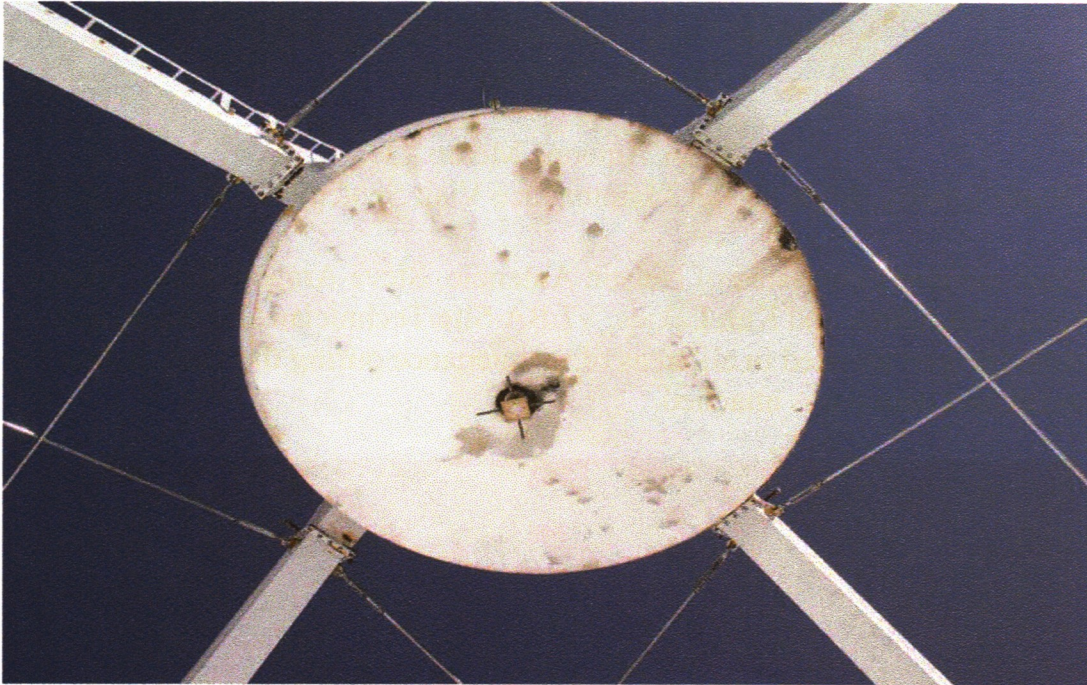


**National Radio Astronomy Observatory
Socorro, New Mexico**

**VLBA Antenna Memo #51
North Liberty, Iowa VLBA Maintenance Visit September 10th thru 16/03.**

Team members consisted of Nelson Antencio, Steve Aragon, Eric Carlowe Ramon Gutierrez and Ken Lakies. VLBA Site Technicians DJ Beard and Mike Burgert assisted in all areas of maintenance during the visit. A task list and action item list is attached.

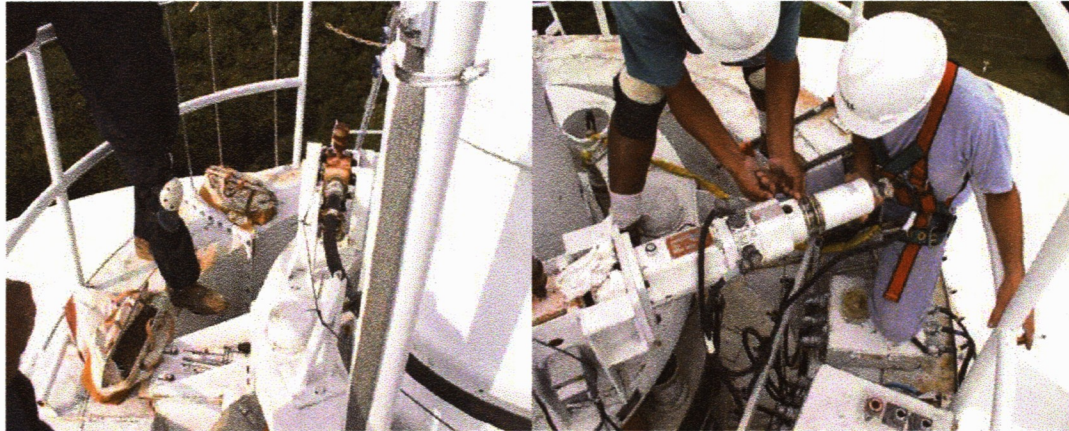




Subreflector paint is stained but otherwise in good condition.



A new ladder and fall arrest was installed. Techs were trained on using the new fall arrest. Quad legs have a lot of surface rust.



The FRM INA bearing zirks were installed. A 2nd screw and guide rod bellows were replaced during the FRM PM. Both focus motor encoder couplings were broken. These were replaced with the new encoder coupling modification. Apex j-boxes and cables are in good condition.

FRM INA BEARING CHECK 50LBS PULL ON PRIMARY SIDE

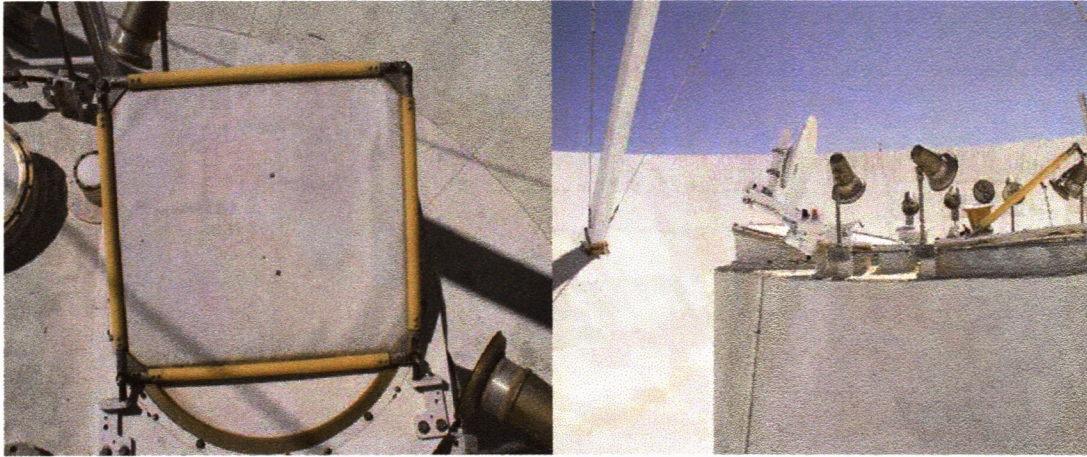
Primary Travel:	+ .001	Secondary Side:	- .001
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FRM INA BEARING CHECK 50LBS PULL ON SECONDARY SIDE

