A STUDENT-BUILT ORBITAL OBSERVATORY TO INVESTIGATE TITAN'S CLOUD DYNAMICS

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Introduction: Titan, Saturn's largest moon, has been the subject of several contemporary scientific studies involving unmanned probes, professional ground-based and orbital observatories, and amateur astronomers [1]. However, with the exception of infrequent large clouds and seasonal changes occurring over a period of many years, Titan's weather pattern is quite dynamic and merits continuous monitoring by the Planetary Science community. A dedicated, student satellite would be a cost-effective solution and would permit uninterrupted observation of Titan's cloud dynamics. Here, we present the preliminary mission design of STIBRO (Student Titan Brightness Observatory), a graduate student-level initiative dedicated to such monitoring.

Observational Potential: STIBRO would likely be placed in a sun-synchronous dawn-dusk orbit at 800 km altitude. This has advantages in terms of the power and thermal subsystems, ample launch opportunities at a reasonable cost, and the beneficial influence of the Earth's magnetic field on the radiation environment in this orbit. STIBRO's payload would include a spectrometer to record Titan's brightness in the near-IR. Clouds can be easily identified in the 2.12-2.17 μm range, although other wavelengths are possible [2]. Cloud data collected would form a unique database and would also serve as an 'early warning system' in the case of large clouds in the process of formation. Upon detection, these clouds could then be observed via powerful ground-based telescopes. In addition, the acquisition of a secondary data set relating to cloud formation on Neptune and Uranus, and to volcanic activity on Jupiter's moon, Io, would be feasible.

Educational Potential: Student satellites have progressively increasing capabilities, with the first lunar student satellite, ESMO, currently under development. STIBRO would require new technologies, pushing the boundaries of student satellite capabilities. It would build upon the heritage of previous student satellites, and be a suitable test bed for new technologies to be used on the next generation of student satellites. Although the design of the student satellite is generally deemed the most important task for students, it would represent only part of the educational potential of this mission. Since the mission duration needs to be substantially longer compared to previous student satellites, the operation of STIBRO would be performed by students over a prolonged period. Potentially, students would have the opportunity to manage this satellite on a day-to-day basis over a period of some years. This experience would prepare them for careers in Operational Satellite Applications, Planetary Science, Space Mission Control, etc.

Future Directions: STIBRO could become a reality with the partnership of a space agency and one or more universities. Thereafter, a full-scale satellite design campaign could be completed. The mission has excellent educational potential, but the scientific potential should also be stressed.

References: [1] Lorenz, R. D., Dooley, J. M., West, J. D., & Fujii, M. 2003. *Planetary and Space Science* 51:113-125. [2] Griffith, C. A., Hall, J. L., & Geballe, T. R. 2000. *Science* 290:509-513.