurisdictions). Each standing committee has a number of subcommittees to further specialise within the broader subject area. The membership of a committee, made up of members of the house within which it sits, is adopted at the beginning of each Congress, and each committee has its own staff to assist with its functions. The committees that are relevant to the military-industrial complex are: the House Appropriations Committee (particularly the Defense Subcommittee), the House Armed

[168] For a breakdown of these numbers and regular updates on personnel statistics, see the Defense Manpower Data Center website: https://dwp.dmdc.osd.mil/dwp/app/dod-data-reports/workforce-reports
[169] Alaska, Delaware, Montana, North Dakota, South Dakota, Vermont, and Wyoming.
[170] Puerto Rico, Guam, American Samoa, the Northern Mariana Islands, and the U.S. Virgin Islands.

Services Committee (which currently has seven subcommittees[171]), the Senate Appropriations Committee (particularly the Defense Subcommittee), and the Senate Armed Services Committee (which currently has seven subcommittees[172]).

3.1.3 The Industry Assemblage

The boundaries between the defence and non-defence sectors of industry can be blurred, and there is often unclear demarcation as to whether a firm can be classified as a defence firm.[173] Some are clearly within the defence space, predominantly making goods like weapons or aircraft that are sold exclusively to the U.S. military. Some companies sell both defence-specific and wider commercial goods and services, both to the U.S. military and to other customers. Some firms are far more within the civilian commercial sector but sell dual-use products and services that have applications in both the civilian and military spheres and are purchased more widely.

The U.S. military is the sole customer of most defence-specific products and services, which are usually made to a set of requirements or specifications determined by the federal government. This makes the defence market not subject just to a monopsony, but to a sovereign monopsony — the federal government is both the sole customer and the definer of the market's rules, norms, and structures.[174]

The economies of scale inherent in the production of large and exquisite weapons platforms in particular — warships, fighter aircraft, missile systems, and so on — mean that there is often a significant amount of monopoly within the defence market as well. There is often only one contractor who can reasonably fulfil a contract for such large and complicated systems, so the contracts to produce these platforms will be uncompetitive, shaped not by open competition but by bargaining between the monopsonist and the monopolist. If the government issues a competitive fixed-price contract, the monopolist can use its information rent (its insider knowledge of how much the programme will actually cost) to bid high to maximise its profit, with the assurance that it will still win the contract as there is no other firm that can complete it. This is why procurement programmes of this kind tend to have cost-plus contracts — the monopolist's power is reduced as it has to reveal its costs, even if it can be difficult for the true costs to be identified or monitored. Additionally, the intricacies of the defence market can confer some monopoly power on suppliers even where there is

[171] Cyber, Innovative Technologies, and Information Systems; Intelligence and Special Operations; Military Personnel; Readiness; Seapower and Protection Forces; Strategic Forces; and Tactical Air and Land Forces.
[172] Airland; Cybersecurity; Emerging Threats and Capabilities; Personnel; Readiness and Management Support; Seapower; and Strategic Forces.
[173] Amara, Jomana & Franck, Raymond E (2021) *The US Defense Economy* (Cambridge: Cambridge University Press) pp2-4
[174] Ibid. p5

competition. An American-based firm can bolster its claim to a contract over foreign competition in some cases by wielding the leverage of the political unacceptability of buying from abroad rather than supporting domestic jobs and economic growth. Furthermore, once a firm wins a contract for a particular platform, it benefits from some added monopoly power in any further negotiations — it is difficult and expensive to replace an incumbent manufacturer that has the tacit knowledge and intellectual property rights specific to that programme.[175]

I define **prime contractors** as privately owned companies run on a for-profit basis that fall within the top fifty defence contractors (excluding China) by defence revenue, as listed by the Stockholm International Peace Research Institute (SIPRI) for 2017.[176]

Small private contractors are organisations run on a for-profit basis, usually registered as a Limited Liability Company or incorporated if within the United States, that do not fall within the "prime" designation.

I define **tech giants** as large, privately owned businesses run on a for-profit basis that focus on emerging technologies. These companies have a footprint that spans a wide range of areas within the technology realm, and their products or services are predominantly civilian rather than military in nature: they make their money primarily from non-defence sales. Examples of such tech giants include Amazon, Google, Microsoft, and IBM.

All three types of company have similar interactions with the other parts of the military-industrial complex at the level of analysis within this chapter, so I have taken them together when looking at the connections.

3.1.4 The Academia Assemblage

Universities are institutions of higher education, in which students study for degrees and academic research is carried out. As of 2018, there were 4,313 degree-granting post-secondary educational institutions in the United States.[177]

Think tanks are organisations of academics and experts providing advice and ideas on specific areas or problems, bridging the divide between the worlds of government and academia. As of 2019 there are over 1,800 such bodies in the United States, more than

[175] Smith, Ron P. (2022) *Defence Acquisition and Procurement* (Cambridge: Cambridge University Press) p32
[176] See chapter 4 for a full list of prime contractors.
[177] For a breakdown of education institutions in the United States, see the National Center for Education Statistics website: https://nces.ed.gov/fastfacts/display.asp?id=84

double the number that existed in 1980.[178] Ben Freeman notes their wide-ranging areas of operation:

> Think tanks conduct in-depth research on public policy, help write laws, testify before Congress, are a go-to source for media on political issues of the day, serve as springboards for future government officials, and give former government officials a channel to express their views.[179]

Richard Haass highlights five ways in which think tanks influence American policymakers: "by generating original ideas and options for policy, by supplying a ready pool of experts for employment in government, by offering venues for high-level discussions, by educating U.S. citizens about the world, and by supplementing official efforts to mediate and resolve conflict."[180]

3.2 Binary Connections

When looking at the assemblage of the military-industrial complex, we must map out not only the actors involved but also their relations to each other. These shape how actors act, how they affect each other, and the flows of process between them. While these will differ slightly in practice the more granular one takes the level of analysis, a broader look adds value in understanding the patterns within the military-industrial complex.

Given the myriad intricacies of the military-industrial complex, it is difficult to fully map these out, but I argue that there are three main types of connection between one assemblage and another, which I call binary connections. The first type, money, covers both direct transfers of cash and the awarding of the opportunity to make money. The second, influence, covers the ability of one actor to affect the decisions made by another, either practical actions or more abstract ideas like the direction of policy or operations. The third, the revolving door, covers the effects of the ability of an individual to be employed by a different actor within the military-industrial complex, which may shape their decision-making.

All of these stem from the core underlying incentive that exists for the actors within the military-industrial complex — to act in pursuit of their own interests. To use a differentiation explored by Deleuze and Guattari in *A Thousand Plateaus*, this is not "power over" (*pouvoir*, the ability of one entity to control another) but "power to" (*puissance*, the desire or potential

[178] McGann, James (2020) "2019 Global Go To Think Tank Index Report" (University of Pennsylvania)
[179] Freeman, Ben (2020) *U.S. Government and Defense Contractor Funding of America's Top 50 Think Tanks* (Washington DC: Center for International Policy) p4
[180] Haass, Richard (2002) "Think Tanks and U.S. Foreign Policy: A Policy-Maker's Perspective" (Washington DC: State Department)

of an entity to act into the world).[181] This *puissance* is the fundamental nature of an assemblage, the ability to affect and be affected, and the structure of an assemblage can be traced through the lines of how actors use their *puissance* and how they are affected by others doing the same. I will explore this more specifically below, but broadly each actor within the military-industrial complex makes decisions based on their own understanding of how to achieve their interests.

The money connection involves individuals acting in their financial interests, whether that is making profit, securing funding for a project, winning a contract, or being paid a current salary. The influence connection involves individuals acting in their more abstract long-term interests, shaping a favourable environment for their future by directing the course of others' decisions. The revolving door also represents a long-term interest, offering an individual a way to secure their future by creating a fertile environment for potentially forthcoming employment.

The below chart shows these main binary connections between the key sub-assemblages of the military-industrial complex, and their direction of travel.

[181] Deleuze and Guattari (1987) p466. This differentiation reflects the influence on their work of Baruch Spinoza, who made a similar differentiation in his *Ethics* between *potestas* and *potentia*.

Money is shown in red, influence in green, and the revolving door in yellow.

I will now elucidate these specific binary connections in turn and explore how they manifest within the military-industrial complex.

3.2.1 Industry and Government

Industry/White House: Given that the White House sets the overarching priorities for an administration's defence and national security policies, the defence industry has an interest in influencing the direction of these priorities in a way that fits with the purchase of the products and services that they offer. A company that predominantly makes surface vessels, for example, will be likely to attempt to influence administration figures to prioritise a focus on naval readiness and the use of Navy forces to achieve goals such as power projection or deterrence. The industry also has a more general and shared interest in influencing an administration to increase the overall defence budget, or to put more money into the research and development or procurement part of that budget. Additionally, industry may lobby the White House to make political appointments to the Department of Defense that

would be beneficial in terms of those individuals' views or networks, particularly at the start of a new presidential administration.

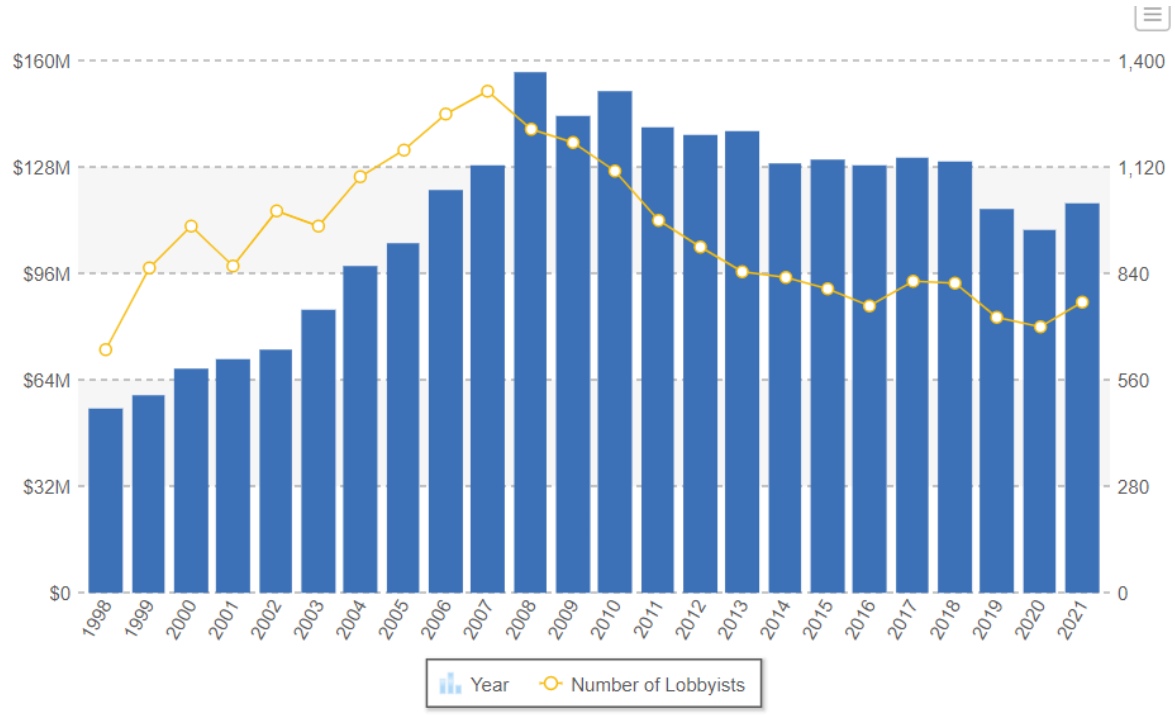
White House/Industry: Conversely, the White House will try to influence industry to place its focus on areas that the administration views as important, encouraging research into particular technologies or the expansion of certain types of offering in order to ensure that the defence industrial base is well-placed to respond to the administration's priorities. The defence industry may also be a source of future employment for political appointees or officials within the administration, particularly those focused on subjects to do with national security, encouraging the development of personal links to smooth possible moves into a new role following an election or other shift.

More broadly, a presidential administration must also consider how to determine and maintain an appropriate defence industrial base as a policy matter, in order that the nation's military and national security requirements can be met currently and into the future. While government purchases shape the defence market inherently due to its position as a sovereign monopsonist, administrations can also wield various tools to mould the defence industry in the pursuit of its own industrial policy priorities. These tools include not only direct market and procurement regulation, but also more subtle instruments like subsidies, taxation, export controls, and rules around foreign investment.[182]

Industry/Senators and Representatives: The defence industry influences individual senators and representatives through lobbying. The prime defence contractors, in particular, have large lobbying teams who spend a great deal of time speaking with congressional members and their staff to put forward their views on policy decisions and argue in favour of plans that benefit the industry. OpenSecrets, a nonprofit tracking declared data from industry and politics, shows the amounts spent on lobbying by the defence industry for over two decades, and notes that around two-thirds of these lobbyists are former government employees:[183]

[182] Smith (2022) p30

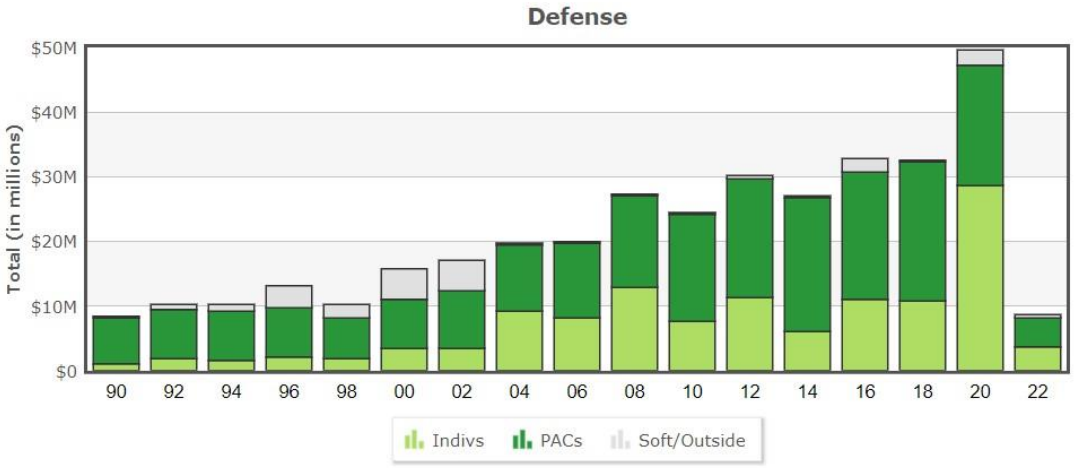
[183] https://www.opensecrets.org/federal-lobbying/sectors/summary?cycle=2021&id=D



Companies have particular leverage with members representing states or districts where that company has a manufacturing or research site, or where it can credibly propose building one, as such sites carry benefits for that member's constituents in terms of employment and boosting the local economy.

The defence industry may also make donations to the political campaigns of key members, ensuring that member's gratitude going forward and/or helping to prevent the electoral defeat of a particularly helpful individual. Data tracking by OpenSecrets shows considerable donations from individuals and political action committees (PACs) associated with the sector to political candidates and PACs in every election year since 1990:[184]

[184] https://www.opensecrets.org/industries/indus.php?cycle=2022&ind=D



Senators and Representatives/Industry: The job of a congressional member is not secure and is subject to their constituents continuing to vote them into office. The defence industry is an area of good prospect for future employment for a senator or representative following electoral defeat or resignation, particularly for those with an interest in the field, and members who are so inclined will be incentivised to develop strong personal links in order to facilitate such moves.

Industry/Congressional Committees: The importance of congressional oversight of and input into the defence budget makes the senators and representatives on appropriations committees an important constituency for the defence industry. Companies can lobby those members for increased budgets overall, increases within specific programmes or funding streams, or to prevent cuts in those same particular areas. The Armed Services Committees of both houses are also key to the defence industry, which can lobby members to influence decisions on or views of particular programmes that are of importance to a company.[185]

3.2.2 Industry and Academia

Industry/Universities: The defence industry is a source of money for universities. Companies can sponsor buildings, programmes, or faculty chairs within universities, as well as commission academics to collaborate on research projects. Universities that rely on such funds or wish to obtain them are incentivised to retain or build smooth relationships with

[185] For an in-depth analysis of defence contributions to and lobbying of committee members, see https://www.opensecrets.org/cong-cmtes/overview?cmteid=H04&cmte=HARM&congno=113&chamber=H (House Armed Services Committee); and https://www.opensecrets.org/cong-cmtes/overview?cmte=SARM&cmtename=Senate+Armed+Services+Committee&cong=117 (Senate Armed Services Committee)

these companies. For example, Lockheed Martin sponsors Howard University's Cybersecurity Education & Research Center.[186]

Universities/Industry: Academics, particularly those with specialisms in relevant fields, can move roles between industry and universities with ease, and may indeed have roles in both at the same time. Defence companies have an incentive to attract such specialists, and to maintain good relationships with possible future employees. Universities are also a key source of graduating students to be recruited into industry roles. The big defence contractors, including General Dynamics, Lockheed Martin, Raytheon, and Northrop Grumman, have extensive recruitment networks at top universities to attract those graduating with relevant degrees.[187]

Industry/Think Tanks: A similar relationship exists between the defence industry and think tanks as does between the industry and universities, particularly given the personnel crossover within academia between universities and think tanks themselves.

Industry also exercises influence over think tanks via funding. In his excellent deep dive into defence industry funding of think tanks, Freeman finds that the top fifty think tanks in the United States received almost $1 billion in funding from the government and military contractors in 2019. The largest contributors in industry were the prime contractors, specifically Northrop Grumman, Raytheon, Boeing, Lockheed Martin, and Airbus.[188]

Cassandra Stimpson argues that this funding can directly impact the output that think tanks produce. She takes the example of the Center for a New American Security, which received around $7 million in funding from big defence contractors between 2014 and 2019. She links this funding to the organisation's support for Battle Force 2045, which calls for a 500-ship U.S. Navy, and under which these very contractors would benefit as the likely manufacturers of those ships; and to the organisation's support for the Columbia-class submarine's key place in the U.S. nuclear deterrent, a platform that is produced by Huntington Ingalls, General Dynamics, and Northrop Grumman, all of which have substantially donated to the think tank. She is careful to make clear that this is not evidence of a conspiracy, but rather of "an ecosystem wherein think tanks are financially incentivized to advocate for uninterrupted Pentagon spending and more money flowing to Pentagon contractors."[189]

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[186] Olivier, Indigo (2022) "Inside Lockheed Martin's Sweeping Recruitment on College Campuses" *In These Times* August 11
[187] Ibid.
[188] Freeman (2020) p5
[189] Stimpson, Cassandra (2020) "New report shows more than $1B from war industry and govt. going to top 50 think tanks" *Responsible Statecraft* 14 October

Think Tanks/Industry: Again, this mirrors the relationship between universities and industry.

3.2.3 Industry and Military

Industry/Department of Defense: The defence industry has a strong interest in influencing the Department of Defense as the source of many of the policy and operational decisions that shape the landscape within which these companies operate. Industry can lobby officials and political appointees within the department, both on specific decisions and more generally to influence the way in which these key individuals view the wider defence space.

Given the specialist nature of the fields involved, the defence industry is also an important source of personnel for the department, particularly around changes of administration. Many of the higher-level appointees within the department have had some experience in industry, and some view this as a benefit to mutual understanding and the ability for the government and industry to work together more smoothly. For example, Michael Brown, the under secretary of defense for acquisition under the Biden administration, said: "We need more cross-pollination, so there needs to be more folks from the tech world who get into government and going back out."[190] However, the presence of former industry personnel within the defence bureaucracy may also lead to close lobbying relationships that could be viewed as ethically inappropriate.

Department of Defense/Industry: The department holds a great deal of power over the American defence industry because it controls the major income source of those companies: contracts. Whether for research and development, services, or manufacturing, these contracts are the lifeblood of defence companies and the reason for their continued profitable existence. The department can use these contracts, or the promise thereof, to shape how industry operates and direct private investment towards areas that the departmental leadership views as important. The defence industry also likes to maintain good relationships with departmental personnel in order to attract them to join its workforce, as these individuals have first-hand experience of the byzantine processes within the acquisition bureaucracy that can be extremely valuable to companies when pitching for future contracts.

Industry/Services: The armed services also represent a key constituency for lobbying by the defence industry, given the importance of the perspectives of uniformed personnel in influencing decisions about equipment procurement and forward planning. Persuading servicemembers, particularly those high up in the chain of command, of the utility of a

[190] Quoted in Sirota, Sara and Fang, Lee (2021) "Joe Biden Is Filling Top Pentagon Positions with Defense Contractors" *The Intercept* May 28

particular weapons platform, for example, can be valuable for a company involved in that platform's manufacture in terms of influencing the military to purchase more or retain an acquisition programme without cuts.

This particular course of influence has a long history. In a 1962 Harvard study, Merton Peck and Frederic Scherer noted:

> Although weapons program decisions are made at high levels, they are based upon information collected largely at lower levels. The most important sources of information are the service operating agencies and commands, which in turn obtain much of their data from the contractors. Thus defense firms are not only major sources of new weapons program ideas, but they also provide information on the technological feasibility of new concepts and on estimated development costs and schedules.[191]

Indeed, Peck and Scherer directly acknowledge the flow of influence here — while appreciating that information from industry is valuable in adding to the context of the decision-making process on a programme, they add that "the information may be colored by the fact that it is provided in hopes of starting a program in which the contractor will participate."

Services/Industry: The services can influence the defence industry to focus their internal research and development (as well as their lobbying) on capabilities that serving personnel may feel are underperforming or missing from current operational frameworks. In common with other areas of the military, the services are also a good source of talented personnel for future employment within the defence industry, so maintaining strong relationships can be beneficial.

3.2.4 Government and Military

White House/Department of Defense: The White House directly sets the predominant direction of the Department of Defense, both by filling political appointee roles and by making the largescale decisions that affect the way in which the department will be asked to operate over the length of a presidential administration. The executive branch also has significant power in terms of money, as a president can decide whether to push for a larger defence budget or which parts of that budget will be prioritised in the near and long term. Personnel with a defence focus working within the White House may also wish to move into employment in the department in future.

[191] Peck, Merton & Scherer, Frederic (1962) *The Weapons Acquisition Process: An Economic Analysis* [Harvard University: Graduate School of Business Administration]

Department of Defense/White House: When setting overall defence policy, the White House will also be influenced by the department itself, drawing on the expertise and institutional knowledge of its personnel in shaping policy priorities. Departmental staff can use this to lobby for particular decisions, or for defence to be given more priority over other areas under the executive branch's purview.

Congressional Committees/Department of Defense: The Armed Services Committees of both houses can exercise influence over the Department of Defense through their oversight activities: what they choose to investigate, the expert witnesses they call upon, and the conclusions they reach. They can bolster departmental decisions or criticise them, shaping how the department approaches key policy areas and acquisition programmes. The Appropriations Committees can similarly shape policy through their deliberations over the defence budget and the individual parts thereof.

Department of Defense/Congressional Committees: The department can influence the deliberations and oversight activities of the Armed Services Committees via its personnel, who are often called upon to give evidence to these committees or to speak with individual members for briefings or discussions. The political appointees within the department's leadership can exercise particular influence over committee members of the same political party as the current administration.

White House/Services: While much of the White House's influence on the military runs through the Department of Defense, the executive branch also influences the services directly. The president's role as commander-in-chief and regular discussions with the Joint Chiefs of Staff provide a clear conduit of influence over the operational side of the military, not just in the direct sense of the chain of command but also in terms of shaping the operational decisions that are delegated to service leadership.

Services/Senators and Representatives: The services can draw upon a number of ways to influence individual members of Congress. Senators and representatives with large bases and military communities within their states or districts have a direct interest in keeping this constituency happy, both for the votes of those people and for the wider beneficial economic effects that military installations can bring. A member may be a veteran themselves, or be close to someone who is, and may value being seen to stand up for the services for both personal and political reasons.

Services/Congressional Committees: Similar to the Department of Defense, the services can influence congressional committees via giving evidence or briefing committee members. Given the value that is often placed on direct experience, particularly of combat, the views of

serving personnel (particularly those high up the chain of command) can be given significant weight, and the services can use this to shape committee deliberations.

3.2.5 Government and Academia

White House/Universities: The executive branch can offer a significant source of employment for university academics, particularly during the transition to a new presidential administration, so it is in the interests of many individuals within universities to build or retain good personal links with White House staff.

White House/Think Tanks: Academics working at think tanks can also view the White House as a potential employment option, but there is an added layer of influence given the political nature of many think tank organisations. Those who are overtly aligned with a particular party (or a wing thereof) will have incentive to keep strong ties with a friendly administration, and the White House can draw upon this to influence the written output of these organisations. Haass specifically notes the revolving door between the White House and think tanks as a source of strength within the U.S. political landscape, arguing that the lack of a permanent high-level civil service in the United States means that a flow of experts from think tanks into the executive branch when a new administration takes over is vital for the good functioning of government. He also notes that think tanks provide a source of employment for departing officials, forming what he calls an "informal shadow foreign affairs establishment."[192]

Senators and Representatives/Universities: Congressional members may employ academics directly on their staffs, or may offer themselves to a university as experienced faculty members following the end of their political career.

Senators and Representatives/Think Tanks: This relationship mirrors that of congressional members with universities, but again with the added level of political affiliation. Having an alignment to a party will incentivise a think tank to keep up cordial relations with senators and representatives of that same party, perhaps to tempt them to join that organisation following their tenure in Congress.

Think Tanks/Senators and Representatives: If a think tank is well-regarded in the defence or national security field, its written output can have great influence over members of Congress, particularly those of a similar political alignment. Think tanks can use this to influence how members approach an issue in general, or how they will vote on a particular matter.

[192] Haass (2002)

Think Tanks/Congressional Committees: Academics working at think tanks are often called upon for expert advice by congressional committees conducting oversight over a particular area, and think tanks therefore have a clear conduit for influence over a committee's conclusions.

3.2.6 Military and Academia

Department of Defense/Universities: The Department of Defense has direct control over contracts, a source of funding and prestige for academic institutions with departments operating within the national security field. This incentivises universities and individual academics to keep up strong relationships with the department, and to lobby directly. For example, Pennsylvania State University's in-house lobbying team advocated for the funding of specific modules during the littoral combat ship programme, to supplement the university's ongoing work with the Navy via its Applied Research Laboratory.[193]

Universities/Department of Defense: Academics are valued as personnel within the Department of Defense, adding experience and brainpower in particular to deliberations over largescale strategic questions, so it is in the department's interest to promote good links with universities.

Department of Defense/Think Tanks: As with universities, the Department of Defense has power over think tanks via commissioning projects, offering money and prestige to those organisations. The political affiliations of think tanks can also come into play, as the department may be more likely to offer such work to organisations of a friendly allegiance. Department officials are also valuable to think tanks as future employees or affiliates once they leave government service, further incentivising close relationships.

Think Tanks/Department of Defense: The output of think tanks, particularly politically friendly ones, can have direct influence over the decisions made within the Department of Defense. Whether critical or supportive, the views of experts are given weight during departmental deliberations. Additionally, as with universities, academics from think tanks are valuable personnel for the department and strong links are therefore important.

Services/Think Tanks: Similar to the Department of Defense, think tanks in the defence space value having military personnel on their teams following the end of their service, incentivising close relationships for future employment opportunities. For example, the Brookings Institution (one of the oldest and best-known think tanks in Washington) has as its president John R. Allen, a retired four-star general.[194]

[193] Wright, Austin (2014) "Universities Chase Defense Dollars" *Politico* August 13
[194] See the Brookings Institution website: https://www.brookings.edu/about-us/

Think Tanks/Services: Expert work from think tanks, especially if they have a good reputation within the defence community, can have influence over the services even if not directly commissioned by them.

3.3 Electoral Incentives

In addition to these binary relations, and rather more abstractly, the democratic system in the United States gives rise to several other shaping forces around the theme of electoral incentives. These affect how the various parts of the government assemblage interact with the military and with industry, as well as impacting the decisions that elected representatives specifically make around defence issues that in turn cascade throughout the rest of the military-industrial complex. A complete account of the military-industrial complex is thus not possible without mapping these further.

3.3.1 The Military in Politics

The principle of civilian control of the military is deeply rooted in the United States, and since the country's founding the American military has never attempted to break away from this model. However, nearly every administration over the past century has worried that its predecessor has allowed the civil-military relations balance to tip too far in favour of the influence of the military. As Peter Feaver and Richard Kohn highlight, this forms a paradox at the heart of the American polity: "the unbroken record of civilian control and the nearly unbroken record of worry about civilian control."[195] They argue that this stems from the fact that the military of a superpower, as the United States has become and remained in the last century, has far more influence than the authors of the American constitution would have seen as safe or proper in a republic. The threats and duties facing the U.S. military may necessitate such power, but the civilian politicians of each administration naturally worry about its existence.

The traditional view of civil-military relations can be found in Samuel Huntington's *The Soldier and the State*,[196] in which he lays out a division of responsibility roughly along the lines of strategy versus tactics. Civilians make decisions on strategy and policy, with advice from the military, while the military is left to use its expertise to determine tactical and operational matters — loosely speaking, civilians decide who and when to fight, and the military decide how to fight. However, as Feaver and Kohn point out, the line between what is civilian and what is military fluctuates both between and within presidential

[195] Feaver, Peter & Kohn, Richard (2021) "Civil-Military Relations in the United States: What Senior Leaders Need to Know (and Usually Don't)" *Strategic Studies Quarterly* Summer pp13-14
[196] Huntington, Samuel (1957) *The Soldier and the State: The Theory and Politics of Civil-Military Relations* (New York: Belknap Press)

administrations, and a decision that their civilian masters wish to make may fall considerably within the purview that the military believe to be "best insulated from civilian encroachment."[197]

The American public places a great deal of trust in the military as an institution. Gallup polling in 2020 showed that 72 percent of respondents had either "a great deal" or "quite a lot" of confidence in the military, reflecting a trend going back decades: the military is the only American institution to have higher levels of public confidence today than in 1980, and has consistently been top of the institutional trust rankings in Gallup polls since 1986.[198] What is striking is that this trend has not been substantially affected by the actual performance of the military, or by other scandals that have befallen the armed forces over the last four decades — while there were small dips during failures (such as the nadir of the Iraq War) and small spikes during big victories (such as the 1991 Gulf War), the overall confidence that the public places in the military has not been shaken. Raphael Cohen highlights that this trend would not be of particular note were it not for the concurrent erosion of public trust in other American institutions, particularly democratic institutions. The Gallup institutional trust polling shows a sharp decline in confidence over the same period: in 2017, only 40 percent of Americans expressed "a great deal" or "quite a lot" of confidence in the Supreme Court, 32 percent in the presidency, and a tiny 12 percent in Congress.[199]

3.3.2 Public Connection with the Military

For the majority of American history, the idealised form of military service was the citizen-soldier, the ordinary citizen who takes up arms when called upon to do so in defence of their nation. However, the establishment of the All-Volunteer Force in 1973 shifted this preference — the last time polling found a majority of the public to be in favour of conscription was 1981.[200] The end of the draft also significantly lessened the number of Americans with a direct connection to the armed forces: around 37 percent of American men had served in 1980, but only 16 percent had in 2014.[201]

In place of the nostalgic vision of the citizen-soldier has risen the professional warfighter, a member of a revered warrior caste who take on the burden of military service that is not

[197] Feaver & Kohn (2021) p15
[198] Brennan, Megan (2020) "Amid Pandemic, Confidence in Key U.S. Institutions Surges" *Gallup* August 12
[199] Cohen, Raphael S (2018) "An Effect Rather than a Cause for Concern: The State of Civil-Military Relations in the Trump Administration" in "Policy Roundtable: Civil-Military Relations Now and Tomorrow" *Texas National Security Review* March 27
[200] Jones, Jeffrey M. (2007) "Vast Majority of Americans Opposed to Reinstituting Military Draft" *Gallup News Service* September 7
[201] Cohen (2018)

shared by the vast majority of the population. Those who serve in the military have become what Susan Bryant and her co-authors call "secular saints" — their service sets them apart from civilians, who see them as exceptional but understand their sacrifices less.[202] Cohen argues that this isolation has led the wider public to romanticise the military, painting servicemembers as paragons of selflessness and patriotism while making their service "a caricature, the subject more of Hollywood than reality."[203] Americans no longer view military service as a civic responsibility, instead expressing their patriotism through the "thank you for your service" mantra and other public displays of strong yet non-specific gratitude. Mara Karlin and Alice Hunt Friend describe this impulse as a "desire for social penitence" based on the underlying understanding that military personnel and their families now bear the lion's share of the burden of war.[204] This was particularly evident throughout the wars in Iraq and Afghanistan, when "the 1 percent went to war and 99 percent went to the mall."[205] As Secretary of Defense Robert Gates warned in a speech in 2010, "For a growing number of Americans, service in the military, no matter how laudable, has become something for other people to do."[206]

Amy Schafer highlights that the composition of the military is different to that of the population, skewed towards men of lower socioeconomic status from the geographical south. She also finds that many of those who serve in the modern armed forces have a familial connection to the military — 2015 data shows that over a quarter of newly enlisted recruits have a parent who has served, a figure that rises to over 75 percent when including other family members. Given that only around 7 percent of the adult U.S. population are veterans, this suggests that those with a direct familial connection are significantly over-represented in the modern American military. While going into the "family business" is not limited to military service, this trend adds a generational element to the separation of the warrior caste, "promulgating a separate group of citizens who are both responsible for and bear the burdens of military service."[207]

3.3.3 Campaign Endorsements

The consistently high levels of public trust in the American armed forces provide a strong incentive for elected politicians to seek to link themselves to the military. Candidates for

[202] Bryant, Susan, Swaney, Brett, & Urben, Heidi (2021) "From Citizen Soldier to Secular Saint: The Societal Implications of Military Exceptionalism" *Texas National Security Review* 4:2
[203] Cohen (2018)
[204] Karlin, Mara & Hunt Friend, Alice (2018) "Military Worship Hurts U.S. Democracy" *Foreign Policy* September 21
[205] Feaver & Kohn (2021) p27
[206] Gates, Robert (2010) "Speech at Duke University" September 29
[207] Schafer, Amy (2017) *Generations of War: The Rise of the Warrior Caste and the All-Volunteer Force* (Center for a New American Security) p6

office, particularly for the presidency, who do not have their own records of military service thus tend to recruit high-profile retired officers to endorse them, hoping to increase their votes with a sheen of the respect garnered by distinguished service. Active-duty personnel are forbidden by regulations from expressing a political preference openly, so candidates turn to "the next best thing: retired senior officers whose first names remain "General" or "Admiral" after they stop wearing the uniform."[208]

Given that veterans have been a significant voting bloc since the end of the Civil War, candidates aligning themselves with veterans' groups and campaigning on their issues is nothing new. However, as Jim Golby and his co-authors point out, recent presidential campaigns have included a new variant of this: individuals or small groups making high-profile endorsements of one candidate over the other, with an explicitly partisan message: "I am a distinguished military voice speaking on behalf of the military. Because 'we, the military' trust this person to be commander in chief, you can, too."[209] Kohn highlights the 1988 presidential election as the first instance of this new type of endorsement, when a retired Marine Corps commandant, Gen. Paul X. Kelley, endorsed George H. W. Bush during the Republican primary.[210] However, the 1992 presidential election saw both candidates seeking high-ranking military endorsements. Bill Clinton aimed to counter the perception of him as a Vietnam War "draft dodger" with the endorsements of a panoply of retired flag officers, including former chairman of the Joint Chiefs of Staff, Adm. William J. Crowe.[211] His Republican opponent, Bush, returned fire with a series of his own military endorsements, starting off a pattern that has continued at every presidential election since. The 2004 election even saw retired generals and admirals speaking on stage in support of primary candidates during both parties' conventions.[212]

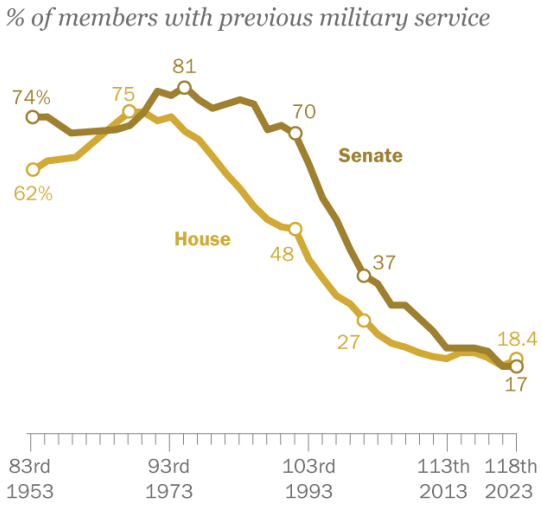
While retired military personnel are no longer bound by the regulations covering active-duty servicemembers, and can therefore exercise their right to make endorsements of particular candidates, in practice the expression of partisan political support gives rise to a blurring of the lines between the military and politics. The endorsements of retired officers and distinguished veterans are valuable to candidates precisely because of their military roles, not because of interest in their views as private citizens, and campaigns rely on the unspoken public impression that these individuals are speaking on behalf of the military. While the endorsers themselves may believe they are drawing a proper distinction by not making their

[208] Feaver & Kohn (2021) p29
[209] Golby, James, Dropp, Kyle & Feaver, Peter (2012) *Military Campaigns: Veterans' Endorsements and Presidential Elections* (Center for a New American Security) p6
[210] Kohn, Richard H. (2000) "Military Endorsements Harm National Interest" *The Washington Times* October 15
[211] Chen, Edwin (1992) "Clinton Backed by 21 Former Military Leaders" *Los Angeles Times* October 13
[212] Golby et al (2012) pp6-7

political views public until they retire, their symbolic role remains — particularly as they are still referred to by their rank, and often appear in uniform. Elections with large numbers of such endorsements, as have become common in recent years, contribute to the undermining of the military as a nonpartisan institution, required to serve their civilian masters of whatever party without reservation. Instead, the military looks more like "just another interest group serving its own bureaucratic and political interests."[213]

3.3.4 Veterans in Congress

The number of senators and representatives in the U.S. Congress with previous military experience has declined precipitously since the end of World War II, with recent elections giving the lowest share of veterans in either chamber in modern times. Both the 117th[214] and the 118th[215] Congress show far fewer veterans — while the 118th Congress had a small increase over its predecessor, the numbers remain low compared to previous decades. The Pew Research Center analysed the share of veterans in the Senate and the House of Representatives,[216] and found a steep decline since 1975:



These figures reflect the wider trends in the number of Americans serving in the armed forces. The high levels of veteran representation up until 1975 reflect the mass mobilisations and drafts for World War II, the Korean War, and the Vietnam War — more of the population served during these conflicts, so it is more likely that those standing for election in the following years will be veterans. Since the introduction of the All-Volunteer Force in

[213] Golby et al (2012) p15
[214] Shane, Leo (2020) "Veterans in the 117th Congress, by the numbers" *Military Times* December 28
[215] Shane, Leo (2023) "Breaking down the number of veterans in the 118th Congress" *Military Times* January 3
[216] Desilver, Drew (2022) "New Congress will have a few more veterans, but their share of lawmakers is still near a record low" *Pew Research Center* December 7

1973, the U.S. population has not been subject to a draft, so the numbers of elected representatives who have served reflects the drop in the number of serving personnel.

Congressional representatives who are veterans are likely to have a different view of the issues that come before them, both in terms of oversight and appropriations. Direct military experience gives a type of expertise that someone who has not served can never attain — while this certainly does not mean that non-veteran representatives cannot effectively oversee military affairs, the decline in the numbers of veterans over recent decades will change the nature of the expertise available to the legislative branch of government. For instance, Danielle Lupton's research shows that veterans in Congress will have an increased preference for more congressional oversight over war operations than non-veterans,[217] and David Stadelmann and his co-authors find that politicians who have volunteered for military service have a higher likelihood of accepting pro-military legislative proposals[218] — fewer veterans in Congress should therefore lead to such effects being less pronounced overall.

3.3.5 Generals in Cabinet

While a number of former generals have successfully been elected president, although none since Eisenhower,[219] all recent presidential administrations have appointed former generals to serve in the executive branch of government, in a range of high-level cabinet positions. For example, George W. Bush picked Gen. Michael Hayden (director of central intelligence) and Gen. Colin Powell (secretary of state), while Barack Obama tapped Gen. David Petraeus (director of central intelligence), Gen. James Jones (national security advisor), and Lt. Gen. James Clapper (director of national intelligence). The president who made the largest number of such appointments, however, was Donald Trump, who chose both current and former generals as cabinet secretaries, national security advisors, and his own chief of staff — a change in degree, if not in kind, from previous holders of the office.[220] During the presidential transition, Trump appointed Gen. James Mattis (secretary of defense), Gen. John Kelly (secretary of homeland security), and Lt. Gen. Michael Flynn (national security advisor), the latter of whom was replaced a month into the administration by an active-duty officer, Lt. Gen. H. R. McMaster. Midway through his first year in office, Trump moved Kelly out of the cabinet and made him White House chief of staff, a traditionally far more political

[217] Lupton, Danielle L. (2017) "Out of the Service, Into the House: Military Experience and Congressional War Oversight" *Political Research Quarterly* 70:2

[218] Stadelmann, David, Portmann, Marco & Eichenberger, Reiner (2015) "Military careers of politicians matter for national security policy" *Journal of Economic Behavior & Organization* 116

[219] The generals who were elected as president were George Washington, Andrew Jackson, Ulysses S. Grant, and Dwight D. Eisenhower.

[220] Cohen, Raphael S (2018) "An Effect Rather than a Cause for Concern: The State of Civil-Military Relations in the Trump Administration" in "Policy Roundtable: Civil-Military Relations Now and Tomorrow" *Texas National Security Review* March 27

role that caused particular concerns about the politicisation of the military — although such concerns were balanced by hopes that these generals would bring some steadiness to an unpredictable and inexperienced president, as the "grown-ups in the room."

The appointment of current or former generals to such high-level civilian posts in the executive branch raises concerns in two main areas: the effect on policymaking, and the effect on the public perception of the military. As Jessica Blankshain argues, the policymaking part of this has "both a relational component — the prospect of normalizing the privileging of military over civilian views — and a policy content component — a further "militarization" of American foreign policy."[221] Her use of "militarization" is not meant to mean initiating more wars, as those who have served tend to be more wary of starting a conflict given their experience of what it is like to fight one, but rather that foreign policy will be dominated by the military perspective, and the armed forces may become the most prominent option on the table to the exclusion of alternatives — as the old saying goes, to a man with a hammer, everything looks like a nail. The public perception strand centres around the explicit connection of the military with the political arena, particularly given Trump's predilection for using "my generals"[222] as a political prop, undermining the traditionally non-partisan status of the armed forces.

However, by the end of the Trump administration, the pendulum had swung in the other direction — moving from an over-prominence of the military to a weak civilian cabinet team. The president's generals left their posts one by one, and Trump ended his term in office having fired his secretary of defense and instituted a White House chain of command of the military via unconfirmable "acting" officeholders. As Feaver and Kohn summarise: "After beginning his administration with boasts about how much the military loved him and he loved the military, Trump ended his term with some of the most fractious relations in recent decades."[223] Trump's successor, Joe Biden, did not break from the pattern of appointing a general to his cabinet, with his choice of Gen. Lloyd Austin for secretary of defense necessitating a congressional vote to waive the prohibition on appointing an officer fewer than seven years after their retirement,[224] but Austin was careful to expressly commit to and shore up the principle of civilian control of the military.[225]

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[221] Blankshain, Jessica (2018) "Trump's Generals: Mattis, McMaster, and Kelly" in "Policy Roundtable: Civil-Military Relations Now and Tomorrow" *Texas National Security Review* March 27

[222] "See my generals, those generals are going to keep us so safe." Trump, Donald J. (2021) "Inaugural Luncheon Remarks" C-SPAN January 20

[223] Feaver & Kohn (2021) p25

[224] This had been done only twice before in the 69 years that the office of secretary of defense had existed: for Gen. George C. Marshall in 1950 and Mattis in 2017.

