Paper ID: 16841
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SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT (D3)
Novel Concepts and Technologies for Enable Future Building Blocks in Space Exploration and Development (3)

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ATRM: AIRBORNE TITAN RECONNAISSANCE MISSION - A TITAN AIRPLANE MISSION CONCEPT

Abstract

We describe a mission concept for a stand-alone Titan airplane mission: Airborne Titan Reconnaissance Mission (ATRM). With independent delivery and direct-to-Earth communications, ATRM could contribute to Titan science either alone or as part of a sustained Titan Exploration Program. As a focused mission, ATRM as we have envisioned it would concentrate on the science that an airplane can do best: exploration of Titan's global diversity. We focus on surface geology/hydrology and lower atmospheric structure and dynamics. With a carefully chosen set of seven instruments—2 near-IR cameras, 1 near-IR spectrometer, a RADAR altimeter, an atmospheric structure suite, a haze sensor, and a raindrop detector, ATRM could accomplish a significant subset of the scientific objectives of the aerial element of flagship studies. The ATRM spacecraft stack is composed of a Space Vehicle (SV) for cruise, an Entry Vehicle (EV) for entry and descent, and the Air Vehicle (AV) to fly in Titan's atmosphere. Using an Earth-Jupiter gravity assist trajectory delivers the spacecraft to Titan in 7.5 years, after which the ATRM AV would operate for a One Earthyear nominal mission. We propose a novel 'gravity battery' climb-then-glide strategy to store energy for optimal use during telecommunications sessions. We would optimize our science by using the flexibility of the airplane platform, generating context data and stereo pairs by flying and banking the AV instead of using gimballed cameras. ATRM would climb up to 14 km altitude and descend down to 3.5 km altitude once per Earth day, allowing for repeated atmospheric structure and wind measurements all over the globe. An initial Team-X run at VSSC ISRO priced the ATRM mission at FY10 $715M based on the rules stipulated in the recent Discovery announcement of opportunity. Hence we find that a standalone Titan airplane mission can achieve important science building on Cassini's discoveries and can likely do so within a New Frontiers budget.