

**NATIONAL RADIO ASTRONOMY OBSERVATORY**  
Socorro, New Mexico

VLBA Antenna Memo Series No.22

**Hancock, New Hampshire- Maintenance Visit, June 22 - 28, 1999 - Trip Report**

J. E. Thunborg  
September 2, 1999

**Attachments:** Azimuth Rail Level Survey, Servo Trip Report, Electronics Trip Report, Paint Report, Task Schedule

The Hancock maintenance team consisted of S. Aragon, R. Gutierrez, S. Tenorio, S. Troy, J. Thunborg and P. Ulbricht. The team worked at the Hancock antenna from August 16 - 22, 1999. The Site techs M. Alfero and D. Whiton also worked toward the completion of the scheduled tasks.

All of the azimuth bearing races were rotated 180 degrees. Both Az#1 drive bearings and the Az#2 outside idler bearing had slightly pitted sections on the outer bearing races. These bearings were not changed and will probably last a few more years, since the outer races were rotated. These bearings should be scheduled for change during the next Hancock maintenance visit in 3 years.

A hydraulic wrench was used to loosen 18 pintle-bearing bolts. Dial indicators were then placed on the bearing and the antenna was rotated. The measured vertical runout was 0.003".

The paint on the antenna was in excellent condition except on the panels, subreflector and a few small areas.

The following items were tested/inspected and repaired if needed. A more detailed list/schedule is attached to this document.

1. Extend elevation platforms providing additional access to drive motors.
2. Add toe boards to elevation axle platform.
3. Install elevation hard stops.
4. Install elevation bearing grease trays.
5. Measure pintle bearing pocket flatness.
6. Bearing Inspections/grease samples - Azimuth, Pintle and Elevation
7. Rotate azimuth bearing outer races.
8. Gearbox inspections - Azimuth and Elevation
9. FRM inspection/PM - per detailed checklist.
10. Subreflector inspection.
11. Feeds and DiChroic reflector inspection
12. Quad leg and guy wire inspection.
13. Antenna structure - Cracks, tighten loose bolts, repair insulation.
14. Bull and pinion gears - lubricate and tighten bolts.
15. Swinging platform and hoist inspections.
16. Detailed corrosion inspection.

17. Paint Inspection - Complete Hancock Paint report.
18. Rail inspection and level measurement.
19. Drive Motor Inspections/PM - brakes, couplings, commutators and brushes
20. Servo system - Complete checkout per servo shop checklist.
21. Lightning protection inspection/repair- cables, straps and grounding.
22. Replace ped room A/C
23. Control building Contempo upgrade.
24. HVAC inspections per detailed checklist.
25. Utilities - Water, Sewer and Propane System
26. Vertex room HVAC repairs/mods.
27. Anemometer inspection/repair.
28. Antenna electrical inspections - Per detailed checklist
29. Station building electrical inspections - Per detailed checklist
30. Other electrical Inspections- Generator, Weather Station and Grounds.
31. Checkout fire alarm.
32. Add internet site camera
33. Replaced Ped room A/C unit with a Marvaire Unit.
34. 3mm modifications to B-rack

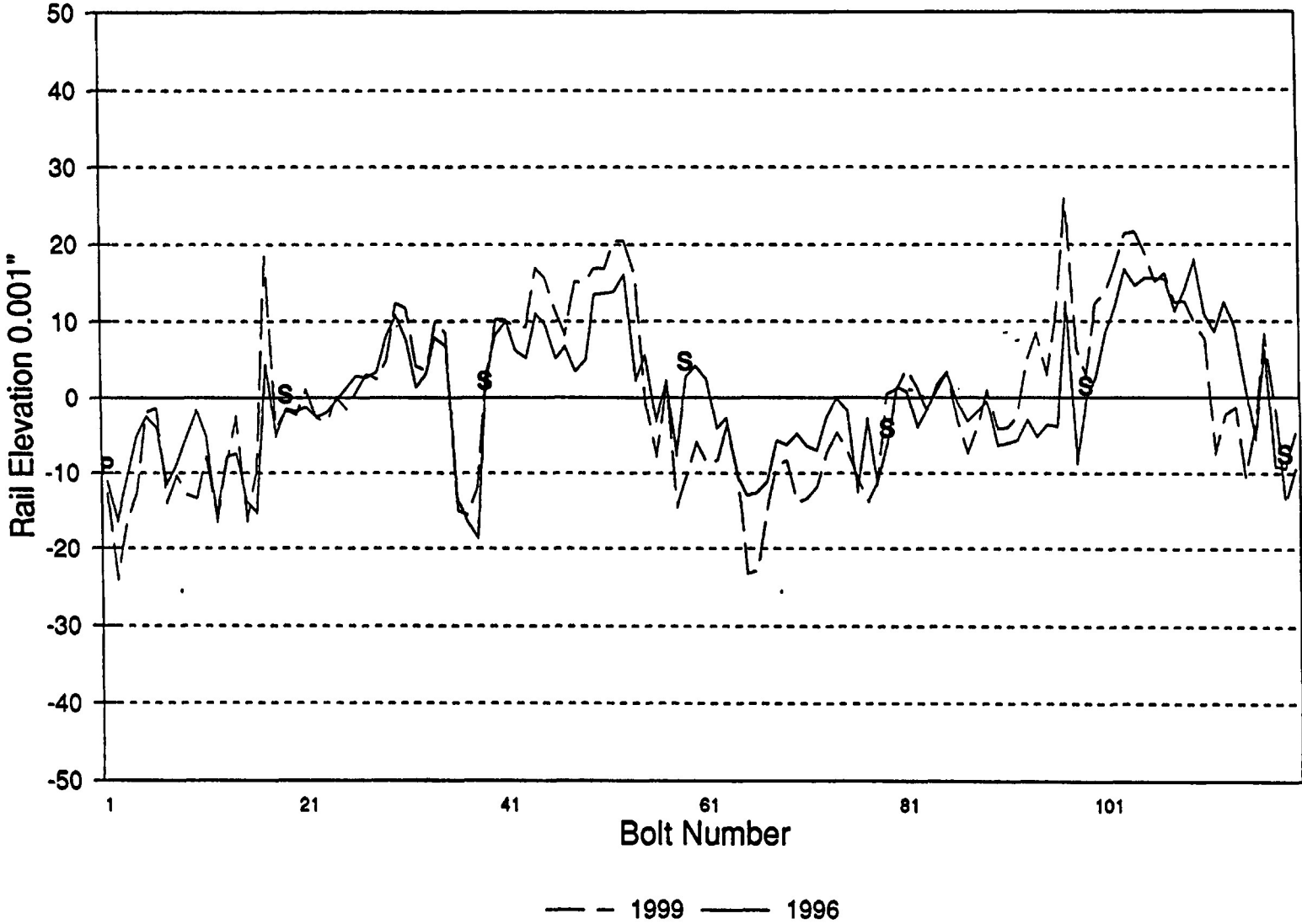
The following non-scheduled items were also completed.

