Statement of Work (SOW)

Naval Center for Space Technology

CODE 8212 – PROCESSING & TEST SECTION
CPP SHROUD REPLACEMENT FOR BIG BLUE VACUUM CHAMBER

05/07/2014

Version 19

TABLE OF CONTENTS

1 Introduction 4

1.1 Mission 4

1.2 Background 4

1.3 Scope 5

2 Applicable Documents 5

3 Performance Requirements 6

3.1 Design Requirements 6

3.2 Existing Shroud Removal and Disposal Requirements 13

3.3 New Shroud Installation Requirements 13

3.4 Inspection and Acceptance Testing Requirements 14

3.5 Design Reviews 16

4 Acronyms/Abbreviations 19

Appendix A: PHOTOGRAPHS 21

Appendix B: Drawings 23

TABLE OF FIGURES

Figure 1-1: NRL Building A-59 20

Figure A-1: “Big Blue” Chamber Zones (original shroud) 21

Figure A-2: Clean Room & Big Blue with door Open during Satellite Integration 22

Figure A-2: Chamber Interior during Satellite Integration 22

Statement of Work (SOW)

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1 Introduction

This Statement of Work (SOW) describes the requirements applicable to the replacement cryogenic shroud in the U.S. Naval Research Laboratory (NRL) Code 8212 large thermal vacuum (TVAC) chamber, known as “Big Blue”. The first floor plan of NRL Building A-59 identifying the location of “Big Blue” is shown in Figure 1-1.

1.1 Mission

The US Naval Research Laboratory’s Naval Center for Space Technology – NCST (Code 8000) is comprised of two Departments, the Spacecraft Engineering Department – SED (Code 8200) and the Space Systems Development Department - SSDD (Code 8100). NCST is the focal point for the Navy's in-house spacecraft bus capability, and functions as "Program Manager" for Navy space programs. Activities range from concept and feasibility studies through the on-orbit operation of Navy space systems. As Program Manager for spacecraft and space experiments, the NCST performs system engineering, and provides technical direction for Navy space programs, while maintaining an active in-house satellite development capability. The NCST functions as a prototype laboratory, and ensures that designs are transferable to industry for incorporation into subsequent satellite hardware builds. The NCST also supports the Navy Program Office by providing expert technical consultation on architectural, acquisition, and operational issues.

1.2 Background

The Test & Processing Section (Code 8212) conducts thermal vacuum testing for satellites and spacecraft components in the Payload Checkout Facility (PCF). The section operates three large thermal vacuum chambers which can simulate both the vacuum and thermal environments of space that satellites and spacecraft encounter during spaceflight.

The largest chamber, known as “Big Blue”, has a horizontal cylindrical working envelop of 16’ diameter x 30’ long. This working envelop is inside the thermal shroud of the chamber. The chamber has a beam running the length of the top of the chamber just internal to the thermal shroud. The chamber is pumped by three CVI TM900 cryopumps. Roughing is by two blowers and a Stokes dry pump. This chamber has a shroud that is divided into five zones, each zone having its own Thermal Control Unit (TCU). Zone One TCU is shared with the South chamber. The chamber and thermal

control system was built about 1975 by Tenney Engineering, Inc., Union, NJ with the vacuum vessel built by the Hodge Boiler Works, East Boston, MA.

Tenney Engineering, Inc. is unable to provide any information on the TCUs. The available documentation shows a temperature range of -175C to +150C and a pressure range of 3psig to 50psig. The TCUs run under constant density control. The control system allows the density set point to be changed; we are currently running a set point of 0.30. We have measured the pressure drop at 20C to be 1.3psi. This measurement was taken at test ports on the inlet and outlet of each blower, with all zones approximately the same. Each blower motor is rated at 3450 rpm. The blower housing and impeller drawings will be provided so that the flow can be calculated. The procedure to flood the shrouds would require cooling to -175C with gas before flooding with LN_2.

1.3 Scope

The scope of this work is to replace the thermal shroud in the Code 8212 large TVAC chamber (a.k.a. “Big Blue”). The new shroud system is to retain the current configuration of five control zones with zones 1, 2, 4 and 5 running horizontally and zone 3 covering the back wall and door. The two parts of zone 3 are connected by vacuum jacketed piping with a flexible section to allow the door to open (see Figure A-1).

Pictures and drawings for the original and current configurations are included for reference purposes as appendixes A and B, respectively, to this Statement of Work.

2 Applicable Documents

2.1 Department of Defense Standards

- MIL-STD-100G, DoD Standard Practice for Engineering Drawings

2.2 Non-government standards and other publications

- NASA Reference Publication 1124
- ISO Standard 14644
- IEST-STD-CC1246

3 Performance Requirements

3.1 Design Requirements

The contractor shall design, manufacture, and install the Laboratory's Thermal Shroud replacement.

3.1.1 The shroud shall be of a geometric shape known as a right rectangular circular cylinder. The inner diameter shall be no less than 16 feet. The inner length shall be no less than 30 feet (see appendices A and B for reference). [CDRL A0006, A0009]

3.1.1.1 The shroud shall fit into the existing vacuum chamber (a.k.a. “Big Blue”).

3.1.2 The shroud shall operate within the temperature range from -180C to +150C provided by the facility’s circulating processed gaseous nitrogen (GN_2) system.

3.1.3 The shroud shall maintain a set temperature during steady-state operation with a uniformity of ±5C across the entire internal surface of the shroud, at any temperature within the operating range defined by requirement 3.1.2, with a test load of 100 watts per square foot of shroud area.

3.1.3.1 The contractor shall verify the set temperature uniformity by test with a test load per 3.1.3 at -160C and +125C as part of the Acceptance Test Plan (ATP). [CDRL A0006, A0009]

3.1.3.2 The contractor shall provide verification of the set temperature uniformity across the entire operating range by analysis, to be delivered as part of the End Item Data Package (EIDP). [CDRL A0008]

3.1.4 The shroud shall be divided into five (5) independently controlled zones in the same functional configuration as the current shrouds.

See Figure A-1 and Appendix B (Sheets 5 & 6)

3.1.4.1 There shall be a high conductance vacuum flow pumping path (i.e. baffles) in the shroud adjacent to the four (4) cryopump openings along the west side of the chamber as part of zones 1 and 5; approximately the top 2.5 feet of zone 1 and approximately the bottom 2.5 feet of zone 5.

See Appendix B (Sheet 5)

3.1.4.1.1 The high conductance vacuum flow pumping path area shall be divided horizontally with the top section part of (attached to) and controlled

by zone 5 and the bottom section part of (attached to) and controlled by zone 1; to extend the horizontal full length of the shroud.

3.1.4.2 There shall be high conductance vacuum flow paths (i.e. baffles) aligned to ports 12E, 13W and 14W.

See Appendix B (Sheets 3 and 4)

3.1.5 The shroud design shall allow the installation of the existing I-Beam Rail (S7 x 15.3 Steel) at the top of the chamber (see Figure A-1).

3.1.5.1 The contractor shall provide new I-beam mounts to the vacuum vessel and I-Beam Rail able to support a 15,000 lbm load at any single location along the length of the rail.

3.1.5.2 The contractor shall provide verification by analysis of requirements within 3.1.5.1 by analysis, to be delivered as part of the End Item Data Package (EIDP). [CDRL A0007]

3.1.6 There shall be 25 shroud openings corresponding to feed-through ports (1N, 1S, 1E-11E, and 1W-12W) in the vacuum chamber wall.

See Appendix B (Sheets 3 & 4)

3.1.6.1 The centerlines of the shroud openings and feed-through ports shall be aligned to within +/- 0.5”, with the exception of ports 2W and 4W.

3.1.6.2 The shroud openings shall provide full unobstructed concentric access to the inner diameter of the feed-through ports, with the exception of ports 2W and 4W.

3.1.6.3 For ports 2W and 4W the shroud openings shall be aligned along the radial axis of the shroud as close as possible to ports, with accommodation made for requirement 3.1.4.1.

3.1.6.4 Blank blackout covers shall be provided for each feed-through port opening for optically sealing the opening when not in use.

3.1.6.4.1 Covers shall be easily installed and removed (i.e. with common hand tools and lifting without special fixtures) from inside the shroud.

