

1.0 SCOPE

1.1 Document Purpose

This Installation Requirements Document:

- a. defines and controls specific requirements for the subassembly installation of a payload by the NSTS into the Shuttle Cargo Bay.
- b. is not intended to duplicate or replace data provided in other program documents, i.e., PIP, PIP Annexes, ICD, etc.

1.2 Definition

The installation identified in this document consists of the MightySat payload and Satellite de Aplicaciones/Cientifico - A (SAC-A) subassembly interfaces. The interfaces defined between the Orbiter and the Cargo Element are documented in the MightySat Interface Control Document (ICD), ICD-A-21358. The Mightysat 1 Payload assembly consists of the MightySat experiment mounted on a Hitchhiker (HH) carrier. The HH equipment consists of one HH Light Weight Avionics Plate (LAP), one HH avionics box, one 5.0 ft³ Get-Away-Special (GAS) canister, and one HH Adapter Beam Assembly (ABA). The SAC-A payload assembly consists of one 5.0 ft³ canister and one HH ABA.

1.3 Effectivity

This document is applicable to all Shuttle Orbiter and Cargo Element subassembly configurations unless otherwise specified.

1.4 Configuration Control

Configuration control shall be initiated upon signature approval and maintained in accordance with the Mission Integration Control Board Configuration Management Procedures, NSTS 07700 Vol IV.

1.5 Relationship to the Interface Control Document (ICD)

The IRD is not intended to duplicate any data in the Interface Control Document (ICD). The MightySat ICD defines and controls the design of interfaces between the Shuttle Orbiter and the Payload. The IRD defines and controls the installation procedure of Cargo Element assemblies which do not mechanically interface with NSTS hardware. In the event of a conflict between MightySat ICD and the IRD, the ICD will take precedence.

2.0 DOCUMENTATION

2.1 Applicable Documents

The following documents form a part of this IRD to the extent specified herein.

ICD-A-21358 Current Issue	Shuttle Orbiter / MightySat Cargo Element Interfaces (Ref. Para. 1.1, 1.5, 3.0, 4.0)
NSTS 07700 Current Issue	Mission Integration Control Board Configuration Management Procedures (Ref. Para. 1.4)
STS87-0551 Current Issue	Critical Installation Sequence Review Criteria for Payload Mission Kits (Ref. Para. 3.1)
STS89-0366 Current Issue	Critical Installation Sequence Review Criteria for Orbiter Mission Kits (Ref. Para. 3.1)
MA0113-306 Current Issue	Electrical Bond Space Shuttle (Ref. Para. 6.1)
MA0101-301 Current Issue	Installation of Threaded and Collared Fasteners (Ref. Para. 6.1)
MS33540 Current Issue	Safety Wiring and Cotter Pinning, General Practices for (Ref. Para. 6.1)
MIL-STD-5088 Current Issue	Wiring Aerospace Vehicle (Ref. Para. 6.2)
MA0106-373 Current Issue	Sealing With Single Component Thixotropic Silicone Rubber - Low Outgassing Applications (Ref. Para. 6.1)
MA0112-303 Current Issue	Applied Lubricants For Use On Various Spacecraft Applications (Ref. Para. 6.1)

3.0 Certification

The Payload Customer shall be responsible for the certification of the MightySat using the Orbiter environments defined in ICD-A-21358. The Payload Customer shall also be responsible for the installation certification of the payload subassemblies defined in this document.

3.1 Safety Critical Installation

The Payload Customer shall be responsible for identifying safety critical installation sequences in accordance with STS89-0366 and STS87-0551.

4.0 Payload Installation Steps

The MightySat 1 /SAC-A subassemblies to be installed are as follows:

1. The Hitchhiker (HH) Adapter Beam Assembly (ABA) shall be mounted to the Orbiter sidewall prior to MightySat 1/SAC-A payload installation. The ABA to Orbiter interfaces are defined in ICD-A-21358, Para 3.0.2.1.1, Figure 3.0.2.1.1-1.
2. The HH Avionics/Light Weight Avionics Plate (LAP) assembly shall be mounted to the HH ABA. The Avionics/LAP assembly shall be installed as defined in Section 5.1. (This step is not applicable for SAC-A element)
3. The electrical bonding of the LAP assembly to the HH ABA shall be as defined in Section 5.1.
4. The 5.0 ft³ MightySat 1 /SAC-A canisters shall be mounted in bay 6 for MightySat 1 and bay 2 for SAC-A as defined in Section 5.1.
5. The electrical bonding of the payload to the HH ABA shall be as defined in Section 5.1.
6. The cable routing and connector mating shall be as defined in Section 5.2.
7. The thermal blanket handling shall be as defined in Section 5.3.

5.0 Dimensions and tolerances

Unless otherwise specified, all linear dimensions are in inches, all angular dimensions are in degrees, and the tolerances are as follows:

Decimals:	X.X =	± 0.1
	X.XX =	± 0.03
	X.XXX =	± 0.010

Fractions:	$\pm 1/16$
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Angles:	$\pm 0^{\circ}30'$
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6.0 Subassembly Installation Hardware and Requirements

The Payload Customer shall provide all installation hardware required, unless otherwise stated. The payload subassembly installation requirements shall be as defined in this section.

6.1 Mechanical Installation and Electrical Bonding

The general orientation of the MightySat payload; mechanical installation and electrical bonding for the MightySat canister; and the HH Avionics/LAP installation and electrical bonding are as shown in Figure 6.1-1.

