

**EXHIBIT C – ANTENNA SPECIFICATIONS**

**1.0 - Antenna Description**

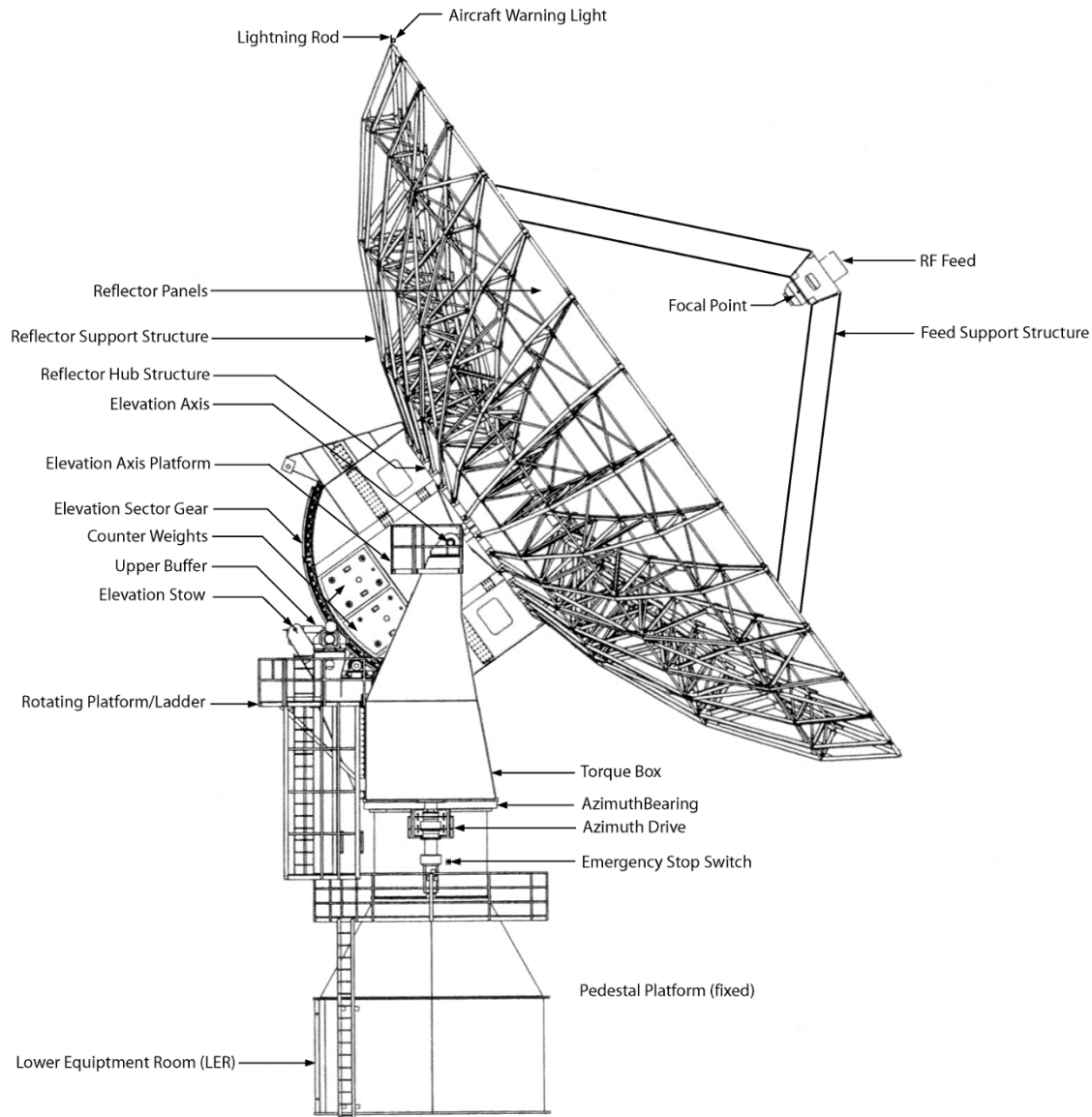
The Space Science Center (“SSC”) Space Tracking antenna is a full-motion, directional, parabolic antenna. The antenna system is located above the campus of Morehead State University in Morehead, KY, USA. The antenna is oriented with an azimuth axis of 0 degrees oriented due North. Basic performance parameters and RF performance characteristics are provided below.

FUNCTION	PERFORMANCE
<b>Antenna Diameter</b>	21 Meter
<b>Receive Polarization</b>	RHCP,LHCP,VERT,HORZ
<b>Travel Range</b>	AZ +/- 275 degrees from due South (180 deg) EL -1 to 91 degrees POL +/- 90 degrees
<b>Velocity</b>	AZ Axis = 3 deg/sec EL Axis = 3 deg/sec POL Axis = 1 deg/sec
<b>Acceleration</b>	AZ = 1.0 deg/sec/sec min EL = 0.5 deg/sec/sec min
<b>Display Resolution</b>	AZ/EL = 0.001 deg POL = 0.01 deg
<b>Encoder Resolution</b>	AZ/EL = 0.0003 deg (20 Bit)
<b>Tracking Accuracy</b>	<= 5% Received 3 dB Beamwidth (0.028 deg RMS L-band) (0.005 deg RMS Ku-Band)
<b>Pointing Accuracy</b>	<= 0.01 deg rms

<b>21 m Performance Characteristics (S-Band)*</b>	
frequency band and performance values listed are ranges in which the 21 m system has capabilities, not for which the system is licensed.	
Performance Measure	Performance Value
<b>S-Band Downlink Range*</b>	2.2 – 2.3 GHz
<b>S-band Uplink Range*</b>	2.02 to 2.12 GHz
<b>LNA Temperature</b>	~35K
<b>System Temperature T<sub>sys</sub></b>	~135 K
<b>Antenna Gain</b>	51.6 dBi (@2.25 GHz)
<b>G/T at 5° Elevation</b>	30.8 dBi/K
<b>Time Standard</b>	H- MASER (1ns/day)
<b>Transmitter Output Power</b>	100 W
<b>HPBW</b>	0.37 deg
<b>Data rates</b>	100 bps to 20 Mbps
<b>Line Coding</b>	NRZ-L, NRZ-M, NRZ-S, Biphase-L, Biphase-M, Biphase-S, RZ
<b>Modulation/ Demodulation</b>	PM, BPSK, QPSK, SQPSK, DQPSK-Normal, DQPSK- Alternative, FSK, GFSK, GMSK, MSK
<b>Decoding</b>	Viterbi/ convolutional rate ½, Reed Solomon (255, 223)
<b>Front end processing</b>	CCSDS compatible, stores data on system, transmit data via TCP/ IP, FTP. Space Link Extension (SLE) modules

**2.0 - Antenna Diagram**

Vertical profile sketch of total structure of the Morehead State University 21 M Space Tracking Antenna, including complementary structures, with heights in meters above ground for all significant features.



**Dimensions**

Reflector: 21 m (68.9 ft)

Maximum vertical height above ground (apex of feed at 90 degrees elevation): 25.6 m (84 ft)

Height to elevation axle: 14.17 m (46.5 ft.)

Height to center of feed ring at 0 degrees pointing elevation: 14.17 m (46.5 ft.)

Height of LER 3.08 m (10.1 ft)



*Photograph of the Morehead State University Space Science Center 21 Meter Space Tracking Antenna September, 2019*