3.1.6.4.2 Covers shall be conductively coupled to the shroud when installed.

3.1.6.4.3 Covers shall be interchangeable for all like-size feed through port openings.

3.1.6.4.4 Covers and feed through ports shall be labeled identifying their installation location.

3.1.7 There shall be eight (8) shroud openings corresponding to all cart rail pedestals.

3.1.7.1 The shroud openings shall align with the cart rail pedestals to allow full unobstructed penetration of the pedestals through the shroud.

3.1.7.2 The shroud openings shall be 14 inches by 12 inches with the 14 inch length along the surface of the shroud and perpendicular the centerline of the shroud (see Figure A-1).

3.1.7.3 Blank blackout covers shall be provided for each cart rail pedestal opening for optically sealing the opening when not in use.

3.1.7.3.1 Covers shall be easily installed and removed (i.e. with common hand tools and lifting without special fixtures) from inside the shroud.

3.1.7.3.2 Covers shall be conductively coupled to the shroud when installed.

3.1.7.3.3 Covers shall be interchangeable for all cart rail pedestal openings.

3.1.7.3.4 Covers and cart rail openings shall be labeled identifying their installation location.

3.1.8 There shall be eight (8) shroud openings corresponding to all hard mounts in the top of the chamber.

3.1.8.1 The shroud openings shall be aligned with the hard mounts to allow full unobstructed access to the hard mounts through the shroud.

3.1.8.2 Blank blackout covers shall be provided for each hard mount opening for optically sealing the opening when not in use.

3.1.8.3.1 Covers shall be easily installed and removed, (i.e. with common hand tools and lifting without special fixtures) from inside the shroud.

3.1.8.3.2 Covers shall be conductively coupled to the shroud when installed.

3.1.8.3.3 Covers shall be interchangeable for all hard mount openings.

3.1.8.3.4 Covers hard mount openings shall be labeled identifying their installation location.

3.1.9 There shall be shroud openings corresponding to all mounts for the I-Beam in the top of the chamber.

3.1.9.1 The openings shall be aligned with the I-Beam mounts to allow full unobstructed penetration of the mounts through the shroud.

3.1.10 The shroud shall be optically tight across all zones, including any openings for the pumps, feed through port, cart rail pedestals, beam mounts, and hard mounts with all covers installed.

3.1.11 All materials selected for use inside the chamber shall be made of low outgassing vacuum compatible materials.

3.1.11.1 The contractor shall select materials per NASA Reference Publication 1124 (latest revision), “Outgassing Data for Selecting Spacecraft Materials”; wherein low outgassing materials are defined as those materials meeting two criteria: a maximum total mass loss (TML) of 1.0 percent and a maximum collected volatile condensable material (CVCM) of 0.10 percent.

3.1.12 The interior surfaces of the shroud {i.e. all surfaces exposed to the internal working volume (16 feet diameter x 30 feet length) of the chamber} shall be black with an emissivity greater than 0.85. [CDRL A0006, A0009]

3.1.12.1 The contractor shall clean the shroud, apply and cure the paint to the shroud prior to delivery to NRL for installation.

3.1.12.1.1 The contractor shall clean and prepare the shroud for painting, apply the paint, and cure the paint to the shroud at one location.

3.1.12.2 The paint shall be AkzoNobel 463-3-8 flat black temperature control topcoat over AkzoNobel 10P4-2 primer applied and cured per AkzoNobel specifications.

3.1.13 The exterior surfaces of the shroud, all surfaces exposed to the vacuum vessel walls, shall have an emissivity of less than 0.1.

3.1.14 The physical attachment of the shroud to the vacuum chamber shall be sufficient to provide structural support and positioning of the shroud with regard to the working envelope per requirement 3.1.1.

3.1.14.1 All shroud mounts and supports shall be thermally isolated from the chamber pressure vessel wall as defined herein to permit the shroud to be compliant with requirement 3.1.3.

3.1.14.2 The contractor shall provide verification by analysis of requirements within 3.1.14.1 by analysis, to be delivered as part of the End Item Data Package (EIDP). [CDRL A0007]

3.1.14.3 The shroud mounts and supports shall provide easy installation and removal of the shroud into and out of the chamber.

3.1.14.4 Any shroud mount or support separable mechanical connections shall be designed such that they can be connected and disconnected with common hand tools

3.1.15 The shroud shall be easily removed and installed by rolling into and out of the chamber, off of and onto handling fixtures, respectively.

3.1.15.1 Handling fixtures shall be sufficient in number to allow the removal of all shroud section.

These fixtures will become the property of NRL.

3.1.16 The design shall provide connection of the shroud GN_2 piping to the facility processed GN_2 system.

3.1.16.1 Separable mechanical connections shall provide for connecting the shroud GN_2 piping to the facility processed GN_2 system that allow easy installation and removal of the shroud into and out of the chamber.

3.1.16.2 All GN_2 system separable mechanical connections shall be external to the exterior of the vacuum vessel.

3.1.16.3 Any separable mechanical connections shall be designed such that they can be connected and disconnected with common hand tools

3.1.17 GN_2 or LN_2 piping, plumbing, and associated connections internal to the chamber vacuum vessel (e.g. exposed to the chamber vacuum environment) shall be free of separable mechanical connections.

3.1.18 The shroud and piping shall operate fully flooded with liquid nitrogen (LN_2).

3.1.19 GN_2 or LN_2 piping, plumbing, and associated connections external to the chamber vacuum vessel shall be frost-free under all operating temperatures, including the connection to the facility feed source tie-ins. [CDRL A0006, A0009]

3.1.20 The shroud shall be able to withstand personnel loading on the two lower shroud zones (zones 1 & 2) between the cart rails without structural yield or ultimate failure of the shroud.

3.1.20.1 The shroud shall be able to withstand an impact load from a 250 lb. person descending free-fall from a height of 3 feet (i.e. from the cart) landing on one foot (est. surface area of 48 sq.in.) anywhere onto the lower areas of the two lower shroud zones (zones 1 & 2) between the cart rails without structural yield or ultimate failure of the shroud.

3.1.20.2 The shroud shall be able to withstand steady state non-impact loading of five (5) 250 lb. persons present anywhere on the two lower shroud zones (zones 1 & 2) between the cart rails without structural yield or ultimate failure of the shroud.

3.1.20.3 The contractor shall provide verification of requirements within 3.1.20 by analysis to be delivered as part of the End Item Data Package (EIDP). [CDRL A0007]

3.1.21 Vacuum rated LED lights shall be installed to illuminate the interior volume of the chamber.

3.1.21.1 Lighting shall be white, evenly distributed, and no less than 40 foot-candles illumination at any elevation in the chamber. [CDRL A0006, A0009]

3.1.21.2 Lighting shall allow replacement of bulbs, fixtures, and servicing of wiring connections without removing the shroud.

3.1.22 The design shall provide ten (10) thermocouples on each of the following portions of the shroud, zones 1, 2, 3 door, 3 rear wall, 4, and 5 for a total of sixty (60) thermocouples.

3.1.22.1 The contractor shall provide high accuracy, 18 gage (AWG), TFE Teflon insulated type "T" thermocouple wire per ASTM E230-ANSI MC 96.1, or equivalent in all places where thermocouple wire is installed.

3.1.22.2 The contractor shall provide thermocouple harnesses, internal patch panels and feed-throughs for each shroud zone, and an external patch panel.

3.1.22.3 The contractor shall provide locations of the thermocouples and the method of mounting included in the final design package, and no later than the final design review. The locations shall be nominally located at the inlet, outlet, and equally spaced throughout for each zone.

3.1.22.4 The contractor shall provide all thermocouple wire harnesses with connections to the shroud at one end and connections to the internal patch panel at the other end.

3.1.22.5 The internal patch panels shall be located near the front of the chamber so that they are easily accessible when the door is open.

3.1.22.6 The internal patch panels shall connect via thermocouple wire harness to a feed-through(s) located at port 8W.

3.1.22.7 The external patch panel shall connect to the thermocouple feed-throughs at port 8W.

3.1.22.8 Labels shall be clearly readable at both ends of every wire and on the internal patch panels.

3.1.23 Four (4) 6” CF (ConFlat) flange – fixed (316LN SS) ports shall be installed at port locations 12E, 1W, 13W, and 14W.

