

Summary of Purpose

Our purpose is to create a microwave power transmission system to supply the required energy for a space elevator robotic climber prototype. This robotic climber will be used to compete in a NASA sponsored Centennial Challenge competition (<http://exploration.nasa.gov/centennialchallenge>).

The 2006 Beam Power Challenge is organized by the Spaceward Foundation (www.spaceward.org). This competition will take place in Las Cruces, New Mexico, October 20 through October 22, 2006. We at Centaurus Aerospace will require special temporary authority to perform testing and to compete in this contest. More information about this competition can be found at www.elevator2010.org.

Microwave energy transmitted from two antennas will be used to power the prototype climber which will ascend a tether suspended by a crane to a height of 60 meters. The climber will require enough power to carry itself, plus a payload, at a minimum speed of 1 meter/second. We will be constructing two rectenna (rectifying antenna) arrays to receive the transmitted microwave energy and convert it back into DC electrical power.

Transmitting Equipment

We will transmit using two, high-gain parabolic dish antennas with a diameter (D) of 3 meters. Each dish will be fed by a Chaparral style circular feed horn. We will use two, Panasonic, 1.25 kW magnetrons (Model number 2M261-M32) for each feed horn to achieve dual-polarization. Thus, a total of four magnetrons with a combined power of 5 kW will be used. Each magnetron will be powered by a Panasonic power supply (Model number F66456G02AP). The magnetrons operate at a frequency of 2450 MHz ($\lambda = 0.124$ meters).

The gain (G) from each of the transmitters is given by

$$G = 6 \times \left(\frac{D}{\lambda} \right)^2 = 3512.0 = 35.5dB$$

where D is the diameter of the parabolic antenna and λ is the wavelength. The beamwidth (B) for each of the two beams is calculated with

$$B = 70 \times \left(\frac{\lambda}{D} \right) = 2.89^\circ$$

The Effective Radiative Power or ERP for each of the two beams is given by

$$ERP = G \times Power_{transmitted} = 3512.0 \times 2500 = 8.78MW$$

Hence, the combined ERP for both antennas is 17.56 MW.

Testing

Prior to the actual competition, we will test the equipment near Logan, Utah beginning September 29, 2006. Testing will be done in a horizontal manner, while the actual competition will require that the beams be transmitted vertically. To avoid interference, all horizontal testing will be performed in a rural area near Logan, UT. Hills and trees in the background will help shield the antenna and the antenna will be pointed away from any nearby aircraft landing areas or other structures. As an additional precaution, EM fields near the antenna will be measured and shielding material will be used as necessary to minimize the possibility of interference to other equipment. Figure 1 is a schematic of the horizontal test configuration. Each test will last from 10 to 90 seconds with a total of 20 to 30 tests.

Competition

At the competition, the microwave beams will be transmitted vertically, parallel to the tether that the climber will ascend. Figure 2 is a schematic of the competition configuration. The competition will be held at Las Cruces, New Mexico from October 20, 2006 through October 22, 2006. In addition, vertical testing (competition qualification) will be performed in Las Cruces prior to the competition, beginning as early as October 14, 2006.

During the competition we will be provided with three climb attempts, each with a maximum duration of 60 seconds. Prior to the competition, we will also be provided with three climb attempts, each with a maximum duration of 60 seconds. Again, we will employ the use of shielding material to avoid interference to others operating in the same spectrum. EM fields will be monitored during the transmitter operation, to ensure that microwave levels remain below the maximum exposure guidelines of ANSI and the FDA where people are present.