[225] Foran, Clare & Cohen, Zachary (2021) "Biden's defense secretary pick pledges to uphold 'principle of civilian control of the military'" *CNN* January 19

3.3.6 Civilian Deference to the Military

While the American system places the ultimate decision-making power in the hands of civilian leaders, it is expected that those civilians will exercise a modicum of deference to the military in areas in which the latter has clear expertise, normally operational and tactical matters. However, there is a tendency for civilian leaders to defer to the military on policy decisions for political reasons, giving them cover should the policy go badly, insulating them from criticism, and drawing on the military's public popularity.

Ronald Krebs and Robert Ralston argue that deference to the military has grown over the past two decades, finding that fewer survey respondents agreed with the statement "In general, high ranking civilian officials rather than high ranking military officers should have the final say on whether or not to use military force" in 2021 than in 1999.[226] They note that the late 1990s would be likely to be a high point for deference — the U.S. military had recently won the Cold War and the Gulf War, with several generals like "Stormin' Norman" Schwarzkopf and Colin Powell performing well in public. Even the wars in Afghanistan and Iraq did little to undermine deference to the military, likely due to the civilians of the Bush administration taking much of the public anger for the failures in both. Krebs and Ralston argue that this stems from the American tendency to valorise service, highlighting that the nation has "long granted the military unusual social standing, cast officers as heroes and soldiers as paragons of good citizenship and patriotism, and hailed servicemembers as models for their fellow Americans." Karlin and Hunt Friend argue that the twin myths of military service — that it represents superior civic virtue and generates superior policy judgment — form the basis of a belief that civilian experience alone is inadequate for national security leadership and decision-making.[227] Given this veneration, it is unsurprising that the American public tend to trust the judgement of the military over that of their elected politicians, who they are likely to view as both less competent and less patriotic.

Hunt Friend and Sharon Weiner explore deference through three case studies, in each of which civilian leaders with access to various information sources ultimately adopted the military's policy preference despite that being the opposite of the president's initial preference.[228] They argue that the consistent deference of the civilian leadership to the military in such differing conditions over several decades shows that military dominance over policymaking is a choice made by those civilians, not a structural feature of the

[226] Krebs, Ronald & Ralston, Robert (2021) "More Deferential But Also More Political: How Americans' Views of the Military Have Changed Over 20 Years" *War on the Rocks* November 17
[227] Karlin & Hunt Friend (2018)
[228] Hunt Friend, Alice & Weiner, Sharon (2022) "Principals With Agency: Assessing Civilian Deference to the Military" *Texas National Security Review* 5:4

American system nor a function of limited access to information. The factor at play here is political — it is politically beneficial for civilian leaders to align with expert military judgement and politically challenging to oppose it — and these incentives give the armed forces more sway over civilian decision-making than they would otherwise have. Military institutions have broad trust and credibility within both the public and governing elites, so civilian leaders are willing to outsource decisions to them — perhaps to yield direct electoral rewards, or to protect them from the electoral consequences of failure.

If civilian leaders are getting good advice from the military, is deference a problem? Polina Beliakova argues that it is — such deference enshrines popular acceptance of the military as a policymaking authority, while engendering a sense of entitlement among some officers, which may make it harder for civilians to take back decision-making power that they have outsources to the armed forces.[229] She identifies three political drivers for the civilian government to defer to the military: boosting approval, avoiding responsibility, and cajoling the military with power. She notes that such deference can happen by omission or by commission, including the assignment of a military person to a post or tasks normally held by a civilian, or the withdrawal of civilians from the policymaking process. Beliakova also notes that civilian administrations can compensate for a lack of policy approval by relying on highly respected serving or retired military officers, such as when Bush created a new position in 2007 (referred to colloquially as the "war czar") for a prominent military officer to advise him on the unpopular Iraqi surge policy.[230]

Lindsay Cohn also highlights that deference to military advice can limit the range of information that civilian leaders have access to while making important policy decisions.[231] While senior officers, in particular, have a great deal of experience, this is centred around their service — they are experts on what the American military can do, and how it can achieve missions given to it, but their expertise in military matters does not translate to a special understanding of how to keep the nation safe. They do not have particular knowledge of the other tools of statecraft that should be considered when exploring policy options, such as multilateral diplomacy, trade, and international law. Nor do they have special insight into how domestic politics affects such decisions, such as budgetary trade-offs or gaining buy-in from other branches of government. If a civilian administration has a strong tendency to

[229] Beliakova, Polina (2021) "Erosion By Deference: Civilian Control and the Military in Policymaking" *Texas National Security Review* 4:3
[230] Leibovich, Mark (2007) "The Tin-Star Title for the Too-Tough Job" *New York Times* May 20
[231] Cohn, Lindsay P (2018) "Civil-Military Relations One Year In" in "Policy Roundtable: Civil-Military Relations Now and Tomorrow" *Texas National Security Review* March 27

defer to military advice, they risk missing other options and defaulting to military solutions to the problems that the nation faces.

3.3.7 The Political Nature of the Defence Budget

The congressional budget process distinguishes between "authorisations," which establish or define the activities of the federal government, and "appropriations," which finance those activities. In itself an authorisation does not provide funding for government activities. In the defence context, this means that Congress oversees the budget primarily through two yearly bills: a defence authorisation bill, which organises defence agencies, sets policies for the Department of Defense, and authorises the appropriation of funds; and a defence appropriations bill, which provides the necessary budget authority for the military and defence agencies to draw funds from the Treasury.

Before 1961, congressional authorisation was only required for defence construction funds, not for other defence appropriations. In 1959, the House and Senate Armed Services Committees attached a rider to that year's construction authorisation to require prior authorisation of appropriations to procure planes, missiles, and ships, beginning in 1961.[232] The Armed Services Committees hoped to regain a share of control over defence programmes, which had hitherto been solely exercised by the House and Senate Appropriations Committees.

The process begins with the president submitting his budget proposal to the Armed Services Committees and the Appropriations Committees. This is initially formulated by the Department of Defense under the Planning, Programming, Budgeting, and Execution process,[233] wherein civilian and military leaders decide which programmes and force management requirements to fund based on strategic objectives. The committees and their subcommittees then hold hearings on the authorisation and appropriation bills for the year. The appropriations subcommittees generally convene a series of hearings in which the senior civilian and military leadership of the Department of Defense, the military services, and other defence agencies are invited to testify before the subcommittees on the budget request. At the same time, members of Congress, including those not serving on the committees, can submit requests and make recommendations. The bills are then marked up and reported out, often with an accompanying report document.

[232] Congressional Quarterly (1961) "Extra Funds Approved For Planes, Missiles, and Ships" *CQ Almanac* 17th edition [Washington, DC: Congressional Quarterly]

[233] For an overview of the Planning, Programming, Budgeting, and Execution process, see Congressional Research Service (2022) *Defense Primer: Planning, Programming, Budgeting, and Execution (PPBE) Process* [Washington, DC: Congressional Research Service]

Each bill is debated and potentially amended in the House of Representatives, and then moves on to the Senate after it passes a vote. The Senate can either amend and pass the House bill, or it can report out and pass its own bill. If there are two bills passed that differ, a conference committee appointed by the leadership of each chamber negotiates a compromise bill through the reconciliation process. If this bill is passed by a vote of both chambers, it is sent to the president for his consideration and signature. The authorisation bill is normally considered first, then the process is repeated for the appropriations bill, but they can be considered in the opposite order or at the same time.[234] If a fiscal year ends without the completion of the appropriations process, Congress can pass a continuing resolution, which grants an extension of budget authority for a specified temporary period, typically confined to funding activities that were authorised the previous year. In addition to the amounts provided via regular appropriations, the president may request Congress to enact additional funding for selected activities through supplemental appropriations measures (or supplementals). Like continuing resolutions, these provide specific amounts of funding for individual activities, normally as a response to unforeseen or pressing circumstances.

The U.S. defence budget is split into four main categories,[235] each of which offers slightly different electoral incentives to congressional representatives.

Personnel covers cash compensation for servicemembers (including basic pay, housing allowances, and bonuses), post-retirement compensation (including retired pay and healthcare), and travel reimbursements. Congressional members have an electoral incentive to increase pay and pensions for servicemembers as a general matter, to show their support for the armed forces. This is increased if they have a substantial number of personnel based or resident within their state or district, where electoral support may be gained or lost given the direct financial effect on those voters and their families.

Operations and Maintenance (O&M) covers the operating costs for each of the services, as well as Department of Defense management and support costs. This includes pay and benefits for civilian employees; fuel, supplies, spare parts, and maintenance and overhauls of aircraft, ships, ground vehicles, electronic equipment, and facilities; and recruiting, training, professional education, administrative activities, and headquarters and supply operations. The main electoral incentives within this category lie with congressional representatives with large bases or installations within their state or district — if they can secure funding for

[234] For more detail on the authorisation and appropriations processes, including voting methods, see Congressional Research Service (2021) *Defense Authorization and Appropriations Bills: FY1961-FY2021* [Washington, DC: Congressional Research Service], and Congressional Research Service (2022) *Defense Primer: Defense Appropriations Process* [Washington, DC: Congressional Research Service]

[235] The defence budget also includes funds for working capital, construction, and other smaller categories comprising around 2 percent of the total, but the bulk of the funding is contained within these four.

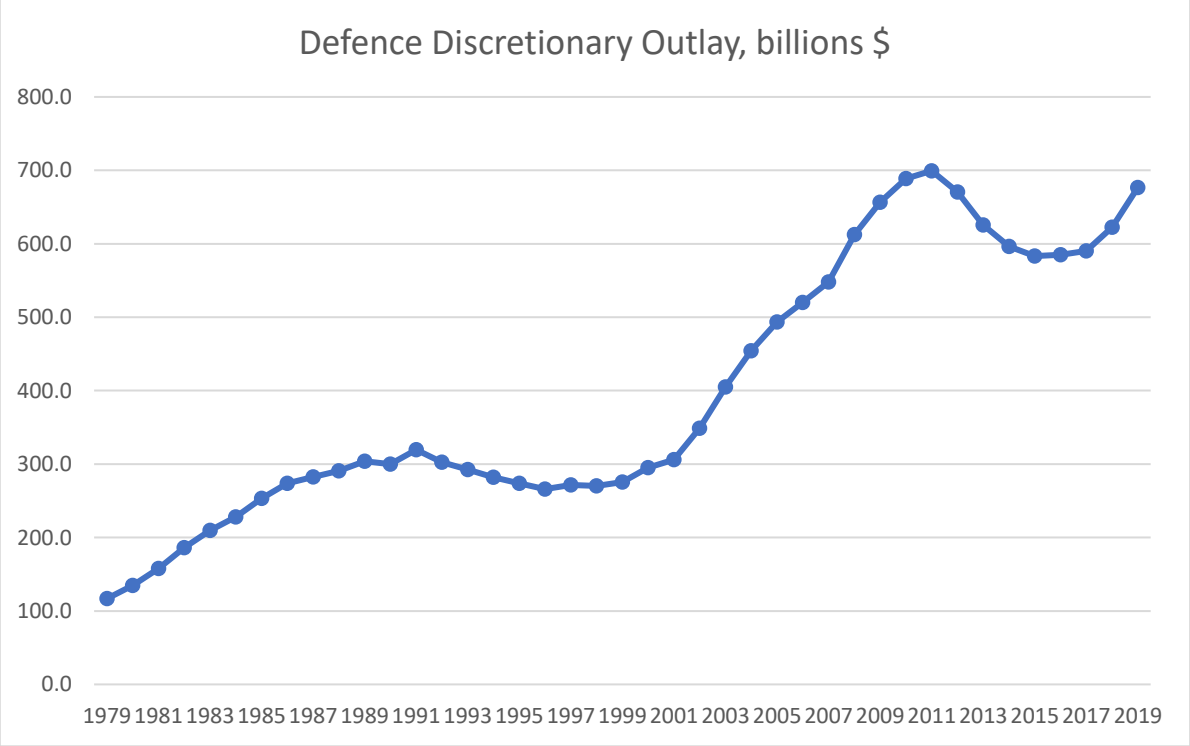
improvements that directly affect these sites and the personnel serving there, they can tout this as a success during electoral campaigns.

Procurement covers the purchase of new equipment and weapons platforms, as well as modifications to those already in use. The electoral incentives here mainly accrue to congressional representatives whose districts or states contain defence industry manufacturing sites, as more funds for procurement mean more jobs for their constituents and a boost to the local economy, all of which can be used as part of campaigning.

Research, Development, Testing, and Evaluation (RDT&E) covers research into new areas or modifications to existing equipment or platforms for all services. Similar to the procurement incentives, congressional representatives with entities in their states or districts that benefit from these funds (be they universities, federally funded research centres, or private companies) can publicise their success in securing jobs and investment in their local communities.

3.3.8 Military Spending and the "Ratchet Effect"

The total amount of the U.S. defence budget per fiscal year is shown below:[236]



Unsurprisingly, there are peaks of higher defence spending at times of conflict or national security crisis. Prior to the period shown on the graph above, there were peaks during World

[236] Data source: Office of the Under Secretary of Defense (Comptroller) (2021) *National Defense Budget Estimates for FY2022* [Washington, DC: Department of Defense] (aka "The Green Book") Table 6-8 pp123-129

War II, the Korean War, and the Vietnam War. The figures covered here show the peak of President Ronald Reagan's defence build-up in the mid to late 1980s, which included huge investments in the Strategic Defense Initiative and high-tech weapons systems like the B-2 stealth bomber, all in response to a perceived need to outmatch the Soviet Union in a period of renewed Cold War frostiness. The budget ticks upwards again after the 9/11 attacks, when the George W. Bush administration needed to fund the Global War on Terror and the interventions in Afghanistan and Iraq, with a particular peak starting around 2007 at the time of the Iraq surge.

The times between these peaks are no less significant. As Andrew Bacevich highlights, before the 1950s the U.S. military scaled up and down in response to security crises — a grave threat to the nation caused the federal government to institute a military build-up, but once that threat had passed, the military returned back to its minimum size. This happened in 1865, in 1918, and in 1945 — even when the United States had begun to see the value in remaining active on the world stage after World War II, the armed forces still shrank from 8 million to 1.8 million men within a year of VJ Day, and shrank further by 1947.[237] The baseline level of defence spending between the peaks of national crisis were consistently low, the minimum level required to secure the nation but no more. As Michael Sherry summarises, "until well into the twentieth century national defense claimed only a minor part of the nation's resources. War imposed enormous burdens, but defense as an ongoing activity did not."[238]

However, as Chalmers Johnson argues, the baseline level of military spending during the latter half of the 20th century and the start of the 21st century never returns to its pre-Cold War level, much less its pre-World War II level. Rather, the new baseline throughout the Cold War and beyond is far higher — even presidents who ostensibly cut defence spending, like Clinton, actually simply "allowed military spending to return to what had become its normal level."[239] As Bacevich bluntly puts it:

> Since the end of the Cold War, having come to value military power for its own sake, the United States [...] is committed as a matter of policy to maintaining military capabilities far in excess of those of any would-be adversary or combination of adversaries.[240]

[237] Bacevich, Andrew J. (2005) *The New American Militarism: How Americans Are Seduced by War* (Oxford: Oxford University Press) p16
[238] Sherry, Michael S. (1995) *In the Shadow of War: The United States Since the 1930s* (New Haven: Yale University Press) p6
[239] Johnson, Chalmers (2004) *The Sorrows of Empire: Militarism, Secrecy and the End of the Republic* (London: Verso) p56
[240] Bacevich (2005) p16

Aaron Friedberg calls this the "ratchet effect"[241] of defence spending — after the mid-1950s, it was easy for military spending to go up but a lot harder for it to go down. Defence budgets now had a new normal, one with far more funding than the previous minimum, and arguments within the government shifted more towards how to spend the money than on whether to spend it at all.

3.4 Conclusions

The size and intricacy of the military-industrial complex means that any attempt to fully describe it with a complete diagram would be impossible — there are simply too many connections, too many parts, and too many changes over time. However, the value of description remains. A partial attempt to describe the military-industrial complex, as this must inevitably be, nevertheless allows us to better understand its complexity and to recognise patterns that are useful in comprehending how it works and what its effects are.

Working systematically through the parts and interactions of the military-industrial complex to elucidate its diagram, even in a necessarily incomplete manner, clearly shows the limitations of the iron triangle concept and the benefits of an assemblage approach. The three corners of the traditional triangle — Congress, the defence bureaucracy, and industry — are still present and important, but a thorough mapping of the military-industrial complex requires the recognition of other actors that are not represented within the iron triangle. Even adding in another corner and broadening their scope to make an "iron rectangle" of the military, government, industry, and academia does not solve this problem, as there remains the fact that these actors are not monolithic. Particular subsections of the government, for example, have different motivations and incentives, and competing imperatives, that are not recognised or given space to exist within traditional conceptions of the military-industrial complex.

This is where assemblage thinking offers considerable value in improving our understanding of how the military-industrial complex functions. The assemblage of the military-industrial complex is made up of four smaller assemblages — the military, government, industry, and academia — but these are themselves assemblages of assemblages, and so on. Working through these via a diagram allows us to sketch out the connections between individual actors and reveal the intricacies of the parts and wholes that themselves form parts of other wholes. This approach permits the tracing of agency throughout the military-industrial complex, from bottom to top and vice versa, while allowing for the prospect of unintended consequences and emergent behaviour. The binary connections I identify — money,

[241] Friedberg, Aaron L. (2000) *In the Shadow of the Garrison State: America's Anti-Statism and Its Cold War Grand Strategy* (Princeton, NJ: Princeton University Press) p30

influence and the revolving door — are central to explaining how the parts of the military-industrial complex interact with each other and manifest effects, but an assemblage approach also allows external causes — electoral incentives — to become part of the picture, weaving together the intentional choices made by rational individuals within the military-industrial complex with the more nonlinear aspects of causality.

CHAPTER FOUR

Mapping Change Within the Military-Industrial Complex

The assemblage approach to the military-industrial complex requires not only mapping it in the abstract, but also considering how it has manifested in practice over time. Viewing the U.S. military-industrial complex as an assemblage requires discerning its parts and how they interact, but must also recognise the importance of change — while assemblages may appear to be solidly structural, they are constantly and inherently changing, allowing us to analyse them only while recognising their provisional and fluid nature, "things that are always in the midst of unfolding."[242] It is thus imperative when studying the military-industrial complex not simply to view it as a snapshot at one point in time, but to look at how it has changed over time. The fluidity of the military-industrial complex becomes clearer if we can also map out shifts within it.

Looking at the military-industrial complex in this way thus requires a historical approach as well as a theoretical one. While a wholly contemporary description of the military-industrial complex has considerable immediate value, it is only by extending that description to different periods and bringing in the wider historical context that we can reach a proper understanding of it, broadening out the diagram explored above to show how its parts and their relations change and have changed along with the context within which it sits and operates.

As with diagramming it, it is impossible to cover the whole history of the military-industrial complex, even when limiting it to the United States. In this chapter, I explain my approach to the historical portion of this work and the value it provides to the understanding of the military-industrial complex over time. While my approach is a messy one from a traditional viewpoint, as explored above, it nonetheless provides value in recognising that the subject of study is in itself messy as well.

4.1 Qualitative Research

The sheer amount of material that one could include in describing the military-industrial complex is overwhelming, and I have necessarily considerably narrowed down what I use here. Any one of the small connections or parts that I touch on throughout this dissertation could likely have a book-length explanation written about them — indeed, many have. Existing historical works, primary sources, data reports, technical documents, and so on all add helpful nuance and detail to my description of the military-industrial complex, even if my inclusion of them must necessarily not be exhaustive. Tracing every relation or shift is a

[242] "The Carpenter and the Bricoleur" p19

daunting task. However, by combining qualitative and quantitative approaches on a subset of these relationships, we can uncover broader trends and patterns. This dual methodology not only highlights significant insights but also offers a robust evidential foundation for the conceptual framework being employed. Qualitative analysis allows for a deeper understanding of the nuances and contexts that shape these shifts, while quantitative data provides measurable and generalisable evidence. Together, they complement each other, providing a comprehensive view that a single approach might miss. This integrative method enhances the reliability and depth of my findings, ensuring that the conceptual approach I use is also grounded in solid evidence. By focusing on a specific subsection of case studies, it is possible to draw meaningful inferences that reflect the larger phenomena at play, balancing between the need for comprehensive insight and the restrictions of a manageable research goal and thesis. Ultimately, this strategy facilitates a clearer elucidation of patterns and trends, ensuring that the research is both rigorous and applicable to broader contexts.

I also explore several historical case studies, centred around particular procurement programmes. The use of case studies as a research strategy has a deep basis in many fields of academia, comprehensively defined by J. W. Creswell:

> Case Studies are a qualitative design in which the researcher explores in depth a program, event, activity, process, or one or more individuals. The case(s) are bound by time and activity, and researchers collect detailed information using a variety of data collection procedures…[243]

These perform a descriptive as well as an explanatory function, showing how the military-industrial complex manifests within a real-world context at a particular time while also identifying the causal factors behind the outcome. Again, I could not hope to be able to analyse every major acquisition programme that may add to a fuller description of the military-industrial complex — indeed, every acquisition programme by its very nature highlights at least parts of the complex — but the ones I have chosen either illustrate particular points rather well or provide a helpful vignette of the military-industrial complex during a specific time period.

When I began this dissertation, I had hoped to supplement my case studies with fieldwork, including archival visits and interviews with the major players within each acquisition programme I studied, but the COVID-19 pandemic meant that I was not permitted entry to the United States for almost two years. I have thus had to rely on archival material available online or shared with me by colleagues, and replaced my interview plans with informal

[243] Creswell J. W. (2014) *Research Design: Qualitative, Quantitative, and Mixed Method Approaches* (4th ed.) (SAGE Publications) p241

background talks with some individuals who had access to video-conferencing platforms rather than a formalised interview structure. Further work on these case studies along these lines is therefore deserved, but I nonetheless believe that I have been able to analyse them successfully for my purposes here using the material that was available to me.

The Strategic Defense Initiative provides useful context to explain the dominance of the academia assemblage within the military-industrial complex during the Cold War, exemplifying both the Reagan administration's focus on competing with the Soviet Union through military technology and the consequent need to forge and maintain links with the academic institutions performing the necessary early-stage research for the project. While this case study reflects a much longer trend rather than something specific to the period it existed, it is a useful window through which to view the ways in which academic institutions could use their abilities to bring cutting-edge technologies to the military to gain funding and contracts.

The littoral combat ship clearly illustrates the dominance of the big prime defence contractors following the industry consolidation of the 1990s, as the contractors involved were able to lobby both elected representatives and the defence bureaucracy to push for more production and more funding for the project. The F-22 Raptor also shows this dominance, but with more of a focus on electoral incentives, as the aircraft's manufacturer was able to use its specific leverage over the representatives of districts with links to production to get the programme extended far beyond its useful life. The Joint Improvised Explosive Device Defeat Organization provides further context for the dominance of the primes during the Bush administration, showing how the big contractors were able to feed off the large budgets available to reorient the U.S. military towards the challenges of counter-insurgency warfare in Iraq.

The Strategic Computing Program provides a helpful illustration of the concept of technology spin-off from the military to the civilian world and the gradual shift to technology spin-on and commercial off-the-shelf procurement in the high-technology realm. I also explore other tech-focused case studies to bring out some of the key threads that emerged during the 2010s: the JEDI Project to show how the big civilian technology companies began to work with the military; Project Maven to show how Silicon Valley values clashed with military projects; and Palantir and SpaceX to illustrate the difficulties that non-prime companies faced in moving into working with the Department of Defense.

4.2 Quantitative Research

In addition to the sources and case studies mentioned above, I wanted to make use of some of the available quantitative data to flesh out my analysis of how the military-industrial

complex has changed over time. Again, the amount of empirical data that could potentially be applied to the understanding of the military-industrial complex is overwhelming. Paradoxically, however, while there is a huge amount of data, it is not always useful — given the wide range of sources, there is considerable discrepancy in the quality and historical scope of data caches, limiting their usefulness for illustrating wide-lens patterns.

The largest source of data, as one might expect, is the U.S. federal government itself. I have used federal defence budget data, for example, to show patterns in defence spending over time, which helps to demonstrate the historical patterns I identify. However, to delve more deeply into a particular facet of the military-industrial complex, I used federal contract data to analyse where defence research and development contracts were going over time.

I chose research and development for this purpose due to its relevance to all parts of the military-industrial complex — it touches upon the realms of the military, the government, industry, and academia — and because it is present in all military procurement programmes, whether or not they are successful. An idea or prototype may never reach fruition as a weapon (for example) and thus not be represented within the acquisition portion of the data, but whatever contracts were issued for its initial development will be within the research and development listings. Using research and development contract data, therefore, gives a wider lens on the full spectrum of military contracting. While this approach is one possibility out of many, such as focusing on an individual military service over time or following the path of a particular procurement programme throughout its life, I believe looking at research and development offers the best way in which to view the broader expanse of change within the military-industrial complex while also folding in the case studies outlined above to illustrate particular points.

The data were exported from a search of the Federal Procurement Data System,[244] which was designed as a comprehensive web-based tool for reporting contract actions undertaken by agencies of the U.S. federal government. These agencies are required to report contracts with a value higher than that of a "micro-purchase" and any modifications thereto. These requirements are contained within subpart 4.6 of the Federal Acquisition Regulation.[245] Given that there is no other extant source on equivalent contract actions with which to cross-check, it is impossible to know for certain whether the Federal Procurement Data System dataset is complete. However, the fact that reporting is a requirement under the Federal Acquisition Regulation gives me high confidence that the dataset is as complete as it is reasonable to expect.

[244] https://www.fpds.gov/fpdsng_cms/index.php/en/ - search carried out November 2019
[245] https://www.acquisition.gov/content/subpart-46-contract-reporting

Each contract listed on the Federal Procurement Data System has a Procurement Source Code that gives a broad indication of the contract's type.[246] I searched the Federal Procurement Data System for all contract actions classified under the three codes normally used for defence research and development: AD91 (Other Defense – Basic Research), AD92 (Other Defense – Applied Research/Exploratory Development), and AD93 (Other Defense – Advanced Development).

The search returned all contract actions issued by government agencies under these three codes for the calendar years available (1979 to 2019 inclusive). As 2019 did not yet have a full dataset when I performed this search, I excluded these contracts, giving 40 calendar years of data from 1979 to 2018 inclusive. I removed any contract with a value listed as below $500, and all those where errors or poor reporting meant that the dollar value or vendor was missing from the dataset (although there were few enough of these problems that the bulk of the dataset remains intact). This left 71668 contract actions.

I faced some problems in taking this approach. Firstly, the federal government has not made public the definitions used for coding procurement contracts into any of the Procurement Source Code categories. As I found when first attempting to define my dataset, the number of codes listed with some apparent relevance to defence is extensive, and there was no clear indication as to which of these referred to the research and development that I was looking for, as opposed to the procurement of physical goods, weapons systems, and so on. I decided to get a better idea of the codes used for research procurement by searching the Federal Procurement Data System for an agency that has a sole focus on defence research and development, and would thus likely have used the relevant codes, namely the Defense Advanced Research Projects Agency. When looking through the dataset resulting from this search, I found that each of the contracts tendered by that agency over the entire time period was coded as one of AD91, AD92, or AD93. I therefore took these three codes as my search parameters for my wider dataset. I cannot be entirely certain whether this approach means that I have been able to encompass every one of the defence research and development contracts that I could potentially include, but I am confident that this is a reasonable way in which to focus my search.

Secondly, I have been unable to ascertain what the difference is between the specifics of these individual Procurement Source Code names. Whilst I can hazard a guess as to the likely definitions of the three codes, the lack of detailed official definitions makes it difficult to know whether this is correct. Additionally, I do not know whether those officials tasked

[246] The full list of Procurement Source Codes used by the federal government is available here: https://psctool.us/

with coding the contracts and filing the reporting are working from a central definition list that is merely unpublished to the public, whether the definitions differ from agency to agency, or whether the particular staff members make their decisions based on their own assumptions as and when they do the reporting. This makes little difference to my dataset when looked at as a whole, but it means that I am not confident that a narrower analysis of the data from any of the three codes individually would be meaningful.

Thirdly, the data available on an individual contract is very limited in nature, likely due to the classification of the entirety or certain parts of a range of programmes encompassed by defence research and development. The listing given on the Federal Procurement Data System for a contract action shows only basic information: agency name, date issued, dollar value, name of vendor, and the aforementioned codes. There is no data on what the contract was specifically for, what type of research and development it refers to (beyond very general assumptions that can be drawn from the identity of the contracting agency), and whether the contract action relates directly to any others issued previously or subsequently. It is therefore impossible accurately to analyse the data by research type, or to follow the contract actions for a particular research programme through the time period.

I classified each contract into one of three groups, based on the status of the vendor listed.

> *Academic Institution and Nonprofit:* either a university (or a sub-organisation directly linked to a university), a federally funded laboratory, or a federal agency. All of these run on a not-for-profit basis.
>
> *Private Contractor:* an organisation run on a for-profit basis, usually registered as a Limited Liability Company or incorporated if within the United States, that does not fall within the "prime" designation.
>
> *Prime Defence Contractor:* a private contractor (either the vendor itself or its parent company) that falls within the top fifty defence contractors (excluding China) by defence revenue, as listed by the Stockholm International Peace Research Institute (SIPRI) for 2017.[247]

Rank	Company	Nationality	Defence Revenue
1	Lockheed Martin	USA	$44.9 billion
2	Boeing	USA	$26.9 billion
3	Raytheon	USA	$23.8 billion
4	BAE Systems	UK	$22.9 billion
5	Northrop Grumman	USA	$22.3 billion

[247] https://www.sipri.org/sites/default/files/2018-12/fs_arms_industry_2017_0.pdf pp9-10

6	General Dynamics	USA	$19.4 billion
7	Airbus	EU	$11.2 billion
8	Thales	France	$9 billion
9	Leonardo	Italy	$8.8 billion
10	Almaz-Antey	Russia	$8.5 billion
11	United Technologies	USA	$7.7 billion
12	L3 Technologies	USA	$7.7 billion
13	Huntington Ingalls	USA	$6.8 billion
14	United Aircraft	Russia	$6.4 billion
15	United Shipbuilding Corporation	Russia	$4.9 billion
16	Honeywell	USA	$4.6 billion
17	Rolls-Royce	UK	$4.4 billion
18	Leidos	USA	$4.3 billion
19	Naval Group	France	$4.1 billion
20	Textron	USA	$4.1 billion
21	Booz Allen Hamilton	USA	$4 billion
22	General Electric	USA	$3.8 billion
23	Tactical Missiles Corporation	Russia	$3.5 billion
24	Mitsubishi Heavy Industries	Japan	$3.5 billion
25	Rheinmetall	Germany	$3.4 billion
26	MBDA	EU	$3.3 billion
27	Babcock International Group	UK	$3.2 billion
28	Elbit Systems	Israel	$3.2 billion
29	Russian Helicopters	Russia	$3.1 billion
30	Bechtel	USA	$3.1 billion
31	Harris Corporation	USA	$3 billion
32	CACI International	USA	$2.9 billion
33	Safran	France	$2.9 billion
34	High Precision Systems	Russia	$2.8 billion
35	Science Applications International Corporation	USA	$2.7 billion
36	Saab	Sweden	$2.6 billion
37	Indian Ordnance Factories	India	$2.6 billion
38	Hindustan Aeronautics	India	$2.6 billion
39	CSRA	USA	$2.5 billion
40	United Engine Corporation	Russia	$2.5 billion

41	Israel Aerospace Industries	Israel	$2.4 billion
42	Orbital ATK	USA	$2.3 billion
43	Rockwell Collins	USA	$2.3 billion
44	General Atomics	USA	$2.2 billion
45	Rafael	Israel	$2.2 billion
46	CEA	France	$2.1 billion
47	Russian Electronics	Russia	$2.1 billion
48	Kawasaki Heavy Industries	Japan	$2.1 billion
49	Hanwha Techwin	South Korea	$2.1 billion
50	Dassault Aviation	France	$2.1 billion

The companies from this list that appear in the dataset are: Lockheed Martin, Boeing, Raytheon, BAE Systems, Northrop Grumman, General Dynamics, Leonardo, United Technologies, L3 Technologies, Huntington Ingalls, Honeywell, Rolls-Royce, Leidos, Textron, BAH, General Electric, Elbit Systems, Harris Corporation, CACI International, SAIC, CSRA, Orbital ATK, Rockwell Collins, and General Atomics. The overwhelming majority of these are U.S. companies. The predominant non-U.S. prime contractor in the data is BAE Systems, which is British although it has a separate U.S. subsidiary — the other non-U.S. companies (Leonardo, Rolls-Royce, and Elbit Systems) had only a handful of contracts each over the span of the data.

Given the number of mergers and acquisitions within the defence industry, particularly following the period of consolidation shortly after the end of the Cold War, these primes have not solely existed in their current form over the period I cover. In order to make my data comparable, I have classified a company as a prime in earlier data if it was subsequently bought by or merged with a prime. For example, Lockheed and Martin Marietta are under my prime classification when they appear, as is Lockheed Martin, the product of their merger.

I then analysed the resultant data for trends in both the number of contracts and their dollar value over the whole period.[248] These are shown in graph format below:

[248] See Appendix A for tables showing the data results.

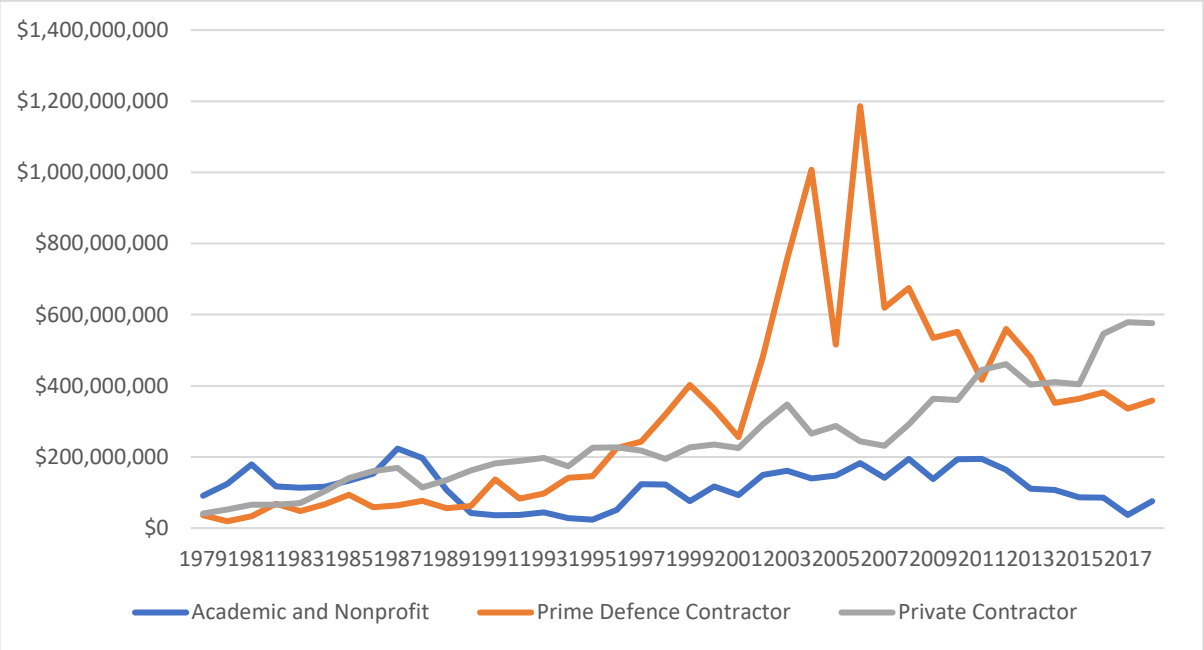


Fig 1: Dollar value of contracts per year

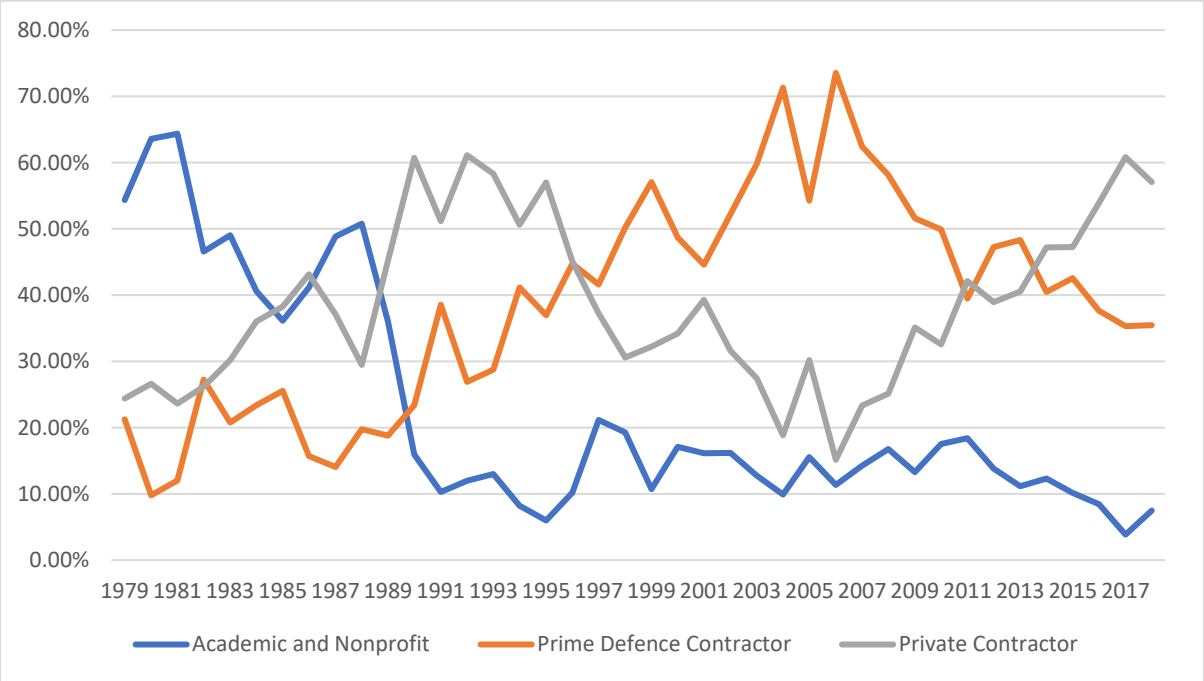


Fig 2: Dollar value of contracts per year as percentage of annual total

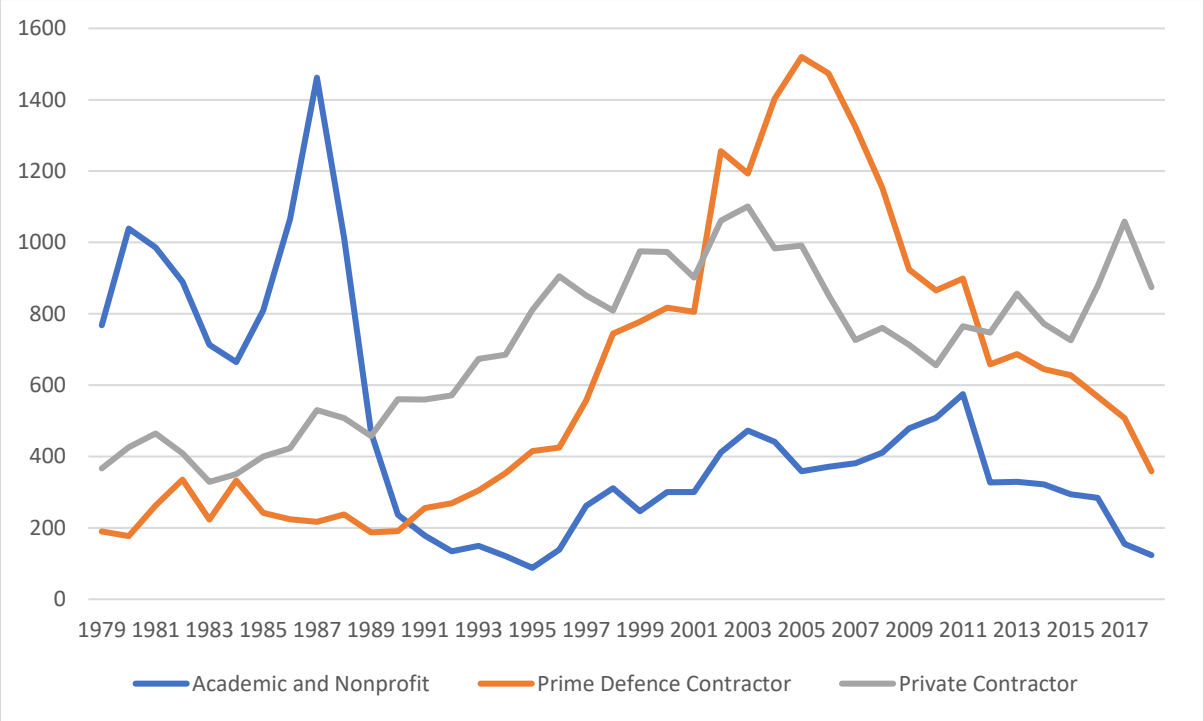


Fig 3: Number of contracts per year

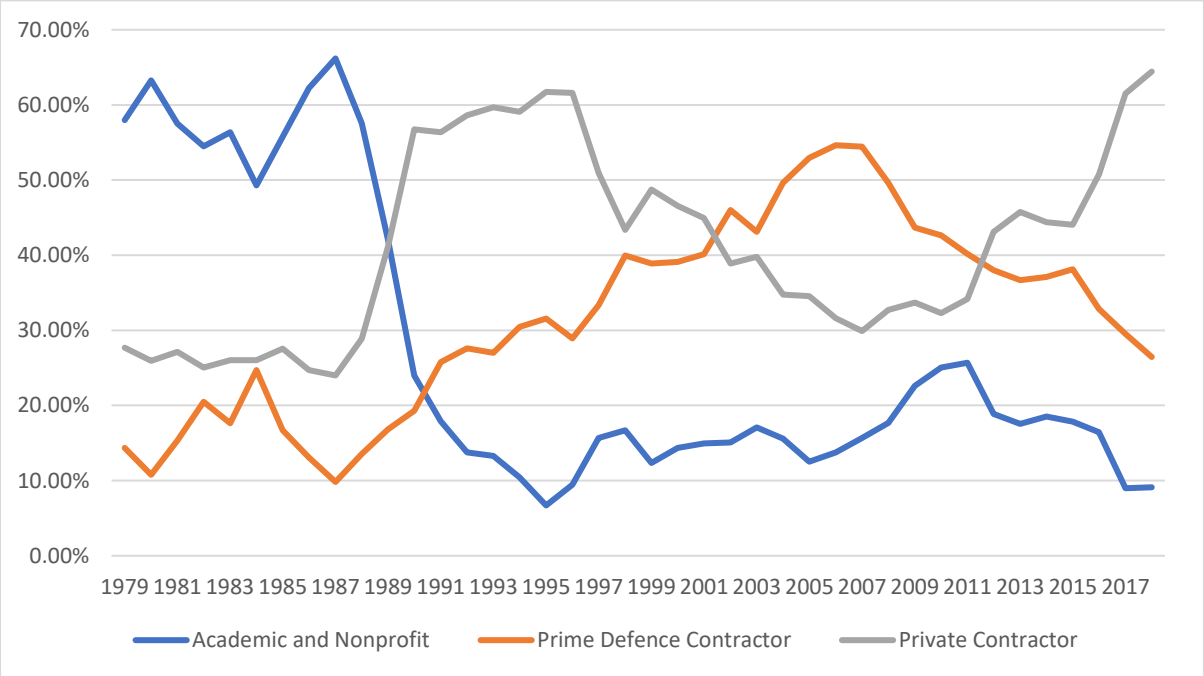


Fig 4: Number of contracts per year as percentage of annual total

Three periods emerged as interesting loci — the late 1980s (peak for academic institutions), the early 2000s (peak for prime contractors), and the mid-late 2010s (peak for non-prime private contractors).