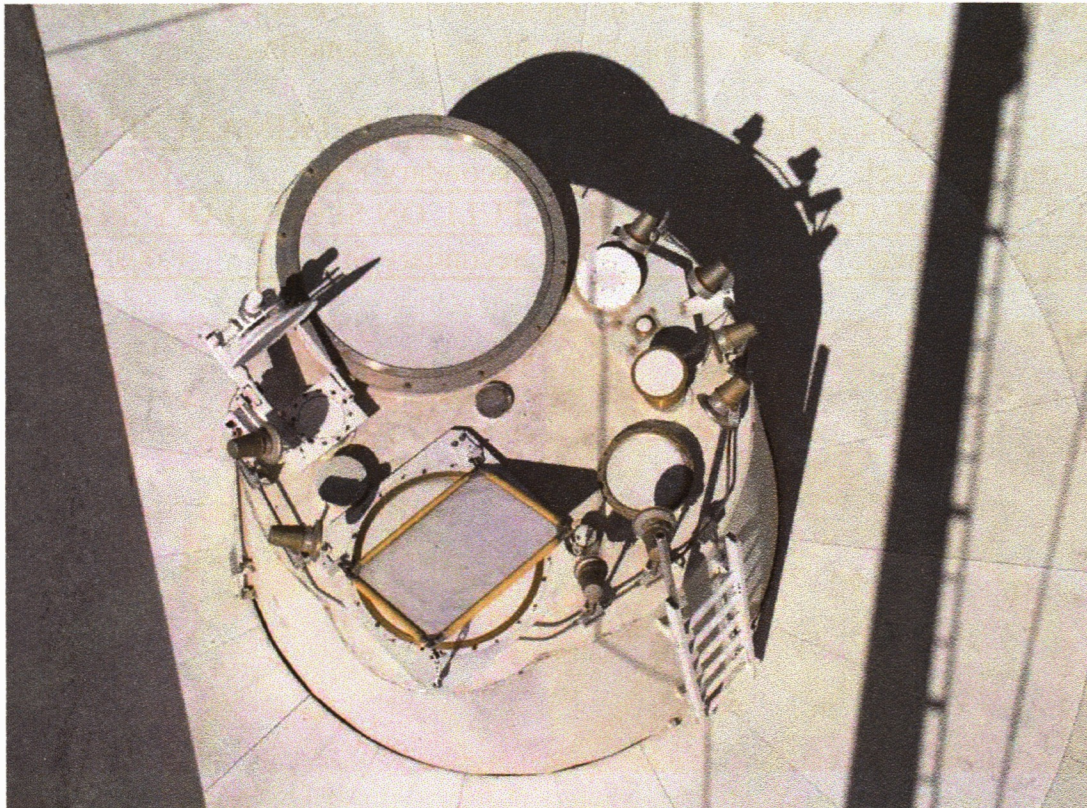
Primary Travel:	- .001	Secondary Side:	+ .001
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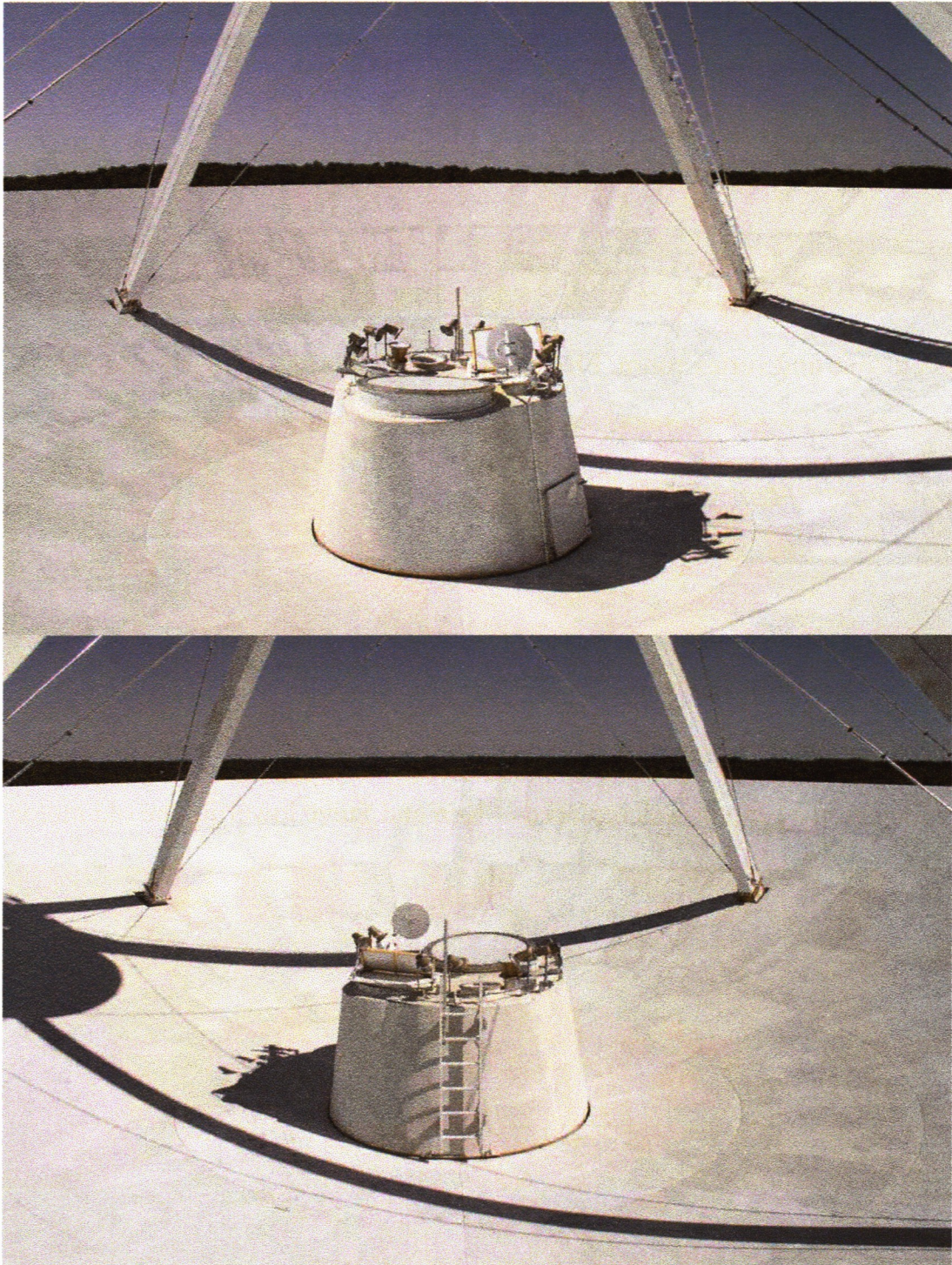
90/50 FE cables and connectors are in good condition. Subreflector drain holes are clear. Dipole is in good condition. Apex has lots of surface rust.



