National Radio Astronomy Observatory
VLBA Antenna Memo Series – No. 107

David Paul

TRIP REPORT – St Croix, June 21-22, 2023
ENGINEERING INSPECTION

Trip Summary

A group from the VLA traveled to the St Croix, USVI VLBA station (SC) to inspect the antenna for future work planning related to corrosion metal replacement and painting along with any other heavy mechanical and electrical repairs.

David Paul
Jon Thunborg
Dave Schafer

Along with the VLA staff, there were the SC VLBA site techs on site to help and answer questions.

Greg Worrell
Del Correa

Figure 1: The Fort Davis VLBA station antenna.

Due to the antenna's location in a tropical marine environment and past experience in maintaining this antenna, corrosion is a serious concern. Past work on this antenna has included cutting out and replacing rusted away areas of the structure and it has been UHP water jetted and painted twice. We were pleasantly surprised with the overall condition of the antenna. Del Correa has put forth a lot of effort in cleaning and painting on the accessible areas below the elevation bearings. He uses a pneumatic needle scaler to clean the rusted areas, applies 2-part epoxy primer and a urethane top coat. Work was also done to repair with fiberglass and resin then paint in the upper center pintle area. See Figures 2 and 3.

Figure 2: Upper Center Pintle Area Rust Repair

Figure 3: Example of Lower Structure Paint Maintenance

The lower (snake pit) and upper pintle area was found to be dry and in good condition including the cable wrap structure and the associated mechanism. See Figure 4 & 5.

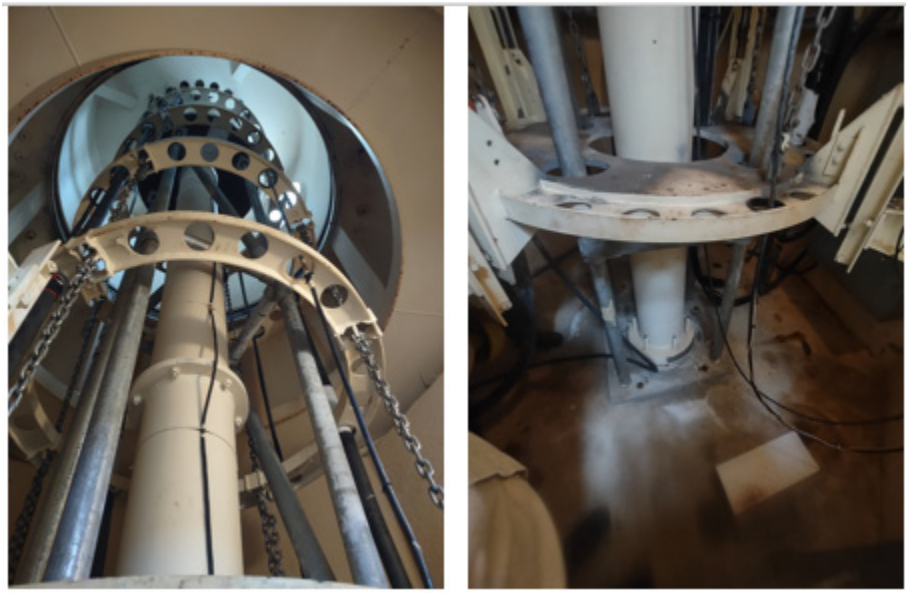

Figure 4: Snake Pit Condition

Figure 4: Upper Pintle – Cable Wrap Area Condition

The site technicians requested that the lower service platform be rebuilt to facilitate access for performing service activities to this area of the antenna. There was a platform here originally but was removed in years past due to excessive corrosion. New platform should be made with galvanized heavy angle and bar grating. It can be attached to the two existing large angle sections. See Figure 5.

Figure 5: Lower Service Platform Needs Replaced

Some portions of the walk way hand rail have corroded away. Some of the under-structure for the walkways has significant corrosion. See Figures 6 & 7.

Figure 6: Hand Rail Corrosion Examples

Figure 7: Walk Way Under Structure Corrosion Examples

The gate and adjacent hand rail near the swinging catwalk needs to be rebuilt. The lower gate pivot is gone and some of the uprights have rust holes. See Figure 8.

Figure 8: Swinging Catwalk Gate and Adjacent Hand Rail

The large boxed in portions of the structure have been repaired in the past which looks good. See Figure 9. Other portions of the big boxes need repaired and drain holes added. See Figures 10 & 11.

Figure 9: Condition of Past Repairs to one of the Box Areas

Figure 10: Box Areas that Need Repaired

Figure 11: Box Areas that Need Repaired

The structure at the base of the quad legs that support the FRM have been repaired in the past. Some of these repairs where accomplished by putting new steel over the original. Overlapping of plates creates a moisture trap and those areas are severely rusted out. Repairs to these areas will have to be planned and executed carefully to remove sections for replacement while leaving enough structure remaining for support. See Figures 12 & 13.

Figure 12: FRM Quad Leg Support Structure Rust Out

Figure 13: FRM Quad Leg Support Structure Rust Out

Some of the corners of the structure show concentrated rust and need to be checked for holes when an aerial work platform is available. See Figure 14.

