ET-Sat™

Student Payload REV. A Board

DRAFT

Interface Control Document (ICD)

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This document describes the functional, physical, and electrical characteristics of the Payload Board. This interface control document is intended to provide the payload integrator with the necessary technical information to integrate the Payload board.

Operational Description

Two types of data packets are sent from the Payload: Serial data and Beacon data. Beacon data is a set of digital and analog inputs that are sent at a set interval for health and safety information. From the ThinSat Payload, there are six Analog inputs, two Digital Inputs, and 1W available for Beacon to the NSL Bus. Serial data is created and commanded by the Payload. It can be sent whenever the transmitter is not Beaconing to the NSL Bus.

Document Classification	
X	NSL Proprietary

Freedom and Constraints: Within the keep-out zone space it is up to you (the Payload) to do as you like (see Figure 5). You do not have to make a student PCB as shown in Figure 4. For example, you can use electronic modules, MEDO parts, Spark Fun Parts, mechanical mechanisms, and others as long as you use the established mounting screw holes. You have 5 Sensor Ports to assess space outside and you may be able to drill other openings in the frame with approval. It is strongly suggested that you include a payload Diagnostic port for checking your payload when it is in the launch tube or on a FlatSat (you could use Sensor Port 1 location). All electronic interconnects and power are available through the NSL 20-pin connector for EyeStar Radio transmit. You have 6 mounting supports as shown in Figure 4.

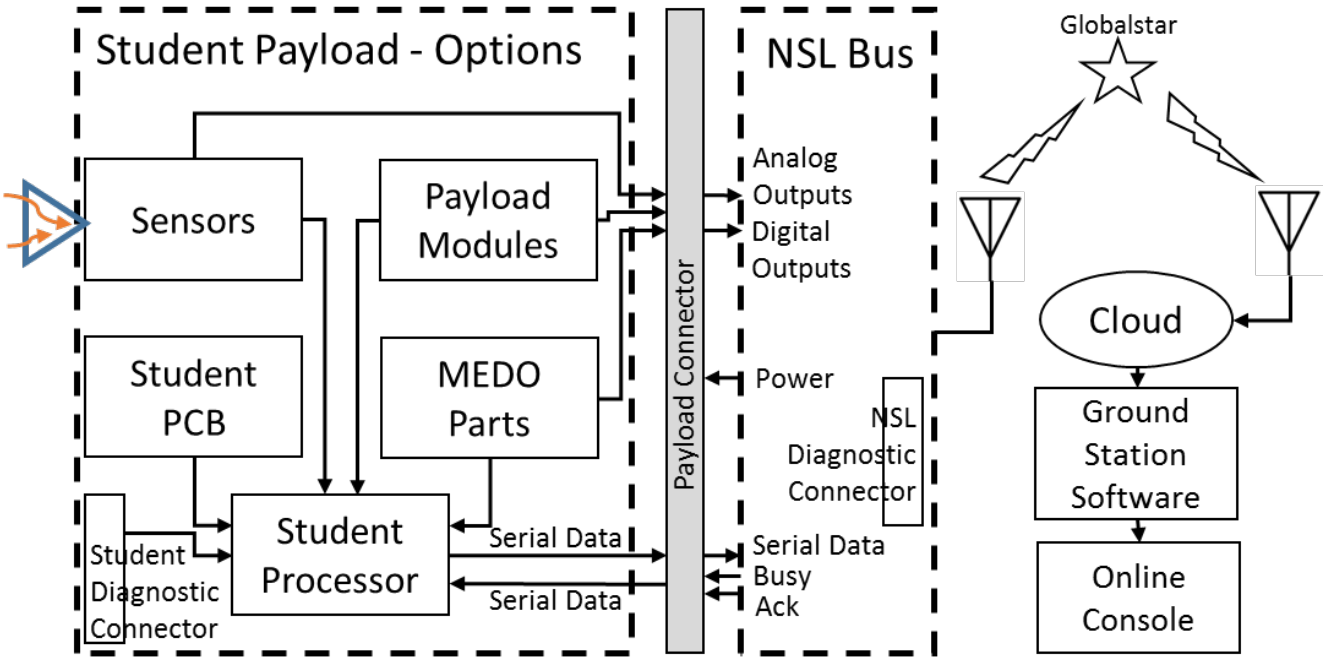
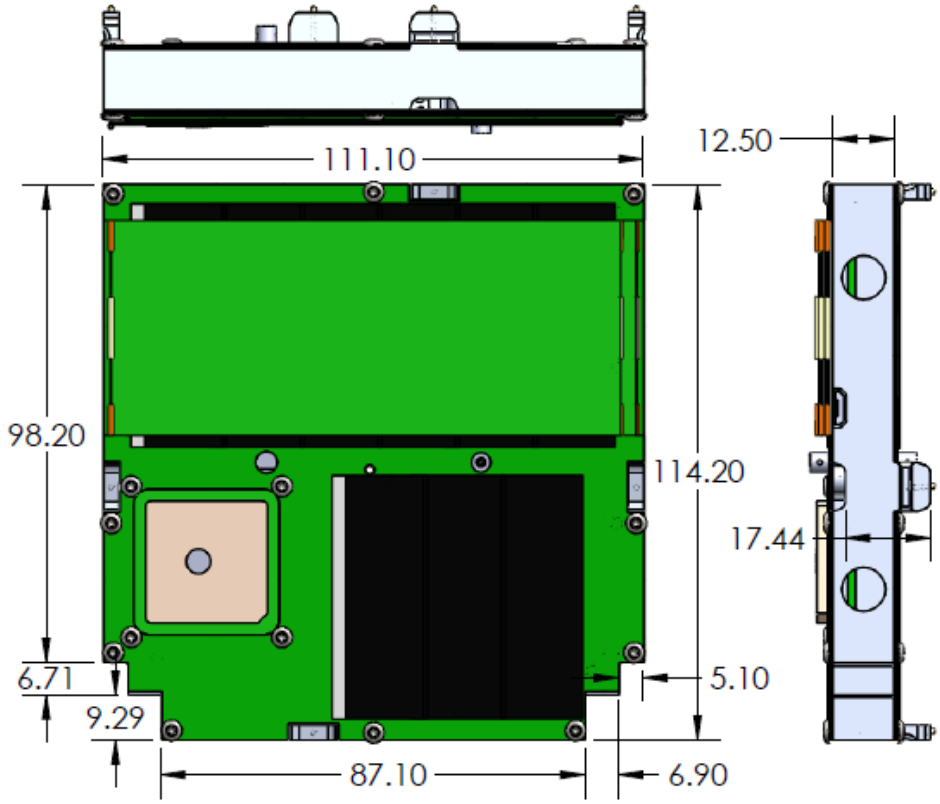


