

KGCS and ECS Local HMI Display Control System Engineer

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Computer Science

NIFS Intern Fall Session

10-26-2017

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I. Nomenclature

ECS - Environmental Control Subsystem
EDL - Engineering Development Laboratory
EMI - Electromagnetic Interference
EUT - Equipment Under Test
GSE - Ground Support Equipment
HF - Human Factors
HMI - Human-Machine Interface
KGCS - Kennedy Ground Control System
LCC - Launch Control Center
LCS - Launch Control System
ML - Mobile Launcher
OPI - Offline Processing and Infrastructure
PLC - Programmable Logic Controllers
SCCS - Spacecraft Command and Control Systems
SLS - Space Launch System
VIL - Vehicle Integration and Launch

II. Introduction

The Ground Systems Design and Operations program, whose primary objective is ‘to prepare the center to process and launch the next-generation vehicles and spacecraft designed to achieve NASA's goals for space exploration’, has been a heavy focus at Kennedy Space Center. The realization of the idea of deep space travel is about to become a reality due to this particular program, among others. The many different programs and projects working towards the launch of Exploration Mission 1, and the SLS missions that follow, are extremely important in the success of the SLS. Mankind has been launching into space for over fifty years, to get a different perspective on what is occurring on our planet as well as what is occurring in the universe around it. Advancements are being made to the technology at KSC to ensure a successful, efficient, safe and reliable launch of both NASA and commercial products and missions into space.

The widespread responsibilities of the KGCS include the ECS, along with many other subsystems. Control and monitoring of ECS field components is performed from the LCC. An outside contractor has supplied HMI displays to use with the ECS in order to verify normal status of Pad B's various components. However, these displays do not conform to SCCS requirements. These requirements must be met in order for the displays to be used with the ground components at KSC. The screens will be consolidated while improvements are made to appearance and functionality; additionally, new displays will be added for the interface of the ML.

III. Objectives

One objective that has been accomplished over the course of this internship is making various changes to the current ECS HMI displays, including adding new displays for use with the LCC. The contractor has supplied incomplete displays that need to be brought to completion by changing functionality; changing parameter files to work with the operations needed to successfully produce efficient testing procedures was also needed. This is accomplished using specific software provided by NASA in the EDL which works directly with the PLCs.

The other objective that I have accomplished involves EMI testing, which is a very important process in the qualification of each piece of hardware used on the launch vehicle. The intention of this testing is to analyze the effect of Electromagnetic Interference on the PLC chassis and to include several different modules, ensuring each device functions as intended around any electromagnetic development in any foreseen environment. The KGCS is a PLC-based control system. It provides monitoring and control of GSE and field devices such as sensors, valves, heaters, and motors. It is a component of SCCS and it will be an integral part of the VIL and OPI elements. It will enable LCS functions such as launch processing, maintenance, and test operations. The KGCS will interface with GSE subsystems to provide distributed monitoring and control as required by the subsystem's operational criteria.

IV. Technical Approach

The main objective of this project will be completed by working with a team of both NASA and contractor employees. The team will work with specific software to edit the current displays to meet SCCS and Human Factor standards for HMI displays in both functionality and appearance. This will require extensive and thorough knowledge of the standards to which NASA conforms in order to apply them to the displays. The displays will have improved functionality by using power indicators and controls, trending screens, alarms, position and status indicators, manual/auto switches, and much more. These functions will be communicating back and forth from the LCC to the user through the HMI. These sensors include temperature, pressure, humidity, and more. Consolidation of the displays will require use of global objects and parameters.

The intention of the EMI qualification test procedure is to monitor the effects of the EMI to all the components inside of the PLC chassis, which is the EUT, to include each module under test. The test setup used for this test may not represent the exact setup that will be used in the real environment, but it should still provide adequate similarity for the sake of testing. All the data collected during this test will be used for design purposes. This qualification test will be performed on a specific set of assumed requirements as established in this qualification test procedure.

V. Schedule

Task	Start Date	End Date
Familiarization with software tools	09/04/2017	9/8/2017
Development of interface indication displays	09/11/2017	10/15/2017
Performance of EMI Testing	10/02/2017	10/18/2017
Development of Qualification Test Report for EMI Test	10/19/2017	10/20/2017
Performance of test procedures for ECS HMI screens	10/23/2017	11/30/2017
Enhancement of vendor displays to work with LCC/FR	11/01/2017	12/15/2017

VI. Conclusion

Many software upgrades are vital to the Launch Complex 39B locally, in order to ensure all systems run smoothly for the ECS within the LCC. All HF must be met by certain criteria for the displays to be acceptable by NASA Standards. Performing tests on the ECS application code is necessary to ensure that the equipment is operated within safe parameters, and to guarantee personal safety.

This internship has increased my understanding of the HMI processes and how vital it is all test procedures are in perfect working order to establish a successful launch. As of September 4th, I have been successful in recreating screens associated with the ML, LCC, and Launch Pad 39B to meet NASA standards.

VII. Acknowledgments

I want to thank Terri White, KGCS ECS software lead, and John Van Sickle, Sierra Lobo - ESC Electrical Engineer, for the opportunities made available to me during my time here at NASA. I am confident my experience here will boost my future career from the experience and knowledge shared with me throughout the 16 weeks I have been fortunate enough to be a part of.