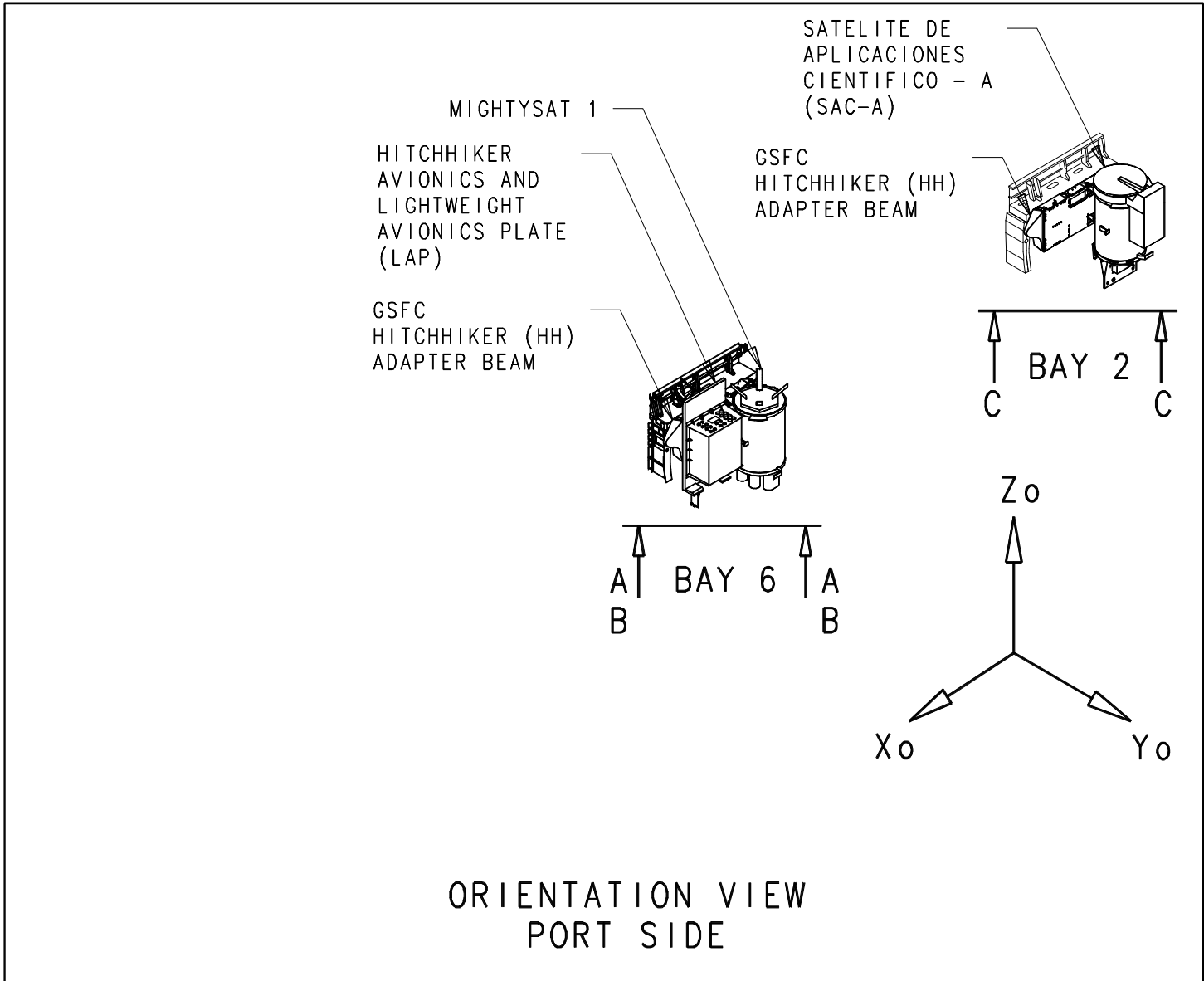
6.2 Cable Routing and Connector Mating

MightySat electrical cable interfaces will be as shown in Figure 6.2-1. The Payload will verify all connector mates and cable routing are in accordance with MIL-STD-5088 and is as shown in Figure 6.2-1. Tie wraps shall be provided by Payload. There are no safety critical wiring installations. The cable installation sequence is as shown in Figure 6.2-1.

6.3 Thermal Blanket

After the HH LAP is installed, secure the thermal blanket sides to their original positions. Upon completion of the cable installation, close-out thermal boot assemblies in two places by tying the lacing cord located at the bottom of each thermal boot assembly.

FIGURE 6.1-1 MECHANICAL INSTALLATION AND BONDING (SHEET 1 OF 6)



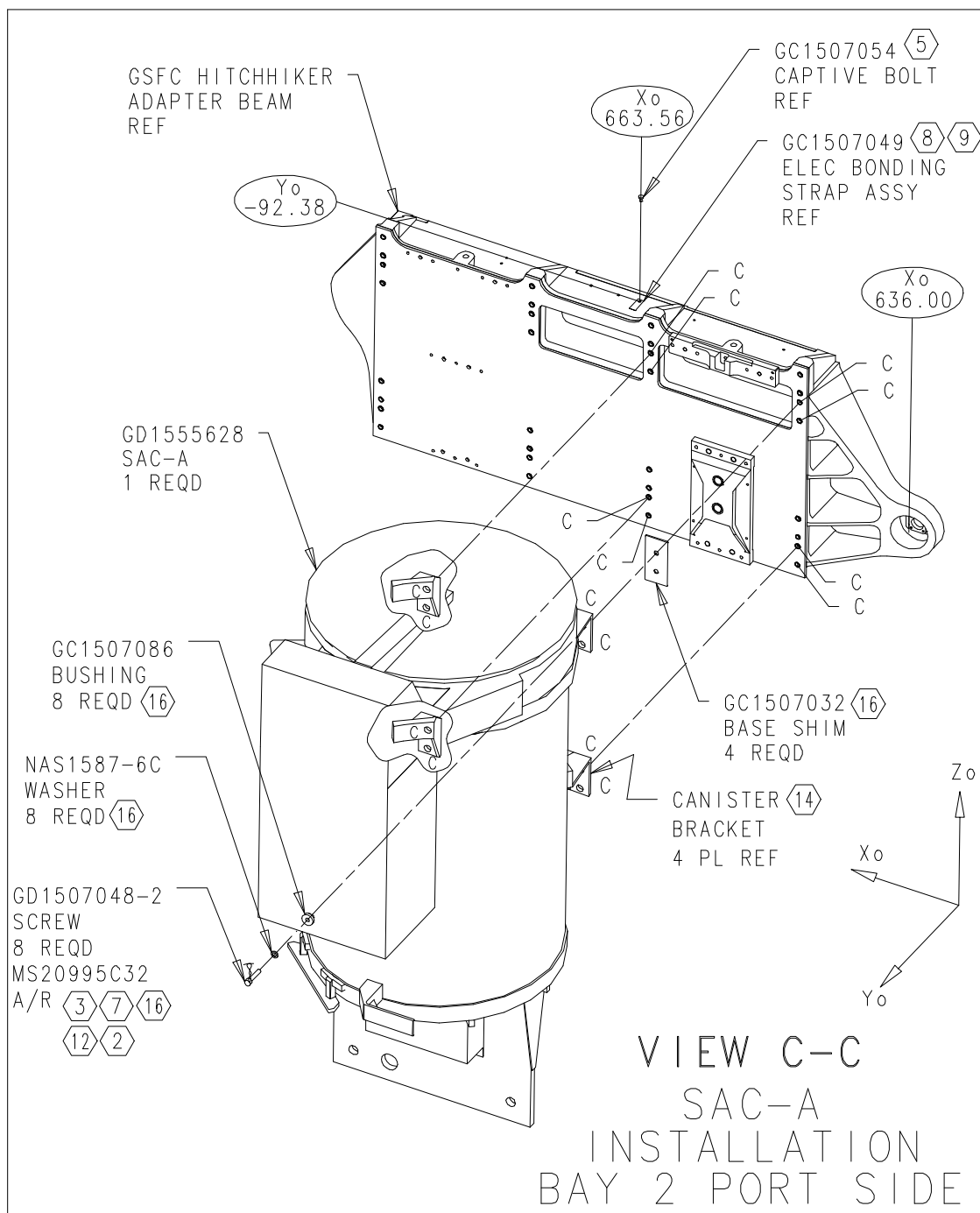


FIGURE 6.1-1 MECHANICAL INSTALLATION AND BONDING (SHEET 2 OF 6)

