Internship Experience at L3Harris during Summer 2023

Researching the Federal Defense Budget for 2023 Fiscal Year

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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Introduction

One of the Department of Defense's (DoD's) five major funding appropriations is the Research, Development, Test and Evaluation (RDT&E) sector. The RDT&E sector of the DoD is responsible for the development of equipment, material, or computer application software and its required evaluation and testing done by federal contractors or government organizations (AcqNotes LLC, 2021). Of all federal Research and Development (R&D) funding, the DoD has typically received more than half annually (Seelarbokus, 2021).

The defense R&D program helps fund the military-industrial complex, which refers to the network of individuals and entities involved in the production of weapons and military technologies. Military R&D programs are "outsourced to private business companies, which are tasked with weapons production and other military applications, and which also exert a significant role in advocating for specific production programs" (Seelarbokus, 2021, para. 3). A prominent figure who gave warning to the military-industrial complex was President Dwight D. Eisenhower in his farewell address in 1961. He warned that, "In the councils of government, we must guard against the acquisition of unwarranted influence" of the military-industrial complex, and continues, "The potential for the disastrous rise of misplaced power exists and will persist" (Bucholz, 2008, para. 2). There are concerns that the military-industrial complex uses their growing influence to "corrupt budget and policy processes," and could propose military solutions that are not in the country's best interest but rather in the interest of the industry (Freeman & Hartung, 2023, para. 1). The military-industrial complex also "exhausts huge human and intellectual capital" (Seelarbokus, 2021, para. 10). Some critics of the DoD's R&D sector argue that "defense-related R&D might displace private R&D and therefore could even have a negative impact on the total amount of innovation" (Steinwender et. al., 2019, para. 4). Taking resources

away from the private and commercial sectors in order to fund military operations could stifle technological innovation for the sake of military advancement.

While there are many arguments for the decrease of funding of the R&D sector of the DoD, there are also some arguments saying that the continued increase of funding for the R&D sector is beneficial. Some argue that the many inventions and technological innovations that the department has created over the years have an overall positive impact on the commercial market as well as for national security. Over the years, the DoD's R&D sector's technological advancements have been crucial for the commercial success of jet engines, computers, radar, nuclear power, semiconductors, GPS, and the internet (Steinwender et. al., 2019). Some also say that without enough funding for R&D and the ability to produce new technologies the United States will be left in a place of vulnerability and disadvantaged compared to other adversaries who are investing in their defense technology (Pfaff, 2020).

If the federal government gives too much funding to the R&D defense program, they could give growing power to the military-industrial complex while taking away resources from the private sector, however, if they do not give enough funding, they could stifle steady innovation and leave national security in a place of vulnerability. In my technical research paper, I will demonstrate how I implemented functions to enhance the signal processing abilities of a military submarine, and will show how the federal funding the company received impacted my ability to do that. In my STS research paper, I will research how the federal government decides what the appropriate amount of funding is for the RDT&E sector of defense through looking at a specific fiscal year's budget.

Technical

Through my internship experience, I had the opportunity to work on a signal processing team that was through a federally contracted company. The team specifically worked on sensors for submarines, so the submarines could have active and passive sonar. Active sonar is when a submarine emits a sound and listens for the echoes, while passive is when a submarine just listens for sounds. The specific project I worked on was the MFTA towed array. A towed array is a system of hydrophones that is attached to a cable that is dragged behind the submarine (Ametek SCP, 2019). These hydrophones can detect different sounds and signals underwater and allow the submarine to have a better understanding of threats and their surroundings.

