

**National Radio Astronomy Observatory  
Socorro, NM**

**VLBA Antenna Memo Series #32**

**Los Alamos Maintenance Visit  
April 17<sup>th</sup> through 23<sup>rd</sup>, 2001  
Trip Report**

Jim Ruff  
5/1/01

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

The team consisted of Steve Aragon, Ramon Gutierrez, Doug Scott, Tom Frost, Ken Lakies, Steve Troy and Jim Ruff. Site Techs Paul Johnson and Gene Dunn assisted throughout. Shane Baca was present for two days.

An apex handrail and a Sellstrom quad leg fall arrest system were installed. On future trips we need to allow the mechanics an extra day for this time consuming job.

The pintle bearing pocket was checked for flatness. Measured TIR was under 0.001".

The FRM INA bearing clearance measured less than 0.002".

The azimuth bearings were inspected. Metal flakes were present in Drive 1 outside and Drive 2 inside. Drive 1 outside was replaced. The metal in Drive 2 was brass, with flakes to about 0.06" across. This is alarming, as this bearing is part of the new wheel assembly installed in October 2000. I asked Paul and Gene to grease the bearing weekly to flush out the metal, and to keep inspecting the purged grease and let me know what they find.

We checked alignment of Drive 1, and found it to be out of spec. The axle and gearbox are off by almost 4' vertical and 1.5' horizontal. This misalignment can not be corrected without replacing the axle/wheel assembly. We also noticed that the taper collars were never tightened on either bearing. When we replaced the outer bearing, we tightened its collar for RIC 0.005" and final internal clearance 0.005". We tightened the inner bearing collar to 0.007" final clearance. It would have required jacking up the antenna to tighten the collar further, and we didn't have enough time for that. The wheel radius measurement was unreliable because the wheel floats in and out due to the combination of misalignment and loose inside bearing collar.

	Drive 1	Drive 2	Idler 1	Idler 2
Inner	OK	A few brass flakes.	OK	OK
Outer	Replaced.	OK	OK	OK

The outer races had been rotated previously, so we didn't do it.

The bearings on this antenna are getting plenty of grease. Paul and Gene are to be commended for their conscientious job.

Az and El gearbox oil was changed. The manifold sight glasses cleaned up nicely thanks to the Exxon System Cleaner. An az strainer was replaced to repair a stripped stud. The old one will be repaired and put into the warehouse.

The vertex house door is rusting. (Figure 1) This door should be replaced during the next tiger team visit.

The dichroic panel is in good condition. (Figure 2)



**Figure 1: Vertex house door**



**Figure 2 : Dichroic Panel**

The azimuth rail grout is bad in several places. The areas that were previously patched with epoxy grout appear to be holding up well. More patching is called for. (Figures 3 through 6)