I have organised my historical exploration of the military-industrial complex around these three periods, as the peaks shown in the data match and help to elucidate the wider forms of change within the military-industrial complex over this time. Each period brings out a different facet of the military-industrial complex, showing the relative dominance of one assemblage over the others and what this means for the wider military-industrial complex, but I also explore the context between these peaks to allow for a fuller historical sweep, spanning from the beginning of the Cold War to the present day. This remains necessarily an incomplete picture — but offers up a constellation of points that allow us to trace patterns.

CHAPTER FIVE

Academia, Reagan, and the Strategic Defense Initiative

"Universities might have formed an effective counterweight to the military-industrial complex by strengthening their emphasis on traditional values of our democracy, but many of our leading universities have instead joined the monolith, adding greatly to its power and influence."[249]

My data show that the role of academia within the U.S. military-industrial complex is particularly pronounced in the 1980s, under the administration of President Ronald Reagan. This period in particular emphasises the importance of bringing the academia assemblage into the broader assemblage of the military-industrial complex, as the military-industrial complex as it manifested throughout this time period cannot be properly understood without an exploration of the role of academic institutions, federally funded laboratories, and other nonprofit research organisations. While the role played in the military-industrial complex by the actors within the academia assemblage is not restricted to this period, their relative dominance is most pronounced during these years and their influence over the wider workings of the military-industrial complex is best understood when viewed through the lens of the Cold War.

Given his commitment to competing with the Soviet Union via technological superiority and the substantial increases in the defence budget, Reagan's tenure in the White House brought significant defence contracts for and stronger links with academic institutions, cementing their dominance during this period. The Strategic Defense Initiative, Reagan's headline project, was technologically immature and thus required a great deal of early-stage research — research that academic institutions were well-placed to perform, and that the administration was keen to spend amply on. In prioritising defence research, Reagan built on earlier links between the military and academia, the latter of which had provided a great deal of technology for the defence realm from World War II onwards.

In this chapter I will explore the context of this period, and show that the priorities of the Reagan administration, rising defence budgets, and the deliberate establishment of the Strategic Defense Initiative as a research programme are key in explaining the dominance of academic institutions within the military-industrial complex of the 1980s.

[249] Sen. J. William Fulbright (1967) "The War and Its Effects" *Congressional Record – Senate* December 13 pS18485

5.1 Data Analysis

My data show a clear peak in the late 1980s for academic institutions in defence research and development contracting, both in terms of the number of contracts and their dollar value. In order to analyse this more clearly, I have taken only the data from 1979 to 1990 and shown this in graph form:

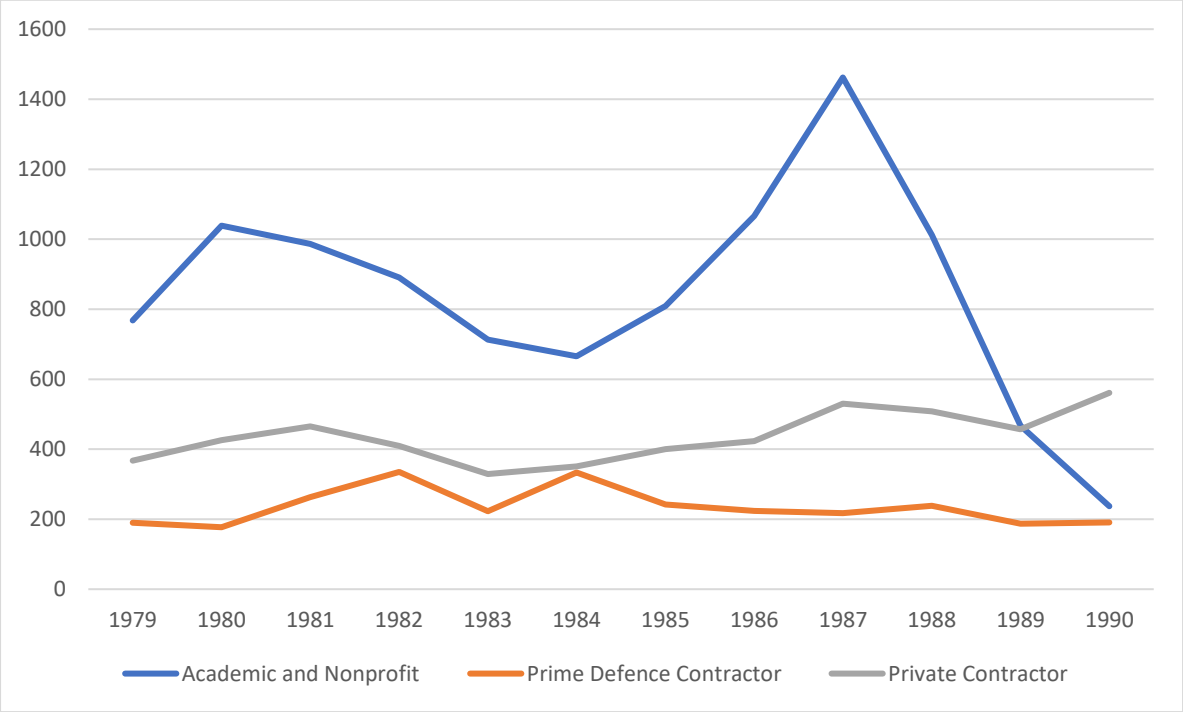


Fig 1: Number of contract actions per year, 1979-1990

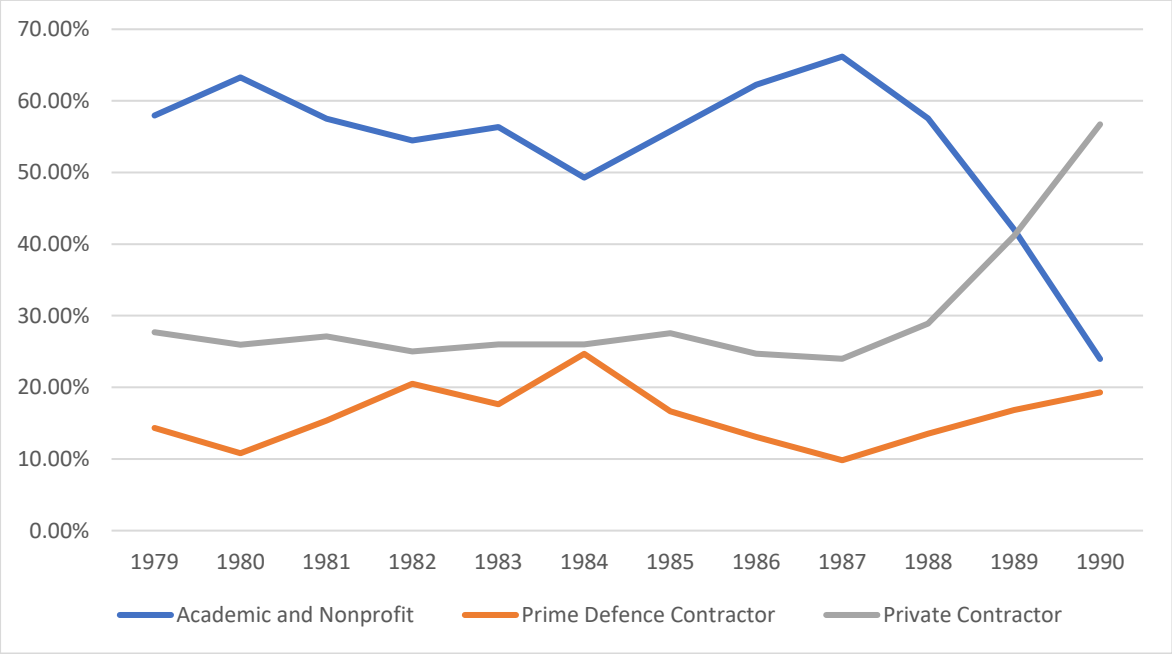


Fig 2: Number of contract actions as percentage of total per year, 1979-1990

If we look at the number of contracts won by academic and nonprofit institutions over this period, their dominance is stark over both private and prime contractors. The clearest peak occurs in 1987, at the height of the Reagan administration and the Strategic Defense Initiative programme. The contracts going to academic institutions tail off sharply from this peak, coinciding with the ending of the Cold War and the mothballing of the Strategic Defense Initiative. While the peak looks particularly stark in the graph showing the raw number of contracts, if we look at these as a percentage of the total number of contracts the picture become more nuanced, with clear academic dominance over the whole decade up until the tailing off moving into the 1990s.

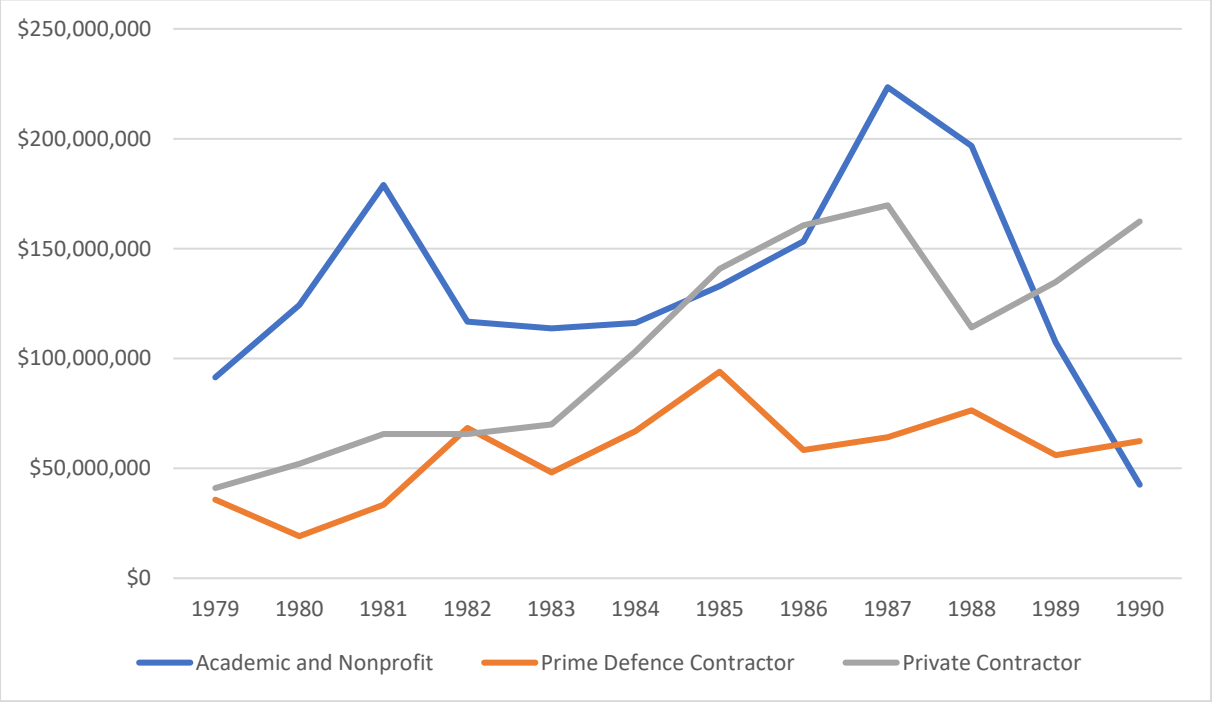


Fig 3: Dollar value of contracts per year, 1979-1990

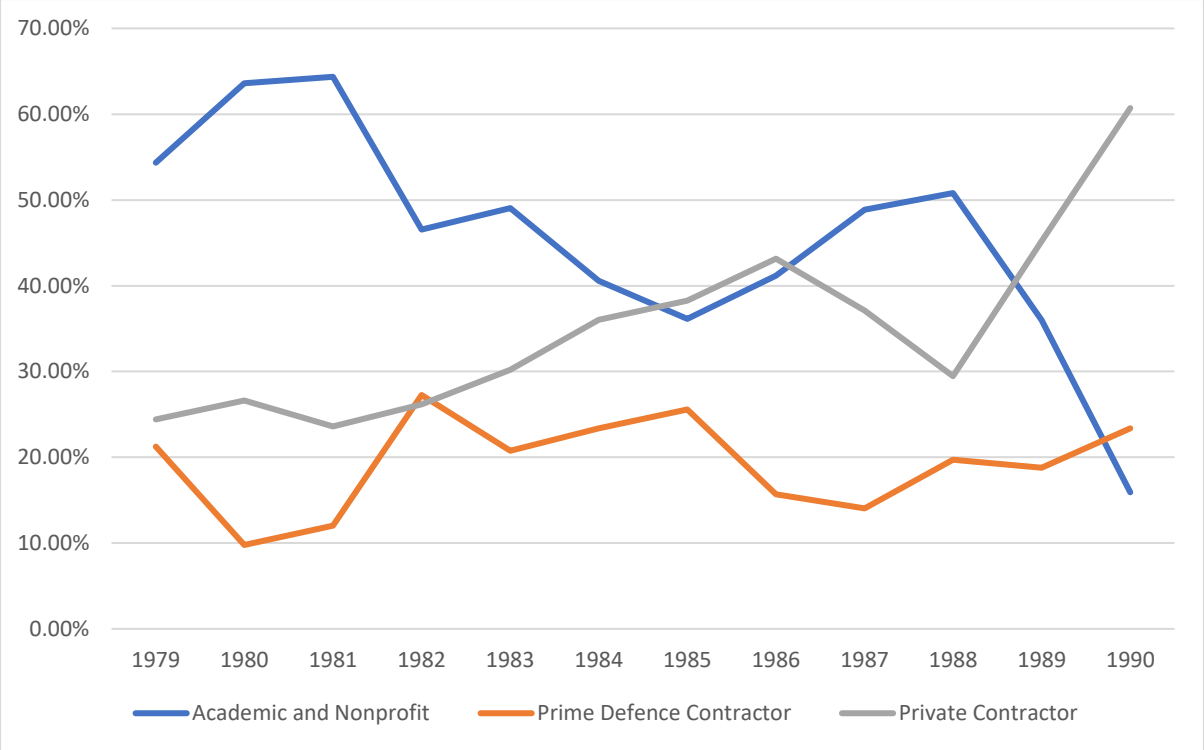


Fig 4: Dollar value of contracts as percentage of total per year, 1979-1990

When looking at dollar value, the dominance of academic institutions remains, with the clear peak in 1987, but the private contractors appear to be much closer. Given the comparison with the number of contracts, this would suggest that while private contractors were winning fewer contracts, those they did get were of a higher individual dollar value. However, the academic institutions remain ahead for the majority of the years nonetheless. This data set also shows most clearly that the decline of academic institutions towards 1990 was to the benefit of these private contractors, with a sharp uptick going into the new decade.

5.2 Historical Context

In order to explore the reason for the dominance of academic and nonprofit institutions during this period, it is important to look further back and identify the relevant trends leading into the 1980s.

In the years following the end of World War II, the Department of Defense became the largest single patron of science in the United States. The federal government believed that high technology would offer a valuable competitive advantage over the Soviet Union and invested heavily not only in engineering and the physical sciences, but also in many of the social and natural sciences. The wartime peak in spending for defence research and development was fifty times higher than pre-war levels but spending by the end of the Korean War had surpassed even this. The shock of Sputnik only added to the demands for more technology research, and defence research and development spending reached $5.5

billion ($56.7 billion today) a year by 1960. Throughout the 1950s, the Department of Defense accounted for around 80 percent of the federal research and development budget. As Stuart Leslie explores, the Cold War (and this decade in particular) redefined American science and its relationship with the government.[250]

The Vietnam War sapped the strength of the U.S. military, and defence budgets and procurement dropped dramatically following its end to their lowest levels since the late 1940s. The American public were tired of overseas conflicts — this war weariness spread through the national press and into Congress, forcing defence spending down in every year of the Nixon and Ford administrations. Furthermore, the end of the draft and a period of pay rises for the newly all-volunteer armed forces left fewer dollars in the defence pot for research or procurement. During this period of what Jacques Gansler calls "unilateral disarmament"[251] from 1968 to 1975, the defence industrial base significantly deteriorated. While the bigger contractors were able to stay afloat, often by selling to American allies abroad, many of the smaller companies either went under or left the defence market. Ben Martin notes that it is difficult to conclude whether this was a policy of deliberate neglect or simply a period of unavoidable decline given this context.[252]

Soviet military power, in contrast, appeared ascendant — the Soviet Union both outspent the United States and substantially improved its forces during this period.[253] While it is always difficult to compare spending between the two, the military investment figures do show a dramatic shift: while American and Soviet investment levels were roughly equal in 1970, by the end of that decade the Soviet Union was investing almost twice as much as the United States in its military procurement and research and development.[254] The growing sophistication of Soviet military technology was a particular concern, as summed up by the Department of Defense itself:

> While the United States continues to lead the USSR in most basic technologies, the gap continues to narrow in the military application of such technologies. Increasingly, the incorporation of critical Western technologies is permitting the USSR to avoid costly R&D efforts and to produce, at a much earlier date than would

[250] Leslie, Stuart W (1993) *The Cold War and American Science: The Military-Industrial-Academic Complex at MIT and Stanford* (New York: Columbia University Press)
[251] Gansler, Jacques (1982) "Can the Defense Industry Respond to the Reagan Initiatives?" *International Security* 6(4) p104
[252] Martin, Ben L. (1985) "Has There Been a Reagan Revolution in Defense Policy?" *World Affairs* 148:3 pp173-174
[253] Mahnken, Thomas G. (2008) *Technology and the American Way of War Since 1945* (New York: Columbia University Press) p123
[254] Martin (1985) p173

otherwise be possible, Soviet weapons comparable to or superior to fielded US weapons.[255]

The United States increasingly recognised that the Soviet Union had increased both the size and the sophistication of its armed forces — not just modernising its strategic nuclear arsenal, but also implementing changes in doctrine and expanding investment for its conventional forces.[256] As Bacevich notes, "the Soviet 'other' provided both focus and a sense of urgency to their campaign of military revitalisation."[257]

5.3 Carter and Reagan

During his 1976 presidential campaign, Jimmy Carter spoke of cutting more from the defence budget, and he delayed or cancelled several defence programmes upon his election. However, events during his term (including the Iranian hostage crisis and the Soviet invasion of Afghanistan) convinced him that more defence spending was needed, and real defence spending rose by 12 percent over the four years he was in office. The Carter administration also developed the "offset strategy," led by Secretary of Defense Harold Brown, which aimed to use advanced technology to counter the Soviet Union's numerical advantage. This made explicit one of the central planks of American defence planning in the last half-century: that the United States could give its forces a significant edge on the battlefield through a lead in technology, while countering the Soviet lead in heavy industry. It is here that we see the beginnings of serious defence investment in modern electronics and computing to increase the effectiveness of American forces, as well as stealthy weapons platforms and electronic countermeasures designed to render the Soviet equipment stockpile obsolete.[258]

The Republican presidential challenger, Ronald Reagan, seized upon the Iranian hostage crisis and the Soviet invasion of Afghanistan, turning widespread disquiet about American standing in the world to his electoral advantage. He campaigned hard on the perception of a weakened America, asserting that underfunded defence budgets throughout the 1970s had undermined the nation and increased the threat from the Soviet Union. He portrayed Carter as soft on defence: "In military strength we are already second to one: namely the Soviet Union."[259] This meant that issues of defence and foreign policy were high on the agenda

[255] Department of Defense (1984) *Soviet Military Power* (Washington, DC: Department of Defense) p105
[256] Korb, Lawrence J. and Brady, Linda P. (1984) "Rearming America: The Reagan Administration Defense Program" *International Security* 9:3 p11
[257] Bacevich, Andrew (2005) *The New American Militarism: How Americans Are Seduced By War* (New York: Oxford University Press) p45
[258] Mahnken (2008) pp123-124
[259] Reagan, Ronald (1980) quoted in Stubbing, Richard (1985) "The Defense Program: Buildup or Binge?" *Foreign Affairs* 63(4) p851

during the 1980 election campaign,[260] and the public were very aware of the differences in position between the two candidates: polling at the time showed that more people correctly characterised the relative approaches of Carter and Reagan on defence spending than on any other issue, and about a third saw foreign policy and defence as the nation's most important problem. Carter had seemingly failed to protect the national interest as commander-in-chief, and this failure "persuaded Americans that the enfeebled state of the armed services had become intolerable."[261] During the campaign season, the percentage of the public favouring defence spending increases grew to outnumber by 40 percentage points the number who wanted decreased spending.[262]

This strong electoral challenge from the more hawkish Reagan meant that the last year of Carter's term saw him approve plans for 5 percent annual real growth in the defence budget in FY1981–FY1986.[263] This sharp rise at the tail end of the Carter administration lessens the contrast to Reagan's eventual budget decisions, and these projections suggest that in a second term Carter would have been likely to approve defence spending increases at least in line with those that his opponent put into place.

5.4 The Reagan Administration

During Reagan's first term as president, exploiting the American technological edge to compete with the Soviet Union became explicit policy:

> The US must modernize its military forces – both nuclear and conventional – so that Soviet leaders perceive that the US is determined never to accept a second place or a deteriorating military posture. Soviet calculations of possible war outcomes under any contingency must always result in outcomes so unfavourable to the USSR that there would be no incentive for Soviet leaders to initiate an attack. The future strength of US military capabilities must be assured. US military technology advances must be exploited, while controls over transfer of military related/dual-use technology, products, and services must be tightened.[264]

As Reagan's assistant secretary of defense, Lawrence Korb, wrote in 1984, "there existed a near-term requirement to improve readiness and sustainability in order to be prepared to deter aggression in the immediate future."[265] If deterrence failed and the Soviet Union

[260] Torres-Reyna, Oscar and Shapiro, Robert Y. (2002) "Trends: Defense and the Military" *The Public Opinion Quarterly* 66:2 p280
[261] Bacevich (2005) p105
[262] Bartels, Larry M. (1991) "Constituency Opinion and Congressional Policy Making: The Reagan Defense Build Up" *The American Political Science Review* 85:2 p459
[263] Martin (1985) pp174-175
[264] National Security Decision Directive 75 (1983) "US Relations with the USSR" January 17
[265] Korb and Brady (1984) p14

attacked, the United States had to be prepared to respond in the most appropriate way, and to fight for as long as necessary. The Reagan administration recognised that the extended period of lower defence spending under previous administrations had led to shortfalls in the quantity and quality of equipment provided to serving personnel, leading some defence officials to view the U.S. Army as a "hollow" force.[266] However, there was also a longer-term requirement to invest in modernisation,[267] which placed a premium on areas such as research and development. As Stephen Kirby noted, this focus was obvious even a few months into Reagan's first term:

> President Reagan is committed to more for defence though he has not yet settled upon either specific weapons systems, or a long-term defence policy. However, funds have been requested for research and development work on a remarkably wide range of weapons including laser battle stations in space, nerve gases and several types of ballistic missile defence.[268]

This period also saw the shift from the Carter administration's Active Defense doctrine towards a more offensive version known as "AirLand Battle," set out in the 1982 edition of Army Field Manual 100-5. This emphasised the role of offensive action, abandoning the previous focus on direct-fire engagements in favour of strikes deep behind enemy lines — this was built on a more assertive type of deterrence, envisioning taking the war to Soviet territory from the outset.[269] This new doctrine drove the need for development of a new generation of sensors and weapons that would warn of attack, identify forces deep within Soviet territory, and strike them at long range, as well as a command and control system to link these parts together smoothly.

This shift in priorities, coupled with the strong electoral basis for increasing defence spending, led to significant increases in the defence budget over Reagan's first term. Less than two months after taking office, Reagan's secretary of defense, Cap Weinberger, submitted a five-year defence spending plan to Congress that called for expenditures of $1.5 trillion — by FY1985 the defence budget would be $286.8 billion, double that of the last year of the Carter administration. Before 1980, the peacetime defence budget had never increased in real terms for more than three consecutive years,[270] but Weinberger's plan broke this

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[266] Ibid.
[267] Posen, Barry and Van Evera, Stephen (1983) "Defense Policy and the Reagan Administration: Departure from Containment" *International Security* 8(1) p14
[268] Kirby, Stephen (1981) "Reagan, Congress and National Security" *The World Today* 37(7/8) p271
[269] Mahnken (2008) pp128-129
[270] Korb, Lawrence J. (1987) "Spending without Strategy: The FY 1988 Annual Defense Department Report" *International Security* 12:1 p166

norm. Taking the late increases during the Carter administration into account, by the end of Reagan's first term the defence budget would have increased for six consecutive years.

As Mark Kamlet and his co-authors show in their work, Reagan's first-term budget priorities are a significant departure from those of previous post-war administrations — defence spending was higher and spending on controllable domestic programmes was lower than would otherwise have been.[271] Their model highlights the stability of aggregate budgetary priorities from Eisenhower through to Carter, and a dramatic departure under Reagan. They also note that previous administrations had not allowed defence spending to rise because they had also cut taxes, whereas Reagan moved away from this logic — he built up substantial budget deficits by both cutting taxes and increasing the defence budget.[272]

Despite these looming deficit increases, Congress strongly supported Reagan's defence increases, voting through these substantial planned rises; the representatives and senators could not ignore the strong constituency demand for increased defence spending that had been made apparent during the 1980 election campaign, and members of the new Republican majority in the Senate had a particular gratitude to Reagan for inspiring down-ticket votes in their states. Larry Bartels finds that this constituency demand added around 10 percent (almost $17 billion) to the total FY1982 defence appropriation — he only attributes less than $1 billion of this to district-level competition and similar contexts, finding that the remaining $16 billion in additional spending was due to "across-the-board responsiveness by even the most safely incumbent representatives."[273]

This was an outlier year for the defence appropriations process, and in subsequent years Congress resumed its traditional course of voting sizeable reductions to each request — however, the Reagan administration anticipated this and included a substantial reserve each year to absorb any reductions. Even though these cuts went through, therefore, they made no material difference, and Richard Stubbing notes that they simply reflect the awareness amongst representatives and senators that certain parts of the defence budget could be "skimmed off with no repercussions."[274] For example, in 1983 and 1984 Congress cut over $17 billion from the procurement portion of the budget, around 10 percent of the total, but the largest weapons procurement programmes were virtually unaffected — the cuts were absorbed by the inclusion of numerous budget items that could be deferred to later years or reduced in price without affecting their outcomes. Congress therefore appeared to be

[271] Kamlet, Mark S, et al (1988) "Upsetting National Priorities? The Reagan Administration's Budgetary Strategy" *The American Political Science Review* 82:4 p1293
[272] Ibid. p1304
[273] Bartels, Larry M. (1991) "Constituency Opinion and Congressional Policy Making: The Reagan Defense Build Up" *The American Political Science Review* 85:2 p457
[274] Stubbing, Richard (1985) "The Defense Program: Buildup or Binge?" *Foreign Affairs* 63(4) p849

trimming the defence budget, while the Department of Defense ended up with substantial increases in funding nonetheless.

These halcyon years came to an end in 1985 with the passing of the Gramm-Rudman-Hollings Act, which was intended to deal with the large structural budget deficits that Reagan had been accumulating throughout his first term, and the political stalemate that had emerged between the president and Congress about what to do. While the share of gross national product devoted to defence had increased from 5 to 6.4 percent, the Reagan administrations tax cuts reduced the revenue share of gross national product by 5 percent, and despite Weinberger's attempts to convince Congress that the Department of Defense had succeeded in getting its money's worth from prior budget increases, there was a widespread suspicion that he was simply throwing money at the matter without a strategy in place.[275]

Reagan refused to cut defence spending or raise taxes; Congressional Democrats refused to cut low-income programmes or other domestic controllable programmes; and neither wanted to cut middle-class entitlements. The Act sought to break this deadlock by instituting politically unpalatable consequences for inaction. If the two sides did not agree on a budget that came close to the Act's deficit target within the specified timescale, the target would be met by forced sequestration: automatic cuts drawn equally from the defence budget and certain domestic programmes.

In their excellent analysis of the Act's effects, Sung Deuk Hahm and his co-authors show that while it did constrain defence spending, with the Department of Defense budget as a share of gross national product declining almost to its pre-Reagan level by FY1989, of all the military spending categories only the research, development, testing, and evaluation section bucked this trend and increased over that period, although much of the spending here was a "bow-wave" effect created by the multiyear consequences of the dramatic budget increases earlier in the decade.[276] This section of expenditure normally takes up around 10 percent of the Department of Defense budget, and is the smallest of the main categories — the bulk of the budget goes to procurement, personnel costs, and operations and maintenance. Alex Mintz splits these categories into purchase (procurement and research, development, testing, and evaluation) and operating costs (personnel and operations and maintenance), and shows that the Reagan administration heavily prioritised the former: over 55 percent of the growth in defence spending between FY1982 and FY1986 went towards either the procurement of or

[275] Korb (1987) pp168-169

[276] Hahm, Sung Deuk, et al (1992) "U. S. Defense Spending under the Gramm-Rudman-Hollings Act, 1986-1989" *Public Administration Review* 52:1 pp11-12

development of new weapons systems.[277] Korb and Brady note that the funding for research, development, testing, and evaluation specifically rose by around 69 percent during this period, reflecting the Reagan administrations priorities in deterring the Soviet Union, as explored above.[278] Adams calls this "an investment-driven defense budget" and notes that the Reagan administration took the increases in the final Carter budget plan and went even further, particularly on weapons systems, adding to the "bow-wave" of spending committed once research and development programmes are approved and require funding for testing and production.[279]

Colin Norman highlights the military "shift in the center of gravity" within research and development budgets overall — by the end of Reagan's tenure, defence programmes had expanded from half to two-thirds of the entire federal research and development budget, while funding for civilian research and development programmes barely kept pace with inflation. He also notes that the lion's share of these defence increases was taken by the development of specific weapons systems, which accounted for more than 90 percent of the defence research, development, testing, and evaluation budget during the 1980s.[280] Leslie Roberts also explores this shift towards the military, as does Laura Tangley — both quote Reagan's science advisor, George A. Keyworth, as explaining that rapid research and development funding increases were specifically channelled to defence.[281]

5.5 Academic Institutions

Academic institutions had considerable predominance during the late 1980s, gaining more contracts than either the prime defence contractors or smaller private companies. In order to be able to place this in context, we must look at how and why the federal government and academic institutions had such close links.

Federal support of research activities at American academic institutions has a long history. While state sponsorship of academic research projects can be found as far back as the Reconstruction era after the end of the Civil War, it is not until the military build-up just before the start of World War II that we see defence funding channelled to specific research

[277] Mintz, Alex (1989) "Guns Versus Butter: A Disaggregated Analysis" *The American Political Science Review* 83:4 p1290
[278] Korb and Brady (1984) pp15-16
[279] Adams, Gordon (1986) "Defense Choices and Resource Constraints: The Dilemma of the Investment-Driven Defense Budget" *Yale Law & Policy Review* 5(1) p14
[280] Norman, Colin (1981) "Reagan Budget Would Reshape Science Policies" *Science* 211:4489 p1399, and Norman, Colin (1990) "Defense Research After the Cold War" *Science* 247:4940 p272 – the former of these pieces predicted such shifts, and the latter shows he had been correct to do so.
[281] Roberts, Leslie (1983) "Reagan's 1984 Budget: R&D Would Rise 17 percent, but Defense Gets the Lion's Share" *BioScience* 33(4) p240; Tangley, Laura (1984) "Reagan's 1985 Budget: R&D up, but Life Sciences Lose out Again" *BioScience* 34(4) p214

projects at universities. President Franklin D. Roosevelt created the Office of Scientific Research and Development by executive order in June 1941 to ensure "adequate provision for research on scientific and medical problems relating to the national defense."[282] The Army, Navy, Marine Corps, and Army Air Corps all saw the need to accelerate the advancement of their technological capabilities to successfully fight the Axis powers, and this meant taking advantage of the best research and engineering talent found in the laboratories and research facilities of the nation's academic institutions.[283] The degree to which American defence research and development was undertaken in universities set the United States apart from other nations, where much of this kind of work was instead done either in government installations or private laboratories. Furthermore, this departed from the American approach during World War I, when academic researchers were given military commissions and absorbed into one of the services rather than funding being directed into the academic sector.[284]

These partnerships, managed by the Office of Scientific Research and Development, led to substantial advances in technologies such as radar, proximity fuses, and long-range aircraft, as well as the atomic bomb. Given these successes stemming from government investment in research and development, Roosevelt wrote to Vannevar Bush, the director of the Office of Scientific Research and Development, in 1944 asking for his recommendations on what more the government could do to facilitate the future of America's scientific enterprise. Bush submitted his report on this question in July 1945 to Roosevelt's successor, President Harry S. Truman, in which he argued for an expanded federal role in supporting both research programmes and scientific talent to meet the needs of the nation, including to ensure America's "security as a nation in the modern world" and "means of defense against aggression."[285]

The war-winning technological wizardry coming out of academic institutions meant that many of the often *ad hoc* arrangements between the military and academia created in this period became more formalised following the end of World War II.[286] The military had been shaken by the "wonder weapons" of the war, and realised the power of the contract to deliver them, so wanted to extend the wartime model of cooperative research, drawing up detailed

[282] Roosevelt, Franklin D. (1941) Executive Order 8807 "Establishing the Office of Scientific Research and Development" June 28
[283] Delauer, Richard D. (1989) "The Good of It and Its Problems" *The Annals of the American Academy of Political and Social Science* vol. 502 p131
[284] Abrams, Richard M. (1989) "The U. S. Military and Higher Education: A Brief History" *The Annals of the American Academy of Political and Social Science* vol. 502 pp20-21
[285] Office of Scientific Research and Development (1945) *Science: The Endless Frontier* [Washington, DC: Department of Defense]
[286] Wilson, David A. (1989) "Consequential Controversies" *The Annals of the American Academy of Political and Social Science* vol. 502 p41

plans. Rather than demobilising the wartime academic laboratories, the military picked many of them up under fresh contracts — the Navy took the Johns Hopkins Applied Physics Laboratory and the Army took Caltech's Jet Propulsion Laboratory, for example.[287]

Mounting tensions with the Soviet Union as the Cold War began meant that military research and development budgets did not fall much from their wartime peaks, but the outbreak of the Korean War in 1950 saw the cementing of the military-academic partnership. Defence research and development funding flooded into academic contracts for applied research, and the military also established entirely new laboratories under university management — including the Massachusetts Institute of Technology's Lincoln Laboratory, Berkeley's Lawrence Livermore Laboratory, and Stanford's Applied Electronics Laboratory. This period also saw the creation of the Advanced Research Projects Agency, and the enhancement of the existing research management organisations within the individual service branches, particularly the Office of Naval Research and the Air Force Office of Scientific Research.

During the Vietnam War, growing anti-war sentiment and student protests on campuses around the country led to some faculty members objecting to military-funded classified research taking place within their institutions.[288] Many universities began to adopt policies that precluded any more of such research being done on campus, although they did not tend to ban individual faculty members from taking part in projects of their own volition. Some laboratories reacted to this by disengaging themselves from military research (such as Caltech's Jet Propulsion Laboratory moving towards doing work for NASA rather than the Department of Defense), whereas others wanting to keep their military contracts instead were divested from their parent universities (such as the Lincoln Laboratory becoming independent of the Massachusetts Institute of Technology). This was coupled with a reduction in funding for research contracts by the Nixon administration, due to what Richard Delauer calls a "lack of regard" for the importance of technical research, and it was not until the Ford and Carter administrations that funding returned to a more normal level.[289]

Following Reagan's election to the presidency, and in the context of the rapid defence funding increases and the desire for advances in military technology explored above, the Department of Defense recognised that the relationship between the military and academia needed to be reestablished to improve the flow of knowledge and collaboration. The

[287] Leslie (1993) pp7-8
[288] For an in-depth exploration of these events, see Kaysen, Carl (1989) "Can Universities Cooperate with the Defense Establishment?" *The Annals of the American Academy of Political and Social Science* 502
[289] Delauer (1989) p134

department commissioned 16 reports into the technology base over a number of years, and many of these recommended stronger links between the Department of Defense and universities.[290] The recommendations were often stated very broadly and included provisions for collaborative projects between the Department of Defense, universities, and industry, and provisions for better exchange of knowledge and personnel among the three sectors. Some recommended better funding for research and development, and others gave specific recommendations for improving relations, including the creations of additional university-based centres of research and development excellence, the awarding of more graduate fellowships, and work to enhance dialogue to resolve the tension between the advantages of open scientific communication and the necessities of security and classification of results in the national interest.

Perhaps the most specific of these was the so-called "Bennett report"[291] produced by a Defense Science Board task force that had been commissioned to look specifically at how universities were responding to the national security requirements of the United States. The Defense University Research Instrumentation Program was created in 1983 as a result of the report's recommendations, providing $150 million over five years for university research equipment. The report also led to the creation of the Department of Defense–University Forum, cochaired by the Under Secretary of Defense for Research and Engineering and a selected university president, which met quarterly for nearly three years. This forum had the participation of almost every academic institution that had showed interest in being involved in military research, as well as the endorsement of most of the nation's higher education industry organisations. Delauer notes that the forum was successful in improving trust between the defence establishment and academia and did a great deal to reconfirm the previous mutual interdependence of the two in research endeavours, proving that not all universities retained a desire to disengage from military research and the funding that went with it.[292]

The largest disagreement was over classification: Department of Defense officials of a more military bent had tended to overcompensate and classify every project funded by defence monies, whatever its contents or direction, whereas other officials with a more technical research and development background argued that a large proportion of these projects were in fact basic research and did not warrant secrecy in the publication or dissemination of their results, a position that the academic institutions tended to agree with. The latter group won

[290] For a summary of these, see Cattoi, R. L. (1987) *Historical Perspectives: A Review of Studies of the Department of Defense Science and Technology Program* (Washington, DC: White House)
[291] Department of Defense (1982) *Report of the Defense Science Board Task Force on University Responsiveness to National Security Requirements* (Washington D.C.)
[292] Ibid. pp136-137

out, and Reagan issued a policy directive stating that military research conducted by universities should be unclassified unless specifically excepted at the project's initiation, giving the university a fully informed choice whether to take the contract and allowing their faculty to publish their results.[293]

The Department of Defense also created its University Research Initiative, which included funding not only for new equipment at academic institutions but also for sabbaticals for faculty to either start or take forward their research project at federal defence laboratories.[294] This went a long way to fostering a collaborative working relationship between the Department of Defense and the academic institutions, reestablishing the kind of interdependence last seen in the 1940s and 1950s. The Reagan administration recognised that this period had been a fruitful one for military technology and wanted to harness the research skills of the nation's academics in the unregimented and multidisciplinary environments of universities. Confining research contracts to federally owned facilities unnecessarily limited the available talent pool, particularly given that many talented researchers chose universities over federal laboratories so they could teach — not to mention that academic faculty tended to be cheaper than researchers than those who were government employees.

5.6 Federally Funded Research and Development Centers

Federally Funded Research and Development Centers (FFRDCs)[295] have been an important part of the defence research and development landscape since World War II, augmenting the military's in-house research efforts. They are research and development institutions that are exclusively or substantially funded by an agency of the federal government, but are different to federal laboratories in that they are not subject to civil service regulations — despite being placed under some budgetary and personnel controls by their sponsoring agency and/or Congress, each FFRDC is essentially run like a private corporation. Their management was primarily based on the Office of Federal Procurement Policy Letter 84-1 and implemented via section 35.017 of the Federal Acquisitions Regulations.[296] The policy mandates that an

[293] Ibid. pp137-138
[294] Abrams (1989) p24
[295] For an in-depth exploration of FFRDCs, see Congressional Research Service (1987) *The Strategic Defense Initiative Institute: An Assessment of DoD's Current Proposal* (Washington D.C.); Office of Technology Assessment (1995) *A History of the Department of Defense Federally Funded Research and Development Centers* (Washington D.C.); and Dale, Bruce C. and Moy, Timothy D. (2000) *The Rise of Federally Funded Research and Development Centers* (California: Sandia National Laboratories)
[296] OFPP Letter 84-1 was rescinded in 2000, as it was felt that the FAR regulations on FFRDCs were sufficient by themselves. See https://obamawhitehouse.archives.gov/omb/fedreg_policyltrs/

FFRDC should only be established if the sponsoring agency cannot accomplish the activity in house, through other government agencies, or via normal procurement procedures.

Many FFRDCs either had direct links to academic institutions or had been created from laboratories that had been divested by their parent universities. Between 1942 and 1963 the Department of Defense established 39 FFRDCs, at a time when the federal government was unable to attract the talented personnel needed to perform in-house military research, due in large part to offering lower salaries than the private sector with slow and bureaucratic hiring procedures. While such talent was available in industry, the Department of Defense preferred to use FFRDCs to provide technical expertise rather than contract with these private companies, given their strong vested interests in promoting programmes that would lead to lucrative production contracts further down the line. While their numbers have fluctuated over the years since, due to closures, mergers, and new creations, the Department of Defense has continued to support a variety of FFRDCs specialising in the key technology areas of the day. During the late 1980s, the department sponsored nine FFRDCs, including the Lincoln Laboratory at the Massachusetts Institute of Technology. Ronald Moe notes that the fall in number of FFRDCs does not necessarily mean closure: "Some FFRDCs have ceased to be listed, although not all those unlisted have ceased to exist; in several instances they have become private organizations."[297]

FFRDCs have some recognisable advantages over other structures. As they are not constrained by the salary and promotion system used within the civil service, they can attract talented personnel with competitive pay, avoiding the problems with staff hiring and retention in federal laboratories highlighted by the Packard Commission report.[298] Their lack of links with private industry means that conflicts of interest do not arise between picking winners in the research stage and lucrative production contracts later on. A close relationship between the FFRDC and its sponsoring agency not only means that it does not have to compete for funding, but also that the agency can build strong communication links to get the best out of the centre's personnel and ensure that priorities are met quickly.

However, these factors also have downsides. The secure funding source may mean that an FFRDC has no incentive to control its costs, which could make it an expensive option once the higher staff salaries are also taken into account. A sponsoring agency may use one of its FFRDCs for new work given their relationship, even when the work could be done better or

[297] Moe, Ronald (2001) "The Emerging Federal Quasi Government: Issues of Management and Accountability" *Public Administration Review* 61(3) p295

[298] President's Blue Ribbon Commission on Defense Management (1986) *A Quest for Excellence: Final Report to the President* (Washington D.C.)

more cheaply in another institution or via a private contract.[299] These closely intertwined relationships also make accountability difficult; if a decision on a research and development programme is made by an FFRDC rather than by the federal agency's officials, it is more difficult for Congress or others to scrutinise the process, and the FFRDC personnel are not subject to the rigours of peer review as are their colleagues in universities.[300]

The reliance of Reagan's Defense Department on FFRDCs can be seen through the actions of the Senate Appropriations Committee in the last years of his second administration. In 1990, the committee noted that funding from the Department of Defense to FFRDCs had grown substantially since 1985, even though the overall defence budget had fallen over the same period, and the budget request for FFRDC funding was cut.[301] In their report on the FY1991 budget request, the committee members highlighted that both employee numbers and salary costs had risen at a time when the same was not true of other federal defence staff: "The FFRDCs and their employees should adjust to defense spending constraints — and to the likely contraction in the defense infrastructure — just as the Department of Defense and its military and civilian personnel are required to do so." The report also stated that FY1987 had been the "high point" for defence research and development funding, and that the committee felt that the reduced amount was "a more acceptable level of support for the FFRDCs."[302] The committee also cut the amount allocated for FFRDCs in FY1992 and FY1993, for similar reasons.[303]

Steven Pearlstein explores the particular problem of interlocking directorships, a microcosm of the military-industrial complex. In a 1991 piece for the *Washington Post*, he enumerates 17 directors of FFRDCs who also served on the boards of prime defence contractors — for example, former Secretary of Defense Frank Carlucci was at that time a director of both the RAND Corporation, an FFRDC that advised the Department of Defense on the procurement of the F-22 Raptor, and of General Dynamics, one of three defence companies involved in manufacturing the same aircraft.[304] Pearlstein calls FFRDCs a kind of "shadow Pentagon," operating away from the oversight of both the public and of Congress despite receiving their funding from federal sources. He argues that congressional unease about this led to calls for

[299] Moe (2001) p296
[300] Hruby, Jill M., Manley, Dawn K., Stoltz, Ronald E., Webb, Erik K., and Woodard, Joan B. (2011) "The Evolution of Federally Funded Research and Development Centers" *Public Interest Report* 64(1) p25
[301] "Aerospace Corp., Lincoln Labs, Mitre would be hardest hit: Committee wants to cut $197 million from Federal Research Center budget" (1990) *Inside the Pentagon* 6(42) pp1-2
[302] Senate Committee on Appropriations (Subcommittee on Defense) (1990) *Department of Defense appropriations for fiscal year 1991: hearings before a subcommittee of the Committee on Appropriations, United States Senate, One Hundred First Congress, second session* (Washington D.C.: U.S. G.P.O.)
[303] "Senate Appropriations Bill Tightens Reins on FFRDC Funding, Oversight" (1992) *Inside the Pentagon* 8(39) p11
[304] Pearlstein, Steven (1991) "Reining in Pentagon's Think Tanks" *Washington Post* July 2

their funding to be cut and interlocking directorships to be banned — although he also attributes this, ironically, to lobbying from private consulting firms that felt they were losing out on federal contracts to favoured FFRDCs taking advantage of uncompetitive bidding and links with the federal establishment, despite these consulting firms having similar ties with large defence companies that had also resulted in accusations of conflicts of interest.

