

**VLBA Antenna Memo #29**  
**Los Alamos Elevation Bearing Replacement**  
Jim Ruff                      Photos by Gene Dunn  
1/30/01

Metal was found in the grease from the condenser-side elevation bearing late in October 2000. The decision was made to replace the bearing. A team consisting of Steve Aragon, Ramon Gutierrez, Steve Troy, John Wall and Jim Ruff went to do so during the week of January 8<sup>th</sup>, 2001. This was the first time a VLBA Elevation Bearing had been changed in the field.

Prior to the actual replacement, a crew went to LA to verify dimensions and make preparations, including tapping holes for the jack support beam. This was done concurrently with the azimuth wheel replacement described in VLBA Antenna Memo #28.

The following is a summary of what we did. See the attached procedure for a more detailed listing of tasks.

**Monday, 1/8**

Steve Troy arrived on site early to begin pumping down the HVAC unit. The rest of the crew showed up by 11:00, just in time to remove the condenser. The hose support beam above the pillowblock was removed to make room for the crane. The jack support beam was brought up and placed in position. The pillowblock welds were burned off.



**Figure 1: Condenser**



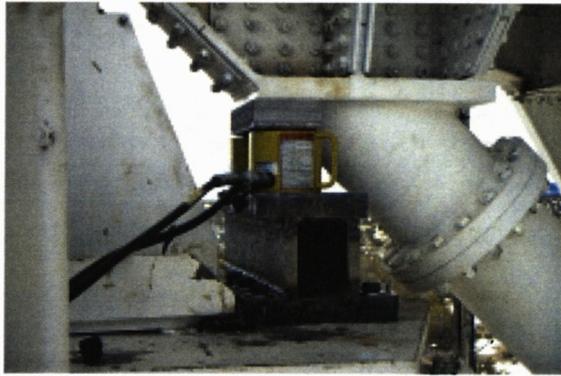
**Figure 2: Jack Support Beam**

**Tuesday, 1/9**

Removed insulation from the structural tube to allow the brace beam to be welded in place. Installed the brace beam, jack support beam and anti-rotation pin. Verified elevation brake torque. Unbolted the pillow pillowblock and removed the elevation synchro and pillow block covers. Marked the original pillow block position by scribing the base plate through the bolt holes. Positioned the jacks and did a trial lift. Replaced two pillow block bolts prior to leaving for the night.



**Figure 3: Anti rotation pin**



**Figure 4: Jacks**

Wednesday, 1/10

Lifted the axle. Note that it took about 6200 psi and over ½ inch of jack travel to get adequate clearance - 1/8 inch - under the pillowblock. When in position, we put horseshoe shims around the jack rods to prevent drift. Positioned the crane and used 3 small Porta-Powers to release the bearing taper. The pillowblock was attached to the crane using a 1.5 ton come-along and safety chain. Lowered the pillowblock to ground level and installed the axle support.

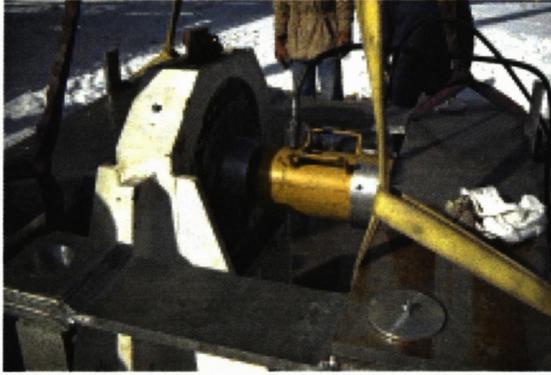


**Figure 5: Pillowblock on the way down**

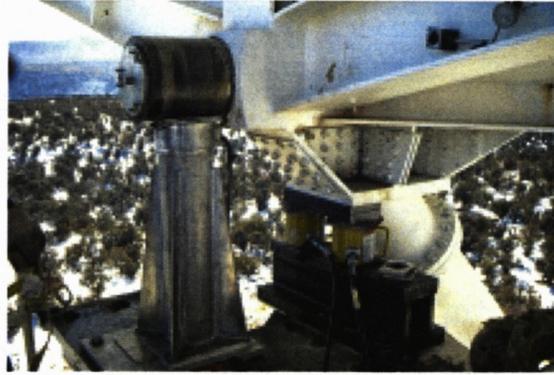


**Figure 6: El Axle Support**

The old bearing was pressed out using the 100 ton press. Cleaned up the bore, applied NeverSieve, and put in the new bearing. Cleaned and inspected the axle. Installed a new taper sleeve on the axle. Cleaned and smoothed the base plate.