Figure 1 Payload Block Diagram

External View



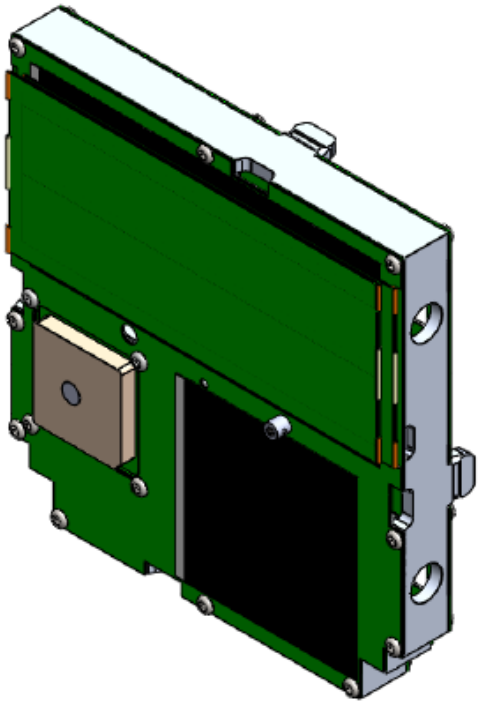


Figure 2 External View of ET-Sat. Shown without Rails as most will not have them

Student Payload Space