1. Repaired pintle bearing Grease tray.
2. Repaired winch post.
3. Replaced Lovejoy couplings on all drive motors
4. Adjusted cable wrap to allow additional clearance.
5. Repaired leak in ped room cable feedthroughs
6. Repaired feedcone insulation
7. Replaced lovejoy couplings
8. Installed offset Stainless steel J-boxes on drive motors.
9. Found & repaired a leak in the suction line located in Vertex room.
10. Replaced oil saturated HVAC tube insulation in Vertex.
11. Repaired Refrigerant leak in Building A/C condensing unit.
12. Installed 2 feed heaters.

Several details were left uncompleted. These details and their required follow-ups are listed below. .

1. Inspected Propane piping & found that it is Sch. 40 pipe instead of Sch.80. Steve Troy asked Doug to get a quote to replace the piping to determine if we should have it done locally or on our next visit, depending on cost.
2. The panel bolts were only spot checked in order to preserve the paint.

**HN Azimuth Rail**  
Measured 8/20/99



# **interoffice**

## **MEMORANDUM**

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**To:** List  
**From:** Steve Tenorio  
**Subject:** Trip report VLBA HANCOCK  
**Date:** 24 AUG 99

14aug99 Day # 1 Travel from San Antonio N.M. to Alb. N.M..

15aug99 Day #2 Travel from Alb. N.M. to Keen N.H.

16aug99 Day #3 Rewired Az. #2 tach. Cable, Az # 1 and Az. #2 E-stop cables, and Az.stairway E-stop. Started replacing Az. Motor j-boxes.

17aug99 Day#4 Completed installation of Az. Motor j-boxes. Replaced El. Motor j-boxes. Completed Drive Cabinet pm. Checked grounding in ped. Room. Completed ACU. and Data Converter pm. Cleaned and seated Az. Brushes. Checked El. Brushes.

18aug99 Day#5 Rewired El. E-stop to new platform extention. Mounted warning horn to El. Platform j-box. Ty-wrapped El platform cables. Completed electrical checks in ped. Room. Check current on gear box heaters. Completed servo test.

19aug99 Day#6 Helped antenna mechanics with hardstops. Replaced motor blower filters. Changed motor coupling spiders on Az. And El. Motors. Sealed motors and motor blowers with rtv to try and stop pollen problem. Helped S. Troy replace ped. Room A/C. Painted blower motors. Helped mechanics paint welds.

20aug99 Day#7 Cleaned up ped. Room and replaced electrical panel covers. Checked lighting protection on antenna. Helped J. Thunborg shoot rail. Checked Az. Cable wrap and limits. Checked El. Cable wrap and limits. Helped grease El. Bearing.

21aug99 Day#8 Ty-wrapped cables into drive cabinet. Helped ant. Mech. Grease pintal bearing. RTVed leak in ped. Room. Adjusted bracket on cable wrap for Pete. Cleaned up antenna and loaded container.

22aug99 Day#9 Traveled back from Keen N.H. to San Antonio N.M.

**Conclusion:** Hancock site is in real good shape. One suggestion is that the blower filters be changed from the metal type to the paper type.



**TO: Jon Thunborg**

**FROM: Pete Ulbricht**

**SUBJECT: Hancock Maintenance Trip**

The Maintenance Visit to Hancock was from August 15-22, 1999. The site was in very good condition. It was evident that the site personnel take pride in maintaining their facility.

I installed the 3mm modifications to the B-Rack which included relocating S11 and S12. With the exception of North Liberty, all sites should have this change completed. I found several discrepancies comparing the drawings with the locations of cables feeding the back of the B-Rack. Although none of the changes affected the operation of the Electronics, I corrected them to match the schematics for future reference. The P-Band cables were cross-polarized at the back of the B-Rack. I could not find a reason for this (second cross). The labels on the cables are from the original outfitting and the frontend has not been changed. Operations has not had any complaints with it's operation, so I left it as I found it.

I installed 2 feedheaters and repositioned the existing ones to better utilize the heat. I ran new cables from the Vertex Room DDC Smart Controller down through the spare MCB cable to the building and into room 103. I also ran cables for the Contempo DDC controller including; a temperature sensor under the floor in room 104 under the Maser, a humidity sensor mounted through a ceiling tile in room 103, and a RS-232 cable into room 103 to an A-B switch so the site techs can check the controllers from the PC using PCTool software. Mark and Doug installed the new SCSI hard drive into the Station VME Computer.

I checked all the J-boxes in the Station Building with the IR thermometer for hot spots----only found one "warm" one. I tightened the connection. I checked all the IF cables, the 500Mhz, and the 100 Mhz with the TDR and found them to be very good. The power loss from the Vertex Room to the station building was consistent from cable to cable at about 7.8 db.

