OA-II Payload Modules General Architecture

ES00005

Rev: A01

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1 Introduction

1.1 Scope

All the hardware and software structure in this document is the fundamental across all version of OA-II VEH Payload Modules. **Each version might have modification above this version, please review relevant document.**

1.2 Purpose

This document include the design general detail of ORBiT Avionics System II Vehicle Electronics Payload Modules such as software and hardware structure and block diagram.

1.3 Relevant Documents

ER00002 ORBiT Avionics System II Requirements

ES00002 ORBiT Avionics System II Architecture

ES00003 OA-II Vehicle Electronics (VEH) System Architecture

DR00001 OA-II Backplane Bus System

DR00002 OA-II VEH Camera System Design

DR00003 OA-II VEH COM System Design

DR00004 OA-II VEH TAM System Design

DR00005 OA-II VEH PAM System Design

1.4 Revision History

Rev	Author	Approver	Changes	Date
A01	Jinzhi Cai	Jinzhi Cai	Initial draft	2019-7-22

Table 1: Summary of Revision History

2 System State Machine

2.0.1 Initialization

In the initialization stage, OA-II VEH COM MCU(Main Control Unit) will sense all the on board device and running a check to exam all the device is functioning correctly. During this stage, all the command and the reply will happen in the Command bus, and each device will start to configuring the data bus interface. The final checking message will send from the MCU via the command bus and reply by each device via data bus.

2.0.2 Launch-Ready

After the initialization stage, the whole vehicle will be into launch ready stage. In this stage, all the ignition process will download to all the unit via command bus and waiting for synchronize ignition signal. All the sensor will running in full speed and deliver data into MCU to monitor vehicle status via the data bus.

2.0.3 Mid-Flight

After the ignition, all the sensor will running in full speed and deliver data into MCU to monitor vehicle status and recording via the data bus. Command Bus will be in the standby mode to be ready to emergent messege to passby.

2.0.4 Post-Flight

After landing, the MCU will do a final checking to all existing units via the Command bus before turn all the sensor unit power off. The data bus will be off during the whole landing process.

2.0.5 Failure-Safe

3 Computing and Operation Module

3.1 Main Control Unit

Main Control Unit contain:

- SoC FPGA that contain 80K LUT and 800MHz to 1GHz processor
- Power manager chip
- Four low temperture sensors for electronics
- Three axis IMU for Spare
- Barometer for Spare
- 2Gbit DRAM for SoC
- 64GB Storage Media(SD card)
- Low Power Radio
- RTC
- Diagnosis Connector

The SoC FPGA will be use as the main processor and come with few sensor attach with it. Those sensor is monitor the status of the SoC FPGA and spare for the critical sensors.

The power manger IC will be able to convert 28V main power to the processor required standard. The main power rail will contain two main power line. Each line will need a power manager IC and a IC that can switch between those two power supply.

All the onboard analog sensor will connect to an 10KHz 16bit AD on the MCU and connect to the main processor. All the sensor will be up and running before **Launch Ready** status.

The RTC and Diagnosis Connection should be always on during the flight and if any of them lost the connection. The FRU will active and cutoff the MCU.

Each second, one Vehicle Status Report will be create and save to the storage media. It include all the sensor data during this time and a brief status exam.

3.2 Failure Recovery Unit

Failure Recovery Unit contain: [1]

- SoC FPGA that contain 80K LUT and 800MHz to 1GHz processor
- Power manager chip
- Four low temperture sensors for electronics
- Three axis IMU for Spare
- Barometer for Spare
- 2Gbit DRAM for SoC
- 64GB Storage Media(SD card)
- Low Power Radio
- Diagnosis Connector

The FRU will have the same hardware structure compare with the MCU. It mainly have two jobs. The first job is execute the same command with MCU but not send it out, those command will only use for check the MCU is sending the same command as the plan. The second job is get the MCU information from the Diagnosis Connection to exam the main controller status and detect failure scenario for execute emergent cutoff.

3.3 Sensor Fusion Unit

TBD [2]

[1] The same with the MCU
[2] This unit will not be avaliable in the first version.

3.4 Module Chip Selection

Chip Name	Price	Feature/Description	Unit Belongs
XC7Z030	$331.5	Processor	MCU/FRU
TLV62130RGT	$2	Processor Power	MCU/FRU
TPS51200	$1	Processor Power	MCU/FRU
SPX3819M5-3-3	$0.6	Processor Power	MCU/FRU
DDR3 16bit	$13	Memory	MCU/FRU
SDcard Slot	$1	SDcard Slot	MCU/FRU
		Three axis IMU	MCU/FRU
		Barometer	MCU/FRU
		Low Power Radio	MCU/FRU

Table 2: Summary of Revision History

3.5 Product Code

OA2-COM-XXX-[YY-Z]

XXX The version number. More detail please see relevant document.

YY Designer name.

Z Revision number.

example: OA2-COM-N01-[JC-I]

First generation Computing and Operation Module Main Control Unit design by Jinzhi Cai.

4 Telecommunication and Acquisition Module

4.1 Data Record Unit

4.2 Telecommunication Unit

4.3 Low Speed Sensor Unit

4.4 High Speed Sensor Unit

4.5 Product Code

OA2-TAM-XXX-[YY-Z]

XXX The version number. More detail please see relevant document.

YY Designer name.

Z Revision number.

example: OA2-TAM-N01-[JC-I]

First generation Telecommunication and Acquisition Module Data Record Unit design by Jinzhi Cai.

5 Power and Actuator Module

5.1 Power Manager Unit

5.2 Pyrotechnic Power Unit

5.3 Actuator Power Unit

5.4 Product Code

OA2-PAM-XXX-[YY-Z]

XXX The version number. More detail please see relevant document.

YY Designer name.

Z Revision number.

example: OA2-PAM-N01-[JC-I]

First generation Power and Actuator Module Power Manager Unit design by Jinzhi Cai.