**Figure 3: Bad grout**



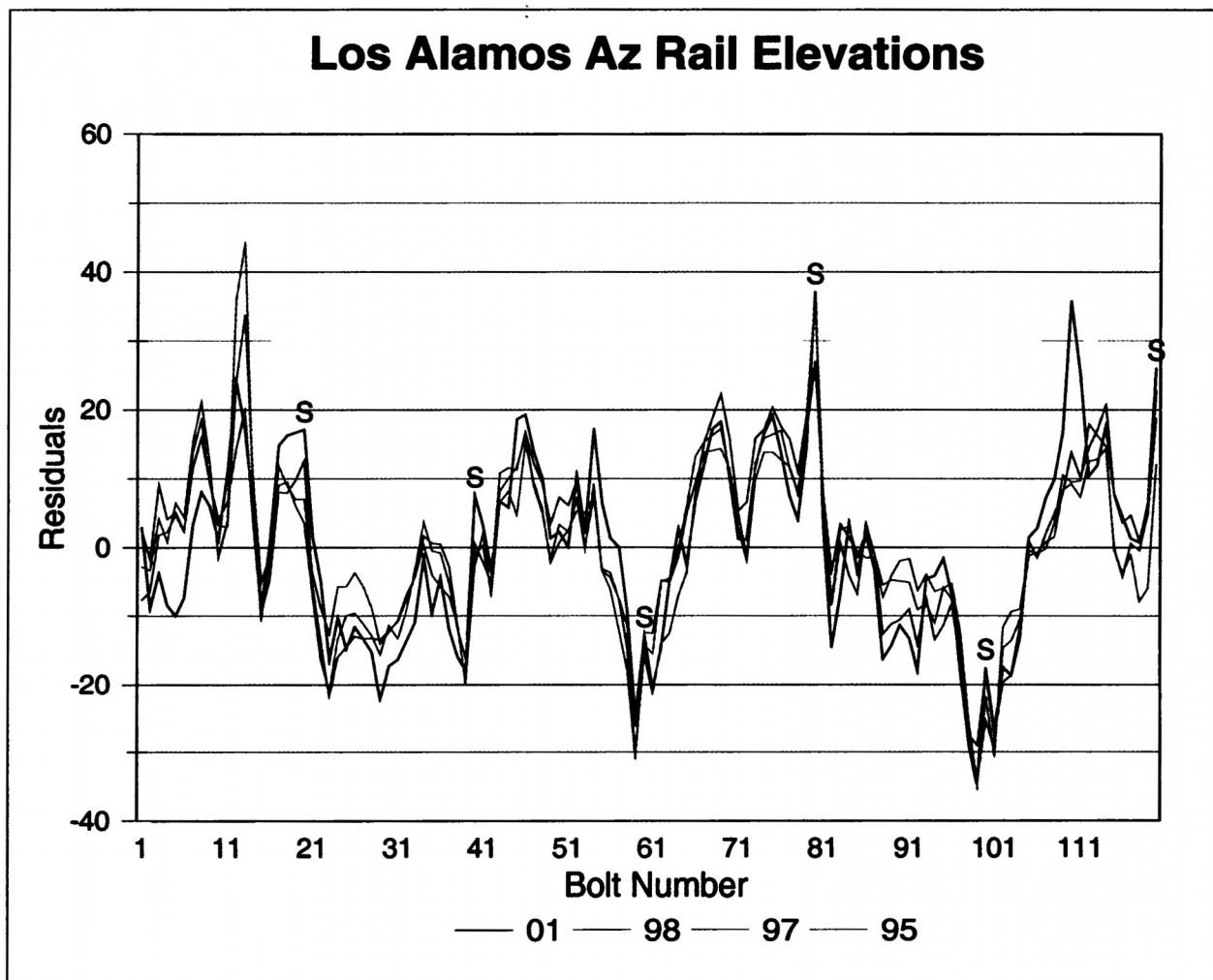
**Figure 4: Grout failing under Vulkem**



**Figure 5: More bad grout**



**Figure 6: More bad grout**





The paint on this antenna is in excellent condition. (Figures 7 through 10) We did some touch up painting around the mid-level handrails, pedestal structure, and the elevation bearing that was changed last January.



**Figure 7: Apex**



**Figure 8: BUS**



**Figure 9: Quad leg & dish**



**Figure 10: BUS**

No structural cracks were found.

Steve Aragon designed and built an improved latch for the swinging catwalk gate. This latch will be installed on other sites as needed.