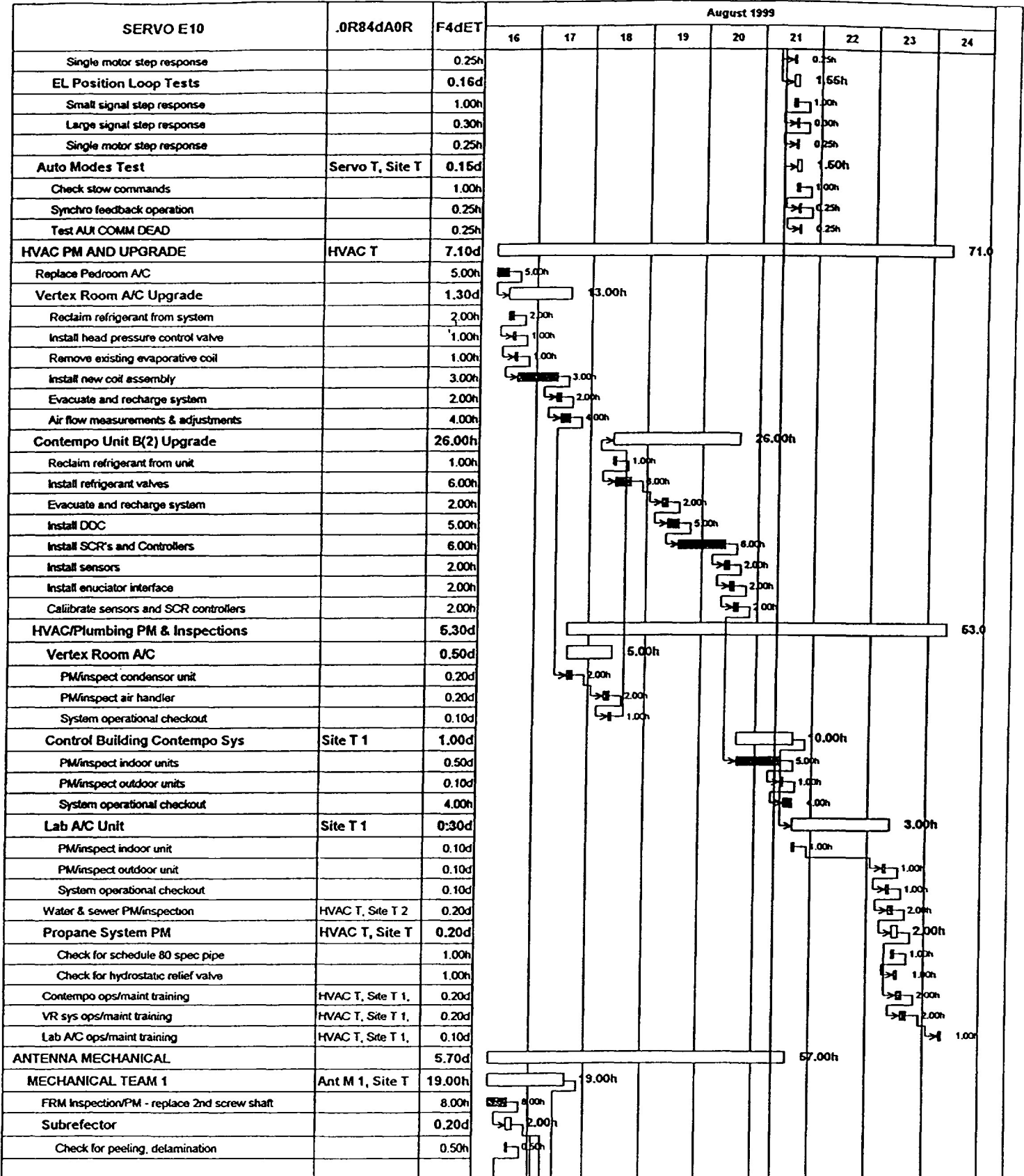
I installed the video camera at the top of the Weatherstation Tower and cabled it into the Station building using the underground conduit. We had to remove a connector and pull out the fiberoptic cables before pulling the new cables in with the existing cables. We included an RS232 cable at the request of the site techs. Doug and Mark tied it into the existing RS232 cable, W-115 and installed a connector out at the Weatherstation to connect to the laptop computer.

I completed a top-to-bottom inspection of the antenna. The azimuth cablewrap bothered me a little. At one spot during the rotation, the arm supporting one end of the spring assembly was so close to the phenolic tray that my credit card would not slide between the two. The arm had no adjustment. Steve Aragon and Ramon Gutierrez were able to redrill and raise the arm to give a margin of safety to it's operation.

1999 VLBA Tiger Team Maintenance  
Task Listing for MK, HN and SC

Task Name	Resources	Durat	August 1999							
			16	17	18	19	20	21	22	23
<b>SERVO</b>		<b>10.84d</b>	108.40h							
<b>SAFETY TESTS</b>	Site T 1, Site T	<b>2.00h</b>								
MULTIPLE FAULT STATUS		0.10h								
MANUAL MOOES TEST		0.20h								
INDIVIDUAL FAULT STATUS		0.20h								
REMOTE BOX TESTS		0.50h								
<b>AZ Travel Limit Switch Tests</b>		<b>0.05d</b>								
AZ Clockwise tests		0.25h								
AZ Counter-Clockwise tests		0.25h								
<b>EL Travel Limit Test</b>		<b>0.05d</b>								
Elevation up tests		0.25h								
Elevation down tests		0.25h								
<b>BRAKE HOLDING-TORQUE TESTS</b>	Servo T, Site T 1	<b>8.00h</b>	8.00h							
<b>Motor Inspections</b>	Servo T, Site T	<b>13.00h</b>	13.00h							
Motor and Tach Couplings		2.50h	2.50h							
Drive motors wiring orientation		8.00h	8.00h							
Commutator & Brush Inspection		2.50h	2.50h							
<b>Servo PM</b>	Servo T, Site T	<b>3.50h</b>								
Drive Cabinet PM		2.50h								
Rewire Lockout Switch		2.50h								
ACU PM		1.00h								
<b>INSPECT ANTENNA POWER PANELS</b>	Servo T, Site T 2	<b>3.00h</b>								
<b>INSPECT GEARBOX HEATERS</b>	Servo T, Site T 2	<b>2.00h</b>								
<b>Lightning Grounding</b>	Servo T, Site T	<b>1.95h</b>								
EL Bearing Ground Cables		0.25h								
EL Motor Platform to Pintle Turret		0.20h								
Pedestal Room Grounding		0.75h								
AZ Wheel Ground Straps		0.50h								
Pintle Bearing Room Grounding		0.25h								
EL encoder inspection		8.00h								
Replace W39 cable - AZ stair e-stop to drive cabinet		1.00h								
Replace W43 cable - AZ#2 e-stop to drive cabinet		1.00h								
Replace W39 cable - AZ#2 motor j-box to drive cabinet		1.00h								
<b>Detailed Test</b>	Servo T, Site T	<b>7.80h</b>								
System and Axis Faults		2.00h								
Motor Fault Status		0.30h								
Measure EL Velocity		0.25h								
EL counterweight balance measurements		4.00h								
Measure AZ Velocity		0.25h								
Record 1st Limits EL/AZ		1.00h								
<b>Recordings</b>	Servo T	<b>8.60h</b>								
<b>EL System Response Test</b>		<b>0.28d</b>								
Implement test setup		1.50h								
Calculate acceleration		0.25h								
Locked rotor resonance, AZ/EL		0.10d								
<b>AZ System Response Test</b>		<b>0.28d</b>								
Implement test setup		1.50h								
Calculate acceleration		0.25h								
Locked rotor resonance, AZ/EL		0.10d								