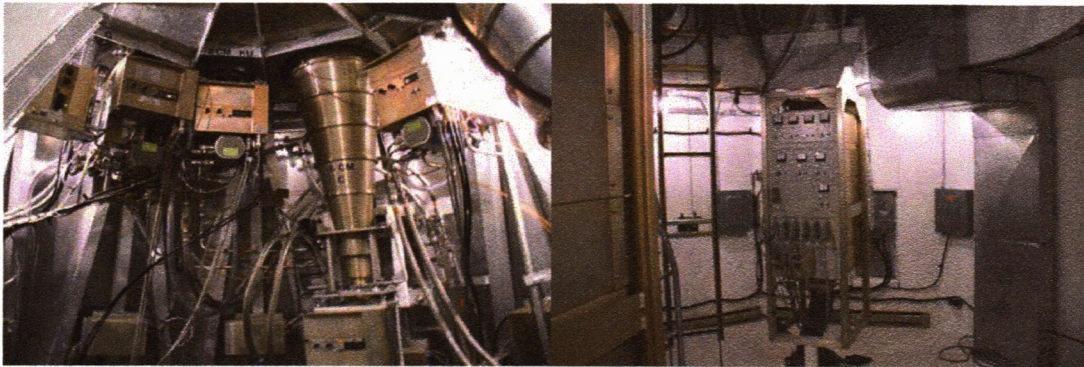
Dichroic reflector needs to be replaced. Elipsoid is in good condition.



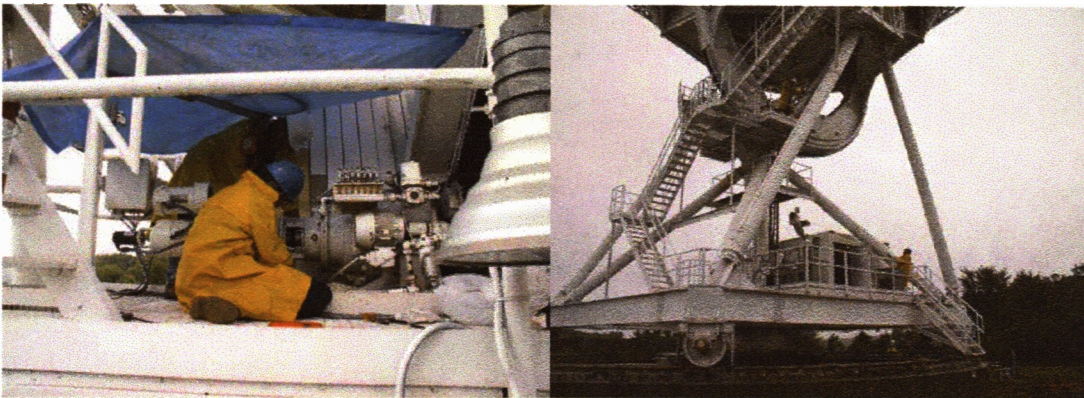
Feed cone needs spot sealed and painted. FE windows are in good condition. Insulation on top of the feed cone has been removed by the site techs. The insulation was retaining water and leaking into the vertex room.



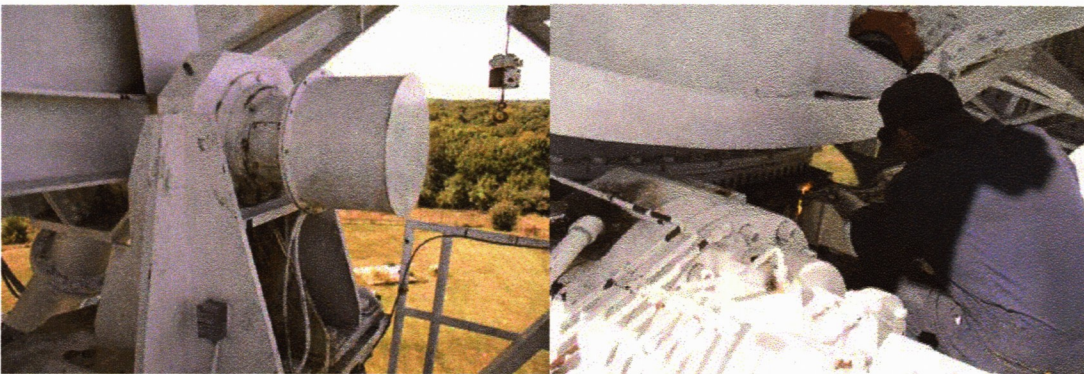
Dish panels are in good condition. Quad legs and guys wire have surface rust. Quad leg bases should be wire brushed and painted with chem-prime.



