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ALIGNMENT OF THE LDUA OPTICAL ALIGNMENT SCOPE

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Test Procedure for Calibration, Grooming and Alignment of the LDUA Optical Alignment Scope

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Abstract: The Light Duty Utility Arm (LDUA) is a remotely operated manipulator used to enter into underground waste tanks through one of the tank risers. The LDUA must be carefully aligned with the tank riser during the installation process. The Optical Alignment Scope (OAS) is used to determine when optimum alignment has been achieved between the LDUA and the riser. This procedure is used to assure that the instrumentation and equipment comprising the OAS is properly adjusted in order to achieve its intended functions successfully.

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TEST PROCEDURE
for
CALIBRATION, GROOMING AND ALIGNMENT
OF THE LDUA OPTICAL ALIGNMENT SCOPE
(LDUA System 6250)

December 7, 1995

by

J.D. POTTER

Remote System and Sensor Applications

Westinghouse Hanford Company
Richland, Washington

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Calibration, Grooming and Alignment
of the LDUA Optical Alignment Scope

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Test Procedure for
Calibration, Grooming and Alignment
of the LDUA Optical Alignment Scope

1.0 TEST ITEM IDENTIFICATION

Relatively small clearances between the mast of the Light Duty Utility Arm (LDUA) and the walls of the tank riser, make it necessary to carefully align the mast with the riser before inserting it into the tank, to assure minimal contact of the LDUA mast/arm with the riser. The LDUA deployment system has the capability to translate and angulate its mast to achieve alignment with the tank riser, but by itself does not have the capability of determining when satisfactory alignment has been reached. The Optical Alignment Scope (OAS) (System No. 6250) is the device by which the operator can evaluate whether satisfactory alignment has been obtained. The OAS is part of the overall LDUA system and the testing defined herein is within the scope of WHC-SD-TD-TP-005, LDUA System Pre-Operational (Cold Test) Test Plan.

The OAS is attached to the LDUA wrist using an end effector Tool Interface Plate (TIP), in like manner as all other LDUA end effectors. It utilizes a TV camera and lights to allow the operator to optimize alignment using optical "bore scope" techniques, and downward looking point laser lights to confirm that the riser walls do not protrude into the path. Before being inserted into the riser, the OAS will provide the operator with real-time information that will assist him/her in making a determination of how to move the LDUA mast for alignment, and for judging that satisfactory alignment has been achieved. When the TV camera and lasers indicate that the OAS is aligned to the riser, the LDUA mast and arm will also be in alignment with the riser (within the ability of the LDUA wrist to correctly hold the OAS). Proximity sensors mounted around the circumference of the OAS allow the OAS to determine clearances between it and the wall of the riser as it subsequently passes through the riser. A positive pressure differential of at least 0.1 inches of water must be maintained within the OAS to allow it to operate inside tanks with flammable atmospheres. The OAS contains a pressure switch that will command all power to be removed from the LDUA and OAS should this positive pressure become too low.

Two different configurations of the OAS will be tested in accordance with this test procedure. Both test units will be clean, new equipment never having been exposed to a radiological or other toxic environment. These two configurations are as follows:

OAS Configuration A: (optional)

OAS configuration A, was designed and fabricated by Savannah River as shown on their drawing EES-22408-R1-021, Revision A, and modified at Hanford by WHC in accordance with drawing H-6-XXXX1 (TBD). Modifications may include addition of a temporary aluminum TIP and other changes. The applicable OAS drawing numbers in effect at time of testing will be recorded on the data sheets. Testing of configuration A is optional, contingent upon availability of configuration B.

OAS Configuration B:

OAS configuration B, will be made by modifying configuration A to include an actual, finalized TIP instead of the temporary aluminum TIP. Other hardware changes derived from the testing of configuration A may also be incorporated into configuration B. Configuration B will be as shown on a later revision of H-6-XXXX1 (TBD). The applicable OAS drawing numbers in effect at time of testing will be recorded on the data sheets.

2.0 GENERAL DESCRIPTION

The ability of the OAS to achieve detection of satisfactory LDUA alignment is directly related to how well the TV camera and lasers are aligned relative to the TIP of the OAS. Therefore, the objective of this test is to assure that the TV camera and downward looking point lasers are properly aligned relative to the TIP, and the side looking proximity sensors (also lasers) are to be individually checked for proper distance readouts. Adjustments will be made to the TV camera and lasers if needed.

OAS configuration A may be tested first because no actual TIP will be available for many weeks after the OAS arrives from Savannah River, yet there is much to be learned by testing the OAS as it was originally received. Therefore, configuration A will be tested to provide adequate time for further design modifications if necessary. Any such modifications will be incorporated into configuration B. OAS configuration B shall be subject to all testing specified in this procedure, as was configuration A. As an option, testing of configuration A may be omitted and only configuration B tested, depending upon when configuration B is available relative to configuration A.

In general, the alignment of the downward looking point lasers and TV camera is accomplished using a special fixture as shown schematically in figure 1, and used as described in figure 2. The side looking lasers, for detecting proximity of the riser wall, will be tested and calibrated using special calibration gages designed for that purpose. The OAS pressure switch settings will be checked with a manometer. All testing will be done in a

clean facility, with no history of exposure to radiological or toxic environments.

3.0 TEST CONDITION LIMITS

Alignment Limits: There are no OAS alignment failure modes in this test that could result in abortion of the test, other than failing to be able to adjust the four point lasers and the TV camera to align with the OAS target to the satisfaction of the CTE. The ability of the OAS to perform its intended function of aligning the LDUA mast housing to the riser will be tested as part of the LDUA Integrated Testing (Cold Test), and is not within the scope of this procedure.