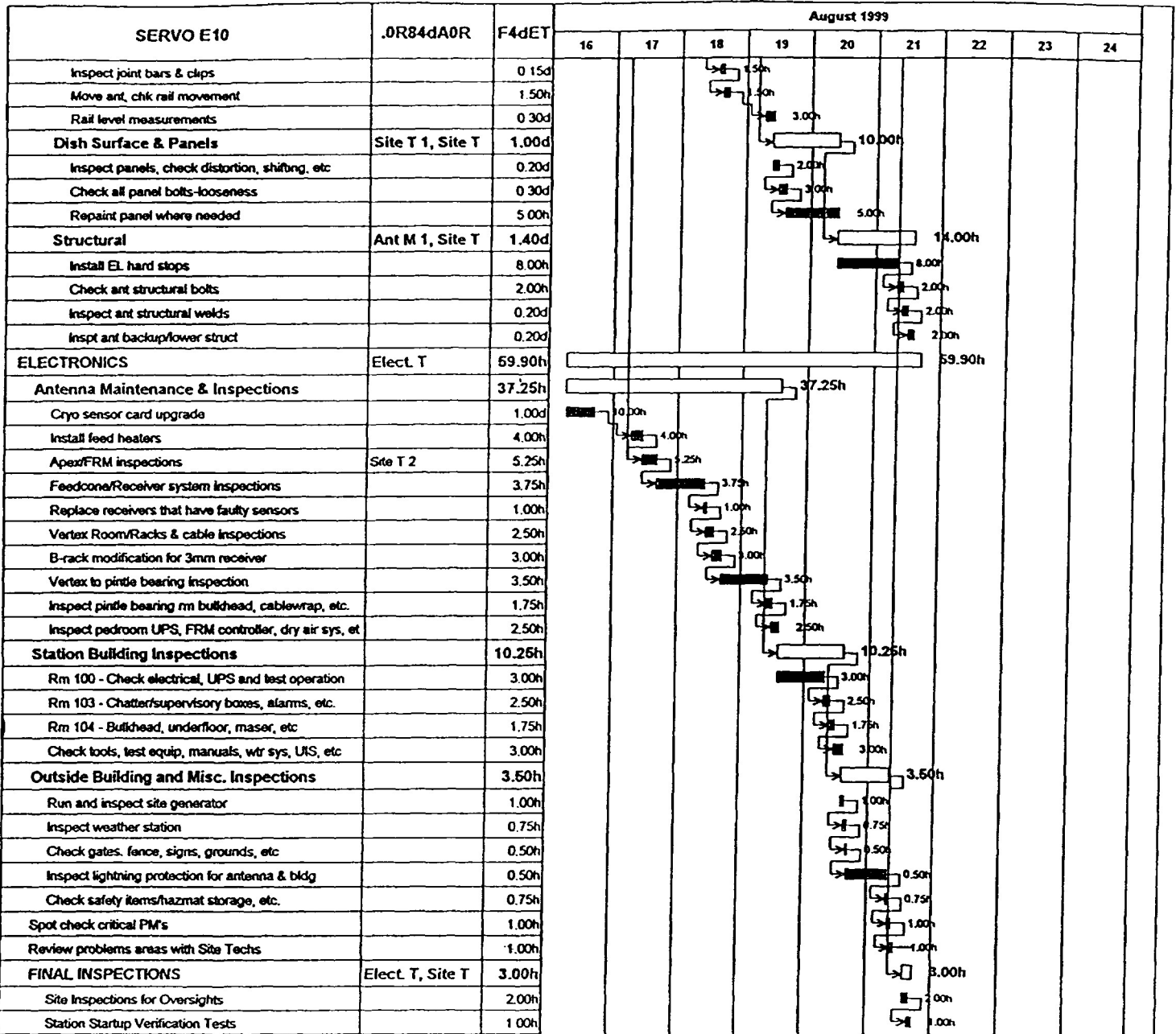
1999 VLBA Tiger Team Maintenance  
Task Listing for MK, HN and SC



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SERVO E10	.0R84dA0R	F4dET	August 1999									
			16	17	18	19	20	21	22	23	24	
Check spider bolts, backside, etc		0.10d		0.0h								
Check Donut Bolts		0.50h		0.5h								
<b>Feeds &amp; Dichroic</b>		<b>0.50d</b>			6.00h							
Inspect feeds, mounts, ntrs, etc		0.10d		1.0h								
Replace Q-band feedhorn window		1.00h		1.0h								
Remove 3mm receiver		1.00h		1.0h								
Repair dichroic reflector, check panel		2.00h		2.0h								
<b>Quad-Legs Guy Wires Etc...</b>		<b>0.10d</b>		1.00h								
Inspect guywires & turnbuckles		0.05d		0.5h								
Inspect quadleg flange bolts		0.05d		0.5h								
<b>Lightning Protection/Anemometer</b>		<b>0.10d</b>		1.00h								
Inspt mounts/chk operation		0.10d		1.0h								
<b>Bull/Pinion Gears</b>		<b>2.00h</b>		2.0h								
Inspt bull/pinion gears		0.10d		1.0h								
Lub El brgs, bull gears as req		0.10d		1.0h								
<b>MECHANICAL TEAM 2</b>	<b>Ant M 2, Team</b>	<b>46.50h</b>						46.50h				
<b>Elevation/Hoist/Swing Platform Work</b>		<b>13.00h</b>		13.00h								
Instl hoist safety mods, checkout winch, etc		0.30d		3.0h								
Checkout swinging platform		0.10d		1.0h								
Extend EL motor platforms		8.00h		8.0h								
Instl condensor platform toe guard		1.00h		1.0h								
<b>EL Bearing Inspection</b>	<b>Site T 2</b>	<b>0.25d</b>		2.50h								
Inspect EL bearings internals		0.05d		0.5h								
Inspect EL bearings lip seals		0.05d		0.5h								
Clean off excess grease		0.05d		0.5h								
Install El bearing grease trays		1.00h		1.0h								
<b>EL Motors &amp; Gearboxes</b>	<b>Site T 2</b>	<b>0.50d</b>		6.00h								
Internal gear inspection		4.00h		4.0h								
Exchange drive motors		1.00h		1.0h								
Inspect pmgs, seals, couplings		1.00h		1.0h								
<b>AZ Wheels &amp; Bearings</b>	<b>Ant M 1, Site T</b>	<b>1.85d</b>			8.50h							
Rotate outer races on Az wheel bearings		10.50h		10.5h								
Check wheel to struct clearances		0.20d		2.0h								
Check axle bolt tightness		0.10d		1.0h								
Pillow block brgs-open & clean		0.40d		4.0h								
Lubricate & take sample as req		0.10d		1.0h								
<b>AZ Motors &amp; Gearboxes</b>	<b>Site T 2</b>	<b>0.40d</b>		4.00h								
Internal gear inspection		3.00h		3.0h								
Inspect pumps, seals, couplings		1.00h		1.0h								
Install grease fitting on #2 motor bearing		1.00h		1.0h								
<b>Paint &amp; Insulation Inspection</b>	<b>Site T 2</b>	<b>3.50h</b>		3.50h								
Inspect ant paint and report		0.50h		0.5h								
Inspect & repair ant insulation as needed		3.00h		3.0h								
<b>ANT. MECHANICS Cont.</b>	<b>Ant M 2, Site T</b>	<b>38.00h</b>						38.00h				
<b>Pintle Bearing</b>		<b>0.60d</b>		6.00h								
Inspect seats, check pocket level & for loose bolts		2.00h		2.0h								
Repair grout under bearing		3.00h		3.0h								
Lubricate bearing as needed		0.05d		0.5h								
Take grease samples as needed		0.05d		0.5h								
<b>AZ Rail Inspection</b>		<b>0.80d</b>		8.00h								
Inspect ant foundation		0.05d		0.5h								
Inspect for rail movement		0.15d		1.5h								