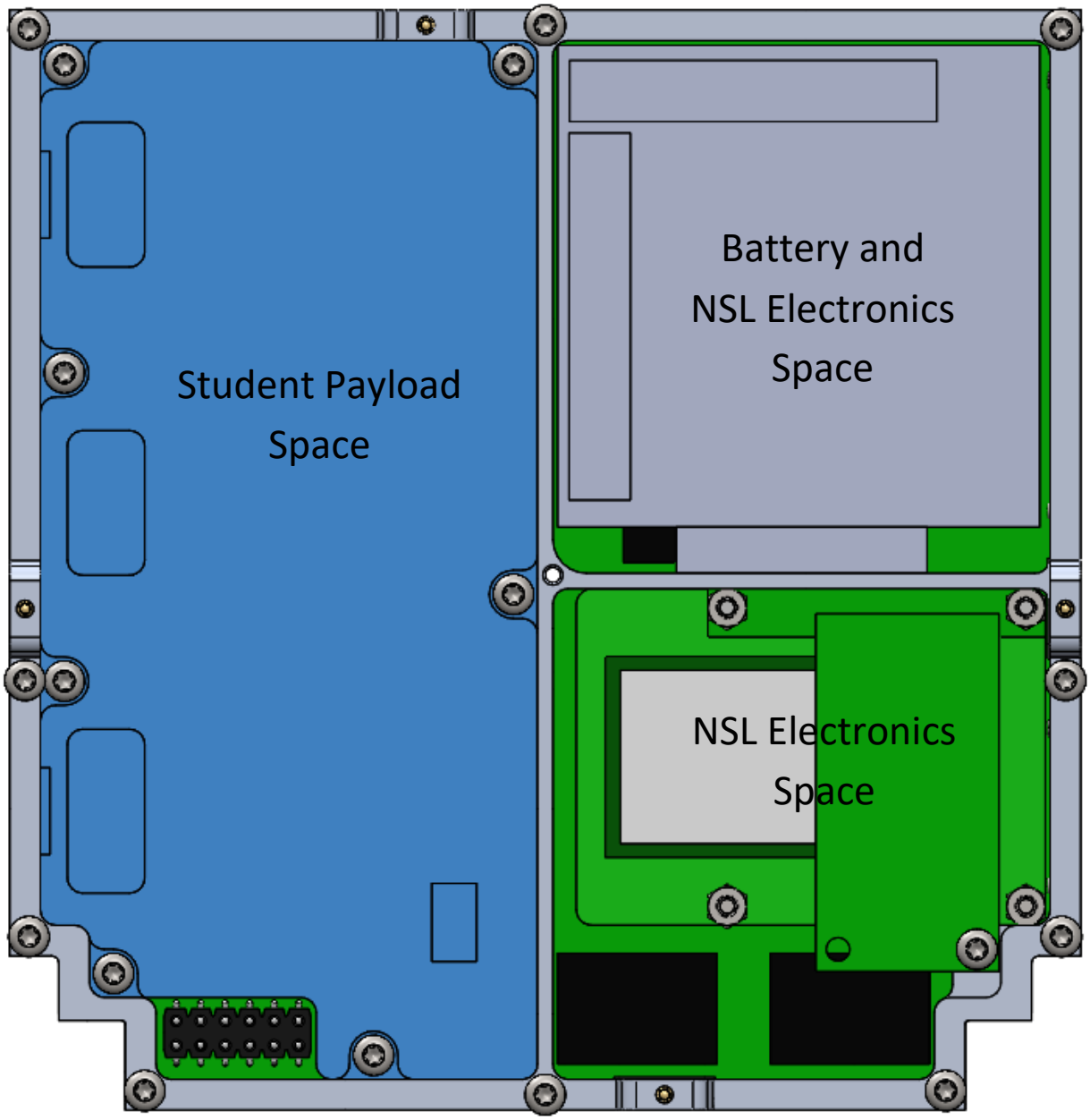


Figure 3 Blue portion is assigned Student Payload Space

Mechanical Layout

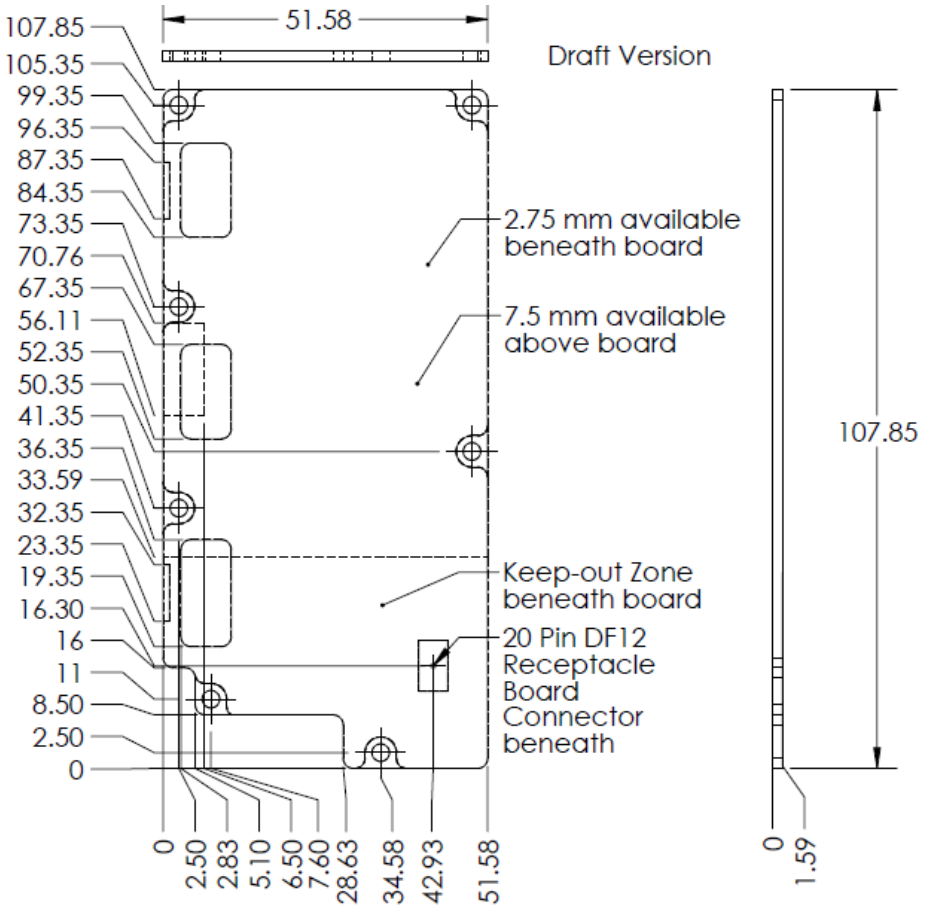
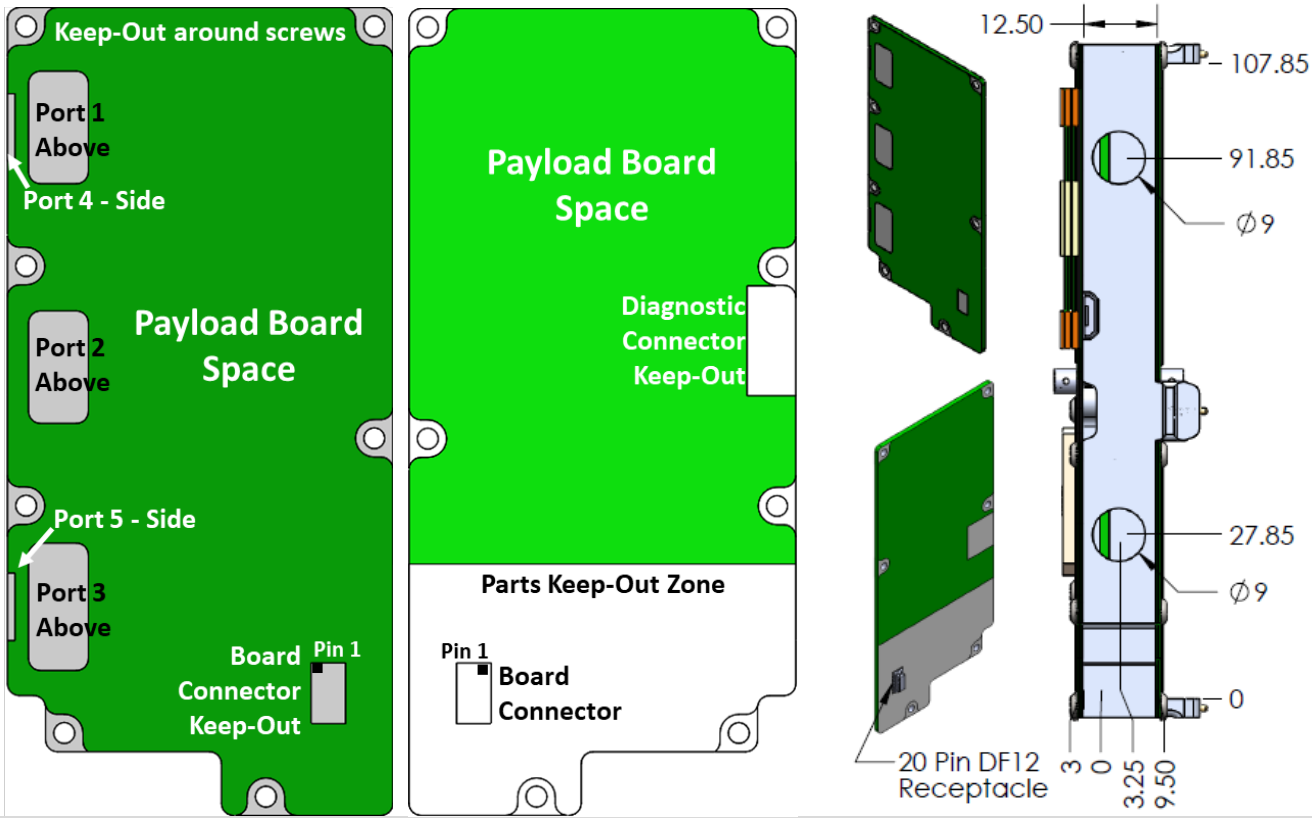


