NASA Pathways: Intern Employment Program

Work Report Summer 2014

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Work Period: Summer 2014

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My second term at Kennedy Space Center offered insight into several specific operations within my branch. Unlike my first rotation where much of my learning was based on a broad understanding of the center processes and my directorate's responsibilities, I primarily focused on developing my understanding of the flow of tasks from planning to execution. The duties of my branch (GP-O6) include both fluids and mechanical systems; my fluids assignments included the Nitrogen-Oxygen Recharge System (NORS) project from my first term at KSC (an ongoing operation that is to resupply the International Space Station (ISS) later this year), as well as Internal Thermal Control System (ITCS) ground systems which are used to fill various flight payloads with conditioned water to maintain safe operating temperatures aboard the International Space Station (ISS). Mechanical operations involved several payload handling operations for the SAGE-III and RapidScat payloads alongside contract personnel and customers from other NASA centers. Despite the design differences in these systems and their operational requirements, many of the documents required for review in conjunction with procedural development are the same. From these operations I was able to understand and apply the lessons I learned to smaller tasks I was assigned to during my tenure, and allowed me to participate in various aspects of operations.

I was assigned to follow up on my projects from Fall 2013 with NORS Engineering Support Equipment (ESE). During my term at school, a dry-run test was performed on the Recharge Tank Assembly (RTA) Engineering Unit (EU) to verify procedures for a full NORS operation. A "lessons learned" session was held after the dry-run to review what could be improved. Two items that came up during the review were related to my projects from my previous term. These pieces of equipment required modifications, and I was tasked with obtaining the necessary hardware for modifications. I was also to report the status of these design changes to the NORS team in order to remove any constraints before the first flight fill in July.

The first issue was related to the Quick Disconnect (QD) support assembly for the RTA QD. The support had a locking channel that was too short and would not effectively stop the lifting motion if an individual over-tightened the lifting knob. A new stopping-block at the base of the support was fabricated and installed per a modification to the original drawing. This required coordination with TOSC personnel, NASA engineers and Quality Assurance (QA) to ensure that the new configuration matched the revised drawing

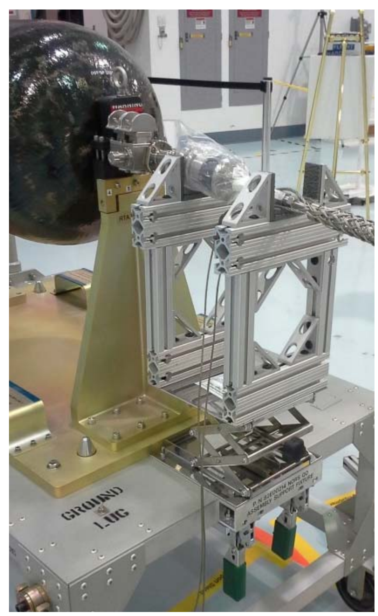

Figure 1- NORS QD Support Assembly with RTA

The other noted item from the NORS dry-run was the RTA thermocouple strap, which was fabricated during my Fall 2013 term. The material used on the nylon loop of the strap was slightly too large, and there was a concern that the strap could slip off the lifting eyelet during operations from the weight of the thermocouple/cable. This thermocouple is used to measure the RTA temperature, which has a safe operating temperature limit. If the thermocouple fell off during the operation, a safety clear prevents personnel from entering the area near the RTA to reattach the strap. With no active monitoring of the RTA temperature, operations would cease. In order to prevent such a delay and to ensure the safety of all personnel, a request was made to modify the strap to change the attach method to the RTA eyelets. I coordinated the fabrication of the new strap with the approved drawing changes, which replaced the nylon loop with a bungee cord. This bungee would be thin enough to slide fully over the eyelet and still retain tension on the thermocouple and cable. Additional non-slip material was added to the underside of the strap as well, allowing a larger area for the thermocouple placement. The placement of the non-slip material had to conform to an Operation and Maintenance Requirements Specifications (OMRS) document where the thermocouple was to be located at a specific distance along the circumference of the RTA in order ot obtain accurate internal temperature estimates.

Figure 2 - RTA lifting eyelet with nylon loop of the RTA strap.

Figure 3 - Comparison of the new and old RTA straps (Top and bottom respectively)

Figure 4 - The thermocouple secured to the RTA under the strap. Non-slip material provides tension and prevents the thermocouple form sliding off the tank surface.

The skills I gained from participating in NORS operations also helped me to understand how processes within my branch and the NORS task team are planned and approved. The NORS project contains both mechanical handling operations—such as lifting of the RTA—and fluid fill operations. My participation in NORS and other operations in my branch allowed me to see how these procedures are developed and implemented along each step of the process. The SAGE III and Rapidscat mechanical operations I witnessed had lifting sequences that required safety briefings and a review of the hazardous steps. Similar safety briefings were used with hazardous fluid filling operations, such as the NORS RTA fill, where high pressure gases are used. These safety briefings are paramount and there is accountability among all members of the task team to report any unsafe conditions or actions.

During this term I also spent time reviewing procedures for some of these operations so that I could understand the details of each operation. Additionally, I was assigned the task of writing a hazardous procedure that would provide me with a greater understanding of the in-depth knowledge required to write these procedures. The steps within these procedures must accurately reference the specific equipment/part that is used in operations. These references can be generic ground equipment or specific valves/gauges, but they must be called out in order for the appropriate steps to be carried out without mishap. Once the draft procedure was completed, it was reviewed by multiple engineering and safety personnel who provided feedback and comments to the draft copy. These reviews ensure that procedures adhere to NASA requirements and are conducted in a safe manner in support of the operation. My procedure was then approved and signed by all the required personnel, and released. This specific procedure also helped to streamline a longer operation, further adding my experience in learning how to carry out operations on the floor more efficiently.