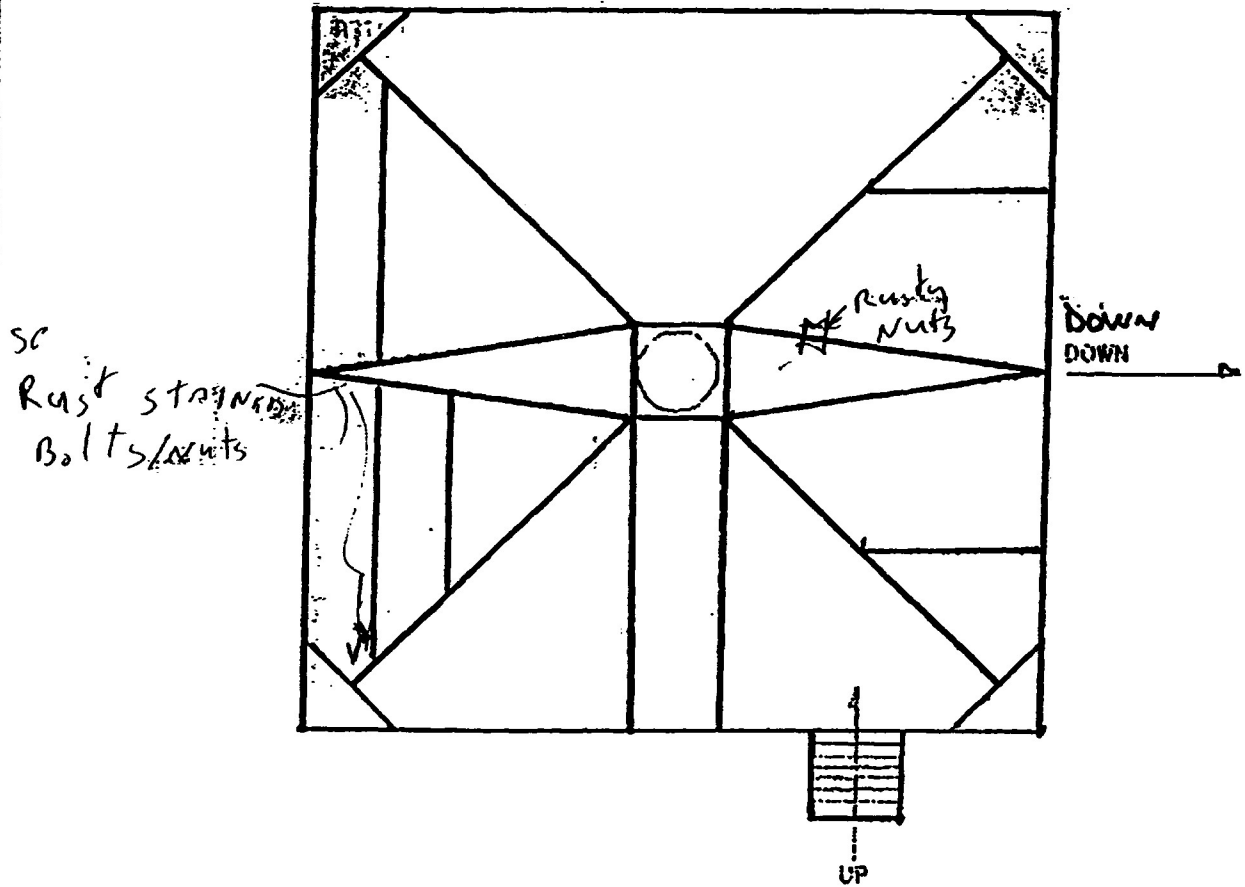
1999 VLBA Tiger Team Maintenance  
Task Listing for MK, HN and SC





AZIMUTH LEVEL PAINT CONDITIONS DATE:

VIEW FROM SKY PERFORMED BY:



