ORBITING VERY LONG BASELINE INTERFEROMETER DEMONSTRATION USING THE TRACKING AND DATA RELAY SATELLITE SYSTEM +

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ABSTRACT A proposal has been made to use the Tracking and Data Relay Satellite System (TDRSS) as an orbiting element for a very long baseline interferometry (VLBI) demonstration. The TDRSS is a satellite system designed to coherently track and relay data between other satellites and the central ground station. This system could also be used to coherently observe a celestial radio source. A ground-based frequency standard would be used to coherently drive the spacecraft receiver local oscillator and transmitter. The data will be telemetered to a ground station, where it will be recorded on a Mark III terminal.

The purpose of this proposal is to demonstrate the technology required for a free-flying orbiting very long baseline interferometry (OVLBI) observatory. A successful demonstration of the techniques required for an OVLBI may improve the chances of obtaining an early approval of a dedicated free-flyer mission.

Conventional ground-based VLBI requires independent frequency standards with instabilities that will not contribute more than a small fraction of a cycle of phase error during an integration interval. The interferometric data are recorded in real time on a wide-band VLBI terminal such as the Mark III. For a low-cost free-flying OVLBI system, such as the proposed "Quasat" OVLBI mission, (Schilizzi, et al., 1983, and Preston, et al., 1982), the frequency reference is supplied from a ground-based standard, and the interferometric data is telemetered to the ground station for recording.

The electronic configuration of Quasat can be simulated fairly closely by the TDRSS. Figure 1 shows the proposed system configuration of the TDRSS. The initial tests will be performed using a ground beacon to obtain overall system stability data. The ground station uses a cesium standard as a frequency reference, which is multiplied up to approximately 15 GHz and transmitted to the spacecraft as a pilot tone. The spacecraft accepts the uplink carrier and uses it to drive a frequency synthesizer, which supplies coherent references to all the onboard

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oscillators. A 5-meter steerable, unfurlable parabolic antenna is used to receive the celestial or beacon signals at S-band. These signals are coherently amplified, frequency translated, and transmitted to the ground station on a telemetry link. The ground station receives the signal and sends a coherent intermediate frequency version to the VLBI trailer, where it will be recorded on a Mark III VLBI terminal. A sample of the station frequency standard will also be sent to the trailer, where it will be compared to a hydrogen maser and a difference signal will be recorded for use in generating corrections in the correlator.

If the first series of tests with a ground beacon shows that the characteristics of the overall system are not adequate to support VLBI experiments, the investigation will be terminated. If the stability of the complete system is adequate (as our initial analysis indicates), then celestial VLBI will be demonstrated in conjunction with ground-based radio astronomy observatories.

REFERENCES:

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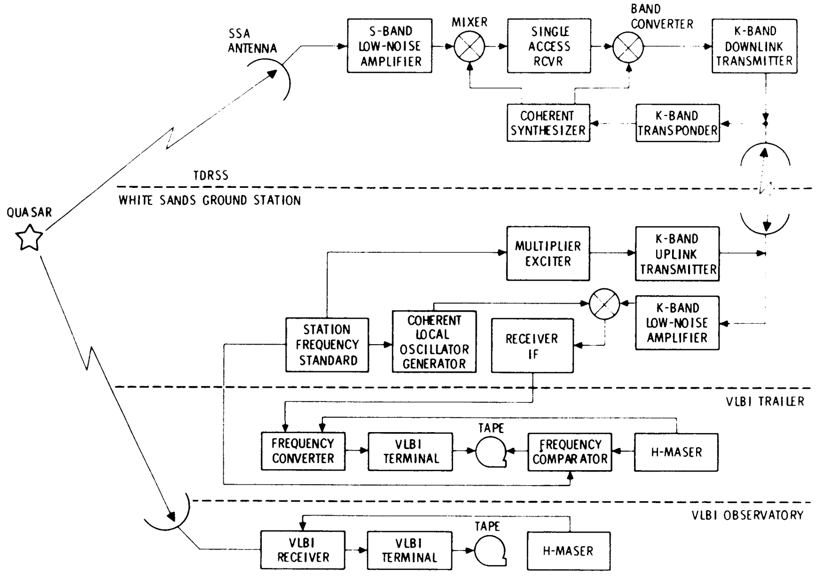

Figure 1. Demonstration block diagram.

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