Deep Space Exploration Society

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Multi-Band Feed Operational Setup

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1.0 Introduction

The multi-band feed is now installed on the Plishner 60-foot dish. The cable installation is planned for late September 2016. This science update outlines the basic receiver and computer setup to take advantage of the multi-band feed.

2.0 Multi-Band Feed System

A multi-band feed system was developed by Ray Uberecken for use with the 60-foot diameter dish in order to achieve the radio-astronomy goals of measuring neutral hydrogen (1420.406 MHz), and communicating Earth-Moon-Earth, tropospheric and ham radio communications using 1296 MHz, 432 MHz and 144 MHz frequencies. These frequencies will also be used for radio astronomy monitoring.

The completed feed is shown in Figure 1 with the 4 frequency antennas.

Figure 1: Multi-Band Feed

The feed installed on the dish is shown in figure 2.

Figure 2: Feed Installed on dish

3.0 Communication Trailer Configuration

The communications trailer configuration for the multi-band feed is shown in figure 3 from the August 2016 science meeting.

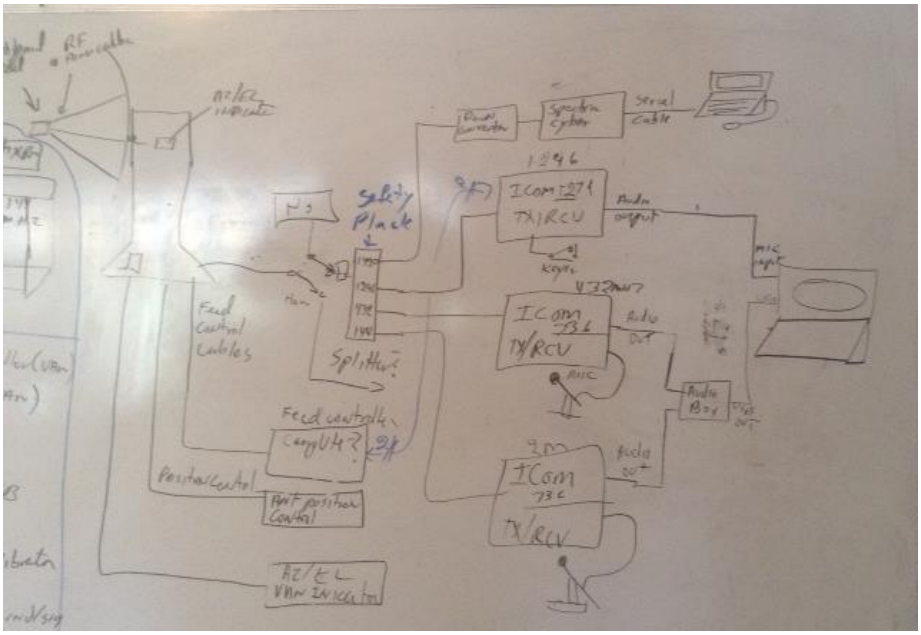

Figure 3: Communications Trailer Configuration

3.1 Feed Controller

The feed controller was installed in the rack as shown in figure 4. It is connected to the multi-band feed through cabling that goes from the communications trailer to the pedestal and then through the center of the dish to the feed.

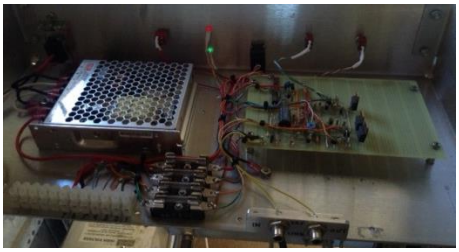

Figure 4: Feed Controller

3.2 Bandpass Splitter

The RF output will go through a bandpass splitter that will output the four frequency bands: 1420.406 MHz, 1296 MHz, 432 MHZ, and 144 MHz.

3.3 1420.406 MHz neutral hydrogen setup

The 1420.406 MHz frequency is used to monitor neutral hydrogen. The 1420.406 MHz RF output will be hooked to a downconverter and then to the Spectracyber. The Spectracyber software is installed on the laptop which connected to the Spectracyber with a serial cable. This allows for the neutral hydrogen to be monitored remotely in the drift scan mode. Figure 5 shows the Spectracyber installation.

Figure 5: Spectracyber installation

3.4 The 1296 MHz frequency setup

The 1296 MHz RF output is connected to the ICOM 1271. The primary purpose for this band is for Earth-Moon-Earth (EME) communications. The audio will be hooked to a computer through the audio port. This will allow the monitoring of the frequency using Skypipe software.

The ICOM 1271 is modified to accept controls from the feed controlled through a cable. This allows for the synchronization of the transmit and receive for EME.

3.5 The 144 MHz and 432 MHz frequency bands

These frequencies will be connected to two ICOM 736s. The ham radio mode will allow for tropospheric communications. The radio astronomy mode has an audio output from the ICOMs through an audiobox audio to usb interface to a computer using Skypipe.

3.6 AZ-EL Indicator

The AZ-EL indicator monitors the azimuth and elevation encoders in the pedestal. The output is displayed in the communications trailer. The software will also convert to Right Ascension – Declination. This is the coordinates of objects in the celestial sphere which is essential in the radio astronomy mode.

3.7 Dish Control

The dish can be controlled locally at the pedestal or remotely in the communications trailer.

4.0 Operations Plan

The goal of the testing and operations of the system will provide performance data of the communications and radio astronomy modes. The following testing sequence is as follows:

1) Test the AZ-EL indicators. The indicator will need to be calibrated to a known pointing angle.

2) Neutral Hydrogen (1420.406 MHz) – monitor Cygnus A and Cassiopeia A and verify that the signatures are the same as known signatures.

3) EME communications (1296 MHz) –

- a) conduct self-echo test
- b) monitor the moon beacon
- c) participate in the ARRL EME contest in October 2016.

4) 432 MHz and 144 MHz

- a) Communications mode: conduct tropospheric communications
- b) Radio Astronomy mode: calibrate Skypipe, monitor and store data

5.0 Summary

The multi-band feed provides new capability for the Deep Space Exploration Society. This system provides both radio astronomy and radio communications capability.