Final Paper

Internship with Jacobs/NASA (Supervisor Kay Corr)

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Cybersecurity Internship

As a student in the cybersecurity classroom this semester at ODU, I specifically chose to do my internship at the National Aeronautics and Space Administration in Hampton Virginia at the Langley Airforce base, also known as NASA. I specifically chose NASA as it has always been a dream to learn more about how technology plays apart in the research and studies conducted at NASA, and how they play a part on the technology services, research and applications of the technology derived from the importance of the cumulative studies and researched conducted within this organization.

Being a Virginia native, mother of three sons, ex-spouse of a military member, who still supports our nation's military as well as live within the communities that shelter and support our nation's military, advancing scientific breakthrough and supportive agencies here in the Tidewater area, NASA, and the technologies that are created and maintained for the safety and security of all Americans hold a fascination for me that started when my children learned and were mesmerized by the jets, rockets, space shuttles that were part of their childhood. That fascination, mingled with a desire to learn and develop my own sense of wonder while staying as current as possible in the ever-growing technology of today's society, put me step by step closer to my goals and aspirations of learning all that I could.

Learning the concepts of the devastation that could cripple our nation by cybersecurity breeches made this journey of discovery fascinating. Learning how the pieces of the puzzle, hold together the great works performed by America's governmental agencies while addressing the growing need to protect those works, and the individuals that work within can be a driving factor in research, development and protection of American assets carried on by such an agency.

NASA was first started in 1957 when the Soviet Union launched its satellite Sputnik, opening for "business" in October of 1958 and was developed to oversee the United States space exploration and aeronautic research and development (About NASA, 2024).While most Americans think that NASA only does space research, launch rockets, or walk on the moon, they actually have a much more valuable task. NASA not only does inter-space research, but they also help design technologies for cutting edge aircraft used by our US military forces, develop things that everyday people utilize such as smoke detectors, medical tests, newly improved robotics, satellite technologies, and solar powering to name a few. NASA also creates and grows research and assists in educating our nations educators who then aide and assist the generations of Americans under their tutelage by giving them the tools to grow the excitement for research, technologies and advancements of sciences.

It was with great interest that I looked forward to this internship. My goals for a takeaway from this experience was to ascertain how technology impacts the day-to-day functionality of NASA, the measures by which problems are found, and fixed within the cybernetwork and to learn the ramifications of a cyberattack and how they are prevented within the structure that was presented during this learning event.

During my initial orientation in my first week, I received standard Human Resources training, learned about non-disclosures, security clearances, as well as my log in and to meet the team who I would shadow for my internship and orientation.

Safety and security are the main focuses of learning the environment that NASA operates under while also becoming acquainted with the software, security configurations and overall IT support structures. During my training, I was able to utilize practical methods learned during cybersecurity enabling me to utilize that knowledge as well as expand on essential components in IT skills and security settings. This aided in expanding my knowledge base, reinforce the fragility of cyber systems and to minimize issues that can be found within, even for a simple user attempting to gain access to a printer. Sustaining, reinforcing, and developing an effective system is paramount to security across the board.

Learning how to diagnose, patch and reset computers that had been decommissioned was interesting, challenging as well as rewarding as I found an ease to complete tasks as the instructors gave clear instructions as well as assigning specific duties. By being able to be easily led through diagnostic issues, learning of importance of safety, and taking direction within an interdisciplinary team was just as important as the actual tasks assigned. By learning the different departments, specialties, specialty departments, and interfaces I was surrounded by knowledge, able to address issues that arouse and learning how to troubleshoot these issues with the team, made this learning environment a pleasant experience that further expounded on my desires to pursue career choices within this sector of governmental agencies and its multitude of departments. Being able to interact, develop my skills and being fortunate enough to network within the agency while also seeing how to further my career, skillsets, and advancement possibilities within the agency tiers of advancement and development.

Watching from within the corridors and offices of NASA was an eye-opening experience. Having the availability to pick the minds of some of the country's top-notch IT and OT specialists opened my eyes to the endless possibilities to grow within this agency should I pursue a career choice within. Having a look inside what most normal civilians would deem secretive, unattainable was not only humbling but exhilarating.

The management and supervisory staff that I had the fortune to engage with were very welcoming. While most aspects of this internship are not subjects that most would understand, nor could the information acquired during my internship be readily shared or even discussed due to the confidentiality of the work conducted, I found that despite the legal and ethical needs for such confidentiality most individuals within the agency were warm and welcoming. While there may be issues from department to department due to challenges, knowledge base, need or issues presented, most were very welcoming, very pleasant, and willing to impart knowledge, lend a helping hand and engaged to their coworkers.