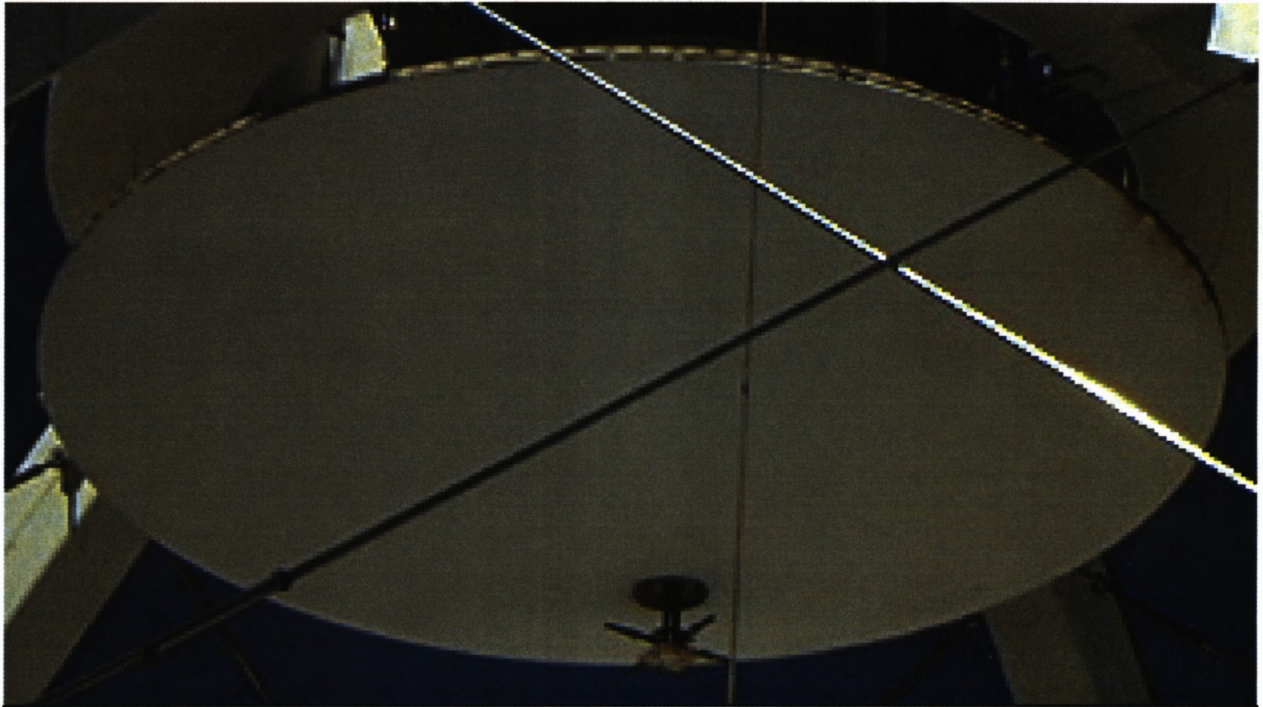
In order to speed up future trips, we would like to consider some changes to the apex PMs:

- 1) Have the antenna mechanics check cables inside the subreflector support tube instead of the electronics tech. (The mechanics have to climb in there anyway...)
- 2) Have the electronics tech check the aircraft lights instead of the mechanics. That way, the mechanics don't need a volt meter.

We are also going to look into putting a central point lube system on the FRM bull gear.



The subreflector is showing some small dark spots, but otherwise looks OK. (Figure 11)



**Figure 11: Subreflector**

A modified Southco #9770-220-11 latch was tried out for the vertex room hatch. It worked well, so more have been ordered and we will begin replacing broken rubber latches with these. (Figure 12)



**Figure 12: New vertex room latch**

## Servo Trip Report

# Memo

**To:** Distribution  
**From:** Thomas W. Frost  
**Date:** 01 MAY 01  
**Subject:** Tiger Team Visit VLBA LA

**DAY 1** Travel to Los Alamos Site and unpack equipment from container

**DAY 2** Perform Servo System PM procedures in Pedestal Room, Pintle Bearing Room, and on Elevation Platform

**DAY 3** Finished Servo PM procedures on AZ Motors, Limit Switch & Safety Interlock System, and AZ Motor Brakes

**DAY 4** Assist Antenna Mechanics with AZ Bearing Inspection & Replacement

**DAY 5** Start Servo System Response Tests, but had to abandon because of winds in excess of 58 MPH, Assist Antenna Mechanics with Bearing Lubrication

**DAY 6** Completed Servo Response Tests without any winds, Troubleshoot ACU problem down to module level, replaced terminal blocks in EL Platform j-box

**DAY 7** Packed up equipment in container and return to Magdalena

During the performance of the Servo PM procedures in the Pedestal Room, the following items were noted and corrected:

**Drive Cabinet**-on the D/C Interface Bds, IC B-17 was not fully seated in it's socket, this was noted on both AZ/EL side-this could be a result of either a Tachometer Scaling adjustment or inspection where IC B-17 is used as the monitor point.