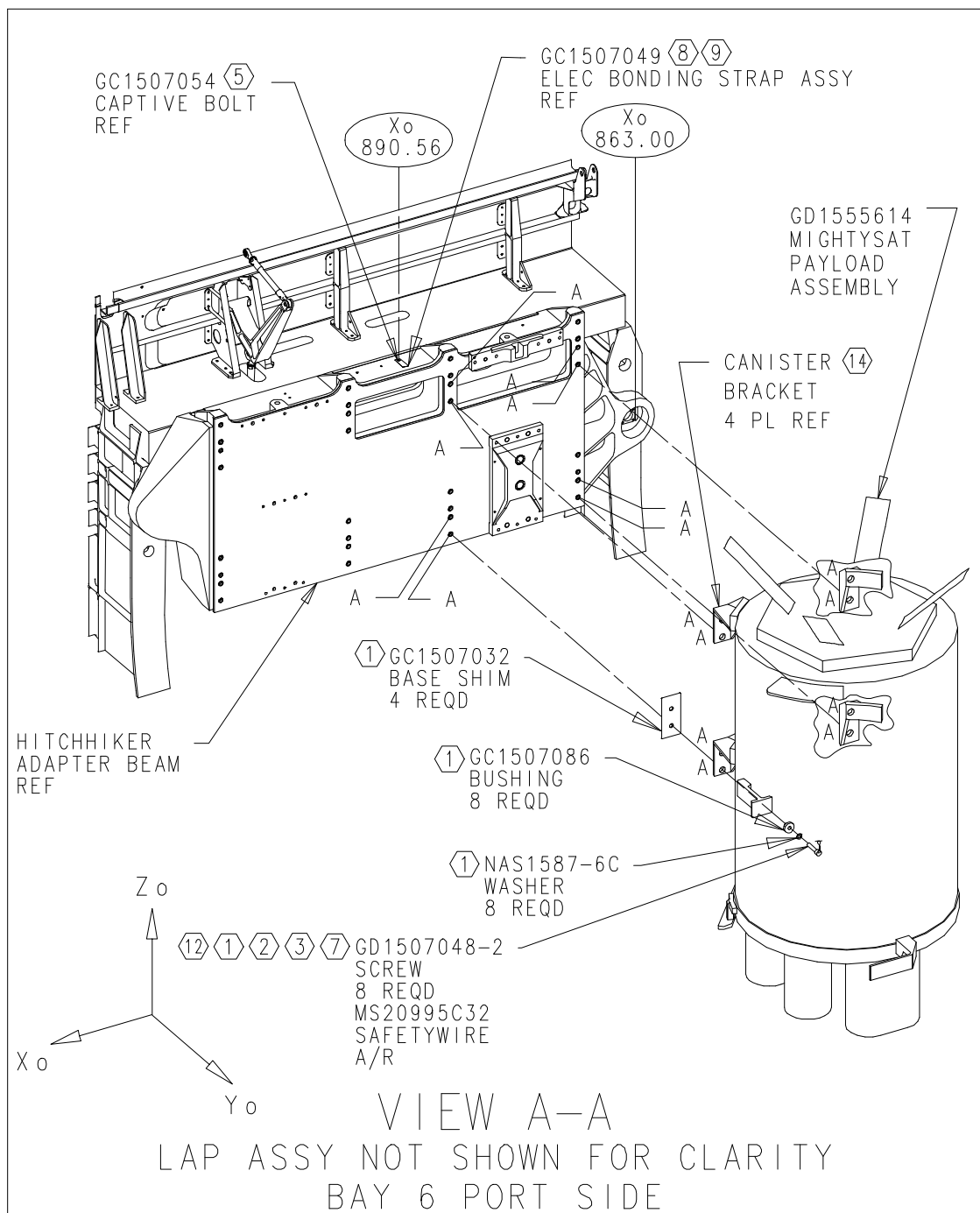


FIGURE 6.1-1 MECHANICAL INSTALLATION AND BONDING (SHEET 3 OF 6)