5.7 Where Did Academic Contracts Go?

When looking at the contracts issued for research and development in the 1980s, there is a clear trend towards the dominance of academia, but in order to get a clearer picture of the period we must drill down further into the data. A predominance of contracts clearly fell to academic institutions, but which ones? Did certain institutions have a significant lead over their counterparts in winning these research and development contracts over the period?

To explore this, I took the data for the 1980s period and parsed out the contracts that had gone to academic institutions, and then coded these by institution. While many universities and institutions were represented within the data, with a wide range winning substantial contracts at various points during the decade, when looking at the top institutions there are four that show a clear dominance within the military research and development field: the University of California, Stanford University, the University of Southern California, and the Massachusetts Institute of Technology (MIT). The graph below shows the data for the top 30 institutions by dollar value of contracts won:

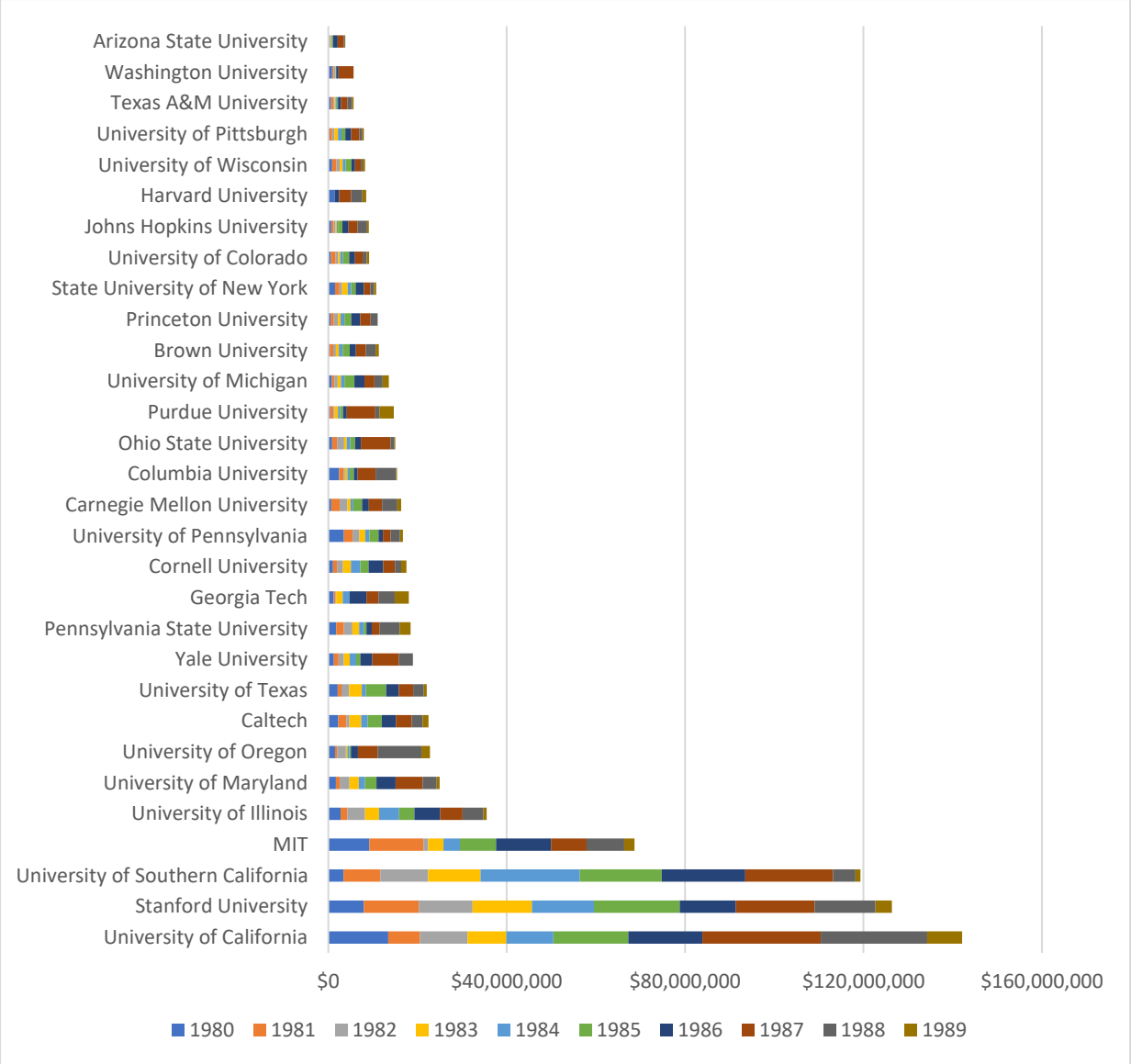

Fig 5: Dollar value of contracts per institution per year, 1980s, top 30 institutions

The dominance of the top four is stark, with no other institutions coming close to the value of their contracts — while there is a cluster of universities with roughly similar footprints below them, the top four race ahead. Furthermore, while all of the institutions show an increase in contracts during the peak period of 1986–1989, the top four had a healthy contracting history before this that outstrips their competitors — if one looks just at the 1980–1985 portion of the graph, the difference is distinct. The story of the top four from this data is one of a consistent dominance of military research and development contracts throughout the decade, as opposed to the more common narrative among the other universities of a distinct increase towards the middle and end of the period.

Why these four institutions in particular? What was it about them that made them so predominant in military research and development contracts in this period? There are two

distinct geographical clusters here, one around the Massachusetts Institute of Technology and one in California[305] — Leslie names these the "Massachusetts Miracle" and "Silicon Valley Fever."[306] In order to gauge what led to the supremacy of these two areas, we must explore their context more deeply.

5.8 Silicon Valley Fever

The state of California has a long history of technological research, even before the Silicon Valley ecosystem we know today came to the forefront. Allen Scott notes that California has been an important contributor to military research and development and production, identifying a series of "technopoles" running the length of the state (comprising high-tech industrial clusters and research centres) in which "the U.S. military-industrial complex has found its most advanced and dense regional expression" since the end of World War II.[307] An early focus on aviation technology in the state was consolidated into a proper industry during the war, with its consequent need for both research and development and production in the fields of aeronautics and electronics.

Although founded in 1885, Stanford University only truly moves into this narrative with its partnership with Lockheed in the early 1950s. Lockheed moved its missile systems division from Van Nuys to a large Silicon Valley site at Sunnyvale and built a research laboratory for advanced studies in missiles and unmanned aircraft on a 22-acre site in the newly created Stanford Industrial Park. While Stanford had a great deal of expertise in electronics, including via the Stanford Research Institute, its aeronautical engineering programme was floundering, and Lockheed's managerial team recognised the potential advantages of rebuilding the programme based around its needs. Leslie notes that the partnership "would ultimately change the character and direction of both the company and the university's research"[308] and highlights that "Lockheed had a far greater impact on Stanford than Stanford would ever have on Lockheed."[309] Although Stanford could help to fill some important positions within Lockheed's teams given the technical expertise of its graduates, Lockheed more than returned the favour as a source of adjunct faculty, a participant in various honours programmes, and as the predominant local employer of graduating aeronautical engineers.

[305] The spillover effects of technical research in these two clusters are mathematically modelled in Jaffe, Adam (1989) "Real Effects of Academic Research" *The American Economic Review* 79(5)
[306] Leslie (1993) p254
[307] Scott, Allen J. (1991) "The aerospace-electronics industrial complex of Southern California: The formative years 1940-1960" *Research Policy* 20:5 p439
[308] Ibid. p115
[309] Ibid. p121

Given their close partnership, it is not surprising that Stanford and Lockheed shared a predominant source of growth: military contracts. By the end of 1959, the university had an expanding number of contracts with military agencies like the Office of Scientific Research and the Office of Naval Research, and the aeronautical engineering department increasingly shifted its research and teaching programmes to reflect the specific technical needs of the missile age. The presence of Lockheed provided the catalyst for the growth of an aerospace complex surrounding and intersecting with the Stanford University ecosystem — including the Western Development Laboratories, founded by Philco in 1957 and then further prospering when bought by Ford in 1961. Lockheed and the Western Development Laboratories together provided a nexus for smaller aerospace companies to grow around, and Stanford continued to take advantage of this local talent to keep its own programmes up to date in popular specialities.

Much of Stanford's faculty could thus move easily between academia, industry, and the military. While teaching or supervising graduate students at the university, many of them consulted for Lockheed or the other local aerospace companies, or served on military advisory panels. The Silicon Valley firms also provided a source of talented graduate students as well as a source of employment for those students after they had finished their research degrees. Leslie notes that the Office of Scientific Research saw the Stanford research programmes as an important long term investment, "with the dividends paid in graduate students trained in scientific and engineering fields of special interest to the Air Force and its corporate contractors."[310]

The Silicon Valley area also contained another research behemoth: the University of California, which currently comprises ten campuses and numerous other related research organisations, many of which were either set up or consolidated into the University of California system during the 1960s.[311] Four of these campuses (Berkeley, Davis, San Francisco, and Santa Cruz) are located within the Silicon Valley area. Many of the University of California's faculty and board members have had links to defence and national security organisations over the decades since its founding, including the CIA, the Department of Defense, and the Department of Homeland Security.[312]

Although the three largest laboratories affiliated to the University of California system were sponsored by the Department of Energy (Lawrence Berkeley, Lawrence Livermore, and Los Alamos), as well as NASA's famous Ames Research Center, there was also considerable focus

[310] Ibid. p130
[311] https://www.universityofcalifornia.edu/uc-system/parts-of-uc
[312] Bond-Graham, Darwin (2013) "The University of California and the Military-Industrial Complex" *CounterPunch*, July 18

on military work at the university, including the Naval Biological Laboratory[313] and the research arms of the U.S. Navy's Balboa Hospital.[314] As at other academic institutions, these larger laboratories became the nexus for a system of smaller spin-offs. Roger Geiger notes that the University of California was one of the few academic institutions to invest seed capital from institutional funds to assist in the development of such research units, giving a strong base from which to attract funding and eminent faculty.[315]

The University of Southern California, although based a little further south in Los Angeles, also fed into this research ecosystem. While the university does not sponsor any specifically defence-linked research centres, it made defence contracts a cornerstone of its funding strategy into the 1980s.[316] It is far less clear where these contracts went within the university given the absence of such specific centres during this period, but recent collaboration between its Viterbi School of Engineering and the U.S. Army in the form of the Institute for Creative Technologies[317] would suggest that research and development contracts were directed to some of that department's many laboratories focusing on related areas such as computer science and aeronautical engineering.[318] Leslie also suggests that Lockheed made use of faculty links with the University of Southern California, as the company did with Stanford and the University of California.[319]

5.9 The Massachusetts Miracle

The high-tech industrial cluster in Massachusetts formed around the Massachusetts Institute of Technology and its various research laboratories after the end of the Second World War.[320] Alvin Weinberg, the director of the Oak Ridge National Laboratory, joked in 1962 that it was becoming increasingly hard "to tell whether the Massachusetts Institute of Technology is a university with many government research laboratories appended to it or a cluster of government research laboratories with a very good educational institution attached to it."[321]

The Massachusetts Institute of Technology developed its ties with federal agencies during World War II, when it was the largest university contracting for defence research and

[313] Coddington, D. C. & Milliken, J. G. (1970) "Future of federal contract research centers" *Harvard Business Review* 48(2) p105
[314] https://federallabs.org/labs/naval-medical-center-san-diego-nmcsd
[315] Geiger, Roger L. (1990) "Organized Research Units – Their Role in the Development of University Research" *The Journal of Higher Education* 61:1 pp12-13
[316] Leslie (1993) p256
[317] https://ict.usc.edu/
[318] https://viterbischool.usc.edu/
[319] Leslie (1993) p114
[320] Dorfman, Nancy S. (1983) "Route 128: The Development of a Regional High Technology Economy" *Research Policy* 12
[321] Nelkin, Dorothy (1972) *The Military and the University: Moral Politics at MIT* (Ithaca, NY: Cornell University Press) p24

development and a key source of top scientific advisers for the military. For example, all four non-military personnel on the governing body of the National Defense Research Committee of the Office of Scientific Research and Development were from there.[322]

By the end of the war, the Massachusetts Institute of Technology was the nation's largest industrial defence contractor, and it held a strong position throughout the early Cold War years even when compared with the big defence corporations.[323] Much of this funding went into the institution's interdepartmental laboratories, linking into the growing importance of federally supported laboratories in which research work was closely integrated with national policy goals. These laboratories, numbering around 100 by the late 1960s, became the centrepieces of the post-war Massachusetts Institute of Technology: the Research Laboratory of Electronics, the Instrumentation Laboratory (later renamed the Charles Stark Draper Laboratory after its founder), the Laboratory for Nuclear Science and Engineering, the Lincoln Laboratory, and their many spinoffs.[324]

The two largest were the Instrumentation Laboratory and the Lincoln Laboratory, which together accounted for just over half of the Massachusetts Institute of Technology total budget — the former was funded by individual contracts from agencies attached to the Department of Defense and NASA, while the latter was a Federal Contract Research Center and received fixed annual core funding from the Department of Defense.[325] Its faculty continued to sit on scientific advisory boards for the Air Force, Army, and Navy, as well as consulting for a range of private military contractors like Lockheed.[326] Geiger notes that the research funds that the Massachusetts Institute of Technology gained from federal sources gave rise to and supported "far larger and more prestigious departments than instruction *per se* could ever have justified."[327]

5.10 Divestments

All four of these institutions saw campus protests in the late 1960s, as students demonstrated against the use of academic facilities and personnel for classified military research.[328] As a direct result of these, Stanford University divested the Stanford Research Institute and the Massachusetts Institute of Technology divested the Charles Stark Draper

[322] Ibid. p16
[323] Pursell (1972) p339
[324] Leslie (1993) p15
[325] Nelkin (1972) pp18-19
[326] Ibid. p22
[327] Geiger (1990) p12
[328] For an exploration of the different student movements and their links, see MacLean, Eliza (2015) "A Genealogy of Social Movements in the American West: The Spatial Occupation of the Military-Industrial Complex and its Effects on the Legacy of Activism" *U.S. History Scene*

Laboratory and the Lincoln Laboratory. Each of these laboratories maintained close campus affiliations with their former institutions despite the formal change of status into FFRDCs, as Leslie details, noting that "in every way that mattered, nothing had changed except on paper."[329] All three laboratories had been substantially reliant on military contracts, and this only became more apparent following their divestments. Upon gaining their independence, the laboratories each moved swiftly to the heights of the federal contractor charts, with the bulk of these contracts coming from the Department of Defense and its agencies.[330]

5.11 Case Study: The Strategic Defense Initiative

It is impossible properly to consider the defence context in the 1980s without looking at the Strategic Defense Initiative. The programme dominated research and development spending in the latter half of the decade and was the focus of much of the Reagan administration's defence research and development policy during this period. It was the culmination of the trends explored above, aiming to achieve U.S. hopes to facilitate countering the Soviet Union through technological dominance while relying in a stronger manner on the talents of the researchers and scientists at the country's top academic institutions.

In March 1983, Reagan called for the scientific exploration of the feasibility of defending the United States against Soviet missile attack — a proposal for a Strategic Defense Initiative, labelled "Star Wars" by various detractors. Reagan departed from the strategic orthodoxy of the previous decade, which focused on mutual vulnerability and assured destruction as the basis for deterrence, by asserting the superiority of mutual invulnerability and assured survival.[331] George Keyworth, the president's science advisor, testified to the Senate Foreign Relations Committee that Reagan wished to achieve his goal through research:

> This hope is one which the President challenged both the scientific and arms control communities to bring to fruition. I would remind this distinguished audience that he linked the two inexorably together in his oft-misquoted March 23 speech of last year. I quote: "I am directing a comprehensive and intensive effort to define a long-term research and development program to begin to achieve our ultimate goal of eliminating the threat posed by strategic nuclear missiles. This could pave the way for arms control measures to eliminate the weapons themselves."[332]

[329] Leslie (1993) p250
[330] Ibid. p251
[331] Martin (1985) p178
[332] Senate Committee on Foreign Relations (1984) *Strategic defense and anti-satellite weapons: hearing before the Committee on Foreign Relations, United States Senate, Ninety-eighth Congress, second session, April 25* (Washington D.C.: U.S. G.P.O.) p7

The Strategic Defense Initiative had a much different relationship with the research community than had been the case in previous projects such as the development of anti-ballistic missile systems. It was a defensive strategy that depended on the credibility of new technology. Its systems were little more than concepts at the outset, and many of the technologies involved had not made their way out of the laboratory (or off the back of the envelope).[333] The immaturity of the technology meant that the Strategic Defense Initiative Office established within the Department of Defense had a strong focus on research, and a specific directorate (Innovative Science and Technology) was set up to reach out to academic institutions to perform the needed work.

Given the substantial amount of money that had been put behind the Strategic Defense Initiative, there was considerable interest from universities, although some scientists who shared concerns about the impracticability of the programme organised a boycott of Strategic Defense Initiative-sponsored research.[334] Indeed, some scientists at the time thought that the envisioned systems were impossible, or at least entirely impractical, as well as being unnecessarily provocative to the Soviet Union.[335] However, most institutions got round this as they had done with previous military contracts, by allowing individual faculty members to decide to take part for themselves without the institution taking an official stance on the issue as a whole. As Peter Gollon wrote at the time, although there were disagreements among scholars over whether the Strategic Defense Initiative would practically work:

> … there is much less disagreement among academics and researchers over the desirability of accepting the Pentagon's Star Wars research contracts, despite petitions being circulated at some laboratories and campuses. Indeed, one might conclude from watching the scramble to help the Pentagon spend its money, that Star Wars money is the only research money around.[336]

The controversy did not stop around 3,000 academic researchers submitting grant proposals in FY1984, many of whom worked in institutions that had either never done military research before, or for which these projects represented a substantial increase in their involvement with the defence world.[337] By June of 1985, the Strategic Defense Initiative Office had announced the awarding of long-term contracts to research consortia involving 29

[333] Wilson (1989) p46
[334] Kogut, J., and Weissman, M. (1986) "Taking the pledge against Star Wars" *Bulletin of the Atomic Scientists* 42(1)
[335] See, for example: Bethe, Hans A., et al. (1984) "Space-Based Ballistic-Missile Defense" *Scientific American* 251:4
[336] Gollon, Peter J. (1986) "SDI funds costly for scientists" *Bulletin of the Atomic Scientists* 42(1) p24
[337] Ibid. p26

universities in 16 states, to the tune of $62 million.[338] The office itself also used the awarding of contract funding as a method of proving the programme's legitimacy to Congress, announcing these awards to academic institutions before Congress had even started its deliberations on the programme's overall funding within the FY1986 defence budget. As James Ionson, the director of the Strategic Defense Initiative Office's Innovative Science and Technology Program, said of this approach:

> It's probably something that's never been done. But this office is trying to sell something to Congress. If we can say that this fellow at MIT will get money to do such and such research, it's something real to sell. That in and of itself is innovative.[339]

Academic institutions were not the only beneficiaries of the Strategic Defense Initiative programme. The prime defence contractors had an early seat at the table and were keen to become involved in the Strategic Defense Initiative given the imminent end of lucrative contracts for weapons systems like the Pershing missile and B-1 bomber. In December 1984, the Department of Defense announced it had chosen 10 companies to perform $1 million contracts for "system architecture studies," designed to provide initial assessments of different options for the missile defence system's potential construction and operation, and five of these were chosen for second-phase study contracts of $5 million in the summer of 1985. All of these studies were performed by big prime defence contractors (Lockheed, Martin Marietta, GRC, Hughes Aircraft, McDonnell Douglas, SAIC, Sparta Inc., TRW, Rockwell, and Teledyne Engineering),[340] and concerns were raised at the time about the potential conflicts of interest involved: for example, Sen. William Proxmire questioned whether they would be able to provide independent advice given the potential for profitable contracts in the future, saying that the contractors "look at SDI as an insurance policy that will maintain their prosperity for the next two decades."[341]

However, the value of these contracts pales in comparison to those awarded to academic institutions, as shown in my data. In exploring this more deeply, contemporary testimony from administration officials to congressional committees provides an excellent resource to see how these officials contextualised the Strategic Defense Initiative at the time and where they wanted funding to be directed. I have chosen to focus on the Senate Committee on Appropriations, whose Subcommittee on Defense ran a series of hearings specifically on the Strategic Defense Initiative programme on an annual basis throughout Reagan's two

[338] Hartung, William (1986) "Star Wars pork barrel" *Bulletin of the Atomic Scientists* 42(1) p23
[339] Quoted in Sanger, David E. (1985) "Campuses' Role in Arms Debated as 'Star Wars' Funds Are Sought" *The New York Times* 22 July
[340] Ibid. p21
[341] Quoted in Sanger, David E. (1985) "Pentagon and critics dispute roles of space arms designers" *The New York Times*, 5 November

presidential terms. While other House and Senate committees also had numerous hearings on various aspects of the programme, including on its potential effects on relations with the Soviet Union and its interplay with the concept of nuclear deterrence, it is in the appropriations hearings that we unsurprisingly find the clearest focus on funding and contracts.

Looking at the testimony before the subcommittee over the period that the Strategic Defense Initiative programme was active, we can see that the project was very much framed as one of pure research, with a strong focus on academic institutions and related non-profit laboratories. For example, Dr James Wade, Under Secretary of Defense for Research and Engineering, describes the Strategic Defense Initiative as having a specific link to academia:

> Our basic research is the source of new ideas and new science that underpins technological developments vital for sustaining superior technology. Much of this work is performed by universities [...] We are proposing to provide funding for new research initiatives to foster stronger interactions between DoD laboratories and universities and to provide a sounder basis for the development of technological options to solve national security problems.[342]

Wade's testimony shows that the administration recognised from the beginning that the Strategic Defense Initiative programme would require extensive investment in research and development, and that the Department of Defense would be looking primarily and deliberately to academic institutions to fulfil these needs, not private contractors.

Lt. Gen. James Abrahamson, Director of the Strategic Defense Initiative Office, outlines a specific programme (under the new Innovative Science and Technology directorate) to reach out to universities to encourage them to perform Strategic Defense Initiative work, for which he requested $100 million in the FY1986 budget, noting that the programme would provide "research institutes and universities with the opportunity to focus their science and technology efforts towards common goals."[343] In his testimony the following year, he reinforced its importance:

> ... we are still trying to maintain a generous program in this area. In fiscal 1986 we are aiming, for example, at $50 million exclusively for university-type research in this innovative area. Now, this is not the total of university research. In fact, it is

[342] Senate Committee on Appropriations (Subcommittee on Defense) (1985) *Department of Defense appropriations for fiscal year 1986: hearings before a subcommittee of the Committee on Appropriations, United States Senate, Ninety-ninth Congress, first session* (Washington D.C.: U.S. G.P.O.) vol 1 p452
[343] Ibid. pp114-115, p121

> substantially more than that [...] those are very generous programs, but they have some incredible payoffs as well.[344]

Abrahamson's testimony reinforces that of Wade, highlighting the shared view between the Department of Defense and the Strategic Defense Initiative Office that academic institutions would be the predominant recipients of the extensive research and development funding needed to get the Strategic Defense Initiative off the ground, and that their work was vital in achieving the programme's goals.

We can also see the Strategic Defense Initiative's research focus when looking at how it sits within the defence priorities of the period; these were, unsurprisingly, framed primarily as a response to Soviet military build-up and their advances in ballistic missiles in particular. Throughout the late 1980s, Department of Defense officials and high-ranking officers from the three main services consistently speak to the growing threat from the Soviet Union and the need to modernise American forces to meet that threat in their testimony on the general matter of defence funding before various Congressional committees. This underlying rationale in clearly reflected in their support for the Strategic Defense Initiative, but the Soviet threat in this case is instead framed as a build-up specifically of research and development capability. For example, Dr Richard DeLauer, Under Secretary of Defense for Research and Engineering, spends pages of testimony in 1984 outlining the status of Soviet research and development and lamenting the falling behind of the United States, specifically linking this to defence research by academic institutions:

> Our science and technology base is one that I again urge you to seriously consider in our budget, because it is the one area that in the past decade has taken a very hard licking in regard to the amount of resources put into it. It is also the one area that provides our interface with the university community. It is our 6.1 and 6.2 level [research and development] money that is the basis for us to interact with the universities and to provide the necessary support to them so that they can continue to work on the basic research necessary to develop the capability for upgrading our forces [...] As the Soviets continue to increase their R&D efforts and proliferate their new systems, we must match their progress with contributions from a vigorous R&D

[344] Senate Committee on Appropriations (Subcommittee on Defense) (1986) *Department of Defense appropriations for fiscal year 1987: hearings before a subcommittee of the Committee on Appropriations, United States Senate, Ninety-ninth Congress, second session* (Washington D.C.: U.S. G.P.O.) vol 2 pp49-50

> effort consisting of the defense industry, independent R&D programs, and allies who are technologically advanced.[345]

He notes that the number of active research institutions in the Soviet Union had increased substantially over the last twenty years, with Soviet funding for military research and development growing faster than other defence spending over that period. His successor, Wade, continued this line in subsequent hearings, noting that "the best qualified Soviet scientists and engineers are selected for military research and development" and reinforcing the Soviet commitment to funding and progressing research and development programmes.[346]

The academic focus of the Strategic Defense Initiative is also at the forefront when we look at how its successes were framed. Abrahamson, speaking on progress in 1987, firmly placed the project within this sphere:

> I am pleased to report that in research and technology development, many exciting developments have taken place over these four years. As a result of their active interest and participation in the SDI program, our nation's scientific, industrial, and academic communities have fostered some of the finest, most sophisticated technological advances of this decade.[347]

It is clear from these testimonies that those in charge of the Strategic Defense Initiative saw its primary focus as being research, and thus its primary recipients as academic institutions.

5.12 The Strategic Defense Initiative Institute

Academic institutions often had links to FFRDCs, as explored above, and these organisations were a crucial component of the military research and development ecosystem. It is indicative of the Reagan administration's academic approach to the Strategic Defense Initiative that officials believed that a new FFRDC devoted solely to it, to be called the Strategic Defense Initiative Institute, would be of considerable value. The Department of Defense proposed this in 1986, arguing that the new organisation was needed to provide technical advice on ongoing Strategic Defense Initiative research, including the evaluation of

[345] Senate Committee on Appropriations (Subcommittee on Defense) (1984) *Department of Defense appropriations for fiscal year 1985: hearings before a subcommittee of the Committee on Appropriations, United States Senate, Ninety-eighth Congress, second session* (Washington D.C.: U.S. G.P.O.) vol. 1 pp547-552
[346] Senate Committee on Appropriations (Subcommittee on Defense) (1985) *Department of Defense appropriations for fiscal year 1986: hearings before a subcommittee of the Committee on Appropriations, United States Senate, Ninety-ninth Congress, first session* (Washington D.C.: U.S. G.P.O.) vol 1 p409
[347] Senate Committee on Appropriations (Subcommittee on Defense) (1987) *Department of Defense appropriations for fiscal year 1988: hearings before a subcommittee of the Committee on Appropriations, United States Senate, One hundredth Congress, first session* (Washington D.C.: U.S. G.P.O.) vol 2 p177

proposed architectures and key technologies, as well as to assist in the analysis of the optimal trade-offs between the different research strands within the programme.

Once again, contemporary congressional testimony provides a valuable window into the thinking behind this proposal. A joint hearing[348] was held in May 1987 by the Senate Committee on Governmental Affairs (Subcommittee on Oversight of Government Management) and Senate Committee on Armed Services (Subcommittee on Strategic Forces and Nuclear Deterrence) to assess whether a Strategic Defense Initiative Institute was necessary, and how it would potentially operate. The hearing drew upon a Government Accountability Office report[349] into the options for such an institute, as well as testimony from Strategic Defense Initiative Office leadership, a former director of the Defense Advanced Research Projects Agency, and representatives from private professional services contractors, who maintained that the work could be better performed by contracting out into the private sector. As Sen. Carl Levin, Chair of the Senate Armed Services Committee, noted in his opening statement:

> In light of their record of excellence, FFRDCs have gained special privileges in their conduct of government research. They have government sponsors, are exempt from civil service rules and are exempt from having to compete for the research projects that are assigned to them. I have begun to suspect that DoD wants an SDII to share in these privileges without also possessing the independence that enables an FFRDC to give advice which is objective, even if unpopular.[350]

In his testimony,[351] Brig. Gen. Martin O'Neill, Deputy Director of the Strategic Defense Initiative Office, summed up the government's evaluation of the available options. The Department of Defense had concluded that a governmental organisation would be slow to respond to changing requirements and might have difficulties in attracting and retaining qualified personnel — while using a for-profit firm could bring up conflicts of interest that would be detrimental to the operation of the Strategic Defense Initiative Institute. The FFRDC mechanism, however, could offer responsive handling of the Strategic Defense Initiative Office's needs while allowing for more freedom in incentivising talented people to work there with attractive salary structures. O'Neill argued that no existing FFRDC had the

[348] Senate Committee on Governmental Affairs (Subcommittee on Oversight of Government Management) and Senate Committee on Armed Services (Subcommittee on Strategic Forces and Nuclear Deterrence) (1987) *Need for and operation of a Strategic Defense Initiative Institute: joint hearing before the Subcommittee on Oversight of Government Management of the Committee on Governmental Affairs and the Subcommittee on Strategic Forces and Nuclear Deterrence of the Committee on Armed Services, United States Senate, One hundredth Congress, first session, May 6, 1987.* (Washington, D.C.: U.S. G.P.O.)
[349] Government Accountability Office (1987) *Proposed Strategic Defense Initiative Institute* (Washington, D.C.)
[350] *Need for and operation of a Strategic Defense Initiative Institute* p4
[351] Ibid. pp51-54

breadth of specialised expertise needed to undertake major review of the programme, nor the ability to offer exclusive focus on the Strategic Defense Initiative given their ongoing work, so establishing a new FFRDC would be the best option.

Dr Robert Cooper, the former director of the Defense Advanced Research Projects Agency, also testified to the joint hearing,[352] drawing on his experience of extensive dealings with FFRDCs over his career. He noted that the relevant expertise did not exist within the private aerospace industries or the laboratories within the military services, but that various FFRDCs were already performing extensive work for the Strategic Defense Initiative. He gave the example of the Lincoln Laboratory, a centre of expertise in ballistic missile defence, where a quarter of its work was contracted by the Strategic Defense Initiative Office. Cooper listed four overarching principles for making such institutions work well: first, that they should only be created if there is a long term national interest that needs that kind of support; second, that they should be closely associated with, and preferably attached to, a high-quality technical university; third, that the funding should be independent in order to give the institution the means to give independent advice; and fourth, that a sizeable proportion of the scientists should be experienced in hands-on research and development work. He argued that setting up a good FFRDC following these principles from scratch would take years, but that redirecting an existing institution towards solely focusing on Strategic Defense Initiative work would also require substantial effort.

While the Strategic Defense Initiative Institute was never successfully created, the debates over its potential establishment further highlight the focus of the Strategic Defense Initiative on dealing with academia over industry. In even considering the creation of an FFRDC focused solely on the Strategic Defense Initiative, the federal government under the Reagan administration made clear the focus of the programme on research.

5.13 Conclusions

The Cold War was a time of prominence for academic institutions within the military-industrial complex, building on links created during World War II and creating a web of relations between academia and the defence world that persisted up to and throughout the 1980s. From the very beginning, the Reagan administration saw technological advantage as the primary means by which the United States would be able to compete with the Soviet Union and viewed military research and development as vital in this endeavour. The Strategic Defense Initiative, which was the cornerstone of Reagan's priorities when it came to

[352] Ibid. pp42-45

defence technology, was envisioned and run as a research programme, and the beneficiaries of contracts were thus predominantly academic institutions and their related organisations.

As Geiger notes, there existed a continuum of federally funded research in the post-war era.[353] At one end, we have the traditional academic model of research conducted within the departments of particular institutions without the need for additional forms of organisation. At the other end are the federal laboratories and FFRDCs, which were entirely the creations of federal agency programmes and did research that was funded solely due to its presumed utility for its sponsors. In between these two lay a whole host of institutes, centres, and so on that were linked to academic institutions, and blended the programmatic interests of the federal agencies tendering out contracts with the research interests of the faculty therein.

The Strategic Defense Initiative clearly highlights the limitations of the iron triangle model in understanding the military-industrial complex, as the corners of the triangle (military, government, and industry) do not include academia at all. An iron triangle approach to exploring this case would thus struggle to fully comprehend the links with academia, much less the varying types of academic institution involved and their different relationships with parts of the military, the federal government, and the defence industry. In doing so, such an approach would fail on a basic level to explain how the Reagan administration viewed research and development as integral to national security and what that meant for military spending, contracts, and technology during the Cold War. An iron triangle view of the military-industrial complex under Reagan would thus be both structurally incomplete and unable to provide an explanation for the ways in which it was shaped by the overarching impetus for technological dominance over the Soviet Union.

An assemblage approach, on the other hand, permits not only the inclusion of academia overall, but also the exploration of how the various parts of the academia assemblage interact differently with the other assemblage actors within the military-industrial complex. The relationships that universities, FFRDCs, and other research institutions had with the government, military, and industry are subtly different, and viewing these within the context of an assemblage allows us to pick out these individual threads and explore how they shaped the wider Cold War-era military-industrial complex.

This period is one of relative dominance for the academia assemblage within the military-industrial complex — these institutions were able to take advantage of the funding available under the Reagan administration's build-up in defence spending and the focus on research and development. However, this was not to last, and the next two decades saw the decline of academia within the military-industrial complex due to the consolidation of the defence

[353] Geiger (1990) p9

industry and the rise of the prime contractors, which brought the industry assemblage to the forefront.

CHAPTER SIX

Prime Dominance: Defence Industry Consolidation and the War on Terror

After the end of the Cold War, the United States took advantage of the so-called "peace dividend" to cut back on military spending. The Clinton administration actively encouraged defence companies to merge with each other to better weather this downturn, creating the big prime defence contractors and changing the face of the industry assemblage of the military-industrial complex. Following the attacks on New York and the Pentagon of 11 September 2001, the Bush administration's renewed focus on national security, combined with new overseas combat operations in Afghanistan and Iraq, led to a substantial increase in military budgets that created a feeding frenzy for these new industrial behemoths, cementing their dominance within the military-industrial complex throughout the 2000s. The relative increase in power of the industry assemblage with its newly consolidated actors in vital in understanding the military-industrial complex, particularly as the prime contractors are a key part of the military-industrial complex not only during this period but also still today.

In this chapter, I will explore the consolidation of defence companies during the 1990s that created the primes and show how their pre-eminent position coming into the Bush administration put them in a position to dominate the military-industrial complex throughout the first decade of the "Global War on Terror." I will illustrate this through analysis of my own data as well as through three representative case studies — the littoral combat ship, the F-22 Raptor, and the Joint Improvised Explosive Device Defeat Organization — that demonstrate the extent of the primes' power and their ability to shape the military-industrial complex in their own interests through their aptitude in taking advantage of electoral incentives.

6.1 Data Analysis

My data shows that the prime defence contractors began to draw closer to their other private competitors during the 1990s, and then leapt substantially ahead around 2001 to become the primary recipient of defence research and development contracts in the United States during the 2000s.

My data show a clear peak in the 2000s for the prime defence companies in defence research and development contracting, both in terms of the number of contracts and their dollar value. In order to analyse this more clearly, I have taken only the data from 1991 to 2008 and shown this in graph form:

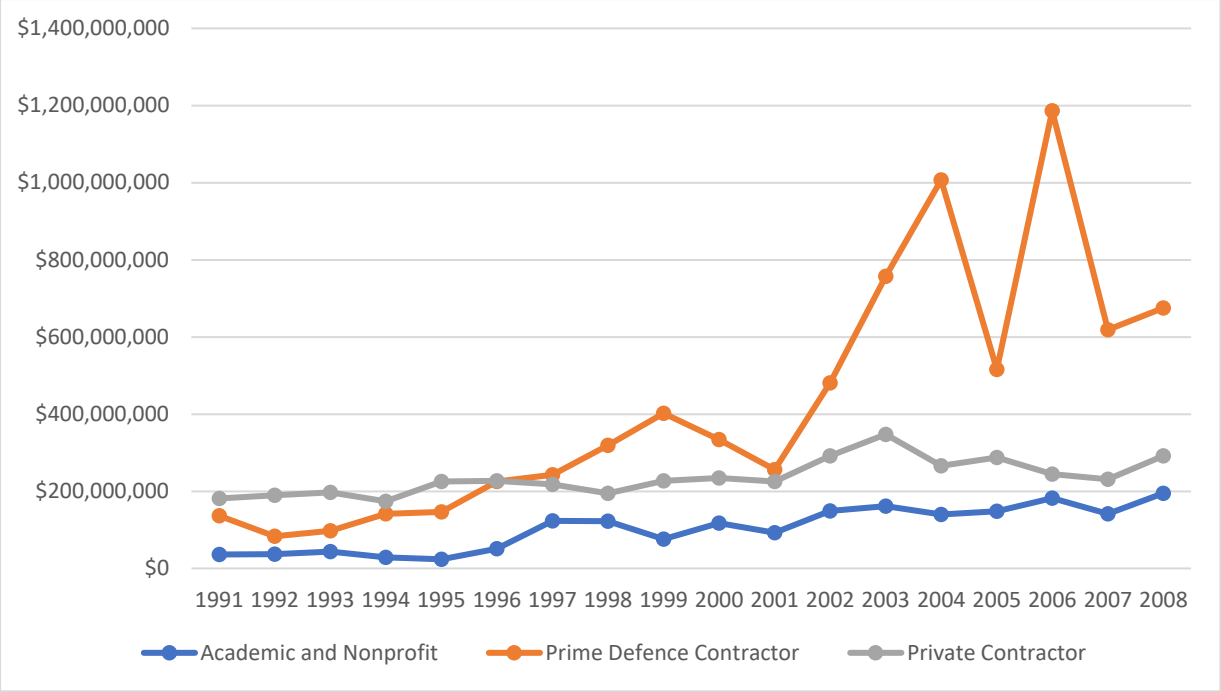

Fig 1: Dollar value of contracts per year, 1991-2008

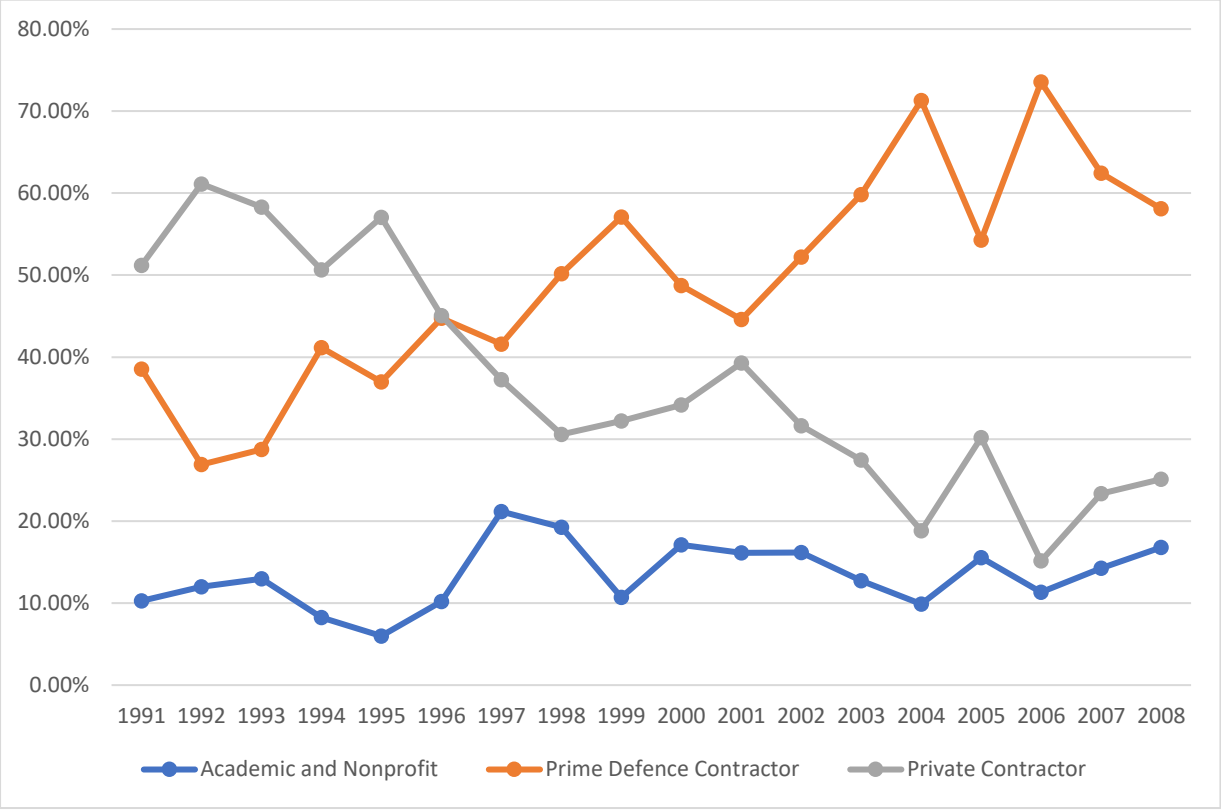

Fig 2: Dollar value of contracts as percentage of total per year, 1991-2008

When looking at contracts in terms of dollar value, the gap between the primes and the other private contractors steadily closes throughout the 1990s, and from 1997 onwards the primes begin to overtake the other private contractors. The primes' largest leap ahead begins in

2001, carrying on to the end of this period, with a substantial lead in dollar value both overall and as a percentage of the total.

