FireSat Physical Structure

Development

Prepared by

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Overview

This document details the physical decomposition of the systems involved in the example fire detection satellite system described by the OML vocabulary. This includes information about the assemblies used, what assemblies are used to create other assemblies, and mass constraints for all the assemblies.

1. Subsystem and Assemblies

The FireSat system is composed of multiple subsystems. These subsystems have a mass constraint, and are the aggregate of multiple assemblies. These assemblies also have a mass constraint that must be met, and some assemblies contain multiple base assemblies put together.

Table 1.1. Subsystems

Acronym	Subsystem	Mass
2000	ADCS and GNC	9.74
513000	Magnetometer	0.85
514000-1	Reaction Wheel 1	0.1975
514000-2	Reaction Wheel 2	0.1975
514000-3	Reaction Wheel 3	0.1975
514000-4	Reaction Wheel 4	0.1975
515000	GPS Antenna	0.25
516600	GPS Receiver Unit	1.0
516800	ADCS Electronics Unit	2.0
516900-1	Magnetorquer 1	0.5
516900-2	Magnetorquer 2	0.5
516900-3	Magnetorquer 3	0.5
556000	Sun Sensor	0.6
557000	Earth Sensor	2.75
7000	Command and Data Handling	38.07
510000	Base Plate Module	0.6
511000	Base Plate	1.32
516000	Avionics Stack Section	0.6
516300	Primary Flight Computer Unit	2.35
520000	Launch Vehicle Interface Module	0.6
521000	Launch Vehicle Adapter	5.0
522000	Separation System	3.0
531000	Propellant Tank Mounting Panel	2.7
533000-1	Propulsion Structure Post 1	0.6
533000-2	Propulsion Structure Post 2	0.6
533000-3	Propulsion Structure Post 3	0.6
533000-4	Propulsion Structure Post 4	0.6
534000	Pressurant Tank Mounting Panel	2.7
542000	Payload Structural Interface	3.5
550000	Top Panel Module	0.6
551000	Top Panel	2.7
552000-1	Structure Post 1	0.6
552000-2	Structure Post 2	0.6

Acronym	Subsystem	Mass
552000-3	Structure Post 3	0.6
552000-4	Structure Post 4	0.6
552000-5	Structure Post 5	0.6
552000-6	Structure Post 6	0.6
560000-1	Side Panel 1	0.8
560000-2	Side Panel 2	0.8
560000-3	Side Panel 3	0.8
560000-4	Side Panel 4	0.8
560000-5	Side Panel 5	0.8
560000-6	Side Panel 6	0.8
6000	Communications	3.26
516400	Transmitter Unit	2.1
516500	Receiver Unit	1.0
553000	Transmit Whip Antenna	0.04
554000	Transmit Hi-Gain Antenna	0.04
555000	Receive Whip Antenna	0.08
3000	Electric Power System	9.31
512000-1	Battery Pack 1	3.103
512000-2	Battery Pack 2	3.103
512000-3	Battery Pack 3	3.103
1000	Payload System	28.1
540000	Payload Module	0.6
541000	Sensor	28.1
4000	Propulsion	44.14
516700	Propulsion System Control Unit	1.0
517000	Primary Thruster	1.0
518000-1	ACS Thruster 1	0.5
518000-2	ACS Thruster 2	0.5
518000-3	ACS Thruster 3	0.5
518000-4	ACS Thruster 4	0.5
518000-5	ACS Thruster 5	0.5
518000-6	ACS Thruster 6	0.5
519000	Propellant Handling Section	0.6
519100	Fill/Drain Valve Unit	3.75
519200	BP Propellant Line Unit	2.695
530000	Propulsion Module	0.6
532000	Propellant Tank	20.0
535000	Pressurant Tank	10.0
536000	PM Propellant Line Unit	2.695

Acronym	Subsystem	Mass
0000	Spacecraft System	235.1
500000	Spacecraft System Segment	0.6
5000	Structures and Mechanisms	5.0
516100	Power Control Unit	5.96
516200	EPS Regulators and Converters Unit	14.48
580000-1	Solar Array with SADA 1	7.965
580000-2	Solar Array with SADA 2	7.965
8000	Thermal Control	3.9
570000	Thermal Blankets	3.9

1.1. ADCS and GNC

The mass constraint of ADCS and GNC (2000) is 9.74.

1.1.1. Magnetometer

The mass of Magnetometer is 0.85.

1.1.2. Reaction Wheel 1

The mass of Reaction Wheel 1 is 0.1975.

1.1.3. Reaction Wheel 2

The mass of Reaction Wheel 2 is 0.1975.

1.1.4. Reaction Wheel 3

The mass of Reaction Wheel 3 is 0.1975.

1.1.5. Reaction Wheel 4

The mass of Reaction Wheel 4 is 0.1975.

1.1.6. GPS Antenna

The mass of GPS Antenna is 0.25.

1.1.7. GPS Receiver Unit

The mass of GPS Receiver Unit is 1.0.

