SRI Big Dish Antenna Exhibit 24 May 2012
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Antenna Background

For this experiment, SRI International will use the Bluestar antenna, which is known locally as the Big Dish. SRI built this antenna in the early 1960s on Stanford University land under contract to the U. S. Navy. The U. S. Government owns the antenna today via the Naval Research Laboratory (NRL), and SRI continues to operate it under contract to the Navy. Our agreement with the Navy allows SRI to use the antenna on programs funded by other entities and for in-house research. Past research use has either involved either receive-only operation (such as radioastronomical surveys) or has been performed using a frequency authorization provided by a U. S. Government client, such as the U. S. Navy or NASA.

The Big Dish has been a local landmark for about 50 years. It is visible from I-280 and has long been used by pilots as a visual landmark. The Big Dish is a controlled-access facility. Figures 1 and 2 below provide an overview of the Big Dish structure and surrounding environment.

This experiment will not require any modifications to the antenna or antenna structure other than changing the feed, which is a routine operation that we perform by lowering the tripod apex to ground level. (See Figure 3.)

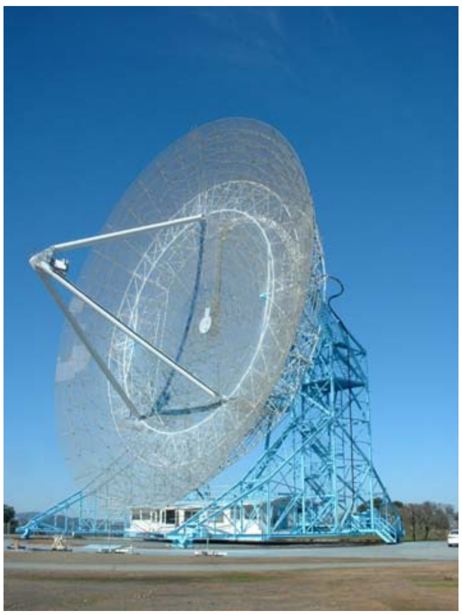

Figure 1. Big Dish Antenna

Figure 2. Environment Surrounding the Big Dish.
(The white cross denotes a USGS survey marker.)

Antenna Parameters

Table 1 below describes the structure and performance of the Big Dish. The Dish reflector, tripod, and support structure include red aviation warning lights.

SRI has provided a dimensioned vertical profile of the antenna structure to the FCC as a separate document.

Table 1. Big Dish Performance and Structural Parameters

Location	N 37° 24 30.83506 Latitude and longitude of the azimuth rotation axis W 122° 10 49.49988 WGS-84 (at epoch 2001.073) 121.495 m altitude Ground level (circular azimuth track)
Frequency band	902 – 928 MHz (10 - 12 MHz will be selected)
Polarization	LHCP or RHCP
Emitted waveforms	CW or LFMCW
Pointing range	Full 360° azimuth, +3° to zenith elevation (mechanical limits)
Max. antenna pointing error	0.01°
Min. beam pointing gain	51 dB
Max. EIRP	54.3 MW
Max power at feed port	435 W
Max. spurious or harmonic emission	-60 dBc
Dish diameter	45.72 m (150 ft.)
F/D ratio	0.42 (focus is 19.2 m from vertex)
3 dB beamwidth	0.44° azimuth, 0.44° elevation
1st sidelobe	-18 dB relative to boresight, 0.76° off boresight
30 dB half-angle	1.85°
40 dB half-angle	4.6°
Max. slew rate	1°/s
Max. acceleration	$1°/s^2$
Structure height	47.7 m above ground level (pointed at min. elevation) 47.1 m above ground level (pointed at zenith)
Distances to area landing strips	Palo Alto airport (general aviation), 7.9 km San Carlos airport (general aviation), 13.0 km Moffett Federal Airfield, 11.6 km San Jose International Airport, 22.9 km San Francisco International Airport, 28.8 km

Figure 3. Antenna Tripod in Lowered Position.

Plan for Experimental Operation

Our bistatic radar tests will involve illuminating non-functional debris objects, such as spent rocket bodies and known radar calibration spheres. Each test will involve tracking an ephemeris generated from the available orbital elements for each target and emitting either a continuous-wave (CW) tone at a fixed frequency or a linear frequency-modulated continuous wave (LFMCW) chirp. Test intervals will range from a few tens of seconds for objects in low Earth orbit (LEO) to 30 to 45 minutes for objects in geosynchronous Earth orbit (GEO). The transmitter will be turned off during the intervals between tests.

The highest ground elevations in the area surrounding the Big Dish are in the foothills near Skyline Drive. The ridgeline lies below 700 m altitude and is slightly over 7.5 km from the Big Dish at the point of closest approach. We propose to use a 10° horizon mask in all directions except towards the ridgeline, where we will use a 15° horizon mask. This will reduce the power emitted towards ground-level locations by 50 dB from our boresight EIRP.

The nearest developed land areas are the Stanford Golf Course, which is 1.02 km away at its closest point, and a residential area on Junipero Serra Blvd., which is 1.05 km away. I-280 passes within 760 m at its point of closest approach, but the line of sight from this portion of the road is blocked by hills. The largest power density expected at any of these ground locations 74.5 $\mu W/m^2$ (I-280 at point of closest approach, *neglecting* hilltop LOS blockage). When the LFMCW waveform is used, this corresponds to a power spectral density of 0.75 $pW/m^2/Hz$. In addition, we note that we will only operate at or near our horizon mask momentarily as objects rise or set. We plan to perform most of our tests at higher elevation angles. In addition, we will use a spotter watching for any aircraft and will stop emitting when aircraft approach our beam.

The equipment in place at the facility does not currently support azimuth blanking, but we can select target passes for operation to avoid emitting at desired azimuths and at low elevations. The facility will be manned at all times during operation, and personnel will visually inspect the beam area before and during emission to ensure that local aircraft are not illuminated. We will also provide a designated point of contact to terminate transmissions in interference is reported.

SRI plans to conduct this experiment in a responsible and safe manner and will discuss additional experimental constraints as required to address any FCC concerns.