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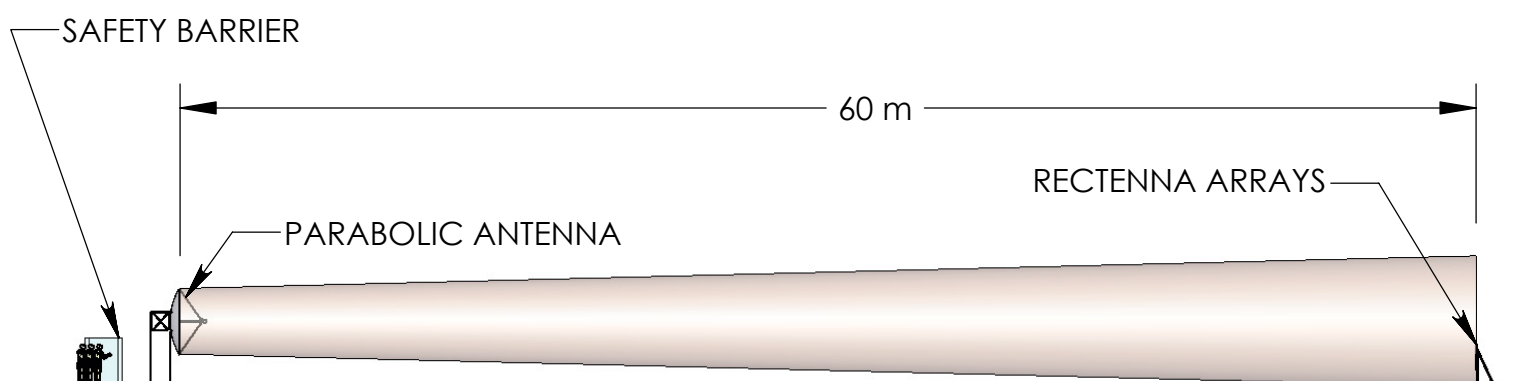
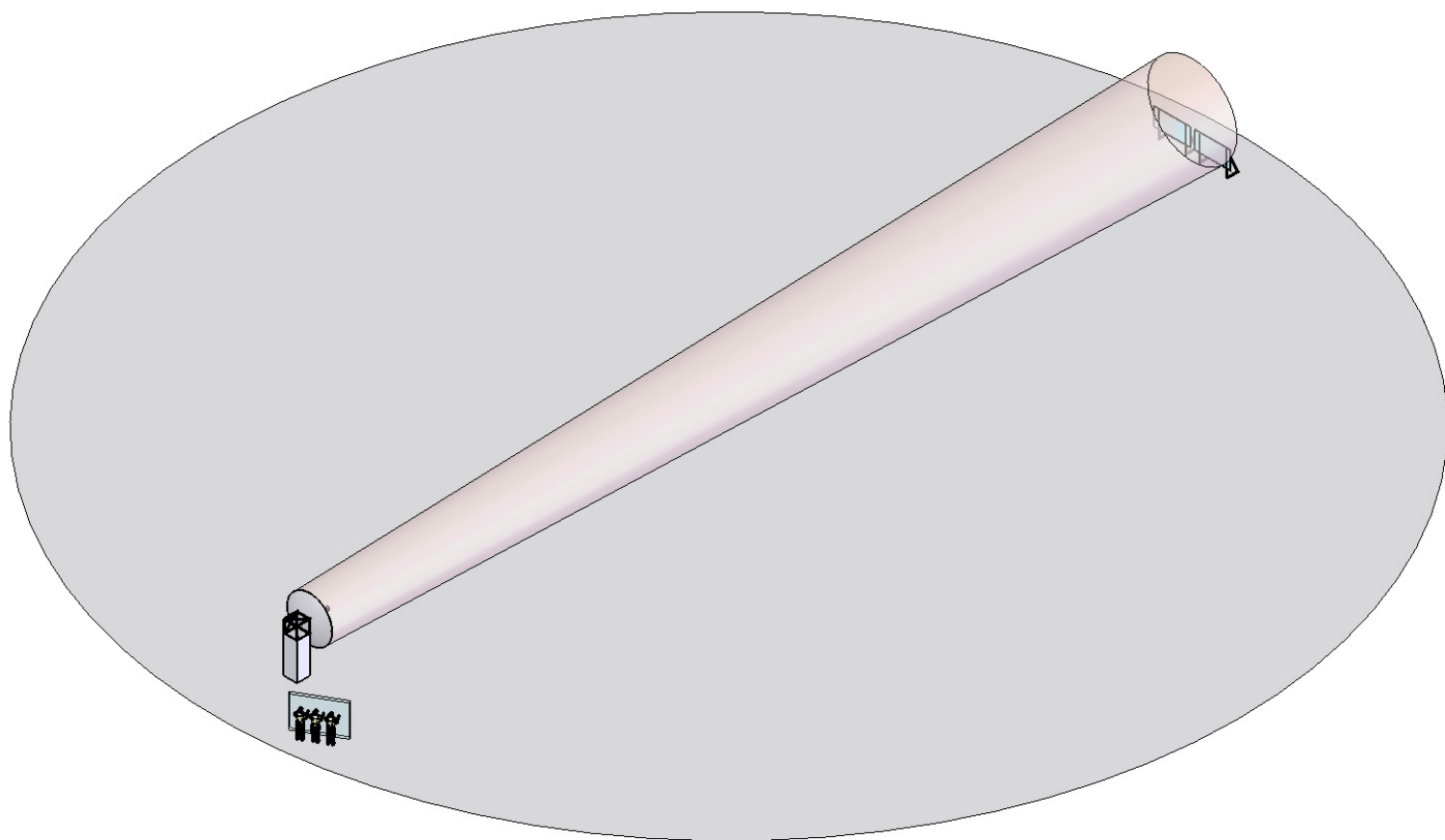