Figure 4 Layout of Student Payload Board Space

Note #2 clearance holes



Payload Available Space and Keep-Out Zones

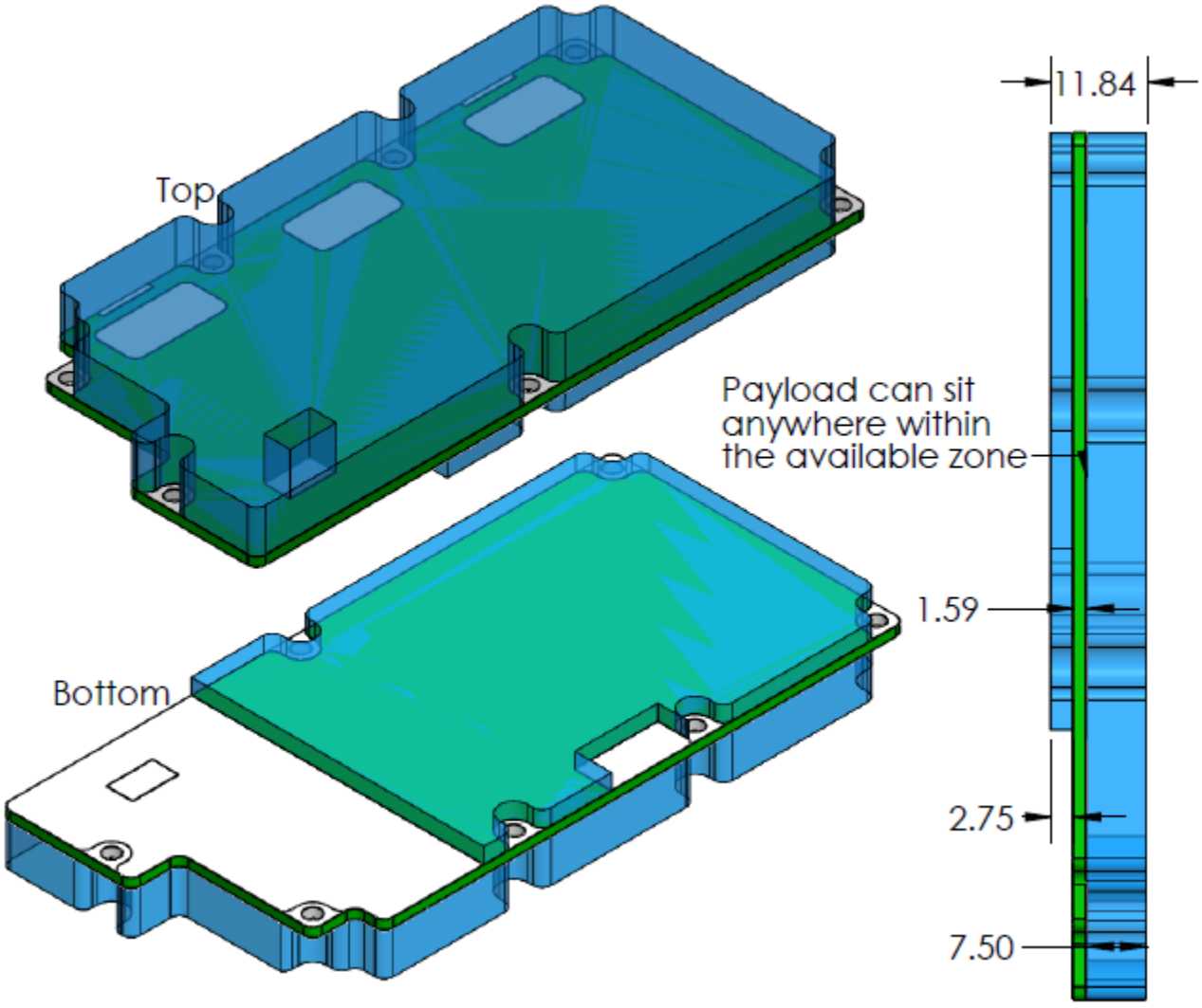


Figure 5 Keep-Out Zones and allowable space (Blue and green) for Student Payload. PCB boards can be placed anywhere within the allowable region.

DF12 Payload Interface Connector DF12(3.0)-20DS-0.5V(86)

Payload Board	Connector	NSL Board
	PWR	
	JP6.1	Analog Input 1 (0-5Vdc)
	PJ6.2	Analog Input 2 (0-5Vdc)
	JP6.3	Analog Input 3 (0-5Vdc)
	JP6.4	Analog Input 4 (0-5Vdc)
	JP6.5	Analog Input 5 (0-5Vdc)
	JP6.6	Analog Input 6 (0-5Vdc)
	JP6.7	Digital Input 1 (TTL)
	JP6.8	Digital Input 2 (TTL)
<<< MEDO RX Input (LVTTL)	JP6.9	<<< MEDO TX Output (LVTTL)
>>> MEDO TX Output (LVTTL)	JP6.10	>>> MEDO RX Input (LVTT)