I worked on signal processing techniques for the passive sonar of the MFTA towed arrays. Specifically, I worked on beamforming and pre-processing techniques. I helped translate their legacy GMP software into their new SPE software using C programs. I worked on existing C programs that performed beamforming and added capabilities for half azimuth, which is an array that only has hydrophones that cover 180 degrees. The problem our team ran into however, was the half azimuth beams were not compatible with the functions associated with the active sonar that built off the array that I was working on. So, a solution that we came up with was to create a function that could mirror the beams of the half azimuth before the tap off to the active sonar. I added a new select_mode for the beams in the configuration file called beam_mirror. This loops through the array of half-azimuth beams and copies the beams over to a new side, creating a full-azimuth array, which is beams covering 360 degrees. I also had to take special cases into consideration, such as the guard beams of the array and the endfire beams, which do not get copied over and depending on the configuration had to either be moved or removed. Creating this function allowed for a more efficient, seamless beamformer.

In the future, there should be more thorough testing of the new beam_mirror function and of the passive and active sonar processes. Throughout development, in order to test, I used MATLAB comparison tools to compare the output of the new code with what it should be after passing raw data through the processes. The legacy code works as intended, so after passing the raw data through the new SPE processor, I would compare the SPE output to the legacy GMP output. The MATLAB tools show the beam data on multiple graphs and allows you to compare the raw data that is being processed through the beamformer. There should be more comprehensive testing of the total actual output of the array compared to the expected to ensure that everything is working as intended. Funding plays a big role in the efficiency of the technology we produced and worked on. With less funding, the team had to find more creative ways for the sensors to be able to meet the demands of the client.

STS Research

How did the federal government decide how much money from the annual budget is allocated to the Department of Defense's RDT&E sector for the 2023 fiscal year? I will research the political motivations for the funding of the defense RDT&E sector. Defense funding has been a historically bi-partisan issue, however, in recent years, as the two major political parties have become more polarized, there has been more disagreements on how the Department of Defense gets funded. (Cooper, 2023). I will research more about why these two parties have differing beliefs and how they resolve it in debate in order to pass a budget. I will also research whether the development of military technologies is a polarized issue and how opinions on them affect funding.

There are many social factors that play a role in the funding of the defense budget, including the perspectives of various groups that have a stake in the defense R&D sector. In

order to further research this, I will use the Social Construction of Technology (SCOT) framework, which is a framework that argues that society shapes technology, and that different groups and stakeholders have an influence on how technology is developed and perceived (Pinch & Bijker, 2012). I will research the motivations behind groups such as political groups, commercial groups, civilian interests, federal groups, and different industry groups, and how they play a role in how much funding is allocated to the sector. Industry groups have a major influence on political groups through their financial contributions, which ultimately plays a big role in funding the sector (Opensecrets RSS). Through the SCOT framework, I will be able to understand the network of actors that work together in order to influence the federal government on how to allocate resources to the defense R&D sector.

Researching how the federal government allocates money to the R&D sector is significant because there can be more clarity on the rationale behind the government's spending on the Department of Defense which has major impacts on things like the economy, people's well-being, and the overall state of the country and world (Beattie, 2021). Through examining the process for how the appropriate amount of funding is allocated, people can hold more informed opinions regarding government spending and the military as well.

I will conduct this research by reading the actual budget proposal to see how much money they're allocating to the defense R&D sector. In particular, I want to research how the money that they fund for military technologies is reflective of current affairs. I will also look at the different comparisons between what the House proposes versus the Senate, to see how that reflects the different political motivations between the parties and political bodies. I will look at what gets proposed versus what gets passed to see how compromises are reached. I also will read and watch the debates that go on in Congress about the budget and how they resolve their

differences or go about actually getting the defense budget to pass with so many differing views. I will research the contributions of different groups of interest to political figures and parties to see how external influences affect the budget process as well.

Conclusion

Through my technical and STS research papers, a better understanding can be gained of how the defense R&D sector gets funded and its impacts. Researching how much the federal government allocated to the RDT&E sector for the 2023 fiscal year can give better insights to the federal budgeting process. Revealing the political motivations and external influences that affect the budgeting process can help ensure that the appropriate amount of funding is provided to the sector. Too little or too much funding can have negative consequences, and researching how the funding gets appropriated helps give transparency to the process and helps understand whether the right amount of funding is being allocated to the defense R&D sector.

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