Hydrogen Line Telescope

Warren Herrington, Johanna Hein

**Schedule and Validation**

FIRST REVISION

30th November 2021

# Schedule:

|  |  |  |  |
| --- | --- | --- | --- |
| Work | End Date | Owner | Status |
| Midterm Presentation | 6-Oct | All |  |
| Image Processing Program Outline | 11-Oct | Johanna Hein |  |
| GUI Program Outline | 11-Oct | Johanna Hein |  |
| Motorized Mount 3D Model | 11-Oct | Warren Herrington |  |
| Antenna 3D Model and Simulation | 11-Oct | Warren Herrington |  |
|  |  |  |  |
| Create & Read in Test Data | 18-Oct | Johanna Hein |  |
| Route Planning Program Outline | 18-Oct | Johanna Hein |  |
| Read in Data, Account for Earth's Rotation | 18-Oct | Johanna Hein |  |
| Mathematical Analysis of Motorized Mount | 18-Oct | Warren Herrington |  |
| Antenna Manufacturing Plan | 18-Oct | Warren Herrington |  |
|  |  |  |  |
| Projects Updates | 25-Oct | All |  |
| Signal Processing Program Outline | 25-Oct | Johanna Hein |  |
| Order Linear Actuators | 25-Oct | Warren Herrington |  |
| Single Element Antenna & Design Verification | 25-Oct | Warren Herrington |  |
|  |  |  |  |
| Heat Map for 2-D Scan | 1-Nov | Johanna Hein |  |
| Finalized Element Design | 1-Nov | Warren Herrington |  |
|  |  |  |  |
| Heat Map for 2-D Terrestrial | 8-Nov | Johanna Hein |  |
| Read in from SDR | 8-Nov | Johanna Hein |  |
| Route Planning 2-D Scan & 2-D Terrestrial | 8-Nov | Warren Herrington |  |
| Finalized Element Construction | 8-Nov | Warren Herrington |  |
|  |  |  |  |
| Final Presentation | 15-Nov | All |  |
| Heat Map for 1-D Terrestrial | 15-Nov | Johanna Hein |  |
| Calculating Frequency and Magnitude | 15-Nov | Johanna Hein |  |
| Interacting with Skymap | 15-Nov | Johanna Hein |  |
| Create GUI for All Four Modes | 15-Nov | Johanna Hein |  |
| Motorized Mount Prototype Finished | 15-Nov | Warren Herrington |  |
| Interacting with Linear Actuators & Gyroscope | 15-Nov | Warren Herrington |  |
| Helical Antenna Array Assembled | 15-Nov | Warren Herrington |  |
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| Heat Map for RPA | 22-Nov | Johanna Hein |  |
| Consolidate Signal Data in CSVs | 22-Nov | Johanna Hein |  |
| Route Planning RPA & 1-D Terrestrial | 22-Nov | Warren Herrington |  |
| Antenna Phase Alignment | 22-Nov | Warren Herrington |  |
|  |  |  |  |
| Send CSVs via Network Drive Connection | 26-Nov | Johanna Hein |  |
| Output Route Planning Coordinates in CSVs | 26-Nov | Johanna Hein |  |
| Output Data from GUI in CSVs | 26-Nov | Johanna Hein |  |
| Linear Actuators Generate Movement based off of Gyroscope | 26-Nov | Warren Herrington |  |
| Antenna Array Signal Combined | 26-Nov | Warren Herrington |  |
|  |  |  |  |
| Subsystem Demo | 29-Nov | All |  |
|  |  |  |  |
| Final Report | 5-Dec | All |  |
|  |  |  |  |
| System Integration and Full System Testing | 28-Feb | All |  |
| System Refinement and Validation | 30-Mar | All |  |
| Final Report and Demo | 2-May | All |  |

# Gantt Chart:

Table

Description automatically generated with medium confidence

# Validation Plan:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference | Test Name | Success Criteria | Methodology | Status | Responsible Engineers |
| 3.2.1.1 | Antenna Beam Width | The HPBW of the antenna shall be equal to or less than 10 degrees | Antenna to antenna gain mapping in a quiet room. | IN PROGRESS | Warren L. Herrington |
| 3.2.1.2 | Antenna Positioning | The motorized mount will position the antenna to within 5 degrees of the desired scanning location. | Use a digital level to measure locations. | IN PROGRESS | Warren L. Herrington |
| 3.2.1.3 | Data Processing | The data processing shall have less than a 30% inaccuracy rate when outputting the frequencies and magnitudes calculated from the SDR output | Compare peak magnitude & frequency output with raw data. | IN PROGRESS | Johanna K. Hein |
| 3.2.1.4 | Graphical User Interface | The graphical user interface shall be intuitive and user friendly. All HLT modes of operation and data results shall be easy to view and understand. | Allowed potential user to interact with & review the GUI. | COMPLETE | Johanna K. Hein |
| 3.2.1.5 | Antenna Routing | The positional system shall be able to correctly route the antenna at least 90% of the time | Compare output to desired route path. | UNTESTED | Johanna K. Hein |
| 3.2.1.6 | System Runtime | The system shall be able to position the antenna and collect data for up to 6 hours. | Run full system test for desired time. | UNTESTED | All |
| 3.2.2.1 | Mass | The system shall be made up of separable parts that are less than or equal to 25 kg per component. | Weigh each part. | UNTESTED | All |
| 3.2.2.2 | Volume Envelope | The antenna and motorized stand shall each stand less than or equal to 1 meter cubed. | Measure each part. | UNTESTED | Warren L. Herrington |
| 3.2.2.3 | Mounting | The antenna shall be mounted on a motorized stand that may rest on any stable, relatively level surface. | Complete mounting construction. | UNTESTED | Warren L. Herrington |
| 3.2.3.1.1 | Power Consumption | The maximum peak power of the system shall not exceed 45 watts. | Use a wattmeter to measure peak power consumed | UNTESTED | All |
| 3.2.3.1.2 | Input Voltage Level | The input voltage level for the Raspberry Pi 4 shall be 5V, the input voltage level for the DC stepper motors shall be less than or equal to 24V. | Measure input voltages for the Raspberry Pi and motors. | UNTESTED | All |
| N/A | Full System Demo | A user of the HLT will be able to perform any of the desired modes within 15 minutes of training. | Complete user training and analyze performance. | UNTESTED | All |

**Performance on Execution Plan:**

The execution plan shows completed progress in all electrical and programming sections of the subsystems. A few minor mechanical checkpoints have not been completed yet due to timing issues with FEDC equipment and badges. However, all parts for the mechanical parts have been acquired and some are mostly assembled. These mechanical checkpoints will be completed during the winter break and start of the spring semester.

**Performance on Validation Plan:**

All possible validation was completed on each subsystem. The GUI subsystem validation for the reference 3.2.1.4 was completed. All of the validations marked in progress indicate that some validation for that subsystem is complete and the rest must be completed after integration due to the nature of the validation checkpoint. The majority of the validation checkpoints listed in the validation plan will be completed during ECEN 404 when the subsystems are integrated. All currently completed validations are described in detail in the Subsystem Reports document.