1.1.8. ADCS Electronics Unit

The mass of ADCS Electronics Unit is 2.0.

1.1.9. Magnetorquer 1

The mass of Magnetorquer 1 is 0.5.

1.1.10. Magnetorquer 2

The mass of Magnetorquer 2 is 0.5.

1.1.11. Magnetorquer 3

The mass of Magnetorquer 3 is 0.5.

1.1.12. Sun Sensor

The mass of Sun Sensor is 0.6.

1.1.13. Earth Sensor

The mass of Earth Sensor is 2.75.

1.2. Command and Data Handling

The mass constraint of Command and Data Handling (7000) is 38.07.

1.2.1. Base Plate Module

The mass of Base Plate Module is 0.6.

Table 1.2. Base Plate Module Contained Assemblies

Assembly	Mass
ACS Thruster 1	0.5
ACS Thruster 2	0.5
ACS Thruster 3	0.5
ACS Thruster 4	0.5
ACS Thruster 5	0.5

Assembly	Mass
ACS Thruster 6	0.5
Avionics Stack Section	0.6
Base Plate	1.32
Battery Pack 1	3.103
Battery Pack 2	3.103
Battery Pack 3	3.103
GPS Antenna	0.25
Magnetometer	0.85
Primary Thruster	1.0
Propellant Handling Section	0.6
Reaction Wheel 1	0.1975
Reaction Wheel 2	0.1975
Reaction Wheel 3	0.1975
Reaction Wheel 4	0.1975

1.2.2. Base Plate

The mass of Base Plate is 1.32.

1.2.3. Avionics Stack Section

The mass of Avionics Stack Section is 0.6.

Table 1.3. Avionics Stack Section Contained Assemblies

Assembly	Mass
ADCS Electronics Unit	2.0
EPS Regulators and Converters Unit	14.48
GPS Receiver Unit	1.0
Magnetorquer 1	0.5
Magnetorquer 2	0.5
Magnetorquer 3	0.5
Power Control Unit	5.96
Primary Flight Computer Unit	2.35
Propulsion System Control Unit	1.0
Receiver Unit	1.0
Transmitter Unit	2.1

1.2.4. Primary Flight Computer Unit

The mass of Primary Flight Computer Unit is 2.35.

1.2.5. Launch Vehicle Interface Module

The mass of Launch Vehicle Interface Module is 0.6.

Table 1.4. Launch Vehicle Interface Module Contained Assemblies

Assembly	Mass
Launch Vehicle Adapter	5.0
Separation System	3.0

1.2.6. Launch Vehicle Adapter

The mass of Launch Vehicle Adapter is 5.0.

1.2.7. Separation System

The mass of Separation System is 3.0.

1.2.8. Propellant Tank Mounting Panel

The mass of Propellant Tank Mounting Panel is 2.7.

1.2.9. Propulsion Structure Post 1

The mass of Propulsion Structure Post 1 is 0.6.

1.2.10. Propulsion Structure Post 2

The mass of Propulsion Structure Post 2 is 0.6.

1.2.11. Propulsion Structure Post 3

The mass of Propulsion Structure Post 3 is 0.6.

1.2.12. Propulsion Structure Post 4

The mass of Propulsion Structure Post 4 is 0.6.

1.2.13. Pressurant Tank Mounting Panel

The mass of Pressurant Tank Mounting Panel is 2.7.

1.2.14. Payload Structural Interface

The mass of Payload Structural Interface is 3.5.

1.2.15. Top Panel Module

The mass of Top Panel Module is 0.6.

Table 1.5. Top Panel Module Contained Assemblies

Assembly	Mass
Earth Sensor	2.75
Receive Whip Antenna	0.08
Structure Post 1	0.6
Structure Post 2	0.6
Structure Post 3	0.6
Structure Post 4	0.6
Structure Post 5	0.6
Structure Post 6	0.6
Sun Sensor	0.6
Top Panel	2.7
Transmit Hi-Gain Antenna	0.04
Transmit Whip Antenna	0.04

1.2.16. Top Panel

The mass of Top Panel is 2.7.

1.2.17. Structure Post 1

The mass of Structure Post 1 is 0.6.

1.2.18. Structure Post 2

The mass of Structure Post 2 is 0.6.

1.2.19. Structure Post 3

The mass of Structure Post 3 is 0.6.

1.2.20. Structure Post 4

The mass of Structure Post 4 is 0.6.

1.2.21. Structure Post 5

The mass of Structure Post 5 is 0.6.

1.2.22. Structure Post 6

The mass of Structure Post 6 is 0.6.

1.2.23. Side Panel 1

The mass of Side Panel 1 is 0.8.

1.2.24. Side Panel 2

The mass of Side Panel 2 is 0.8.

1.2.25. Side Panel 3

The mass of Side Panel 3 is 0.8.

1.2.26. Side Panel 4

The mass of Side Panel 4 is 0.8.