See Appendix B (Sheets 3 & 4)

3.1.23.1 Port location 12E will be a new feed-through port.

3.1.23.2 Port locations 1W, 13W, and 14W will be conversions of existing feed-throughs ports.

3.1.24 The contractor shall create a 3D model of the interior of the vacuum vessel after removal of the old shroud.

3.1.25 The contractor shall provide Computer Aided Design (CAD) models and engineering drawings of the shroud design and installation. The design models shall detail all geometry that requires NRL approval before fabrication and installation. [CDRL A0002]

3.1.25.1 The drawings shall conform to MIL-STD-100G or ASME Y14.100M.

3.1.25.2 All CAD models shall be in the Standard for the Exchange of Product model data (STEP) format.

3.1.25.3 The Contractor shall provide five (5) hard copies of “as installed” drawings as well as a DWG CAD file of each drawing and STEP files of the as installed models at a minimum in the End Item Data Package (EIDP). [CDRL A0003]

3.1.25.4 The Contractor shall provide five (5) hard copies of operating manuals and one (1) electronic version at a minimum in the End Item Data Package (EIDP). [CDRL A0004]

3.1.25.5 The Contractor shall provide one (1) hard copy of Vendor manuals for all components at a minimum in the End Item Data Package (EIDP). [CDRL A0005]

3.2 Existing Shroud Removal and Disposal Requirements

The Contractor shall remove and dispose of the Existing Shroud.

3.2.1 The Contractor shall protect the TVAC clean room connected to the vacuum chamber during all operations, including shroud removal, such that it shall be returned to certified ISO 7 level (FS 209E Class 10K), or better, per ISO Standard 14644 by the contractor upon completion of shroud installation and as part of the Acceptance Test Plan (ATP). [CDRL A0006, A0009]

See Figure 1-1

3.2.2 The Contractor shall dispose of the old shroud within two weeks upon removal.

3.3 New Shroud Installation Requirements

The Contractor shall install the New Shroud, and all associated items per the design requirements in section 3.1.

3.3.1 The contractor shall install the new mounts for the I-beam at the top of the chamber.

3.3.1.1 The contractor shall install the support I-beam upon finishing the new shroud installation.

3.3.2 The contractor shall provide protection for the existing vacuum chamber mid-sections o-ring seals such that installation of the shroud will not damage the o-rings.

3.3.3 The contractor shall attach mounts or supports without drilling into the chamber pressure vessel wall.

3.3.4 The contractor shall certify the chamber interior, shroud, and adjacent clean room are delivered at a surface cleanliness level 300A, or better, per IEST-STD-CC1246 upon completion of all work.

3.3.4.1 The contractor shall clean the interior of the chamber to surface cleanliness level 300A, or better, per IEST-STD-CC1246 before the new shrouds are installed.

3.3.4.2 The shroud and associated components shall have a surface cleanliness level 300A, or better, per IEST-STD-CC1246 for operation inside an ISO 7 (FS 209E Class 10K) clean room prior to installation into the chamber.

3.3.5 The contractor shall provide that the clean room is precision cleaned and certified to a cleanliness level of ISO 7, or better, per ISO Standard 14644 upon completion of all work.

3.3.5.1 Cleanroom certification shall be documented and performed as part of the Acceptance Test Plan (ATP). [CDRL A0006, A0009]

3.4 Inspection and Acceptance Testing Requirements

The Contractor shall provide Inspection and Acceptance Testing of the Shroud.

3.4.1 All inspections and acceptance tests shall be documented and performed per the Acceptance Test Plan (ATP). [CDRL A0006, A0009]

3.4.1.1 The Contractor shall submit an initial draft Acceptance Test Plan (ATP) to NRL for review and comment no later than Preliminary Design Review (PDR).

3.4.1.2 The Contractor shall submit the final ATP for review and approval by NRL no later than Critical Design Review (CDR).

3.4.2 The Contractor shall perform inspections and acceptance testing prior to shipment of shroud components to NRL to verify compliance with approved designs and requirements herein. [CDRL A0006, A0009]

3.4.2.1 The Contractor shall inspect and test the shroud plumbing and piping prior to shipping to NRL for installation in the following order: 1) pressure check, 2) leak check, 3) thermal shock check, and then 4) leak check.

3.4.2.1.1 The Contractor shall pressure test the shroud and piping to 150 psig.

3.4.2.1.2. The Contractor shall check for leaks in the shroud and piping following pressure test and repair if necessary.

3.4.2.1.3 The Contractor shall thermal shock the shroud and piping by flooding with Liquid Nitrogen.

3.4.2.1.4 The Contractor shall check for leaks in the shroud and piping following the thermal shock and repair if necessary.

3.4.2.1.5 The Contractor shall re-test all repairs per the order specified in section 3.4.2.1 until the sequence is completed without failure.

3.4.2.2 The shroud and piping shall not exhibit any leaks greater than 1.0 x 10-9 atm-cc/sec by utilizing a calibrated Mass Spectrometer Leak Detector, traceable to NIST standard, per the manufacturer's instructions. [CDRL A0006, A0009]

3.4.2.3 The Contractor shall provide a schedule for performing all required testing to NRL. The schedule will allow a NRL representative to be present to witness the testing at NRL's discretion.

3.4.2.4 The Contractor shall provide all equipment and consumables for the tests.

3.4.3 The Contractor shall perform inspections and acceptance testing of any shroud subassemblies completed during shroud installation on-site at NRL prior to final acceptance testing of the shroud system to verify compliance with approved designs and requirements herein. [CDRL A0006, A0009]

3.4.3.1 The Contractor shall inspect and test the shroud plumbing and piping assemblies after installation at NRL and prior to final shroud system acceptance test in the following order: 1) pressure check, 2) leak check, 3) thermal shock check, and then 4) leak check.

3.4.3.1.1 The Contractor shall pressure test the shroud plumbing and piping to 150 psig.

3.4.3.1.2. The Contractor shall check for leaks in the shroud plumbing and piping following pressure test and repair if necessary.

3.4.3.1.3 The Contractor shall thermal shock the shroud plumbing and piping by flooding with Liquid Nitrogen.

3.4.3.1.4 The Contractor shall check for leaks in the shroud plumbing and piping following the thermal shock and repair if necessary.

3.4.3.1.5 The Contractor shall re-test all repairs per the order specified in section 3.4.3.1 until the sequence is completed without failure.

3.4.3.2 The Contractor shall inspect and test all chamber vacuum vessel modifications performed as part of installation at NRL prior to final shroud system acceptance test in the following order: 1) visual inspection, 2) dye penetrant inspection, and then 3) leak check.

3.4.3.3 The chamber vacuum vessel modifications and shroud plumbing and piping shall not exhibit any leaks greater than 1.0 x 10-9 atm-cc/sec by utilizing a calibrated Mass Spectrometer Leak Detector, traceable to NIST standard, per the manufacturer's instructions. [CDRL A0006, A0009]

3.4.3.4 The Contractor shall provide a schedule for performing all required testing to NRL. The schedule will allow a NRL representative to be present to witness the testing at NRL's discretion.

3.4.3.5 The Contractor shall provide all equipment and consumables for the tests.

3.4.4 The Contractor shall conduct a final acceptance test of the shroud system upon completion of shroud installation.

3.4.4.1 The final acceptance test shall be shall be documented and performed per the Acceptance Test Plan (ATP). [CDRL A0006, A0009]

3.4.4.2 The Contractor shall certify that all requirements are met by the delivered system through the test procedure.

3.4.4.3 The Contractor shall run the final acceptance test at the Naval Research Lab with NRL personnel on hand to run the chamber, witness the test and verify operation of the system.

NRL will provide the LN_2 for the final acceptance test.

3.5 Design Reviews & Project Schedule

3.5.1 Concept Design Review (CoDR) [CDRL A0001]

The CoDR affirms the project requirements and examines the proposed concept for meeting those requirements.

Successful completion of the CoDR is required in order to proceed into Phase I – Preliminary Design

3.5.2 Preliminary Design Review (PDR) [CDRL A0001]

The PDR demonstrates that the preliminary design meets all project requirements with acceptable risk and within the cost and schedule constraints and establishes the basis for proceeding with detailed design. It will show that the correct design options have been selected, interfaces have been identified, and verification methods have been described.