Pressure Switch Settings: The pressure switch contacts shall open before the switch internal pressure is decreased to a differential of not less than 0.1, nor more than 0.3 inches of water.

4.0 INSTRUMENTS AND CALIBRATION

The only instruments used in this test required to be within calibration are:

- The precision level, used to level the OAS Alignment Fixture, will be calibrated by the WHC instrument lab. This level has a sensitivity of 0.0005 inches per foot.
- The water manometer, used to test the actuation pressure of the pressure switch, will be calibrated by the WHC instrument lab. This instrument will have a sensitivity of 0.01 inches water.

The Proximity Sensor Calibration Gages, H-4-302540-1 and -2, are special gages with certain machined features which will have been measured and verified by QC to provide known distances for calibration of the lasers used for proximity sensing. These machined features represent the closest distances of approach allowed by an object to the outer surface of the OAS before lowering of the LDUA mast is stopped for further decision/analysis. The two gages are each of one piece machined construction and will have no need of future re-verification of dimensions.

5.0 FACILITIES, EQUIPMENT, AND MATERIALS

Testing will be conducted in room 319 of the 427 building (FMEF). Modifications to the mezzanine in this room have been made per ECN 611746 to allow the OAS Alignment Fixture to be installed. The OAS Alignment Fixture and OAS will be installed on the mezzanine of this room, with the OAS target located on the floor beneath the mezzanine, as shown in figure 2. The equipment and materials listed below are necessary to perform this test:

- OAS, configuration A or B
- OAS Alignment Fixture, H-6-14330-1 (by LATA)
- OAS Alignment Target, H-6-14336-1
- Proximity sensor calibration gages H-4-302540-1, and -2
- Starret Model No. 199 Master Precision Level, sensitive to 0.0005 inches per foot or better
- Plumb-bob and string
- Eye protection for class IIIa lasers
- Rope and stanchions for roping off the work area
- Miscellaneous (e.g. duct tape, common tools, log book, etc.)
- Chain-fall and lifting slings
- 0 to 10 inch water manometer, sensitive to 0.01 inches water
- Hand operated vacuum pump
- Multi-wire cable (i.e. test cable)
- Common End Effector Electronic Chassis
- Control Chassis
- Fiber optic cable
- TV monitor

6.0 SAFETY

The following safety considerations, warnings and cautions pertaining to personnel hazards and equipment damage should be observed and adhered to during the performance of this testing:

- Lifting and hoisting equipment must comply with DOE-RL-92-36, Hanford Site Hoisting and Rigging Manual.
- Equipment shall be operated in accordance with WHC-CM-1-10, Safety Manual.
- The Lock and Tag Procedure for the FMEF shall be adhered to as applicable, whenever doing maintenance or other servicing of the OAS or test equipment.
- Before beginning a task, the Cognizant Test Engineer (CTE) is responsible to assure that all personnel taking part in the test have been briefed for their tasks and that they understand the procedure section being performed and any hazards associated with the task.
- Some sections of the procedure require the OAS lasers to be adjusted while they are illuminating a target. This requires that the adjustment be made while electrical power of less than 50 volts is applied to the OAS.
- The OAS target is mounted on the floor of room 319 in building 427. This room is often used by people in the building as a through passage to other areas. The area around the immediate proximity of the target shall be roped off to exclude foot traffic from the work zone whenever the target is on the floor, to preclude inadvertent exposure to class IIIa lasers and trip hazards. When lasers are energized eye protection will be worn within the roped zone. The roped off section will be posted with a danger sign indicating the laser hazard and warning persons that "direct beam eye exposure or eye exposure to strong reflections is prohibited."

7.0 MAINTENANCE AND FAILURES

The CTE shall maintain a log book to document daily test activities, all test anomalies, test deviations, and equipment failures. The log book shall include the immediate resolution of anomalies and equipment failure, and the proposed long term resolution (if different than the immediate resolution). The CTE shall sign and date each entry made in the log book.

There are no components within the OAS which should require maintenance during the period of test performance. Any OAS component which has been re-

adjusted, or fails and must be removed or replaced shall be subject to a repeat of those portions of this procedure to which the component has been previously subjected to.

8.0 TEST DATA

OAS alignment data obtained in this test is to be used only for WHC engineering information, and is not intended to provide quantitative data to be used for other LDUA applications. The OAS alignment information provided to engineering will assist them in making intelligent, informed, real-time decisions during the LDUA alignment operation.

The alignment data obtained by these tests is both qualitative and quantitative. The qualitative alignment data is of a type which relies on the experience and visual acuity of the observer (i.e. the CTE) as to its acceptability. The acceptability of qualitative data is so indicated by the signature of the CTE at the end of each respective section. Quantitative alignment data will be recorded on data sheet 2 (provided in section 13.0) and has no pass or fail limitations. The person entering the data in the data sheets shall sign and date at the time entry is made.

The data obtained during the testing of the pressure switch (section 11.2) is quantitative and will be used to confirm that the purge air pressure within the OAS is within acceptable limits to allow it to be used for LDUA Integrated Testing (Cold Test). Pressure switch data will be recorded on data sheet 1 (provided in section 13.0). A WHC QA representative shall witness those portions of the pressure switch testing in which their signature (and that of the person entering the data) is required in the data sheet.

9.0 PERSONNEL REQUIREMENTS

No special training, beyond that normally provided to WHC technicians, is required to perform these tests. Persons operating hoists or other lifting equipment must be qualified to operate the equipment. The testing and work performed on the OAS per this procedure will be accomplished by Engineers and technicians of WHC Remote System and Sensor Applications, under direction of the WHC Cognizant Test Engineer (CTE). One electrical engineer and one technician will be required. Persons authorized to serve as CTE for this test are: J.D. Potter, A.F. Pardini, C.M. Smith, or K.E. Bennett.