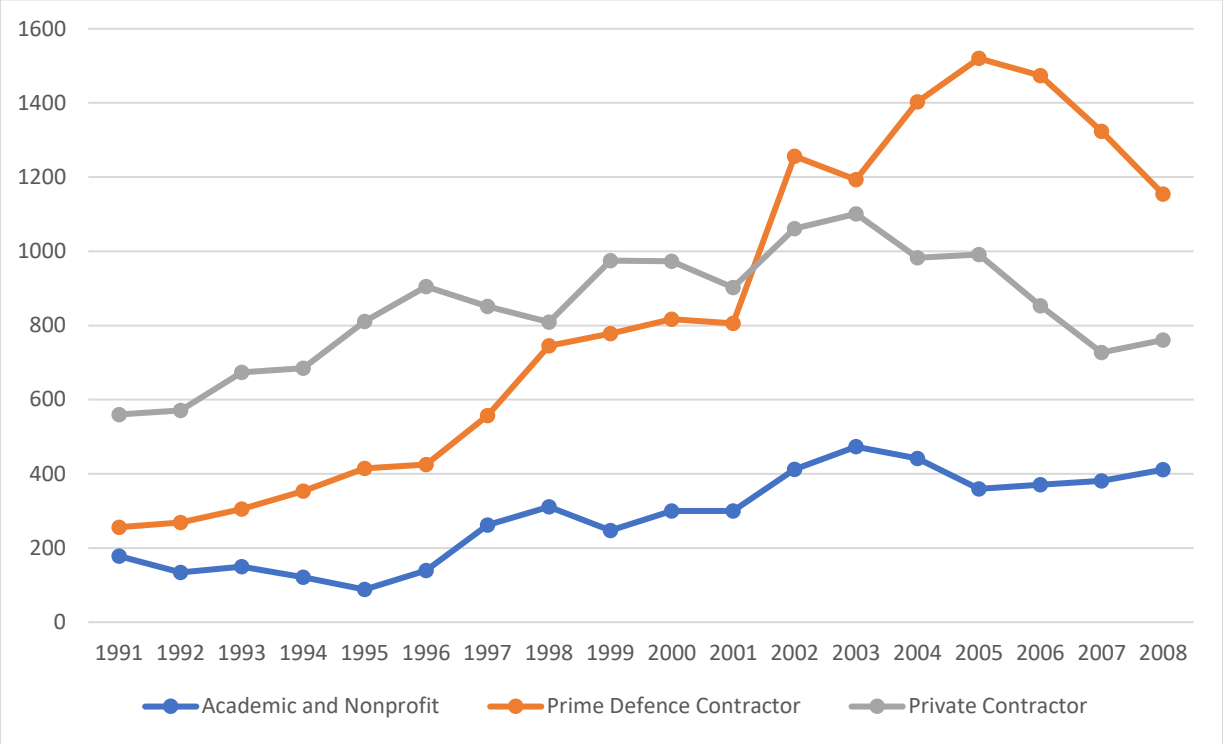

Fig 3: Number of contract actions per year, 1991-2008

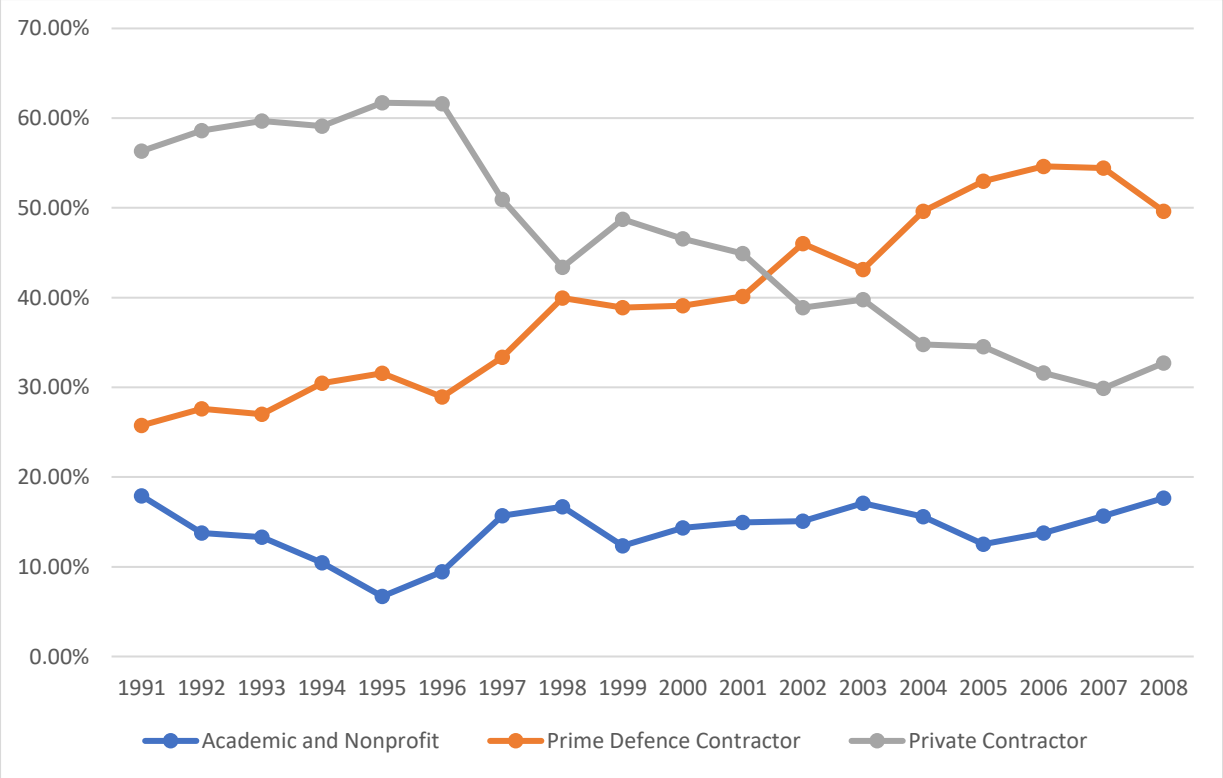

Fig 4: Number of contract actions as percentage of total per year, 1991-2008

When looking at numbers of contract actions, both overall and as a percentage of the total, the closing of the gap remains clear through the 1990s but the primes do not begin to overtake the other private contractors until 2002. This shows that although 2002 was when the primes truly became dominant in all four measures, they won contracts with large individual dollar values that pushed them ahead in the dollar value stakes from 1997.

6.2 The Peace Dividend

The presidential election of 1992, in which the incumbent George H. W. Bush faced off against Bill Clinton, centred for national security purposes around a key issue: the "peace dividend" from winning the Cold War. Throughout the past four decades, the United States had funded and maintained a huge military establishment, with particular peaks during the Vietnam War and under the Reagan administration. Now that the Soviet Union had collapsed and the United States was the sole remaining superpower, many felt that it was possible to scale down the U.S. military, limiting it to a smaller force protecting the homeland and defending vital American interests overseas. The consequent fall in defence spending, under this view, would mean that funding could then be redirected towards domestic matters, such as education, healthcare, and economic stability — the reprioritisation of butter over guns.

This clashed with the prevailing view that the United States should not withdraw into isolationism as it had after World War I and should instead take on a global role as the "world's policeman" to ensure the maintenance of the *Pax Americana* and the defence of the liberal world order. This point had been hammered home by the recent experience of the Gulf War, during which the U.S. military had decisively and swiftly defeated the Iraqi army and pushed Saddam Hussein out of Kuwait. Given the clear technological mismatch between the two sides and the unexpectedly quick achievement of the operation's goals, the Gulf War cemented America's view of itself as leader of the free world and the bearer of unassailable military power. Such a global role would require a larger military establishment and defence industrial base than that necessary for simply defending the homeland, but both could be more modest than those of the Cold War era given the disappearance of the existential threat that had been posed by the Soviet Union.[354]

The George H. W. Bush administration had a firm answer to this question — "no peer rival" or (unofficially) the Wolfowitz doctrine, named after then-under secretary of defense for policy Paul Wolfowitz. The concept first appeared in *Defense Planning Guidance FY1994-*

[354] Roland, Alex (2021) *Delta of Power: The Military-Industrial Complex* (Baltimore: Johns Hopkins University Press) pp95-97

1999,[355] a preliminary internal document written by Wolfowitz's deputies, which was classified but leaked to the press only a month after its internal circulation in 1992. The document argued that America must "maintain the mechanism for deterring potential competitors from even aspiring to a larger regional or global role" with the goal of preventing the rise of a new superpower to take the place of the Soviet Union in rivalry with the United States, keeping America as the one superpower in an otherwise multipolar world.[356] This would require a sufficient military and defence industrial base to support actions overseas beyond the narrow defence of American interests, and the maintenance of the technological and military superiority of the United States. While the public outcry following the leak led the administration to tone down this kind of rhetoric, many of the more hawkish members of the Republican side continued to incorporate it into their thinking. This was reflected in the administration's 1993 *National Security Strategy* — while avoiding the more obvious language of the "no peer rival" doctrine, the document contained similar ideas, describing the United States as the "preeminent world power" with "great responsibilities" of leadership.[357]

However, Bush lost the 1992 election, and the incoming Clinton administration had a different view. Clinton planned to use the peace dividend as part of a large economic conversion plan, unveiled shortly after he took office in 1993, which would use the savings from smaller defence budgets to enhance competitiveness and reinvest in infrastructure, job training, and civilian research and development.[358] This approach would have big implications for the defence industry.

6.3 Clinton, the Last Supper, and Industry Consolidation

As the Cold War drew to an end, the defence industry sustained a series of contractions and consolidations as military procurement budgets fell. Employment in the industry also fell, with over 2 million civilian workers losing their jobs,[359] and many long-established companies either folded or were subsumed by larger competitors. Those that were left, however, were big beasts with a wide range of portfolios. The mid-1990s are thus when we see the rise of the prime defence contractors, bolstered by the direct intervention of the Clinton-era Department of Defense.

[355] Office of the Under Secretary of Defense for Policy (1992) *Defense Planning Guidance FY1994-1999* (Washington, DC: Department of Defense)
[356] Roland (2021) pp97-99
[357] Bush, George H. W. (1993) National Security Strategy (Washington DC: White House)
[358] See Bischak, Greg (1997) *Defense Conversion* (Washington DC: Institute for Policy Studies); and Feldman, Jonathan (1993) "Broadening the Peace Dividend" *Society* 30(4)
[359] Tirpak, John A. (1998) "The Distillation of the Defense Industry" *Airforce Magazine* 1 July

The rapid shrinking in the industry looked to some like the United States was losing its defence industrial base, and therefore would not be able to meet the challenge of future large conflicts without substantial reconstitution. However, the Clinton administration did not see it this way. Secretary of Defense Les Aspin and his fellow leaders within the Department of Defense instead viewed these kinds of shifts within the defence industry as both unavoidable and necessary. The department was convinced that the defence industry in the United States was lumbered with huge excess capacity. The nation had five makers of fighter aircraft and three of bomber aircraft, for example, with similar numbers of manufacturers of other large weapons platforms like tanks, submarines, and missile systems. The government believed that the end of the Cold War and the now unipolar pre-eminence of the United States meant that there would not be a conflict between large armed forces in the foreseeable future, and that the true challenge would be from technological competitors, particularly Japan.[360]

The United States therefore needed to shift its talent and investment into new technological paths, not dead-end Cold War projects aimed against a superpower rival that no longer existed. Without the Soviet Union, there was no nation-state that could come close to matching the United States in terms of aircraft, ships, submarines, and other large weapons platforms. The Clinton administration thus felt it to be unnecessary to maintain within the defence industrial base expensive surge capacity for the production of these types of platforms, capacity that had been viewed as imperative while the Soviet Union remained a threat. This view was communicated directly to the heads of the largest American defence contractors in 1993 at a Pentagon dinner, known colloquially as the "last supper." At this event, Aspin and his deputy (and successor) William J. Perry candidly informed the businessmen that the level of defence spending, already falling, was only going to fall further, and this would endanger at least half of the contractors represented in the room that evening.[361] The defence industry thus needed to move further and faster in the ongoing consolidation of the big companies, as the demand from the U.S. military for their products would only shrink going forward. Fewer and larger companies would be better at providing the smaller industrial base necessary for the lower amount of spending on big-ticket items like weapons platforms. Aspin and Perry made clear that the department would not be the one to decide which firms would survive and which would not — the industry would be rationalised and streamlined via market forces alone. However, the Department of Defense would facilitate the process by offering financial incentives, such as permitting

[360] Markusen, Ann (2001) "How We Lost the Peace Dividend" *The American Prospect* 3 December
[361] Mintz, John (1997) "How a Dinner Led to a Feeding Frenzy" *Washington Post* 4 July

reorganisation expenses to become part of reimbursable contract costs, and advocating consolidations in the event of antitrust challenges.[362]

After the dinner, Perry bluntly said: "We expect defense companies to go out of business. We will stand by and watch it happen."[363] Interviewed years later, he recalled that the central goal of this process was to lower the cost of military acquisitions by "compelling the defense industry to become leaner."[364] John Deutch, who was Undersecretary of Defense (Acquisition and Technology) from April 1993 to May 1994 and Deputy Secretary of Defense from March 1994 to May 1995, wrote shortly after this period that the objective was "to assure a defense industrial base [...] that meets our security needs" by actively encouraging mergers to create a healthier environment for defence acquisitions. He argued that the United States could not "rely on financial markets to give us a properly sized defense industrial base" and that this required the government to "take decisive action."[365]

Industry leaders were not opposed to the idea, as they recognised that lower defence budgets did not bode well for their companies' future health in any case. As Norman Augustine, a former head of Lockheed Martin, summarised in a speech in 1996:

> It is much better to have ten strong competitors than two. Unfortunately, that choice is basically irrelevant, since it is not among the options we have been given. The choice we have been given is more precisely characterized as one between having ten weak competitors with dubious futures or two strong ones with hopeful futures.[366]

The "last supper" gave new impetus to the consolidation already happening within the industry, as long-established firms like McDonnell Douglas and Hughes Aircraft were brought under the umbrellas of a handful of larger contractors. The main mergers following the Department of Defense's direct encouragement were Northrop with Grumman (April 1994, forming Northrop Grumman), Lockheed with Martin Marietta (August 1994, forming Lockheed Martin), and Boeing with McDonnell Douglas (December 1996). However, the proposed further merger of Northrop Grumman and Lockheed Martin in 1998 was a step too far, particularly for what was by then new leadership at both the Department of Defense and the Department of Justice, so the large defence company mergers came to a halt.[367]

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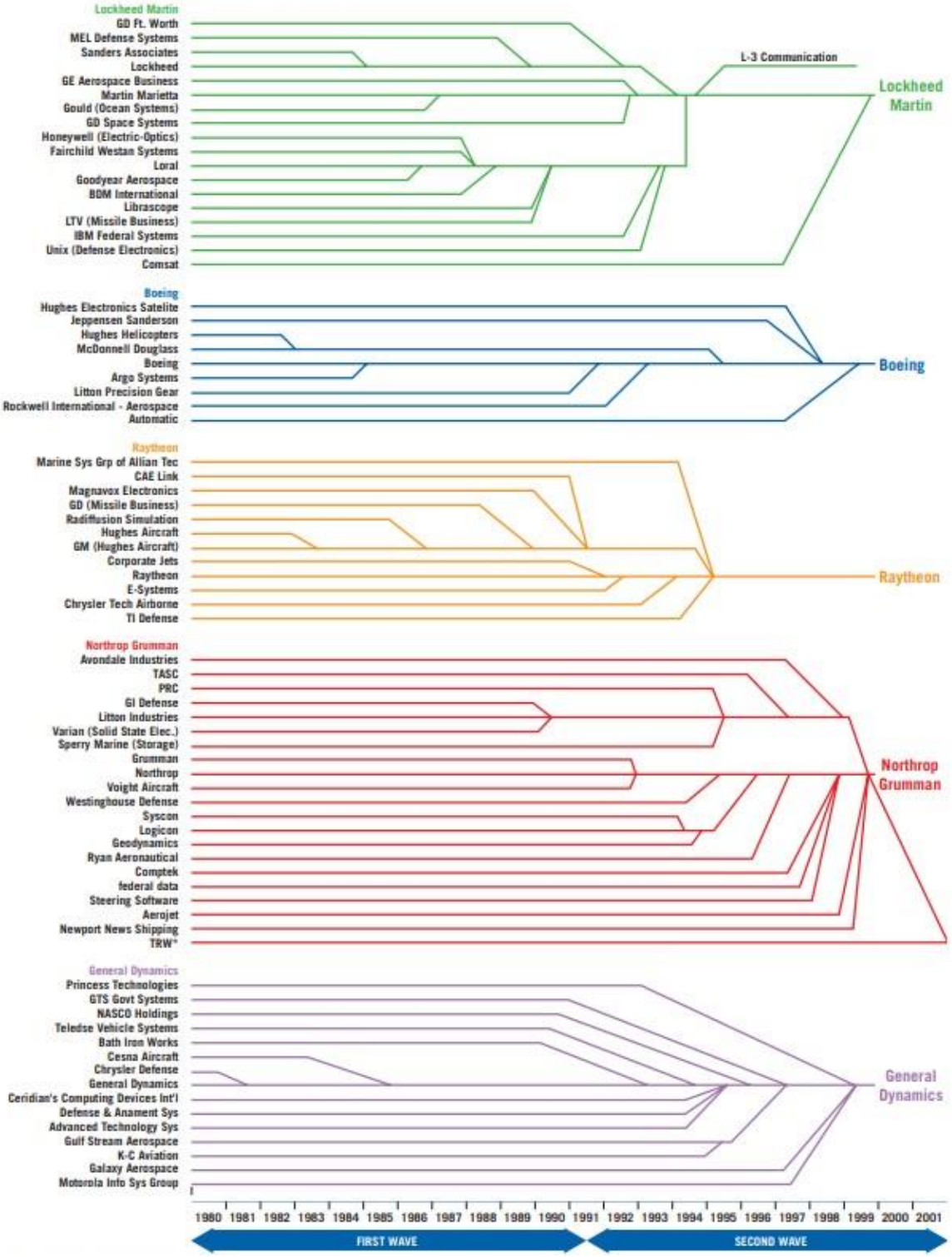
[362] Amara, Jomana & Franck, Raymond E (2021) *The US Defense Economy* (Cambridge: Cambridge University Press) p34
[363] Quoted in Tirpak (1998)
[364] Quoted in Erwin, Sandra (2015) "Former SecDef Perry: Defense Industry Consolidation Has Turned Out Badly" *National Defense* December 2
[365] Deutch, John M. (2001) "Consolidation of the U.S. Defense Industrial Base" *Acquisition Review Quarterly* 8(3) p148
[366] Quoted in Tirpak (1998)
[367] Amara & Franck (2021) pp34-35

Some primes further hedged against the shrinkage in defence spending by growing their commercial aviation portfolios, like Boeing and General Dynamics (through their purchase of Gulfstream), but others hedged by widening their footprint within the defence industry, with holdings now spanning multiple types of hardware and weaponry.[368] By the end of the decade, the number of companies operating within the defence industry was substantially smaller than had been the case at the time of the "last supper," and these companies became the top tier of the defence contractors.[369] This consolidation is shown in particularly vivid terms in a 2002 report from the Commission on the Future of the United States Aerospace Industry, which included a diagram of some of the mergers happening during this period.[370] The 75 companies listed in 1980 become just five by the end of the 1990s, and those five are some of the largest prime defence contractors: Lockheed Martin, Boeing, Raytheon, Northrop Grumman, and General Dynamics.

[368] Berenson, Doug, Higgins, Chris, & Tinsley, Jim (2021) "The U.S. Defense Industry in a New Era" *War on the Rocks* 13 Jan

[369] Carter, Ashton B, Lettre, Marcel, & Smith, Shane (2001) "Keeping the Technological Edge" in *Keeping the Edge: Managing Defense for the Future* ed. Ashton B. Carter & John P. White (Cambridge, Massachusetts: MIT Press) p138; see also Department of Defense (2022) *State of Competition within the Defense Industrial Base* (Washington, DC: Office of the Under Secretary of Defense for Acquisition and Sustainment)

[370] Commission on the Future of the United States Aerospace Industry (2002) *Final Report of the Commission on the Future of the United States Aerospace Industry* (Arlington, VA) p134


Lockheed Martin
GD Ft. Worth
MEL Defense Systems
Sanders Associates
Lockheed
GE Aerospace Business
Martin Marietta
Gould (Ocean Systems)
GD Space Systems
Honeywell (Electric-Optics)
Fairchild Westan Systems
Loral
Goodyear Aerospace
BDM International
Librascope
LTV (Missile Business)
IBM Federal Systems
Unix (Defense Electronics)
Comsat
L-3 Communication
Lockheed Martin
Boeing
Hughes Electronics Satelite
Jeppensen Sanderson
Hughes Helicopters
McDonnell Douglass
Boeing
Argo Systems
Litton Precision Gear
Rockwell International - Aerospace
Automatic
Boeing
Raytheon
Marine Sys Grp of Allian Tec
CAE Link
Magnavox Electronics
GD (Missile Business)
Radiflusion Simulation
Hughes Aircraft
GM (Hughes Aircraft)
Corporate Jets
Raytheon
E-Systems
Chrysler Tech Airborne
TI Defense
Raytheon
Northrop Grumman
Avondale Industries
TASC
PRC
GI Defense
Litton Industries
Varian (Solid State Elec.)
Sperry Marine (Storage)
Grumman
Northrop
Voight Aircraft
Westinghouse Defense
Syscon
Logicon
Geodynamics
Ryan Aeronautical
Comptek
federal data
Steering Software
Aerojet
Newport News Shipping
TRW*
Northrop Grumman
General Dynamics
Princess Technologies
GTS Govt Systems
NASCO Holdings
Teledse Vehicle Systems
Bath Iron Works
Cesna Aircraft
Chrysler Defense
General Dynamics
Ceridian's Computing Devices Int'l
Defense & Anament Sys
Advanced Technology Sys
Gulf Stream Aerospace
K-C Aviation
Galaxy Aerospace
Motorola Info Sys Group
General Dynamics
1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001
FIRST WAVE
SECOND WAVE

These behemoths had advantages over their smaller competitors when bidding for contracts, as they were able to leverage their size and experience to tout themselves as the best choice. This was particularly true given the range of companies absorbed — a prime now containing subsidiaries in wide-ranging subfields (air, surface naval, space, and so on) could use this to pitch for a concomitantly wide range of contracts. Furthermore, a larger company could afford to have a larger lobbying staff to put pressure on the military, the Department of Defense, and Congress — and more laboratory or manufacturing sites under a prime's umbrella meant more leverage with the congressional representatives of those communities, both in the House and in the Senate. Nonetheless, the pickings were still slim under the Clinton administration given the flat defence budget and the lack of a dangerous adversary for the United States and its allies. This was to change rather abruptly, however, soon after the turn of the millennium.

6.4 Bush and the Global War on Terror

Following the 2000 election, the George W. Bush administration came into office with two key national security goals. The first was to deploy a working ballistic missile defence system, a programme that had never recovered after the failures of the Strategic Defense Initiative. The second, led by new Secretary of Defense Donald Rumsfeld, was defence reform.[371] Rumsfeld and new Vice President Dick Cheney were the co-leaders of an informal group of powerful Republicans called the "Vulcans," who shared the goal of a more assertive foreign policy backed by a stronger military. The group's views also included the remnants of the "no peer rival" doctrine that had caused so much trouble for the previous Bush administration, with a belief that the strengthening of the military would deter the emergence of new rivals to American unipolar pre-eminence. Rumsfeld in particular believed that the armed forces were emerging too slowly from the Cold War paradigm and wanted to shake them out of their long-held habits in planning, training, and acquisition.[372]

The landscape was abruptly transformed by the terrorist attacks of 11 September 2001. Rather than being able to use a period of peacetime to retrench and update the U.S. military for the new technological age, the Bush administration was now committed to a "Global War on Terror" that required the sustainment and equipping of intensive combat operations in Afghanistan and later Iraq, both of which then morphed into expensive and unprecedented counter-insurgency campaigns. This new context led to substantial interest in research and development to tackle the Islamist terrorist threat.[373] The FY2003 budget, the first written entirely by the George W. Bush administration, has two chapters containing anti-terrorism

[371] Roland (2021) pp130-133
[372] See Rumsfeld, Donald (2002) "Transforming the Military" *Foreign Affairs* 81:3
[373] Noll, R. (2003) "Federal R&D in the Antiterrorist Era" *Innovation Policy and the Economy* 3 p62

research and development programmes, one under the new rubric of "homeland security" and another relating to the international aspects of the war on terror.[374]

Even before the 9/11 attacks, the Bush administration had intended to increase funding for defence research and development as part of its plans to modernise the U.S. armed forces. The FY2002 budget, which was finalised prior to the events of 11 September, contained an overall increase in federal research and development, a large part of which would go to the Department of Defense — total defence research and development increased by 8.5 percent to $45.9 billion.[375] Following 9/11 and the subsequent anthrax attacks, Congress approved $1.5 billion for terrorism-related research and development, half of which came from normal appropriations and half from emergency funding approved after the attacks. The Department of Defense saw another large increase in its research and development budget, which increased by 17.3 percent to $50.1 billion.[376] Following years saw further increases in funding for defence and homeland security research and development, with much of the money going to the Bush administration's prioritised development projects like missile defence and the Joint Strike Fighter.[377]

Throughout Bush's tenure as president, the Department of Defense and the Department of Homeland Security were the only departments that saw their research and development funding steadily rise — the research and development funding for all other federal agencies either stagnated or declined throughout the period.[378] The cost of the conflicts in Afghanistan and Iraq, with a backdrop of record-breaking federal budget deficits, led to Bush holding non-defence discretionary spending flat from 2004 onwards — although increases in homeland security spending and international aid mean that other spending actually fell over the period. The necessary funds for defence research and development had to be offset by cuts in other programmes felt to be non-essential.[379]

Bush saw the experience of Afghanistan as directly relevant to defence transformation and used the early successes of the war to give the concept a boost.[380] As he said in a military

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[374] Office of the Under Secretary of Defense (Comptroller) (2002) *National Defense Budget Estimates for FY 2003* (Washington, DC: Department of Defense)
[375] "DOD, NIH big winners in Bush R&D budget; other agencies face cuts" (2001) *Issues in Science and Technology* 17(4)
[376] "Federal R&D in FY 2002 will have biggest percentage gain in 20 years" (2002) *Issues in Science and Technology* 18(3)
[377] "Nondefense R&D would take a hit in proposed FY 2004 budget" (2003) *Issues in Science and Technology* 19(3)
[378] "Defense, homeland security dominate Bush's FY 2005 R&D budget" (2004) *Issues in Science and Technology* 20(3)
[379] "Bush budget would cut most R&D programs" (2005) *Issues in Science and Technology* 21(3)
[380] Mahnken, Thomas G. (2008) *Technology and the American Way of War Since 1945* (New York: Colombia University Press) pp204-205

college speech in December 2001, "the conflict in Afghanistan has taught us more about the future of our military than a decade of blue-ribbon panels and think-tank symposiums." In the same speech, he argued that the new need to defeat terrorist networks would itself spur innovation in the American military:

> Our military must be willing to sacrifice some of their own pet projects. Our war on terror cannot be used to justify obsolete bases, obsolete programs, or obsolete weapons systems. Every dollar of defense spending must meet a single test: It must help us build the decisive power we will need to win the wars of the future.[381]

The defence industry reacted to the new direction. The primes swiftly ramped up their production of the kinds of equipment needed for the new counter-insurgency operations, with capabilities such as protecting combat vehicles against improvised explosive devices, providing persistent surveillance with uncrewed aerial systems, and parsing the increasingly large amounts of intelligence data that such surveillance delivered, as well as meeting the need for improved command, control, and logistics software that arose from managing and sustaining such large campaigns overseas. The success of the primes in this period of high defence spending is reflected in the attractiveness of their stock to investors — from 2001 to 2007, defence stocks delivered annualised return of 14 percent while the broader market was only up by 1 percent over the same period.[382]

6.5 Case Study: The Littoral Combat Ship

Following the end of the Cold War, the disappearance of the threat from the Soviet Union meant that the U.S. Navy lost its great *raison d'etre*. The lack of a clearly defined naval mission in the 1990s, combined with the same budgetary pressures as the other services as defence funding fell, meant that the U.S. Navy needed a new purpose. This came in the form of network-centric warfare, which emerged in the late 1990s and gave key roles to the U.S. Navy in maintaining a global presence via sea basing and ensuring access to contested regions.[383] Network-centric warfare gave prominence to the idea of small, light, and fast "nodes" that connected together in conflict scenarios, and this meant that the U.S. Navy needed to move away from its traditional platforms — huge, complex, and multipurpose ships. Furthermore, network-centric warfare focused more on projecting power ashore, meaning that ships that could operate in coastal waters were required.

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[381] Bush, George W. (2001) *Remarks at the Citadel in Charleston, South Carolina* 11 December (Washington, DC: White House)
[382] Berenson et al (2021)
[383] Dombrowski, Peter and Gholz, Eugene (2006) *Buying Military Transformation: Technological Innovation and the Defense Industry* (New York: Columbia University Press) p35

During the 2001 Quadrennial Defense Review, the first of the new Bush administration, Rumsfeld made clear that the U.S. military needed to improve its ability to tackle anti-access/area denial threats and project power in contested theatres, and his office quietly informed U.S. Navy leaders that they needed to include a small surface combatant in any plans they put forward.[384] The new Chief of Naval Operations, Adm. Vern Clark, did just that. In November 2001, the U.S. Navy announced its new DD(X) Future Surface Combatant Program,[385] which encompassed the acquisition of three new classes of ship: DD(X), a destroyer for precision long-range strike; CG(X), a cruiser for missile and air defence; and a littoral combat ship that could operate in shallow-draft and coastal waters. Rather than being a multi-mission ship like its larger brethren, the littoral combat ship would be equipped to perform one primary mission at any given time, with either individual ships focusing on one mission throughout their service or having their mission orientation changed by swapping out a modular mission package.[386] Clark declared the littoral combat ship to be his top priority, and Rumsfeld approved the request's inclusion in the FY2003 Department of Defense budget submission.[387]

Naval shipbuilding experienced the same consolidation as the rest of the defence industry in the 1990s. Between 1995 and 2001, the "Big Six" shipyards went from being owned by six separate firms to being part of a duopoly of prime contractors — Ingalls, Avondale, and Newport News owned by Northrop Grumman; and Electric Boat, Bath Ironworks, and NASSCO owned by General Dynamics. During the same period, the Navy's technical staff fell victim to a series of efficiency cuts, and the service lost much of its in-house specialised design expertise. This slack was picked up by the Big Six shipyards, and the Navy began to rely on these private-sector staff to understand its interests and develop designs for new seaframes.[388] The primes thus had the technical staff, the competency, and the close customer relationship with the Navy that would make them the obvious choice for the littoral combat ship.[389]

The U.S. Navy stated that it planned to set up multiple competitions among industry teams for each of the three programmes. In May 2004, contracts for the littoral combat ship were awarded to two teams, one led by Lockheed Martin and the other by General Dynamics — a

[384] Work, Robert O. (2014) *The Littoral Combat Ship: How We Got Here, and Why* [Washington DC: Office of the Undersecretary of the Navy] p3
[385] "Navy Announces DD(X) Program" (2001) *MarineLink* 1 November
[386] O'Rourke, Ronald (2019) *Navy Littoral Combat Ship/Frigate (LCS/FFGX) Program: Background and Issues for Congress* [Washington DC: Congressional Research Service] p2
[387] Work (2014) p5
[388] Ma, Jason (2005) "Wynne seeks boost in engineering base: As Navy loses technical experts, role of contractors increases" *Inside the Navy* 18(18)
[389] Dombrowski & Gholz (2006) pp52-53

third team, led by Raytheon, was unsuccessful. Each team was thus headed by a prime defence contractor, but also included a smaller shipbuilder — General Dynamics brought in Austal USA, and Lockheed Martin brought in Bollinger Shipyards and Marinette Marine.[390] The Lockheed Martin team was awarded a seven-month, $46.5 million contract, while the General Dynamics team was awarded a 16-month, $78.8 million contract.[391] Each team would complete a final system design of a littoral combat ship, called a Flight 0 ship, and build a prototype. The Lockheed Martin team would design and build the LCS-1 or Freedom-class ship, based on a steel monohull, while the General Dynamics team would work on the LCS-2 or Independence-class ship, based on an aluminium trimaran hull. The U.S. Navy stated that both designs met the programme's key performance parameters.[392]

The Navy initially expected to test one prototype of each design, and then downselect to a single variant for Flight I production thereafter, but this plan proved to be unworkable. Both Lockheed Martin and General Dynamics argued that building a single Flight 0 prototype and then idling their design teams and production lines until a decision on the winner was made would be excessively expensive. This led to the addition of another Flight 0 prototype each before the downselect. However, this plan allowed only a very short time for the Navy to comparatively test the two designs, as the time needed for the production of a second prototype pushed the construction too close to the planned date for transition to Flight I production. The final budget submissions, as reflected in the National Defense Authorization Acts for FY2005 and FY2006, thus called for more Flight 0 seaframes to be built (nine in the FY2005 plan, raised to 14 in FY2006) before the final downselect decision, with the option to put both designs into production.[393]

In the summer of 2004, the House of Representatives attempted to remove funding for the littoral combat ship from the FY2005 defence budget:

> The committee continues to have concerns about the lack of a rigorous analysis of alternative concepts for performance of the LCS mission, the justification for the force structure sought by the Navy, and whether the program's acquisition strategy is necessary to meet an urgent operational need. [...] the committee is concerned about the Navy's ability to resolve these issues before committing to the design for the LCS and beginning construction of the first ship. [...] Consequently, the committee

[390] Dombrowski & Gholz (2006) p37
[391] O'Rourke, Ronald (2004) *Navy DD(X) and LCS Ship Acquisition Programs: Oversight Issues and Options for Congress* (Washington DC: Congressional Research Service) p20
[392] O'Rourke (2019) p7
[393] Work (2014) pp33-34

> recommends $244.4 million in PE 63581N for the LCS, a decrease of $107.7 million for LCS construction.[394]

The head of the projection forces subcommittee of the House Armed Services Committee, Rep. Roscoe Bartlett, argued that the littoral combat ship concept was "immature" and convinced the full House to make the cut. The Navy argued that any cuts to the DD(X) programme would be disastrous for the industrial base. Naval acquisition executive John Young warned publicly that cuts and delays would lead to "substantial layoffs" at the shipyards, leading to a loss of skilled workers that would "come back to haunt the Navy" when shipbuilding resumed in the future.[395] In order to allay these fears, and those about the effect a cut would have on naval force structure, Bartlett proposed funding two additional Arleigh Burke-class destroyers instead.[396]

This threat of funding removal came at the same time as the Navy's planned announcement of the results of the downselect to the final two Flight 0 teams who would build their prototypes, and the Navy argued that they could not fully make the case for the programme's maturity until the two finalists had been announced. The contractors responded quickly. Lockheed Martin, along with their teammates, launched a lobbying campaign, intended both to tilt the downselect decision in their favour and to rally congressional support for the littoral combat ship programme as a whole. The company ran advertisements in newspapers and defence magazines touting their expertise and track record — including taglines like "Don't just look at what we say. Look at what we do." — and blanketed the metro stations serving Capitol Hill and the Pentagon with posters pushing for the littoral combat ship as a programme — with slogans like "Littoral Dominance Assured."[397] Lockheed Martin also planned a trade-show style display in the Capitol to show off their design to congressional members and staffers, including scale mock-ups of the ship itself and its modules.[398]

The House's threat caused a small showdown in Congress, as the Senate had voted to keep the littoral combat ship programme fully funded. In the end, the congressional authorisation conference committee report simply "note[d] the concerns" that Bartlett had expressed, and the final spending authorisation bill actually ended up fully funding the construction of the

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[394] House of Representatives, Committee on Armed Services (2004) *Report on National Defense Authorization Act for Fiscal Year 2005 (108-491)* [Washington DC: Government Publishing Office] p184
[395] Brown, Malina (2004) "Navy paints bleak picture of industry impact: Young building case to persuade lawmakers to repeal DD(X), LCS cuts" *Inside the Navy* 17(25)
[396] Dombrowski & Gholz (2006) p55
[397] Brown, Malina (2004) "Ads blanket Washington area: In littoral ship contest, Lockheed seeks edge with media blitz" *Inside the Navy* 17(21)
[398] Brown, Malina (2004) "Company touts maturity of ship design: Lockheed aims to rally support for littoral ship on Capitol Hill" *Inside the Navy* 17(23)

two littoral combat ship prototypes at a higher level than had been proposed by the Navy, the House, or the Senate in the original authorisations.[399]

The beginnings of the littoral combat ship programme thus provide a clear-cut example of the dominance of the prime defence contractors during this period. The U.S. Navy cited concerns about the defence industrial base when answering congressional queries on the programme's funding, specifically at the Big Six shipyards owned by primes. Lockheed Martin and General Dynamics were able to successfully argue first for additional Flight 0 prototypes, then for both designs to be put into production, and finally for the programme to be not only funded but to receive even more money. Lockheed Martin, in particular, took full advantage of its lobbying teams to push Congress in what it viewed to be the right direction.

Furthermore, the programme exemplifies the practical workings of the military-industrial complex more widely. In choosing two teams to build Flight 0 prototypes, the Navy widened its base of support within the industry, an incentive that was directly acknowledged in comments made by anonymous Pentagon sources at the time.[400] Each shipyard could call upon its local congressional representatives, in the House and in the Senate, to keep the jobs flowing in their communities, and more shipyards thus meant more pressure on Congress. Not only did the primes and their partners in each team want to ensure the programme's survival, but the other shipyards like Bath Iron Works did too — they had received other contracts in the FY2005 defence budget to keep them going, but they could also anticipate the possibility of littoral combat ship construction contracts further down the line if the winning seaframe could not be produced solely at its designers' sites.

6.6 Case Study: F-22 Raptor

The dominance of the primes and their ability to use the electoral incentives present within the military-industrial complex are shown very clearly in the case of the F-22 Raptor. The acquisition of this aircraft was extended long beyond either the military or the executive branch of the federal government felt that it should be, due solely to congressional pressure. Representatives were influenced by electoral considerations, particularly around pork-barrel spending in their states or districts, as well as direct lobbying by the prime defence contractors involved in manufacturing the fighter.

The F-22 Raptor[401] was the winning prototype of the 1981 Advanced Tactical Fighter programme to replace the F-15, with the contract awarded to Lockheed Martin and partners

[399] Dombrowski & Gholz (2006) p56
[400] Ma, Jason (2004) "Lockheed to build first LCS in FY-05: Navy, industry advertise maturity and low risk of LCS selections" *Inside the Navy* 17(22)
[401] For the plane's full specifications, see U.S. Air Force (2015) "F-22 Raptor Fact Sheet"

in 1991. The plane's primary role was to secure air superiority as a dogfighter, intended to match and outgun the Soviet Union's fighter fleet, particularly the Sukhoi Su-27s and Mikoyan MiG-29s under development at the time. However, the end of the Cold War meant that the F-22 was left without a clear mission. As Kyle Mizokami put it, "There's little doubt the F-22 Raptor is the greatest air superiority fighter of its time. The problem was that the fighter's development went on for so long that its primary adversary, the Soviet air force, went out of business."[402]

The first assault on the future of the F-22 occurred in 1999, when Rep. Jack Murtha (D-PA) and Rep. Jerry Lewis (R-CA)[403] partnered up to protest the programme's hugely overrunning costs by withholding funding.[404] This was intended as a temporary measure to call the U.S. Air Force's attention to the cost of the Raptor, rather than an end to the programme outright, but Lockheed Martin took it very seriously. The company deployed a former senator and two former representatives on its payroll to lobby congressional members directly. One representative recalled being lobbied by a former colleague in the House steam room, to which ex-members retain access: "We sat on the sauna naked together and talked about the F-22 [...] That's the advantage former members have."[405] While the U.S. Air Force is not technically permitted to lobby members of Congress, it put together a "Raptor Recovery Team," circumventing the rules by classifying this as an "informational" activity rather than a lobbying effort. The team included Gen. Claude Bolton, who described the task as "a full court press to tell our senior leadership in Congress [...] that we believe the Air Force and the country need this."[406]

While the initial proposal had been to purchase 750 F-22s for $25 billion, by this point the U.S. Air Force was getting 339 planes for a projected cost of more than $62 billion — half as many planes for double the price.[407] While some of this was down to missteps in the design process, Lockheed Martin had also used the old procurement tactic of "buying in," putting in a low bid for the initial acquisition contract in the knowledge that the planes would end up costing far more, then raising the price once the contract was locked in. The Air Force had also contributed to the problem by "gold-plating" the Raptor's design, adding new and more difficult performance requirements after the plane was already in production. Lewis and

[402] Mizokami, Kyle (2021) "The F-22 Raptor Was the Best Fighter Jet—Until America Stopped Producing It" *The National Interest* 30 December
[403] Lewis, Jerry and Murtha, Jack (1999) "Why the F-22 Fighter Plan Doesn't Fly" *Washington Post* 2 August
[404] "Lockheed's F-22 at Center of Congress Battle; Funding for Advanced Fighter Faces Some Enemies in House" (1999) *Orlando Sentinel* 12 Sept
[405] Eilperin, Juliet (1999) "F-22's Future Stalls as Last-Minute Bargaining Begins" *Washington Post* 23 Sept
[406] Whittle, Richard (1999) "Fierce Lobbying Aims to Save F-22; Lockheed, Air Force Enlist Help to Try to Get Fighter's Funding Restored" *Dallas Morning News* 9 Sept
[407] Hartung, William D. (2011) *Prophets of War: Lockheed Martin and the Making of the Military-Industrial Complex* (New York: Perseus Books) pp5-6

Murtha were concerned that the ballooning F-22 programme was crowding out spending on other Air Force priorities and argued that the funds would be better spent on upgrading the F-15, along with investing in surveillance aircraft, aerial refuelling capabilities, and pilot training. The U.S. Army agreed, wanting to regain some defence funds for their service too: Army officials firmly noted that a whole division could be equipped for the cost of the F-22.[408]

The final deal was hammered out in October 1999, which gave Lockheed Martin $2.5 billion. This was a compromise — it was more than the reduced amount that Lewis and Murtha had pushed for, but less than the Clinton administration had originally budgeted for, and came with an attached requirement for further testing. Lockheed Martin had learned to be wary of Congress, but also that its lobbying could see off challenges and get it (roughly) what it wanted. While cost concerns continued into the start of the George W. Bush administration, the programme was put on solid footing in the new security climate after 9/11 — no major defence programmes would be cut, even if they were not directly related to fighting terrorism. As Boeing's vice president put it in an interview shortly after the attacks, "any member of Congress who doesn't vote for the funds we need to defend this country will be looking for a new job after next November."[409]

The Obama administration changed the calculus for Lockheed Martin and the F-22. The new Secretary of Defense, Robert Gates, pledged to cut outmoded and unnecessary programmes from the defence budget, citing the need to better prepare the American military for current and future conflicts. As part of this, Gates announced that he was ending the F-22 programme at a total of 187 planes, around half the number that Lockheed Martin had been pushing for. This total was made up of the 183 planes that had already been acquired and four more that were part of the FY2009 emergency appropriations for Afghanistan and Iraq. These four were in essence a gift to Lockheed Martin, given that the F-22 had never been used in either conflict, and would extend production by a few months into 2012. The decision was counterbalanced by increases in the F-35 programme, a plane also manufactured by Lockheed Martin — while F-22 jobs would fall by 11,000 by 2011, the F-35 programme would gain 44,000 jobs over the same period. Gates specifically noted that he had done "a pretty good job, I think, of taking care of the defense industrial base."[410]

Despite having secured three more years of F-22 production and gained so much from the F-35 programme, Lockheed Martin swung its lobbying machine into action. The company,

[408] Melvin, Don (1997) "F-22 a High-Tech – and Costly – Lethal Weapon" *Atlanta Journal-Constitution* 2 Feb
[409] Squeo, Anne Marie and Pasztor, Andy (2001) "Pentagon's Budget Becomes Bulletproof" *Wall Street Journal* 15 Oct
[410] Department of Defense (2009) "DoD News Briefing with Secretary Gates from the Pentagon" 6 April

along with its F-22 production partners Boeing and Pratt & Whitney, got 44 senators and 200 representatives to sign on to a "save the Raptor" letter, and 12 state governors signed a similar missive. The language was designed to elicit alarm, not about the security of the country but about the future of the defence industry: "We urge you to sustain 95,000 jobs by certifying continued production of the F-22 Raptor — a defense program that is critical to our defense industrial base."[411] Given that military contracts create identifiable jobs in large locations, and are directly linked to decisions made in government, this played directly on congressional members' fears of not doing enough to keep local sites going or, worse, being seen to directly vote against jobs in their state or district.

