Pioneer 10 and 11 Mission Support

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The current estimate of the Deep Space Network (DSN) performance capability in tracking the Pioneer 10 and Pioneer 11 spacecrafts to the end of their projected life expectancy is given.

I. Introduction

Performance estimates based on measured performance indicate that a 64-meter station, using the existing 18.5-kelvin low-noise S-band cone, will be able to support the Pioneer 10 spacecraft through 1989. This is about 13 AU and 4 years further than previous estimates (Ref. 1) due to reduction of deletion rate requirements by Project.

The above 64-meter station configuration will support the Pioneer 11 spacecraft well beyond its predicted life expectancy.

II. Projected Spacecraft Life

Both Pioneers 10 and 11 are expected to have sufficient attitude control propellant (necessary for antenna pointing) out to 1990. The projected life expectancy is based upon when the Radioisotope Thermoelectric Generators (RTG) output has degraded to the minimum power for spacecraft operations of 76 watts. This degradation is expected to occur by 1990 for both spacecraft.

III. Telecommunications Limits for Pioneer 10 and Pioneer 11

The telecommunications limits as predicted in the downlink performance graphs (Figs. 1, 2, and 3) for each spacecraft indicate that the 64-meter station capability will exceed the life expectancy of the radioisotope thermoelectric generators.

Two cautions are in order with regard to estimating the end of both Pioneer 10 and 11 missions. The first is that the RTG life is only an estimate. Although the RTG performance has been following the updated prediction of its degradation for the past two years, it is possible for the rate of degradation to change. The second is to notice the leverage that a small uncertainty in dB has in both range and time for the telecommunications limit.

Acknowledgment

The downlink performance estimates were provided by Ursula Mayer of the Telemetry Performance Analysis Group.

Reference

1. Miller, R. B., "Pioneer 10 and 11 Mission Support," in *The Deep Space Network Progress Report 42-47*, pp. 21-25. Jet Propulsion Laboratory, Pasadena, Calif.

