ORBiT Avionics System II Requirements

Sys-Req

Rev: A01

Jinzhi Cai

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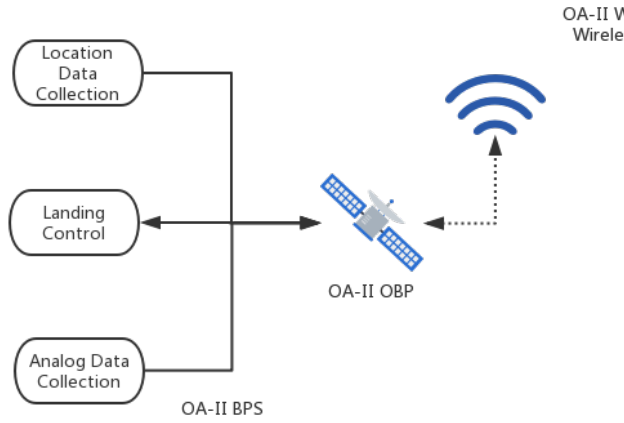
1 System Description

1.1 Introduction

The ORBiT Avionics System II (OA-II) is the next generation avionics system for the Orange Rocket Ballistics Team experimental hybrid rocket. It include two major assemblies, the Vehicle Electronics, and the Base Station Electronics. All components in the OA-II system are intercon-



nected with a unique backplane system and wireless system.

Vehicle Electronics (VEH)

The OA-II VEH is used to control the rocket's various subsystems, collect information about the rocket's performance, and communicate this with the BAS for remote control and monitoring. It also has autonomous software and onboard storage, to allow for continued operation in case of failure of the wireless link.

Base Station Electronics (BAS)

The OA-II BAS is used to communicate wirelessly with the VEH and perform basic realtime analysis on rocket status. The BAS provides live location and performance information, and data storage for further analysis. The BAS can also help to locate the rocket after landing.

Backplane System (BPS)

The OA-II BPS is a unique, multi-level information exchange system that links modules in in the OA-II VEH and BAS. It provides different speed modes for different components.

Wireless System (WLS)

The OA-II WLS is a wireless communication system which provides communication between the VEH and BAS. It also provides a basic location landing signal in case of failure of other subsystems.

1.2 Requirement

Vehicle Electronics (VEH)

- Data receiving and transmission to base station
- 3D linear kinematics data.
  - X, Y, Z (position)
  - V_X, V_Y, V_Z (velocity)
  - A_X, A_Y, A_Z (acceleration)
- 3D rotational kinematics data
  - θ_X, θ_Y, θ_Z (position)
  - ω_X, ω_Y, ω_Z (velocity)
  - α_X, α_Y, α_Z (acceleration)
- Static and dynamic air pressure
- Redundant 28V power supplies and power management
- High frequency data collection ($F_s \geq 10kHz$)
- Actuator and ignitor control ($P_{pk} \geq 50W$)
- 1080p 60Hz RGB Camera $\times$ 4
- Landing location broadcast (up to 2 hours, 3km range, low power consumption)

Base Station Electronics (BAS)

- Data receiving and transmission to rocket
- Display rocket status information
- Basic data analysis (normal/warning/error status).
- Live location display
- Ignition control system
- Engine oxidizer control system
- Safety oxidizer cutoff

- Parachute control
- Launch control
- Automatic system checking

Backplane System (BPS)

- Provide different speed modes with low latency
  - Info level ($\leq 3MB/s$)
  - Data level ($\approx 50MB/s$)
  - Stream level ($\geq 100MB/s$)
- Tolerate high vibration and EMI
- Tolerate high temperature ($\leq 75°C$)

Wireless System (WLS)

- High speed wireless link (10MB/s, 3km range)
- Low speed wireless link (1kB/s, 10km range) with time-of-flight location

2 Revision History

Rev#	Editor	Delta	Date
A02	Gabriel Smolnycki	Edits for clarity	2019-06-25
A01	Jinzhi Cai	Initialize	2019-6-21
-	Jinzhi Cai	Add Radio requirement	2019-6-24

Table 1: Summary of Revision History