The letters were loudly backed up with action from congressional members who had particular local interests in the F-22 programme. Sen. Saxby Chambliss of Georgia[412] (home of the F-22 assembly plant) joined with Sen. Joseph Lieberman and Sen. Christopher Dodd from Connecticut (home of Pratt & Whitney, who produced the F-22's engines) in a pledge to put around 20 planes back into the FY2010 defence budget.[413] The representative for the district of Georgia where the assembly plant was located, Rep. Phil Gingrey, announced that the plane should be funded instead of "wasting money" on developing a vaccine for swine flu.[414] However, Lockheed Martin was taken off the board by Gates, who called the company's CEO into his office and said, "If you oppose me on this, I'll eat your lunch."[415] Given the Department of Defense's central importance as a customer, and the other contracts that were ongoing and forthcoming, Lockheed Martin then announced that it would no longer lobby on keeping the F-22 programme going: "We think we had a full hearing of that discussion. We are disappointed with these decisions, but we will accept those and go on."[416]

The congressional members with F-22 sites in their states or districts, however, pledged to keep fighting for the F-22.[417] Their goal was to get the programme to at least 243 planes, the Air Force's initial goal and 56 more than the Obama administration was willing to acquire, at a cost of around another $10 billion. They began in the Senate Armed Services Committee,

[411] Hartung (2011) p2
[412] Keefe, Bob and Chapman, Dan (2009) "F-22 Fight on Horizon: Administration Plan to End Production Has Georgia, Much of Congress Furious"
[413] Bumiller, Elizabeth and Drew, Christopher (2009) "Military Budget Reflects a Change in U.S. Strategy *New York Times* 7 April
[414] Keefe, Bob (2009) "Georgia Lawmakers: Don't Waste Money on Swine Flu Vaccine" *Atlanta Journal-Constitution* 8 May
[415] Hartung (2011) pp9-10
[416] Cox, Bob (2009) "Lockheed Martin No Longer Lobbying Against Defense Secretary's Decision on F-22" *Fort Worth Star-Telegram* 22 April
[417] Eggen, Dan (2009) "Plan to Cut Weapons Programs Disputed; Defense Supporters Say 100,000 Jobs Are in Jeopardy" *Washington Post* 28 April

which voted 13-11 to build another 7 F-22s — this would not only extend the life of the production line, but also keep the door open for further funding in future years. Two of the supportive members of the committee, Sen. John Kerry and Sen. Ted Kennedy, were from Massachusetts, a state with minimal connection to the programme — Raytheon, which is based in the state, had a subcontract for some key F-22 electronics systems, but much of the work on this was actually done in California. It appeared that they would vote in favour of Raytheon even if the jobs were not directly tied to their local communities.[418] Sen. John McCain (R-AZ) joined with the committee's chairman, Sen. Carl Levin (D-MI), to vote against the F-22's continuation. The action then moved to the House Armed Services Committee, where members voted on an amendment to add $369 million in long lead-time funding to keep the F-22 going. The amendment passed 31-30, after a dramatic vote in the early hours of the morning. Again, some supportive members had rather more tenuous links to the programme — Rep. Rob Bishop (R-UT) based his support on his wish for F-22s to be deployed at his local base.[419]

The next vote on the F-22's future took place on the floor of the Senate, during consideration of the defence budget as a whole. McCain and Levin joined together once more to propose an amendment that would remove the $1.75 billion in funding for the F-22 programme that had been added by the Senate Armed Services Committee, shifting the money back into operations and maintenance spending for the armed services. They were heavily backed up by the Obama administration — Gates had told the president that he would be unable to get anything else done on defence budget reform if he lost the fight over the F-22, so Obama threatened to veto any defence bill that included extra funding for the plane. Gates also joined Vice President Joe Biden and White House Chief of Staff Rahm Emmanuel in whipping the issue with senators.[420]

During the floor debate,[421] Chambliss and Dodd reprised their roles in vehemently supporting the F-22. Dodd argued that it was unwise to put so many thousands of jobs (including in his state) at risk for an amount of funding that was only "two-tenths of one percent of the [defence] budget," particularly during a recession, and made an analogy between the F-22 programme and the bailout of the automotive industry. He also made the classic defence industrial base argument, suggesting that keeping skilled personnel in the defence aerospace industry was essential and that there would be a damaging production gap

[418] Bender, Brian (2009) "The Dogfight Obama Seems Bound to Lose; Congress Backs F-22 Fighter the Pentagon Doesn't Want" *Boston Globe* 12 July
[419] Burr, Thomas (2009) "Bishop Helps Keep F-22 Production Alive" *Salt Lake Tribune* 19 June
[420] Hartung (2011) pp12-13
[421] *Congressional Record*, Vol. 155, No. 110, 111th Congress, 1st Session, 21 July 2009, ppS7724-S7740 https://www.congress.gov/congressional-record/2009/07/21/senate-section/article/S7723-8

before the F-35 programme ramped up: "To assume that the thousands of workers across the Nation who work on the F-22 will stand idly by until 2014 when we begin to build the F-35 Joint Strike Fighter is naive at best."

The two were joined by other senators with F-22 jobs in their states, including Sen. Barbara Boxer (D-CA) and Sen. Patty Murray (D-WA). In her floor speech, Murray specifically argued that the withdrawal of funding from the F-22 programme would damage the military-industrial complex:

> But maintaining that technology has depended on an important partnership and that is a partnership between the Pentagon, which determines the needs of our war fighters, and industry, which does the research and design and builds the next generation of military equipment that meets those needs. It is a partnership that is vital to our military strength, to our economy, and to the health of our domestic industrial base. Unfortunately, it is also a partnership that is being weakened by amendments such as the one we are considering today.

Others supported the amendment who did not have F-22 jobs locally. Sen. Daniel Inouye (D-HI), who had spent over 20 years as a leading member of the Defense Appropriations Subcommittee of the Senate Appropriations Committee and prided himself on securing defence earmarks for his state,[422] noted: "While some of my colleagues obviously support the program because it means jobs in their States, others like myself who have no F-22 jobs in their States support the program because of its capabilities and their concern for the future." However, while that particular plane may not have been produced in Hawaii, there were several Lockheed Martin facilities located there and Inouye had received over $50,000 in campaign contributions from the company over the previous two years.[423]

McCain and Levin hit back at these arguments in their own floor speeches. Levin openly warned his Senate colleagues that they should not support the purchase of unnecessary F-22s for "parochial reasons." He also noted the clear-cut direction received from the defence establishment:

> The Senate has heard from the senior leadership of the Defense Department, both civilian and military, that we should end F-22 production. The recommendation is strong and clear, as strong and clear as I have ever heard when it comes to ending the production of a weapons system [...] President Eisenhower noted, from time to time, the military industrial complex will push for more and more, more than is needed. In

[422] "Inouye Earmarks Beneficial to Hawaii" *Honolulu Advisor* 23 August 2009
[423] Taxpayers For Common Sense (2009) "Inouye, Cochran Benefit From Earmark Recipients" 23 August

> this case, however — in this case — the senior military leadership is not pushing for more.

Levin highlighted his support for the Obama administration's view that the most likely conflicts that the United States would face in the short and mid-term were more likely to require F-35s and uncrewed aerial vehicles, and that in the unlikely event that enemy fighter planes would have to be shot down, the current buy of 187 F-22s would be more than sufficient.

McCain backed up Levin's arguments, but also used his speech to directly tackle the issue of the congressional role in the debacle:

> I will match my commitment to equipping the men and women in the military with that of anyone in this body, but it has to stop, and this vote on the F-22 will determine whether it is business as usual with the earmarking and pork-barreling of billions of dollars which has bred corruption [...] or whether we are going to finally get it under control.

He then directly quoted two paragraphs of Eisenhower's farewell address on the military-industrial complex, adding that he would prefer the term "military-industrial-congressional complex" given Congress's central role in funding the acquisition of unnecessary platforms like the F-22. These fiery speeches, along with the Obama administration's whipping operation, meant that the amendment to strip the F-22 funding won more handily than expected, by 58-40 — even some senators who had voted in favour of more funding in committee, like Kerry, changed their minds for the Senate vote due to White House pressure.

The F-22 programme was thus finally ended at the 187 planes that Gates had planned for. While the programme's proponents ultimately failed to secure further pork-barrel spending under its auspices, the difficulty of the fight that the Obama administration had to wage, even with Lockheed Martin taken off the field, shows the power of congressional pressure in acquisition decisions. As McCain highlighted in his floor speech, the role of Congress in the military-industrial complex cannot be dismissed lightly, and even programmes that have lost the support of the other big military and government players (the White House, the Department of Defense, and the services) can be prolonged if legislators wish it. The F-22 saga also clearly shows the important role of prime contractor lobbying, pork-barrel spending, and electoral incentives in influencing congressional members, particularly those serving on the armed services committees — keeping jobs and economic centres in their districts or states meant more to these congressional representatives than the actual national security requirements of the United States, and the primes were able to use that to push for the continued production of a plane that was no longer needed.

6.7 Case Study: JIEDDO

As major combat operations ended, the U.S. and allied forces on the ground in both Iraq and Afghanistan in the mid-2000s faced a new kind of warfare: counter-insurgency. The number one threat to troops was from the improvised explosive device, or roadside bomb. Thousands of these explosive devices were planted throughout Iraq and Afghanistan in places where they could be remotely detonated to cause harm to coalition troops, often along major roads. The munitions and explosives used in the devices were cheap and easy to obtain, and could often be homemade. Improvised explosive devices were easy to use, as they could be set off in a variety of ways without risk to the person who had placed them, often via a mobile phone or radio signal. The improvised nature of the devices meant that they could be quickly modified to overcome countermeasures, with the latest tactics and techniques shared between groups on the internet. But they were used so often primarily because they worked — a cheap and simple improvised explosive device, properly detonated at the right time, could kill or injure troops and destroy their equipment with little difficulty, despite the coalition forces' superiority in numbers, resources, and technology.[424]

While the use of such weapons by guerrilla or insurgent groups was not new, and cheap unconventional weapons can often have an outsize impact on conventional forces, the U.S. military recognised the need to counter the use of improvised explosive devices in both Afghanistan and Iraq if forces were going to remain there. In the summer of 2004, with coalition casualties from improvised explosive devices rising, Gen. John Abizaid, the commander of U.S. Central Command, sent a memo to the secretary of defense calling for a "Manhattan Project-like" effort to tackle the threat.[425] The U.S. Army formed a task force of 12 to do so shortly afterwards, with a $100 million-dollar budget. This was turned into a joint forces team with $1.3 billion of funding in 2005, but as deaths continued to rise the Department of Defense sought a much grander endeavour. In February 2006, the Joint Improvised Explosive Device Defeat Organization (JIEDDO) was formally established under the leadership of retired four-star Army general Montgomery Meigs, with an even larger budget of $3.6 billion. The overt reference to the Manhattan Project was "meant to convey the need for a large-scale, focused effort, combining the nation's best scientific minds with nearly unconstrained resources to develop technical solutions to the problem."[426]

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[424] House of Representatives, Committee on Armed Services, Subcommittee on Oversight and Investigations (2008) *The Joint Improvised Explosive Device Defeat Organization: DOD's Fight Against IEDs Today and Tomorrow* (Washington, DC: GAO) p13

[425] Cary, Peter and Youssef, Nancy (2011) "JIEDDO: The Manhattan Project That Bombed" *The Center for Public Integrity*

[426] House Committee on Armed Services (2008) p11

JIEDDO's activities fell under three lines of operation. The first was, unsurprisingly, "Defeat the Device" — researching and developing countermeasures intended to neutralise an improvised explosive device after it had been placed. The second was "Attack the Network" — this aimed to locate and stop the people making and placing the devices before they could do so, focused around JIEDDO's hub for fusing operations and intelligence data, the Counter-IED Operations Integration Center. The third was "Train the Force" — teaching the troops on the ground how to protect themselves from improvised explosive devices, and how to effectively use any new equipment that sprang from the ongoing research. This tripartite focus meant that JIEDDO was simultaneously collecting and analysing intelligence, developing new technology, and training U.S. forces — giving it, in practice, a mandate that spanned almost the entirety of ongoing combat operations in Afghanistan and, primarily, Iraq.[427] Word quickly spread around defence companies, universities, and contractors that JIEDDO had a huge portfolio and a huge budget to go with it, and was looking for high-tech solutions to the improvised explosive device problem.

From the beginning, JIEDDO was a huge rapid-acquisition programme for new technology, and it went all in. It developed jammers to counter remote detonation signals; acquired armoured troop carriers with V-shaped underbellies to deflect blasts; bought mine-rollers to explode pressure-sensitive bombs; and built networks of cameras on vehicles, towers, and airships. In 2006 alone, JIEDDO investigated 857 new technologies under its "Defeat the Device" stream, started work on 282 of these, and eventually fielded 52. The "Attack the Network" stream gave rise to 21 new technologies out of a starting field of 282, and "Train the Force" yielded 9 from an original 42. By the end of 2010, JIEDDO had invested in around 1000 technologies, of which 219 had been approved to be transferred to the military.[428] These transfers gave a service, combatant command, or other military organisation the responsibility of operating and sustaining a successful programme going forward, with additional funding from supplemental appropriations.[429]

JIEDDO's funding was appropriated through the Joint IED Defeat Fund, and the budget was available for three years from the date of the appropriation. The secretary of defense also had special authority to transfer these funds between different types of accounts (personnel, operations and maintenance, procurement, research and development, and working capital) without the usual requirement to gain approval from the Congressional defence committees. According to testimony given to the House Armed Services Committee, JIEDDO officials believed this length of funding and the ability to shift priorities quickly was critical to

[427] Atherton, Kelsey (2017) "When Big Data Went to War – And Lost" P*olitico* 11 October
[428] Cary & Youssef (2011)
[429] House Committee on Armed Services (2008) p20

developing and fielding new counter-improvised explosive device measures, giving the flexibility needed when the threat itself was changing so rapidly.[430] JIEDDO could, in essence, get technologies from development to deployment in months, rather than the years normally taken by the standard Department of Defense research and development pipeline. Like that of making the devices, the countermeasure process was iterative — some technologies did not work as expected or straight away, but the overall speed was useful in dealing with a threat of the nature of the improvised explosive device.[431]

With a broadening mandate and an increasing budget, JIEDDO grew in size from the small Army taskforce of 12. By mid-2008 it had a permanent staff of 468 employees, both military and Department of Defense civilian, supplemented with an additional 1370 "wartime" personnel. Much of this supplementary staff was made up of contractors, with a ratio of contractors to government personnel of over six to one. Despite expressing concerns about JIEDDO's dependence on contractors, the House Armed Services Committee stated that this level of reliance was "understandable for an organization that needed to stand-up rapidly to meet urgent wartime needs."[432] Using the agency's own cost multiplier of $225,482 per contract staffer, JIEDDO spent over $375 million on contractor staff in 2010 alone.[433]

In their newly dominant position within industry, the prime defence contractors were making the most of the opportunities that JIEDDO offered, and they did well out of it. In April 2008, Lockheed Martin (in concert with BAE Systems, ITT, and Wexford-CACI) was awarded a $453 million contract for "support services." The following year, Lockheed Martin won another contract of its own, for $318 million, to provide operations support services to JIEDDO analytical teams. That same year, five contractors (SAIC, Lanmark, GS5, Wexford-CACI, and ITT) were awarded a $494 million contract to support JIEDDO with strategic planning, intelligence analysis, and other operational tasks. And in June 2010, Lockheed Martin again won a set of contracts worth $460 million, this time to provide analytical support for JIEDDO's Counter-IED Operations Integration Center, including over 500 staff. As a former defence official commented in 2011, "A lot of people were feasting off of JIEDDO."[434]

JIEDDO faced a number of problems over its lifetime, many of them structural. It was not initially set up with a comprehensive strategic plan, and several prods from Congressional committees and the Government Accountability Office were required before one was

[430] House Armed Services Committee (2008) p30
[431] Atherton (2017)
[432] House Armed Services Committee (2008) p29
[433] Cary & Youssef (2011)
[434] Ibid.

published in 2008. The House Armed Services Committee flagged issues to do with measuring success, noting that it was "impossible to demonstrate which of the specific initiatives and programs supported by JIEDDO are effective."[435] The Government Accountability Office noted a lack of coordination among the various counter-improvised explosive device efforts across the spectrum of Department of Defense entities, leading to potential duplication of effort and difficulty in ensuring that the best solutions made it to the troops on the ground.[436]

JIEDDO stands as a clear example of the dominance of the prime defence companies during the 2000s. These companies were able to take advantage of the opportunity provided by JIEDDO, with its huge budget and expansive mandate, to win contracts for large sums of money providing both support services and technological research. The organisation's extensive reliance on these contractors for staff and other support services was not particularly questioned given the urgent nature of the threat and the wartime context of the period, and there is a clear sense that the Bush administration's focus on doing everything possible to tackle the improved explosive device threat meant that money could be spent without a clear plan of action. Despite the number of projects that JIEDDO worked on, and the millions of dollars ploughed into them, it did not find a new high-tech way of detecting or defeating improvised explosive devices. What it did provide, however, was a substantial pay-day for the prime contractors.

6.8 Conclusions

The 1990s were a period of intense consolidation for the defence industry, with mergers, acquisitions, and absorptions bringing the number of companies within the industry sharply downwards. This process created the prime defence contractors, whose portfolios now spanned a range of fields after absorbing smaller firms that had been more specialised. However, the dominance of the primes did not fully manifest until the Bush administration, where the new landscape of the Global War on Terror created a feeding frenzy for the primes on projects like JIEDDO. The primes were able to assert their dominance within the military-industrial complex — they could exert considerable lobbying power over both the military and the government, particularly Congress, and used this to further their own interests by expanding programmes, as can be clearly seen in the cases of the littoral combat ship and the F-22 Raptor.

[435] House Armed Services Committee (2008) p40
[436] Government Accountability Office (2009) *Actions Needed to Improve Visibility and Coordination of DOD's Counter-Improvised Explosive Device Efforts* (Washington, DC: GAO)

The dominance of the primes during this period changed the way in which the military-industrial complex worked. The government and the military had previously been focused on building links with universities, laboratories, and other academic institutions — now, they were dealing with big industrial leviathans unlike any company that had existed previously in the defence world. While the academic institutions had produced a great many advancements in military technology during World War II and the beginning of the Cold War, they had not recently produced anything like the wonder-weapon wizardry of those years for the U.S. military. The Strategic Defense Initiative, supposed to be the Manhattan Project of its day, had failed to achieve much of anything, much less the lofty promises of the original proposals, despite the amount of funding pumped into various parts of the academia assemblage in pursuit of the programme's goals. The primes, however, could use their new size to their considerable advantage, concentrating their lobbying power to press those making the decisions, particularly congressional representatives, leveraging their dominance over the defence industry to extract more contracts, larger acquisition programmes, and favourable conditions. These industrial giants could not only make the argument that contracts helped provide jobs and economic growth in the areas where facilities were located, but also that in times of insecurity the United States needed to maintain a healthy defence industrial base overall.

This period is another example of why an assemblage approach is more fruitful than the iron triangle in understanding the military-industrial complex. While the iron triangle does better here than in the previous period, given that the important interactions are between its three corners of military, government, and industry, the problem is that the iron triangle does not allow for differentiation between the actors within those three categories. An assemblage approach, in contrast, permits us to look at how the prime contractors began to dominate within the industry portion of the military-industrial complex during the post-Cold War era, and then to analyse how their interactions differed with the myriad parts of the other two. The F-22 case, for example, cannot be fully explained without the primes having different interactions with parts of the government assemblage — particularly with congressional members who did and did not have electoral interests stemming from the programme, and again with the executive branch (both the White House and the Department of Defense) — and these intricacies would not be elucidated under an iron triangle approach.

While academia was still gaining defence funding and producing research during this period, the primes were able to overtake them quickly — the academic institutions simply could not keep up with the prime defence contractors once they had come into being. This pattern was to shift again, however, during the following decade.

CHAPTER SEVEN

The Traditional Complex in Decline: From Defence Primes to Tech Titans

Today's military-industrial complex consists of a small group of conglomerates that are coping with declining Pentagon sales, investing less money in new technology and increasingly depend on the global market for innovation.

Bill Lynn, former deputy secretary of defense and CEO of Finmeccanica North America[437]

As I have explored, much of the leading-edge military technological research in the United States after the end of World War II was funded by the federal government, and the Department of Defense did a great deal to push forward the boundaries of innovation during this time. This still held true to some extent in recent years, but there was a dramatic shift in the relative balance of power beginning around 2010. Firstly, the defence primes that had been so powerful over the 2000s began to lose ground, being overtaken by other smaller private companies and start-ups that had not been traditional participants in the defence ecosystem. Secondly, the large commercial technology companies, which had grown from the seeds of Silicon Valley start-ups around civilian consumer technologies, began to become relevant to defence contracting through dual-use products given the increasingly high importance of such technologies to the U.S. military. This shift reflects a wider change within the industry assemblage and thus within the military-industrial complex assemblage overall — the relative decline of the prime contractors due to the rise of both small defence start-ups and huge civilian technology companies within the defence industry. In this chapter, I explore the historical and policy context around this important shift, through my data analysis and several smaller case studies — the Strategic Computing Program, the JEDI Project, Project Maven, Palantir, and SpaceX.

Innovation remained strong in the United States but was different to what it was in previous decades. While the big technology companies invest hugely in research and development, they are incentivised to focus most heavily on the latter, in order to produce products and services for the global commercial markets that are their main source of profit.[438] While the Department of Defense and its agencies remained major sponsors of research in a wide range of fields, a far greater percentage of this research was now coming out of the labs of civilian

[437] Erwin, Sandra (2015) "Defense Technology At a Crossroads: Can the Pentagon Regain Its Innovation Mojo?" National Defense 99:737 p18

[438] Lewis, James A. (2021) *Linking National Security and Innovation: Part 1* Center for Strategic and International Studies p2

companies: the centre of gravity for technological innovation moved away from the defence sector and the government.[439]

> For most dual-use technologies, the prominence of government investment has lessened in the past four decades, as the size of the defense market has shrunk and as the private sector has taken on by far the larger share of research and development in key twenty-first century technologies.[440]

Many of the technologies that will shape the twenty-first century have been and are being developed in the pursuit of profit within the commercial sector, by companies like Amazon, Microsoft, and Google. These companies are global in reach, have access to huge resources, and can take advantage of the constant refinement of their products in the hothouse of commercial business.

The development of the Third Offset Strategy at the beginning of this period was intended to increase the military's use of new technologies, particularly those related to computing, and this was coupled with a rise in research and development budgets. The Department of Defense also encouraged the integration of commercial off-the-shelf technologies into defence systems in order to reduce costs while increasing capabilities, as well as shortening the cycles for both acquisition and development. Drawing on the best commercial systems and incorporating them into military products enables the United States to avoid falling behind overseas competitors, who also hope to cherry-pick the best commercial technologies for their own militaries.[441] Although the Department of Defense was for many years a net exporter of technologies to the commercial sector, it became a net importer — a shift from technology spin-off to spin-on. This shift is important — a spin-off relationship means that the balance of power rests with the military, but the newly-formed spin-on relationship changed the dynamic, leaving more power in the hands of the non-defence commercial sector. Although the beginnings of this shift can be found in the 1980s and 1990s, its true expression does not come until the 2010s.

However, the Department of Defense struggled to work out how best to leverage the burgeoning dominance of the American civilian technology sector in support of U.S. military might.[442] While the information revolution arguably started in the defence world when

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[439] Carter, Ash (2019) *Inside the Five-Sided Box: Lessons from a Lifetime of Leadership in the Pentagon* (New York: Dutton) p320

[440] Hunter, Andrew, Sheppard, Lindsey, Karlen, Robert, and Balieiro, Leonardo (2018) *Artificial Intelligence and National Security: The Importance of the AI Ecosystem* Center for Strategic and International Studies p16

[441] Dombrowski, Peter and Ross, Andrew L (2008) "The Revolution in Military Affairs, Transformation and the Defence Industry" *Security Challenges* 4:4 p28

[442] Flournoy, Michèle A and Lyons, Robert P (2016) "Sustaining and Enhancing the US Military's Technology Edge" *Strategic Studies Quarterly* 10:2 pp3-4

ARPAnet was built, commercial technology companies now controlled much of the innovation and research and development spending in emerging fields like artificial intelligence and machine learning. The federal government was once the primary funder of technologies of strategic importance, but no longer. While this did not necessarily limit innovation — the big tech companies had no shortage of talent or funds for research and development — it did mean that the direction of travel could no longer be shaped by national security goals. Identifying and acquiring technologies that advance these goals was made more difficult by the extra layer of civilian commercial priorities, and the federal government needed to figure out how best to ascertain what would add value to the American military and then how to bring that through a cumbersome and bureaucratic procurement process. The way in which the military-industrial complex works has shifted accordingly.

The void between the military and the commercial tech sector has grown considerably. The technology giants of this decade are not simply the new defence primes — on the contrary, many of them neither needed nor particularly wanted defence contracts, preferring to focus predominantly on their commercial operations. As a result, commercial technology has leapt ahead of that in the defence world, and it has become necessary for the Department of Defense both to grapple with the civilian commercial sector and to learn how to partner with smaller defence-focused companies outside of their usual prime contractor options. The federal government needed to figure out to be more like the companies it wished to buy from, as James Lewis argues,[443] bringing in elements of the venture capitalist mindset and learning how to speak the Silicon Valley language. However, if this can be done correctly, it may well prove to be the case that it is more efficient for the Department of Defense to buy and modify commercial off-the-shelf technologies in the pursuit of national security goals than to develop its own. Either way, the rise of both huge civilian commercial technology companies and smaller defence-focused start-ups within the defence industry space marks a substantial change in the nature of the industry assemblage within the military-industrial complex, one that is likely to persist over the next few decades.

7.1 Data Analysis

My data show a clear peak in the mid-2010s for non-prime private entities in defence research and development contracting, persisting until the end of my dataset, both in terms of the number of contracts and their dollar value. In order to analyse this more clearly, I have taken only the data from 2009 to 2018 and shown this in graph form:

[443] Lewis (2021) p3

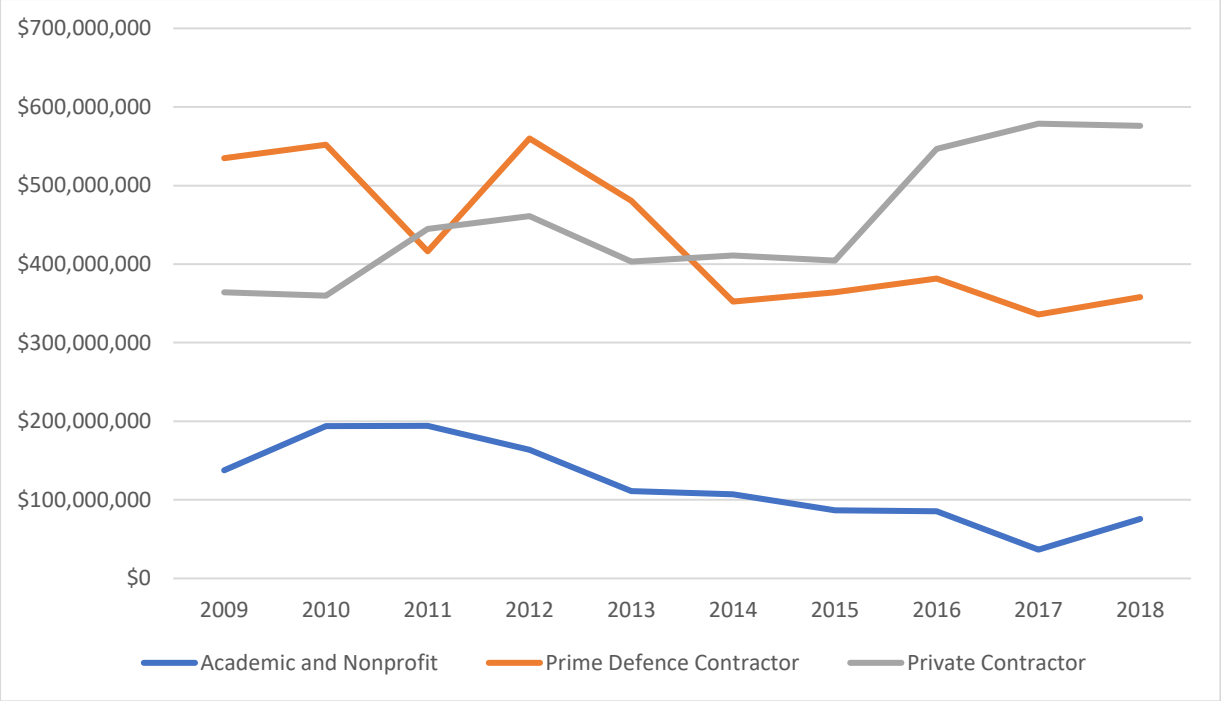

Fig 1: Dollar value of contracts per year, 2009-2018

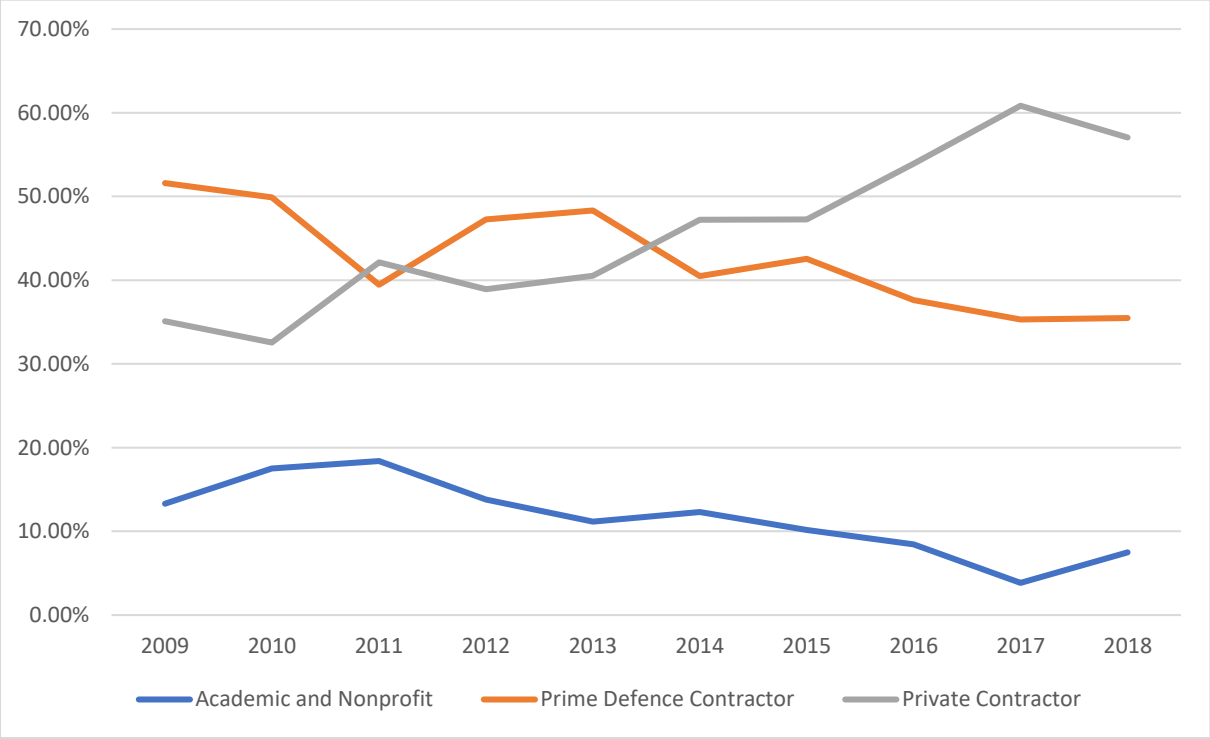

Fig 2: Dollar value of contracts as percentage of total per year, 2009-2018

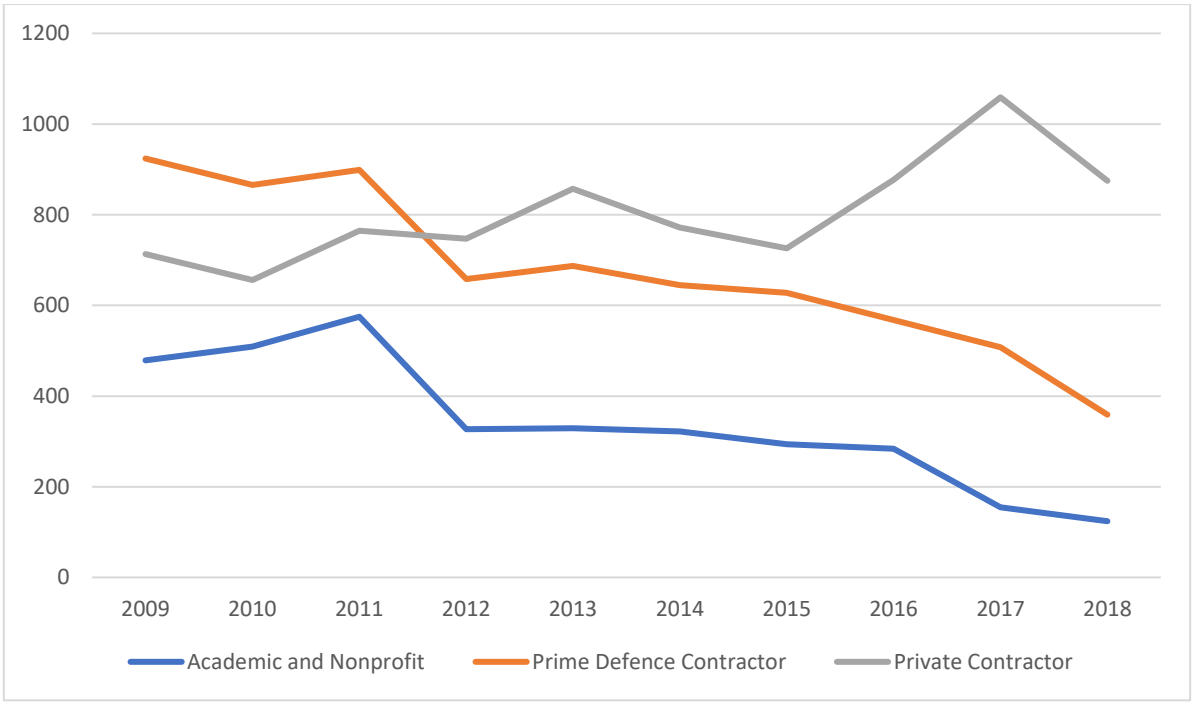

Fig 3: Number of contract actions per year, 2009-2018

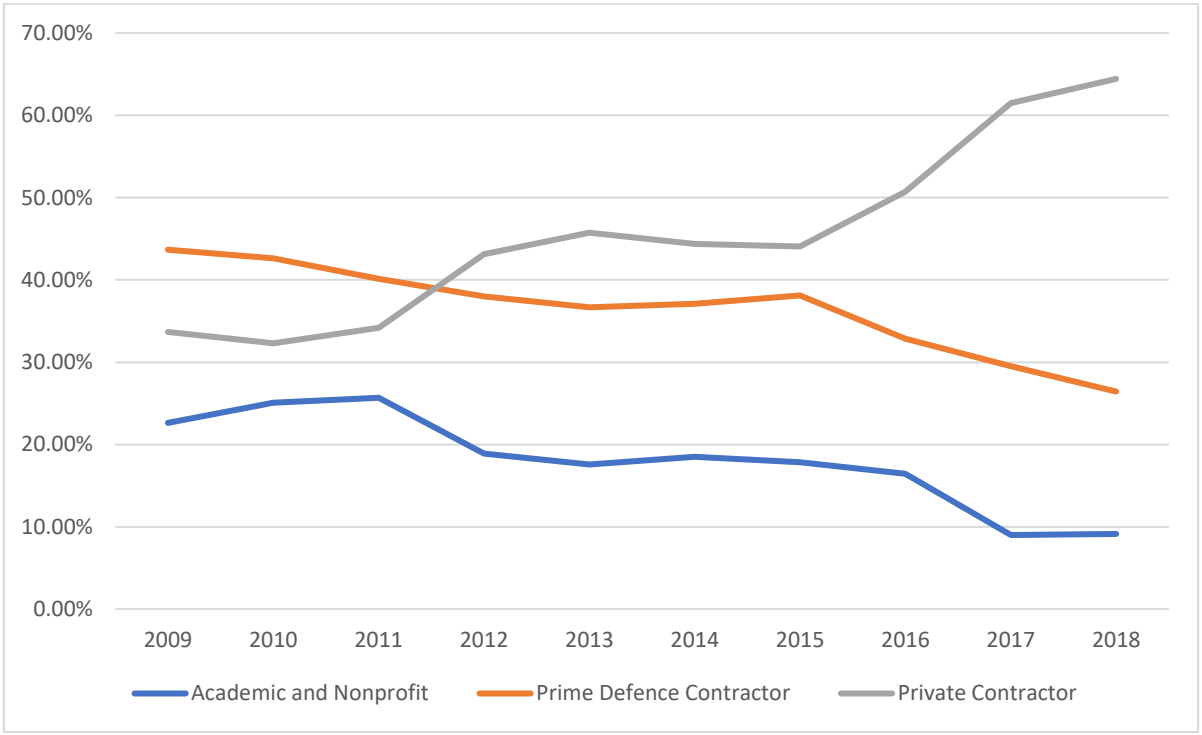

Fig 4: Number of contract actions as percentage of total per year, 2009-2018

The data on both dollar value and number of contracts reveal a similar trend, with private contractors overtaking the prime contractors around the middle of the decade. The crossover point comes a little later when looking at dollar value, indicating that the contracts that the

prime contractors received between 2012 and 2014 may have been fewer but were high in individual value. The divergence between the prime contractors and the other private contractors becomes pronounced in all measures from 2015 onwards and grows larger towards the end of the dataset.

In order to analyse the types of non-prime companies that took research and development contracts during this period, I took the decade as a whole and drew out the twenty companies that were top in number of contracts. I looked at their corporate websites[444] and compiled the below information on their operations:

Company	**Date founded**	**Product areas**
Alion Science and Technology Corporation	2002	C4ISR,[445] artificial intelligence, software, network engineering
Applied Research Associates Inc.	1979	C4ISR, modelling, simulation, prototyping
Assured Information Security Inc.	2001	Cybersecurity, testing
Azimuth Corporation	2001	Modelling, sensors, optics, electronics, biotech
Dynetics Inc.	1974	Uncrewed aerial systems
Engineering Research & Consulting Inc.	1988	Space vehicles, propulsion, developmental testing
Fibertek Inc.	1985	Lasers, lidar
Innovative Defense Technologies LLC	2006	Software, cloud computing, cybersecurity
Intelligent Software Solutions Inc.	1997	Data analysis, systems integration, software
KBR Inc.	2006	Artificial intelligence, software, testing
Manufacturing Techniques Inc.	1992	Sensors, system integration, testing
Millennium Engineering and Integration LLC	1995	C4ISR, sensors, missile systems
OptiMetrics Inc.	1979	Simulation, software, testing
PAR Technology Corporation	1968	Information management, software

[444] See Appendix B for a full list of sources.
[445] Command, control, communications, computers, intelligence, surveillance, and reconnaissance.

Securboration Inc.	2001	C4ISR, software, modelling, cybersecurity
SimVentions Inc.	2000	Systems, cybersecurity, modelling, software
The AEgis Technologies Group Inc.	1988	C4ISR, simulation, testing
Torch Technologies Inc.	2002	Modelling, simulation, software, sensors, product engineering
UES Inc.	1970	Aerospace, biotech, propulsion
Universal Technology Corporation	1961	Sensors, data analysis, aerospace

All of the companies provide research and development services, as the whole or larger part of their commercial offering. Half of the top twenty were founded after 1995, making them young when compared to the traditional primes.

While the range of operations is broad, touching on most (if not all) areas of defence, there is a clear skew towards computing. Those that work with kinetic platforms and weaponry, such as missile systems, tend to focus on the software and systems integration aspects rather than the more physical technology. Others focus entirely on software and information technology systems, working on areas such as command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) and cybersecurity where computing is at the centre. Many of the companies offer testing and evaluation of products, but predominantly via simulations and computer modelling.

However, the companies now contracting with the military are not just those that are defence focused, but also those that produce technology products largely for the civilian commercial sector. A partial window into this is provided by an analysis performed by Tech Inquiry, who in their exploration of contracting data found that civilian technology firms have had a considerable amount of work from U.S. federal agencies, including the Department of Defense, in recent years.[446] They recognise that the data available is messy and incomplete, and their conclusions are somewhat vague, but this study nonetheless supports the general point that non-defence technology firms are contracting more with the military than previously.

[446] Poulson, Jack (2020) "Reports of a Silicon Valley/Military Divide Have Been Greatly Exaggerated" *Tech Inquiry* June 7

As in my analysis of previous periods, the context of the decade can explain a great deal. This peak in research and development contracts for non-prime private companies comes at a time when the Department of Defense was attempting to fold new technologies into its thinking through the Third Offset Strategy.

7.2 The Third Offset Strategy

After the Department of Defense started to truly grapple with the implications of emergent technologies for the future of warfare in the early 2000s, it started to publish a series of roadmaps for future investment, each of which attempted to look 25 years into the future. These were intended to sketch out needs and wants for future technologies, covering fields such as weapons, drones, sensors, propulsion, and other key enabling technologies, in order to inform future investments by the federal government and the defence industry.[447]

The true expression of this came in the form of the Third Offset Strategy, launched in 2014 to reinvigorate the U.S. technological advantage and ensure that the nation's armed forces could take full advantage of emerging technologies. At the time, the wars in Afghanistan and Iraq appeared to be winding down, while American military planners became conscious of the fact that great-power competition was returning. Both Russia and China seemed to have taken advantage of the U.S. focus on the Middle East since 9/11 to significantly increase and improve their warfighting capabilities, while the United States had lost its edge in conventional warfare due to its concentration on the Global War on Terror. The Third Offset Strategy, as envisioned by its central creator, Deputy Secretary of Defense Bob Work, was intended to draw on advanced technologies to offset or overmatch China and Russia's advances.[448] The Secretary of Defense, Ash Carter, pumped more money into the defence research and development budget for these new technologies, describing the strategy as "the huge strategic reorientation we were making from fifteen years of counterterrorism and counterinsurgency to the big-ticket, full-spectrum threats associated with Russia and China."[449] While Work and some of his colleagues in the Department of Defense explicitly identified technologies to focus on — centred around artificial intelligence, machine learning, and robotics — others were agnostic about the specifics as long as the technologies employed were connected to new operational concepts.[450]

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[447] Scharre, Paul (2018*) Army of None: Autonomous Weapons and the Future of War* (New York: W. W. Norton) pp14-15

[448] I am indebted to Bob Work for speaking with me about the Third Offset Strategy.

[449] Carter, Ash (2019) Inside the Five-Sided Box: Lessons from a Lifetime of Leadership in the Pentagon (New York: Dutton) p22

[450] Gentile, Gian, Shurkin, Michael, Evans, Alexandra T., Grisé, Michelle, Hvizda, Mark, and Jensen, Rebecca (2021) *A History of the Third Offset, 2014–2018* (Santa Monica, CA: RAND Corporation) pp1-2

The use of the "third offset strategy" terminology was intended to site the plan directly within the lineage of the earlier two, in which the United States had also used technological innovation to offset identified advantages of its great-power competitor. The First Offset Strategy (or New Look) was a product of the early Cold War, intended to leverage the best of America's laboratories and technological talent to limit the Soviet Union's ambitions via nuclear deterrence, using tactical and strategic nuclear weapons to offset the Soviet conventional advantage. Later in the Cold War, the policy of Soviet containment led to the development of the Second Offset Strategy, which aimed to use qualitative advances in military technology to offset the greater numbers available to Warsaw Pact forces — rather than a focus on nuclear technology, this was centred around areas like microprocessors, networking, and other information technologies.[451] Both of these strategies involved using federal funding to drive technological advancements, through contracts with academic institutions and large industrial partners, and these technologies were filtered into commercial applications in various ways.