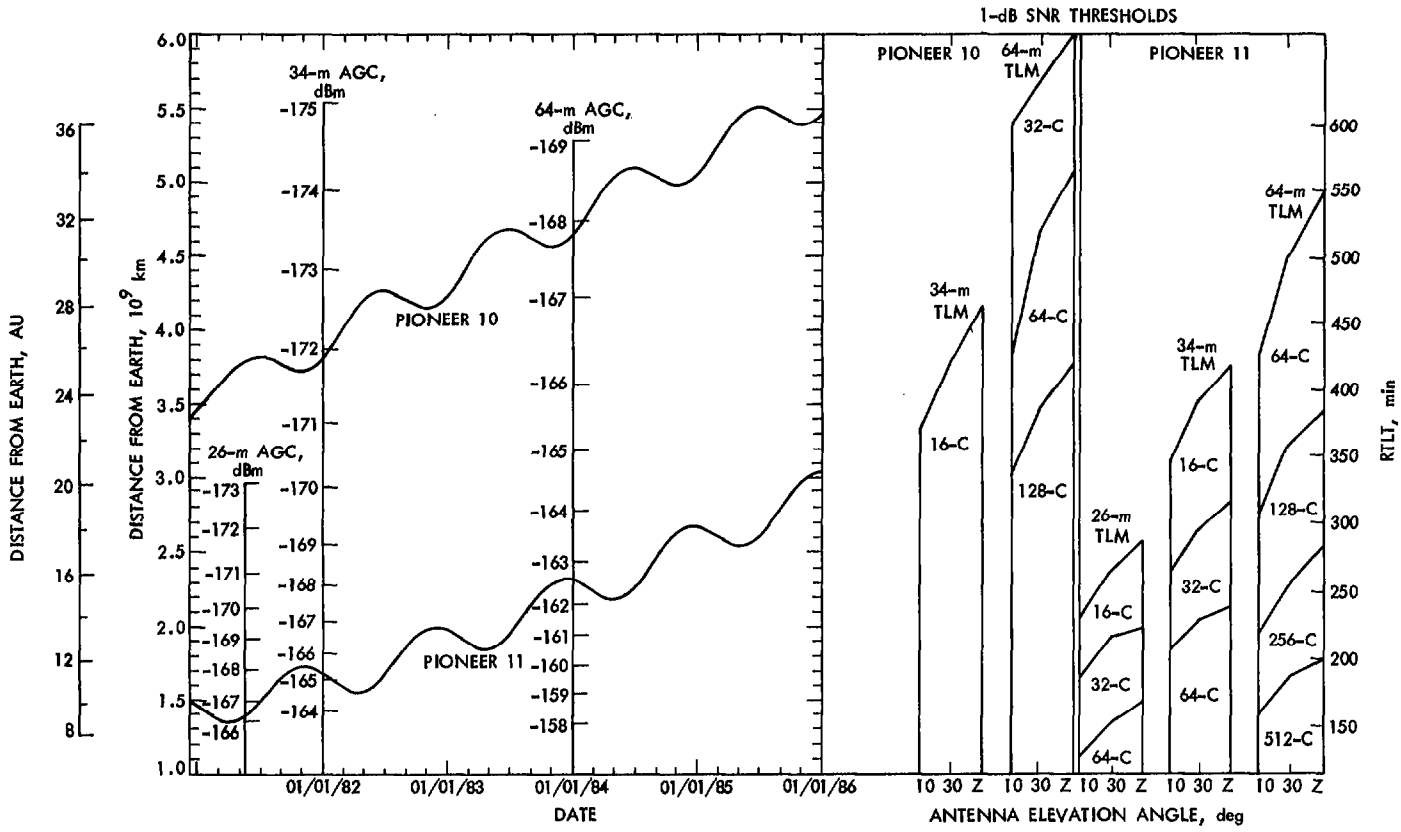

Fig. 1. Downlink performance estimates for 1982 through 1986

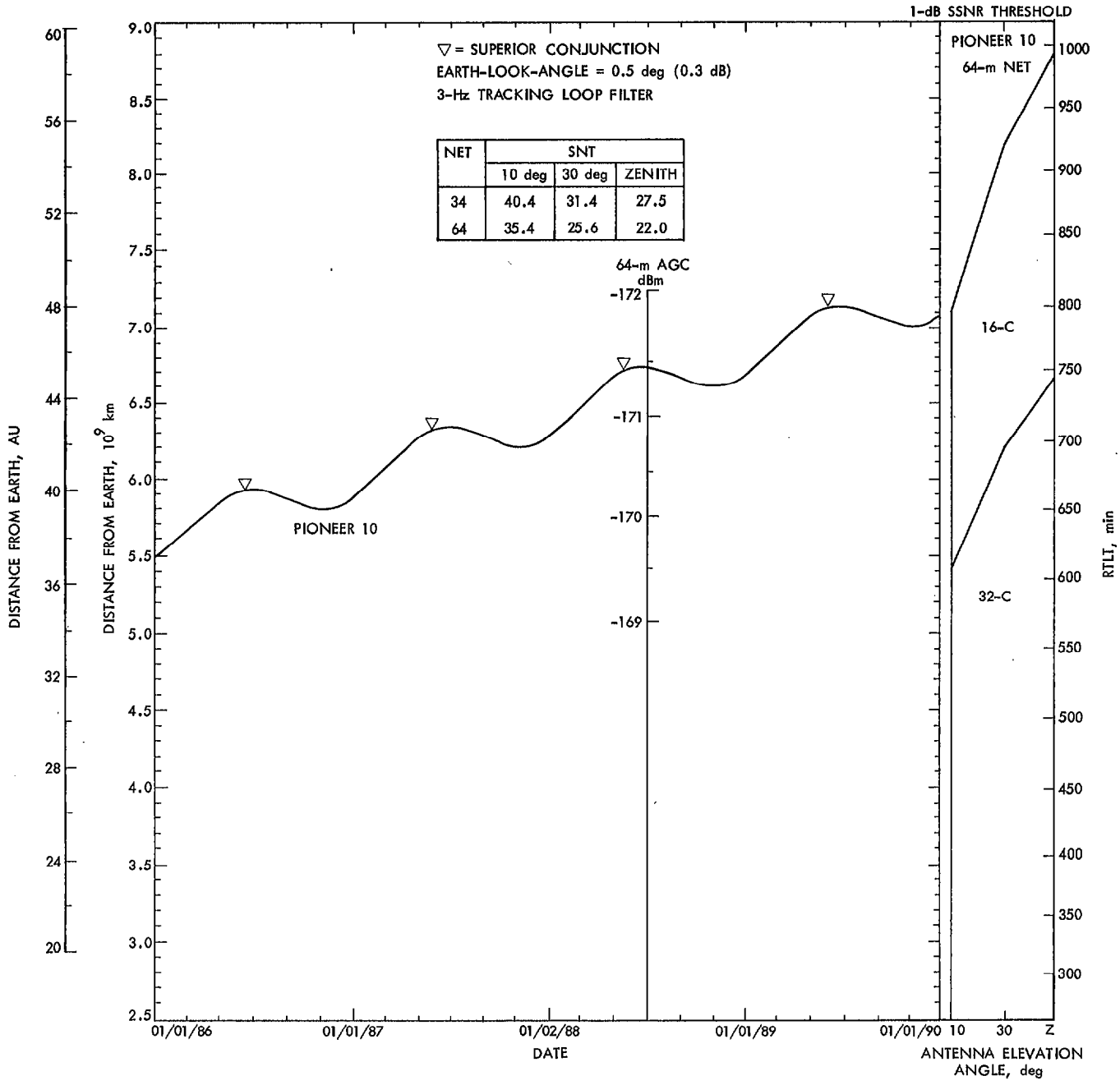