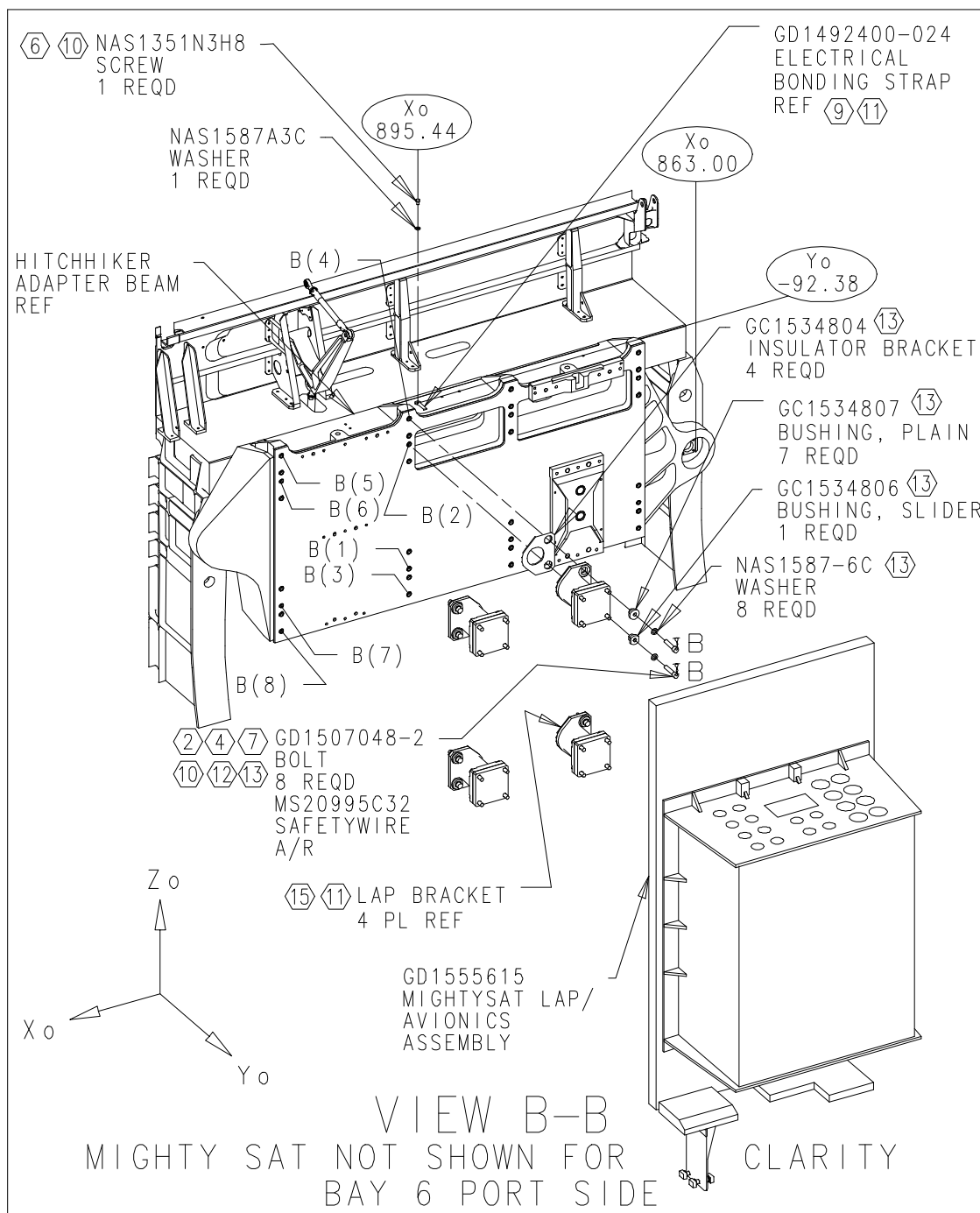


FIGURE 6.1-1 MECHANICAL INSTALLATION AND BONDING (SHEET 4 OF 6)

1. ALL HARDWARE SUPPLIED BY PAYLOAD CONTRACTOR UNLESS OTHERWISE SPECIFIED.
- ① 2. CANISTER ATTACH HARDWARE PROVIDED AS PART OF GSFC KIT GD1491527, CLEANED & PACKAGED TO GSFC CLEANING SPECIFICATION SSPP-PROC-161. INSTALLATION OF GD1507048-2 (SCREW), NAS1587-6C (WASHER), AND GC1507086 (BUSHING), GC1507032 (BASE SHIM) TO BE LOCATED THROUGH ALL HOLES CODED "A", 8 TOTAL.
- ② 3. "THIS STEP IS CRITICAL" - ⑦ INSTALL THREADED FASTENERS PER MA0101-301 AND TORQUE AS FOLLOWS WHERE INDICATED:
 - ③ 395 - 405 IN-LBS.
 - ④ A) TORQUE BOLTS TO 180-210 IN-LBS WITH TORQUE SEQUENCE BY LOCATION NUMBER (X) AS SHOWN.
B) TORQUE BOLTS TO FINAL TORQUE OF 320-340 IN-LBS WITH TORQUE SEQUENCE BY LOCATION NUMBER (X) AS SHOWN.
4. INSTALL THREADED FASTENERS PER MA0101-301 AND TORQUE AS FOLLOWS WHERE INDICATED:
 - ⑤ 23 - 25 IN-LBS
 - ⑥ 27 - 33 IN-LBS
- ⑦ 5. THIS STEP HAS BEEN IDENTIFIED AS PART OF A CRITICAL INSTALLATION SEQUENCE THAT IF PERFORMED IMPROPERLY MAY RESULT IN A CRITICALITY 1 OR 1R EVENT.
- ⑧ 6. MOUNTED TO CANISTER BY PAYLOAD CONTRACTOR PRIOR TO INSTALLATION TO ADAPTER BEAM.
- ⑨ 7. ELECTRICAL BOND AND TEST PER ROCKWELL SPECIFICATION MA0113-306, (CLASS R, TYPE I). MAXIMUM RESISTANCE NOT TO EXCEED 2.5 MILLIOHMS, (REF: MIL-B-5087B).
- ⑩ 8. DELETED.
- ⑪ 9. MOUNTED TO AVIONICS/LAP ASSY BY PAYLOAD CONTRACTOR PRIOR TO INSTALLATION TO ADAPTER BEAM.

FIGURE 6.1-1 MECHANICAL INSTALLATION AND BONDING (SHEET 5 OF 6)

12. INSTALL SPACE SHUTTLE PROGRAM (SSP) PROVIDED SAFETY WIRE, MS20995C32, PER MA0101-301 AFTER TORQUEING USING DOUBLE TWIST METHOD.
13. LAP ATTACH HARDWARE PROVIDED AS PART OF GSFC KIT GD1491531, CLEANED AND PACKAGED TO GSFC CLEANING SPECIFICATION SSPP-PROC-161. INSTALLATION OF GD1507048-2 (BOLT), NAS1587-6C (WASHER), GC1534807/GC1534806 (BUSHING), GC1534804 (INSULATOR BRACKET) TO BE LOCATED THROUGH ALL HOLES CODED "B", 8 TOTAL.
12. THE GSFC GAS BEAM INSERTS (INTERNAL THREADS) ARE PRE-LUBRICATED WITH APIEZON L LUBRICANT BY THE PAYLOAD PRIOR TO INSTALLATION.
14. THE BEAM MATING SURFACES OF EACH CANISTER BRACKET ARE PRE-LUBRICATED WITH APIEZON L LUBRICANT BY THE PAYLOAD CONTRACTOR PRIOR TO INSTALLATION. CARE SHOULD BE TAKEN DURING HANDLING AND INSTALLATION TO KEEP FROM TRANSFERRING THE LUBRICATION TO ANY OTHER PARTS.
15. SURFACES OF THE LAP BRACKET ARE PRE-LUBRICATED WITH BRAYCOTE 601 BY THE PAYLOAD CONTRACTOR PRIOR TO INSTALLATION:
- A. THE MATING SURFACES OF THE BRACKET.
 - B. THE BUSHING SLIDE SURFACE OF THE XY BRACKET (AT THE GC1534806 BUSHING LOCATION).
- CARE SHOULD BE TAKEN DURING HANDLING AND INSTALLATION TO KEEP FROM TRANSFERRING THE LUBRICATION TO ANY OTHER PARTS.
16. CANISTER ATTACH HARDWARE SHALL BE CLEANED & PACKAGED TO GSFC CLEANING SPECIFICATION SSPP-PROC-161. INSTALLATION OF GD1507048-2 (SCREW), NAS1587-6C (WASHER), AND GC1507086 (BUSHING), GC1507032 (BASE SHIM) TO BE LOCATED THROUGH ALL HOLES CODED "C", 8 TOTAL.