However, many of the technologies that the Department of Defense now wanted to incorporate into its capabilities were being developed outside of its control and within a global marketplace. Not only did the United States no longer have exclusive access to the breakthroughs created by American companies, but its relative purchasing power had diminished within the global economy, especially as other states such as Russia and China began to focus more intently on the modernisation of their armed forces. The Third Offset Strategy therefore reflected the reality that the Department of Defense could no longer drive innovation, as it had been able to during the first two offsets, and needed to find new methods of cultivating innovation while working with the commercial sector, notably Silicon Valley.[452] The department also needed to change how it did business in the acquisitions space. As John Dowdy and Chandru Krishnamurthy note, "the Third Offset is a direct challenge to the business model the Pentagon has practised since World War II" — the department was being forced to shift away from cost-plus research and development contracts with entities that derived most of their work from federal sources, and instead deal with primarily commercial businesses.[453]

Not only had the pace of technology innovation accelerated, and become more disruptive and transformative throughout many sectors of society, but the new technologies that had become necessary to enhance military capabilities were being developed in the global

[451] FitzGerald, B, Sander, A and Parziale, J (2016) *Future Foundry: A Strategic Approach to Military-Technical Advantage* (Center for a New American Security: Washington DC) p14
[452] Gentile et al (2021) p3
[453] Dowdy, John and Krishnamurthy, Chandru (2019) "Defense in the 21st Century: How Artificial Intelligence Might Change the Character of Conflict" in Bitounis and Price (ed.) (2019) pp85-86

commercial marketplace, with far more complicated supply chains than in previous decades. This reduced the ability of the Department of Defense to shape the defence industrial base with traditional policy levers, as the base itself was becoming far more diffused with different incentives and vulnerabilities. The global nature of these companies meant that they did not (and are unlikely to) sell their products only to the U.S. armed forces, so the competitive advantage that may spring from integrating these technologies into the military context would go to whichever state did so more quickly, be that an American ally or adversary.[454] As Gen. Jim Mattis noted in the 2018 National Defense Strategy, "Success no longer goes to the country that develops a new technology first, but rather to the one that better integrates it and adapts its way of fighting."[455]

The challenge for the U.S. military was not in identifying new technologies, but in making use of them — bringing them into the force and utilising them effectively to create military advantage.[456] Success now depended on how well the Department of Defense could both embrace and integrate commercial technologies into their forces. As former Defense Advanced Research Projects Agency director Arati Prabhakar put it, the secret of success was finding how "to harness that commercial technology and to turn it into military capabilities much more powerful than anyone else."[457]

7.3 Spin-off to Spin-on and the Strategic Computing Program

The transitioning of state-funded military technologies into the civilian commercial sector that we see during the period of the First and Second Offset Strategies is known as spin-off. A good example of this is the Strategic Computing Program — the potential for spin-off was an explicit part of the Defense Advanced Research Projects Agency's pitch to Congress for programme funding. The 1983 prospectus document contains a section headed "Spinoffs from the Technology Base Can Stimulate National Economy" and says that the programme "promises the production of machine intelligence technology that will enable yet another major cycle of new economic activity in the computer and electronics industry [...] Spinoffs from a successful Strategic Computing Program will surge into our industrial community."[458]

Despite the fact that the Defense Advanced Research Projects Agency has long been known for its high-risk, high-reward philosophy, the Strategic Computing Program represented a

[454] Manyika, James, McRaven, William H., and Segal, Adam (2019) *Innovation and National Security: Keeping Our Edge* Council on Foreign Relations pp11-13
[455] Department of Defense (2018) *Summary of the 2018 National Defense Strategy of the United States of America: Sharpening the American Military's Competitive Edge* [Washington, DC: Department of Defense] p10
[456] FitzGerald et al (2016) p17
[457] Quoted in Segal, Adam (2017) "Bridging the Cyberspace Gap: Washington and Silicon Valley" PRISM 7:2 p71
[458] DARPA (1983) p9

project of unprecedented ambition.[459] Alex Roland and Philip Shiman argue that the best way to view the programme is as "a pot of money used to nourish the technology base, not a coordinated assault on machine intelligence."[460] Vincent Mosco shares this view, arguing that military projects like the Strategic Computing Program are the "primary legitimate means" of providing state funding for corporate research and development, in a manner that would be criticised as improper government intrusion if done openly; this enables the government to harmonise corporate activity with perceived national interests, while directly feeding the nation's technology sector.[461] Dwight Davis adds to this by noting that the Strategic Computing Program was sold to Congress "as much by stressing its economic benefits to the civilian sector as by detailing its military potential".[462]

This was very much in keeping with the Defense Advanced Research Projects Agency's historic approach. Many of the projects funded by the agency involved generic or dual-use technologies, and private companies that have developed technologies under a Defense Advanced Research Projects Agency contract have usually been free to incorporate these into commercial products as well as selling them to the military. As Roland and Shiman summarise:

> Long before it became fashionable nationally, DARPA understood that technologies such as computer development contribute to national security in ways that transcend rigid distinctions between military and civilian.[463]

The role that the Defense Advanced Research Projects Agency takes is to push a technology at least as far as proof of concept, particularly in overlooked or cutting-edge areas that do not appear to be attracting sufficient research and development funding, and then move it out into the hands of commercial partners who will carry it forward to practical fruition. It is a cross between a research laboratory and a venture capital firm — it works in researching leading-edge technologies, but does so by funding external projects rather than running its own laboratories.[464]

Tarja Cronberg argues that the concept of spin-off became a generally established assumption underlying the relationship between military and civilian technology during this period, whereby the defence research and development establishment creates a base from

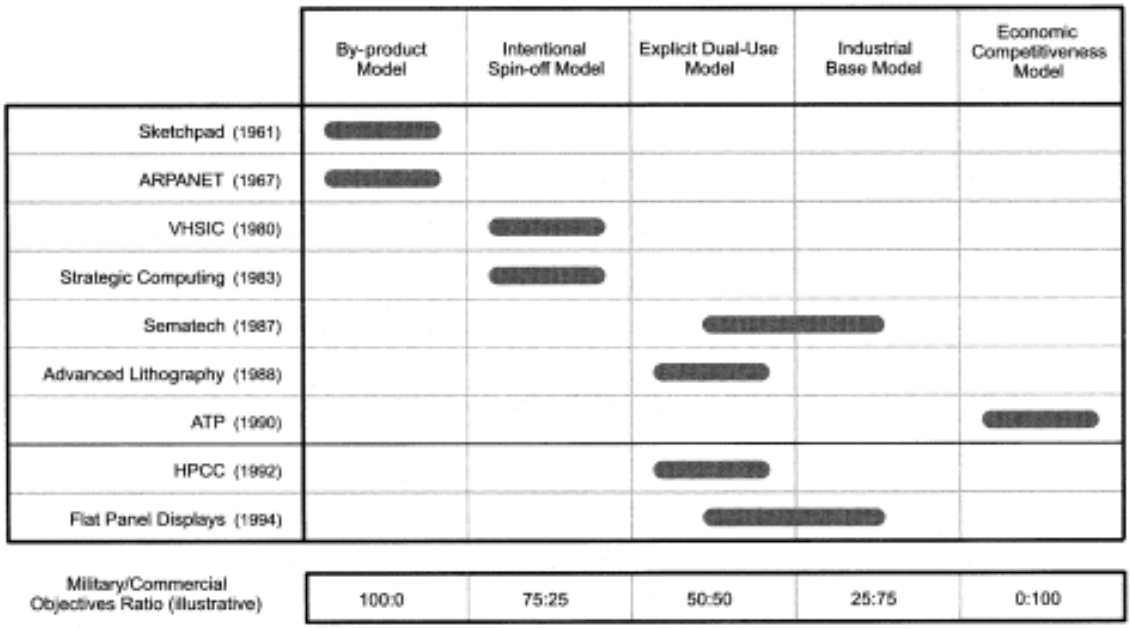
[459] See also Salisbury, Emma (2020) "A Cautionary Tale on Ambitious Feats of AI: The Strategic Computing Program" *War on the Rocks*, May 22
[460] Roland, Alex and Shiman, Philip (2002) *Strategic Computing: DARPA and the Quest for Machine Intelligence, 1983-1993* (Cambridge, MA: MIT Press) pp330-331
[461] Mosco, Vincent (1989) "Strategic offence: Star Wars as military hegemony" in Levidow & Robins p100-101
[462] Davis, Dwight B (1985) "Assessing the Strategic Computing Initiative" *High Technology*, April p43
[463] Roland and Shiman (2002) p8
[464] Botkin, James & Dimanescu, Dan (1984) "The DARPA Exception" in Tirman p225

which technologies, innovations, and knowledge diffuse into the commercial sector. On the micro level, specific civilian applications (such as the microwave oven) emerge from military innovations, but on the macro level the defence-industrial technology base provides the "big science" that create the techno-economic paradigms experienced across both military and civilian industry.[465]

In his excellent analysis of spin-off within U.S. military research programmes, Glenn Fong creates a useful typology to pin down the degree to which a project has programmed into it the flow between military and civilian technology. He splits the spectrum into five types of cases. The first is the "by-product" model: commercial spin-offs from the military project may happen, and may be significant, but they are unintended and not the goal of the research. The second is the "intentional spin-off" model: the project remains overwhelmingly guided by military needs, but commercial spin-offs are explicitly considered during the planning and implementation. The third is the "explicit dual-use" model: these projects have the express goal of benefitting both military and commercial needs, with a built-in balancing of objectives between the two. The fourth is the "industrial base" model: military benefits are expected, but only after civilian industrial advances are supported, so the commercial orientation exceeds the defence orientation of the programme. Lastly, there is the "economic competitiveness" model: there is no military rationale for the project, and it exists as unabashed state support for the commercial technology sector.[466]

Fong looks at a series of U.S. projects, and situates each one within his typology:[467]

[465] Cronberg, Tarja (1994) "Civil Reconstructions of Military Technology: The United States and Russia" *Journal of Peace Research* 31:2 pp208-209
[466] Fong, Glenn R (2000) "Breaking New Ground or Breaking the Rules: Strategic Reorientation in U.S. Industrial Policy" *International Security* 25:2 pp159-160
[467] Ibid. p161



He argues that commercial spin-offs moved from being afterthoughts in the 1960s, with the ARPANET and Sketchpad programmes, towards being directly considered in the formulation of the Strategic Computing Program in the early 1980s. The technologies that were the goals of the project represented the means to achieve clear defence goals, but the civilian sector would see the benefit of their development with commercial applications.[468] This shows a reorientation within the Department of Defense towards involving commercial businesses in military planning, with the aim of subsidising the development of dual-use technologies that could find applications within both the commercial and defence worlds.

By the end of the 1970s, the spin-off approach had created an enclave within the U.S. economy inhabited by companies that based their business plans on winning defence contracts, selling their goods to the U.S. state, and perhaps moving any new technologies into a civilian context (or selling them off to companies who would). This was a high point for the defence industry portion of the military-industrial complex, but it left those firms with strategies and organisational structures that were unresponsive to competition in the commercial sphere and largely oblivious to the flow of civilian tech innovation.[469] Overreliance on spin-off harms civilian economic competitiveness, particularly when commercially irrelevant military performance requirements are already designed into the

[468] Ibid. pp169-170
[469] Borrus, Michael and Zysman, John (1992) "Industrial Competitiveness and American National Security" in Sandholtz et al p35

diffusing applications,[470] or when slow diffusion allows alternative commercial applications to make it to market.[471]

Towards the end of the Carter administration, a series of reports appeared from various military sources criticising the deterioration of the U.S. defence industrial base, and the consequent weakening of the civilian backbone of the U.S. military posture. Projects coming out of the Department of Defense in the early 1980s, like the Strategic Computing Program, were thus designed not only to boost the economy through spin-off, but also to extract military-specific applications from commercial producers who would not otherwise engage with defence: this is known as spin-on. However, as Jay Stowsky argues, the new technologies created in this period tended to fall foul of esoteric military performance and security requirements, and never fulfilled their promise of reducing the bifurcation in the U.S. technology base: "New military applications were in fact created, sometimes in a way that genuinely advanced the technology base, but these advances were few in comparison to the rapid-fire achievements emerging simultaneously from the civilian sector…"[472] There were very few commercially successful applications created through the Strategic Computing Program, and the advances in artificial intelligence made in the 1980s and 1990s came instead from commercial development trajectories.

The failure of projects like the Strategic Computing Program to address this bifurcation meant that it only grew more prominent, and spin-on began irreversibly to shape the U.S. military-industrial base from the 1980s onwards. The increasing globalisation of the demand for high technology gave private companies the ability to make their own research and development pay off commercially — they could take advantage of high-volume global markets to develop and manufacture applications that were previously thought too risky for any entity other than the Department of Defense to support, spreading their research costs across a larger amount of sales while driving down per-unit manufacturing costs with economies of scale.[473] The commercial sector became increasingly innovative, with products forged in the fire of the immediate feedback on performance provided by capitalist market forces.[474] The defence establishment could not keep up; neither its organisation or its funding could compete with the emerging reality of high-volume commercial technology development.[475]

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[470] Vogel, Steven (1992) "The Power Behind 'Spin-Ons': The Military Implications of Japan's Commercial Technology" in Sandholtz et al p60
[471] Stowsky, Jay (1992) "From Spin-Off to Spin-On: Redefining the Military's Role in American Technology Development" in Sandholtz et al p116
[472] Ibid. p115-116
[473] Ibid. p139
[474] Vogel (1992) in Sandholtz et al p60
[475] Borrus & Zysman (1992) in Sandholtz et al pp34-35

This new reality caused commentators at the time to become pessimistic about the future of military research and development. This is perhaps best seen in Cronberg's work, which views the landscape from the perspective of the mid-1990s — the Cold War had ended, the civilian tech sector was ascendant, and it seemed that there would be "a complete redefinition of the task of the military industries and their role in technological development".[476] She argued that these new innovative private firms were refraining from taking on military contracts, especially when these involved onerous specifications, and that defence procurement would thus be left behind technologically unless the U.S. state took advantage of spin-on and dual-use technologies:

> This means a reintegration of the industrial technology base of the military and the civilian sectors. It means a complete redefinition of the task of the military industries and their role in technological development. It means, in fact, that civilian industries will not only hold the technological edge, but also produce military equipment and weapon systems when needed.[477]

Without the ability to use commercial technologies on an ever-increasing scale, the mainstays of the old military-industrial base would simply disappear.

7.4 The Rise of the Tech Titans

Whilst her prediction has not fully come to pass, Cronberg was correct in her anticipation of the rise of the commercial tech giants at the expense of the traditional defence contractors. Profitable and growing markets drive commercial research and development in fields such as artificial intelligence, robotics, software, and the like — all fields of considerable importance to 21st-century military applications. The defence primes, however, have been returning profits to shareholders through dividends and stock buybacks instead of funding research and development. According to a Capital Alpha Partners study, company-funded research and development investment at these firms dropped from 3.5 percent to 2 percent of sales from 2000 to 2012, while the leading civilian commercial companies invested around 8 percent of sales revenue in research and development. [478] Dowdy and Krishnamurthy make a similar point, noting that the traditional defence primes spent only 1 to 3 percent of their revenue on true "at-risk" research and development, versus the 10 to 20 percent of revenue being spent by commercial technology giants.[479] Walter Isaacson highlights that corporate research is more focused on products, and that such research and development tends to

[476] Cronberg (1994) p205
[477] Ibid. pp211-212
[478] Ibid. p107
[479] Dowdy and Krishnamurthy, in Bitounis and Price (ed.) (2019) p85

therefore be focused in areas where there is a clear link between investment and valuable goods or services that can form the basis of expanded sales.[480]

As William Lynn points out, the combined annual research and development budgets of the five largest U.S. defence contractors amount to less than half of the same budget of companies like Microsoft, and these five do not even rank among the top twenty companies for industrial investment.[481] Looking at the data on research and development spending provides a blunt visualisation of the difference between the technology giants and the defence primes when it comes to funding. The top five companies in the tech sector in the United States (Amazon, Alphabet, Facebook, Microsoft, and Apple) spent a total of $72.6 billion on research and development in 2018, while the top five defence companies (Lockheed Martin, Boeing, Raytheon Technologies, General Dynamics, and Northrop Grumman) only spent $6.2 billion in the same year — in fact, as Christian Brose notes, Apple by itself had enough cash on hand that year (around $245 billion) to buy all of the latter five outright. This discrepancy in spend is stark:

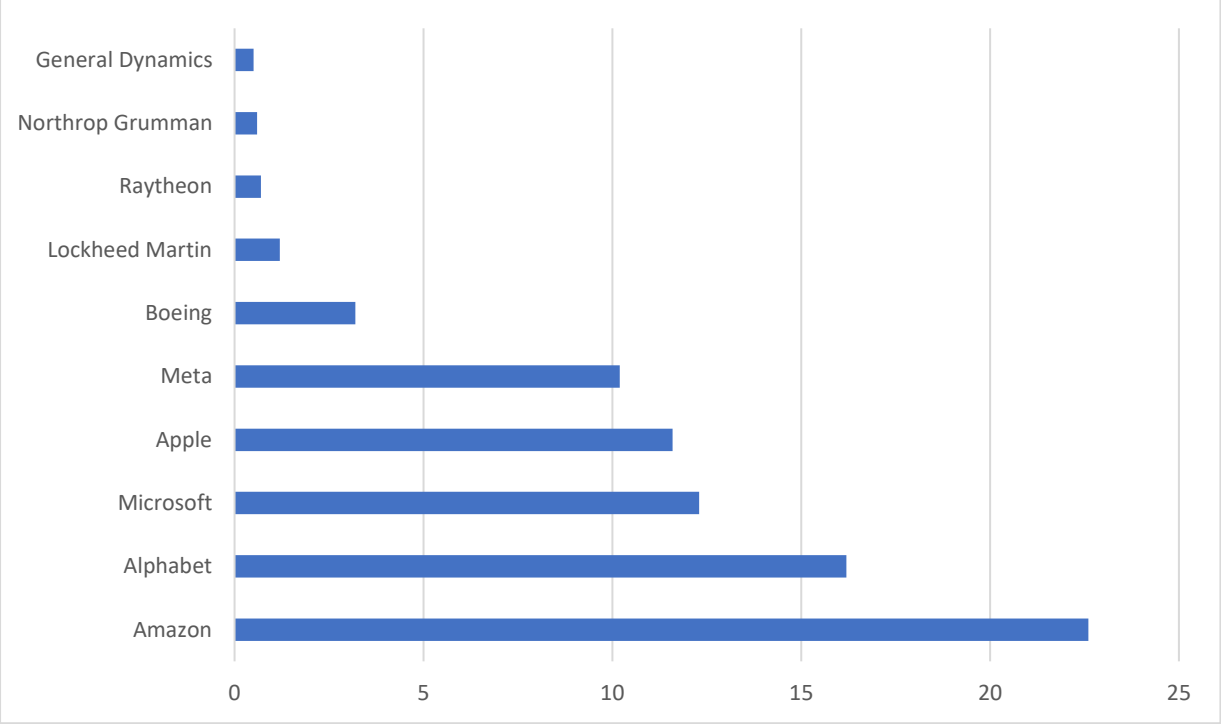

Fig 5: Research and development spending in 2018 by company in billions of dollars[482]

[480] Isaacson, Walter (2019) "The Sources of America's Innovative Edge" in Bitounis and Price (ed.) (2019) p172
[481] Lynn, William J (2014) "The End of the Military-Industrial Complex: How the Pentagon Is Adapting to Globalization" Foreign Affairs 93:6 p107
[482] Data drawn from Statista reports

As Col. Drew Cukor, the head of the algorithmic warfare team, said in 2017, "We are in an AI arms race, frankly, and it's happening in industry. The big five internet companies really are pursuing this heavily."[483]

Indeed, these commercial tech giants have actively subsumed some companies with a more traditional defence focus. Towards the end of 2013, Google acquired Boston Dynamics, a firm best known for creating robots like PackBot and BigDog for use in supporting ground troops. While Google agreed to honour existing contracts with the U.S. military as part of the purchase, it indicated that it might not continue to pursue defence work with its new subsidiary, representing a huge loss to the Department of Defense in terms of access to cutting-edge work in the field of autonomous robotics.[484] The market value and commercial reach of Google meant that it could buy Boston Dynamics in order to access its innovative capabilities without needing to rely on future military business to make the purchase viable.[485] Google was interested in what the firm could add to its own commercial research and development portfolio, not in access to defence contracting potential — a prospect that the Department of Defense had to now consider more carefully. Brose highlights that this was a core dilemma for the Department of Defense in technology investment: "The companies that are most able to help are not always willing to do so, whereas the companies that are willing to help are not always able to do so."[486]

7.5 Building Bridges

While the defence-based parts of the Silicon Valley economy explored earlier had never disappeared entirely, the civilian commercial technology world had seen little upside to doing military work throughout the 2000s. These companies pushed forward into new frontiers, both in software and hardware, while the defence world began to lag behind — the baton of the cutting edge in technology had been passed on.

During his time as secretary of defense in the Obama administration, Carter saw the need for the Department of Defense to cease relying on the traditional defence firms and endeavour to keep up with the vibrant commercial technology base. As a former undersecretary of defense for acquisitions who had also worked in Silicon Valley, Carter was well-placed to

[483] Harper, Jon (2017) "Pentagon Struggling To Take Advantage Of Artificial Intelligence" *National Defense* 102:766 p24
[484] Lynn (2014) pp104-105
[485] Google sold Boston Dynamics in 2017, and the company now focuses solely on civilian commercial products, having signed a pledge in 2022 that it would not allow the weaponisation of any of its robotics products. See Fried, Ina (2022) "Exclusive: Boston Dynamics pledges not to weaponize its robots" *Axios* October 6.
[486] Brose, Christian (2020) *The Kill Chain: Defending America in the Future of High-Tech Warfare* (New York: Hachette) pp74-75

bring a fresh perspective. He believed that conventional pathways to defence innovation would not take the department to where it needed to be, telling the House Defense Appropriations Subcommittee: "We must be open to global, commercial technology as well, and learn from advances in the private sector."[487] He was joined in this vision by Frank Kendall, who was in charge of acquisitions and specifically directed the Department of Defense to reach out to non-traditional players in research and development.[488]

Although he kept the level of Department of Defense research and development spending high, with $72 billion allocated to it in his first budget, Carter identified three causes of gaps in the military's technology needs. Firstly, the in-house research and development projects tended to focus on meeting specific requirement identified by serving personnel, leaving no scope for revolutionary technologies not envisioned by current warfighters; secondly, the lengthy bureaucratic process of defining the requirement and building a system often took far too long; and thirdly, there was what he called a "dangerous gap" between the innovative culture within the Department of Defense and that in the commercial world.[489] Carter became the first secretary of defense to visit Silicon Valley in over two decades, and set up the Defense Innovation Unit – Experimental (DIU-X, known as the Defense Innovation Unit as of December 2020)[490] and the Defense Innovation Board to build stronger bridges between the two. He hoped that this kind of approach would be useful to enable the federal government to identify, invest in, and harvest commercial technologies that could enhance military capabilities.[491]

The Defense Innovation Board was established in 2016 as an independent federal advisory committee. Its members appointed by the secretary of defense from among the senior echelons of leading American technology companies, venture capital forms, universities, and research institutions. The board provides "independent advice and recommendations on innovative means to address future challenges through the prism of three focus areas: people and culture, technology and capabilities, and practices and operations."[492] It has focused strongly on issues of acquisition reform and working with the civilian technology world, as well as problems around retaining talented personnel and the impact of artificial intelligence and machine learning.

[487] Erwin (2015) p18
[488] Ibid.
[489] Carter (2019) pp322-324
[490] For an in-depth exploration of the DIU's work, see Hummel, Robert and Schiller, Kathryn (2016) "Department of Defense's Innovation Experiment" *Potomac Institute* 30 June
[491] See also Dunne, J. Paul and Sköns, Elisabeth (2021) "New technology and the U.S. military industrial complex" *The Economics of Peace and Security Journal* 16:2 pp8-9
[492] See the Defense Innovation Board website at https://innovation.defense.gov/

The Defense Innovation Unit was inspired by In-Q-Tel, which was created by the CIA in 1999 to perform the functions of a venture capital firm. It was designed to work with start-ups and larger technology companies to identify and invest in emerging technologies that might prove to be valuable for the intelligence community.[493] In-Q-Tel allowed the CIA to turn classified intelligence problems into unclassified projects for the commercial sector, collaborating with technology firms in a way that was both comprehensible and profitable for them. However, in return for its investment In-Q-Tel took a portion of the companies in which it invested, which acted as a disincentive for some. The Department of Defense decided to move away from the venture firm model and focus the Defense Innovation Unit on turning specific requirements identified by warfighters into contracts that could be executed within 60 days, for delivery within six months. As Maynard Holliday of the Department of Defense noted in an interview with RAND Corporation researchers, the Defense Innovation Unit offered four "attractants" to incentivise start-ups to collaborate: it didn't ask for a portion of the company in exchange for its investment; it could fast-track patents if the technology answered an acute national security need; it could introduce small firms to prime defence companies for future opportunities or mergers; and it offered access to test ranges, both virtual and actual.[494] The Defense Innovation Unit uses "other transaction" authorities to obtain prototypes from non-traditional defence contractors. These transactions are not subject to federal acquisition regulations (although remain bound by standard contract law and so on) and tend to be viewed as providing more flexibility than traditional acquisition mechanisms such as contracts, allowing agencies to develop agreements that are specifically tailored to the needs of the project and its participants.

While both the Obama and Trump administrations were bullish about the Defense Innovation Unit's potential and value, Congress has been rather more pessimistic, as the conference report on the *National Defense Authorization Act* of FY2017 makes clear. While acknowledging that the Defense Innovation Unit could become an important way for the Department of Defense to "engage with new and non-traditional commercial sources of innovation, as well as rapidly identify and integrate new technologies into defense systems," the report raised some concerns:

> Additionally, the conferees remain concerned that in the Department's rush to try something new, defense leaders have not taken the time to determine how effective recent organizational and management changes are before seeking a rapid expansion of resources. Nor do the conferees believe that the Department has postured DIUx to be successful in the innovation ecosystem with partners across the Department,

[493] Gentile et al (2021) p54
[494] Ibid. p55

> finding ways to multiply the effectiveness and networking potential of DIUx by leveraging the personnel, expertise, authorities, and resources of existing successful research, development, innovation, and tech transfer mechanisms.[495]

However, the Defense Innovation Unit has exhibited some success despite these concerns. In the first five years of its existence, the agency leveraged $11.7 billion in private-sector investment and awarded 208 other transaction authority contracts. Most tellingly, of those awards, 35 percent were to businesses contracting with the Department of Defense for the first time, 77 percent were to small companies, and 87 percent were to non-traditional defence vendors.[496]

As with the Defense Innovation Unit, the Obama administration's general focus on building bridges with civilian technology companies was maintained under the Trump administration. The *National Security Strategy* of 2017 directly acknowledged the need for the Department of Defense to more effectively tap into the innovation happening in the private sector:

> The U.S. Government will use private sector technical expertise and R&D capabilities more effectively. Private industry owns many of the technologies that the government relies upon for critical national security missions. The Department of Defense and other agencies will establish strategic partnerships with U.S. companies to help align private sector R&D resources to priority national security applications. [...] We must eliminate bureaucratic impediments to innovation and embrace less expensive and time-intensive commercial off-the-shelf solutions. Departments and agencies must work with industry to experiment, prototype, and rapidly field new capabilities that can be easily upgraded as new technologies come online.[497]

The *National Defense Strategy* built on this the following year, highlighting the changes that still needed to be made to how the Department of Defense did business with the commercial world:

> New commercial technology will change society and, ultimately, the character of war. The fact that many technological developments will come from the commercial sector means that state competitors and nonstate actors will also have access to them, a fact that risks eroding the conventional overmatch to which our Nation has grown accustomed. Maintaining the Department's technological advantage will require

[495] House of Representatives, Committee on Armed Services (2016) *National Defense Authorization Act for Fiscal Year 2017: conference report to accompany S. 2943* [114th Congress, 2nd session, H.Rept. 114-840] p992
[496] Defense Innovation Unit (2020) *Annual Report 2020* pp6-10
[497] The White House (2017) *National Security Strategy* [Washington, DC: The White House] pp21-29

> changes to industry culture, investment sources, and protection across the National Security Innovation Base.[498]

Mike Griffin, the under secretary of defense for research and engineering, reiterated this focus during committee testimony shortly afterwards, highlighting the potential impact on America's competitiveness against adversaries:

> The incremental democratization of technology has fostered global and easy access to cutting edge capabilities, which has in turn contributed to the ability of our adversaries to achieve technology parity. As a result, our military's advanced technical capabilities and unmatched technological superiority is being challenged by the investments of competing powers. Given the leveled playing field, speed in developing new technologies and delivering capabilities to the warfighter is more critical now than ever. We must be willing and able to tap into commercial research, recognize its military potential, and leverage it to develop new capabilities, while also accounting for the operational and organizational constructs to employ them faster than our competitors.[499]

The military services have stepped up to the plate when it comes to improving their own innovation efforts and reaching out to the civilian technology community. For example, the Air Force has the Small Business Innovation Research programme, part of which includes running "pitch days" to award contracts quickly to start-ups and small companies, as well as a number of accelerators and incubators that offer seed funding, mentoring, and related support.[500] In addition to these, the secretary of the Air Force created AFWERX in 2017, a strategic networking organisation intended to improve the service's capabilities by creating an innovation ecosystem spanning the public and private sectors, thereby streamlining technology transfer and accelerating results.[501]

As well as the more direct attempts to engage with the civilian technology world explored above, there have been other recent changes that will help to focus efforts. For example, the National Defense Authorization Act for FY2017 included the re-establishment of the position of under secretary of defense for research and engineering,[502] third in precedence within the Department of Defense hierarchy behind the secretary of defense and their deputy. This

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[498] Department of Defense (2018) p3

[499] Griffin, Mike (2018) *Testimony before the House Committee on Armed Services Hearing on "Promoting DOD's Culture of Innovation"* 18 April

[500] See the Air Force Research Laboratory website's list of programmes at https://www.afaccelerators.com/

[501] See the AFWERX website at https://www.afwerx.af.mil/

[502] This position had previously existed between 1977 and 1986.

signalled congressional appreciation of the importance of prioritising research within the defence realm, as the Senate Armed Services Committee made clear:

> The committee expects that just as previous USD(R&E) incumbents led the so-called "Second Offset" strategy, which successfully enabled the United States to leap ahead of the Soviet Union in terms of military technology, the new USD(R&E) would be tasked with driving the key technologies that must encompass what defense leaders are now calling a "Third Offset" strategy: cyber and space capabilities, unmanned systems, directed energy, undersea warfare, hypersonics, and robotics, among others.[503]

Margaret O'Mara notes the shift in focus that characterised this period. The military needed to expand its technological capacity, but as quickly and cheaply as possible. To achieve this, the Department of Defense turned the Cold War supply chain into reverse:

> Instead of government-funded academic labs and contracts producing military tech that later could be commercialised, now the defense establishment created VC [venture capital] firms to seed private software companies that could one day become contractors. Instead of the traditional research and procurement process, the Pentagon sponsored hackathons and design charrettes to get government bureaucracies to behave more like start-ups.[504]

The defence establishment recognised that the commercial world was the best source of progress in the kind of technology they needed. This is why the Department of Defense turned to the tech giants for its huge cloud computing procurement mission: the JEDI project.

7.6 Case Study: The JEDI Project

In 2017, Secretary of Defense Jim Mattis ordered the Department of Defense to prepare a plan to modernise the department's information technology infrastructure. The final version of this was published in July 2018 as the Joint Enterprise Defense Infrastructure (JEDI) project, which sought a single vendor to provide secure cloud infrastructure and platform services to the Department of Defense, covering both military operations and the day-to-day bureaucratic needs that any big organisation has.[505] The contract's Statement of Objectives

[503] Senate Committee on Armed Services (2016) *National Defense Authorization Act for Fiscal Year 2017 Report* (114th Congress, S. Rept. 114-255)
[504] O'Mara, Margaret (2019) *The Code: Silicon Valley and the Remaking of America* (New York: Penguin) p384
[505] Congressional Research Service (2019) *The Department of Defense's JEDI Cloud Program* (Washington DC) p5. See also Dunne and Skons (2021) pp10-11

shows the Department of Defense's particular recognition of the importance of the progress being made on these technologies in the civilian sector:

> To maintain our military advantage, DoD requires an extensible and secure cloud environment that spans the homeland to the global tactical edge, as well as the ability to rapidly access computing and storage capacity to address warfighting challenges at the speed of relevance. These foundational infrastructure and platform technologies are needed for DoD to capitalize on modern software, keep pace with commercial innovation, and make use of artificial intelligence and machine learning capabilities at scale.[506]

The separate branches of the military had been using various cloud services for some time, particularly following the Obama administration's Federal Cloud Computing Initiative,[507] but the JEDI project sought to treat the entire defence community as one organisation with a shared strategy for information technology. The sums involved were huge, with a maximum ceiling of $10 billion across a potential 10-year period.

In early April 2019, the Department of Defense announced its initial downselect from four qualified proposals submitted by IBM, Amazon Web Services (AWS), Microsoft, and Oracle, with AWS and Microsoft remaining in contention after meeting the Pentagon's minimum requirements.[508] Microsoft was selected as the winner of the contract in October 2019.[509] However, AWS filed suit in the Court of Federal Claims the following month, alleging that the evaluation process was biased in Microsoft's favour due to President Donald Trump's dislike of Amazon CEO Jeff Bezos, and in February 2020 the judge ordered a temporary block on the contract for the Department of Defense to re-evaluate both companies' bids.[510] In September, the Department of Defense announced that the re-evaluation had been completed and the contract would stay with Microsoft as the "best value" bid[511] but AWS continued to challenge the decision in the courts, and the project could not move forward until all litigation was settled.[512] The Department of Defense warned in a memo to Congress in January 2021 that "the prospect of such a lengthy litigation process might bring the future

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[506] Department of Defense (2018) *Joint Enterprise Defense Infrastructure (JEDI) Cloud Statement of Objectives* p1

[507] White House (2011) *Federal Cloud Computing Strategy* (Washington, DC)

[508] Konkel, Frank (2019) "Pentagon Says No JEDI Conflict, Narrows Field to AWS and Microsoft" *Nextgov* 10 April

[509] McKinnon, John and Tilley, Aaron (2019) "Pentagon Picks Microsoft for JEDI Cloud-Computing Contract Over Amazon" *Wall Street Journal* 25 October

[510] Palmer, Annie (2020) "Judge temporarily blocks Microsoft Pentagon cloud contract after Amazon suit" *CNBC* 13 February

[511] Department of Defense (2020) "DOD Reaffirms Original JEDI Cloud Award to Microsoft" (press release) 4 September

[512] Alspach, Kyle (2021) "Microsoft Could Lose JEDI Contract If AWS Case Isn't Dismissed" *CRN* 5 March

of the JEDI cloud procurement into question" and noted that JEDI might not be the only vehicle by which essential cloud computing capabilities could be secured: "this requirement transcends any one procurement, and we will be prepared to ensure it is met one way or another."[513]

On 6 July 2021, the Department of Defense announced that the JEDI programme was to be cancelled, citing "evolving requirements, increased cloud conversancy, and industry advances" as the reasons behind the decision with no mention of the unresolved litigation.[514] At the same time, the department announced that it would be proceeding with a new effort on cloud computing, called the Joint Warfighting Cloud Capability programme, a multi-cloud/multi-vendor Indefinite Delivery-Indefinite Quantity contract. The presolicitation notice confirmed that the Department of Defense anticipated that it would award two contracts to AWS and Microsoft, but would also award to any "hyperscale" cloud service provider that demonstrated the ability to meet the requirements.[515] By November, the department had added Oracle and Google to its list of companies issued with formal solicitations for the programme, after further "market research" and consultation with the companies, although it declined to solicit a proposal from IBM.[516]

While the JEDI project did not go ahead, it is nonetheless an interesting and illuminating case study. The final four bidders (IBM, AWS, Microsoft, and Oracle) were all big commercial technology companies with their roots firmly in the civilian world — none of the successful bids came from traditional defence primes, or indeed from any defence-focused companies. The bitter and expensive litigation that AWS felt it necessary to proceed with shows that this kind of defence contract was something to fight for, not to be politely given up to the winning bidder. And the four big civilian tech companies that ended up as vendors for the replacement Joint Warfighting Cloud Capability contract — AWS, Microsoft, Oracle, and Google — all clearly saw value in contracting with the Department of Defense.

However, not all civilian technology companies viewed defence contracts as desirable, or worth the hassle of dealing with the Department of Defense.

[513] Eversden, Andrew (2021) "Pentagon could reassess future of JEDI cloud, depending on court action" *C4ISRNet* 29 January
[514] Department of Defense (2021) "Future of the Joint Enterprise Defense Infrastructure Cloud Contract" Press Release, July 6
[515] Department of Defense (2021) *Joint Warfighting Cloud Capability (JWCC) Presolicitation Notice* July 6 [accessed via SAM.gov]
[516] Serbu, Jared (2021) "DoD picks Amazon, Microsoft, Google and Oracle for multibillion dollar project to replace JEDI Cloud" *Federal News Network* November 19

7.7 Burning Bridges

Despite some progress, the forging of relationships between the Department of Defense and Silicon Valley was derailed by the June 2013 leaks from former National Security Agency contractor Edward Snowden, which revealed substantial intelligence gathering operations directed at platforms owned and operated by U.S. companies. A divide emerged over the legitimacy of the use of surveillance and encryption, with the technology companies tending to side with the privacy concerns of their global users over the requirements of intelligence and law enforcement agencies. The rift has widened as employees at several of the largest technology companies have protested the use of artificial intelligence, facial recognition, and other emerging technologies for defence, intelligence, and other national security programmes. Adam Segal notes that the economic interests of these companies led them to distance themselves from the U.S. government — given the share of their revenue garnered from overseas markets, they responded with public outrage to the Snowden leaks, and increasingly portrayed themselves as global actors independent of the American state.[517]

This distrust fed into that inherent in the technology sector due to its counterculture and libertarian roots, and those embedded in the Silicon Valley ecosystem had always tended to believe that public goods would emerge through a free and popular mechanism rather than via the state. The companies were run and staffed predominantly by people who had come of age after the end of the Cold War and had no institutional memory of working with the government or, in particular, the military. Carter highlights this in his memoirs, noting the difference from earlier decades:

> … there's no longer a clear understanding that US companies have some obligation to support the nation's defense effort. With their multinational reach, most high-tech companies naturally don't view themselves as solely US companies, and their CEOs often come from a post-Vietnam generation that knows very little about the DOD and its operations.[518]

The Snowden revelations contributed to a series of further events that undermined the relationship: Apple refused an FBI request to decrypt the phone of the San Bernardino shooter in 2015; Facebook failed to control Russian disinformation on its platform during the 2016 presidential election; and Google withdrew from participation in the Department of Defense's Project Maven in 2018.[519] This latter case provides an important window into the

[517] Segal, Adam (2017) "Bridging the Cyberspace Gap: Washington and Silicon Valley" *PRISM* 7:2 pp67-68
[518] Carter (2019) p330
[519] Castelino, Trushaa (2018) "Google Renounces AI Work on Weapons" *Arms Control Today* 48(6) p33

struggles going on within some companies over whether defence contracts were appropriate in the context of these Silicon Valley values.

7.8 Case Study: Project Maven

The Algorithmic Warfare Cross-Functional Team (known as Project Maven) was established by the Department of Defense in 2017, under the oversight of the under secretary of defense for intelligence, with the aim of integrating artificial intelligence and machine learning more effectively across military operations. Its first task was to be reducing the human burden of analysing video intelligence during the campaign to defeat Islamic State, using computer vision algorithms to improve the speed and efficiency of object detection and classification. Once this task was completed, the team would move on to integrating similar technologies into other defence intelligence mission areas.[520] The project would depend on the big civilian tech companies — only they had assembled the expertise and infrastructure needed to build deep learning systems of the kind required to fulfil this mission, and Defense Secretary Mattis visited several of these companies during a tour of America's west coast over the summer of 2017 to explore the department's options for collaboration.

Cade Metz details the dynamics of Mattis' visit to Google to meet with its CEO, Sundar Pichai, that August.[521] Many of those working in the company were uncomfortable with the idea of facilitating military capabilities, particularly around targeting and autonomous weapons — for example, when Google bought the British artificial intelligence company DeepMind in 2014, the purchase included a contractual clause that barred Google from using any DeepMind technology for military purposes.[522] Others, however, were more willing — Eric Schmidt, the chair of Google's board, was also chair of the Defense Innovation Board that had been set up under the previous administration. The company was already hosting military data on its servers, and many of the top executives saw defence contracts as a way of boosting their cloud business. Ultimately, Google decided to take the opportunity — just over a month after the meeting with Mattis, the company signed a three-year contract for work on Project Maven. Google provided the project with its open source TensorFlow application programming interfaces, part of the company's software system to train deep neural networks, to "assist in object recognition on unclassified data" and flag images for human review.[523] While the sums involved were small by Google's standards, with the contract

[520] Department of Defense (2017) *Memorandum: Establishment of an Algorithmic Warfare Cross-Functional Team (Project Maven)* 26 April
[521] Metz, Cade (2021) *Genius Makers: The Mavericks Who Brought AI to Google, Facebook and the World* (London: Penguin Random House) pp241-243
[522] Ibid. pp115-116
[523] Google spokesperson quoted in Cameron, Dell and Conger, Kate (2018) "Google Is Helping the Pentagon Build AI for Drones" *Gizmodo* 6 March

worth somewhere between $25 million and $30 million, the decision showed that those within the company willing to work with the military had won out.

However, the company realised that it would be easy for the press and its own workforce to couch the decision in terms of a retreat from its stated values — the "Don't Be Evil" slogan writ large. The sales and public relations teams had a long discussion about whether to publicise the contract, or even to release information about it at all. Metz quotes a memo from Fei-Fei Li, the head of one of Google's artificial intelligence labs, that shows the concerns being discussed at the time:

> Weaponized AI is probably one of the most sensitized topics in AI – if not THE most. This is red meat for the media to find all ways to damage Google. […] I don't know what would happen if the media picked up the theme that Google was building AI weapons or AI technologies to enable weapons for the Defense Industry.[524]

Google ultimately decided not to announce its involvement in Project Maven and asked that the Department of Defense not announce it either. Even company employees were not told. However, this kind of secrecy could not be maintained for long — that November, a team of nine Google engineers tasked with building the software for the "air gap" computer network required to begin the project realised what it was for and refused to be involved. Word began to spread around the company, and the nine shared their story via the company's internal social network in February 2018. Despite the attempts of Google executives to downplay the contract's size and emphasise the "non-offensive" nature of the technology, unrest continued to spread.[525] By April around 4000 Google employees had signed an open letter to Pichai, published in the *New York Times*, petitioning him to end the company's participation in Project Maven:

> We believe that Google should not be in the business of war. Therefore we ask that Project Maven be cancelled and that Google draft, publicize and enforce a clear policy stating that neither Google nor its contractors will ever build warfare technology […] By entering into this contract, Google will join the ranks of companies like Palantir, Raytheon and General Dynamics.[526]

The letter was followed by a spate of resignations and a further petition supporting the Google employees from over a thousand academics:

[524] Metz (2021) p245
[525] Ibid. p247
[526] Shane, Scott and Wakabayashi, Daisuke (2018) "'The Business of War': Google Employees Protest Work for the Pentagon" *The New York Times* 4 April

> The extent to which military funding has been a driver of research and development in computing historically should not determine the field's path going forward [...] The DoD contracts under consideration by Google, and similar contracts already in place at Microsoft and Amazon, signal a dangerous alliance between the private tech industry, currently in possession of vast quantities of sensitive personal data collected from people across the globe, and one country's military.[527]

In response, Google announced it would not renew its Project Maven contract with the Department of Defense upon expiry the following year, and Pichai outlined Google's new principles in a post on the company's blog.[528] The post promised that any artificial intelligence technology developed by Google would be safe, unbiased, socially beneficial, and accountable, and that the company would not pursue any technologies or weapons that would be "likely to cause overall harm" or "cause or directly facilitate injury to people." Pichai did not commit to refusing all work with the Department of Defense, concluding his post with: "We want to be clear that while we are not developing AI for use in weapons, we will continue our work with governments and the military in many other areas." Google did cite possible conflict with its corporate principles as among its reasons for withdrawing from contention for the JEDI project in October 2018,[529] although this did not stop it from joining the replacement Joint Warfighting Cloud Capability contract as a vendor just four years later — proof in point that the company seems to have settled on being willing to provide services to the military as long as there is no clear link to weaponisation, however tenuous that distinction may be in practice given the importance of cloud computing to operational matters as well as back-room organisation.