Feed cone and vertex room. FE and rack cables are neat, orderly and secure.



Elevation #1 motor was replaced. Ken and Steve lowering the old motor.



Elevation bearing grease trays were installed. A new stow pin tray and interlock switch were installed.



Elevation #1 gearbox, 1st and 2nd stage gear inspection.



Steve measures $\sim .0015$ of wear with a feeler gauge. Elevation #1 gearbox is in good condition. Both elevation gearboxes oil was changed. Fish eyes and flow gauges were cleaned. Elevation #2 was not opened for inspection.



Azimuth #2 gearbox, 1st and 2nd stage gear inspection.



Steve measures ~.001 of wear with a feeler gauge. Azimuth #2 gearbox is good condition. Both azimuth gearboxes oil was changed. Fish eyes and flow gauges were cleaned. Azimuth #1 was not opened for inspection.



AZ #2 motor was replaced. AZ# 1 rear motor bearing seal was replaced.

AZIMUTH BEARING GREASE INSPECTION

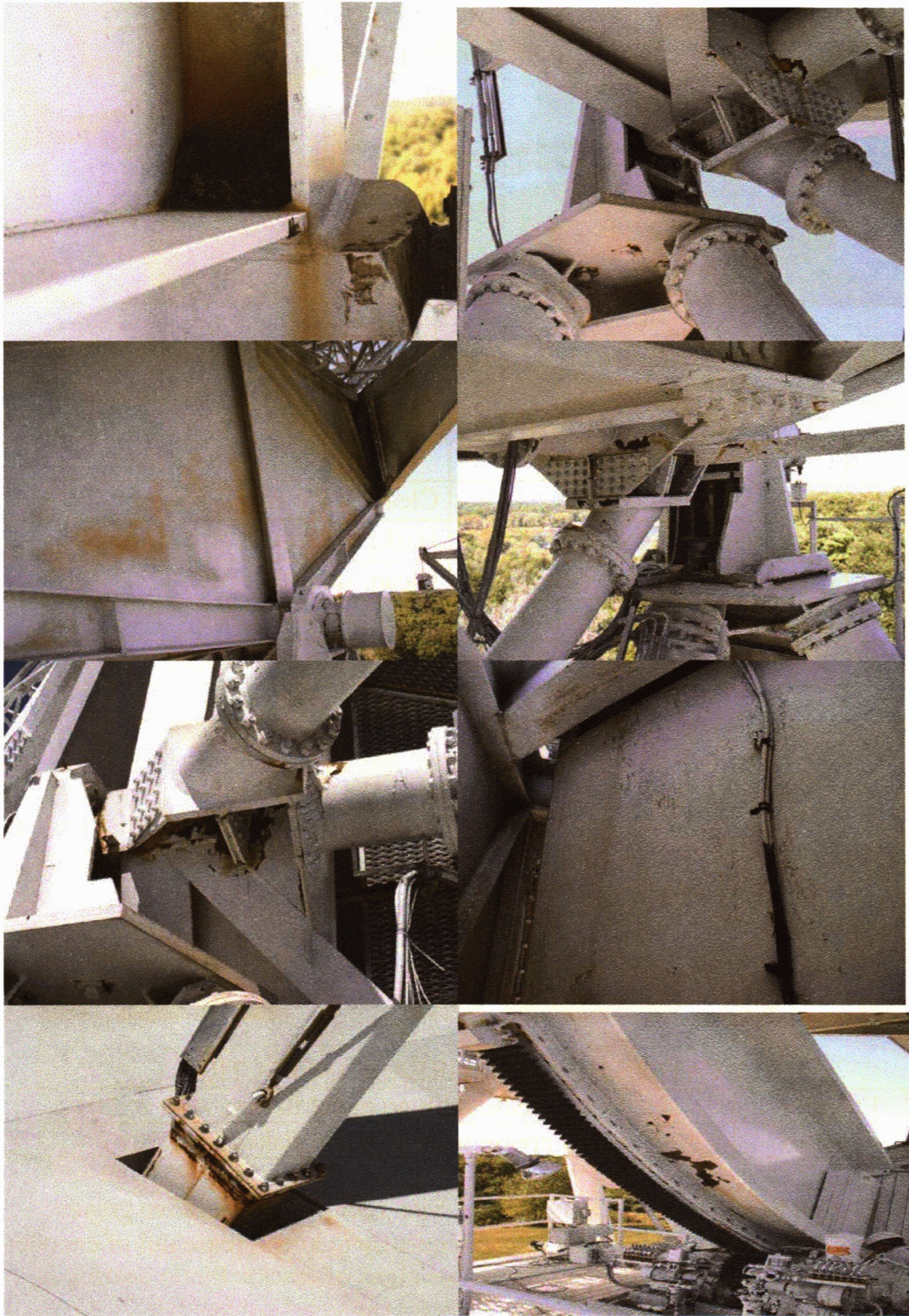
	INNER BEARING	OUTER BEARING
D1	Clean, smooth races.	Clean, a few metal flakes.
D2	Dark, with metal glitter.	Dark, with metal glitter.
I1	Clean, small hole in race.	Clean, smooth races.
I2	Clean, linear scratches on race.	Clean, smooth races.
Azimuth drive #2 wheel assembly needs to be replaced.		