1.2.27. Side Panel 5

The mass of Side Panel 5 is 0.8.

1.2.28. Side Panel 6

The mass of Side Panel 6 is 0.8.

1.3. Communications

The mass constraint of Communications (6000) is 3.26.

1.3.1. Transmitter Unit

The mass of Transmitter Unit is 2.1.

1.3.2. Receiver Unit

The mass of Receiver Unit is 1.0.

1.3.3. Transmit Whip Antenna

The mass of Transmit Whip Antenna is 0.04.

1.3.4. Transmit Hi-Gain Antenna

The mass of Transmit Hi-Gain Antenna is 0.04.

1.3.5. Receive Whip Antenna

The mass of Receive Whip Antenna is 0.08.

1.4. Electric Power System

The mass constraint of Electric Power System (3000) is 9.31.

1.4.1. Battery Pack 1

The mass of Battery Pack 1 is 3.103.

1.4.2. Battery Pack 2

The mass of Battery Pack 2 is 3.103.

1.4.3. Battery Pack 3

The mass of Battery Pack 3 is 3.103.

1.5. Payload System

The mass constraint of Payload System (1000) is 28.1.

1.5.1. Payload Module

The mass of Payload Module is 0.6.

Table 1.6. Payload Module Contained Assemblies

Assembly	Mass
Payload Structural Interface	3.5
Sensor	28.1

1.5.2. Sensor

The mass of Sensor is 28.1.

1.6. Propulsion

The mass constraint of Propulsion (4000) is 44.14.

1.6.1. Propulsion System Control Unit

The mass of Propulsion System Control Unit is 1.0.

1.6.2. Primary Thruster

The mass of Primary Thruster is 1.0.

1.6.3. ACS Thruster 1

The mass of ACS Thruster 1 is 0.5.

1.6.4. ACS Thruster 2

The mass of ACS Thruster 2 is 0.5.

1.6.5. ACS Thruster 3

The mass of ACS Thruster 3 is 0.5.

1.6.6. ACS Thruster 4

The mass of ACS Thruster 4 is 0.5.

1.6.7. ACS Thruster 5

The mass of ACS Thruster 5 is 0.5.

1.6.8. ACS Thruster 6

The mass of ACS Thruster 6 is 0.5.

1.6.9. Propellant Handling Section

The mass of Propellant Handling Section is 0.6.

Table 1.7. Propellant Handling Section Contained Assemblies

Assembly	Mass
BP Propellant Line Unit	2.695
Fill/Drain Valve Unit	3.75

1.6.10. Fill/Drain Valve Unit

The mass of Fill/Drain Valve Unit is 3.75.

1.6.11. BP Propellant Line Unit

The mass of BP Propellant Line Unit is 2.695.

1.6.12. Propulsion Module

The mass of Propulsion Module is 0.6.

Table 1.8. Propulsion Module Contained Assemblies

Assembly	Mass
PM Propellant Line Unit	2.695
Pressurant Tank	10.0
Pressurant Tank Mounting Panel	2.7
Propellant Tank	20.0
Propellant Tank Mounting Panel	2.7
Propulsion Structure Post 1	0.6
Propulsion Structure Post 2	0.6
Propulsion Structure Post 3	0.6
Propulsion Structure Post 4	0.6

1.6.13. Propellant Tank

The mass of Propellant Tank is 20.0.

1.6.14. Pressurant Tank

The mass of Pressurant Tank is 10.0.

1.6.15. PM Propellant Line Unit

The mass of PM Propellant Line Unit is 2.695.

1.7. Spacecraft System

The mass constraint of Spacecraft System (0000) is 235.1.

1.7.1. Spacecraft System Segment

The mass of Spacecraft System Segment is 0.6.

Table 1.9. Spacecraft System Segment Contained Assemblies

Assembly	Mass
Base Plate Module	0.6
Launch Vehicle Interface Module	0.6
Payload Module	0.6
Propulsion Module	0.6
Side Panel 1	0.8
Side Panel 2	0.8
Side Panel 3	0.8
Side Panel 4	0.8
Side Panel 5	0.8
Side Panel 6	0.8
Solar Array with SADA 1	7.965
Solar Array with SADA 2	7.965
Thermal Blankets	3.9
Top Panel Module	0.6

1.8. Structures and Mechanisms

The mass constraint of Structures and Mechanisms (5000) is 5.0.

1.8.1. Power Control Unit

The mass of Power Control Unit is 5.96.

1.8.2. EPS Regulators and Converters Unit

The mass of EPS Regulators and Converters Unit is 14.48.

1.8.3. Solar Array with SADA 1

The mass of Solar Array with SADA 1 is 7.965.

1.8.4. Solar Array with SADA 2

The mass of Solar Array with SADA 2 is 7.965.

1.9. Thermal Control

The mass constraint of Thermal Control (8000) is 3.9.

1.9.1. Thermal Blankets

The mass of Thermal Blankets is 3.9.