

GEODYNAMICS FREQUENCY AND PHASE

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ABSTRACT

The objective of this paper is to discuss NASA's geodynamics experiments in relation to precise time and time interval requirements. In particular we are focusing on two specific experiments, namely the Apollo-ATS-6 gravity anomaly experiment which took place during the 1975 US-USSR Apollo-Soyuz test project and a dedicated earth gravity field mission called GRAVSAT which is planned to take place during the 1986-88 time frame. In these experiments, the earth's gravity field and in particular its spatial variation is determined by measuring extremely small changes in the range rate between two spacecraft.

The ATS-6-Apollo experiment, satellite to satellite range rate errors of about $300 \mu\text{m/s}$ were realized. It will be shown that errors of this magnitude are to be expected from the known phase noise of the Cs-standards used.

For the GRAVSAT mission range rate tracking errors of about $1 \mu\text{m/s}$ are needed. This in turn dictates extremely high engineering requirements in frequency and phase. A fractional frequency stability of 1 part in 11 over 4 second averaging time is required of the reference oscillator. In addition a time interval stability of about 10^{-15} sec over the same averaging time is needed for GRAVSAT range rate tracking system.

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