Not only were managers and supervisory staff easy to engage in discussions, but they were also very open to sharing information and added suggestions for assistance without being rude, or standoffish. The atmosphere in some departments was very friendly with easy banter and camaraderie noted to be missing in other higher stress departments that I was able to observe. While the work of even the lowest personal position to the heads of departments, people were treated with dignity and respect allowing an open, free-flowing sharing of knowledge and troubleshooting enabling personnel to ask for assistance, bounce or troubleshoot ideas off their colleagues.

The practical application of the knowledge and tasks assigned to me during this encounter made the transitioning to more in-depth tasks not as frustrating or demoralizing, as I knew that my direct supervisors were approachable and understanding. While my internship was task centered, being within the agency allowed me to ascertain whether my future career goals aligned with the mission statement and how the staff and managerial personnel interacted with each other without reprisals or outward toxicity noted. Having walked within the walls and engaged personnel showed me that this would be a wise career move with many resources and instances to further advance my knowledge base and grow within NASA on a national scale within their 20 different sites.

Starting on day one with apprehension, a little fear and a lot of excitement, this internship started fast and was extremely in-depth. Orientation and set up with human resources began with a very intimidating run through of cybersecurity, non-disclosure informatics, training and being issued an agency computer for use during my internship. I started on day one with simple tasks such as fixing printer interfaces and resetting subnets. I learned how their systems and processes worked and was tasked with assisting in vulnerability scans and patchwork for internal systems. By day three I was able to utilize a Nessus scan and apply a patch. By the end of week, I had hands on knowledge and practical use with the OS, site/ department specific software, security configurations and was able to ascertain any issues where any high-risk vulnerabilities needed to be addressed. During the hustle of the first week and trying to learn as much as possible, I was able to allay my fears as I was able to successfully use practical knowledge and methods from my learning objectives in cybersecurity while reinforcing how importance diligence is within the realm of technologies to minimize risk, develop, maintain, and sustain effective IT systems.

Week two consisting of the start of day 6, the first activity I was assigned was verifying the inventory for GDS computers on the organization's network, then directed to proceed to patch the computers that happened to be decommissioned in the past DECOM using WSUS. I moved within several buildings on site to set up IP layer communication by installing a flat Layer 2 switch in Building 1230 and a Layer 3 switch in Building 1220 on campus. I found that usually I was able to leave halfway through the working day because I could easily complete the remaining tasks in the evening or the following day as there were no outward pressures on time management just performance with aspects of accuracy. I was able to pick up my unfinished tasks with the VLAN settings that I had been doing the previous day, just as I had been instructed. This internship involved specific safety orientation, after which there was a scrum meeting for summer scrums. Following meetings, I was able to assess the vulnerabilities and patch them with Nessus as educated. I went around the Scramjet with model testing in the control room, and a vacuum cell. Later in the week, I met Paul, an OT specialist, so he could explain to me the differences between OT and IT and why the former should be isolated for security reasons—that is, air gaps within the system. I later was able to collaborate with Dean, who is a Linux specialist, to set up a Cisco switch to log into a CL100 switch using rsyslog. Finally, closing out the end of my day ten, we began with the safety and scrum meetings, then I continued with connecting switches as I had been instructed previously. After allocating the Jabber users across the different offices and the responsible switches, we were able to recognize the logging problem between the Cisco switch and the CL100 switch. This week had turned out to be just brilliant, replete with technical work and practical knowledge. Performing validation and patching on GDS computers placed focus on the system updates. Various challenges

presented this week, in reflection, was when I learned about managing inter-switch connectivity enabled the perfect identification of vital VLAN configurations.