10.0 WITNESSES

A WHC QA representative shall witness those portions of the OAS pressure switch testing specified in section 11.2, where so indicated, and shall indicate acceptability of data by their signature in the applicable block of data sheet 1.

11.0 PROCEDURE

In general, the sequence of testing will be performed in the order in which it is presented in this section of the procedure. However, the CTE may authorize deviation from this test sequence at his discretion, providing he signs in the appropriate space indicated at the beginning of the test section to be performed. The CTE may also eliminate or add other steps to the test procedure at his discretion, providing they are of a non-hazardous nature. Such deviation from the procedure must be clearly red-lined into the procedure at the place where the change is to occur, and signed and dated by the CTE prior to its implementation.

Color videos and color stills may be made of each test setup at the CTE's discretion.

WARNING:

Some steps in this procedure require prolonged, close observation of a class IIIa laser image on a flat surface. Direct beam eye exposure or exposure to strong reflections is prohibited. Proper eye protection is required by persons examining the target during the test.

11.1 WIRING VERIFICATION TEST

This section of the procedure verifies correct point-to-point routing of the electrical wiring within the OAS from the device to the applicable connector pins in the TIP. In general, this is done by verifying that proper transmission of signals, to and/or from each component, is detected at the correct pin in the OAS TIP in accordance with the pin designations specified on drawing H-6-XXXX2 (TBD). The applicable OAS wiring drawing number in effect at time of testing will be recorded below by the CTE.

Applicable OAS wiring drawing number: _____, Revision: _____

Perform this section: _____ (Signature of CTE) _____ (Date)

- 1) Attach the multi-wire cable to the connectors on the OAS TIP. The other end of the cable will attach to the common end effector electronic chassis.
- 2) Attach a fiber optic cable from the common end effector electronic chassis to the control chassis.
- 3) Apply electrical power to the OAS and operate each OAS component (listed below) from the control chassis. Verify that each of the following components respond to the operating command as it should.
 - a) Point Lasers: (see figure 5 for laser location designations)
 - L1 & L3 on together
 - L2 & L4 on together
 - L1, L2, L3, and L4 on together
 - b) Proximity Sensing Lasers: (see figure 4 for laser location designations)
 - T1 on
 - T2 on
 - T3 on
 - T4 on
 - B1 on
 - B2 on
 - B3 on
 - B4 on

c) Purge Pressure Switch:

Pressure switch contacts should be open at ambient differential.

Pressure switch contacts should be closed with OAS at a pressure differential of 8.0 inches water.

d) Video

Camera zoom

Camera focus

Camera manual iris

Camera automatic iris

camera lights

Above section completed: _____ (signature of CTE) _____ (date)

11.2 PRESSURE SWITCH TEST

This section of the procedure is used to check the actuating pressures of the OAS purge air pressure switch. In normal operation the internal portion of the OAS will be positive relative to its outside. For test simplicity, a negative pressure will be applied to the sense port of the pressure switch (located on the outside of the OAS) rather than applying a positive pressure to the inside of the OAS. The OAS need not be installed in the OAS alignment fixture for the performance of this test.

Perform this section: _____
(Signature of CTE) (Date)

- 1) With ambient pressure at the sense port of the pressure switch, verify that the switch contacts are open, by observing LDUA signal at control chassis.
- 2) Attach a 0 to 10 inch water manometer and hand operated vacuum pump to the sense port and slowly draw a negative pressure until the pressure switch actuates (contacts close), as determined by observing LDUA signal at control chassis. Record the actuation pressure differential in the appropriate place in data sheet 1. QA representative signature required in data sheet.

Step complete and acceptable: CTE: _____ date: _____
QA: _____ date: _____

- 3) Starting with the pressure differential observed in step 2 above (or more), slowly allow the pressure differential to decrease until the switch actuates (contacts open), by observing LDUA signal at control chassis. The switch actuation pressure differential shall be no less than 0.1, nor more than 0.3, inches of water. Adjust pressure switch if required. Record the final actuation pressure differential in the appropriate place in data sheet 1. QA representative signature required in data sheet.

Step complete and acceptable: CTE: _____ date: _____
QA: _____ date: _____

- 4) Remove the manometer from the sense port of the pressure switch.

Above section completed: _____
(signature of CTE) (date)

11.3 OAS ALIGNMENT FIXTURE INSTALLATION

This section of the procedure installs the OAS Alignment Fixture (H-6-14330-1), OAS Alignment Target (H-6-14336-1) and the OAS in the test facility, and readies them for initiation of the OAS alignment test.

Perform this section: _____
(Signature of CTE) (Date)

- 1) Rope off the work area at the floor on which the OAS target is to be installed, to exclude persons not involved with the test from inadvertently entering into a zone with potential exposure to class IIIa lasers and trip hazards. The roped off section will be posted with a danger sign indicating the laser hazard and warning persons that "direct beam eye exposure or eye exposure to strong reflections is prohibited."
- 2) Remove the 17 inch diameter X 1/4 inch thick cover plate from the center of the mezzanine deck plate indicated on ECN 611746, and install the support frame of the OAS Alignment Fixture over the hole. Secure the fixture in place with three 3/8-16UNC-2A screws 1.75 inches long.
- 3) Place the Leveling Plate of the OAS Alignment Fixture on top of the support frame, with the bottom of the three leveling screws resting in the three holes provided on top of the support frame. Verify/adjust the three leveling screws to be approximately in their mid-range of travel and snug their jam nuts.