FIGURE 6.1-1 MECHANICAL INSTALLATION AND BONDING (SHEET 6 OF 6)

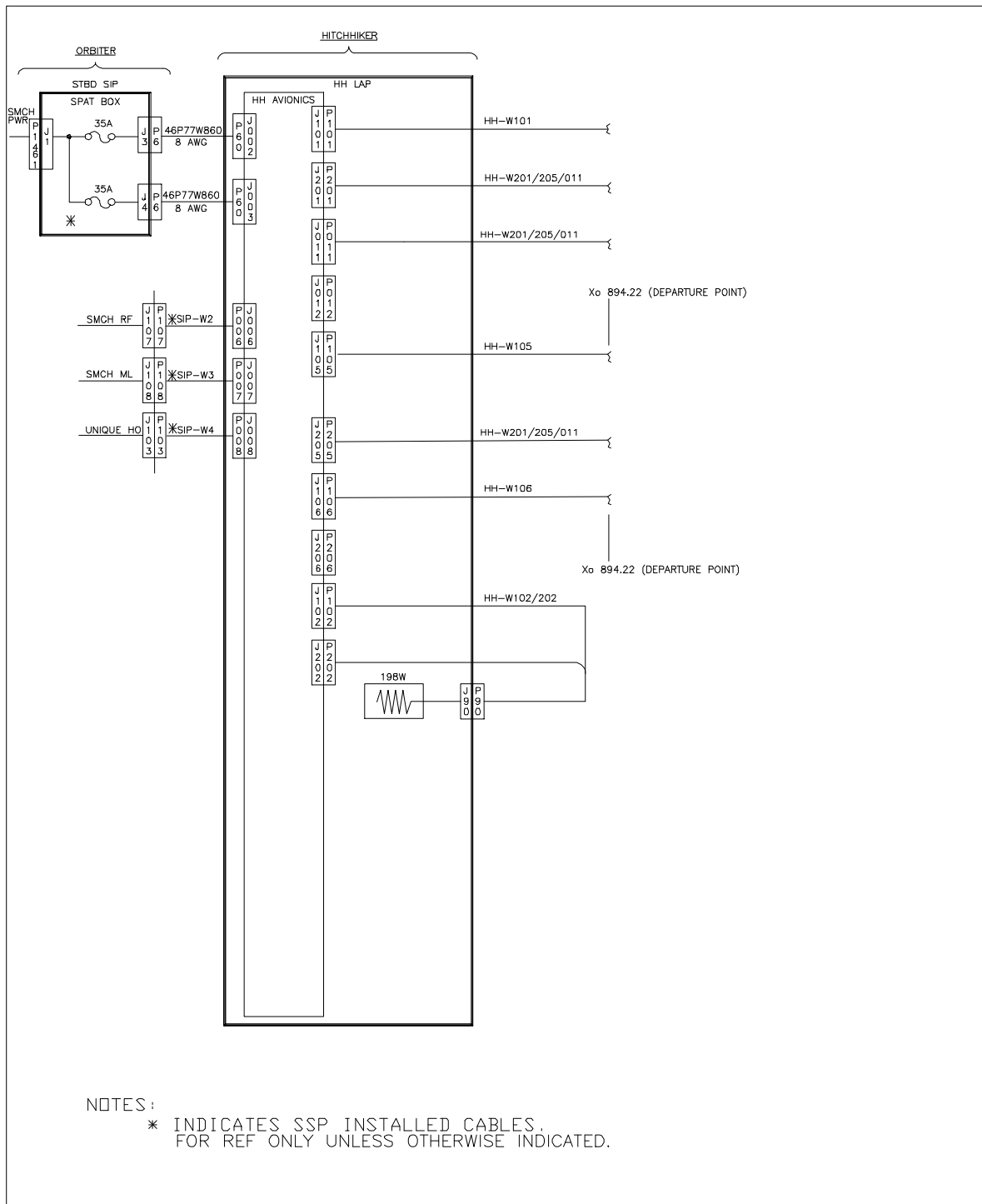


FIGURE 6.2-1 (SHEET 1 OF 9)
MIGHTYSAT 1 PORT SIDE CABLE INSTALLATION ASSEMBLY

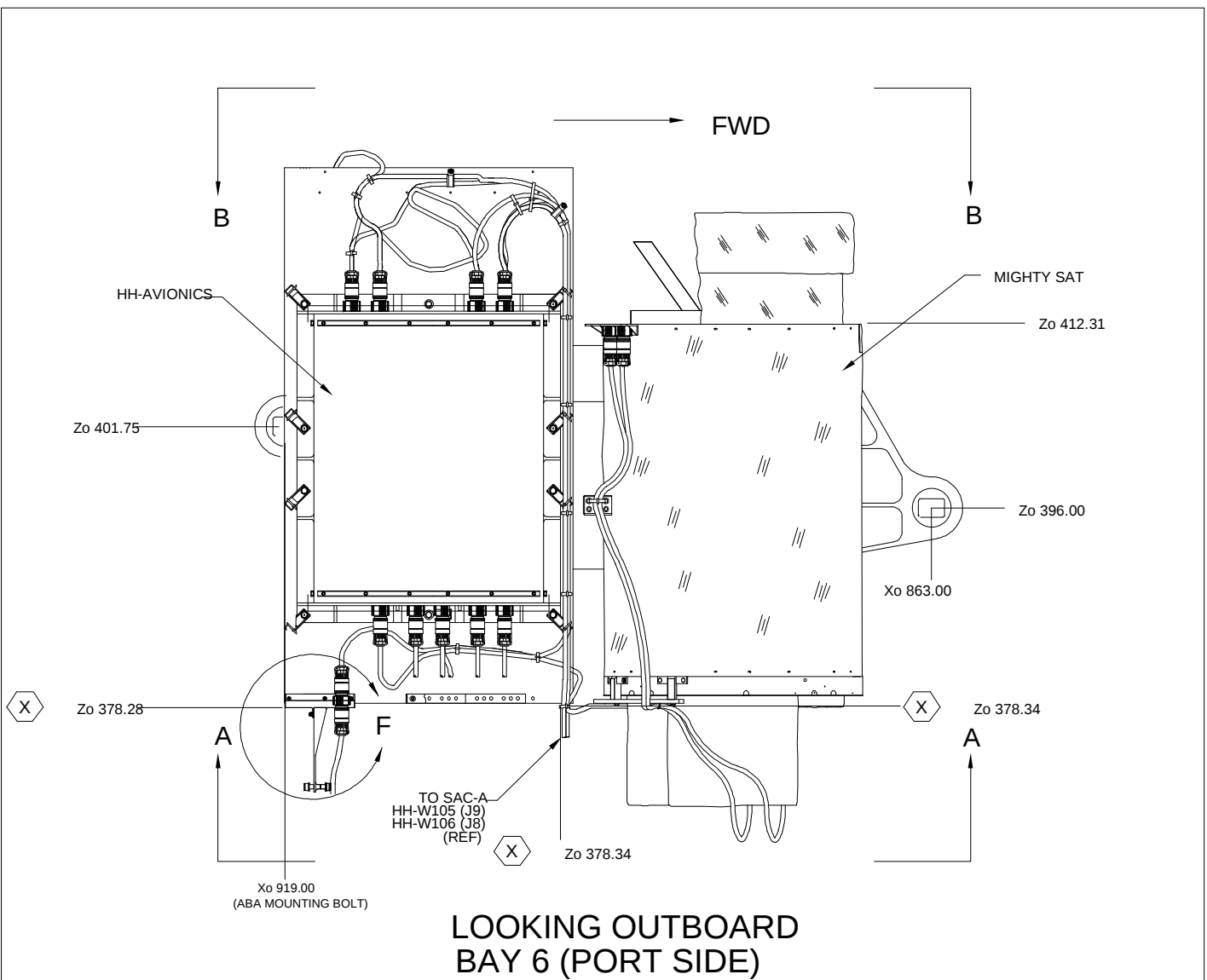


FIGURE 6.2-1 (SHEET 3 OF 9)
MIGHTYSAT 1 PORT SIDE CABLE INSTALLATION ASSEMBLY

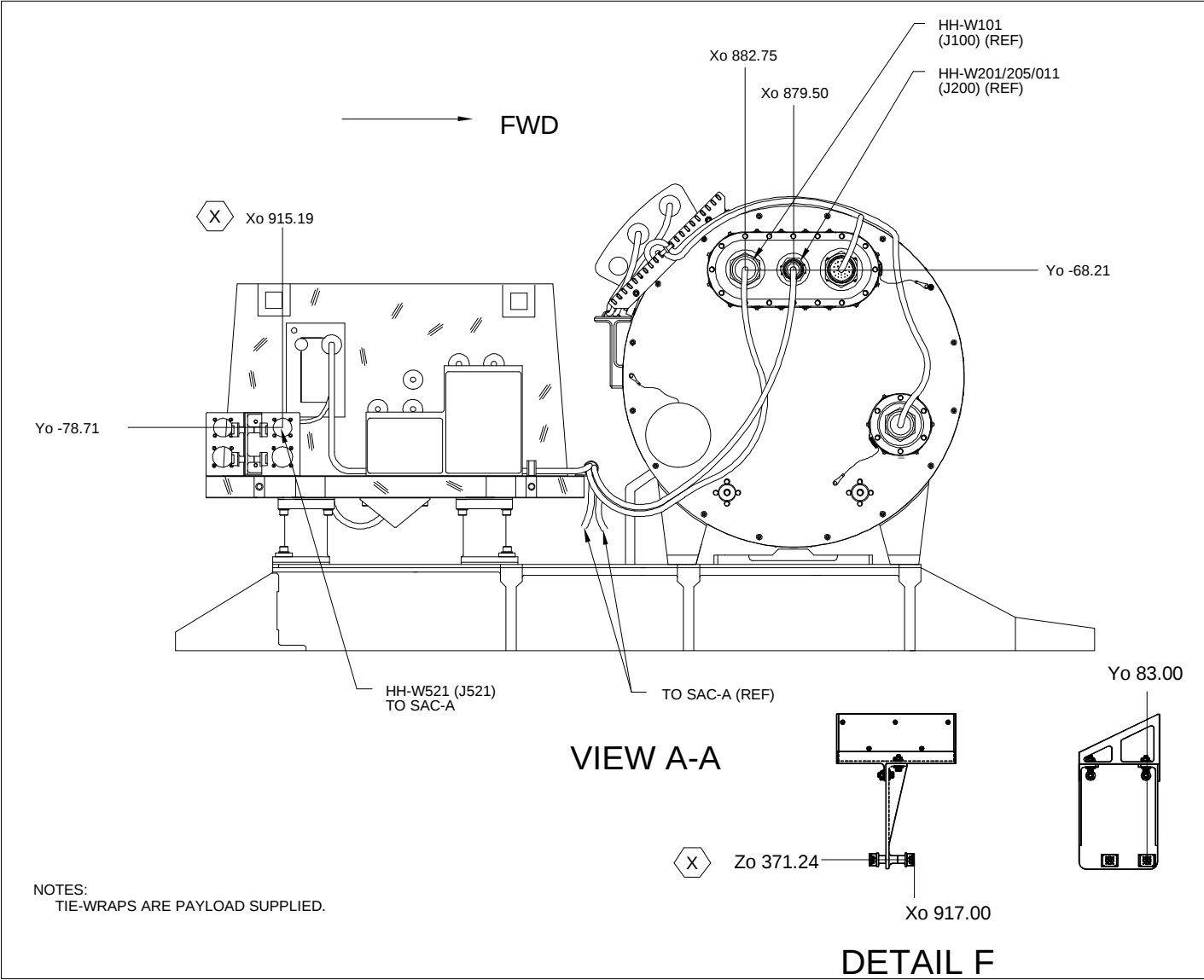


FIGURE 6.2-1 (SHEET 4 OF 9)
MIGHTYSAT 1 PORT SIDE CABLE INSTALLATION ASSEMBLY

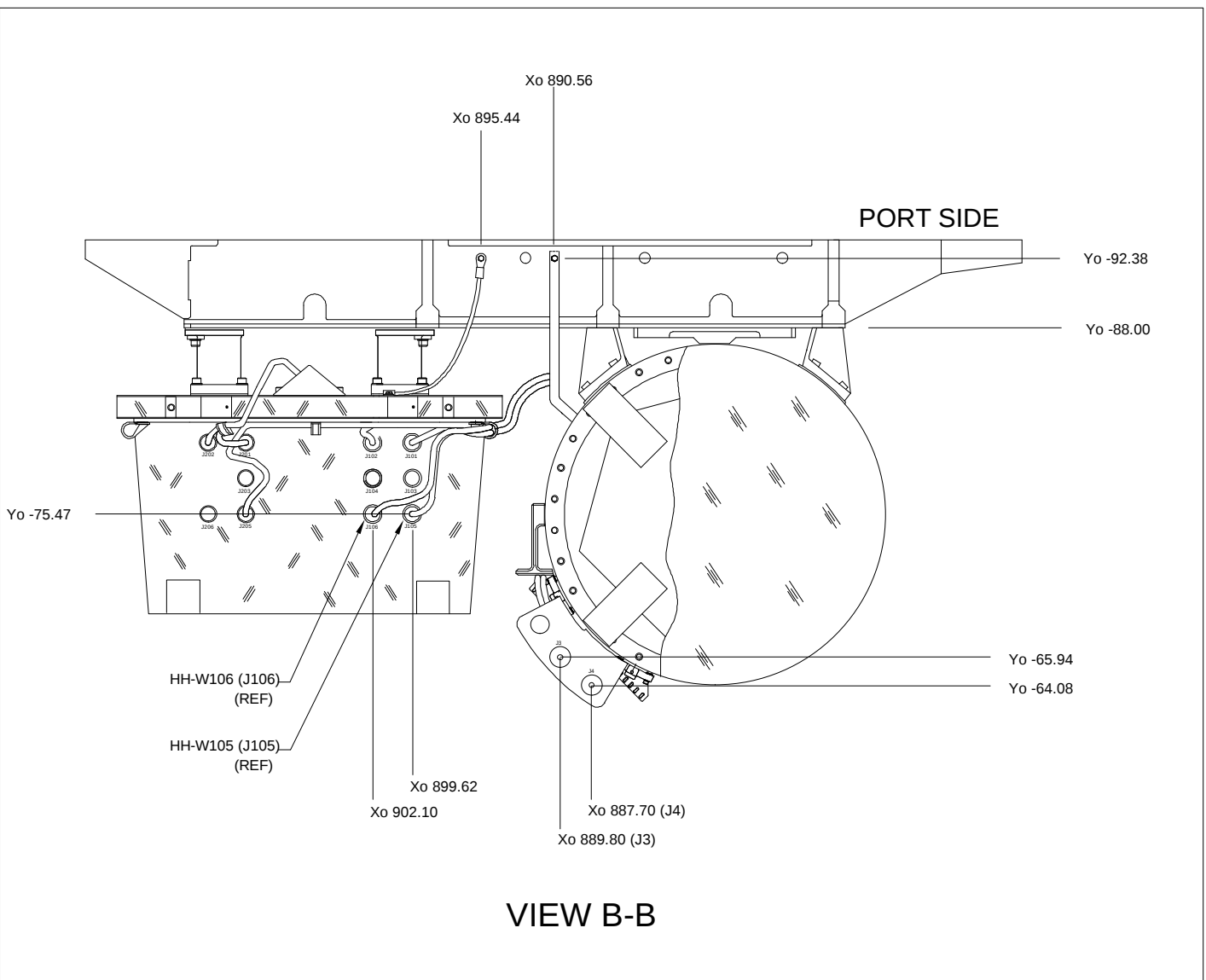


FIGURE 6.2-1 (SHEET 5 OF 9)
MIGHTYSAT 1 PORT SIDE CABLE INSTALLATION ASSEMBLY

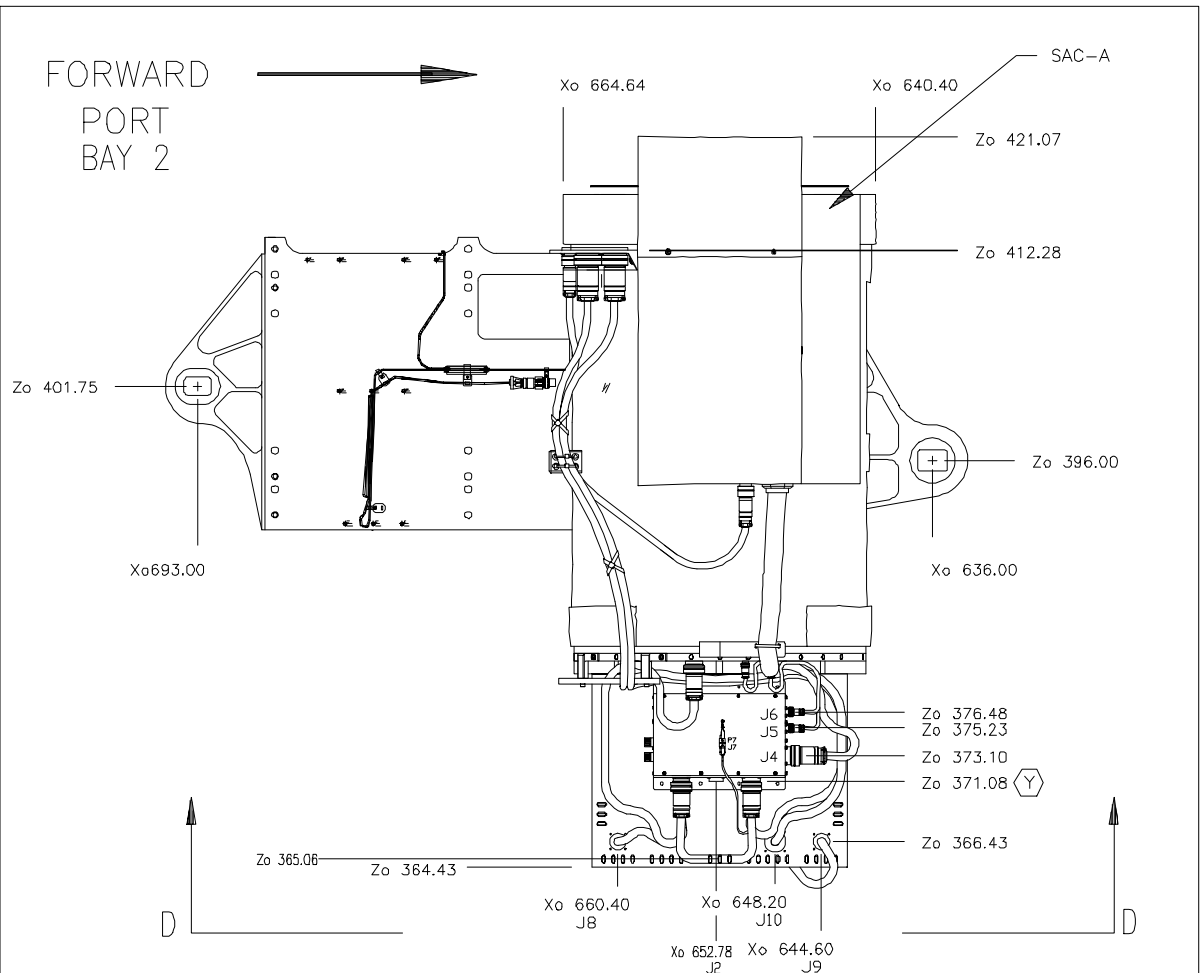


