NASA MUSRP – Internship Final Report

The Process of the Development of an Operator

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Abstract

On the job training is where new employees called operators can start gaining knowledge on what they will be working on during their time in JSC. In these lessons I learned different things that are important ranging from thermal systems to electrical systems. While doing OJT classes the student will learn how to use a portable computer system which has displays that I also helped edit and clean up. The way you can also learn is by reading system briefs which describes the different systems. Due to the fact of a possible change in the ISS I updated a systems brief so that it can be relevant to what is actually on the space station. I was given a task that will help develop my skills and make myself better prepared for my future in the work field. The project that I worked on had me pulling real time data from the International Space Station. The Data I obtained from the space station will be correlated to battery performance. The group I will be working which is called REBA and we will take the telemetry and evaluate the data. I will be working with my mentor Ben Chislom and co-op Tyler along with the Pro team. They then will put this data into a graph so that they can get the discrepancies and find a way to improve the battery performance. The first weeks I read familiarization books that informed me how the ISS works, how it was built, and the systems that are used to keep the station working. This project is going to benefit NASA by finding out how electricity is being used on the ISS and enabling us to see how it can be used more efficiently. This way we can operate the ISS without wasting power. While conducting research that goes on inside the space station knowing all electricity is being used efficiently.

The Mission Operation Directorate is responsible for the numerous extremely intricate human space flight operations from start to finish. During ISS flight it is important for MOD to react in a timely matter to analyze failures, to protect the crew, and maintain vehicle safety and effectively accomplish mission objectives. Pre-flight preparation, safeties of flight work and mission execution is also very important. As NASA is going through a transition meaning the Shuttle retirement MOD will effectively manage shuttle personnel transition plans and the capture of Shuttle unique knowledge and operational techniques. They also continue constant enhancement tasks designed to achieve ISS on operational efficiencies and reduce cost. Within the MOD I worked with DI4 which handles the electrical powers systems in the ISS. In this division there are groups that I was able to work with.

These groups were Power Heating Articulation Lighting and Control (PHALCON) which manages the electricity available to operate space station systems and experiments. Power Resources Officer (PRO) who manages ISS power for mated mission operations. Thermal Operations and Resources (THOR) are responsible for the assembly, operation and checkout of the international space stations thermal control system. To have a clue to everything that these groups do I took multiple OJT classes. One of the classes was an Internal Thermal Cooling System (ITCS) class which deals with keeping certain components of the ISS cooled. As with all electronics with batteries it is well known that they tend to heat up and with the ITCS overheating can be prevented. Sometimes failures can happen in the ITCS and there are steps in place to take care of those problems. When these problems occur there are procedures that are followed so that things can be systematically checked out. The ISS is cooled by two different kinds of loops a single loop and a dual loop which is filled with either water or ammonia. The single loops can either be a low temperature loop or a moderate temperature loop and same goes for dual loops. With these precautions the US Lab can do experiments without worry that they computers will fail because of overheating.

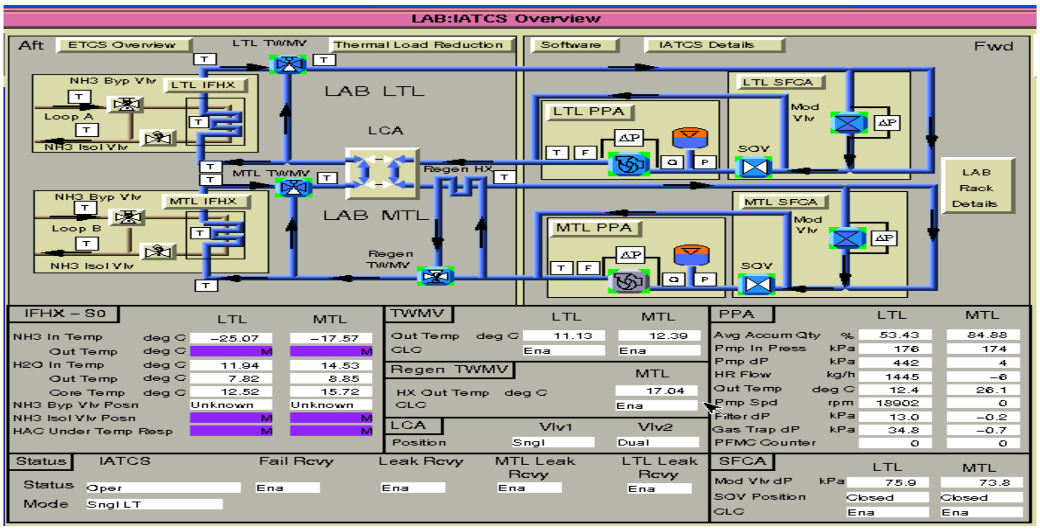

Figure 1: Portable Computer Display of ITCS ***this is a display of all the internal cooling in the US Lab here you can view pump speeds and temps and even make necessary changes to the running configuration.***

Another class that enabled me to understand what is on the ISS was an Internal/External Lighting class. In this class I learned the function and the location of the General Luminary Assembly (GLA) which provides illumination for the modules and passageways. The lights can be turned on and off by using the General lighting Switch (GLS). The lamp power can also be turned on and off by using the lamp power buttons on the assembly, lights can even be dimmed by using the dimmer knob located above the lamp power buttons. They are not only able to provide lighting, GLA’s can be used to help locate certain power failures. When certain lights go out that is an indicator that power was lost from one power supply rather the other. In an event that all power fails the Emergency Egress Lighting System (EELS) will illuminate to provide short term emergency cabin lighting.