NOTE:

The operational TIP used in configuration B will have its own attachment device built into it, which can be manually operated to secure it beneath the leveling plate. The method of attaching the temporary TIP used in configuration A, may differ, but will still be manually attached.

NOTE:

The lower portion of the OAS (housing the TV camera, etc) will have not yet been installed before beginning this section of the procedure.

- 4) Attach the OAS to the bottom side of the Leveling Plate. Secure it in place (see notes above) and attach electrical cabling to its connectors.

- 5) Attach the Centering Arm of the OAS Alignment Fixture to the Leveling Plate.
- 6) Position the OAS Alignment Target on the cell floor, approximately directly beneath the OAS Alignment Fixture, and level it by turning its three adjustment screws. NOTE: Shiny, reflective surfaces of the target with potential exposure to laser beams, including movable gage blocks, shall be painted with a flat luster grey paint.
- 7) Attach the plumb-bob to the Centering Arm and adjust its string length such as to support the plumb-bob approximately 0.03 inches above the OAS Alignment Target.
- 8) Level the top of the Leveling Plate by adjusting the three leveling screws in accordance with the steps a) through f) below, until a levelness of 0.0015 inches per foot (or best practicable) is obtained in all directions as determined with a precision machinists level.

NOTE: Assign a designation of A,B, and C to each of the three leveling screws respectively. The screw designated as A will not be disturbed during the leveling operation. Only screws B and C will be adjusted. Designations are arbitrary and only serve to distinguish sequence of operations in the immediately following steps.

- a) Position the level on top of the Leveling Plate such that it is directly over adjustment screws A and B, adjust screw B until the level indicates levelness within 0.0015 inches per foot, then tighten the jam nut on the screw.
- b) Position the level on top of the Leveling Plate such that it is directly over adjustment screws A and C, adjust screw C until the level indicates levelness within 0.0015 inches per foot, then tighten the jam nut on the screw.
- c) Position the level on top of the Leveling Plate such that it is directly over adjustment screws B and C and verify that the level indicates levelness within 0.0015 inches per foot.
- d) Position the level on top of the Leveling Plate such that it is directly over adjustment screws A and B and verify that the level indicates levelness within 0.0015 inches per foot. Repeat step a) if levelness is not obtained.
- e) Position the level on top of the Leveling Plate such that it is directly over adjustment screws A and C and verify that the

level indicates levelness within 0.0015 inches per foot.
Repeat step b) if levelness is not obtained.

- f) Continue to repeat steps a) through e) until required levelness is obtained in all directions.
- 9) Turn on the four downward looking point lasers.
- 10) Re-position the OAS Target on the cell floor until its center is directly beneath the point of the plumb-bob, and the laser images are near the cross hair lines, as determined by closeup visual examination by the CTE. Relevel the target if necessary. Turn off the lasers.
- 11) Mark on the leveling plate and floor to detect if target should be inadvertently moved. Tape the target to the floor with duct tape, leaving the marks visible.
- 12) Remove the plumb-bob, string and OAS Centering Arm from the Alignment Fixture. Fixture installation is complete.

Above section completed: _____ (signature of CTE) _____ (date)

11.4 ALIGNMENT OF OAS INSTRUMENTS

This section of the procedure checks the OAS for satisfactory alignment of the downward looking point lasers and TV camera relative to the TIP, and makes alignment adjustments if needed.

WARNING: Some steps in this section have potential exposure to class IIIa laser beams. The work area must be roped off to exclude unauthorized personnel. Direct beam eye exposure or exposure to strong reflections is prohibited. Proper eye protection shall be worn within the zone when lasers are energized. This includes persons making adjustments to OAS lasers.

11.4.1 Point Laser Alignment

The steps in this section of the procedure are used to determine whether the four downward looking point lasers are satisfactorily aligned relative to the TIP.

Perform this section:

(Signature of CTE)

(Date)

NOTE: The lower portion of the OAS (housing the TV camera, etc) will have not yet been installed before beginning this section of the procedure.

- 1) Disconnect power leads to all lasers at their connectors located within the OAS body.
- 2) Test each of the four downward looking point lasers as described in the following steps:
 - a) With the laser turned off, look straight into the prism parallel to the longitudinal axis of the OAS, and observe the refracted image of the laser lens. The laser image should be as far radially outward from OAS body as practicable, while still providing a full image. If necessary, adjust laser lens image by loosening the two fasteners of the laser and moving laser body in a direction parallel to the OAS longitudinal axis to cause image to move radially. Retighten fasteners.
 - b) Reconnect the power lead to the first point laser to be tested, leaving others disconnected.
 - c) Turn on the laser and observe the image formed on the OAS target on the cell floor. The outer edge of the laser beam

should form a thin, distinct line on the inner surface of the upright block located on the 10.500 inch circle on the target (see figure 3). If the laser beam pattern is not satisfactory (as determined by the CTE) the laser may be adjusted by loosening one of the two fasteners securing it to the mounting bracket, rotating it for proper indication on the target, then re-tightening the fastener.

- d) Turn off the laser and disconnect its power lead.
- 3) When testing is complete on all four point lasers reconnect their power leads and turn them each on to verify that they operate, then turn them each off.

Above section completed: _____ (signature of CTE) _____ (date)

11.4.2 TV Camera Alignment

The steps in this section of the procedure are used to determine whether the TV camera is satisfactorily aligned relative to the TIP and to center the reticle (as viewed on the TV monitor) on the OAS target.

Perform this section:

(Signature of CTE)

(Date)

NOTE: item numbers in this section are in reference to drawing EES-22408-R1-021, rev.A.

