# T3D

# A Test Flight Instrument for the Stratospheric Terahertz Observatory (STO)

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***Abstract*—The Stratospheric Terahertz Observatory (STO) is a NASA-funded long duration balloon (LDB) experiment designed to address a key problem in modern astrophysics: understanding the life cycle of star-forming molecular clouds in our Milky Way Galaxy. To accomplish this goal, STO will first survey a section of the Galactic Plane in the luminous interstellar cooling line [C II] at 158 microns (1.90 THz) and the important star-formation and ionized gas tracer [N II] at 205 microns (1.45 THz). With a telescope aperture of 80 centimeters illuminating two focal plane arrays of (heterodyne) HEB mixers at 1.4 and 1.9 THz, STO will have the arcminute angular resolution and sub-km/s spectral resolution to resolve and disentangle ionized, atomic, and molecular clouds throughout the Galactic Plane. By building a three-dimensional picture of the interstellar medium of the Galaxy, STO will be able to study the creation and disruption of star-forming clouds in the Galaxy, determine the parameters that govern the star formation rate, and provide a template for star formation and stellar/interstellar feedback in other galaxies.**

**In rapid preparation for a September 2009 test flight from Fort Sumner, New Mexico, an international team is actively developing a prototype instrument payload. This test flight package consists of a liquid helium dewar supporting operation of an HEB mixer in each of the 1.4 and 1.9 THz bands, in addition to an ambient-temperature Schottky receiver operating at 330 GHz. Here, we will present the implementation of the test flight instrument architecture, including HEB mixers, IF processing, spectrometers, telescope optics and gondola subsystems. We will highlight the close relationship between this prototype instrument and the array receiver package for STO's long duration Antarctic flight in late 2010.**