The following are pass/fail criteria of the PDR:

> Certify that all system requirements have been allocated, the requirements are complete, and the flow down is adequate to verify system performance.
>
> Demonstrate that the proposed design is expected to meet the functional and performance requirements.
>
> Demonstrate sufficient maturity in the proposed design approach to proceed to final design.
>
> Demonstrate that the design is verifiable and that the risks have been identified, characterized, and mitigated where appropriate.

Successful completion of the PDR is required for proceeding into Phase II – Final Design and Shroud Removal.

3.5.3 Critical Design Review (CDR) [CDRL A0001]

The CDR is the final design review and demonstrates that the maturity of the design is appropriate to support proceeding with formal release to manufacturing for fabrication, assembly, installation, and test. CDR determines that the technical effort is on track to complete the project specifications and performance requirements within the identified cost and schedule constraints.

The following are pass/fail criteria of the CDR:

> Certify that the "build-to" baseline contains detailed hardware and software specifications that can meet functional and performance requirements.
>
> Certify that the design has been satisfactorily audited by production, verification, operations, and other specialty engineering organizations.
>
> Certify that the production processes and controls are sufficient to proceed to the fabrication stage.
>
> Certify that planned Quality Assurance (QA) activities will establish perceptive verification and screening processes for producing a quality product.

Verify that the final design fulfills the specifications established at PDR.

Successful completion of the CDR is required for proceeding into Phase III – Manufacture.

3.5.4 Project Schedule [CDRL A0010]

The contractor shall produce and maintain a project schedule. The schedule shall at a minimum, detail the projects major milestones, key tasks/activities, critical path, and contain in sufficient detail the networked tasks and associated progress necessary to ensure successful program execution.

The schedule will be used to verify attainability of project objectives, to evaluate progress toward meeting objectives, and to integrate the activities with all related components.

4 Acronyms/Abbreviations

ASME	American Society of Mechanical Engineers
atm	Atmosphere
ATP	Acceptance Test Plan
CAD	Computer Aided Design
CDR	Critical Design Review
cc	Cubic Centimeter(s)
CoDR	Concept Design Review
COR	Contracting Officer Representative
CVCM	Collected Volatile Condensable Material
EIDP	End Item Data Package
GN_2	Gaseous Nitrogen
KO	Contracting Officer
Lbm	Pound Mass
LN_2	Liquid Nitrogen
MIL-STD	Military Standard
NCST	Naval Center for Space Technology
NRL	Naval Research Laboratory
OCI	Organizational Conflict of Interest
PCF	Payload Checkout Facility
PDR	Preliminary Design Review
PCO	Procuring Contracting Officer
QA	Quality Assurance
sec	Second(s)
SOW	Statement of Work
STEP	Standard for the Exchange of Product model data
TCU	Thermal Conditioning Unit
TML	Total Mass Loss
TVAC	Thermal Vacuum

The following figures and pictures below are for reference purpose only.
Actuals shall be obtained through the site visit.