- 1) Verify/turn off all electrical power to the OAS.
- 2) Install the lower portion (i.e. Front Housing Weldment, item 1) of the OAS to the upper portion. Be certain that O-ring seal is installed.
- 3) Apply electrical power to the OAS then turn on the TV camera and lights. The image of the target on the cell floor should be approximately centered in the screen of the viewing monitor. If the image is not satisfactorily centered (as determined by the CTE) perform steps 4 and 5, otherwise these steps may be omitted.
- 4) Remove all electrical power from the OAS, then remove the end plate (item 2), with TV camera, lights and lasers attached, and adjust the TV camera as directed by the CTE. Adjustments may be made by shimming between the lens mounting bracket (item 10) and the end plate and/or between the bracket and the lens (item 8). Re-install the end plate of the OAS.
- 5) Repeat step 3.
- 6) While viewing the OAS target on the TV monitor, zoom in until the target nearly fills the screen. Operate the controls on the control chassis to move the small dotted reticle until its center coincides with the center of the target observed on the monitor, as determined by the CTE.
- 7) Place the transparent overlay of the larger graduated reticle over the screen of the monitor and tape it in place such that its center coincides with the center of the small dotted reticle, as determined by the CTE. Observe the effects of parallax at outer edges of target relative to graduation marks on the transparent overlay (as determined by CTE).

NOTE: this same control chassis must be used for all future OAS operations. If spare chassis are required they should also be subjected to steps 6 and 7 above at this time. All chassis subjected to this test shall have a label permanently attached to them in a prominent location. The label shall state the following information:

"CAUTION! Do not adjust screen parameters.
This unit is used for LDUA alignment."

- 8) Repeat step 2.c of section 11.4.1, remove front weldment of OAS and re-adjust point lasers if required per section 11.4.1.
- 9) Remove electrical power from the OAS.

Above section completed: _____ (signature of CTE) _____ (date)

11.5 PROXIMITY SENSOR TEST

The steps in this section of the procedure are used to calibrate the eight sideward looking lasers for proximity sensing. It is not necessary that the OAS be installed in the OAS alignment fixture for this work.

Perform this section:

(Signature of CTE)

(Date)

WARNING: Some steps in this section have potential exposure to class IIIa laser beams. The work area must be roped off to exclude unauthorized personnel. Direct beam eye exposure or exposure to strong reflections is prohibited. Proper eye protection shall be worn within the zone when lasers are energized.

- 1) Apply electrical power to the OAS for operation of the proximity sensing lasers. Put opaque tape over all eight proximity sensor laser ports and over the ports of the four point lasers before operating any of the lasers.
- 2) Remove the tape from the port of only that proximity sensor to be calibrated. Position the OAS Proximity Calibration Gage H-4-302540-1, over the proximity laser port and firmly secure it in place. Apply tape to cover gaps between the gage and the OAS to block potential laser light reflections.
- 3) Turn on the laser at which the calibration gage is installed. Record the reading observed on the proximity sensor readout display in the appropriate space of Data Sheet 2, referring to the sensor location designations shown in figure 4. Turn off the laser.
- 4) Remove calibration gage, H-4-302540-1, and position calibration gage H-4-302540-2 over the laser port. Apply tape to cover gaps between the gage and the OAS.
- 5) Turn on the laser at which the calibration gage is installed. Record the reading from the proximity sensor in the appropriate space of Data Sheet 2, referring to the sensor location designations shown in figure 4. Turn off the laser.
- 6) Remove the calibration fixture and re-install tape over the port of the sensor.

- 7) Repeat steps 2 through 6 for each of the eight proximity sensor lasers then remove electrical power from the OAS. Remove the tape from all eight proximity sensor laser ports and the four point laser ports.

Above section completed: _____ (signature of CTE) _____ (date)

11.6 RESTORATION OF TEST FACILITY

The test facility shall be restored to its original condition (as it was prior to initiating this procedure) per the following steps:

Perform this section: _____
(Signature of CTE) (Date)

- 1) Verify/turn off all electrical power to the OAS.
- 2) Remove the OAS from the OAS Alignment Fixture and carefully place it in a suitable storage/transportation container.
- 3) Detach the OAS Alignment Fixture from the floor of the facility. Return the OAS Leveling Plate, Centering Arm, Target, machinists level, and plumb-bob, to their storage container(s).
- 4) Re-install the cover plate over the hole in the floor of the facility, securing it in place with the four fasteners (ref. ECN 611746).
- 5) Remove the rope and stanchions used to restrict unauthorized persons from the work area.

Above section completed: _____
(signature of CTE) (date)

12.0 DISPOSITION OF TEST ITEMS

OAS configuration A will be reworked into OAS configuration B at a later date. In the interim, it shall be placed in a suitable, clean container for protection and stored indoors in a clean, environmentally controlled area.

OAS configuration B will be used for alignment of the LDUA in support of the LDUA Cold Test to be conducted in the FMEF. In the interim, it shall be placed in a suitable, clean container for protection and stored indoors in a clean, environmentally controlled area.

13.0 DATA SHEETS

The following pages in this section of the procedure provide the data sheets to be used for documentation of test results when so indicated in the procedure (section 11.0)

DATA SHEET 1

Pressure Switch Test (ref. section 11.2)

Applicable OAS drawings:

Savannah River drawing: _____, Revision No. _____

WHC OAS drawing: _____, Revision No. _____

WHC OAS wiring drawing: _____, Revision No. _____

Step No.	Allowed Value	Actual Value	Units	Name of person entering data	Date	Witness (QA rep.)	Date
11.2, 2	(record only)		inches of water				
11.2, 3	0.1 to 0.3		inches of water				

DATA SHEET 2

Proximity Sensor Readings (Ref. section 11.5)

See figure 4 for location designations applicable to each respective proximity sensor. Note: The gages are designed to provide a given "Test Distance" from the outer body of the OAS, while the proximity sensor is reading the distance from its mounting bracket located within the OAS, thus a significant difference between the two distances is normal. The test distances provided by gages H-4-302540-1 and -2 are 0.545 inches and 0.380 inches respectively.