Figure 5 - Pressure regulation panel for HMA testing.

One of the other projects I participated in was Restore, a robotic mission in development by NASA to service satellites in orbit. This system will repair and refuel satellites that are running low on propellants, or perform minor maintenance tasks on orbit. Restore will not require Extra Vehicular Activities (EVAs) of the astronauts, reducing risk and cost to customers who would require the repairs. One of the main components of the satellite, a pressurized fuel line, has been under development and testing in the Vehicle Assembly Building (VAB) Engineering Development and Operations (EDO) Lab. The fuel system has a retractable hose that—when pressurized with fuel—must be able to bend and flex to connect to the satellite fuel inlet. In order to test the ability of the hose to withstand static and dynamic loads, a test was created to pressurize the line with distilled water instead of the toxic fuel. Part of my task on this project was to create a Pre-Test Briefing (PTB) for the procedure, utilizing much of the knowledge from my experience in NORS fluid operations. During a PTB, the task or test leader reviews the necessary safety precautions with all personnel that will be actively participating in the test, and provides an overview of the tasks that will be carried out. This ensures that all individuals are familiar with the activities that will take place, and that proper safety measures will be followed ensure the safety of all those involved.

This term, I was allowed to participate in center activities that extended beyond the ISS projects I was involved in. I had the opportunity to participate in New Employee Orientation (NEO) training, a three day program designed to help new employees at KSC meet the management of many of the organizations on center and learn about the activities each directorate provided to NASA. The NEO also offered the opportunity to tour many parts of the center to observe the activities currently taking place in our new role as a multi-user spaceport. Our tour group was able to access the VAB and see the infrastructure being developed to support the new Space Launch System (SLS), as well as the Armstrong Operations and Checkout (O&C) facility where the Orion capsule is being integrated and tested. Tours of the Shuttle Landing Facility (SLF) and Thermal Protection Systems Facility (TPSF) offered insight into some of the commercial enterprises that will possibly utilize our existing NASA infrastructure in the pursuit of commercial space partners. The NEO also gave me the opportunity to meet other pathway students and share our experiences at the center.

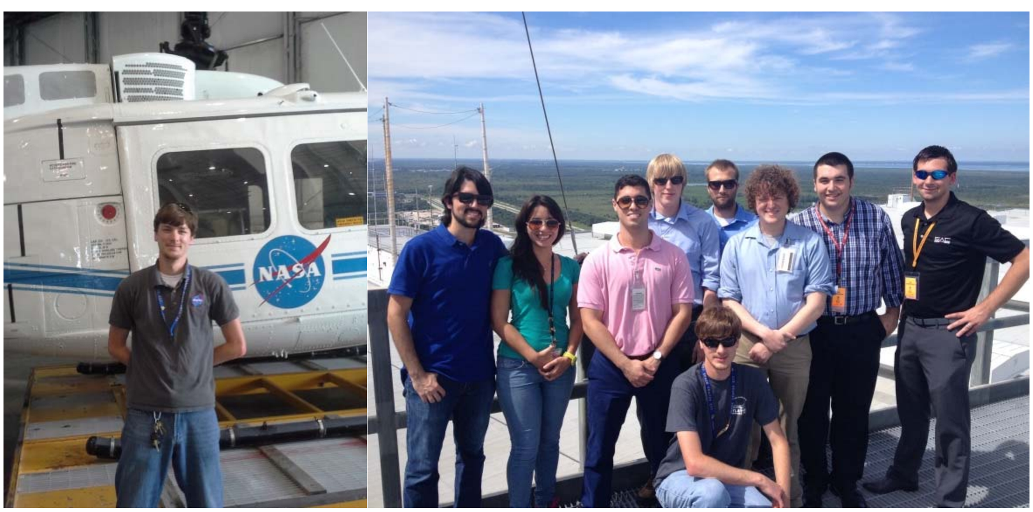

Figure 6 - Tours included the NASA aircraft hangar (left) and VAB rooftop (right).

The most fun project I participated in this summer was a program at NASA called Rocket University. Rocket U, as it is called, trains NASA engineers to build and experiment with high power model rockets and Unmanned Air Vehicles (UAVs) (where electronic autonomous controls are used to fly the aircraft). Rocket U offers several classes that help broaden the skills of NASA engineers so they can understand some of the challenges facing the future launches of payloads with automated technology. Our class included the construction of a high-power rocket utilizing several different techniques. The engineers were instructed how to properly handle and construct the provided rocket kit, as well as the various configurations that area available to construct rockets of this caliber. As the Rocket U classes become more advanced, some new skills may be required; for example, the design of electronic systems for controlling the rocket's descent. My electrical engineering background is limited and would require me to gain these skills which could then be utilized in support of the UAV construction. Rocket U also provided networking opportunities with other center engineers, fostering new relationships with individuals in other organizations.

Figure 7 - LOC Graduator built in RocketU. Approximate altitude 2100 ft.

Overall, my summer term at KSC provided many opportunities that were both new and exciting. Continued work from my previous rotation allowed me to build my knowledge of systems I had learned previously, while new operations offered the opportunity to develop and learn new processes and become familiar with other organizations. My interactions with the various task teams helped to strengthen my relationships with both NASA and contractor personnel, and my exposure to educational programs at NASA helped me to build new skills and relationships with engineers at NASA.