As Brose summarises, many in the federal government saw these kinds of actions as "proof that Silicon Valley had become morally unserious and willing to elevate corporate profits above national defense."[530] The pushback could be fierce — writing during the Project Maven incident, Michael Bloomberg accused Google of "bow[ing] to pressure instead of standing up for our country" and argued that defending the United States "shouldn't be a controversial idea among our nation's business leaders."[531] Former deputy secretary of defense Bob Work also criticised the decision in moral terms:

> They say, 'Look, this data could potentially down the line at some point cause harm to human life.' But it might save 500 Americans, or 500 allies, or 500 innocent civilians

[527] International Committee for Robot Arms Control (2018) *Open Letter in Support of Google Employees and Tech Workers* 25 June
[528] Pichai, Sundar (2018) "AI at Google: Our Principles" *The Keyword* 7 June
[529] Nix, Naomi (2018) "Google Drops Out of Pentagon's $10 Billion Cloud Competition" *Bloomberg* 8 October
[530] Brose (2020) pp73-74
[531] Bloomberg, Michael R. (2018) "Google Walks Away From America's Security" *Bloomberg* 6 June

from being attacked. So I really believe that Google employees are creating a moral hazard for themselves.[532]

7.9 Case Studies: Palantir and SpaceX

However, the problem was not solely that commercial companies may not have wanted to do business with the Department of Defense — in some cases, the military actively resisted doing business with technology companies that did want to work in the defence space. Brose explores the cases of two technology start-ups out of California, Palantir and SpaceX, which had similar experiences when attempting to break into the defence market.[533] SpaceX had developed reusable rockets that significantly reduced the cost of space launch, a capability that would have been valuable to the U.S. Air Force. Palantir offered to assist the government in mapping adversary networks using software that could analyse huge quantities of data for patterns, a capability that the U.S. Army had been trying and failing for years to develop under the Distributed Common Ground System-Army (DCGS-A) intelligence programme, at great expense. Unlike many private tech companies, both SpaceX and Palantir wanted to sell their products to the Department of Defense, but they ran into a problem — neither the Army nor the Air Force wanted to change the status quo, even if the new tech could cut the costs of space launch or provide a data analysis programme that actually functioned. Both companies ended up suing the U.S. military for the right to compete.

SpaceX filed a suit against the U.S. Air Force in 2014, alleging uncompetitive procurement for its Evolved Expendable Launch Vehicle programme. The Air Force had awarded billions of dollars' worth of launches with a non-compete contract under the programme to United Launch Alliance, a joint venture between defence prime contractors Boeing and Lockheed Martin, which SpaceX founder Elon Musk argued "essentially blocks companies like SpaceX from competing for national security launches."[534] SpaceX dropped the lawsuit the following year after a mediated deal wherein the Air Force agreed to make more national security launch missions available for competition and speed up its efforts to certify SpaceX to launch military satellites.[535]

Then came the turn of Palantir. After spending $3 billion and more than a decade on DCGS-A, the Army released a solicitation at the end of 2015 seeking bids to develop a data management platform for the second increment of the programme, to gather, share, and enable visualisation of the data for soldiers in the field. However, the solicitation looked for

[532] Tadjdeh, Yasmin (2018) "Google Versus The Pentagon: The Fallout" *National Defense* 103:777
[533] Brose (2020) pp71-73
[534] Quoted in Gupta, Shruti (2014) "SpaceX Sues Air Force, Protests Lack of Competition in Satellite Launch Contracts" *Industry Week* 25 April
[535] Gruss, Mike (2015) "SpaceX, Air Force Settle Lawsuit Over ULA Blockbuy" *Space News* 23 January

only one lead systems integrator, and Palantir filed a protest with the Government Accountability Office arguing that this wording would shut out private sector companies providing commercial products. The protest was denied, but rather than giving up, Palantir filed a suit against the U.S. Army in the Court of Federal Claims in 2016, claiming that the procurement solicitation was unlawful and deliberately shut out Palantir's commercial offering.

The lawsuit sought to show that Palantir's Gotham Platform did precisely what DCGS-A was intending to do but at a much lower cost, and that the Army's actions were not only illegal but also irrational. Palantir argued that the Army had repeatedly blocked the company from working with them to test whether its commercially available technology could be integrated into DCGS-A. The court agreed that the Army had violated the Federal Acquisition Streamlining Act of 1994, which mandates thorough research into using commercial items to meet capabilities if possible rather than reinventing the wheel through internal research and development. In her oral ruling, the judge ordered the Army "to go back and look seriously at whether there are in fact commercial products that can meet its needs either without modification or with some modification, but whether there are in fact commercial products, including from Palantir, that meet its needs."[536]

The Army complied, and in March 2018 chose Palantir and Raytheon (a traditional defence prime contractor) to take part in a head-to-head competition to provide new intelligence analysis platforms that could be used effectively at the tactical level, where many of DCGS-A's problems lay. Soldiers on the ground had complained that the existing system was difficult to use, and some had even requested to use the Palantir system instead due to its improved functionality. Palantir won out over Raytheon a year later, securing a contract worth $876 million over ten years.[537]

The thread running through these cases is that the companies had to fight for years and file lawsuits in order to convince the U.S. military to buy their technology — it is rare for a business to have to sue its own customers to get them to make a purchase. Brose notes that both SpaceX and Palantir were able to carve their way through the procurement process because they each had a wealthy founder who was willing and able to sustain the struggle.[538] This matters because these two companies, along with Anduril Industries (founded by, among others, former Palantir employees), are the only Silicon Valley start-ups that have

[536] Quoted in Judson, Jen (2016) "Judge Rules in Favor of Palantir in Lawsuit Against US Army" *Defense News* 31 October
[537] Judson, Jen (2019) "Palantir – Who Successfully Sued the Army – Has Won a Major Army Contract" *Defense News* 29 March
[538] Brose (2020) p72

achieved serious status in the defence market since the end of the Cold War — the lesson here thus appears to be that defence is not the sector in which to build a business unless you are a billionaire with a penchant for legal wrangling. This is hardly the impression that the Department of Defense and the U.S. military should be giving if they wish to build bridges with the private tech sector, and it is unsurprising that many other companies did not want to bother.

7.10 Bad Relations

Brose notes the tragic irony in these cases: the American government had spent years preserving the status quo and refusing to break down walls in the relationship with the technology companies, only to come to the conclusion during Carter's tenure as secretary of defense that future U.S. military dominance would depend on the technologies built by those very companies, who were now less willing than ever to provide their services to the Department of Defense.[539] In a 2017 study, nearly 80 percent of survey respondents rated the state of collaboration between the federal government and Silicon Valley as "poor" or "very poor."[540] As a member of DIU-X, Christopher Kirchhoff, wrote in 2018, critics in Silicon Valley have two central objections to collaborating with the Department of Defense: the risk of compromising Silicon Valley values, and the risk of contaminating the tech sector's fast-moving culture with the military's inefficient procurement processes.[541] Despite this, there remains a good proportion of technology professionals who are willing to consider working with the federal government: a 2019 survey of a thousand Silicon Valley technology workers found that 59 percent of them somewhat or strongly agreed that "tech companies should work with the U.S. government on military projects."[542]

While the national security establishment may wish for a change in the Silicon Valley culture of wariness of military contracts, the establishment itself also needs a change in its culture to better reflect the new reality of the innovation base. Samuel Brannen and his co-authors note that the relationship between the big tech companies and the public sector, particularly Congress in its oversight capacity, has become rockier due to the increasingly politicised and partisan nature of the rhetoric around technology. Building shared understandings between

[539] Brose (2020) p74
[540] Schulman, Loren DeJonge, Sander, Alexandra, and Christian, Madeline (2017) *The Rocky Relationship Between Washington and Silicon Valley: Clearing the Path to Improved Collaboration* (Center for a New American Security: Washington DC) p4
[541] Kirchhoff, Christopher M. (2018) "Why Silicon Valley Must Go To War" *New York Times* 2 May
[542] Bernstein, Joseph (2019) "Survey: 51% Of Tech Industry Workers Believe President Trump Has a Point About the Media Creating Fake News" *BuzzFeed* February 23

the commercial and political worlds on what constitutes a productive relationship can only be helpful.[543]

The Department of Defense has not traditionally helped itself in building bridges with the big commercial companies given the byzantine nature of the procurement process. Like all agencies of the federal government, it is guided in its acquisition of goods and services by the Federal Acquisition Regulation, with specific additional supplements for the individual military services. This document is meant to comprehensively outline standard permissible actions in government procurement, as well as circumstances where deviation from these is allowed. Even without the defence-specific supplements, the Federal Acquisition Regulation is both lengthy and ever-growing: for example, it expanded from 1,741 pages in 2018 to 1,988 pages in 2020.[544]

As Lynn notes, the bidding on defence contracts is so difficult and daunting that many companies will not bother — an unfamiliar process combined with exacting requirements means that the process of attempting to get a particular contract may not be worth the necessary time or money.[545] Most venture-backed companies expect to start turning over revenue within two years, but it can take that amount of time for the Department of Defense to award a contract, to be followed by testing, approval, and prototyping: the commercial market gives far shorter sales cycles and more reliable revenue to appease investors.[546] This problem persists despite the increasing number of ways for Defense Department officials to work around the Federal Acquisition Regulation, including other transaction authorities (as explored above) and the proliferating "rapid capabilities" offices with the services.[547] The Department of Defense may also require a company to relinquish the intellectual property rights to whatever is produced, or ask a business to create a costly new accounting system to comply with audit and oversight regulations.

Given that many defence acquisition programmes take a decade or more to transition from development to production, and "the two sides hold different understandings of the value of time,"[548] one can well understand why technology companies may prefer to focus on their commercial business rather than deal with the Department of Defense. Contracts for platforms that will support servicemembers on the battlefield will of course demand stricter

[543] Brannen, Samuel, Haig, Christian, Schmidt, Katherine, and Hicks, Kathleen (2020) *Twin Pillars: Upholding National Security and National Innovation in Emerging Technologies Governance* Center for Strategic and International Studies p8
[544] Amara, Jomana & Franck, Raymond E (2021) *The US Defense Economy* (Cambridge: Cambridge University Press) pp23-24
[545] Lynn (2014) pp107-108
[546] Manyika at al (2019) p29
[547] Amara & Franck (2021) p24
[548] Schulman et al (2017) p5

oversight and higher performance benchmarks, but the wrong balance between risk and supervision will put off companies from dealing with the military. While reforms to the procurement process are constantly mooted, and sometimes even enacted, the department simply has not kept pace with the rapid technological advances coming from the commercial sector.[549] It is not without irony that one must note congressional support for other transaction authorities, for example:

> The committee remains committed to providing the Department of Defense the needed flexibility to acquire advanced capabilities through streamlined and expedited processes. The committee recognizes that other transaction authority has been an effective tool for research and development, particularly for execution of science, technology, and prototyping programs. It provides needed flexibility in terms of adherence to select Federal acquisition regulations.[550]

Congress clearly recognises the importance of flexibility in defence procurement but looks to achieve this via support for a workaround for constricting regulations — not by fixing the regulations themselves. The crux of this pervasive problem was articulated by Griffin in 2018: "we can either retain our national [military] pre-eminence, or we can retain our processes, but we cannot have both."[551]

The expanded use of small business-focused grants, along with other transaction authority contracts, has had some success in broadening the defence innovation base, by providing thousands of start-ups with small amounts of non-dilutive funding. However, despite this, the pathways that such small companies take to transition into success in the defence world are not consistently effective. The most flourishing defence technology start-ups, Anduril and Palantir, already had millions of dollars behind them when they were founded, as explored above. Other start-ups have performed well on small contracts, but they are not yet receiving the kind of regular and repeated business from the Department of Defense that would set them on a secure path, leaving them in danger of perishing in the famous "valley of death" between developing a product and securing recurring and profitable contracts. Trae Stephens, a co-founder of Anduril, summed up the problem in 2021:

> A startup only has like 18 to 24 months of runway at any given time, that's how the financing structure works. And so if you find a willing end user, someone who wants

[549] Nye, Joseph S, Rice, Condoleezza, and Burns, Nicholas (2019) "Navigating Uncharted Technology in the Technological Era" in Bitounis and Price (ed.) p12
[550] House of Representatives, Committee on Armed Services (2018) *National Defense Authorization Act for Fiscal Year 2019, report to accompany H.R. 5515* [115th Congress, H. Rept. 115-676] p162
[551] Hudson Institute (2018) "Regaining the Strategic Advantage in an Age of Great Power Competition: A Conversation with Michael Griffin" 13 April

> to use your product, and they say, 'Okay, give me three years and in three years, we might have this contract somewhere,' the company is dead. [...] The problem is not that it's hard to get research and development and prototype dollars. In fact, it's never been easier in at any point in history, to get a pilot for R&D type of contracts. The counter to that is, it's never been harder [...] to get a production contract.[552]

This inconsistency in success in traversing the valley of death may well be a product of the balkanisation of efforts within the military and federal government, giving rise to a patchwork of organisations that cannot effectively work together towards a shared goal. Recent congressional proposals to bulk up the authority and budget of the Defense Innovation Unit[553] may solve some of these problems, putting the service innovation organisations under the purview of the unit's director and enabling more unity of effort, although it remains to be seen whether these will be enacted — or, indeed, work as intended. Ultimately, while the 2010s were a period of growth for the smaller defence-focused companies, they may not be able to continue along this path unless the military and the government solve the problem of how to work with them effectively into the future.

7.11 Conclusions

The 2010s were a period of relative decline for the traditional defence primes — while they remained huge businesses with considerable turnover and profit, they were overtaken by smaller companies in terms of both the number and dollar value of defence research and development contracts. These smaller companies took advantage of the increased importance of computing technologies to the military, particularly following the Third Offset Strategy, and threatened the position of the primes at the top of the food chain.

The concurrent rise of the big civilian tech giants within the defence space, however, means that this period's context is not simply a case of the displacement of particular companies within the industry assemblage of the military-industrial complex. While the smaller defence-focused companies became a threat to the dominance of the primes, they are ultimately similar — businesses that exist in a context of providing products and services to the defence market. One could easily imagine one of these smaller companies growing to the extent that it could become a prime. The commercial tech titans such as Google, Microsoft, and Amazon, however, are different beasts entirely — their business is firmly within the civilian sphere and does not have an overtly defence focus, and they make the bulk of their profit from the civilian market. The rise of the big civilian commercial tech companies that

[552] Quoted in Insinna, Valerie (2021) "Silicon Valley warns the Pentagon: 'Time is running out'" *Breaking Defense* 21 December
[553] McNally, Ben (2023) "To Promote Defense Innovation, Fund the Defense Innovation Unit" *War on the Rocks* 22 August

had grown up in the Silicon Valley ecosystem has significant implications for the military-industrial complex as a whole. They are not and could not be the new defence primes, and do not fit within the industry assemblage of the military-industrial complex in the same way as the defence-focused companies do. As Dunne and Skons note, it is still too early to predict exactly what these trends will presage for the defence industrial base in the future.[554]

These shifts within the military-industrial complex are vitally important to understand as military capabilities continue to become more dependent on dual-use technologies — and none of this would be possible to draw out under an iron triangle approach. Not only do we once again have the problem of being unable to differentiate between actors within its industry corner, but the addition of the civilian tech giants to the mix is too complicated for the iron triangle schema to cope with. These companies are not part of the traditional defence industry, but they are also not outside of the military-industrial complex — and the iron triangle does not have the flexibility to adapt to this change. The fluidity of an assemblage approach, however, permits us to add in the civilian tech titans to our understanding of the military-industrial complex, including this important shift without losing the coherence of the model.

The lessons we can draw from this period must be also looked at with an appreciation for irony. The military-industrial complex that Eisenhower warned of in his Farewell Address, with the defence industrial titans, federal bureaucracy, and academic institutions feeding off each other, may have been concerning but it at least worked — the military got the benefit of the technological advances that were made, and wider society made hay from the spin-off of commercially adaptable technologies. This period, however, shows failure — the military-industrial complex was unable to adapt to the shift in innovative capability away from federally funded projects and into the commercial sector, forged by companies that did not rely on the military-industrial complex for funding or direction. In many cases, this resulted in an inability to grasp the implications of emerging technologies in a way that would have resulted in quicker and more effective integration into the military, and sometimes even in a closed-off mindset that meant missing out on, or actively resisting, available opportunities. Although links existed and there were some successful projects, overall the commercial world, particularly the giants of the tech start-up ecosystem, simply left the military-industrial complex behind.

The fact remains that the problem of the valley of death and the mismatch between private business and the Department of Defense and/or service bureaucracy has been recognised for two decades but has still not been solved. While there has been a plethora of warm words

[554] Dunne and Skons (2021) p16

and abstract policy suggestions from the government and the military, over at least three presidential administrations of both parties, there remains huge frustration from the industry perspective. If the government and military assemblages cannot change how they work, the industry assemblage of the military-industrial complex may well be left only with the primes, becoming narrower, less innovative, and less able to meet the national security needs of the United States.

Conclusion: The Military-Industrial Complex as Assemblage

The military-industrial complex is not a static concept, and it manifests in diverse ways both over time and in different nations. Since the first use of the phrase by Eisenhower, the military-industrial complex has been many things to many people, complicating the task of discerning what it is, how it works, and what its effects may be. The term is often used a vehicle for wider criticisms of national security policy or the use of military force, further blurring the picture, and dispassionate analyses of the military-industrial complex are few and far between. In exploring the existing literature that covers the military-industrial complex, I have found that definitions tend to be partial, assumed, or overly normative, and there is little extant work attempting to provide a theoretical or holistic view of the military-industrial complex in its entirety.

One can most helpfully define the military-industrial complex as a system of actors and forces bridging the public and private spheres, combining a capitalist profit motive with the design and implementation of defence policy, but a brief definition cannot hope to elucidate the theoretical basis of a concept. The traditional "iron triangle" view of the military-industrial complex — encompassing the military, the government, and industry — does not encompass the full extent of its reach and implies a rigidity that I argue simply does not exist. Rather, the proper starting point for defining the military-industrial complex should begin with an appreciation of it as a kind of system — an intuition that runs through some existing works but is not overtly developed — comprised of those people, institutions, and forces.

An assemblage thinking approach offers a valuable way of exploring the military-industrial complex without relying on a static model like the iron triangle and provides a solid basis for exploring the intuition of the military-industrial complex as some form of system. The parts of an assemblage, which all have the same ontological status, form a network of relations with each other while retaining an independent existence. Looking at the military-industrial complex through the lens of assemblage thinking allows us to ask how it is built and what it does, while encompassing the possibilities of agency and emergent behaviour — its properties are discernible only as the result of the interaction of its parts, rather than being predictable from considering any of those parts in isolation. Rather than trying to understand the object of study in a reified manner, an assemblage approach focuses on understanding the nature of the interactions between actors and their capacities, along with the processes of their arrangement and the power relations that arise from this arrangement.

The concept of assemblage provides a way in which to link the structural and the ephemeral, moving us away from traditional concepts of structure and bringing in puzzles about

processes and relationships between diverse actors. Such an approach prevents us from falling back on reifications that are used without deeper exploration and on the tendency to rely on totalising systems of thought — instead, assemblage thinking folds together the social and the material while recognising that the subject of analysis is provisional and constantly changing. It provides a corrective to the common reliance within the social sciences on *a priori* concepts, which are often used in way that assumes that they are static and transhistorical when they are in fact mutable and dynamic. This reification leads to reductionism, which attempts to explain a larger whole by reference solely to one level of it, be that the individual, society, or some praxis in between. Assemblage thinking, however, gives a framework within which we can locate every level — individual interpersonal networks, intermediate social entities, or wide-lens societal structures — and encapsulate the entirety of each.

Viewing the military-industrial complex as an assemblage also allows us to reach a deeper understanding of causality within it. Individual decisions made by the people acting within the military-industrial complex are part of the story, but we must also consider other nonlinear causal events and how those interact with different actors. As DeLanda argues, "the synthesis of larger social assemblages is many times achieved as the *collective unintended consequence* of intentional action, that is, as a kind of statistical result."[555] This insight permits us to move away from the overly normative and polemical critiques of the military-industrial complex as some kind of conspiracy — it is neither deliberately constructed nor perpetuated, but is rather the collective unintended consequence of the actions and choices of all of the parts of its constituent assemblages.

Using an assemblage approach means that I can unpick the dominant assumptions underlying the military-industrial complex while taking proper account of the messiness, contingency, and intricacy that comes along with any such structure as it exists in the real world — with periods of both stability and fluidity existing within it. Such an approach also recognises the power of description over explanation as a method of analysis, moving towards a fuller understanding by recognising the agency of each actor and unpicking the relationships between them. This is a strong approach for looking at messy and complicated domain of the military-industrial complex, composed of multiple actors and relationships that interact and produce emergent effects — looking at these as assemblages, and describing them and their interactions, gives us a fuller understanding of how the military-industrial complex works.

[555] DeLanda (2006) p25

By deprioritising the normative and focusing instead on the descriptive, the American military-industrial complex can be viewed more clearly. It is impossible to fully describe the military-industrial complex, given the sheer volume of parts, connections, and shifts, but even a partial attempt offers value in moving towards a more complete understanding and identifying broader patterns and trends. Each individual actor within the assemblage is itself an assemblage on a smaller scale, with each having a relation of part-to-whole to a larger one, and of whole-to-part with smaller ones. I identify the four main parts of the military-industrial complex — the government, the military, industry, and academia — and show how each is also an assemblage, made up of others yet smaller, and so on. It is important to recognise the differentiation between these parts and not unthinkingly subsume them into a larger component, as the individual parts interact with each other and with the wider system in diverse ways, and focusing on too limited an array of actors leaves too much out of the story.

There are several types of binary relations between these parts, which I broadly identify as money, influence, and the revolving door — each of which manifests slightly differently depending on the actors involved. There are also other influences that affect the military-industrial complex but do not sit neatly within the binary relations category, which arise from the electoral incentives that shape the actions of those within the government assemblage whose positions rest upon democratic elections and influence how they interact with the other parts of the military-industrial complex — these centre around the interplay between the government and the military, and around the formation of the defence budget. I identify these as the military in politics, public connection with the military, campaign endorsements, veterans in Congress, generals in cabinet, civilian deference to the military, the political nature of the defence budget, and the ratchet effect in military spending.

It is vital when studying the military-industrial complex to recognise its fluidity, something that an assemblage approach allows us properly to consider. We should not simply view it as a still picture at one point in time, but also explore how it has changed over time: bringing in a historical approach as well as a theoretical one. It is only by encompassing different periods and bringing in the wider historical context to a description of the military-industrial complex that we can achieve a fuller understanding of it. While it is impossible to exhaustively analyse every military service, procurement programme, or strand of the defence budget when describing the American military-industrial complex, I selected several case studies that provide useful vignettes of certain time periods or draw out particular points well in order to add nuance and detail to my exploration. These case studies are necessarily an incomplete list of all of the possible options for analysis, but they serve to

highlight the core patterns visible within the military-industrial complex and illustrate the emergent effects of the self-interested behaviour of the players involved in each.

I also used quantitative data to provide another layer of nuance to my historical analysis and give more context in answering the question of how the military-industrial complex has changed over time in the United States. I drew from federal contract data for this purpose and drilled down into the research and development portion of the defence contracting realm. Research and development data provides the most complete picture of the range of military contracting — even programmes that do not succeed in becoming a product, platform, or weapon, and thus will not be included in acquisition contracts, will be represented in the research and development data. This allowed me to fold together the data with the case studies to form a picture of the wider changes within the American military-industrial complex over the last four decades. Three periods emerged as times of particular change, roughly focused around the Reagan administration, the George W. Bush administration, and the Obama administration, and I organised my historical analysis around these. While I also explored the context between these loci in order to bring in additional nuance, the three periods each elucidate a shift in the relative dominance of one assemblage over the others within the broader sweep of the American military-industrial complex, allowing the tracing of patterns over time.

The 1980s under the Reagan administration were a time of relative dominance by the academic institutions within the military-industrial complex, due to the administration's aim of competing with the Soviet Union on technological supremacy and the consequent need for more research into new technologies. The government of this period actively sought to create and improve links with academia and had the increased defence budgets necessary to fund significant research and development, and the academic institutions — particularly in the two hubs of California and Massachusetts — took advantage of these opportunities. This is clearly illustrated by the Strategic Defense Initiative, Reagan's priority in the national security realm, which required a huge amount of early-stage research due to its technological immaturity and deliberately provided an extensive source of work and funding for universities, laboratories, and other related entities during its existence. Although the plans for the Strategic Defense Initiative never came to fruition, the Reagan administration's focus on technological research is vividly shown in its approach to the development of the initiative and the case provides a helpful illustration of how academic institutions could gain funding and contracts based on their abilities to develop cutting-edge technologies for military use.

The cuts in defence spending after the end of the Cold War led the Clinton administration to encourage defence companies to merge, creating a new type of player within the defence industry — the prime contractor. These amalgamated behemoths were able to use their heft

to lobby both the defence bureaucracy and congressional representatives for more funding and more contracts, as ably illustrated by the case study of the littoral combat ship. This is reinforced by the case of the F-22 Raptor, which shows how a prime contractor could use the electoral incentives present in the military-industrial complex to persuade elected representatives to extend the aircraft's production beyond what was militarily needed, particularly with reference to the representatives of states and districts that contained facilities involved in its production. The particular context of the global war on terror is exemplified by the case study of the Joint Improvised Explosive Device Defeat organization, which illustrates the ways in which the primes were able to profit from the opportunity of growing defence budgets and the need to reorient American military operations towards the counter-insurgency challenges faced in Iraq. Each of these illustrates how their new-found dominance enabled the primes to shape the military-industrial complex in pursuit of their own interests — they could not only make the argument that contracts helped to provide economic growth and employment in the communities where their facilities were located, but also that in times of insecurity like the global war on terror the United States needed to more generally maintain a healthy defence industrial base. While the academia assemblage remained part of the military-industrial complex, its institutions simply were unable to keep up with the primes — a significant shift in relative dominance towards the industry assemblage.

As dual-use technologies became increasingly more important to the armed forces in the 2010s following the Third Offset Strategy, the primes began to lose their dominance — the industry portion of the military-industrial complex changed to encompass smaller defence contractors as well as companies that had not previously been participants in the defence industry ecosystem. Rising in dominance in particular were the big civilian commercial technology firms, who did not need (or sometimes want) military contracts, changing the nature of relations between the military and government assemblages and the shifting industry assemblage. Innovation in the civilian world leapt ahead of that in the military world, cementing a shift from technology spin-off to spin-on, and the Department of Defense had to get used to being an importer of technology, changing the balance of power within the military-industrial complex in favour of a new subsection of industry. I explored these trends through several case studies: the Strategic Computing Program to illustrate the change from technology spin-off to spin-on; the JEDI project and Project Maven to elucidate the big civilian technology titans both working with and clashing with the military; and Palantir and SpaceX to draw out the difficulties that the smaller defence-focused companies faced in breaking into the defence contracting space.

I build upon this to show how the American military-industrial complex has been unable to adapt either promptly or successfully to the new context of dual-use technologies coming out of the civilian commercial world. The government and military have struggled to grasp how these technologies can and should be integrated into operational use, and how to effectively source, fund, and acquire these capabilities for military purposes. If the actors within the military and government assemblages cannot change how they approach these thorny problems, they may well be left with a narrower and less innovative industry assemblage, which will be to the detriment of American national security. It is ultimately too soon to tell whether the government and the military will be able to figure out how to navigate this shift, but it is likely to shape the American military-industrial complex for some time to come.

The Strategic Defense Initiative exposes the limitations of the iron triangle model in understanding the military-industrial complex. The iron triangle model, which focuses on the interactions among the military, government, and industry, fails to account for the significant role played by academia in this context. This omission is critical because the connections with academic institutions are essential for a comprehensive understanding of the Strategic Defense Initiative and Reagan's approach to challenging the Soviet Union. The iron triangle approach would struggle to fully grasp these academic links, let alone the diverse types of academic institutions involved and their distinct relationships with various segments of the military, the federal government, and the defence industry. Consequently, this model falls short in explaining how the Reagan administration's emphasis on research and development as a cornerstone of national security influenced military spending, contracts, and technology development during the Cold War. The iron triangle framework is thus structurally incomplete and insufficient for explaining the drive for technological superiority over the Soviet Union that characterized the Reagan era's military-industrial complex. In contrast, an assemblage approach offers a more nuanced understanding by including academia and exploring the different interactions within the broader network of actors in the military-industrial complex. This approach allows us to examine how universities, FFRDCs, and other research institutions had distinct relationships with the government, military, and industry. By viewing these interactions within the context of an assemblage, we can unravel the intricate ways these academic entities influenced the Cold War-era military-industrial complex. This perspective reveals the multidimensional nature of these relationships, which the iron triangle model fails to capture.

Moving into the 2000s, the superiority of the assemblage approach over the iron triangle model becomes even more evident. The defence industry landscape was marked by the dominance of prime contractors, which played pivotal roles in major military projects. While the iron triangle might better capture the primary interactions among the military,

government, and industry during this period than it did in the 1980s, it still lacks the ability to differentiate between the various actors within these three categories, which limits its explanatory power. The rise of prime contractors within the industry sector of the military-industrial complex during the post-Cold War era requires a more detailed analysis of their interactions with other parts of the complex. The case of the F-22 fighter jet illustrates this point — understanding the dynamics of its development involves examining how prime contractors interacted differently with various government actors, including congressional members with and without electoral interests tied to the programme, and the executive branch, specifically the White House and the Department of Defense. Congressional support varied based on regional economic interests, and the executive branch had its own strategic priorities. These intricate relationships cannot be adequately captured by the iron triangle model. An assemblage approach enables us to dissect these relationships and understand how they collectively influenced the programme's development and implementation.

Furthermore, recent shifts in the military-industrial complex underscore the necessity of an assemblage approach. As military capabilities increasingly rely on dual-use technologies, the iron triangle model falls short. It cannot adequately differentiate between the actors within its industry corner, nor can it accommodate the inclusion of civilian tech giants, which play an essential role in the current military-industrial landscape. Companies like Google, Amazon, and Microsoft are now key players in defence-related technologies, but these companies are neither traditional defence contractors nor entirely outside the military-industrial complex, creating a complexity that the iron triangle cannot address. The assemblage approach, with its inherent flexibility, allows for the inclusion of both these civilian tech giants and smaller dual-use technology companies, thereby providing a more coherent and comprehensive understanding of the evolving military-industrial complex. By recognising the evolving nature of industry participants and their interactions with the military and government, an assemblage approach allows for a more dynamic and adaptable understanding of the military-industrial complex, reflecting the contemporary realities of technological and strategic developments.

Overall, the assemblage approach offers a richer, more detailed framework for understanding the military-industrial complex across different eras. It accounts for the diverse actors and their intricate relationships, providing a more comprehensive and accurate analysis. By incorporating academia, differentiating between actors within sectors, and enabling the inclusion of new players, the assemblage approach captures the complexity and fluidity of the military-industrial complex in ways that the iron triangle model cannot. This makes it a superior method for analysing the interplay of various entities that shape

national security and defence strategies, better describing and elucidating the military-industrial complex.

By reaching a fuller understanding of the military-industrial complex as it is, one can move on to exploring how to improve it. An approach grounded in theory, with clear-eyed analysis uncoloured by the pejorative, permits necessary critiques to be made from stronger ground and offers routes to address them. Within the American context, there is a great deal of further work that can be done on this by both scholars and policymakers — picking out the sticking points that cause problems, analysing how and why they manifest within the military-industrial complex, and figuring out how to fix or ameliorate them. I argue that this daunting task is made easier by building on a foundation of an assemblage approach to the complex, offering a fresh perspective on the whole system while also providing a way of unpicking particular issues with a wider understanding of where the connections and incentives flow.

My case studies herein highlight some of the themes of these problems: the clash between the profit motive of private contractors and the military's mission to defend the nation, the warping of political decision-making on defence matters by the electoral incentives inherent in the American system, and the difficulties faced by the military bureaucracy in adapting to new technologies and new suppliers thereof. Some of these issues are fixable via policy changes, while others are so deeply embedded in the wider system that they can only be worked around rather than solved. Either way, improvement requires acknowledgment and understanding of the problems at hand, and the ways in which solving them may require a wider appreciation of the connections between the parts of the system.

Furthermore, those interested in the military-industrial complexes of other nations can use my approach as a starting point — while there will be differences in the actors, connections, and incentives present within another complex, particularly within a nation with a different political and/or economic system, I argue that using assemblage thinking as I have done for the American example here provides a strong foundation for teasing out and analysing how the military-industrial complex manifests in other national contexts, both historically and in the present day.

While it is tempting to view the military-industrial complex as a conspiracy, or to use it as a scapegoat for any defence-related policy that one finds to be wrong or offensive, it is only by stripping out the pejorative and focusing on the descriptive that it is possible to identify what the military-industrial complex is and how it works. The military-industrial complex certainly can distort policy priorities, waste taxpayers' money, and weaken the defence of a nation — but it is also the mechanism through which a nation is protected, and a military-

industrial complex that works well should provide a nation's military with the capabilities it needs to fulfil its missions, while responding to the policy priorities of elected representatives and maintaining a resilient industrial base. Making sure that we fully and properly understand the messy assemblage of the military-industrial complex — and how it can both benefit and undermine national security — is vital to making the choices that ensure that our nations are well defended.

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Appendix A: FDPS R&D data results

Contracts by dollar value per year:

	Academic and Nonprofit	Prime Defence Contractor	Private Contractor	Total
1979	$91,386,000	$35,751,000	$41,042,000	$168,179,000
1980	$124,378,000	$19,124,000	$52,051,000	$195,553,000
1981	$178,979,000	$33,494,000	$65,628,000	$278,101,000
1982	$116,798,000	$68,381,000	$65,645,000	$250,824,000
1983	$113,766,000	$48,175,000	$70,044,000	$231,985,000
1984	$116,232,000	$66,992,000	$103,174,000	$286,398,000
1985	$132,934,000	$93,997,382	$140,736,000	$367,667,382
1986	$153,281,000	$58,395,000	$160,622,000	$372,298,000
1987	$223,459,000	$64,168,000	$169,714,084	$457,341,084
1988	$196,805,000	$76,447,000	$114,205,000	$387,457,000
1989	$107,324,000	$56,068,000	$134,866,916	$298,258,916
1990	$42,559,000	$62,480,000	$162,322,341	$267,361,341
1991	$36,427,000	$136,681,000	$181,450,888	$354,558,888
1992	$37,138,000	$83,293,000	$189,293,000	$309,724,000
1993	$43,877,000	$97,209,000	$197,274,000	$338,360,000
1994	$28,280,000	$141,427,000	$174,056,000	$343,763,000
1995	$23,714,000	$146,284,000	$225,637,000	$395,635,000
1996	$51,320,960	$225,117,480	$226,836,747	$503,275,187
1997	$123,568,124	$242,732,893	$217,549,922	$583,850,939
1998	$122,484,900	$319,328,666	$194,489,474	$636,303,040
1999	$75,574,023	$402,366,630	$226,993,064	$704,933,717
2000	$117,423,623	$334,481,553	$234,645,794	$686,550,970
2001	$92,472,604	$255,677,252	$225,221,744	$573,371,600
2002	$149,074,590	$481,223,862	$291,368,379	$921,666,831
2003	$161,499,447	$757,362,168	$347,681,529	$1,266,543,144
2004	$139,791,973	$1,007,242,235	$265,770,151	$1,412,804,359
2005	$147,977,185	$516,212,739	$287,241,448	$951,431,372
2006	$182,618,274	$1,186,188,934	$244,157,062	$1,612,964,270
2007	$141,171,892	$618,843,969	$231,298,505	$991,314,366
2008	$194,931,754	$675,202,609	$291,755,573	$1,161,889,936
2009	$137,762,193	$534,973,750	$364,061,138	$1,036,797,081
2010	$193,748,450	$551,787,929	$359,882,201	$1,105,418,580
2011	$194,180,566	$416,445,178	$444,778,520	$1,055,404,264
2012	$163,667,844	$559,965,709	$461,321,178	$1,184,954,731
2013	$111,077,151	$480,783,745	$403,278,064	$995,138,960
2014	$107,108,770	$352,418,285	$410,859,512	$870,386,567
2015	$86,891,111	$364,137,564	$404,322,203	$855,350,878
2016	$85,664,114	$381,597,925	$546,520,802	$1,013,782,841
2017	$36,613,504	$335,902,715	$578,770,876	$951,287,095
2018	$75,575,408	$358,219,994	$576,129,030	$1,009,924,432

Contract dollar value as percentage of annual total:

	Academic and Nonprofit	Prime Defence Contractor	Private Contractor
1979	54.34%	21.26%	24.40%
1980	63.60%	9.78%	26.62%
1981	64.36%	12.04%	23.60%
1982	46.57%	27.26%	26.17%
1983	49.04%	20.77%	30.19%
1984	40.58%	23.39%	36.02%
1985	36.16%	25.57%	38.28%
1986	41.17%	15.69%	43.14%
1987	48.86%	14.03%	37.11%
1988	50.79%	19.73%	29.48%
1989	35.98%	18.80%	45.22%
1990	15.92%	23.37%	60.71%
1991	10.27%	38.55%	51.18%
1992	11.99%	26.89%	61.12%
1993	12.97%	28.73%	58.30%
1994	8.23%	41.14%	50.63%
1995	5.99%	36.97%	57.03%
1996	10.20%	44.73%	45.07%
1997	21.16%	41.57%	37.26%
1998	19.25%	50.18%	30.57%
1999	10.72%	57.08%	32.20%
2000	17.10%	48.72%	34.18%
2001	16.13%	44.59%	39.28%
2002	16.17%	52.21%	31.61%
2003	12.75%	59.80%	27.45%
2004	9.89%	71.29%	18.81%
2005	15.55%	54.26%	30.19%
2006	11.32%	73.54%	15.14%
2007	14.24%	62.43%	23.33%
2008	16.78%	58.11%	25.11%
2009	13.29%	51.60%	35.11%
2010	17.53%	49.92%	32.56%
2011	18.40%	39.46%	42.14%
2012	13.81%	47.26%	38.93%
2013	11.16%	48.31%	40.52%
2014	12.31%	40.49%	47.20%
2015	10.16%	42.57%	47.27%
2016	8.45%	37.64%	53.91%
2017	3.85%	35.31%	60.84%
2018	7.48%	35.47%	57.05%

Number of contract actions per year:

	Academic and Nonprofit	Prime Defence Contractor	Private Contractor	Total
1979	768	190	367	1325
1980	1039	177	426	1642
1981	986	263	465	1714
1982	890	335	409	1634
1983	713	223	329	1265
1984	665	333	351	1349
1985	809	242	400	1451
1986	1066	224	423	1713
1987	1462	217	530	2209
1988	1012	238	508	1758
1989	467	187	457	1111
1990	237	191	561	989
1991	178	256	560	994
1992	134	269	571	974
1993	150	305	674	1129
1994	121	353	685	1159
1995	88	415	811	1314
1996	139	425	905	1469
1997	262	557	851	1670
1998	311	745	809	1865
1999	247	778	975	2000
2000	300	817	973	2090
2001	300	806	902	2008
2002	412	1256	1061	2729
2003	473	1193	1101	2767
2004	441	1403	983	2827
2005	359	1520	991	2870
2006	371	1474	853	2698
2007	381	1324	727	2432
2008	411	1154	761	2326
2009	479	924	713	2116
2010	509	866	656	2031
2011	575	899	765	2239
2012	327	658	747	1732
2013	329	687	857	1873
2014	322	645	772	1739
2015	294	628	726	1648
2016	284	568	877	1729
2017	155	508	1059	1722
2018	124	359	875	1358

Number of contract actions as percentage of annual total:

	Academic and Nonprofit	Prime Defence Contractor	Private Contractor
1979	57.96%	14.34%	27.70%
1980	63.28%	10.78%	25.94%
1981	57.53%	15.34%	27.13%
1982	54.47%	20.50%	25.03%
1983	56.36%	17.63%	26.01%
1984	49.30%	24.68%	26.02%
1985	55.75%	16.68%	27.57%
1986	62.23%	13.08%	24.69%
1987	66.18%	9.82%	23.99%
1988	57.57%	13.54%	28.90%
1989	42.03%	16.83%	41.13%
1990	23.96%	19.31%	56.72%
1991	17.91%	25.75%	56.34%
1992	13.76%	27.62%	58.62%
1993	13.29%	27.02%	59.70%
1994	10.44%	30.46%	59.10%
1995	6.70%	31.58%	61.72%
1996	9.46%	28.93%	61.61%
1997	15.69%	33.35%	50.96%
1998	16.68%	39.95%	43.38%
1999	12.35%	38.90%	48.75%
2000	14.35%	39.09%	46.56%
2001	14.94%	40.14%	44.92%
2002	15.10%	46.02%	38.88%
2003	17.09%	43.12%	39.79%
2004	15.60%	49.63%	34.77%
2005	12.51%	52.96%	34.53%
2006	13.75%	54.63%	31.62%
2007	15.67%	54.44%	29.89%
2008	17.67%	49.61%	32.72%
2009	22.64%	43.67%	33.70%
2010	25.06%	42.64%	32.30%
2011	25.68%	40.15%	34.17%
2012	18.88%	37.99%	43.13%
2013	17.57%	36.68%	45.76%
2014	18.52%	37.09%	44.39%
2015	17.84%	38.11%	44.05%
2016	16.43%	32.85%	50.72%
2017	9.00%	29.50%	61.50%
2018	9.13%	26.44%	64.43%

Appendix B: Sources for information on top twenty non-prime contractors

All accessed 25 April 2021

Alion Science and Technology Corporation	https://www.alionscience.com/
Applied Research Associates Inc.	https://www.ara.com/
Assured Information Security Inc.	https://www.ainfosec.com/
Azimuth Corporation	https://www.azimuth-corp.com/
Dynetics Inc.	https://www.dynetics.com/
Engineering Research & Consulting Inc.	https://www.erc-incorporated.com/
Fibertek Inc.	https://www.fibertek.com/
Innovative Defense Technologies LLC	https://idtus.com/
Intelligent Software Solutions Inc.	https://www.issinc.com/
KBR Inc.	https://www.kbr.com/en
Manufacturing Techniques Inc.	https://www.mteq.com
Millennium Engineering and Integration LLC	https://www.meicompany.com/
OptiMetrics Inc.	https://www.omi.com
PAR Technology Corporation	https://www.partech.com/
Securboration Inc.	https://www.securboration.com/
SimVentions Inc.	https://www.simventions.com/
The AEgis Technologies Group Inc.	https://aegistg.com/
Torch Technologies Inc.	https://www.torchtechnologies.com/
UES Inc.	https://www.ues.com/
Universal Technology Corporation	https://www.utcdayton.com