



National Radio Astronomy Observatory VLBA Antenna Memo Series – No. 104

David Paul

TRIP REPORT – FORT DAVIS, FEBRUARY 14-17, 2023
ANTENNA INSPECTION AND GEARBOX INSPECTION

1. Trip Summary

A group from the VLA traveled to the Fort Davis, TX VLBA station (FD) to perform an overall antenna inspection to include tear down of an azimuth and an elevation gear box and site inspection. Some observations were made for planning of future work activities.

David Paul

Jon Thunborg

Ephraim Ford

Dave Schafer

Patrick Martinez (Tech)

Carlos Morales (Tech)

Along with the VLA staff, there were the FD VLBA site techs on site to help.

Juan De Guia

Julian Wheat



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Figure 1: The Fort Davis VLBA station antenna.

2. Plan Summary

Complete a visual inspection of the antenna and the control building. Disassemble one azimuth drive gear box and one elevation drive gear box. Meet and work with site techs Juan and Julian. Discuss site equipment, operation and maintenance challenges. Look at rail section and grout to plan for future rail replacement activity.

Azimuth Gear Box – Sumitomo Compower Gear Reducer – Model SPHJ-135S-848



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Elevation Gear Box – Sumitomo Compower Gear Reducer – Model SPHJ-135S-737

3. Trip Details

Tuesday, February 14, 2023

Two vehicles were driven from Socorro, NM to Alpine, TX. One SUV and one pickup with tools and parts.

Wednesday, February 15, 2023

Met the site technicians and got acquainted. Got a tour of the control building. Mechanics rebuilt brake assembly on azimuth gear box #2. Gear box tear down commenced for the same #2 unit. Inspection of gear wear is the intent of tear down. This will provide information used by engineering for ordering replacement parts.



Figure 2: Pat and Carlos utilizing motor-brake assembly lifting device during removal



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The mechanics had brought a small floor jack with a bracket attached for use in removing the second housing from the gear box assembly. Some on-site rigging was required to pull on the housing to get it to come loose. One end was attached to a pintle bearing housing bolt and the other was attached to the gear box housing. Better rigging could be utilized in the future for this task. See Figure 3.



Figure 3: Rigging around motor assembly to pull off second motor housing.

Inspection of the azimuth gears showed that the sun gears of all 4 stages had significant wear. The planets and ring gears showed little wear. See Figures 4 and 5.



