NATIONAL RADIO ASTRONOMY OBSERVATORY
Socorro, New Mexico

VLBA Antenna Memo Series No.92

2016 - St Croix Mechanical Repair Trip Report

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1.0 Introduction

The June 23-26, 2015 structural inspection documented in VLBA antenna Memo Series No. 90 described the need for several parts of the antenna structure to be either replaced or repaired. Several of these items were addressed by a local contractor, Tang How Brothers, Inc. The remaining items were addressed by a team of antenna mechanics from the VLA on August 15-25, 2016. The antenna mechanics also replaced two wheel/axle assemblies and performed some maintenance painting. The team members after some last minute changes due to Zika Virus were; Anthony Foss, Ken Lakies, Pat Madigan, Brandon Mansell, Ed Soto and Jon Thunborg.

All of the most serious steel corrosion issues were addressed but LBO will need to do a better job of protecting the structure in order to prevent costly repairs in the future. The primary defense against corrosion is the paint system. A paint system in a marine environment requires constant preventive maintenance. The site technicians have not been able to devote adequate resources to this task. Therefore, LBO is going to need to provide either a temporary employee or contractor to perform continuous maintenance painting.

2.0 Structural Steel Remediation

2.1 Contractor Repaired Structure.

Because of the distance and cost of travel, a local contractor, Tang How Brothers, Inc, was selected to complete the structural repairs that could easily be defined and repaired without engineering support. The contractor was instructed to use hot dipped galvanized material and paint all welds with gray epoxy resin galvanizing primer containing 97% zinc dust.

1. Tang How Brothers replaced 17 stair treads with noses and replaced an additional 13 stair noses.




Before and after photos of step replacement.

2. Tang How Brothers replaced several sections of severely corroded bar grating.


Before and after photos of replaced grating.

3. The swinging platform handrail pipes and stair supports were severely corroded. These were all replaced or repaired by Tang How Brothers.

Repair of stair supports and handrail sections.

4. Tang How Brothers replaced the handrails and grating on the elevation platform extensions on both sides of the antenna.

Before and after photos of elevation platform extensions.

5. Tang How Brothers replaced the lightweight grating around vertex house.

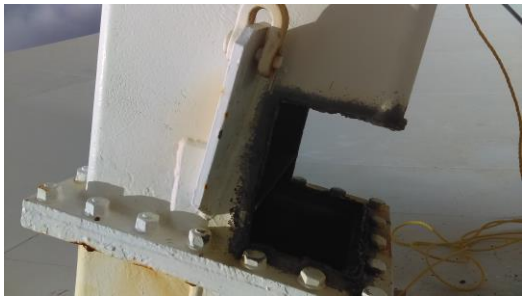
Before and after photos of vertex house grating.

2.2 NRAO Repaired Structure

Several of the repairs required additional expertise and were completed by NRAO personnel during the maintenance visit.

1. Repair corroded quad legs.
   The extent of the corrosion on the quad legs could not be defined until large holes were cut out so they could be inspected from the inside. After cutting these holes it was evident that most of the corrosion was associated with debris that accumulates in the corners and on the quad leg flanges. This debris traps moisture which greatly accelerates the corrosion. Holes were cut in all of the quad legs and the debris was vacuumed out.

   On a tiger team visit in April 2005, the corroded quad legs were repaired by welding steel panels over the corroded areas. This repair did not address the problem with the pockets of trapped debris. Another problem with this type of repair was that moisture was able to get in between the quad leg and patch causing accelerated corrosion of the patch. During the recently completed visit, we completely removed the corroded sections and then welded in thicker galvanized steel pieces. This type of repair takes more time but should result in a longer lasting patch. The new patches were fabricated with drain holes at the bottoms to keep water and debris from accumulating.




Quad leg with corroded section removed. Accumulated debris inside Quad leg.

Repaired quad leg with primer and then with epoxy topcoat.

Smaller quad leg patches below the dish.

2. Repair holes in tank sections

   The tank sections of the antennas have holes corroded through them in all the corners were water gets trapped. We did not have sufficient time on location to repair all of the holes in the tank sections but we did repair a few of these corroded sections by cutting out and replacing pieces of steel. These patches will be evaluated over the next few years to determine how they hold up to the corrosive environment. The corroded holes on the tank sections are not yet large enough to pose a risk to the structure. What we call the tank sections of the antenna are actually sections of the structure containing shear panels used to minimize the deflection of the dish when it is tipped. The shear panels will still perform well in spite of the holes caused by corrosion. However, the holes should be repainted regularly so that they do not continue to grow.

Repaired corroded hole in tank section.

3. Replace HVAC condenser platform.
   The HVAC condenser platform was replaced by NRAO personnel instead of a contractor because of the need for a certified HVAC technician to evacuate the Freon before the condenser could be removed. The corroded condenser platform was removed and replaced with a new one.

Replaced HVAC platform.

3.0 Paint System

The St Croix antenna, being situated next to the Caribbean Ocean, is subject to extremely corrosive conditions. The coating systems on this antenna are its only defense against this corrosive atmosphere. This coating system needs constant preventive maintenance in order to continue to protect the antenna. Replacement of a failed coating system would cost approximately $600,000. Therefore, it is imperative that we continue to maintain the coating system.

In the past, we have assumed that the site technicians would maintain the coating system on a regular basis and the tiger teams would also paint when they were on location. This has not been the case. When the antenna was inspected in June of 2015, there were several places where the site technicians had needle scaled the steel in preparation for

painting. These areas had re-rusted because paint had not been promptly applied. In theory these areas would have been re-needle scaled and promptly painted by the site technicians. These areas were still bare steel when we returned for this visit over one year later. Therefore, I am assuming, there has been little or no painting accomplished by the site technicians during the previous year. In order to preserve the paint system, we need to institute a preventive maintenance plan for the paint system on this antenna.

During this maintenance visit, a portion of the crew was assigned to maintenance painting. These painters did the bulk of their painting on the parts of the antenna that are unreachable while the antenna is in use. Using the daily progress of these painters as a yardstick, I estimate that at least 600 man hours of painting will be required on an annual basis to satisfactorily maintain the paint system. It is evident that the existing site technicians cannot devote enough time to painting to accomplish this preventive maintenance. Therefore, it is imperative that we acquire additional resources to accomplish this painting. In the past we hired a local contractor to paint for several weeks during the year. We have not had an outside contractor paint since 2002.

We need to either hire a contractor or a part time employee to perform regular maintenance painting on this antenna. In areas where there is heavy rust scale, the surface needs to be surface prepped by needle scaling and then repainted. Areas where there is light rust staining or tightly adhered rust can be cleaned and over-coated.

4.0 Wheel/Axle Replacement

Both azimuth drives #1 and #2 were replaced with the current wheel axle design. Drive #1 moved out of alignment several days after it was installed. It was found that the pillow block that attaches the drive to the structure slide horizontally. The antenna began making popping noises as it rotated along the rail due to this misalignment. The electronics tiger team crew discovered this wheel popping and extended their stay on the island and realigned the wheel.

This is the second VLBA wheel that has moved after it was aligned. The author of this report believes this is because we have been re-using the pillow block bolts and nuts. The impact wrench that we use to tighten the pillow block bolts may be damaging the threads to the point where they are able to loosen up after a few days' use. In the future, we will install new hardware after the wheel/axle assemblies are installed.

The final alignment values are provided in the table below.

Drive #	Coupling Runout	Horizontal Error	Vertical Error	Conic Radius
#1	.0035	0.001	-.002	300.125
#2	.0015	-.010	0.012	299.914