TerraMICRO
Mission and System Requirements Specification

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I. Introduction

TerraMICRO is a high altitude balloon (HAB) technology demonstration mission. The key objectives of this mission are to validate a new HAB avionics architecture called µHAB, experiment with core technologies which enable long duration flights, and collect high quality images from high altitudes.

This document shall list and describe all mission requirements and their criteria for success, all system requirements and their criteria for performance, and (when applicable) methods by which the aforementioned requiremnts shall be evaluated.

The intent of this specification is to quantify and control the criteria by which mission success is defined, and to provide traceability to each subsystem's performance to ensure mission success is achieved by the vehicle's design.

As a technology demonstrator, TerraMICRO flight systems are intended to be used on future HAB systems. TerraMICRO systems are designed to be generic in order to support any future mission. TerraHAB has selected long duration flights as a target for future missions, and as such many of the systems beyond the core avionics are building blocks toward this goal.

II. Mission Requirements

A. Engineering & Technology Objectives

1. Balloon Monitoring

A system will be able to monitor the temperature and pressure within a balloon and report that back to the HAB payload.

2. Payload design (µHAB)

Flight test microHAB– a flexible, expandable, and cost-effective platform to support many different mission profiles/payloads and includes all of the basics for a HAB launch.

3. Altitude regulation

Limit maximum altitude and rate of ascent by thecontrolled release of helium during flight to prolong the mission duration. Maintain 75,000 feet altitude for at least 30 minutes.

4. High quality video

Horizon-looking full color video at 1080p30 fps or better (1080p60fps or 4K30fps preferred).

5. Video capture burst event

Capture the balloon burst event with minimum resolution of 720p60fps or better. (720p120fps or 1080p120fps preferred)

B. Science Objectives

1. NDVI vegetation density

Use NDVI with a commercially available RGB (VNIR) camera to estimate vegetation density from images in real time during flight. Minimum video quality 480p30fps.

C. Key Design Features

There are several design features that are specific requests from TerraHAB engineers. The flight system should meet these requests or provide justification for not including them.

- Externally accessible remove before flight pin(s).
- Include displays and self-test and status check codes to ensure that the balloon is stable and behaving nominally for flight.
- Power pin (included in microhab), startup sequence pin, launch pin, etc.
- Simplify filling during launch preparations and provide a quick-disconnect from helium filling.

D. Key Design Requirements

There are some additional features that are essential for a successful small HAB flight system.

- Multiple independent cut-down mechanisms
- Redundant tracking systems
- 3 to 6 hours of powered flight time
- Under 6 lbs.

III. System Requirements

All of the systems demonstrated by this mission shall be thoroughly tested on the ground prior to launch. Flight data and telemetry recorded during the flight should be consistent with behavior observed during testing.

A. Avionics & Telemetry

B. Bus & Recovery

C. Altitude Regulation

IV. Nomenclature & Glossary

A	=	amplitude of oscillation
a	=	cylinder diameter
C_p	=	pressure coefficient
Cx	=	force coefficient in the *x* direction
Cy	=	force coefficient in the *y* direction
c	=	chord
dt	=	time step
Fx	=	X component of the resultant pressure force acting on the vehicle
Fy	=	Y component of the resultant pressure force acting on the vehicle
f, g	=	generic functions
h	=	height
i	=	time index during navigation
j	=	waypoint index

K = trailing-edge (TE) nondimensional angular deflection rate