**Non Critical Power Panel**-while inspecting the panel CB's with an IR Thermometer, we noticed that some of them were hotter than 'normal'-after panel covers were removed, it was discovered that most of the circuit breakers had loose screw contacts on the order of 1/8-1/4 turn each.

## **Servo Trip Report**

During the AZ/EL Motor PM's the following problems were noted and corrected:

**EL Motors**-both EL motors had missing set screws on the Tachometer Couplings, these were replaced-EL #2 had a loose coupling on the Gearbox side and had slid forward on it's shaft-EL #2 exhibited minor threading that was easily removed with a soft stone.

**AZ Motors**-both AZ motors had deteriorated spiders at the gearbox coupling, these were replaced-both AZ Motor brakes were out tolerance, these were disassembled and adjusted back into specification of 75 ft-lbs each.

### ***Action Items***

The AZ/EL motor j-box modifications were not done due to a lack of available hardware; these could be done during a double Maintenance Day period as this facilitates brush inspection or change outs. Whenever the hardware is available, the Servo Group will send the necessary parts & documentation to the Site Techs for installation. It might also be a good idea to add a note to the PM Manual advising that it is necessary to inspect IC B-17 on the AZ/EL Drive Cabinet Interface Bds. after performing the Tachometer Scaling procedures to be certain it is fully seated in it's socket.

### ***Conclusions***

As we have come to expect from this VLBA Station, the Servo System was in excellent shape with the exception of the minor items noted above. The dedication of the Site Techs was self-evident and the Station was in good shape overall.



## **Electronics Trip Report**

**To:** Jim Ruff  
**From:** Doug Scott  
**Cc:** Paul Rhodes  
Tom Baldwin

5/07/01

**Subj:** Los Alamos Tiger Team Report, Electronics

The Tiger Team maintenance and checkout was performed at the VLBA Los Alamos site from 16-23 April 2001. Overall the site is very good shape. This site reflects the amount and high level of work done by Paul Johnson and Gene Dunn. Their assistance in all areas was superb.

The installation of the new apex ladder and harness in combination with the railing is greatly appreciated. The new method of cleaning the manifolds and oil flow sight glasses on the antenna drive motors is impressive.

Antenna training was conducted by Jim Ruff, on the usage of the new apex handrail and ladder, for the site technicians and myself. Preventive maintenance training was conducted by Paul Johnson with me. These PMs were Q-4 (HVAC) and Q-6 (IF Converter Levels & Synthesizer Settings).

The only outstanding item from my checklist is to replace the caution sign on antenna azimuth ladder (on order).

### **Action Taken:**

1. Replaced signs on maser wall (no parking) and on antenna hoist (caution 500lbs.)
2. Cleaned critical power filter box, located outside vertex room
3. Removed brush from site perimeter fence
4. Inventoried storage cabinet in room 102
5. Repaired FRM switch at apex junction box.

### **Concerns:**

1. No fire alarms were tested, per site manager's request. We have a problem with LANL response team.
2. LANL desires our site fire extinguishers to be checked independently.
3. UPS batteries in the building are dated July 1994. These should be replaced.
4. FRM switch that was replaced is a safety related issue. The FRM was moving (rotation cw) after the manual switch was released. This was known to the site techs, last noticed about a year ago. It occurred for a while then stopped. We may want all sites to check these contacts and replace them with new contacts.
5. Paint cans are stored inside building (rm 102) to keep from freezing. These cans probably should be stored outside in the shipping container.
6. A broken door latch located between the top of the vertex room and the antenna dish was replaced with a new type. The new type is metal where the old is rubber. The old style latches are not in stock. We'll need to check with the site techs to see how these are working out.
7. I inventoried a general storage cabinet and tried to check my list against the site MSDS folder. There are items that should be added to the folder however I am not clear on what are the requirements or how to cross index my list and the MSDS folder.