Figure 14: Structure Corners that need Closer Inspection

There are some rusted out areas on the FRM/Apex structure. See Figure 15.

Figure 15: Apex Structure Rust Out

The Sub-Reflector surface doesn't look very good. A lot of the paint is missing and the fiberglass is showing in a few places. See Figure 16.

Figure 16: Condition of the Sub-Reflector

The transformer for the site that conditions the public power service is in very poor condition. The oil filled portion of the transformer does not have holes in it but corrosion has started to attack the top cover. Preliminary investigation indicates the transformer is owned by the public power provider. A notification will be sent to them reporting the condition and our desire to have it replaced. The power meter associated with the transformer is un-readable so it is assumed our power billing is based on estimates and not actual readings. See Figures 17 & 18.

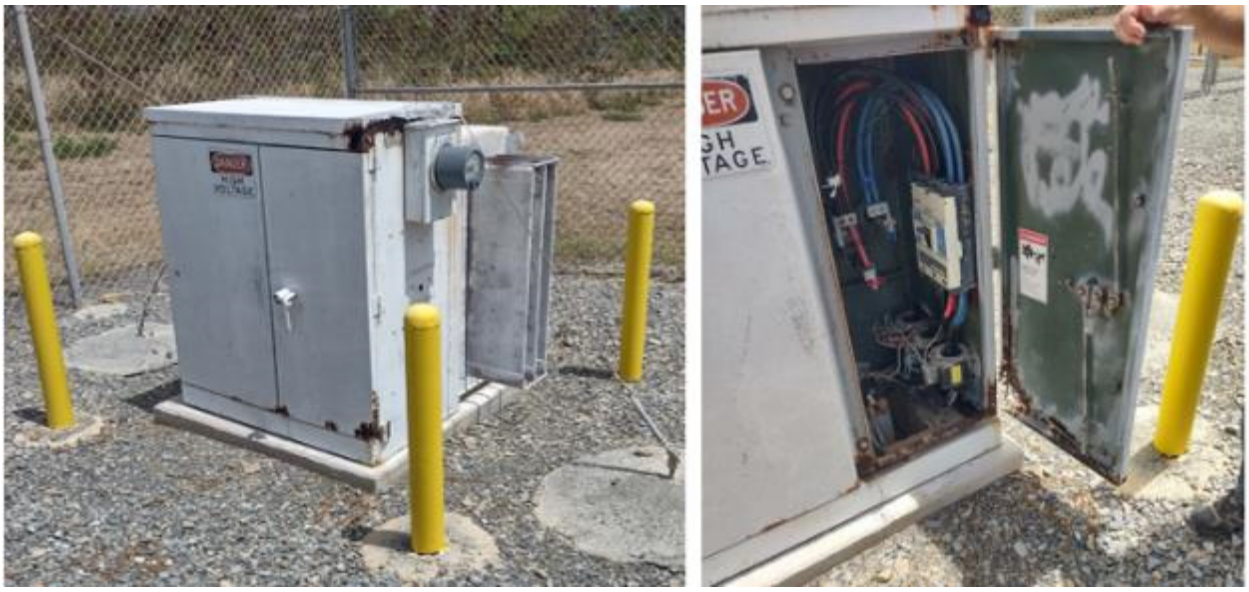

Figure 17: Site Transformer Condition

Figure 18: Site Transformer Condition

The power cables and other cables and wires on the antenna are severely deteriorated. The outside cable jacket is split open and the inside insulated conductors are exposed. See Figure 19.

Figure 19: Antenna Wire Condition

The site technicians brought it to our attention that the Az and El motors' cooling air supply is utilizing a cobbled together filter. See Figure 20. In some cases the cable may need to be replaced. It is recommended that additional protection be added in the form of flexible corrugated conduit or sleeving.

Figure 20: Az Motor Cooling Air Filtration

Rail inspection identified cracked splice bars and one splice at bolts 118 & 119 with about one quarter inch of vertical rail movement. This splice needs disassembled, rail raised and cleaned then new shims installed and clamped back down. See Figure 21.

Figure 21: Splice with Significant Vertical Rail Movement

Grease inspection of the azimuth drive wheel bearings identified that the Az 2 outer wheel bearing is consistently generating metal in the grease. A pick was used to feel the outer race near the top and damage could be felt. See Figure 22.

Figure 22: Az 2 Outer Wheel Bearing Inspection

While on site it was estimated that two people for 2 weeks are required to do the cutting, fitting and welding work. Additionally, 3-4 people should arrive concurrently with the welding to start cleaning and painting new metal and severely rusted spots for a duration of 2-4 weeks. An aerial work platform is required for much of the metal and painting work.

The site techs are doing a good job of maintaining their site and antenna. Ongoing cleaning and painting are required on this antenna due to its location in a marine environment. Repairs are required to retain

this antenna's condition and keep it in good working order. A team, equipment and materials need to be scheduled for completing the tasks outlined in this report.