Titan Orbiter Aerorover Mission. E. C. Sittler Jr.[1], M. Acuna[1] , M. J. Burchell[6], A. Coates[7] , W. Farrell[1], M. Flasar[1], B. E. Goldstein[3] , S. Gorevan[4], R. E. Hartle[1], W.T.K. Johnson[3], D. R. Kojiro[2], H. Niemann[1], E. N. Nilsen[3], J. Nuth[1], D. Smith[1], and J. C. Zarnecki[5]. [1]NASA Goddard Space Flight Center (Greenbelt, MD, 20771), [2]NASA Ames Research Center (Moffett Field, CA, 94035), . [3]Jet Propulsion Laboratory (4800 Oak Grove Dr., Pasadena, CA, 91109), [4]Honeybee Robotics Inc. (204 Elizabeth St., NY, NY, 10012), [5]Open University (Walton Hall, Milton Keynes, MK7 6AA, UK), [6]University at Kent (Canterbury, CT2 7NR, UK), and [7]Mullard Space Science Laboratory (Holmbury St. Mary, Dorking, Surrey RH5 6NT, UK)

Introduction: We propose a combined Titan orbiter and Titan Aerorover mission with an emphasis on both *in situ* and remote sensing measurements of Titan's surface, atmosphere, ionosphere and magneospheric interaction. The biological aspect of the Titan environment will be emphasized by the mission (i.e., search for organic materials which may include simple organics to 'amono' analogues of amino acids and possibly more complex, lightening detection and infrared, ultraviolet, and charged particle interactions with Titan's surface and atmosphere). An international mission is assumed to control costs. NASA will provide the orbiter, launch vehicle, DSN coverage and operations, while international partners will provide the Aerorover and up to 30% of the cost for the scientific instruments through collaborative efforts. To further reduce costs we propose a single PI for orbiter science instruments and a single PI for Aerorover science instruments. This approach will provide single command/data and power interface between spacecraft and orbiter instruments which will have redundant central DPU and power converter for their instruments. A similar approach could be used for the Aerorover. The mission profile will be constructed to minimize conflicts between Aerorover science, orbiter radar science, orbiter radio science, orbiter imaging science and orbiter fields and particles (FP) science. The mission entails a 3 year development phase starting in 2007, launch in 2010 with a 9 year cruise phase to Titan, and about 20 month Titan orbiter-Aerorover phase. The launch vehicle would be a Titan III with Solar Electric Propulsion (SEP) to bring a combined payload of orbiter and Aerorover to Titan with launch mass of 810 kg. The orbiter weight is 490 kg, orbiter science instruments 120 kg, and Aerorover with science instruments 200 kg. The cost to NASA is estimated to be $540M for development and launch phase and $140M for mission operations phase. Aerobraking in Titan's atmosphere is used for orbit capture with elliptical orbit (periapsis at 1000 km altitude, apoapsis at 5 Titan radii and 14 hour orbital period) the Aerorover is injected into Titan's atmosphere, a balloon is used below 10 km altitude. The Aerorover instrument package** may include NIR Camera, EXOBIOLAB (sample collection & distribution unit, chromatography-ion mobility spectrometer, differential thermal analysis, pyrolysis, X-ray florescence, and Neutron Spectrometer), GCMS, seismometer (3-axis accelerometers), pressure and temperature gauge, radar altimeter, Atmospheric Properties Unit (APU), Siphoning Properties Unit (SPU), Siphon Sampling Unit (SSU), Drill Hover Sampling Unit (DHSU), Drill Core Sampling Unit (DCSU), Homochirality Detector (HD) and Cosmic Ray Detector (CRD). The orbiter will be in a polar orbit and while the Aerorover is drifting in Titan's atmosphere (winds are expected to transport the Aerorover once around Titan in 2 to 4 weeks), the orbiter radar instrument will obtain a coarse surface map of Titan; the time to complete a map of Titan's surface is about 1 month (16 day Titan orbit around Saturn). This map will be used to identify continents and oceans on Titan's surface and used to identify landing sites for the Aerorover. The Aerorover will remain in Titan's atmosphere for about two months at various altitudes while potential landing sites are determined. The Aerorover will first sample the oceans using a flexible weighted siphoning hose or SSU and SPU where it will hover 1-2 meters over the ocean. A similar approach will be used for land sites while hovering using DHSU . Finally, Aerorover will land on the surface and detach the balloon for detailed surface analysis at this final site using DCSU. Here the accelerometers could be used to detect Titan quakes. The hovering and landing phase will last about 2 months. We will then obtain a detailed map of Titan's surface using the orbiter radar for about 6 months with 100 meter resolution. Then for 1 month period perform radio science (RS) occultations of Titan's atmosphere, perform gravity experiments and DSN bi-static scattering of radio waves off of Titan to probe Titan's surface scattering properties. We will then have 6 month period for remote sensing of Titan's atmosphere and surface using orbiter imaging instruments** (UV/IR Imaging Spectrometer and submm Hetrodyne Spectrometer for winds) and orbiter FP instruments** to provide *in situ* measurements of Titan's upper atmosphere, ionosphere and magnetospheric interaction (Plasma Spectrometer (PLS), Ion/Neutral MS (INMS), Magnetometer (MAG), Radio-Plasma Wave/ Langmuir Probe (RPWS/LP), and CRD). The PLS and INMS will be designed to optimize organic molecule detection. Combined with MAG they will give information about upper atmosphere winds and heating. The RPWS can be used to detect lightning. During this period we plan to rotate orbit* to provide optimal RS occultation geometry and provide different local times and scattering phase angles for imagers. At end of 6 month period begin 3 month period for RS occultations and decrease orbit inclination from 90° to 0°* for 360° coverage of RS occultations of Titan's atmosphere and ionosphere. Gravity experiments and DSN bi-static scattering of radio waves off of Titan will also be performed. This mission will provide a broad scientific emphasis for the biological aspects of Titan's environment in a cost effective way. (*To be confirmed) (**Options being considered and may change as study progresses regarding science, mass, power, telemetry rate and cost.).