>>> Serial TX Output (TTL)	JP6.11	>>> NSL Serial RX Input (TTL)
<<< Serial RX Input (TTL)	JP6.12	<<< NSL Serial TX Output (TTL)
<<< Serial BUSY	JP6.13	<<< NSL Serial BUSY Output (TTL)
	JP6.14	
	JP6.15	
	JP6.16	1W
	JP6.17	Switched +5.0Vdc (100mA MAX)
	JP6.18	Switched +3.3Vdc (100mA MAX)
	JP6.19	Ground
	JP6.20	Ground

JP6	
1	2
3	4
5	6
7	8
9	10
11	12
13	14
15	16
17	18
19	20

Figure 6 DF12 JP6 Layout, from above

Beacon Digital/Analog Interface Packet

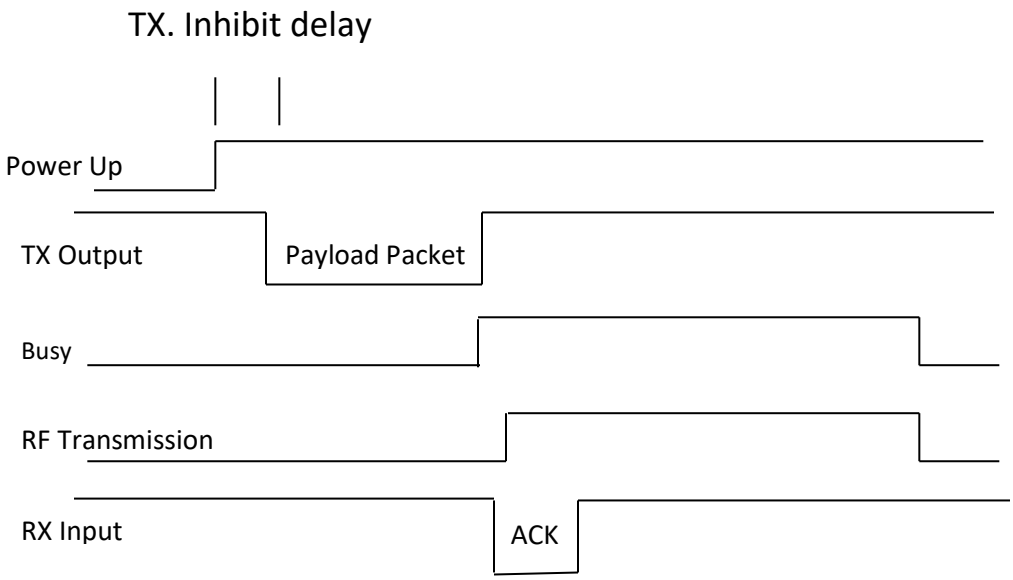
Funtion				Analog Inputs				1W	Packet	Digital				Aux. Inputs				
B5	A1	A2	A3	A4	A5	A6	VCC	TEMP	Counter	P1DI	X1	X2	X3	X4	X5	X6	X7	X8
1 Byte	2 Byte	2 Byte	2 Byte	2 Byte	2 Byte	2 Byte	2 Byte	2 Byte	2 Byte	1 Byte	2 Byte	2 Byte	2 Byte	2 Byte	2 Byte	2 Byte	2 Byte	2 Byte