## Task List

**Project(s):** Los Alamos VLBA Tiger  
Team Maintenance Schedule

### Task

#### SERVO

##### SAFETY TESTS

MULTIPLE FAULT STATUS  
MANUAL MODES TEST  
INDIVIDUAL FAULT STATUS  
REMOTE BOX TESTS

AZ Travel Limit Switch Tests  
AZ Clockwise tests  
AZ Counter-Clockwise tests

EL Travel Limit Test  
Elevation up tests  
Elevation down tests

##### BRAKE HOLDING-TORQUE TESTS

##### Motor Inspections

Install stainless steel j-boxes on drive motors

(4)

Motor and Tach Couplings  
Drive motors wiring orientation  
Commutator & Brush Inspection

##### Servo PM

Replace SCR EL cooling fan  
ACU PM

##### Lightning Grounding

EL Bearing Ground Cables  
EL Motor Platform to Pintle Turret  
Pedestal Room Grounding  
AZ Wheel Ground Straps  
Pintle Bearing Room Grounding

##### Detailed Test

System and Axis Faults  
Motor Fault Status  
Measure EL Velocity  
EL counterweight balance measurements  
Measure AZ Velocity  
Record 1st Limits EL/AZ

##### Recordings

EL System Response Test  
Implement test setup  
Calculate acceleration  
Locked rotor resonance, AZ/EL

AZ System Response Test  
Implement test setup  
Calculate acceleration  
Locked rotor resonance, AZ/EL

##### AZ Position Loop Tests

Small signal step response  
Large signal step response  
Single motor step response

##### EL Position Loop Tests

Small signal step response  
Large signal step response  
Single motor step response

##### Auto Modes Test

Check stow commands  
Synchro feedback operation  
Test AUI COMM DEAD

##### HVAC PM AND UPGRADE

##### Antenna

Pedestal room A/C replacement  
Remove window A/C unit & wall sleeve  
Remove wall heater  
Remove environmental control box  
Install Marvair unit  
Install thermostat  
Install power & control wiring  
Perform operational tests & place unit in

service

Provide Site Techs w/manual and hold

Q&A session.

##### Vertex Room A/C

Inspect air handler  
Inspect condenser unit  
inspect lines & bulkhead fittings  
Repair/replace damaged line insulation  
Replace & calibrate Hoffman fan control  
Replace any suspect bulkhead fitting  
Evacuate & place unit back in service  
Check ROC settings (C!, set 120, Def.30)  
Check PCtool to DDC connection @

computer

Make hard copy of program parameters  
Check programing, save program file to

disk.

Hold Q&A session w/ Site Tech's

##### Control Building

Building A/C System  
Perform operational checks

Inspect indoor & outdoor units  
 Correct deficiencies as needed.  
 Stand-By Contempo  
 Recover refrigerant  
 Condensing Unit  
 Install head pressure control by-pass  
 valve  
 Install & calibrate Hoffman fan units  
 Replace fan unit  
 Indoor Unit  
 Install primary unit interface relay  
 board  
 Install controll relay  
 Instal Hoffman SCR's  
 Replace control panel light  
 Install auxillary terminal block  
 Replace V-belt & adjust pully to  
 maximum  
 Evacuate & recharge refrigerant  
 Perform operational checks  
 Primary Contempo  
 Condensing Unit  
 install & calibrate Hoffman fan  
 control  
 Replace fan switch  
 Indoor Unit  
 Install auxillary terminal block  
 Install utility interface auxillary  
 switch  
 Install wiring to stand-by unit  
 Peform operational checks  
 Check PCTool to DDC connection at  
 computer  
 Make hard copy of program parameters  
 Check program & save program file to  
 disk  
 Perform hard test of emergency power w/  
 Contempo's  
 Review site documments with Site Techs  
 Inspect site utilities  
 \* ANTENNA MECHANICAL  
 \* Install new ladder & fall arrest system  
 \* MECHANICAL TEAM 1  
 \* FRM 2-year PM  
 \* FRM INA bearing check  
 \* Install apex guardrail  
 \* Subrefector  
 \* Check for peeling, delamination  
 \* Check spider bolts, backside,etc  
 \* Check Donut Bolts  
 \* Feeds & Dichroic

