BALDOR®

Success Stories

December 12, 2005

Deep Outer Space Exploration Supported by Baldor Motors at the Prestigious Jet Propulsion Laboratory Located in Pasadena California

The Jet Propulsion Laboratory (JPL), managed for NASA by the California Institute of Technology, is the lead U.S. center for robotic exploration of the solar system. JPL has led the modern world in the exploration of the majority of every known planet in our solar system, except Pluto. In the 1980's JPL helped scientists make new discoveries about the geology and oceanography of our planet when they developed the SeaSat satellite. And *JPL built the Wide Field Planetary Camera 2, onboard NASA's Hubble Space Telescope,* which has been the source of some spectacular images of our universe. *Today, we follow the success of NASA's Mars Exploration Rovers Spirit and Opportunity, designed and built at JPL – an amazing success story with more missions being planned.*[1]

Bill Colton, Manager of Baldor Los Angeles said: "…Baldor has worked with JPL a lot over the years. We have supplied DC motors *(subreflector positioner)* and drive amplifiers *(antenna)* for some of the world's most sophisticated antennae systems developed and used by JPL. The antennas are used to track communications between space satellites and Earth ground communication stations..."

Every U.S. deep space mission is designed to allow continuous radio communication with the spacecraft. Continuous 24-hour coverage for several spacecraft requires several Earth-based stations at locations that compensate for the Earth's daily rotation. *JPL manages the Deep Space Network for NASA*, with antennae complexes in Spain, Australia, and California, which are approximately 120 degrees apart in longitude. This enables continuous observation and suitable overlap for transferring the spacecraft radio link from one complex to the next.[1]

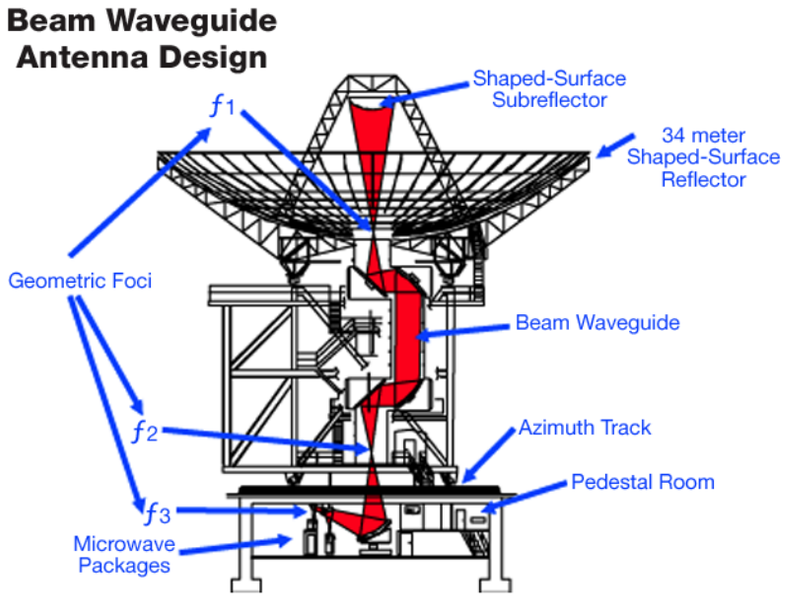
The huge 34-meter bowl shaped surface of the antenna focuses the incoming Radio Frequency energy onto the subreflector. The subreflector is adjusted in position by Baldor motors to optimize the transfer of RF energy to the Signal Processing Center building located adjacent to the antenna.

"Courtesy NASA/JPL-Caltech." JPL Goldstone, CA Complex, 34M Beam Wave Guide (BWG) Antennas

"Courtesy NASA/JPL-Caltech." JPL (HEF70M) Antenna

Illustrated is the JPL 34-Meter (111-foot) diameter High Efficiency Antenna at the Goldstone, Ca. complex. The Goldstone complex is located on the U.S. Army's Fort Irwin Military Reservation, approximately 45 miles northeast of the desert city of Barstow. Each complex is situated in semi-mountainous, bowl-shaped terrain to shield against radio frequency interference. All the stations are remotely operated from

a centralized Signal Processing Center at each complex (in the first photo notice the size of the SPC trailer compared to the size of the antenna). The Centers house the electronic subsystems that point and control the antennas, receive and process the telemetry data, transmit commands, and generate the spacecraft navigation data. Once the data is processed at the Signal Processing Centers, it is transmitted to JPL (a 32-acre scientific community) for further processing and distribution to science teams.



"Courtesy NASA/JPL-Caltech."

The Jet Propulsion Laboratory has made available their own research paper dated November 2000 and titled: *Open- and Closed-Loop Dynamics of the High Efficiency Antenna Subreflector* by: W.B. Kuczenski and W. Gawronski[2] and in this research they describe the Baldor DC motors used to position the subreflector part of the antenna as it is tracking incoming signals from outerspace:

> *"Due to gravity loading of the antenna structure, the subreflector movement in three axes is tied to the antenna elevation movement to maintain the correct focal point. The precision of subreflector response to the controller commands is essential to maintaining the antenna pointing precision.*
>
> *There are a total of five motors in the subreflector positioner assembly, one each for the X and Y-axes and three independently controlled motors for the Z-axis, located in a circular pattern, 120 deg. apart from one another. All five motors are Baldor CDP3320 1/3 hp (185 W) DC motors."*

Each axis has a total travel of 152 mm (6.0 in.). The X-Axis corresponds to the left-right motion of the subreflector. The Y-axis moves the subreflector vertically up and down and the Z-axis zooms the subreflector from close-up to long distance.[3]

1. Retrieved in part from www.jpl.nasa.gov ABOUT JPL—November 11, 2005
2. Open and Closed-Loop Dynamics of the High Efficiency Antenna Subreflector — A JPL published research paper on the mechanical subsystem. The subsystem consists of the Baldor motors, gear reducers, ball screw and subreflector.
3. Ibid. Based on the description in pp.1-2.

BALDOR

Baldor Electric Company
P.O. Box 2400
Fort Smith, AR 72902-2400 U.S.A.
Ph: (479) 646-4711 • Fax (479) 648-5792
International Fax (479) 648-5895
www.baldor.com

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FM600

Printed in the U.S.A.
12/05 PROG 5,000