Beacon Communication Packet Format

The Simplex radio will Beacon at at a set Beacon Rate (see Specifications), a time interval. This Beacon will send out a 36 byte packet of the health and safety of the satellite. Since health and safety only takes up 22 bytes, 13 bytes are available to be used by the Payload. 12 of these 13 bytes are for the 6 Analog inputs (A1 – A6), with 2 bytes each, and 1 byte total for the 2 Digital Inputs (P1DI). The radio will read each of these inputs at a set interval before it Beacons, and fill up the packet with your data before transmitting it.

Payload Serial Mode

If you would like more data sent than simply what is available in the Beacon packet, you can command the Simplex to transmit serially at any point that the radio is not Beaconing, and power is supplied to the Payload.



Payload Serial Communication Packet Format

Payload sends data to the modem when the BUSY signal is LOW. Once data is sent to the modem, the modem will return an ACK (Acknowledge) from RX Input to acknowledge the packet, or a NAK (No Acknowledge) if there is a problem with the packet. If the packet is good, the modem will set the BUSY line HI and send the data to the GlobalStar network. Once finished sending, the BUSY line is set back to LOW and the module waits to receive the next packet from the payload.

Serial Port

A half-duplex LVTTL / TTL / RS232 asynchronous serial port (UART) is the primary interface to payload. The serial port operates with the serial parameters of 38,400bps, 8 data bits, no parity, 1 stop bit. The Tx, Rx, and BUSY lines are 5V TTL.

Each data packet to the modem is sent in serial. Upon receiving the packet, the modem answers with an ACK if the packet is correct, and Transmits the packet. If the packet is incorrect, it will send a NAK back to the payload.

Payload packet format (Function A1)

Total packet size 38 bytes	
Preamble 3 bytes	Payload Data 35 byte
Fixed pattern (hex 50 50 50)	35 bytes Data

Payload Send Data

Header	Payload
50 50 50	35 Bytes

Modem ACK Response

AA 05 00

Modem NAK Response

AA 05 FF

Specifications

Power	Symbol	Minimum	Normal	Maximum	Units
Input voltage	JP6.17		5.0		V
	JP6.18		3.3		
Current		0		100	mA
Time power on/hour			10		min
Communication port					
Protocol			Serial N81		TTL
Bus voltage		3.0		5.2	V
Data rate			38.4		Kbits
Beacon Mode					
Beacon Rate		.25		60	Minute
Analog inputs					
Six	10bit	0		5	VDC
Source impedance			2.5K		Ohm
Digital inputs					
Two	TTL	0	-	5	VDC
Physical					
Mass	Total			280	g
	NSL Bus		150		g
	Payload	0		130	g
Operating Temperature		-30		60	C