\* Install new 3 mm receiver mount  
 \* Inspect feeds,mounts,htrs,etc  
 \* Repair feedcone housing exterior, chk  
 dichroic reflector  
 \* Quad-Legs Guy Wires Etc..  
 \* Inspect guywires & turnbuckles  
 \* Inspect quadleg flange bolts  
 \* Lightning Protection/Anemometer  
 \* Inspt mounts/chk operation  
 \* Bull/Pinion Gears  
 \* Inspt bull/pinion gears  
 \* Lub El brgs, bull gears as req  
 \* Check stow pin  
 MECHANICAL TEAM 2  
 Elevation/Hoist/Swing Platform Work  
 Instl hoist safety mods, checkout winch,  
 etc  
 Checkout swinging platform  
 Extend EL motor platforms  
 Instl condensor platform toe guard  
 EL Bearing Inspection  
 Inspect EL bearings internals  
 Inspect EL bearings lip seals  
 Clean off excess grease  
 Install El bearing grease trays  
 EL Motors & Gearboxes  
 Change gear oil in gearbox  
 Inspect pumps, seals & couplings  
 Fix stripped stud on #1 gearbox oil filter  
 Weep gearbox heater enclosures  
 AZ Wheels & Bearings  
 Pressure wash gear boxes  
 Rotate outer races on Az wheel bearings  
 Check wheel to struct clearances  
 Check AZ wheel radii  
 Check axle bolt tightness  
 Pillow block brgs-open & clean  
 Lubricate & take sample as req  
 AZ Motors & Gearboxes  
 Internal gear inspection  
 Inspect pumps, seals, couplings  
 Install grease fitting on #2 motor bearing  
 Paint & Insulation Inspection  
 Inspect ant paint and report  
 Inspect & repair ant insulation as needed  
 \* ANT. MECHANICS Cont.  
 \* Pintle Bearing  
 \* Inspect seals, check pocket level & for  
 loose bolts  
 \* Lubricate bearing as needed



- \* Close gap in pintle grease catcher
- \* AZ Rail Inspection
  - \* Inspect ant foundation
  - \* Inspect for rail movement
  - \* Inspect joint bars & clips
  - \* Move ant, chk rail movement
  - \* Rail level measurements
  - \* Check popping wheel
- \* Dish Surface & Panels
  - \* Inspect panels, check distortion, shifting,
- etc
  - \* Check all panel bolts-looseness
  - \* Repaint panel where needed
- \* Structural
  - \* Install EL hard stops
  - \* Check ant structural bolts
  - \* Inspect ant structural welds
  - \* Inspt ant backup/lower struct
  - \* Inspect EL axle
  - \* Repair Insulation

#### **ELECTRONICS**

##### **Antenna Maintenance & Inspections**

- Activate & test feed heaters
- Apex/FRM inspections
- Feedcone/Receiver system inspections
- Vertex Room/Racks & cable inspections
- Vertex to pintle bearing inspection
- Replace tie wraps on antenna cabling with metal type
- Install cable wrap strain reliefs
- Inspect pintle bearing rm bulkhead, cablewrap, etc.
- Inspect pedroom UPS, FRM controller, dry air sys, etc.
- Install electrical breaker for air comp & hydraulic wrench
- Station Building Inspections
  - Rm 100 - Check electrical, UPS and test operation
  - Rm 103 - Chatter/supervisory boxes, alarms, etc.
  - Rm 104 - Bulkhead, underfloor, maser, etc
  - Check tools, test equip, manuals, wtr sys,
- UIS, etc

##### **Outside Building and Misc. Inspections**

- Run and inspect site generator
- Inspect weather station
- Check gates. fence, signs, grounds, etc
- Inspect lightning protection for antenna & bldg
- Check safety items/hazmat storage, etc.

#### **FINAL INSPECTIONS**

- Spot check critical PM's
- Review problem areas with site tech's
- Site Inspections for Oversights
- Site clean-up
- Station Startup Verification Tests