**Figure 7: Pressing out the old bearing**



**Figure 8: Support Assembly**

Brought the pillow block back up and positioned it on the axle and sleeve with the crane. Lowered the boom so the pillowblock was hanging from the axle. Set bearing preload using reduction of internal clearance method: Initial clearance: 0.009<sup>+</sup> inch. Final clearance: 0.004 inch. RIC: 0.005 inch. Note: We used the hydraulic nut to advance the bearing up the sleeve. This was a very slow process because the pressure had to be released to measure clearance. Lowered the jacks, installed two pillow block bolts, and breathed a sigh of relief prior to leaving for the night.

Thursday, 1/11

The pillow block came down in a different position from the original. To put it back, we welded jack screws in appropriate locations, raised the axle, and jacked the pillow block into the correct position.

Reinstalled pillow block covers and pillowblock bolts. Torqued the bolts to 1900 ft-lbs using the hydraulic wrench. Removed the anti-rotation pin, jack support and brace beams.



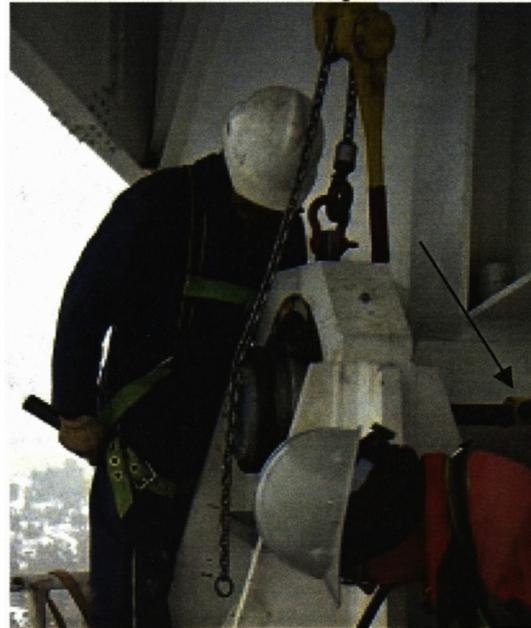
**Figure 9: Support Beams and pillowblock jack screws**

Friday, 1/12

Reinstalled the elevation synchro. Note that the synchro was very poorly centered to the axle. We improved the alignment somewhat by enlarging the bolt holes, but it's still not very good. We also had trouble reinstalling the seal covers because of sloppy bolt circles. Future teams should be sure to bring a set of large drills to allow enlarging the holes. All we had was a taper reamer, which was not very effective. Checked angular alignment of the new bearing. The spec is  $1.5^\circ$  or better. Measured misalignment:  $1.2^\circ$ . Checked the precision level. It showed  $0.0005''/\text{ft}$  (9 arc sec) off from zero. Replaced the condenser. Site clean-up.



**Figure 10: Synchro Reinstalled**



**Figure 11: Small Porta-Power for removing PB**



**Figure 12: Detail of jacks. Note washers RSi used for shims under pillowblock.**

**Random notes and comments:**

This pillow block was not grouted to the base plate. Grout would have made the job more difficult. Conversely, had the pillowblocks been split (like azimuth), this would have been a simple one day job.

We could have set the bearing more squarely to the shaft, but chose to set it close to the original position instead.

No one expected as much deflection as was seen in the pedestal structure. We should probably do a more inclusive FEA model before attempting this job again.

As figure 13 shows, the bearing did indeed need changing!



**Figure 13: Old Bearing**

Congratulations to Aragon, Gutierrez and Wall for their skillful work on this job. Particularly the way they managed to ‘micro-position’ the pillowblock using the crane!  
Thanks to Ramon Molina, Guy Stanzione, and Jon Thunborg for helping us through the exciting parts.

Last but not least, thanks to Paul and Gene for all their help and cooperation.



## **VLBA ELEVATION BEARING CHANGE PROCEDURE**

### **TASKS PRIOR TO ARRIVAL**

#### **Fabricate (Responsible person):**

1. Brace beam (Thunborg)
2. Jack support beam (Thunborg)
3. Shims (Thunborg)
4. Jack shims (Thunborg)
5. Anti rotation pin (Thunborg)
6. 100 ton press (Ruff)
7. Tie two 100 ton jacks together with hydraulic manifold. (Wall)
8. Jacking Bolts (Aragon)
9. Jack Stand (Thunborg)
10. Level platform (Thunborg)
11. Guard rail for HVAC platform (Aragon)
- 12.