FIGURE 6.2-1 (SHEET 6 OF 9)
MIGHTYSAT 1 PORT SIDE CABLE INSTALLATION ASSEMBLY

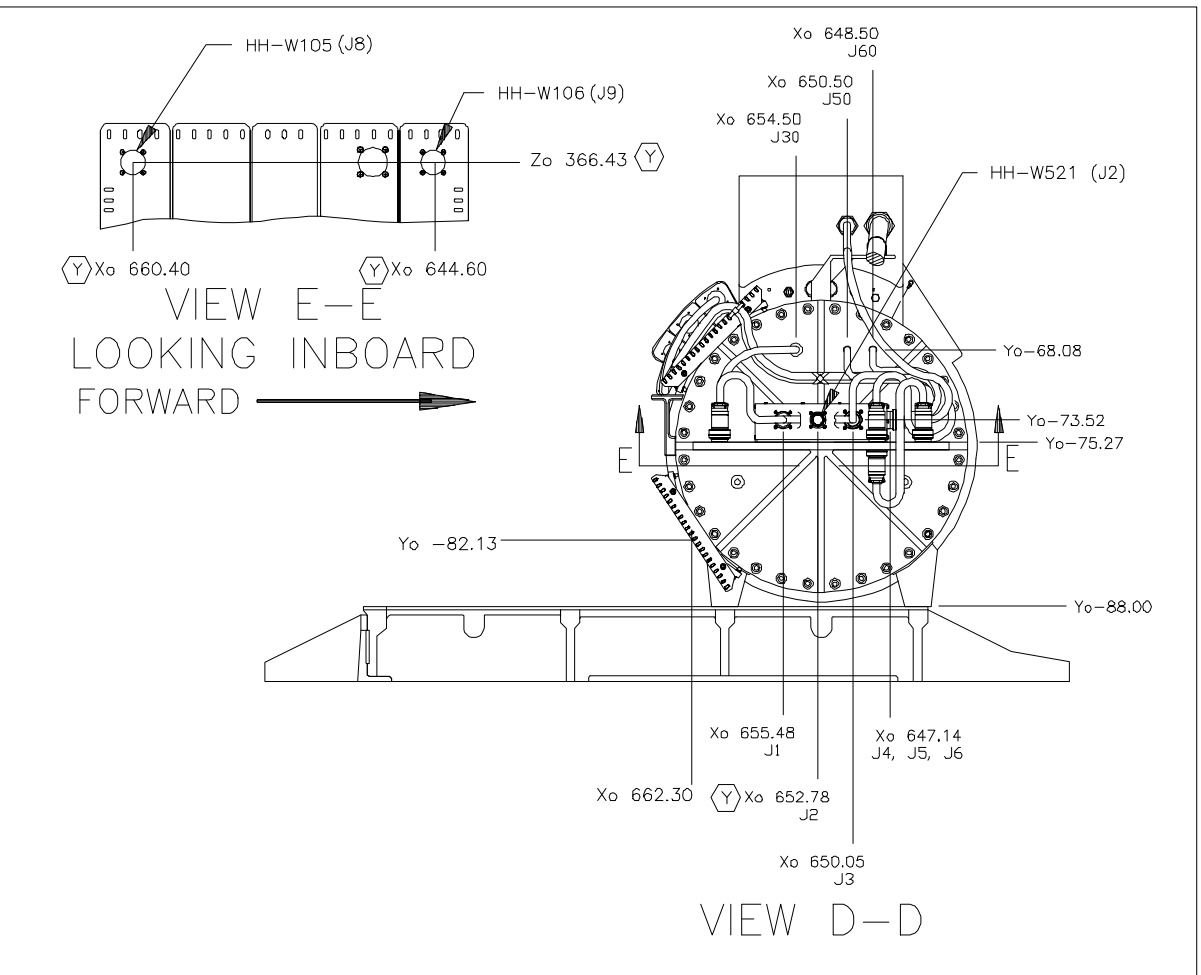


FIGURE 6.2-1 (SHEET 7 OF 9)
MIGHTYSAT 1 PORT SIDE CABLE INSTALLATION ASSEMBLY

NOTES;

1. THE PAYLOAD SHALL SUPPLY TIE-STRAPS FROM POINTS $\langle X \rangle$ AND $\langle Y \rangle$ TO PAYLOAD INTERFACES.
2. STS SHALL PROVIDE TIE-STRAPS BETWEEN POINT $\langle X \rangle$ AND $\langle Y \rangle$ FOR WIRE TRAYS, EGRESSES AND LONGERONS (P/N ME127-0074-0002 QTY DETERMINED BY MANIFEST FOR HARNESES: HH-W105, HH-W106, AND HH-W521.
3. CABLE LENGTHS ARE AS FOLLOWS:

FROM LAST TIE POINT AT HH-AVIONICS	LENGTH (INCHES)	TO: SAC-A