For the CSN project, I set up several syslog servers. This task involved using CL100 Ethernet cables, console cables, Ethernet dongles, and switches. This experience enhanced my understanding of network infrastructure and the importance of proper cabling and connectivity in setting up network systems (Syslog Server Overview and Configuration, 2024). The following day was quite intensive as I performed multiple system restores and image captures. One significant task was to find an equivalent laptop to the Lenovo ThinkPad, as specified in an IT ticket. After thorough research and comparison, I was able to recommend the Panasonic Tough Book for its reliability and business-friendly features, matching the key specifications of the Lenovo ThinkPad. This task improved my research skills and ability to match technical specifications accurately (Lenovo ThinkPad vs Lenovo Think Book: Know the Differences, 2024) while also feeling accomplished in the ability to advocate on a user friendly and affordable alternative for use. Following this challenging but exciting day it was a holiday; hence, it created a loophole for reflecting on the previous challenges as well as the preparation for the next trials that will be faced during the internship. Following this period of reflection, we set up and incorporated the new Windows Server Update Services (WSUS) on new computers. The process involved having an empty USB thumb drive, formatting the USB to NTFS, and window installation using Rufus as recommended by Abdulredah & Kadhim (Abdulredah & Kadhaim, 2020) (Brinkman, 2005-2024). This task was important in identifying the distribution and management of updates and configurations of systems that are key in the consolidation and interaction of IT infrastructures. The following day on duty also presented a challenge due to a system malfunction during data transmission. Despite my attempts to diagnose it, I failed to solve the issue before closing the day. However, I was able to corroborate the data output visually. More specifically, I was able to visually check the correctness of the data output. The day came to an end with a visit to more technologically developed manufacturing companies, which gave the students exposure to a broader view of the application of IT across more technological fields. Notably, these days were pivotal in honing my skills and problem-solving prowess. Each task, whether setting up servers or troubleshooting and configuring WSUS, contributed to my development. The exposure to tech environments and tools during the tour also broadened my field knowledge. This internship stint has been a learning journey that has prepared me for challenges in my IT career which despite its challenges was just as rewarding.

Following these challenges, I was able to refocus on data diode collection for two buildings. The process on the destination side went smoothly, but the source side, involving an old OPDS 100D, presented challenges. A reset resolved the issue, demonstrating the importance of persistence and troubleshooting skills. As my internship progressed, I collected data diode from the 14x22 building and performed a system image restore. Configuring Samba and creating a symbolic link in Linux were critical tasks. A connection issue on the customer's Mac required resolving mapping issues by updating the host table. This highlighted the significance of IP/name resolution in network configurations. After learning these processes, I learned that it involved extensive configuration management tasks, including entering, completing, and validating change requests (CRs). I also located the GDS computer and software baseline repositories and performed inventory validation on GDS computers. These activities enhanced my understanding of configuration management processes and the importance of maintaining accurate inventories. The highlight of my nineteenth day of internship was a Tunnel Tour of the 8-foot wind tunnel

that provided insights into the physical infrastructure supporting our systems. This experience broadened my perspective on the operational environment. The following day was dedicated to Syslog Server Setup Setting up a syslog server for the CSN project. This task was also vital for centralizing log data and ensuring effective monitoring and troubleshooting capabilities. These initial 50 hours have been instrumental in developing my technical and problem-solving skills. Each task, from system resets to network configuration, has contributed to my learning objectives. Troubleshooting real-world issues and setting up critical infrastructure like syslog servers have been particularly rewarding. Observing the operational environment during the tunnel tour provided a deeper understanding of the physical aspects of our systems.

Overall, these experiences have underscored the importance of adaptability, persistence, and continuous learning in a professional setting. Attention was paid to the syslog servers involved in the CSN project. This entailed securing and deploying servers for consolidating log data over the physical layer of the organization's network. Implementation of this central logging mechanism will be beneficial for live analysis, diagnosing some issues, and corporate security policies' adherence. It is something that involved a lot of work and precise approach in order to make sure that all the logs were grouped properly and could be accessed for the analysis (What Is Syslog and How Does It Work in Network Environments?, 2024) The next day concerned setting of the OTMP in this case entailing the following activities: scanning of the systems where thirteen were identified. These scans were very useful in the process of searching for host, backup and in general to find potential weak spots or outdated settings within the system. Further work was spent cleansing the system after the scans had been made. On updating the system, I concentrated on fixing the operating system, updating the applications, SYSLOG SERVERS 3 and improving the security by installing Symantec for end-of-level protection (Welcome to Tenable Nessus 10.7.x, 2024). After not repeating the OTMP activities for a while, on Day 25, I configured WSUS and Hyper-V environments. To be more precise, I focused on Windows servers which had to be updated; all of them had to have the latest patches and security updates. Once I was done with the updates needed, I used commands to both report and scan for update compliance on all systems proving their status compliance.

Further activities during my internship that I carried out were patching in orders to enhance the security as well as the stability of the operating systems I was tasked to work within. This basic functionality entailed revising several operating systems and the Syntec system to improve their protection against detectable weaknesses. Continuing with the task that was done in the previous day was characterized by further patching of systems. This general endeavor was intended to ensure that all systems were updated with the recent patches and updates to enhance the level of security. I also set about conducting rescans using Nessus which assisted in checking the efficiency of the issued patches and to check for other vulnerabilities which were still open and unaccounted for yet. This activity involved the use of the Logicube Forensic Falcon NEO (Falcon®-NEO2, 2024) to image a 1TB hard drive. Finally, the OTMP checklist was addressed. I was able to perform the final safety check with weaponized SUS, making sure that all systems had up to date patches, and were conformant with the organizational requirements as directed. At the last confirmations' scanning, I moved to imagery and inventory, vital for the proper documentation and order of the IT environment. Following this I began a new activity at NTF which involved getting a lab ready for new data diode.