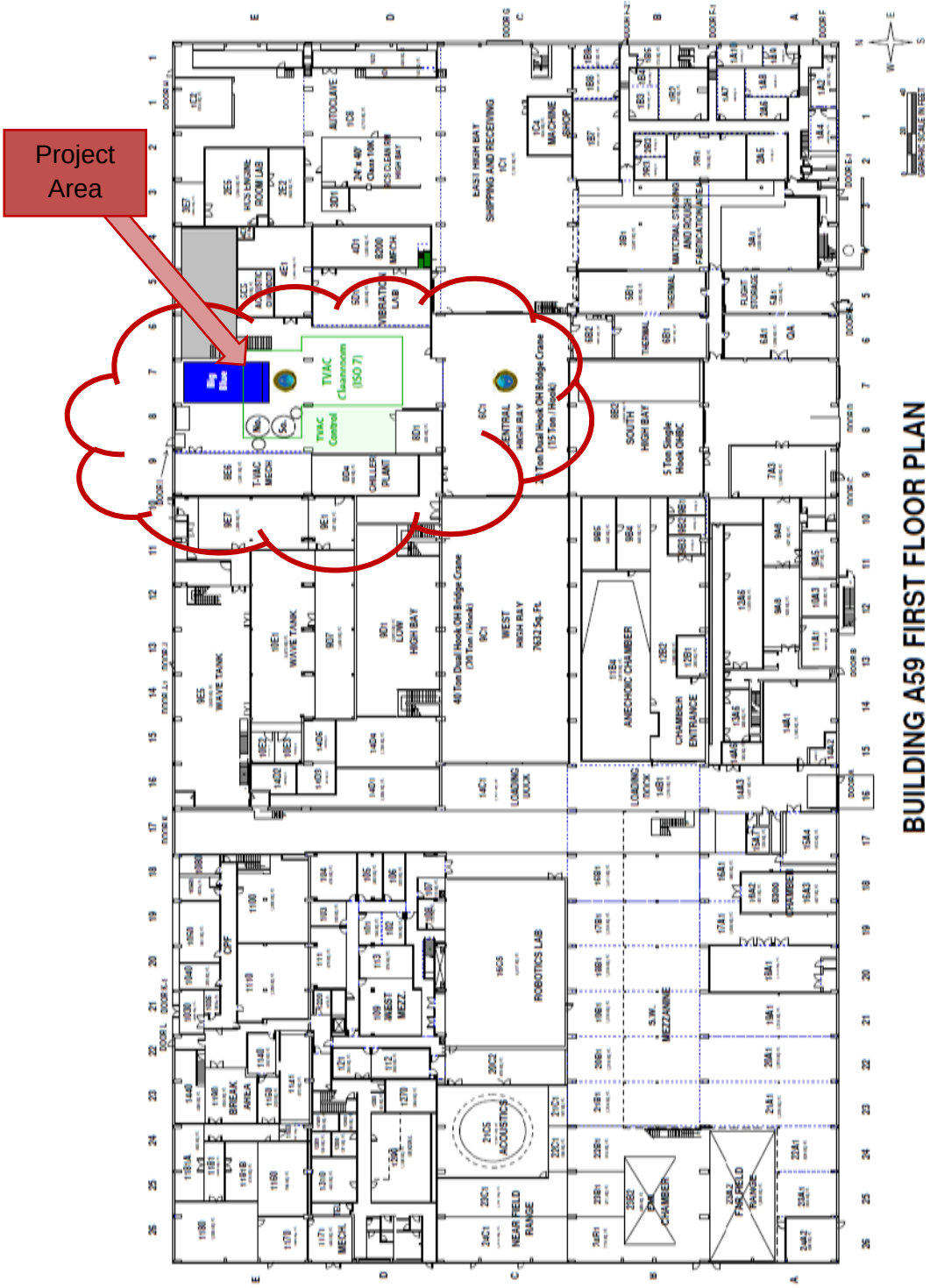


Figure 1-1: NRL Building A-59

Appendix A: PHOTOGRAPHS

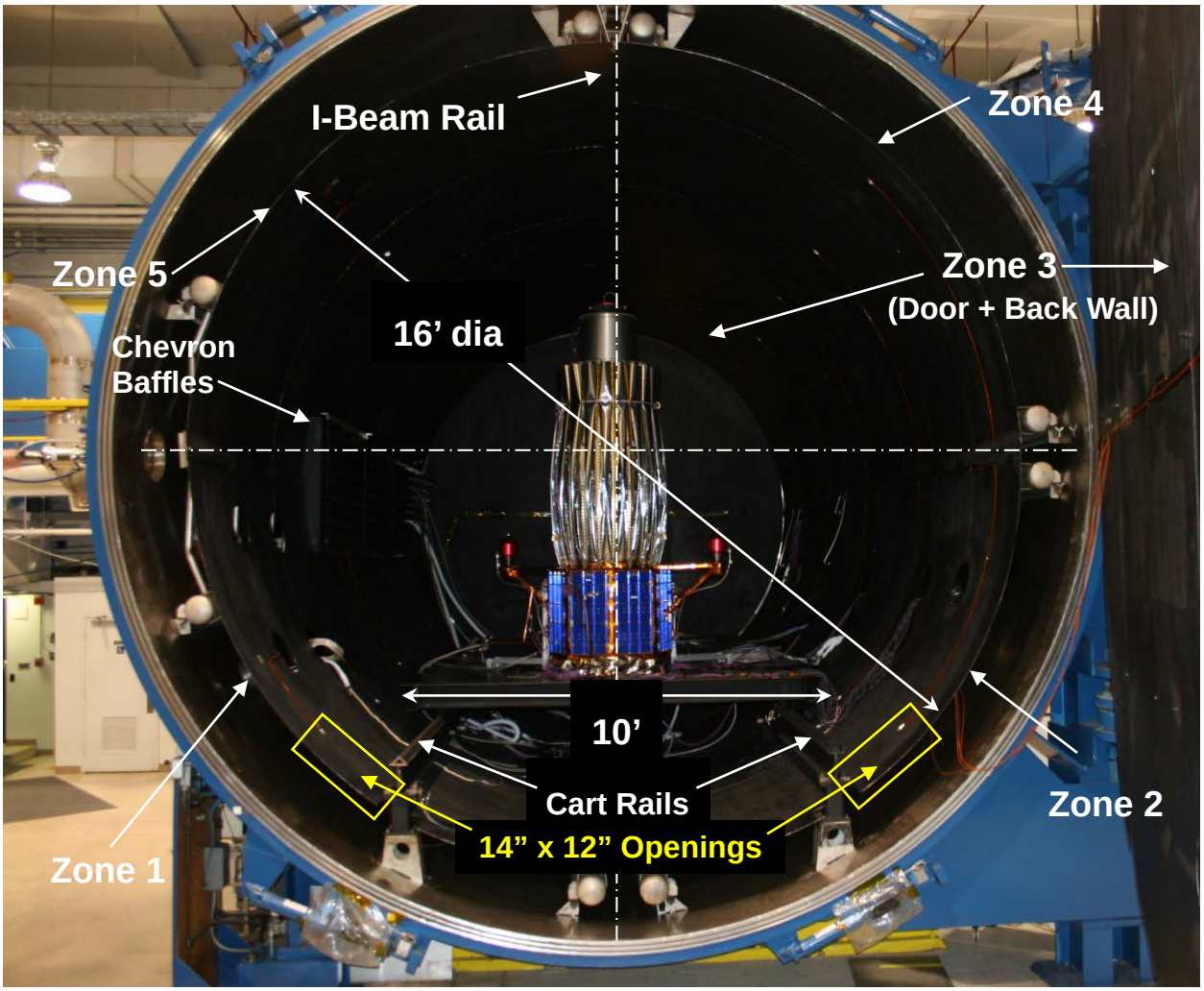


Figure A-1: "Big Blue" Chamber Zones (original shroud)