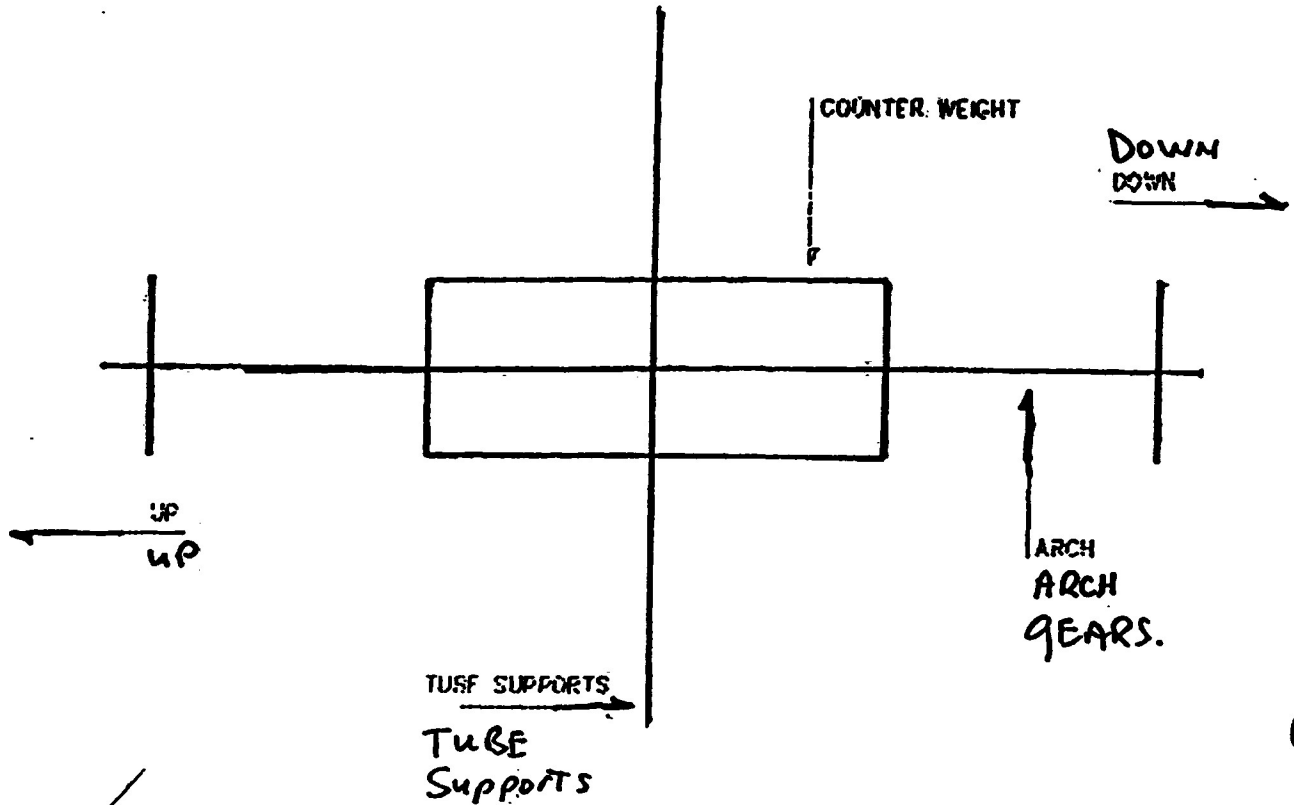
**SYMBOL KEY**

SURFACE AREA DEGRADATION	
■ RUST	□ NO RUST
SPLICE PLATE DEGRADATION	
● RUST	○ NO RUST
WELDED SEAM DEGRADATION	
↙ RUST	↘ NO RUST
T=TOP, B=BOTTOM, C=SIDE	
* -PREVIOUSLY REPAIRED	

# COUNTERWEIGHT PAINT CONDITIONS DATE:

VIEW FROM SKY

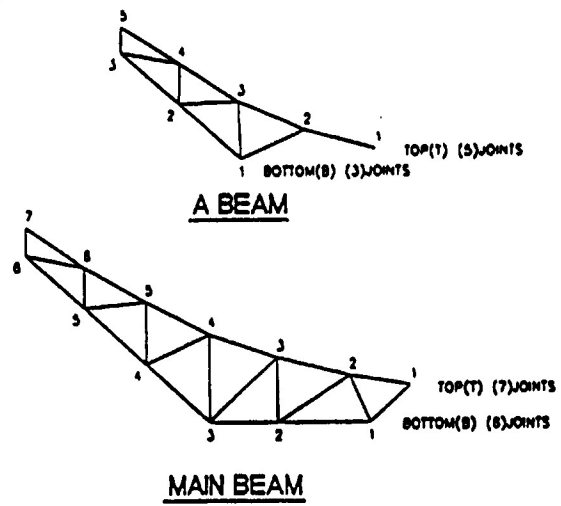
PERFORMED BY:



NRRDs some  
PAINT on  
splices

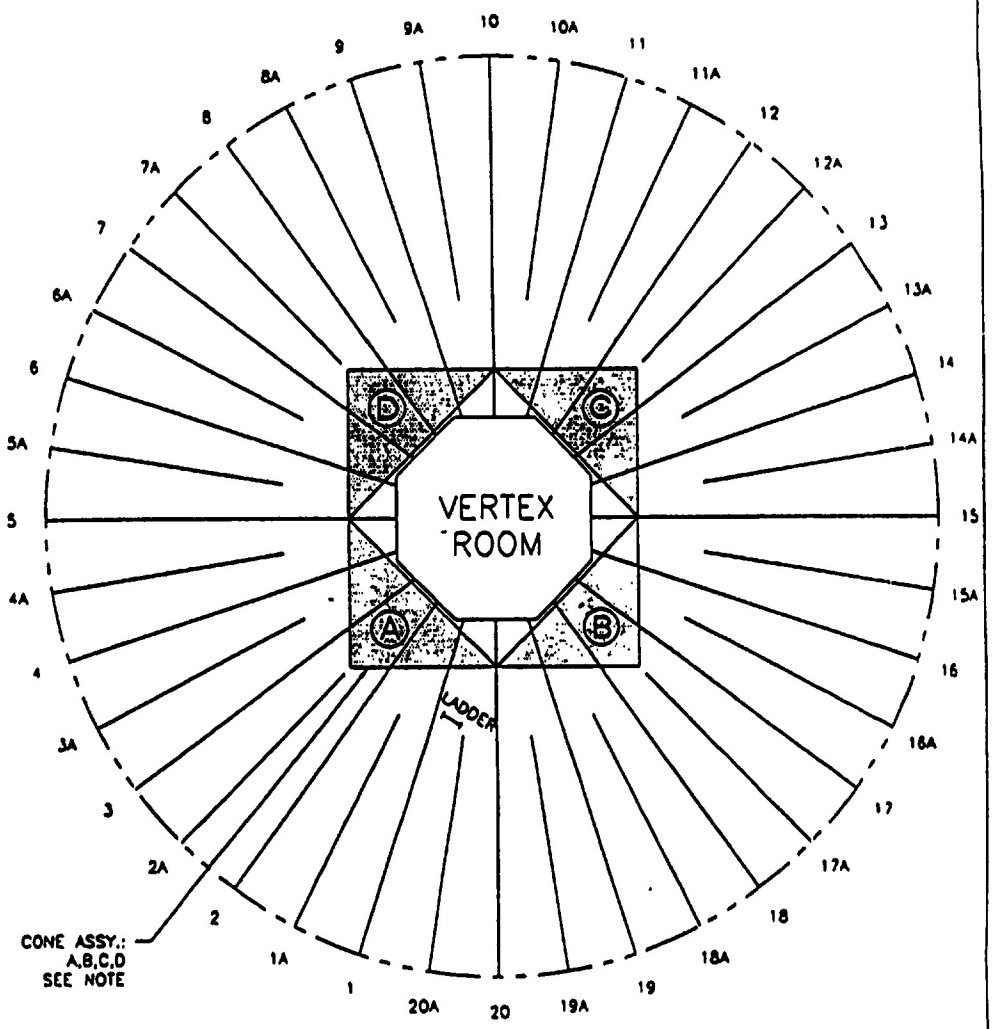
SYMBOL KEY	
SURFACE AREA DEGRADATION	
■ RUST	□ NO RUST
SPLICE PLATE DEGRADATION	
● RUST	○ NO RUST
WELDED SEAM DEGRADATION	
~ RUST	∧ NO RUST
T=TOP, B=BOTTOM, S=SIDE	
* =PREVIOUSLY REPAIRED	





