2015-2019

ORBiT Avionics System II Requirements

ER00002

Rev: A03

Jinzhi Cai

2019–07–09

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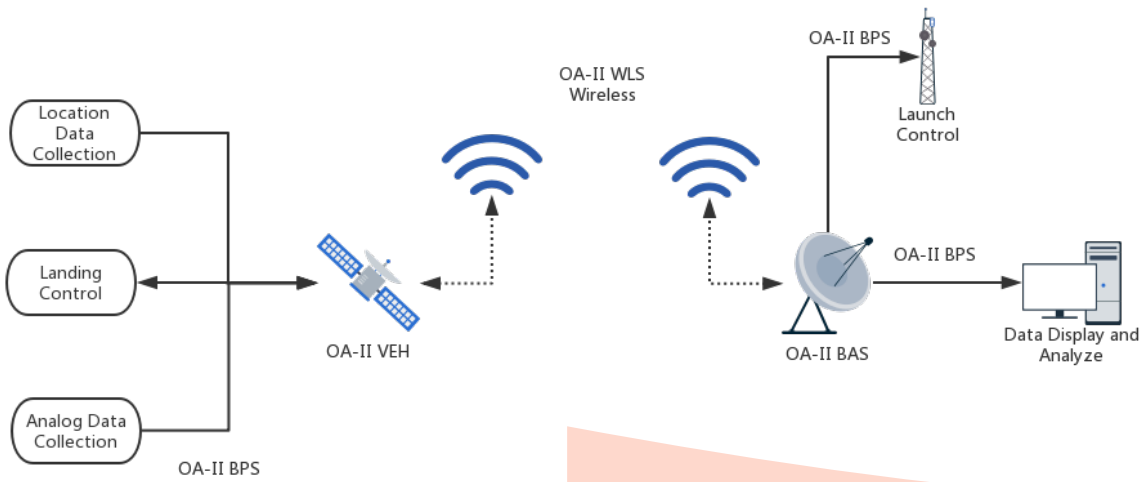
1 Introduction

1.1 Scope

This document covers high level requirements of the ORBiT Avionics System II. This includes the system components, overall functionality, and mechanical constraints.

1.2 Purpose

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. It also includes a Ground Test System and a Radio Communications system.



1.3 Revision History

Rev	Author	Approver	Changes	Date
A01	Jinzhi Cai		Initialize	2019-06-21
-	Jinzhi Cai		Add Radio requirement	2019-06-24
A02	Gabriel Smolnycki		Edits for clarity	2019-06-25
A03	Jinzhi Cai		Add Engine Testing System	2019-07-04
A04	Gabriel Smolnycki		Formatting and consistency with system architecture	2019-07-08

Table 1: Summary of Revision History

2 System Description

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 wireless link failure.

- 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
- Failsafe capability
- High frequency data collection ($F_s \geq 10kHz$, $ENOB \geq 8$)
- Actuator and ignitor control ($P_{pk} \geq 50W$)
- 1080p 60Hz RGB Camera $\times$ 4
- Low power Doppler radio location beacon
  - 24hr battery life
  - 5km range
- Built-in self test (BIST)
- Conformal coating
- Operation over extended 0-85°C temperature range

Base Station Electronics (BAS)

The OA-II BAS is used to communicate with the VEH and perform basic realtime analysis on rocket telemetry data. 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.

- Data receiving and transmission to vehicle
- Display vehicle 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
- Built-in self test (BIST)
- Conformal coating
- Operation over extended 0-85°C temperature range

Ground Testing System (GTS)

TBD

Radio Communication System (RCS)

The OA-II RCS is a wireless communication system which provides communication between the VEH and BAS, or between the GTS and BAS. In the VEH configuration, it also provides a backup Doppler radio beacon for locating the vehicle after landing.

- High speed wireless link (10MB/s, 5km range)
- Low speed wireless link (1kB/s, 20km range) with time-of-flight distance
- Built-in self test (BIST)
- Conformal coating
- Operation over extended 0-85°C temperature range