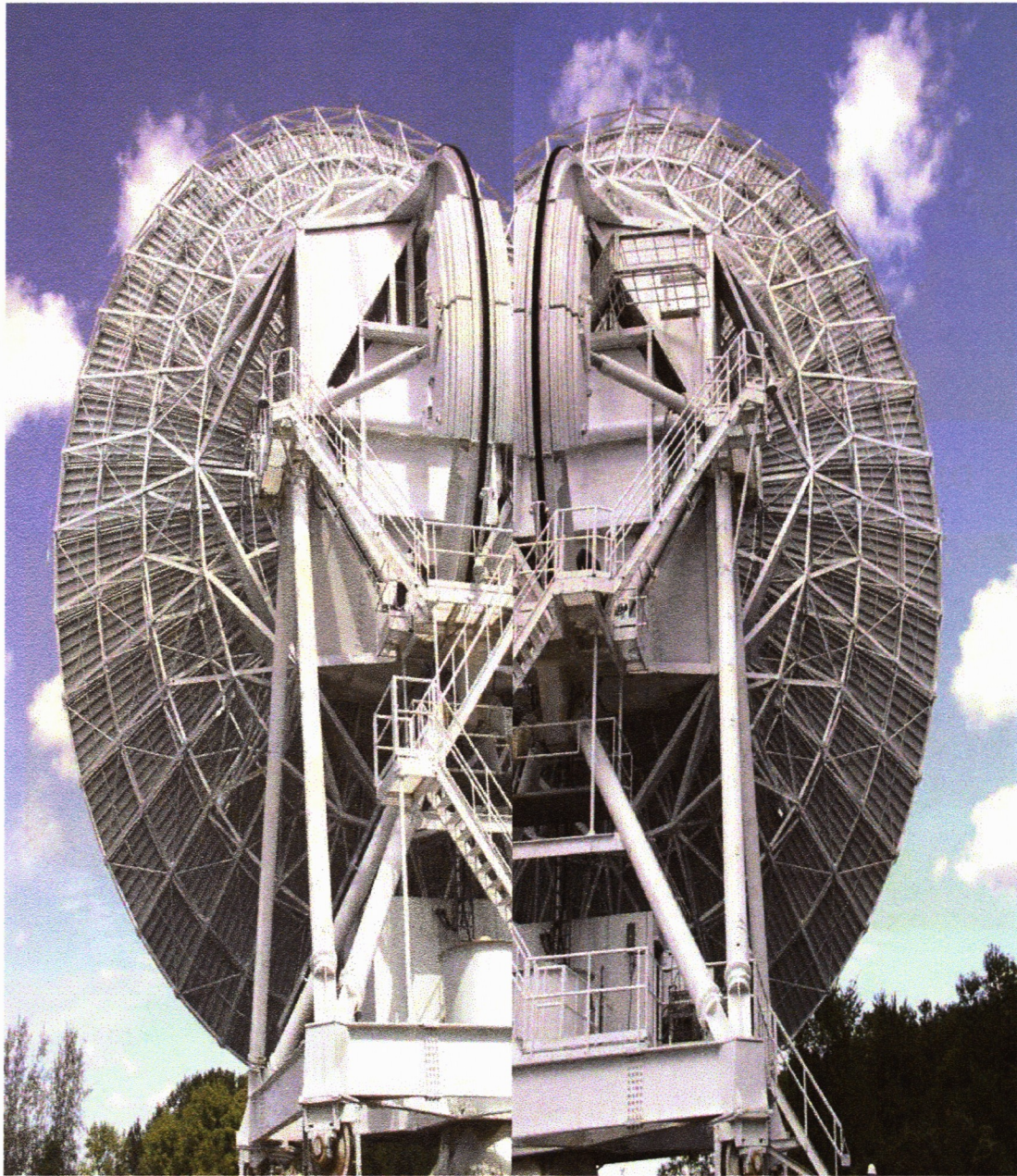


ELEVATION BEARING GREASE INSPECTION

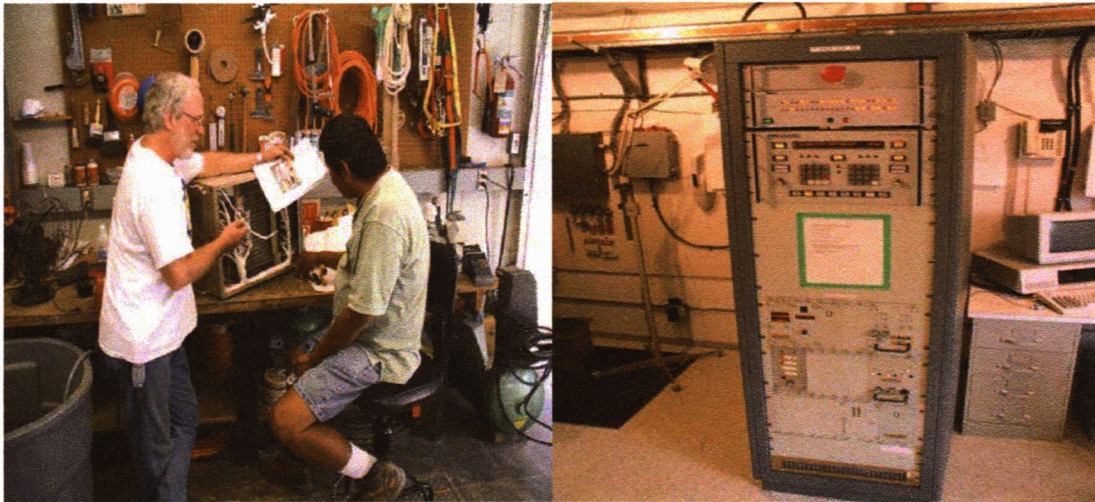
Encoder	Good grease with no metal flakes.
Syncro	Good grease with no metal flakes.

Elevation bearings are well lubricated. Site Techs should remove grease from the encoder side bearing more frequently to keep grease out of encoder electronics. Elevation axle has no visible signs of cracks. Pintle bearing is well greased with no metal flakes.