Fig. 2. Downlink performance estimates for Pioneer 10 for 1986 to 1990

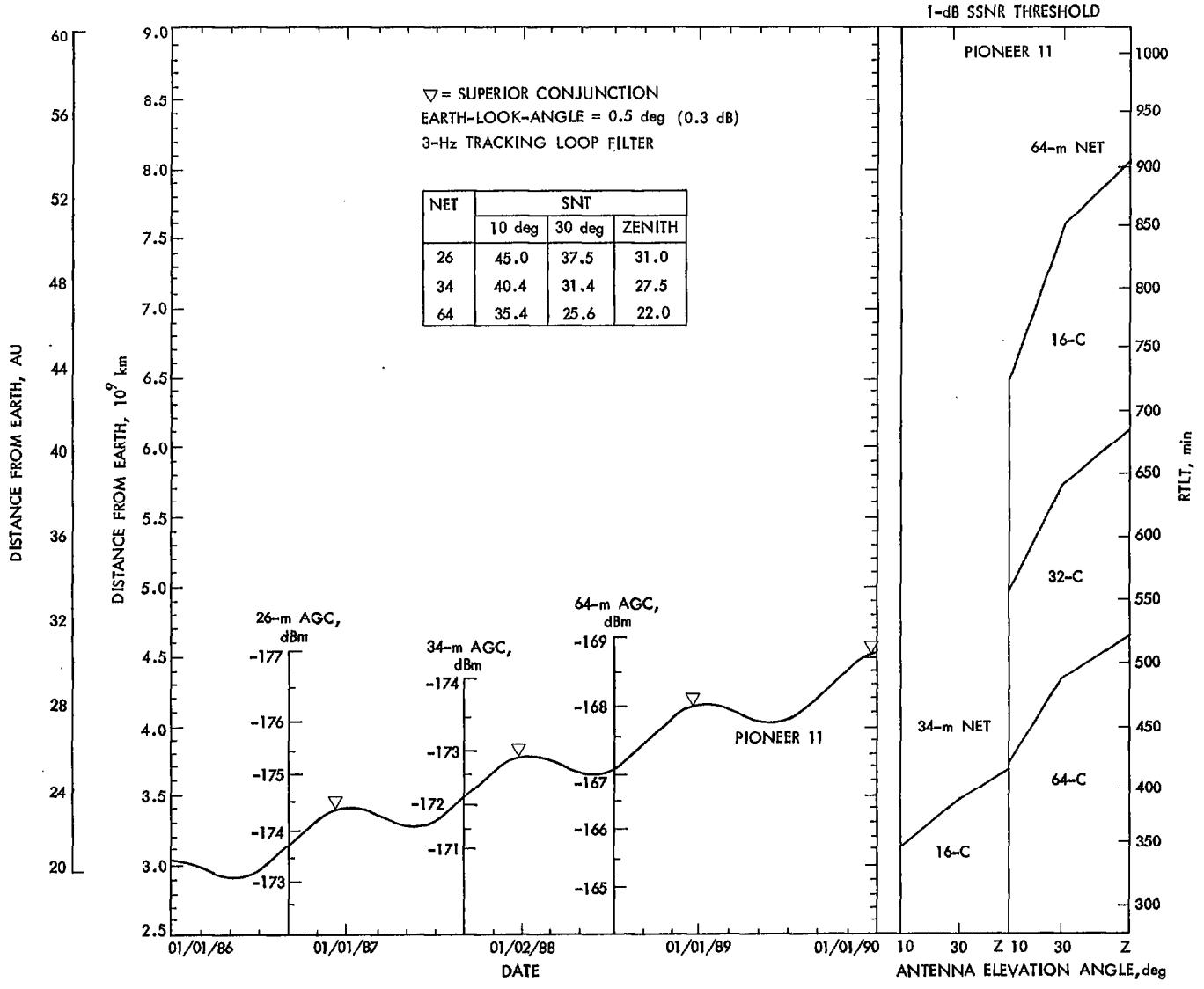

Fig. 3. Downlink performance estimates for Pioneer 11 for 1986 to 1990