Again, on the last day of this internship period, it was back to NTF with a continuation of the project workflow. Thus, I was concentrating on stacking CL100 equipment and making sure all the connections were properly made. This setting was crucial for the process of starting the tests of the new Diode that had been planned for the subsequent week (NFT Infrastructures, 2022).

During the duration of my internship, I was able to use my knowledge base as well as my ODU curriculum to be able to aptly speak in tech terms, speak freely about what knowledge I did or didn't have. I learned and realized the connections taught within the curriculum and their importance within the realm of cybertech and cybersecurity. In a facility such as NASA, knowing how to detect, patch, initiate protocols, programs while using the tools, machinery to complete those tasks are paramount to high level security and prevention of breeches, and not just within a governmental agency such as NASA. The entirety of my internship at NASA based on my educational curriculum was an eye-opening event. Having just scratched the surface of knowledge and its importance within this field demonstrated the need for multi-tiered individuals that work together to tackle monumental tasks while also learning and staying on top of new and developing technologies as NASA is one of the top developers and/or users of top-notch, high tech technology. The accuracy needed, clear headed thinking, ability to prioritize and complete tasks are not just a learned skill at a higher level of education, but is an understanding reiterated by necessity to continue within this chosen field.

This opportunity to perform during this internship was based on my knowledge, the provided curriculum, and the ability to learn in a constructive atmosphere provided me a foundation to further build my career opportunities in the future. Having the foundation of tech terms, equipment, knowledge of infiltration, tech viruses and ability to fix breaks and failure in a system as vast and as important as NASA's operating systems, will aide, assist and grow as my continued education and understanding of the paradigm within the tech community as cybersecurity will only be expanded as the need continues to grow exponentially.

The prospect of being able to be included, yet complete this internship was a daunting concept even when desires for following a dream and establishing a foundation for a career that is not only challenging but fulfilling as well. I specifically chose NASA as I described prior as it was always a dream to learn more about how technology plays part in the research and studies conducted at NASA. Driving by Langley Airforce base, or Oceana Naval Air station seeing the jets, watching the space shuttle launch from Cape Canaveral, knowing that they stand for freedom and how they play a part on the technology services and aiding future generations in those technologies was important to me as an individual. Knowing, learning how the research and applications of the technology derived from the importance of the cumulative studies and researched conducted within this organization and organization like NASA play a part on how technologies are made, maintained and advanced as well as how they play an important role in the protection of our freedoms in America.

Having an up close, in person view of the importance of the works within, how technologies play an integral role, as well as how a simple American can grow and help fight cybersecurity with a cumulative education, a fulfilling internship and the ability to follow one's dreams. Learning from the interdisciplinary teams and properties at NASA showed a foundation that will allow newly developed skillsets and those that wish for the security of knowing they play a significant role in maintaining the properties within the technologies utilized.

Maintaining and staying current as well as exploring new possibilities that technology offers will ultimately also lead to more personal growth as well as expanding my knowledge base. These factors play an important role for me as a mother. Making sure that I have a foundation of experience, knowledge, and a drive for future endeavors such as this, will also allow me to show my sons the importance of not only a higher education, the importance of cybersecurity's but a wonder of new developments in future technologies that my children and subsequent future generations will need. The future of AI, the frequencies of data hacking, breaches or just the necessity of IT members that can troubleshoot, and repair said cyber needs will form the basis of future generations to come.

While my own personal agenda for a higher education, stability in the workforce coupled with the need for expanding my own knowledge base, being at NASA gave me a look inside the window of a world most outsiders never get to see or experience. Not just by means of security clearances, but the ability to weave my way through a system as advanced as NASA as well as networking within the IT realm for future career prospects, I was able to fulfill my own desires to understand what a career in IT cybersecurity means to not just myself, my family but the nation. Having the ability to differentiate accountability, accuracy and being able to work cohesively as a member of an elite team was just as exciting leaving this internship as it was walking into it. Knowing that I was able to work within its walls was a justifiable moment of satisfaction and pride in myself and my personal goals for growth. Knowing the future is held in the hands of those that can maneuver through systems via mouse and keyboard was a fundamental reason for not just my higher education but following a lifelong dream and excitement of seeing behind the "curtain" of secrecy held within the gates of NASA.