Figure A-2: Clean Room & Big Blue w/door Open during Satellite Integration

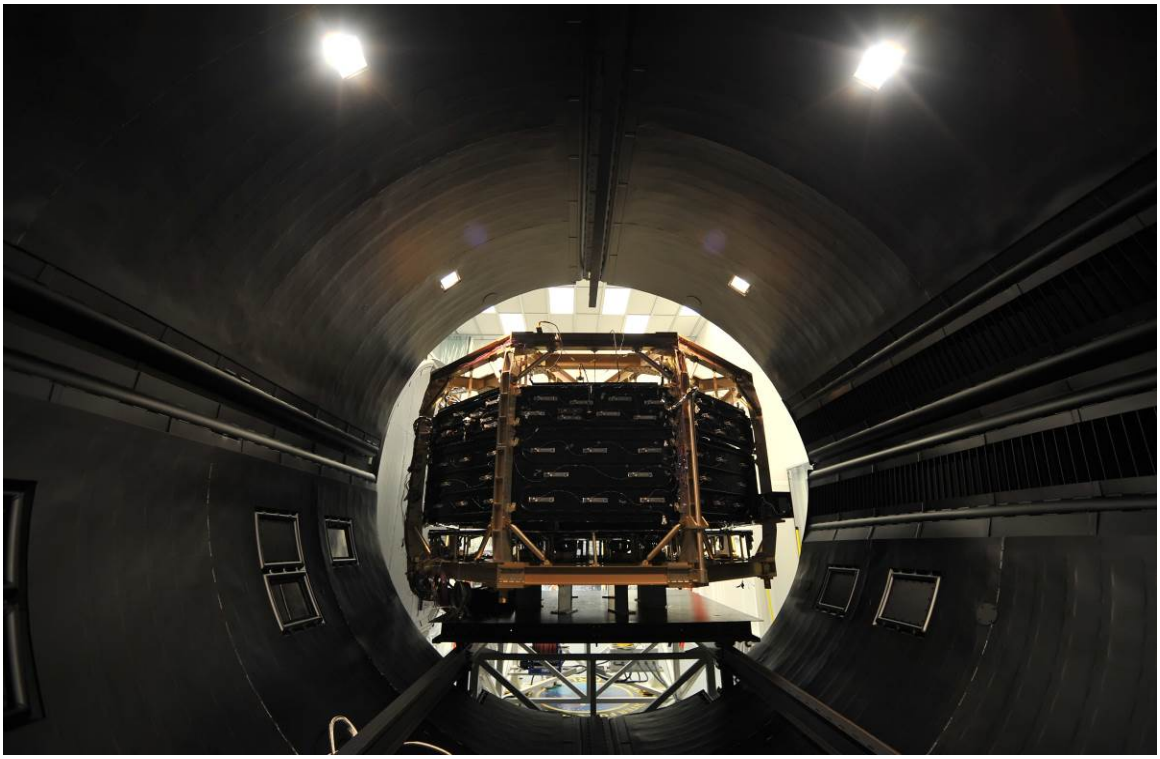
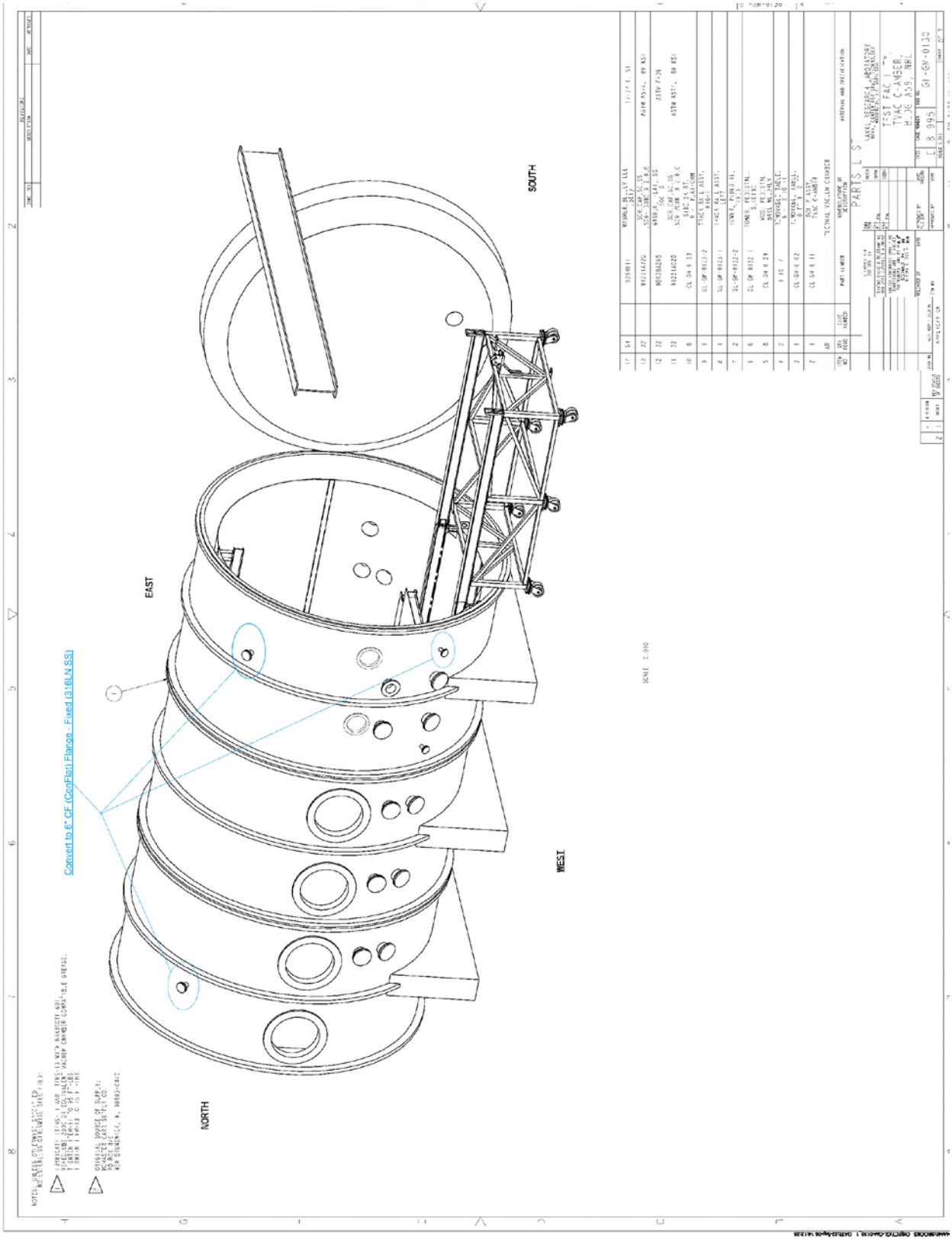
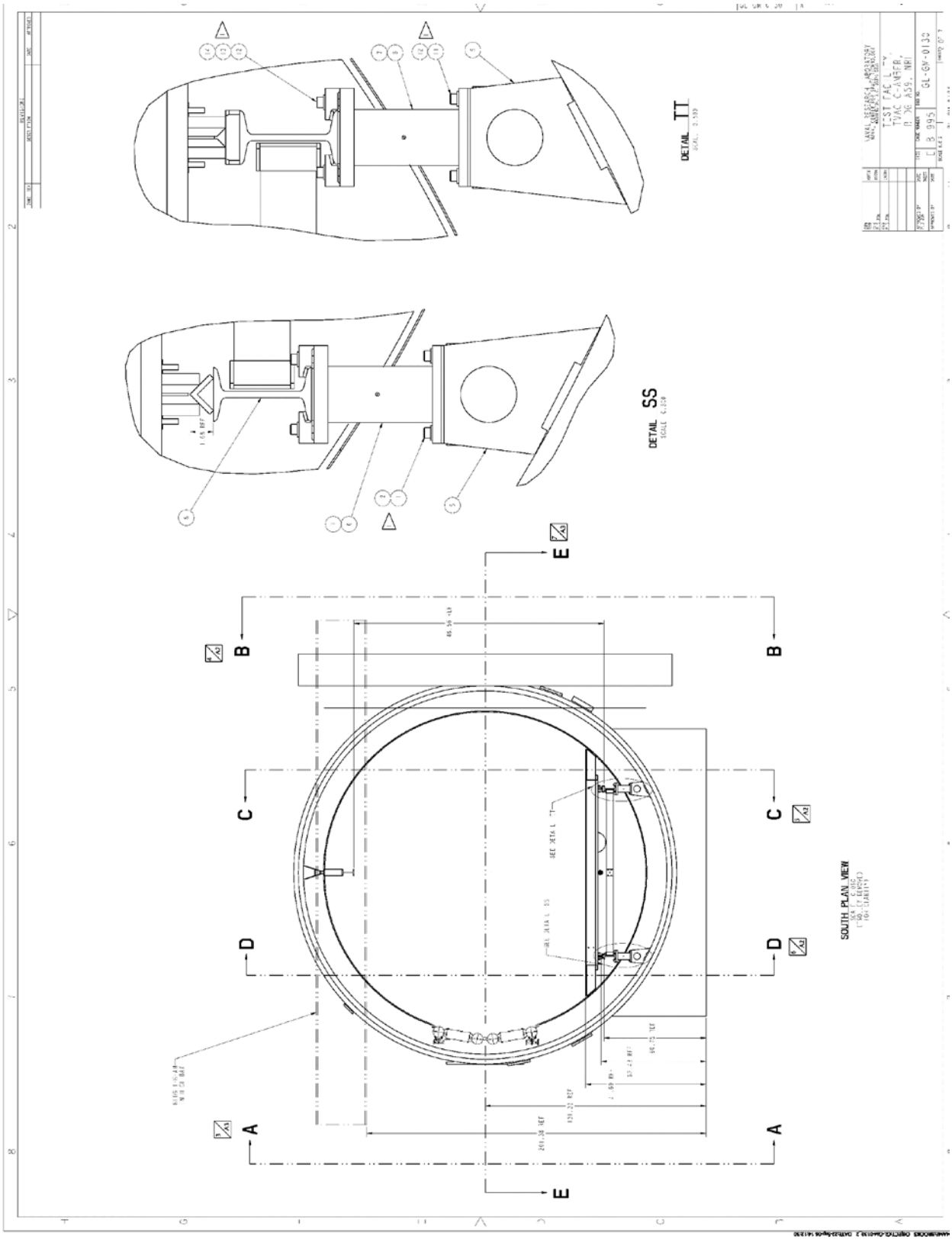
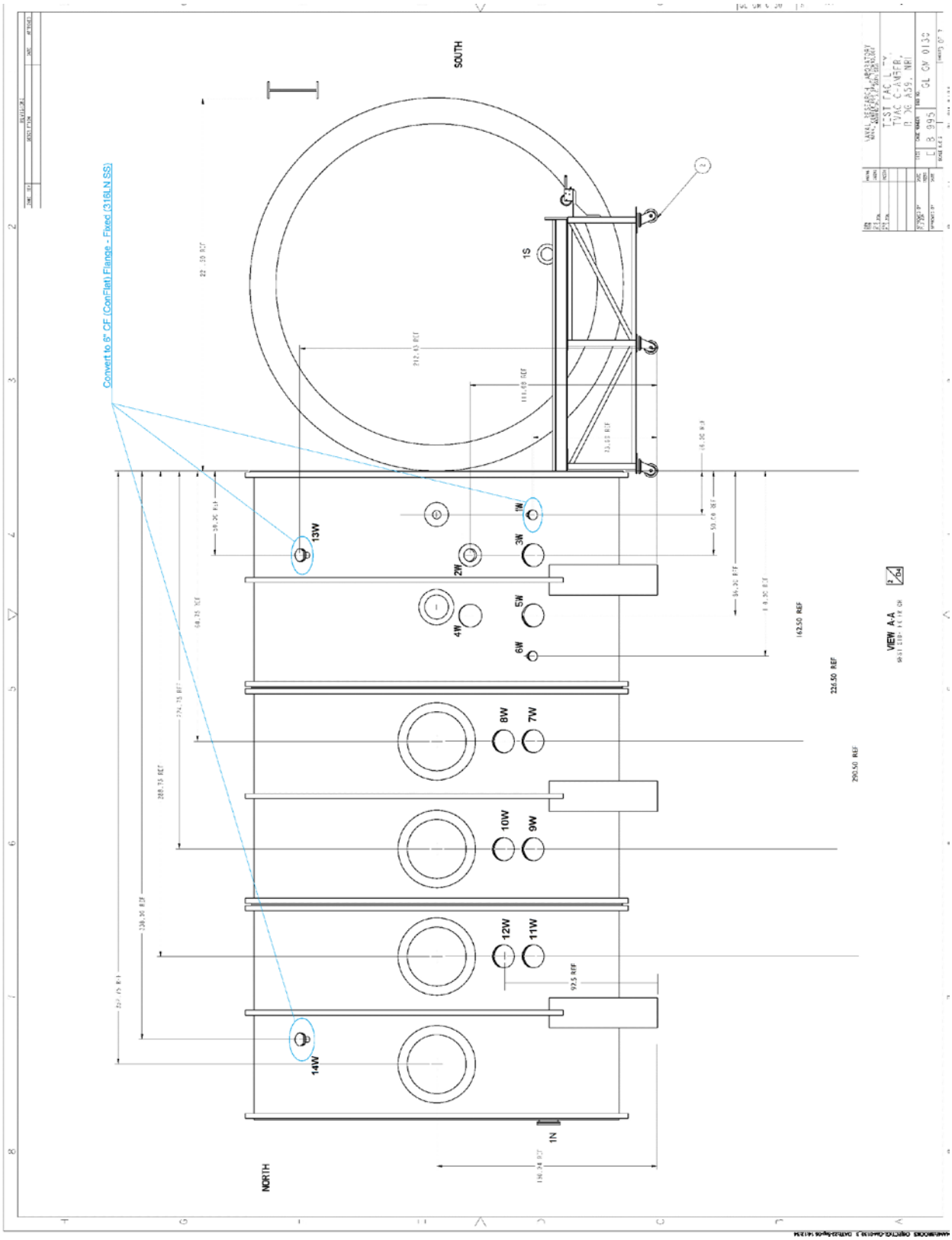


