Lunar Reflective Calibration Beacon for Radio Astronomy and SETI

**Project:** EME  
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**Description and Objectives:**
The SETI League EME Beacon consists of a microwave transmitter with antennas automatically tracking the Moon across the sky, reflecting to Earth a precision weak signal to calibrate radio telescopes worldwide.

**Key Features:**
- High frequency precision, locked to atomic clock
- Transmission in the 23 cm amateur radio band
- Automatic az-el antenna tracking of Moon
- Remotely programmable modulation and power
- Continuous, unattended operation

**Approach:**
- **Location:** Kinnelon NJ USA, Grid Square FN21ta
- **Station Trustee:** Richard Factor, WA2IKL
- **Transmitter:** currently 350 watts CW output (nominal)
- **Frequency:** 1296.000 MHz
- **Accuracy:** better than +/− 2 Hz
- **Feedline:** 60 feet of 5/8 inch Cellwave hardline (estimated loss 3 dB)
- **Antenna:** quad helix array, RHCP uplink; gain +24 dBi
- **Tracking Hardware:** Kansas City Tracker driving Yaesu az/el rotors
- **Tracking Software:** NOVA for Windows
- **EIRP:** estimated at +76 dBm

**Partners:**
- American Astronomical Society
- ARRL Foundation
- SETI Institute

**Schedule Milestones and Deliverables:**

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Technical Readiness Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>04 Mar 2001</td>
<td>First Light, 20 Watt IPA</td>
<td>TRL 4</td>
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<tr>
<td>09 Mar 2001</td>
<td>Successful Arecibo tests</td>
<td>TRL 5</td>
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<tr>
<td>17 Feb 2002</td>
<td>First Light, 200 Watt PA</td>
<td>TRL 6</td>
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<tr>
<td>13 Apr 2003</td>
<td>Arecibo/Jodrell Bank FUDD tests</td>
<td>TRL 7</td>
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<tr>
<td>15 Nov 2003</td>
<td>Released for general use worldwide</td>
<td>TRL 8</td>
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<tr>
<td>13 Mar 2006</td>
<td>Upgraded, 350 Watt PA</td>
<td>TRL 9</td>
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**Applications:**
- Time and Frequency Standard for Project Argus
- Sensitivity calibration for amateur radio telescopes
- End-to-end system verification for Project Phoenix
- Sensitivity calibration for professional observatories

**Keywords:** EME, Moonbounce, Microwave Beacon, Transmitter, Radio Astronomy, SETI, L-Band, Arecibo

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