Self-awareness, timidity, lack of confidence and fear of failure would be the greatest aspect of negative or discouraging aspects of not just this curriculum, but the internship as a whole. While self- doubt is a fear for every person, self-doubt will, in my opinion, ruin a promising career for anyone. The liability of loss, of inaccuracy and failure make one more prone to self-doubt when facing a curriculum as difficult to master as well as the fear of shutting down an entire national operation due to one wrong key stroke where all challenges I faced in the mirror every morning as I got ready to join my team at NASA. While we may jokingly speak about hitting a kill switch, the very real prospect of my doing something minutely wrong gave me momentary anxiety until I learned to trust in myself, my instructors, my school and the team I was assigned to tutelage under while on this internship. This is a career path that one must have a determination to be accurate, concise as well as diligent in all aspect of the work performed. One must be proficient in terms of technology, equipment as well as the small things that add up to big things, ie criminal history, financial stability, credit, driving history as each one of these aspects can and will hinder your ability to work within the IT cybersecurity realm, let alone acquiring employment with super tech agencies such as NASA, APPLE, GOOGLE, etc. As one interdisciplinary team member said, we are our own worst enemies when it comes to achieving our status as tech elites but to maintain those standings and be able to grow within our careers as well while also being able to be held accountable, take constructive criticism, and allow for personal growth.

The greatest challenge to this internship from my perspective would be time management. Not just in relation to the actual internship, but to the class assignment loads as a full-time student and mother. In all honesty the greatest challenge was my own fears of self-doubt. And traffic. Let's not forget traffic. As I live in Virginias Beach and my internship was at Langley Airforce base in Hampton Virginia, I had to take the Hampton Roads Bridge Tunnel which is unfortunately under construction. Long lines of traffic lent me time to sit and reflect on what I have learned, what I needed to hone up on but gave me prospective into my future endeavors that I am hoping my career path may open for me.

Time management is essential in the cybersecurity world as nanoseconds could mean millions in lost revenue, data breeches that can affect an entire nation. Being able to move smoothly from one issue to another is an important aspect of the work needing to be performed. Cybersecurity is not a job that can wait. It needs to be done now and be done with excellent accuracy in its delivery. Time is of the essence if your organization is under attack even remotely from sleeping viruses to downed systems. They could literally mean the difference between life and death when we take in account of how technology drives every aspect of our day to day lives.

My greatest recommendations for any person that would like to pursue an internship like mine at NASA would be to prepare yourself mentally for how direct interpretation of needs for security are. Be prepared for the directness of the human resources teams, the non-disclosure of information you learn or see while moving about the base and installation. Be prepared for the scrutiny of your personal and private business as they do directly impact on the availability of being included in a team or agency that holds some of the world's leading technologies. Being mindful that you are in direct contact with leading individuals in the realm of IT, scientists, military personnel as well as information that is not available to the general public. Being aware of your life experiences and mistakes can have your wants, whims and desires taken away from you due to a singular mistake or lack of judgement. My biggest take away is to be prepared. Have your credentials ready, be ready to learn, ready to take input and criticisms of work applied while not taking it personally. We all are learning and the best time to do so is when we are students but be receptive to those with the greater experience while not allowing for ego to hamper growth only allows for more growth.

In conclusion, my reflection of my time spent at NASA during my internship captures my journey, highlighting the progress towards achieving my learning objectives and providing a platform for deep reflection on my internship experience as well as my personal growth and achievements despite my own self-doubt and limitations. All those activities helped me to gain insights in the field of system administration, protecting the network from the unauthorized access or cyber threats, and the necessity of the systematic approach to the networks maintaining within. My time spent was filled with learning and personal growth in the professional sense. The team at NASA have helped in strengthening my technical competency in system administration, patch management, forensic imaging, and project delivery. Furthermore, the leadership team have stressed the importance of gains made in understanding planning and organization skills, neatness and coordination and communication in team set-ups as well as dependability and accuracy of all work performed.

The time spent during this internship expounded on my curriculum, my professor's knowledge and guidance of myself and my peers not just in the classroom but throughout the

experiences while performing my duties during this internship. It has opened my eyes on the possibilities at my disposal with my educational needs and personal growth as well as the desire to have a promising career that is at my fingertips while challenging me to meet each new challenge, each new class until I am honored with the ability to walk across the stage during my commencement ceremony and not just have the pride shown to me by my loving husband but the pride my three sons and family will have knowing that my choices, my hard work as well as the sacrifices my entire family endured during this period of personal and professional growth.

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