(see fig. 4) Laser Number	(Using Gage H-4-302540-1) Laser Reading (inches)	(Using Gage H-4-302540-2) Laser Reading (inches)	Name of person entering data	Date
B1				
B2				
B3				
B4				
T1				
T2				
T3				
T4				

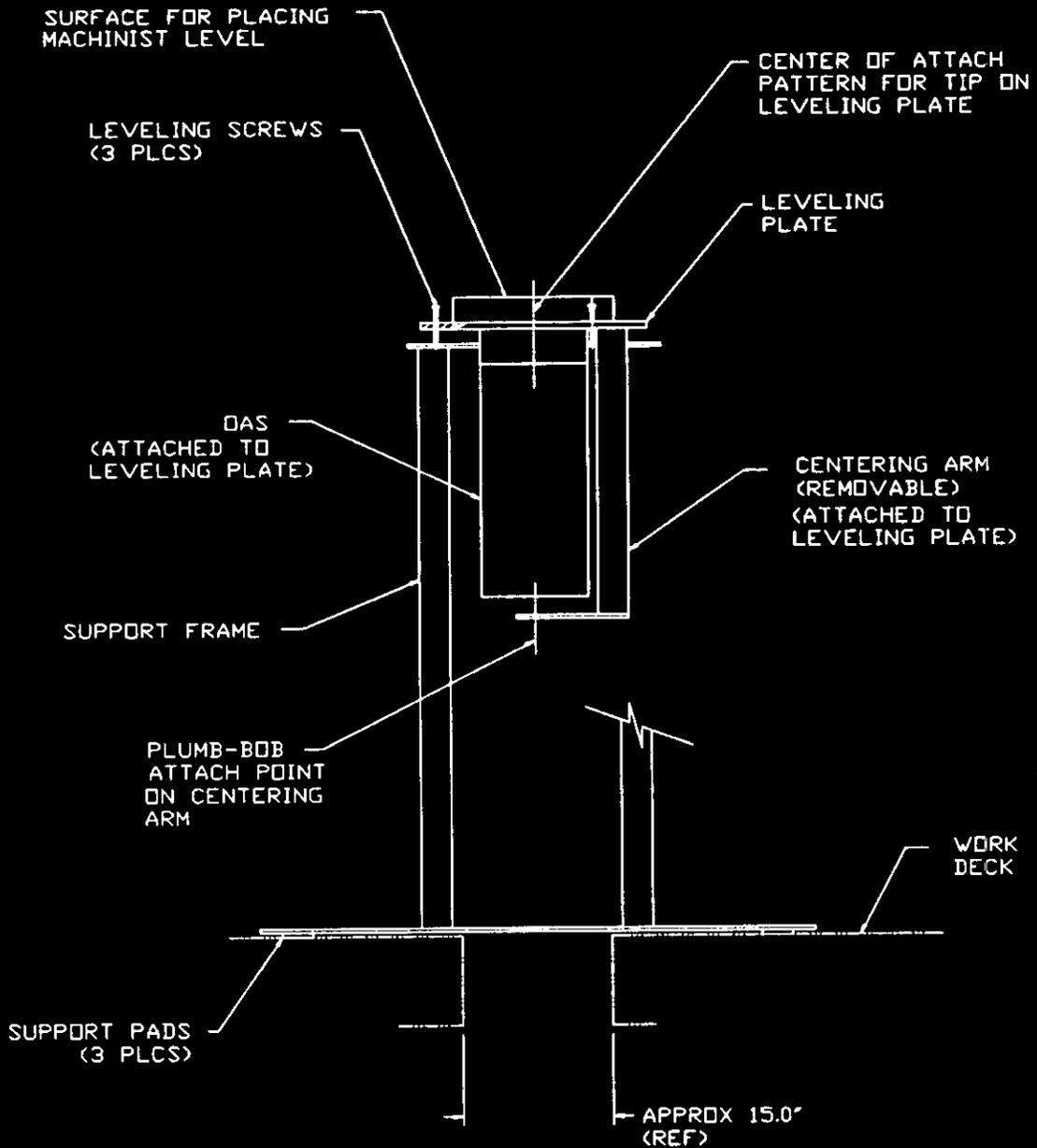
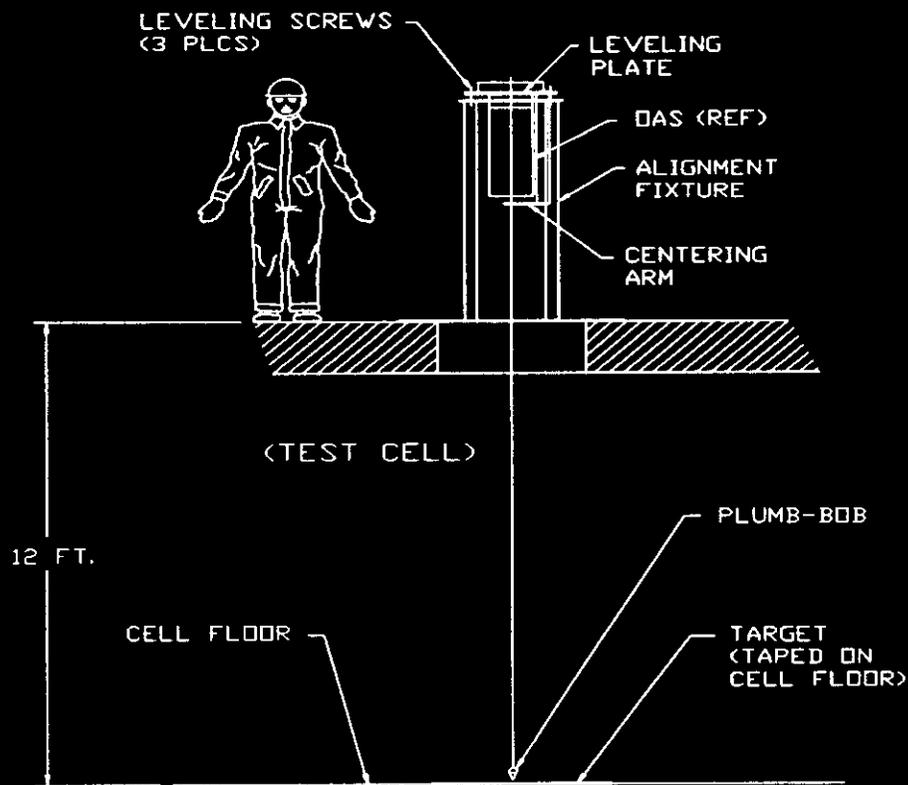


