

HOW TO TAKE 30 YEARS OFF THE LIFE OF AN EARTH-ORBITER NETWORK

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ABSTRACT

In the mid 1960's, the NASA/JPL Deep Space Network installed a global 26-meter antenna network to support a large group of Low Earth Orbiters and Highly Elliptical Orbiters. These spacecraft are characterized as having Earth-station contact times of between 10 minutes and 2 hours per tracking pass. Although the 26-meter network was equipped with what was then considered state-of-the-art equipment, operations was labor-intensive. Each station required 25 people per shift in order to be operated effectively. It was not uncommon to spend up to 45 minutes to configure and test a station in preparation for an upcoming tracking pass. And often another 15 minutes was required to close out the equipment at the end of the pass. In comparison to the lengths of actual tracking passes, these pre-pass and post-pass calibration periods represented sizable amounts of time each day during which no spacecraft could be tracked.

Over the years the 26-meter network has returned data with reliability, but times and conditions have changed dramatically from the 1960's mode. Equipment has become outdated and more difficult to maintain. Technology has advanced many giant leaps. And, with declining federal budgets, there has been an overwhelming demand to reduce staffing and increase autonomous operations to enable supporting more missions. Concurrent with the objective of supporting more missions was the need to reduce station overhead time, thereby freeing more station time that could be used to satisfy the corresponding increase in tracking requests. So the stage was set to take a closer look at re-engineering the 26-meter antenna network.

This effort examined and analyzed all areas of station operations as they pertained to 26-meter overhead times and data acquisition reliability. The scope of the process included functional requirements, development, design, reviews, testing, operational procedures, staffing, logistics, training and maintenance. The elements used to configure and test a 26-meter station for a tracking pass were identified. These included hardware, software, test devices, procedures and personnel. The cost-to-benefit ratio of each of these elements was also analyzed. Metrics were constructed to measure time consumed and reliability added to the baseline state.

The goal of this exercise was to reduce the time needed to configure a 26-meter station for a tracking pass by at least 75%, while at the same time maintaining or increasing the reliability of the provided support. This would enable coverage of additional missions without the need of constructing new facilities. At the same time, it would reduce the burden of needless activity on the staff by conducting all mission activities and data collection from a central point. And it was possible to cut staffing from 25 to 2 people per shift. The goal to add automatic operations to a thirty-year-old system seemed an arduous task at best. To stay within the NASA/JPL budget, commercial off-the-shelf software and hardware were deemed appropriate choices to make the transition a successful endeavor.