FIGURE 1. HORIZONTAL BEAM TESTING

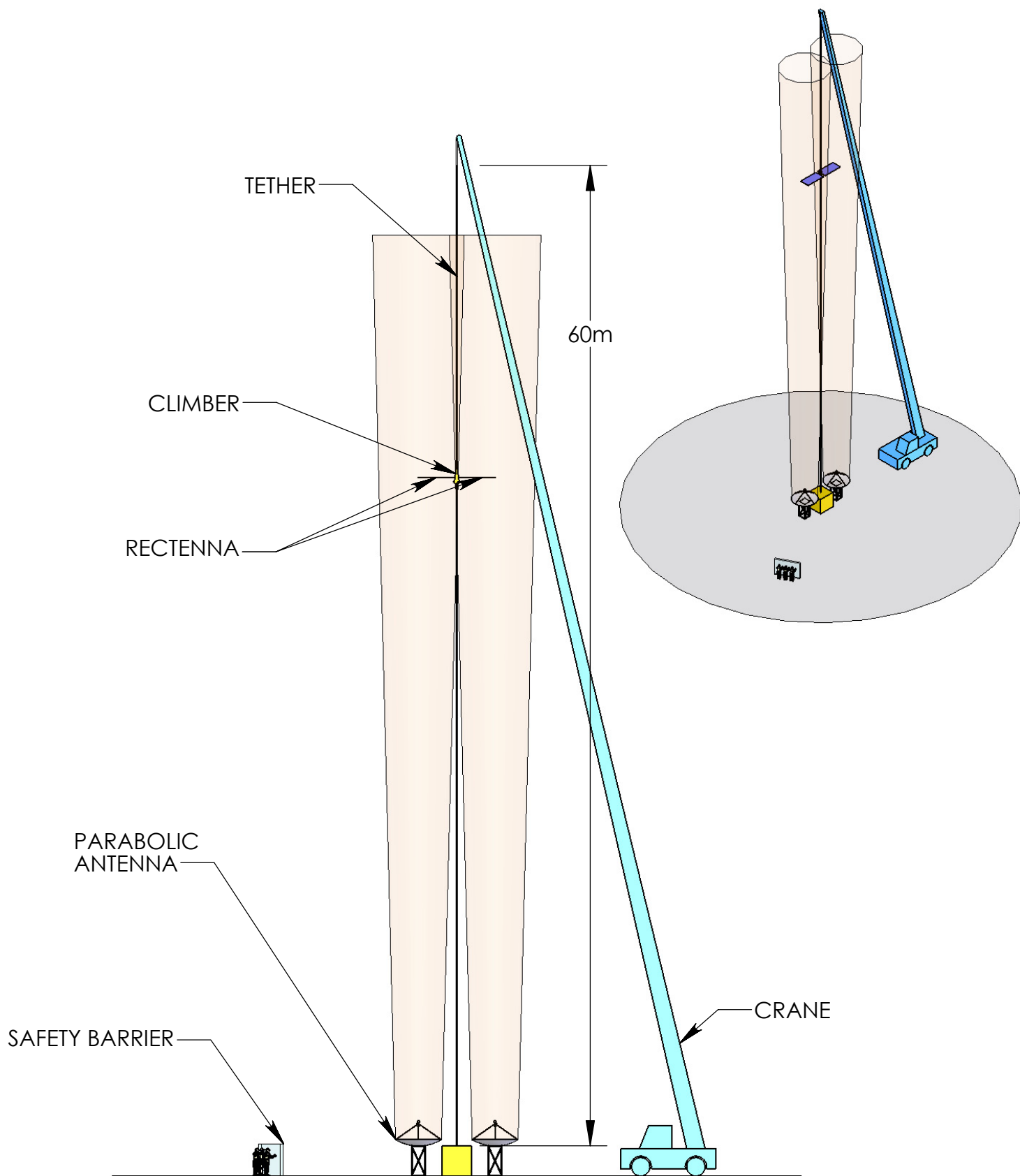


FIGURE 2. CONTEST VERTICAL BEAMING