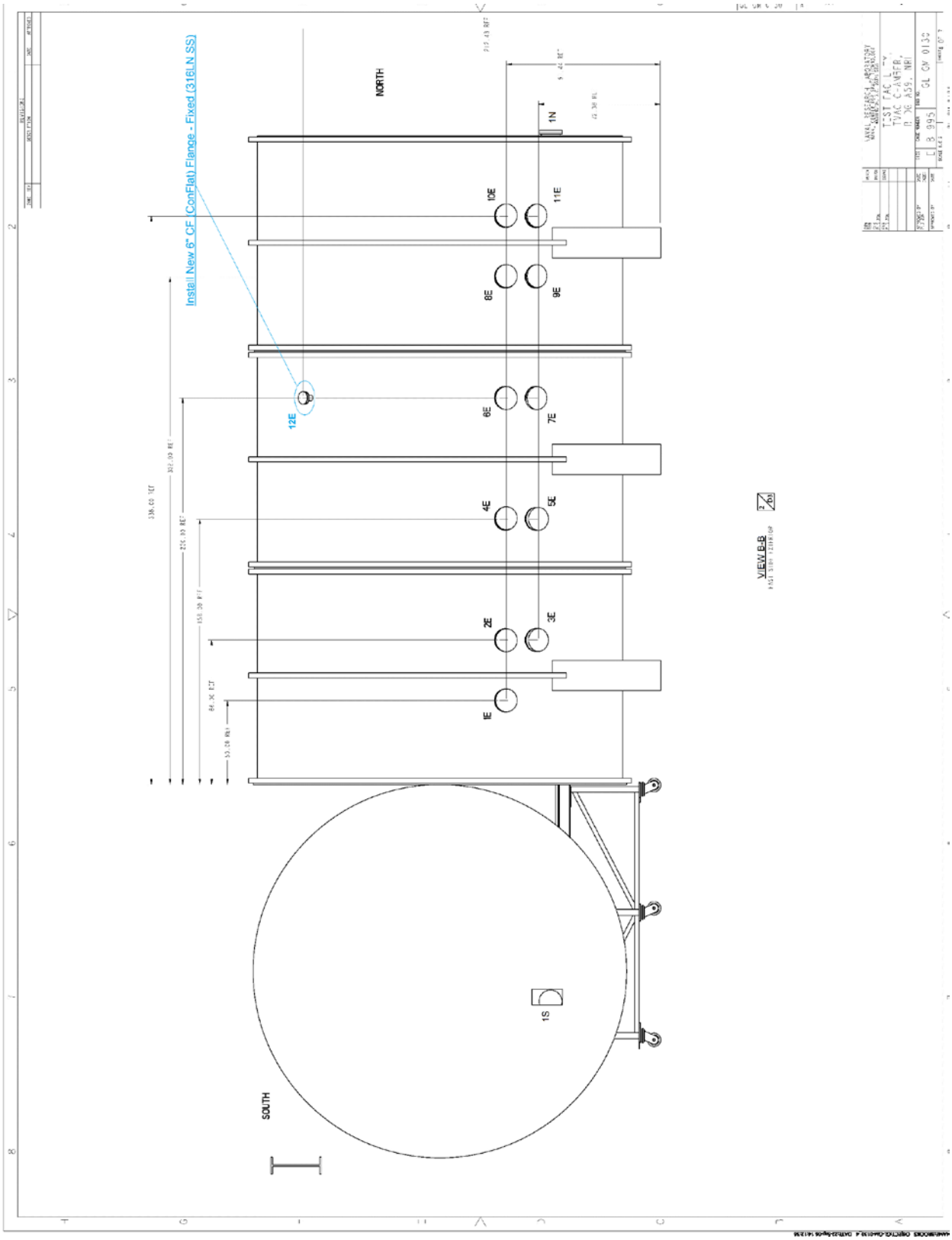
Figure A-2: Chamber Interior during Satellite Integration

