



# National Radio Astronomy Observatory VLBA Antenna Memo Series – No. 86

TRIP REPORT - FORT DAVIS 16-20 MAY 2011  
ELEVATION BEARING CHANGE

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## 1. Trip Summary

A team from the VLA went to the Fort Davis VLBA site to perform the replacement of the encoder side elevation bearing. The bearing had been producing metal particles in the grease for some time, so it was determined inspection and replacement were necessary. The replacement took place between 16 and 20 May 2011. The VLA staff participating in the trip were:

Jon Thunborg  
Matt Evatt  
Ramon Gutierrez  
Martin Lopez  
John Wall  
Adrian Zamora  
Tommy Montoya  
Ken Lakies

Note that there was concurrent work being performed by other groups at the same time on installing a new C-Band receiver and running of new fiber optic cable from the station building to the telescope.

The bearing was changed successfully although the team had to contend with fire restrictions in the area that severely limited the time available for welding and grinding. Some new and updated fixturing was tried out during this trip, and while a few opportunities for refinements were discovered, the fixturing worked well. The refinements will be incorporated for the next bearing change trip which will be to Mauna Kea around October 2011.

In addition to proving the new fixturing, this trip provided an opportunity to train several members of the team who had not previously been involved in a bearing change to perform this task.

## 2. Trip Details

### Monday

We arrived in Fort Davis on Monday evening, 16- May.

### Tuesday

Tuesday morning we reported to the VLBA site around 8:00 AM. The site techs informed us



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that due to the drought conditions in the area and the forecasted high winds, there were burning restrictions in place that would affect our ability to weld and grind. One of the site techs called the Fort Davis fire department to ask them to come out and evaluate our particular situation. The Jeff Davis county fire marshal arrived along with firefighters from the department to review the area. They determined that the winds were already too high that day to permit welding or grinding. Jon was able to negotiate with them to return the next morning at sunrise and to reevaluate the situation.

Our crew was able to spend the rest of the day Tuesday get as much preparatory work done as possible. Additionally, we made a work plan for Wednesday morning assuming we would have about two or two and a half hours from sunrise at 6:00 AM to complete all our welding and grinding for the day, assuming the fire marshal allowed it.

### Wednesday

We arrived at site around sunrise; Jon again had to negotiate with the fire marshal to allow us to perform our welding and grinding if we contained the sparks and slag using welding blankets. He agreed, and after a tailgate meeting, welding and grinding started. All hot work was completed using fire prevention procedures that were acceptable to the fire marshal. By noon, all preparatory work was completed and we were ready to lift the dish. We broke for lunch, and decided that although we could not complete the bearing change that day, we would lift the dish that afternoon then set it back down with some of the pillow block bolts reinstalled, leaving the dish in a secure position but ready for a quick and easy lift again the next morning. This operation was completed successfully; however, it took the rest of the day. It was time very well spent so that we would have the entire day the next day to complete the bearing change and to reinstall the pillow block.

### Thursday

We arrived around 6:45 or so after a tailgate meeting, we immediately began the final lift of the dish. Thanks to the previous afternoon's work, lifting was quick and uneventful. Removing the taper coupling was more difficult. One problem we experienced was that we set up the press fixture incorrectly by allowing a weld between one of the ACME nut and the press beam to take the entire taper coupling removal load (about 86,000 lbs) in shear. The weld wasn't designed to take this load, and it failed. When the weld broke, the ACME rod moved enough to allow the aluminum press plate and sleeve to fall onto the elevation bearing platform. It did not hit anyone or fall off of the platform. We realized that we forgot to put a nut in front of the press beam; we did this and we were



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able to use the fixture without the now broken off welded-on nut. The function of the welded-on nut was to keep the threaded rod centered during fixture assembly. We determined that centering it by hand worked well enough and was not too difficult to do. We will not re-weld the nut onto the beam in the future.

The taper coupling seemed to “pop” several times before we actually got it to release. This was because the bearing was not seated all the way into the bearing pocket against the spacers on the inboard side. During the previous bearing change, the team had difficulty aligning the bearing with the pocket before sliding it into the pocket. Because of this misalignment, it was not possible to seat the bearing completely in the pocket. Additionally, after the initial installation last time, the bearing moved in the pocket towards the outboard side. An area of interference between a bolt head on the taper coupling lock nut and the bearing cover developed due to this movement and additional subsequent motion over the next two years. This interference was most likely the cause of the metal particles found in the grease. The bearing was inspected in place as much as possible, and seemed to be OK. Jon made the decision to proceed with the change based on several factors. First, it was impossible to inspect the bearing thoroughly in place, so real bearing damage could not be ruled out. Second, the cost of the bearing itself is insignificant compared to the cost of the effort to change it. At that point in the effort, proceeding with the change cost very little more than aborting the change. Third, completing the operation provided the crew with some very valuable experience that will be necessary during the next bearing change which will take place in the inhospitable environment of Mauna Kea.

After the taper coupling was removed, bringing the pillow block down and actually replacing the bearing was not difficult. The new fixturing worked well.

The pillow block was lifted back up and moved onto the elevation axle. The hydraulic nut was used to set the bearing roller clearance, then the pillow block was set back into place and bolted down. The elevation axis was then run with dial indicators on the axle. There seemed to be about .005 inches of axial spring-back in the system. Ken began the encoder installation and completed it on Friday.

### Friday

All structural reinforcement parts were removed, except the welded lugs. Those items were left in place for future use. If the bearing has to be changed again, leaving these lugs in



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place will speed up the operation by reducing the amount of welding and fit-up required.

After moving the telescope most of the morning in elevation, no large or unrepeatable axial movement was observed. Jon, Matt, and John W. left the site around noon. The rest of the team remained to finish various tasks like reinstalling the insulation that had been removed from the structure, touch-up painting, and marking the structural reinforcement fixturing with their installation locations. Additionally, some of the crew had been scheduled to help with the other work being performed concurrently.