The antenna has alot rust and peeling paint almost everywhere you look. This summer the Site Techs should clean up and spot paint affected areas they can safely get to with chem prime. VLBA OPS should also dump water out of the antenna before an observation as recommended by Ramon and Jon for the SCVLB antenna.



DJ and Nelson retrofitted the ACU with the new power supply upgrade.



The area inside the fence is neat and orderly.

AZIMUTH DRIVE WHEEL ALIGNMENT

	Spec.	D1	D2
Horizontal error	0d00'00" (~1'30")	1'35"	Needs replaced
Vertical error	3d26'23" (~1'30")	3d25'05"	Needs replaced
Radius error	300.002" (+/- .25)	300.21"	Needs replaced



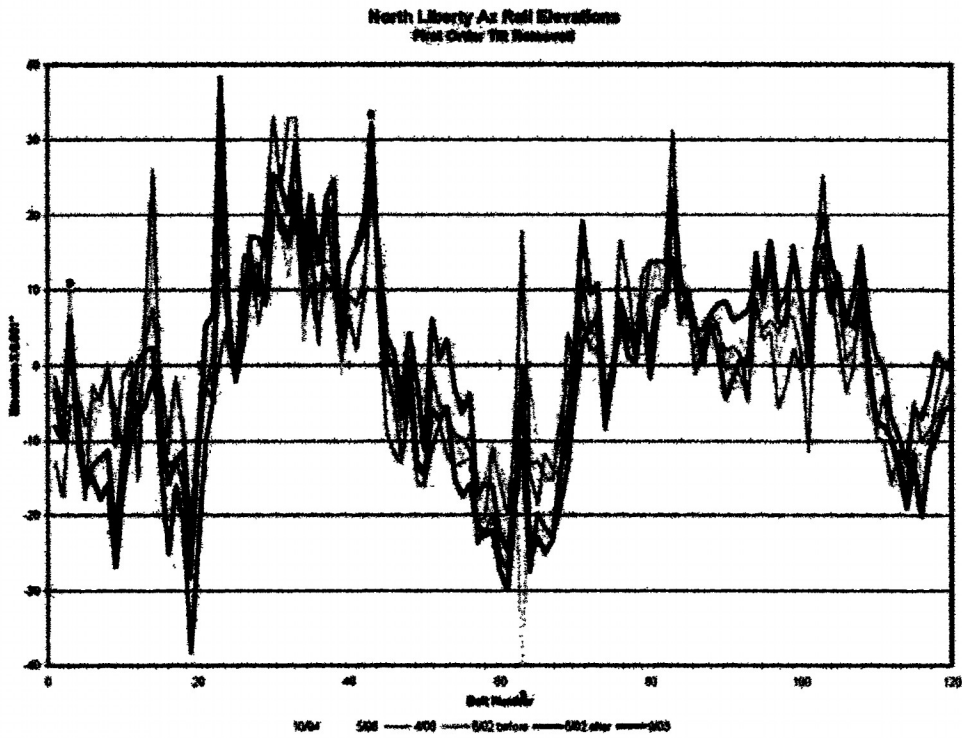
Vulchem is rapidly deteriorating from this rail splice and all the others.



Rail is in good condition. Vulchem is deteriorating off all of the rail clips.



The guy's tightening loose rail splices. All splices were loose.



ACTION ITEMS

- 1. REPLACE FRM X/FORMER CONTROL CABLE.**
- 2. REPLACE AZIMUTH #2 DRIVE WHEEL ASSEMBLY.**
- 3. REPLACE ELEVATION MOTOR #2.**
- 4. REPLACE AZIMUTH MOTOR #1.**
- 5. REPLACE AND ALIGN DICHROIC REFLECTOR.**
- 6. SEAL AND PAINT FEED CONE WITH ELASTOMERIC.**
- 7. REPLACE VERTEX ROOM DOOR.**
- 8. COMPLETE TT SERVO TESTS.**
- 9. REPLACE ELIPSOID ACTUATOR POWER CABLE.**

A maintenance team consisting of, Steve Aragon, Ramon Gutierrez, Jon Thunborg, and Eric Carlowe returned to the NLVLBA site for 4 days in October 20-23. With the help of site techs DJ Beard and Mike Burgert the maintenance team was able to complete action items 1 thru 8. The ellipsoid actuator was also repaired. Action item 9 was completed by site tech Mike Burgert prior to the maintenance team arrival.

ANTENNA MECHANICAL MAINTENANCE NLVLBA 9/10-16/03

APEX INSPECION:

FRM 2-YEAR INSPECTION PM. Done.

● **all INA zirks. Bearing zirks installed on 9/11.**

2nd screw upper bellows and 2nd guide rod bellows were replaced.

FRM INA BEARING CHECK 50 LBS PULL ON PRIMARY SIDE

Primary Travel: +.001

Secondary Side: -.001

FRM INA BEARING CHECK 50 LBS PULL ON SECONDARY SIDE

Primary Travel: -.001

Secondary Side: +.001

SUBREFLECTOR INSPECTION:

Mounting Hardware. Secure in good condition.

Dipole. Good condition.

Peeling paint/delaminating. Paint is peeling and discolored.

QUAD LEGS INPECTION:

Guy wires. Good, Clean and shinny.

Turn buckles. Jam nuts rusty.

● **er pins. Rusty surface.**

Quad leg flange bolts. Surface rust, 1 leg has a couple rust holes at its base.

DISH INSPECTION:

Anemometer mounts & operation. OK.

Panel surfaces. Discolored with a thin film. Could possibly be removed with pressure wash??

Spot check panel bolts. Done, tight.

FEED CONE INSPECTION:

Feed cone surface & insulation. Needs spot sealed and painted with elastomeric!

FE feed windows. Clear, OK.

FE feed mounting hardware. OK.

FE feed heaters. OK.