A task that was given to me was to update a systems brief concerning the EELS system. The Emergency Egress Lighting System batteries known as the Emergency Lighting Power System exceeded their 10 year certification life. A major concern is with battery leaking which is a hazard to crew safety. These batteries cannot be retro-fitted because the ISS Program Office decided Emergence Egress Guidance System were a better solution. The EEGS is an inexpensive (passive) photo luminescent system that provides egress path indication, long lifetime, and low maintenance. The Photo Luminescent system is not bright enough to penetrate through smoky conditions. This is a concern because EELS has LED strips around hatchways that illuminate egress path during loss of all module lighting and can be seen in smoky conditions. The purpose of this was to meet with the requirement defined in section 220.4a of SSP 50021: *"Crewmembers shall be provided with clearly defined escape routes for emergency egress in the event of a hazardous condition."* The EEGS has to be charged for 10 minutes for 8 hours of light. It has a virtually unlimited number of recharge and discharge cycles for up to 10 years, if kept free of surface damage from extreme abrasions and ultra-violet radiation.

Lighting is not only used for the inside of the ISS but also the outside. The lights that are used outside are called Crew and Equipment Translation Aid (CETA). The function of these lights is to provide illumination for the primary paths for Extra Vehicular Activities (EVA) crew on various sections of the station. The way that the CETA lights and the CETA heaters are turned on and off is by using Remote Power Controllers (RPC). The reason that these lights have heaters is because in space temperatures can get very low which would freeze the electronics inside the lighting fixture. Since there is a thermal constrain for the lights if the light is not on then the heater must be.

While in the office I was responsible for gathering ideas for Phalcon's SharePoint. I set up meetings with group members who had ideas to make the site better. The main ideas were to come up with a way for project tracking. Being that I never worked with SharePoint before I started research and examined how the site works. When gathering information about SharePoint and looking at other programs. I figured that Microsoft Access would actually be a solution to what group members were asking for. Access allowed group members to put up projects they are working on and let people know how far along they are. With Access you know the owner of the project, when they got the project, how much of it is completed, and contact information if questions about it want to be asked. This is not the only task that I had that made thinks a little bit easier on the group workload.

I was also responsible for playing an editorial role for a Solar Array Rotary Joint (SARJ) and Thermal Radiator Rotary Joint (TRRJ) display. A SARJ is used to rotate the outboard trusses to point the solar arrays at the sun. The truss is the backbone of the of the ISS and attachments points for external payloads. Truss assemblies also contain electrical and cooling utility lines, and the mobile transporter rails. A TRRJ Mechanism that rotates the radiator beam which contains three radiators. The displays that I fixed up helped with esthetics, so that people who have to use the system can find what they need and implement the changes that are essential to pointing the arrays the right way.

A project that I was able to work on called Refinement of Energy Balance Analysis (REBA) was actually started after a SARJ auto track test was conducted. Auto tracking is used to make sure the Solar Array panels are always facing the sun so that controller does not have to continually input a value so they rays point at the sun. REBA was sent in to motion because specialist wanted to determine what adjustments can be made to their analysis models and methods in order to improve the accuracy of analyses. They first started with focusing on an assessment of actual telemetry versus predicted values for a variety of key parameters related to solar array power generation and battery charge/discharge performances. With this the PRO group is able to the accuracy of their power predictions.

What I did to contribute to this project was pulling telemetry from the ISS. Telemetry is basically data from the ISS giving us information on how electricity is being used. The way that I pulled telemetry was by using a program called Jmews. Jmews is a program that lets me pull data from the ODRC data store in Mission Control Center. The program is run in three segments data retrieval, data viewing, and data conversion. Data conversion allows people to open the data that was pulled in other programs like Excel. The data that I pulled can now be view by anyone who needs it allowing them to make predictions and actually compare them to what is actually going on in the station.

This project that I had a part in helped the PRO team to acquire accurate loads to see the effects of the system. Doing this enables the group to know the limitations on what the ISS can do and use the electrical system to the highest of its potential. They can also analyze how effective the batteries are and determine if they are properly discharging and charging the way they are suppose to. Most importantly it enables PRO to make decisions to determine if a power downs are necessary or not. Knowing this they do not have to lose important systems now they have accurate data readings on what the batteries are putting out.

Throughout this experience I have learned what I am capable of. I can take what I learned and apply it to my future endeavors. Being able to give a presentation to the head of the department, to helping with an ongoing project to help PRO group do its job. I have been impacted and hopefully I had an impact on the people I worked with. I walk away from this experience knowing a lot more then when I came in. I got to work on my communication skills, team work skills, and technical and computer skills. All these skills can help me in the future to convey ideas to others to knowing what the best way to get through a problem is. I would like to thank my Supervisor Molly Meyer-Allyn and Mentor Ben Chisholm for answering all my questions and guiding me to the right direction on task and projects.