ET-Sat System Layout

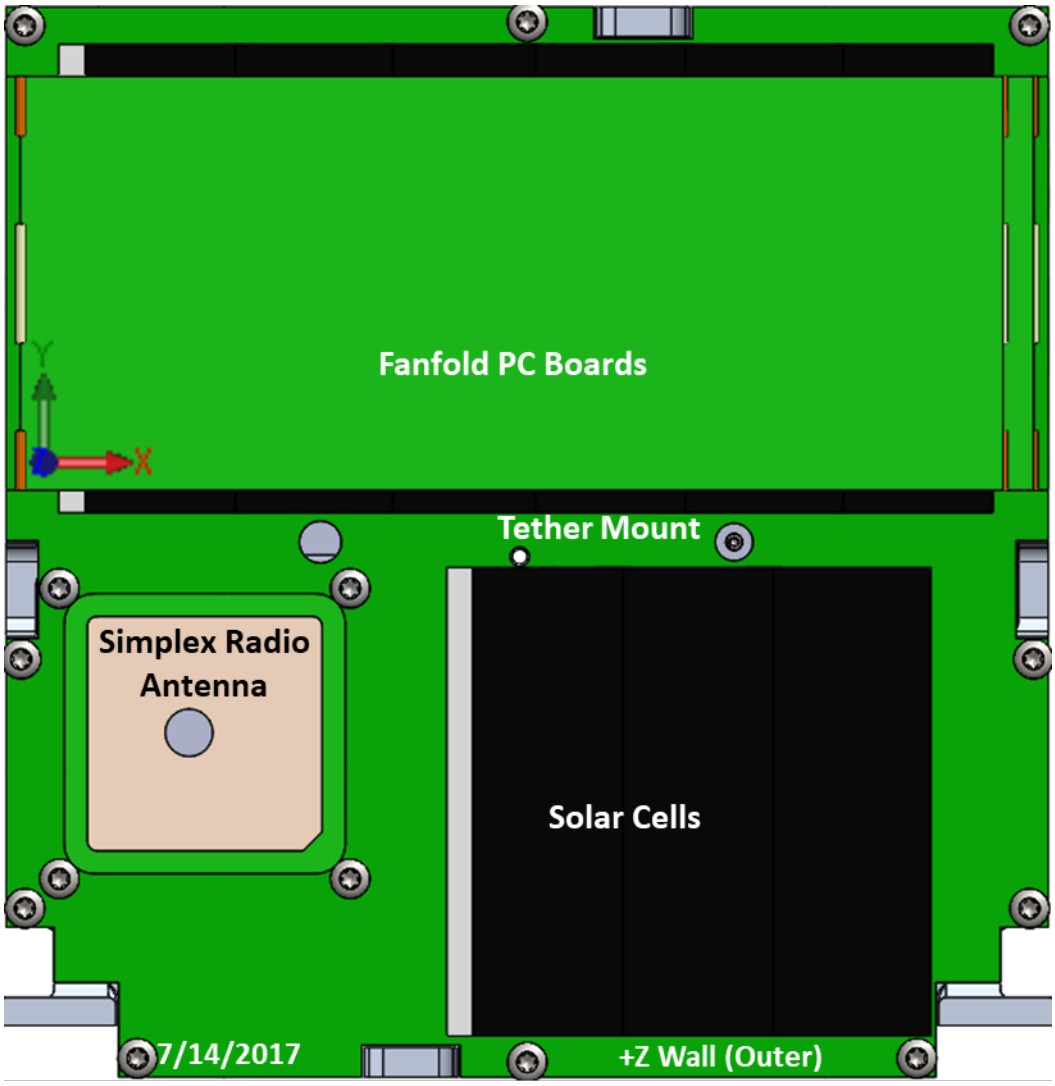


Figure 7 System layout of Outer +Z Wall of ET-Sat. This diagram is shown on the distributed Demo Units