Xo 894.22 Yo -88.87 Zo 378.34	384 +6.00 -0.00	J8 J9
Xo 915.19 Yo -78.71 Zo 379.43	384 +6.00 -0.00	J2

4. INSTALLATION SEQUENCE:

- A. ROUTE CABLES HH-W105, HH-W106, HH-W521.
- B. ATTACH CABLES TO CABLE BRACKETS AND INSTALL CABLE TIES.
- C. STARTING OUTBOARD AND WORKING INBOARD, MATE (IN ANY ORDER):
 - AVIONICS CONNS. J002, J003.
 - SIP-W2 P107, SIP-W3 P108, SIP-W4 P103.
 - MIGHTYSAT CONNS. HH-W101 P100, HH-W201/205/011 P200.
 - SAC-A CONNS. HH-W105 P105, P8; HH-W106 P106, P9; HH-W521 P521, P2.
5. CABLE HARNESS PRE-INSTALLED AND CONNECTED PRIOR TO ORBITER INSTALLATION: HH-SA-W1, HH-TC-W1, HH-W102/202, HH-W201/205/011 (EXCEPT CONN P200), PECAN-W1, HH-SA-W2, HMDA-W1, HMDA-W2, HH-PYRO-W1, HH-PYRO-W2.
6. CABLE HARNESS HH-W101 (P101) WILL BE CONNECTED TO HH AVIONICS UNIT PRIOR TO ORBITER INSTALLATION.

FIGURE 6.2-1 (SHEET 8 OF 9)
MIGHTYSAT 1 PORT SIDE CABLE INSTALLATION ASSEMBLY

NOTES CONTINUED:

7. HARNESS PART NUMBERS.

CABLE ID	PART NUMBER
HH-W101	GD1555877
HH-W105-1	GD1555880
HH-W106-1	GD1555882
HH-W201/205/011	GD1555884
HH-W521-1/2	GD1555891
SIP-W2	GD1555894
SIP-W3	GD1555895
SIP-W4	GD1555896

FIGURE 6.2-1 (SHEET 9 OF 9)
MIGHTYSAT 1 PORT SIDE CABLE INSTALLATION ASSEMBLY