

MINI-ASTROD: MISSION CONCEPT

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Advances in laser physics and its applications triggered the proposition and development of Laser Astrodynamics. Mini-ASTROD is a down-scaled version of ASTROD (Astro-dynamical Space Test of Relativity using Optical Devices). This mission concept has one spacecraft carrying a payload of a telescope, six lasers, and a clock together with ground stations (ODSN: Optical Deep Space Network) to test the optical scheme and yet give important scientific results. These scientific results include a better measurement of the relativistic parameters (γ to 1 ppm, β to a few ppm and others

with improvement), a better sensitivity (several times better) in using the optical Doppler tracking method for detecting gravitational waves, a potential of measuring the solar angular momentum via the Lense-Thirring effect and measurement of many solar system parameters more precisely. These enable us to build a more precise ephemeris and astrodynamics. The weight of this spacecraft is estimated to be about 300-350 kg with a payload of about 100-120 kg. The spacecraft goes into an inner solar orbit with several options. One option is with period 304 days as for the inner spacecraft of the standard two-spacecraft ASTROD mission concept and it takes about 900 days to reach the other side of the Sun relative to the Earth. Another option is to launch with initial period about 290 days and to pass by Venus twice to receive gravity-assistance for achieving shorter periods. For a launch on November 15, 2008, after two encounters with Venus, the orbital period can be shortened to 165 days. After about 400 days from launch, the spacecraft will arrive at the other side of the Sun and the relativistic parameter γ can be determined to 1 ppm. We discuss the payload configuration and outlook for technological developments to reach the mission goals, and summarize the conclusions and recommendations of the first and second organizational meeting for the Mini-ASTROD study.