



T0240 Draper Multi-Environment Navigation (DMEN) Suborbital Rocket Campaign

DRAPER

Technology Need

EDL technology is vital to NASA's strategic plans. From NASA TA9: "... NASA cannot continue to rely on the EDL technology investments of the 1960's and 1970's as a baseline to enable future missions. NASA must develop new and innovative technologies to solve this problem..." As exploration reaches further into the solar system both human missions and a multitude of smaller craft will perform will need to perform EDL to complete their missions. A small, reliable navigation package, such as Draper's, is a necessary technology.

Technology Concept

DMEN consists of a suite of sensors (camera, IMU, and magnetometer), with sensor circuitry, a computer, and a powerful suite of algorithms to process the sensor data into a navigation solution. The algorithms include Tracker (tightly coupled visual-inertial odometry), and IBAL (visual terrain-based absolute positioning). TRL for EDL applications is 4-5.

Technology Development Team

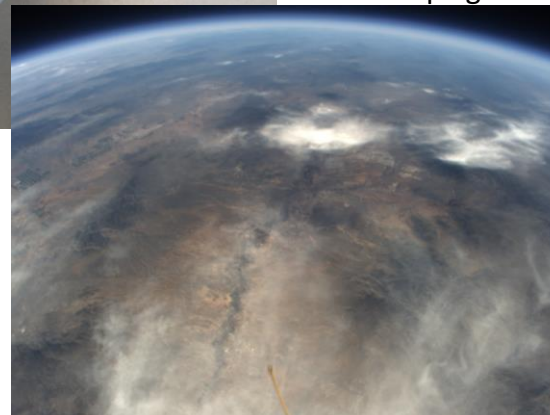
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Test Apparatus

The Draper Multi-Environment Navigator (DMEN) is designed for simple integration and operation. It is a self-contained package that begins recording at power on. It weighs ~4lbs and fits within a volume of 12inx12inx8in. All necessary hardware is contained within the system (including IMU sensor, camera body, processing, sensor circuitry, and battery power), except for the external camera lens.



Image from 1st Balloon Campaign



Flight Requirements/Objectives

Flight plan overview: Two suborbital rocket flights, to be provided by Blue Origin on the New Shepard vehicle. Each flight is to be to an altitude of >60km.

Flight 1. Objective: collect in-environment data with DMEN from high altitude. Personnel req'd.: 2
Flight 2. Objective: collect data from altitude while running navigation algorithms. Personnel req'd.: 2
Flight 1 Readiness Date: 03/01/2020

Technology Advancement

The Draper package has achieved high TRL (6-7) for both ground and low altitude operations, but for the Descent portion of EDL is held at TRL 4 until it can be tested in a relevant environment. Suborbital flights will allow for the collection of data and validation of algorithms in this environment, advancing the system to TRL 5.

Technology End Users

DMEN is designed to operate as a low SWAP navigation sensor for EDL. It can be used on human or robotic missions with a landing component as well as in orbit near small bodies. Algorithms are planned for use in Draper-led CLPS missions.