#### **Equipment needed:**

1. Bearing
2. Taper coupling
3. Grease
4. Hydraulic wrench
5. Replacement seals
6. Brake kit and parts
7. Camcorder
8. Mag Drill
9. torch
10. welding leads
11. National Crane

Maintenance Day (December 12) National crane needed

#### **Crew:**

Jim Ruff  
Steve Aragon  
Ramon Gutierrez  
John Wall

(Security Note: J. Thunborg, G. Stanzione and Ramon Molina may also be present.)

1. Travel to LA,
2. Tailgate meeting, wear safety harnesses
3. Trim Insulation on 16" tube where it meets Brace beam.
4. Drill and Tap (if necessary) bolt holes for Jack support beam.
5. Check Elevation brake holding torque.
6. Place stow pin and record ACU reading.
7. Remove elevation syncro and outside bearing cover. Verify that hydraulic nut can be used for
8. De-installation and installation of bearing.
9. Install jacking bolts
10. fit check, Field modify if needed.
  - a. Rotation Constraint Pin
  - b. Shims
  - c. Brace beam
  - d. Jack support beam.
  - e. Hydraulic Wrench
  - f.

11. Reinstall elevation syncro and replace cover plates
12. Return to Socorro and complete any necessary modifications.

January 8

Crew:

Jim Ruff  
Steve Aragon  
Ramon Gutierrez  
John Wall  
Steve Troy

(Security Note: J. Thunborg, G. Stanzione and Ramon Molina may drive to LA on January 9<sup>th</sup>.)

1. Tailgate meeting.
2. Lock out antenna
3. Bolt Jack support beam to elevation platform.
4. Check brake torque
5. Weld Brace beam into place.
6. Install Rotation constraint pin.
7. Record ACU reading.
8. Loosen pillow block bolts
9. Grind or cut out weld between platform and pillow block.
10. Remove HVAC condensor and platform. (Note: Safety belts required when guard rail is removed.)
11. Install Temporary guardrail.
12. Position National crane to lift pillow block.
13. Position jacks and shims.
14. Remove elevation syncro
15. Remove pillow block covers

January 9<sup>th</sup> , 10<sup>th</sup> and 11<sup>th</sup> .

1. Tailgate meeting
2. Verify antenna is locked out
3. Verify that anti rotation pin is in place.
4. Install dial indicators on bearing pillow block.
5. Manually release elevation brakes.
6. Slowly apply pressure to jacks. Watch high stress joints as indicated from analysis
  - a. Post man on elevation platform – ready to apply brakes if necessary.
  - b. Post man in cherry picker basket below bearing platform to watch for indications of stress.
  - c. Post man on elevation platform to watch stow pin and gearboxes
7. Use dial indicators to verify pillow block travel direction.
8. Lift pillow block 1/16” from platform.
9. Wait 5 minutes.
10. Lift pillow block appx. 1/8” from platform. ¼” maximum
11. Install jack shims between jack body and shim stack.
12. Lower antenna onto jack shims.
13. Apply elevation brakes.
14. Remove bearing nut.
15. Use hydraulic nut to dislodge taper coupling.
16. Remove pillow block and bearing from antenna.
17. Use 100 ton hydraulic press to remove bearing from pillow block. If 100 ton press is not adequate for bearing removal, Take pillow block to Albuquerque and remove at Vertex.
18. If necessary to leave antenna overnight – Install Jack stand under axle and lower antenna onto Jack stand.
19. Install new bearing and seals in pillow block.
20. Locate pillow block as close to its original position as possible.
21. Install taper coupling per UAI installation procedure.
22. Release elevation brakes
23. Lower bearing and bolt in place.

24. Reapply elevation brakes.
25. Remove anti rotation pin
26. Grease and test axis. Watch structure closely making sure it does not rotate into the brace beam and anti rotation plate. Remove anti rotation plate if necessary.
27. If antenna performs adequately, remove jack support, anti rotation structure and brace beams.

January 12<sup>th</sup> .

28. Reinstall HVAC platform (Remember safety harnesses.)
29. Install bearing covers.
30. Go Home