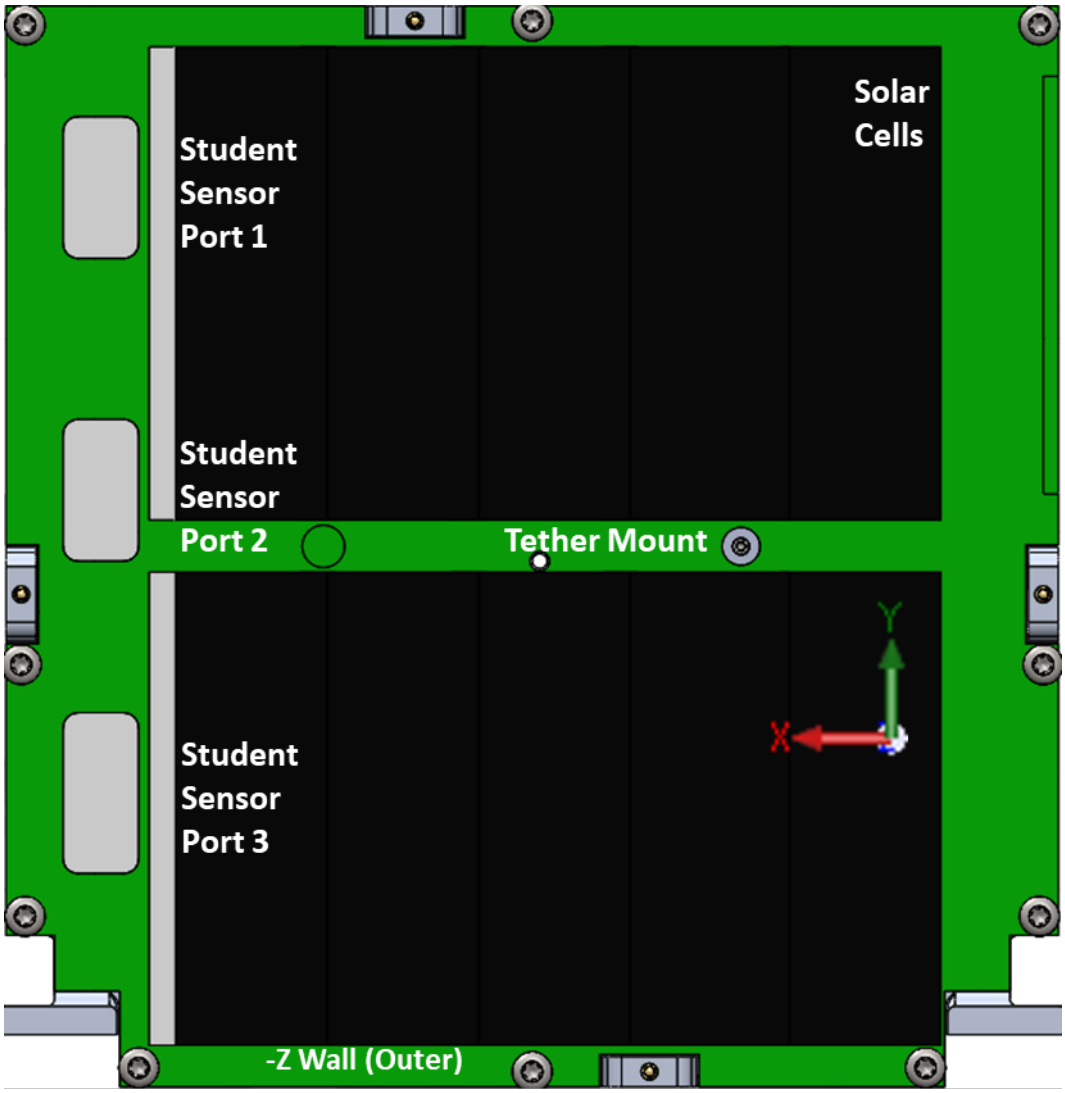


Figure 8 System layout of Outer -Z Wall of ET-Sat. This diagram is shown on the distributed Demo Units

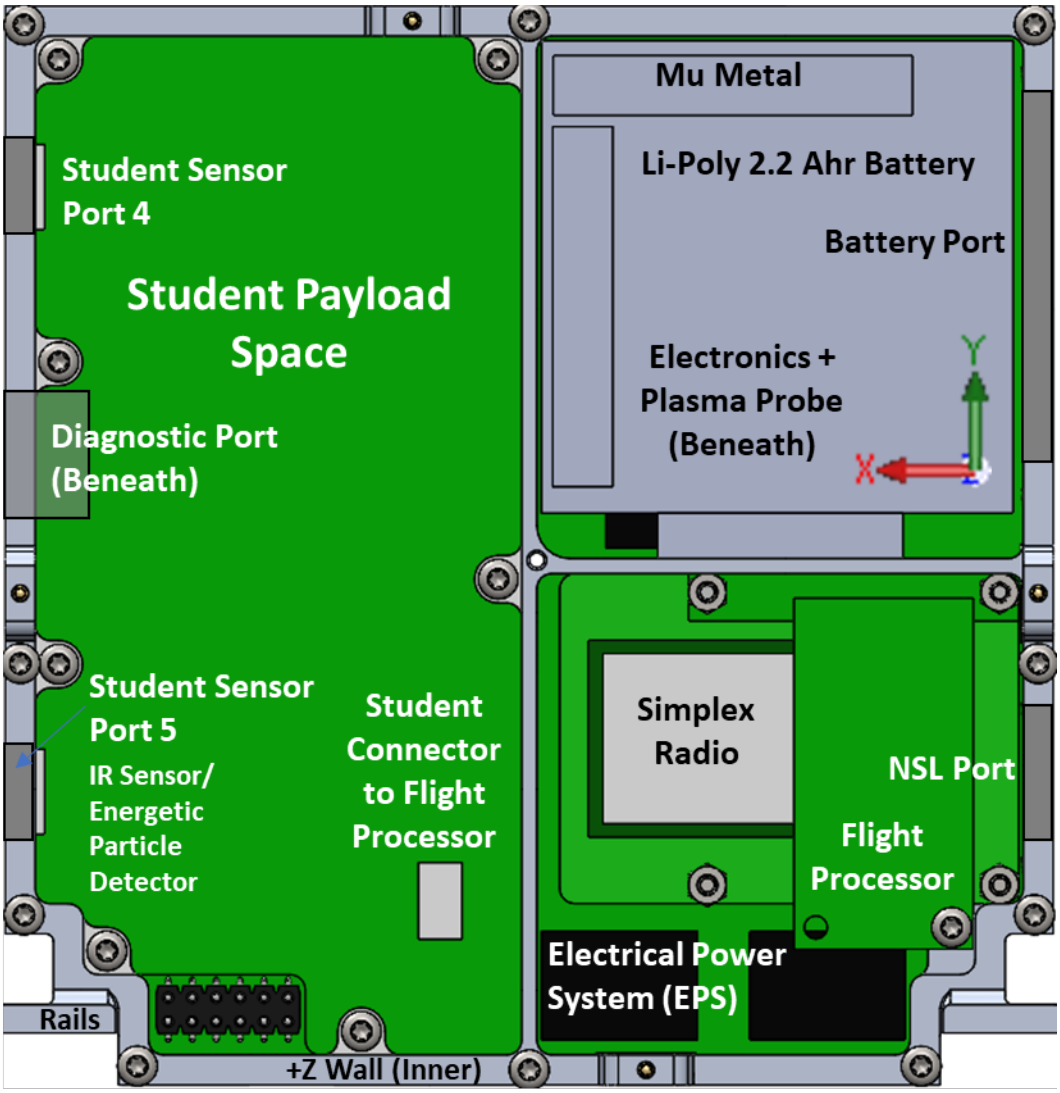


Figure 9 System layout of Inner +Z Wall of ET-Sat. This diagram is shown on the distributed Demo Units

Figure 10 System layout of Inner -Z Wall of ET-Sat. This diagram is shown on the distributed Demo Units