JOINT LISTING REQUIRING REPAIR  
(NOT INCLUSIVE)

*Pretty Good  
A few Missed spots*

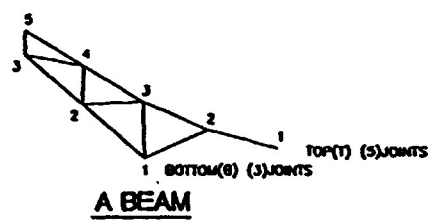
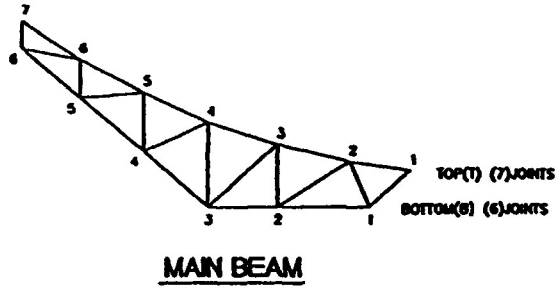


- ANGLE PEELING
- WF BEAM AROUND VERTEX TOUCHUP
- SMALL RUST SPOTS

NOTE: INSPECT CONE ASSY. INTERNALLY  
REPAIR/PAINT AS REQUIRED

ACAD LABEL: VLBAPAIT

	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ANGLES ± ° 3 PLACE DECIMALS LAST ± .003 1 PLACE DECIMALS LAST ± .01 1 PLACE DECIMALS LAST ± .05	V L B A HANCOCK PAINT REPORT LOCATION OF DELAMINATIONS	NATIONAL RADIO ASTRONOMY OBSERVATORY SECONDARY KEY PLATED STEEL
	MATERIAL: _____		FINISH: _____



JOINT LISTING REQUIRING REPAIR (NOT INCLUSIVE)					
BEAM #	BOTTOM	TOP	BEAM #	BOTTOM	TOP
1			11		
1A			11A		
2			12		
2A			12A		
3			13		
3A			13A		
4			14		
4A			14A		
5			15		
5A			15A		
6			16		
6A			16A		
7			17		
7A			17A		
8			18		
8A			18A		
9			19		
9A			19A		
10			20		
10A			20A		

- \* ANGLE PEELING
- \*\* WF BEAM AROUND VERTEX TOUCHUP
- \*\*\* SMALL RUST SPOTS

ACAD LABEL: VLBAPAT

UNLESS OTHERWISE SPECIFIED  
DIMENSIONS ARE IN INCHES  
TOLERANCES UNLESS NOTED:  
± 0.005 INCHES (0.127 mm) ± 0.002 INCHES (0.051 mm) ± 0.001 INCHES (0.025 mm)