Figure 4: Typical Sun Gear Wear

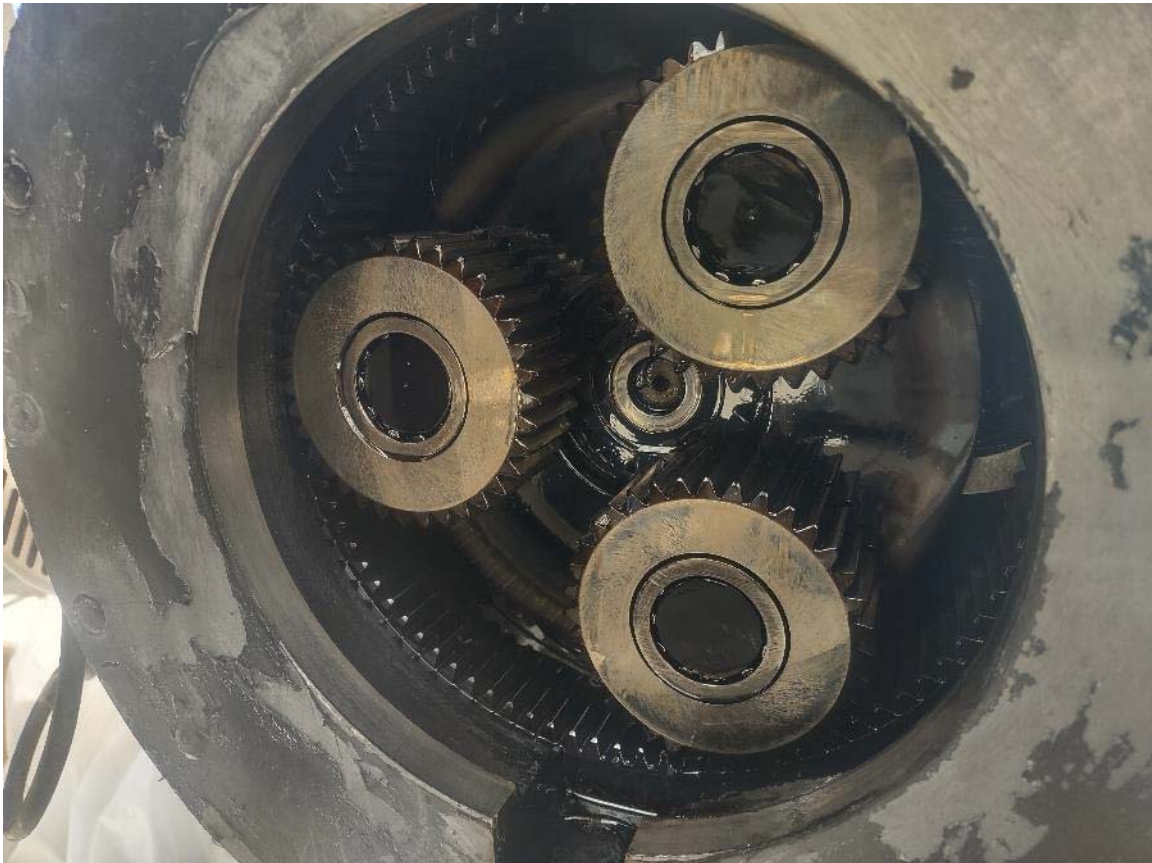


Figure 5: Planet and Ring Gear Showing Little Wear



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Grout volume was measured and calculated for rail section replacement at 21.4 cu ft. See Figures 6 & 7. When a wheel travels over the low spot some noise is heard with the assumption the azimuth drive system is experiencing some instability.



Figure 6: Rail Surface Deformation





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Figure 7: Grout Condition at Rail Splice

Bearing grease was inspected for the azimuth wheel shafts to see if significant metal flakes show up to indicate the bearings are starting to fail. In this case, little metal was found in the grease. The bearings were packed with new grease. New SKF grease cups were installed on the inner and outer axle bearing housings. See Figure 8.



Figure 8: Azimuth Drive Axle Bearing Grease Inspection

Thursday, February 16, 2023

An elevation gear box was disassembled for gear wear inspection. The same sun gear wear was observed in the elevation gears.



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Figure 9: Elevation Drive Gear Box Disassembly

A hoist was rigged to the walkway stairs above the gear box with one nylon round sling on each side.

The dish backup structure was inspected for corrosion and cracks. Access was assessed to tiers 1, 2 & 3 to the dish panel rivets for use in planning Mauna Kea, HI future panel replacement work. See Figures 10 & 11.



Figure 10: Dish Backup Structure Inspection



Figure 11: Dish Backup Structure Inspection



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The ellipsoid and dichroic panel were inspected for overall condition. Overall they are in good condition. See Figure 12. The sub-reflector was inspected from a distance and it was concluded that it needs paint work during the track section replacement trip. See Figure 13.



Figure 12: Dichroic and Ellipsoid Inspection

The FRM was inspected for overall condition and no serious defects were found. The rubber bumpers are deteriorated and alternate part materials will be researched for better service in full outdoor exposure conditions. See Figures 14 & 15.



Figure 13: Sub-reflector Condition



Figure 14: FRM Inspection



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Figure 15: FRM Rubber Bumper Condition

4. Trip Conclusion

Overall condition of the FD antenna is good for its age and constant exposure to the elements. The gear boxes need parts replaced to prevent mechanical failures. The rail section replacement and paint work are scheduled in the next few months. Some small improvements can be made as identified in this report. It should be noted that the site techs are keeping up on regular maintenance and the site looks tidy and well kept.