Dichroic reflector condition. Bubbling out on corners should be replaced.

Ellipsoid dish/mount. OK.

● **FC hatch latches replace as needed. Good shape.**

ANTENNA MECHANICAL MAINTENANCE NLVLBA 9/10-16/03

ELEVATION BEARING & AXLE INSPECTION:

EL. Grease inspection/Encoder side	No metal seen in grease. Bearings well greased.
EL. Grease inspection/DGB side	No metal seen in grease. Bearings well greased.

Grease elevation bearings. Done.
Check elevation axle for cracks. OK, No cracks found.
Listen for popping or grinding. No popping or grinding noises.

ELEVATION BULL & PINION GEAR INSPECTION:

Bull gear. OK.
Bull gear welds/hardware. A-OK.
Pinion gears. OK.
Lube bull/pinion gears as needed. Well lubricated.
Check stow pin. Checked, Installed new stow pin tray.

ELEVATION MOTOR & GEARBOX INSPECTION:

EL.#1 seals/coupling/internal gears. Motor replaced, 1st&2nd stage gears <.0015 of wear.
EL.#2 seals/coupling/internal gears. Spider coupling replaced. Gear Box inspection not needed.
Gearbox heaters/lube pumps. OK, EL 2 heater turned down from 100 deg. to 35 deg.
Flow gauges/fish eyes. No leaks, and were cleaned.
Change gearbox oil as needed. Both gear boxes oil was changed.
Listen for popping or grinding. No popping or grinding was heard.

ELEVATION PLATFORM INSPECTION:

Swinging catwalk. OK.
Hoist operation. OK, worm gear shaft leaking.
Install VTX condenser toe guard. Done on previous visit.

ANTENNA STRUCTURAL INSPECTION:

Spot-check structural bolts. Done, OK.
VTX walk way. Surface rust on unistrut supports.
Antenna structural welds. Good, no cracks.
Antenna backup/lower structure. Done, OK.

ANTENNA MECHANICAL MAINTENANCE NLVLBA 9/10-16/03

AZIMUTH BEARING/GREASE INSPECTION

	INNER	OUTER
●	Clean grease, smooth races.	Clean grease, A few metal flakes.
D2	Smooth races, dark grease with metal glitter.	Smooth races, dark grease with metal glitter.
I1	Clean grease, small hole in race.	Clean grease, smooth races.
I2	Clean grease, linear scratches on race.	Clean grease smooth races.
Bearing races. I1 Inner outside race has a hole in it, no metal found in grease.		

AZIMUTH WHEEL INSPECTIONS:

Wheel to structure clearances. OK.

Listen for popping or grinding. No popping or grinding noises heard.

AZIMUTH DRIVE WHEEL ALIGNMENT

	spec.	D1	spec.	D2
Horizontal error	0d00'00"(~1'30")	1'35"	0d00'00"(~1'30")	Needs replaced.
Vertical error	3d26'23"(~1'30")	3d25'05"	3d26'23"(~1'30")	Needs replaced.
● radius error	300.002"(+/- .25")	300.21"	300.002"(+/- .25")	Needs replaced.

AZIMUTH MOTOR AND GEARBOX INSPECTION:

AZ#1 seals/coupling/internal gears. Grease seal and spider replaced.

AZ#2 seals/coupling/internal gears. 1st&2nd stage had < .001 of wear.

Gearbox heaters/lube pumps. Reduced thermostats to 35 deg.

Flow gauges/fish eyes. Cleaned and no leaks.

Change gearbox oil as needed. Both gearboxes oil was changed.

Listen for popping or grinding. No popping or grinding noises were heard.

PINTLE BEARING INSPECTION:

Cable wrap & cables. Checked, OK.

Check pocket level. Done on previous visit.

Check for loose bolts. None.

Check bearing grease/grease as needed. No metal flakes, bearing well greased.

ANTENNA MECHANICAL MAINTENANCE NLVLBA 9/10-16/03

AZIMUTH RAIL INSPECTION:

Rail level measurement. Done.

Excessive rail movement. Normal to minimal.

Joint bars and clips. All were loose.

Antenna foundation/grout/vulchem. Vulchem should be removed and the rail chemprimed.

Re-torque fish plates as needed. All were loose.

ANTENNA PAINT & INSULATION INPECTION:

Antenna paint condition. Fair to poor, paint flaking off everywhere. Quit a bit of surface rust.

Repair antenna insulation as needed. Needs some attention, need a bucket truck.

MECHANICAL MAINTENANCE ITEMS TO BE COMPLETED:

1. Replace ELEVATION #1 MOTOR. Done.

2. Replace AZIMUTH DRIVE MOTOR. AZ#2 replaced.

3. Install QUAD LEG LADDER and FALL ARREST. Done, Techs trained.

4. Check encoder side EL BEARING is not over greased. Grease was cleaned out.

5. Check VERTEX ROOM DOOR condition. Door needs to be replaced.

ANTENNA MECHANICS NOTES:

AZ D2 inside and outside bearings need to be replaced.

VTX room door needs replaced.

Grease catchers were installed on both elevation bearings.

Dichroic panel needs replaced.

All bearings and gears were well lubricated. Excess grease should be cleaned up more frequently.

AZ#1 and EL#2 need replaced with sealed bearing motors.

Grease should be cleaned out of encoder side coupling more often to keep out of electronics.

FC needs sealed and painted with elastomeric.

Rail ground strap re-welded to rail.

ANTENNA SERVO MAINTENANCE NLVLBA 9/10-16/03

ANTENNA SAFETY TESTS:

All antenna safety checks were good.

BRAKE HOLDING-TORQUE TESTS (FT-LBS)

AZ #1	60lbs. Old grease was cleaned off brakes and the seal was replaced.
AZ #2	90lbs. New motor was installed. Brake switch failed/Brushes not seated.
EL #1	90lbs. New motor was installed.
EL #2	75lbs. Motor needs replaced.