Figure 1

SCHEMATIC OF LDUA
OAS ALIGNMENT FIXTURE



ADJUSTMENT OF DAS LASERS/TV IMAGE

1. Install DAS and alignment fixture over test cell opening
2. Adjust alignment plate to level the DAS TIP, using a machinist level
3. Attach plumb-bob to centering arm, then adjust the target on the cell floor until it is centered beneath the plumb-bob
4. remove plumb-bob and centering arm
5. Adjust DAS lasers and TV camera to be centered about the target on the cell floor

J.D. POTTER JULY 11, 1995
D:\ACDATA\LDUA\DAS_FIXT.DWG

Figure 2

**GENERAL PROCEDURE OUTLINE FOR
VERIFYING/ALIGNING THE OAS**

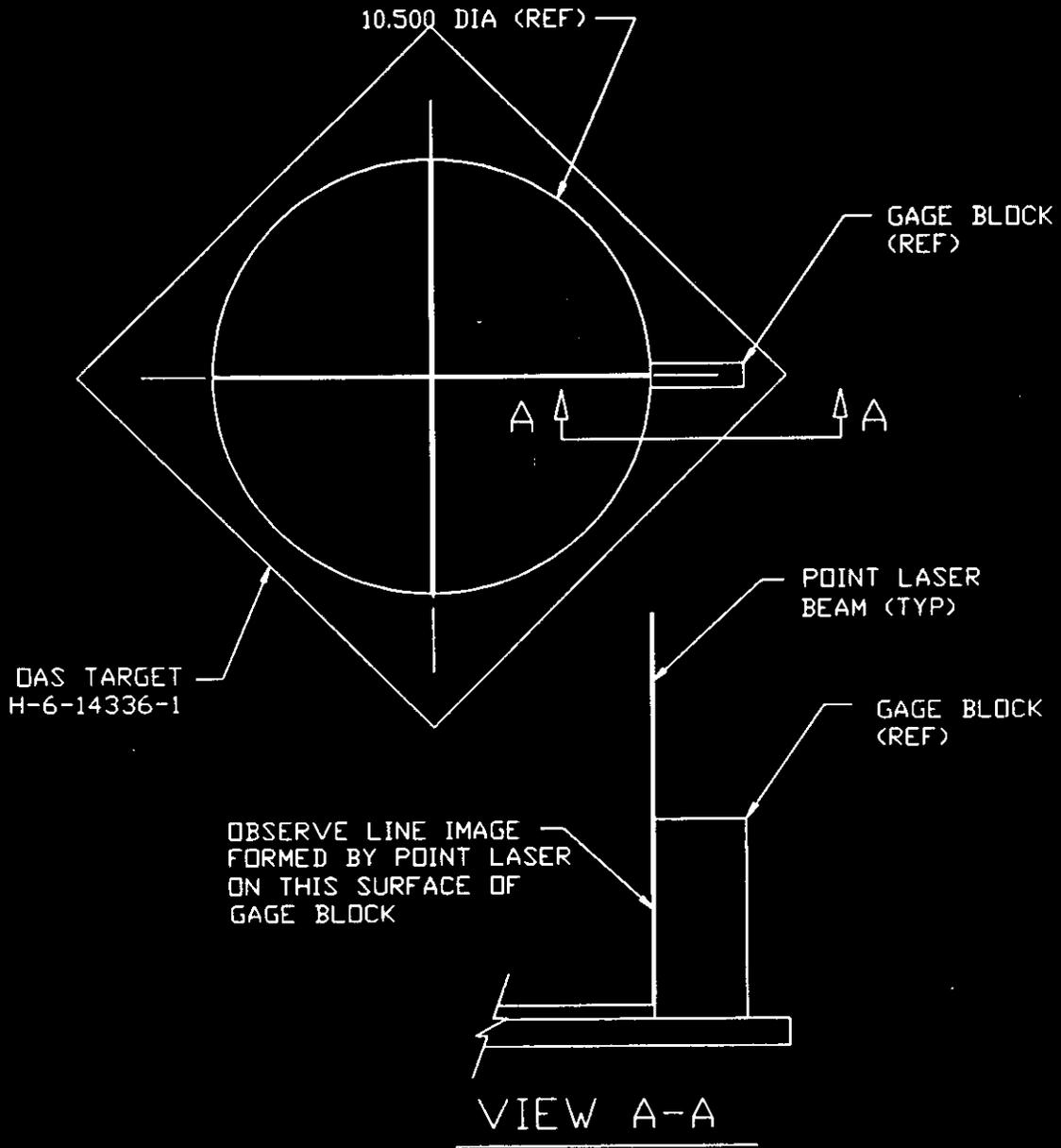


Figure 3

Acceptable Beam Pattern for Point Lasers

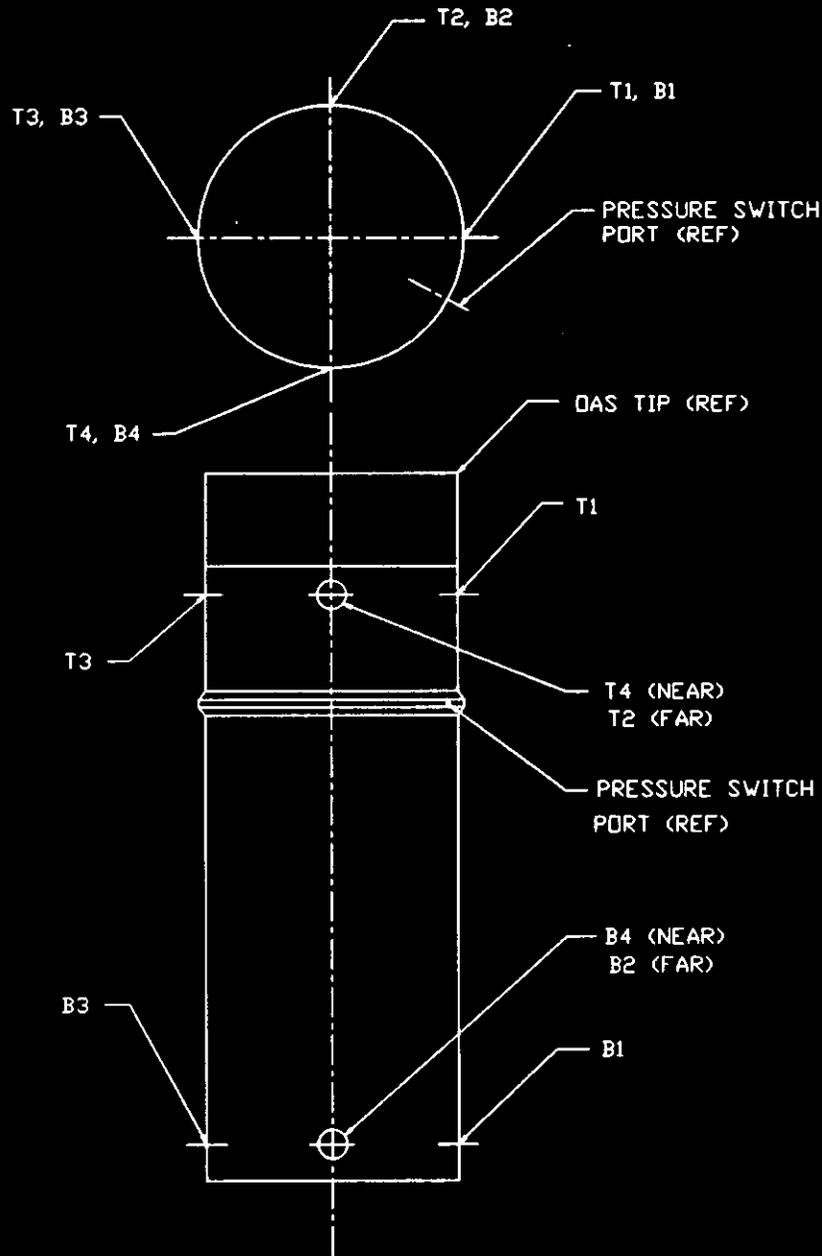