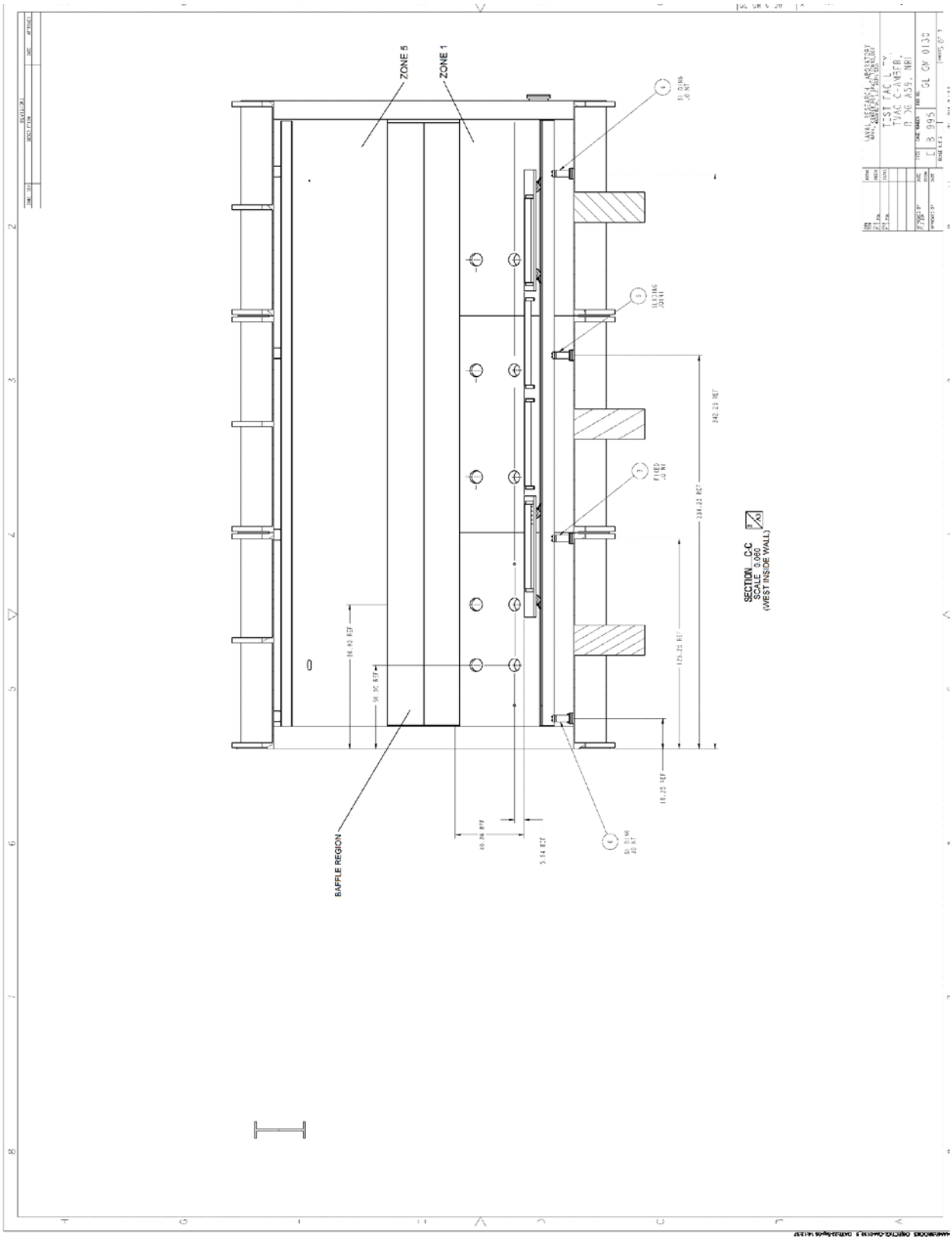
Appendix B: Drawings

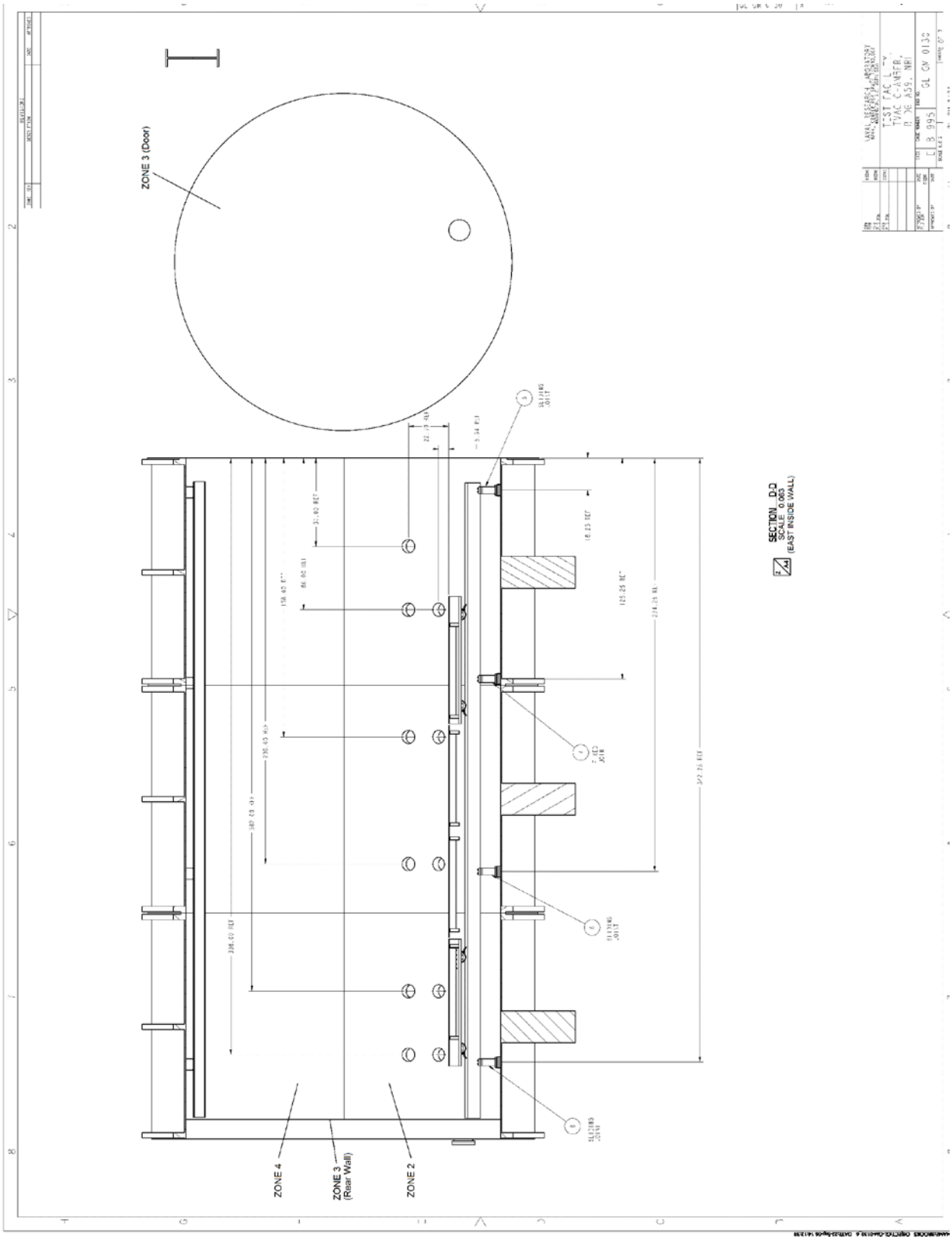


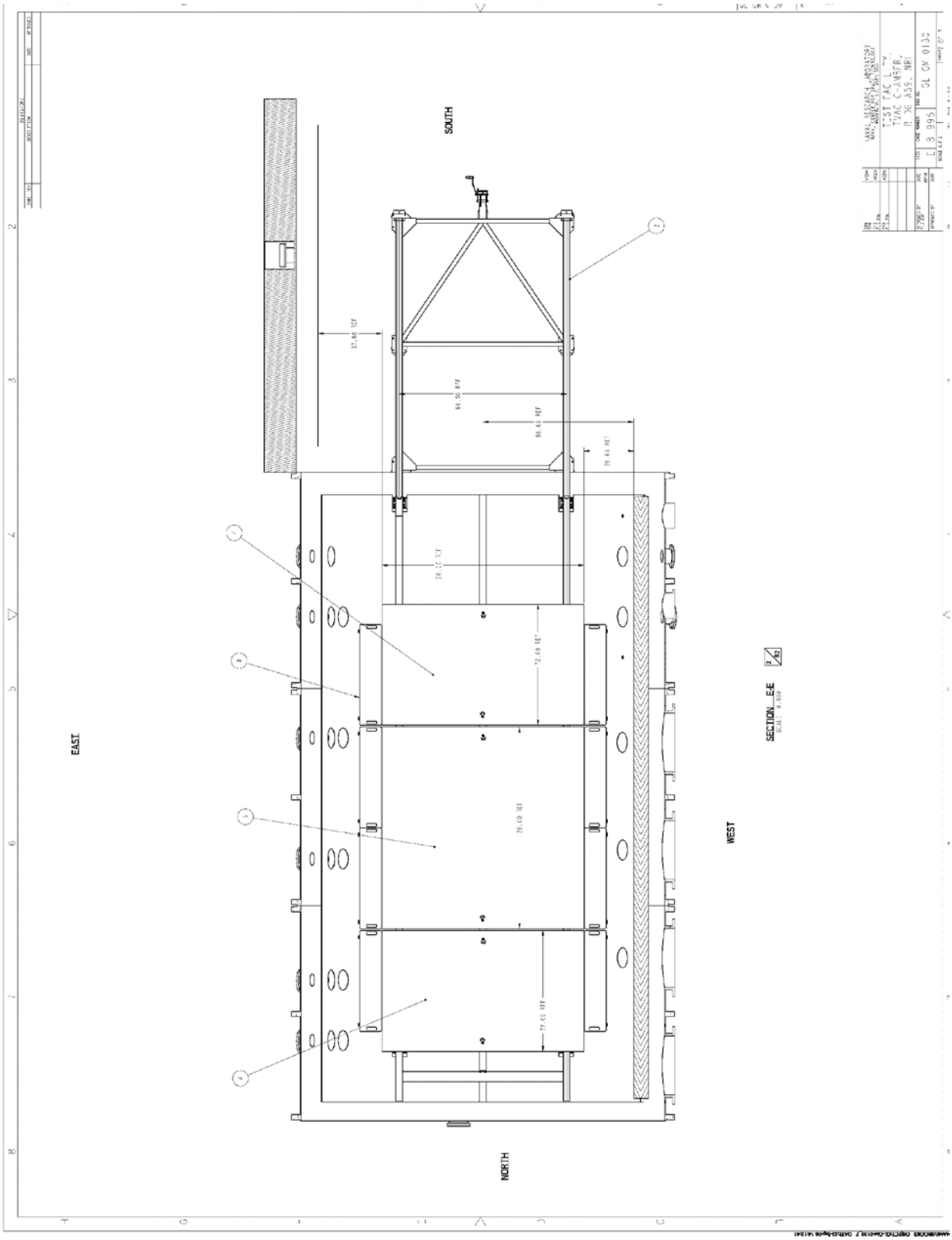

DETAIL TT
DETAIL SS
SOUTH PLAN VIEW
A
B
C
D
E
GL-GV-0130


Convert to 6" CF (ConFlat) Flange - Fixed (316LN SS)
SOUTH
NORTH
1S
1N
1W
2W
3W
4W
5W
6W
7W
8W
9W
10W
11W
12W
13W
14W
VIEW A-A
162.50 REF
226.50 REF
290.50 REF
92.5 REF


Install New 6" CF (ConFlat) Flange - Fixed (316LN SS)
NORTH
SOUTH
1N
1S
1E
2E
3E
4E
5E
6E
7E
8E
9E
10E
11E
12E
VIEW B-B


ZONE 5
ZONE 1
BAFFLE REGION
SECTION C-C
SCALE 0.060
(WEST INSIDE WALL)


ZONE 3 (Door)
ZONE 4
ZONE 3
(Rear Wall)
ZONE 2
SECTION D-D
SCALE 0.063
(EAST INSIDE WALL)


SOUTH
EAST
WEST
NORTH
SECTION E-E
TEST FACILITY
TVAC CHAMBER,
GL OM 0130