MOTOR INSPECTIONS:

Elevation motor/tach couplings. New spiders were installed.

Elevation brush/commutator. OK.

Azimuth motor/tach couplings. New spiders were installed.

Azimuth brush/commutator. AZ #2 brushes were stoned/seated.

ANTENNA GROUNDING INSPECTION:

Elevation ground cable. Synchro side cable broken.

Elevation platform to pintle turret. Done, OK.

Postal room. Done, OK.

Azimuth wheel contacts. Done, OK.

Pintle room/cable wrap. OK.

SERVO RECORDINGS:

Elevation response test. Canceled, No time left.

Azimuth response test. Canceled, No time left.

Elevation position loop test. Canceled, No time left.

Azimuth position loop test. Canceled

ACU AUTO MODE TESTS:

System/axis faults. Done, OK.

AZ/EL motor fault status. Done, OK.

Stow commands. Done, OK.

Synchro feedback. Yes, done.

ACU VME communication. Stows in 10 minutes.

Restore ACU parameters. OK.

ANTENNA SERVO MAINTENANCE NLVLBA 9/10-16/03

SERVO MAINTENANCE ITEMS TO BE COMPLETED:

- 1. Replace ELEVATION #1 MOTOR. Done, had to use old filter box.**
- 2. Install ACU POWER SUPPLY UPGRADE. Done, and tested OK.**
- 3. Check encoder side EL BEARING. Over greased, ~2gals. of grease removed.**
- 4. Replace 1 AZIMUTH MOTOR. Done 9/11, coupling was too tight, caused vibration at high RPM.**

SERVO TECHNICIAN NOTES:

Trained techs on disassembling motor brakes. Showed techs how brake safety block works.

Replaced stow pin switch.

AZ#1 and EL#2 need replaced with sealed bearing motors.

ANTENNA ELECTRONIC MAINTENANCE NLVLBA 9/10-16/03

APEX/FRM INSPECTION:

FRM cable & j-box condition. Good inside and outside.
M motor/encoder. Good here, leaf couplings were broken and replaced.
90/50cm FE/dipole/cables. Good.
Replace tie-wraps w/metal as needed. Done, as needed.

FEEDCONE IN/OUT INPECTION:

Ellipsoid operation. Operating correctly, Cable repositioned, dichroic needs replaced.
Feed heater operation. Operating correctly.
All FE cables. Good condition.
CRYO systems. All systems look good.
FE dry air. Connections on FE's are good.
Replace tie-wraps as needed. Done, as needed.

VTX ROOM IN/OUT INSPECTION:

IF PWR cable/connector/baulk head. Good, installed some ty-wraps.
Power RFI filters @ baulk head. Good, installed some ty-wraps.
A&B racks. Made sure all connections were tight. VTX room looks good. Door needs replaced.

ANTENNA CABLE INSPECTION:

Elevation cable wraps. Cables look good/ ty-wraps replaced.
All cable trays. Good, ty-wraps replaced as needed.
Elevation platform & limit switches. All limit switches work properly.
Replace tie-wraps with metal as needed. Done, as needed.

PINTLE BEARING INPECTION:

Cable wrap & baulk head. Rotated a few cable protectors.
Limit switches. Operating correctly.
Cable strain relief. Strains look good, 3 phase power cable is going to need replaced one day.

PEDESTAL ROOM INSPECTION:

ACU/FRM logic on UPS. All on UPS power.
UPS operation/by-pass switch. UPS operates correctly.
Breakers labeled correctly. Breakers make sense.
Dry air compressor. Failed, and replaced with a Coleman compressor. FRM power control cable is replaced from trans to FRM bin.

ANTENNA ELECTRONIC MAINTENANCE NLVLBA 9/10-16/03

STATION BUILDING INSPECTION:

Room 100: WOW, nice and clean, uncluttered.
UPS operation. Works properly.
Electrical panels. OK.
Onan xswitch. Operates correctly.
Room 102: OK, clean.
Contempo 1&2 operation. Works correctly.
Room 103: OK, clean.
VME/comm. rack. Clean and organized.
Recorders 1&2. Clean and operating correctly.
Fire alarm operation. Need to clean, need to replace several detectors.
Chatter box/phone operation. Operates correctly.
Under floor cables/baulk head. Clean, OK.
Room 104: OK, clean.
Maser/C&D racks. Checked all connectors.
Under floor cables & baulk head. OK.

WEATHER STATION INSPECTION:

Check operation/test alarms. All OK.
Cabinet/tower. Tower works properly, WX operating correctly.

VLBA STATION GROUNDS INSPECTION:

Test generator. Tested using trans switch, OK. No leaks.
Contempo condensers. Tightend several screws.
Station building.
Fence/gate/signs/grounds/storage. Fence in good shape, gate OK.

ELECTRONIC MANTENANCE ITEMS TO BE COMPLETED:

1. Install FRM FOCUS MOTOR ENCODER COUPLING. Done 9/12. Old coupling broken.
2. Install ACU POWER SUPPLY UPGRADE. Done 9/11. Tested good.
3. Replace ELEVATION #1 MOTOR. Done, motor brushes needed stoned.
4. Check FRM SERVO CONTACTORS FOR AUTO RESETTING. All 3 contactors correct.
5. Replace 1 AZIMUTH MOTOR. #2 done, motor brushes stoned, brake switch replaced.

ANTENNA ELECTRONIC MAINTENANCE NLVLBA 9/10-16/03

FINAL ANTENNA & SITE INSPECTIONS:

Spot-check critical PM's.

● TT oversights.

Site cleanup. Done

VLBA operations startup tests. Back to operations the night of 9/14.

VLBA ELECTRONICS TECHNICIAN NOTES:

FRM power control cable needs replaced.

Elipsoid control cable conduit was repositioned on the FC.

FC needs sealed and repainted.

Dichroic reflector needs replaced.

AZ#1 and EL#2 need replaced with sealed bearing motors.

VTX room door needs replaced.