Figure 4

OAS Location Designations for
Proximity Sensors (eight sideward looking lasers)

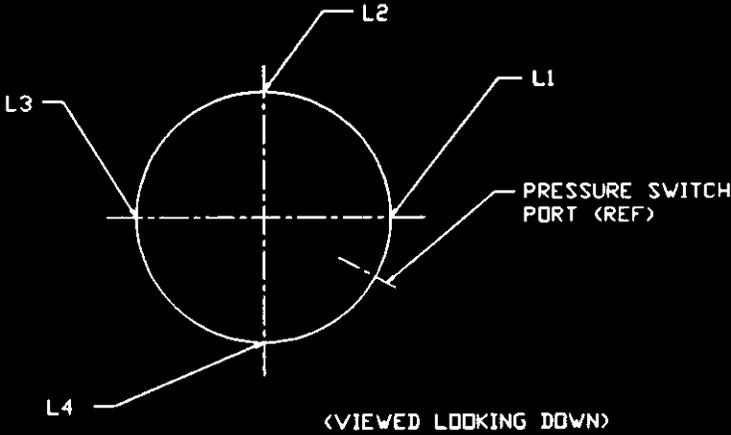


Figure 5

OAS Location Designations for
Point Lasers (four downward looking lasers)

DISTRIBUTION SHEET

To 8A800	From J.D. Potter	Page 1 of 1
Project Title/Work Order WHC-SD-WM-TC-070, Rev. 0, Test Procedure for CG&A of the LDUA Optical Alignment Scope		Date 12/7/95
		EDT No. 140944
		ECN No. N/A

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
T.M. Amundson	N2-10	X			
K.E. Bennett	N1-21	X			
B.A. Carteret	N1-21				X
R.B. Conrad	H5-09	X			
D.S. Dutt	N1-21				X
G.R. Kiebel	N1-21	X			
A.F. Pardini	N1-21	X			
J.D. Potter (3)	N1-21	X			
M.E. Riste	N2-11	X			
C.M. Smith	K5-22	X			