MATERIAL: \_\_\_\_\_

FINISH: \_\_\_\_\_

ANTENNA PAINT REPORT

WORKSHEET

**NATIONAL RADIO ASTRONOMY OBSERVATORY**

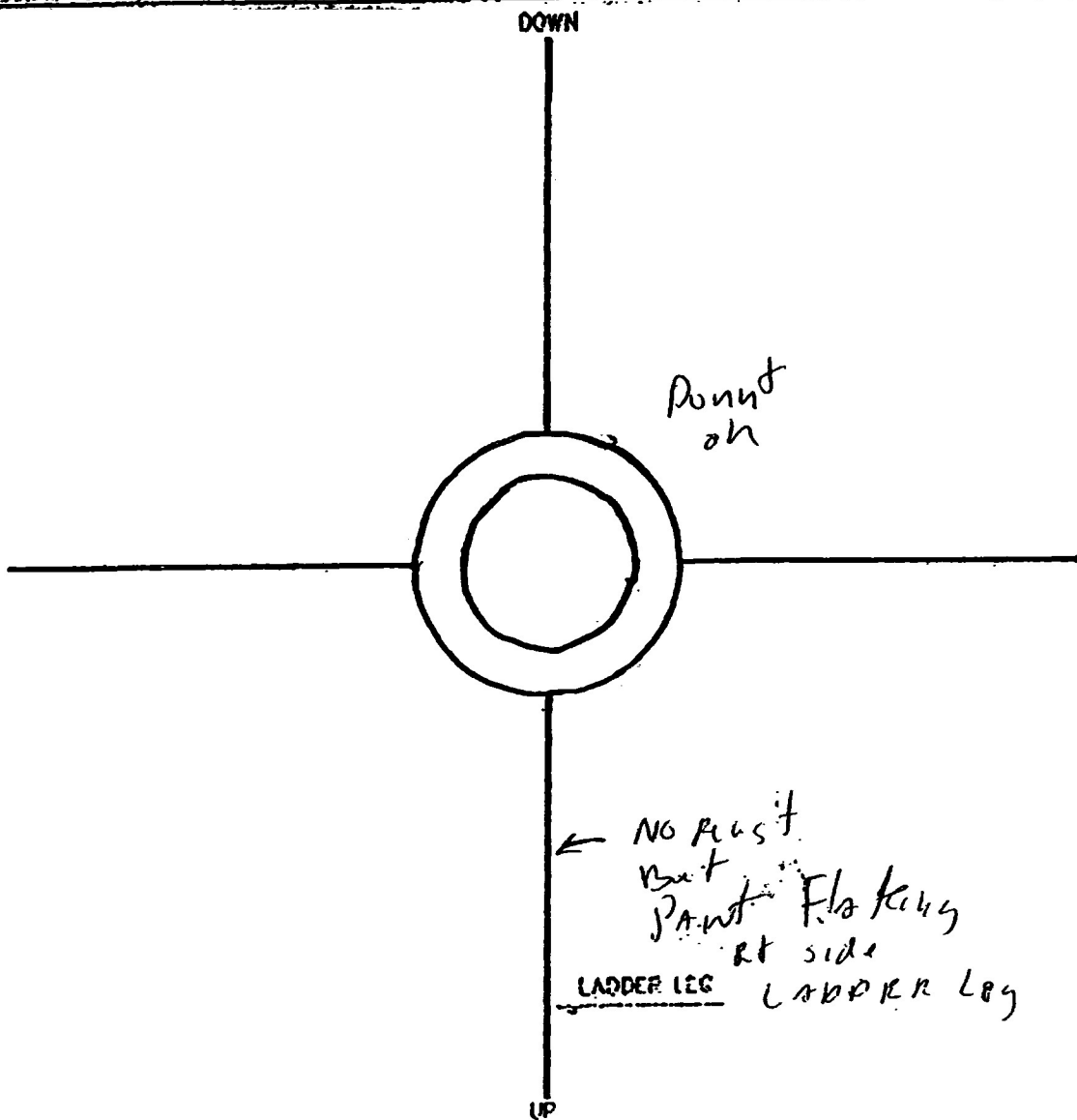
FORM NO. C-000004

REV. 12/00

# QUADRUPED PAINT CONDITIONS: LEVEL 13 DATE

VIEW FROM SKY

PERFORMED BY:



SYMBOL KEY	
SURFACE AREA DEGRADATION	
■ RUST	□ NO RUST
SPlice PLATE DEGRADATION	
● RUST	○ NO RUST
WELDED SEAM DEGRADATION	
← RUST	↔ NO RUST
T-TOP, B-BOTTOM, S-SIDE	
* = PREVIOUSLY REPAIRED	

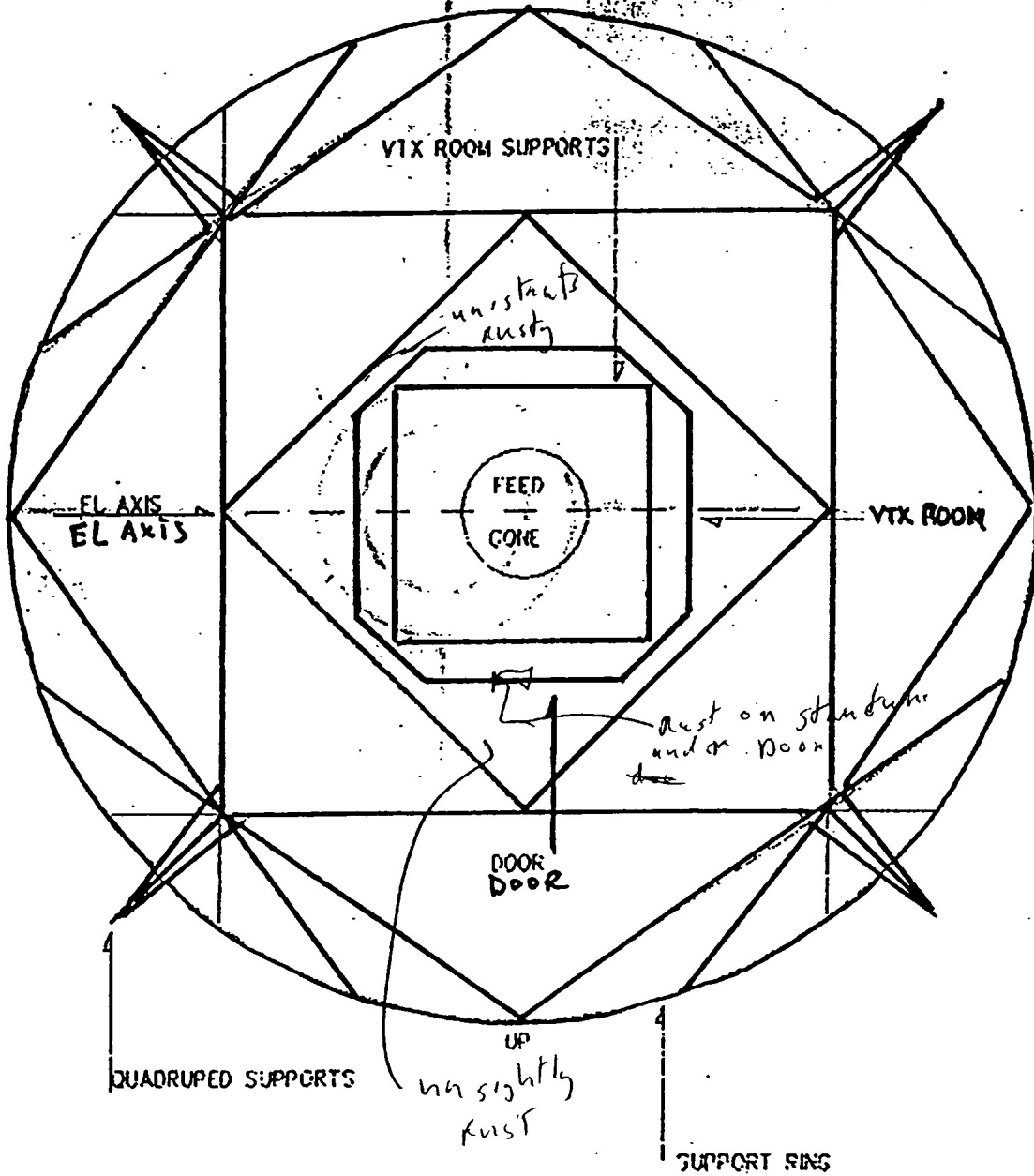
# VERTEX LEVEL PAINT/CONDITIONING AND REPAIR DATE

VIEW FROM SKY

WORK PERFORMED BY

NEW FROM SKY

NWS DOWN



SYMBOL KEY	
SURFACE AREA DEGRADATION	
■ RUST	□ NO RUST
SPLICE PLATE DEGRADATION	
● RUST	○ NO RUST
WELDED SEAM DEGRADATION	
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