NATIONAL RADIO ASTRONOMY OBSERVATORY
Socorro, New Mexico

VLBA Antenna Memo Series No.20

St. Croix Corrosion Report

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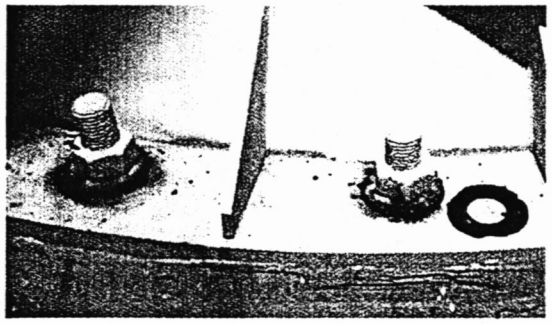
August 7, 1999

Attachments: Hancock Paint Report

During the St. Croix maintenance visit in June 1999, the antenna structure was carefully inspected for signs of corrosion. The extent of the corrosion is documented in this report. This report contains several color photographs that will not be available through the normal memo distribution. If you would like a copy of this report with full color photographs, contact the author (jthunbor@nrao.edu).

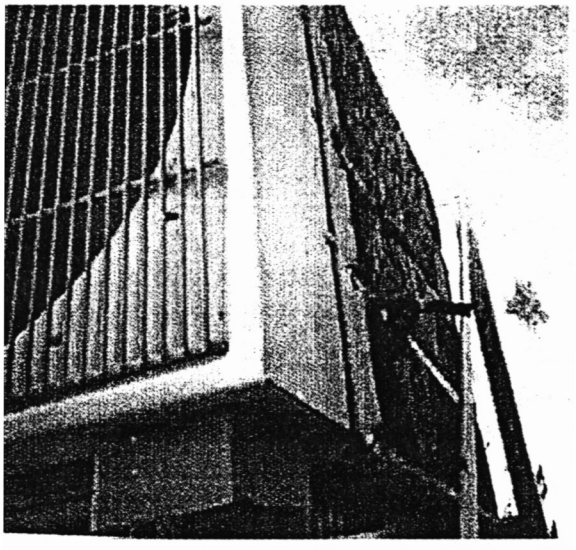


Starting this discussion at the bottom of the antenna and working towards the top. The pintle bearing support structure is reasonably free from rust except for the 2" washers on the pintle bearing bolts. Not all of these washers were bad. If the paint over a washer was not broken it remained in good condition. However the rust spread very rapidly as soon as the layer of paint was compromised. The rusted washers were replaced with galvanized washers and repainted during the maintenance visit. The nuts and bolts did not corrode like the washers because they were originally hot galvanized.

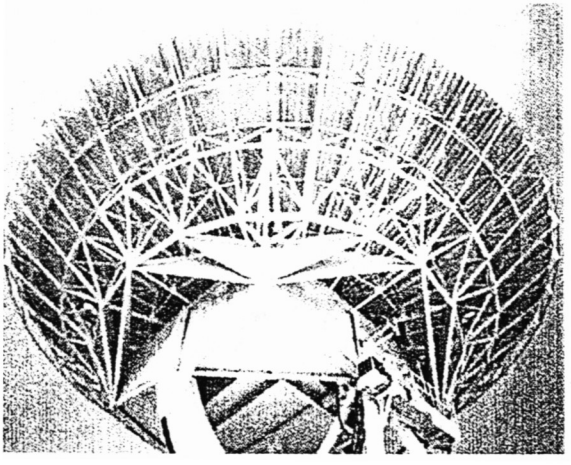
The wheels and track also showed signs of corrosion. This corrosion was not structurally significant, but it does increase the coefficient of friction between the wheel and track. This high coefficient of friction coupled with poor wheel alignment may be the cause for the premature azimuth wheel bearing failures occurring in St. Croix. The bolts on the wheel couplings need to be protected with paint before they rust so much that they can not be removed. This can be a very hard area to paint especially on the drive wheels where space is very limited, and the grease accumulates between the pillow block and the wheel.

The stairways and walkway grating also had places where the rust was severe. The rust on the stair tread shown was so bad that the metal could be broken off by hand. The rust was particularly bad in this location because the structure trapped water. The stair tread shown is the only one that requires repair at this time but the stairs and grating should be inspected occasionally to insure that a safety problem does not develop.

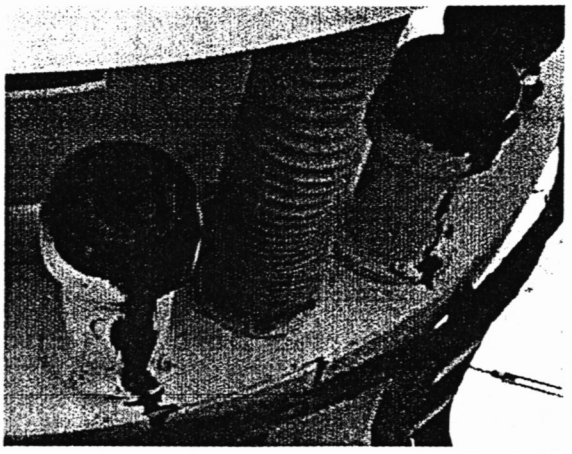
The majority of the metal grate is in decent structural shape with the exception of a few pitted areas where the rust has removed about 75% of the strength. The grating is at greater risk from rust as the paint gets scraped off on the top edge of the metal by normal work activities.



The nonstructural elements of the antenna seem to be most susceptible to rust. The vertex room condenser side panels shown were so badly corroded that the metal could be flaked off by hand. These panels were replaced during the maintenance visit but the rest of the condenser is still in poor shape. The unistrut that holds the condenser to the platform was also in very poor condition and will need to be replaced soon. Several pipe hangers and other hardware were also so badly corroded that they had to be replaced by the tiger team. The bottom of the vertex room door was also completely rusted out.



The backup structure was in good condition. This is because the painters have been asked to spend the majority of their time on this part of the structure. The fasteners in this area were in good shape and the rust that was present was only superficial.



Another interesting phenomenon at St. Croix involved the total deterioration of the hard polyurethane rubber FRM stops. These stops went completely soft and started dripping on the structure. One of the stops was replaced during the maintenance visit. This new polyurethane rubber stop deteriorated overnight. It is interesting to note that an identical stop stored in the shipping container showed no sign of deterioration.

CONCLUSIONS:

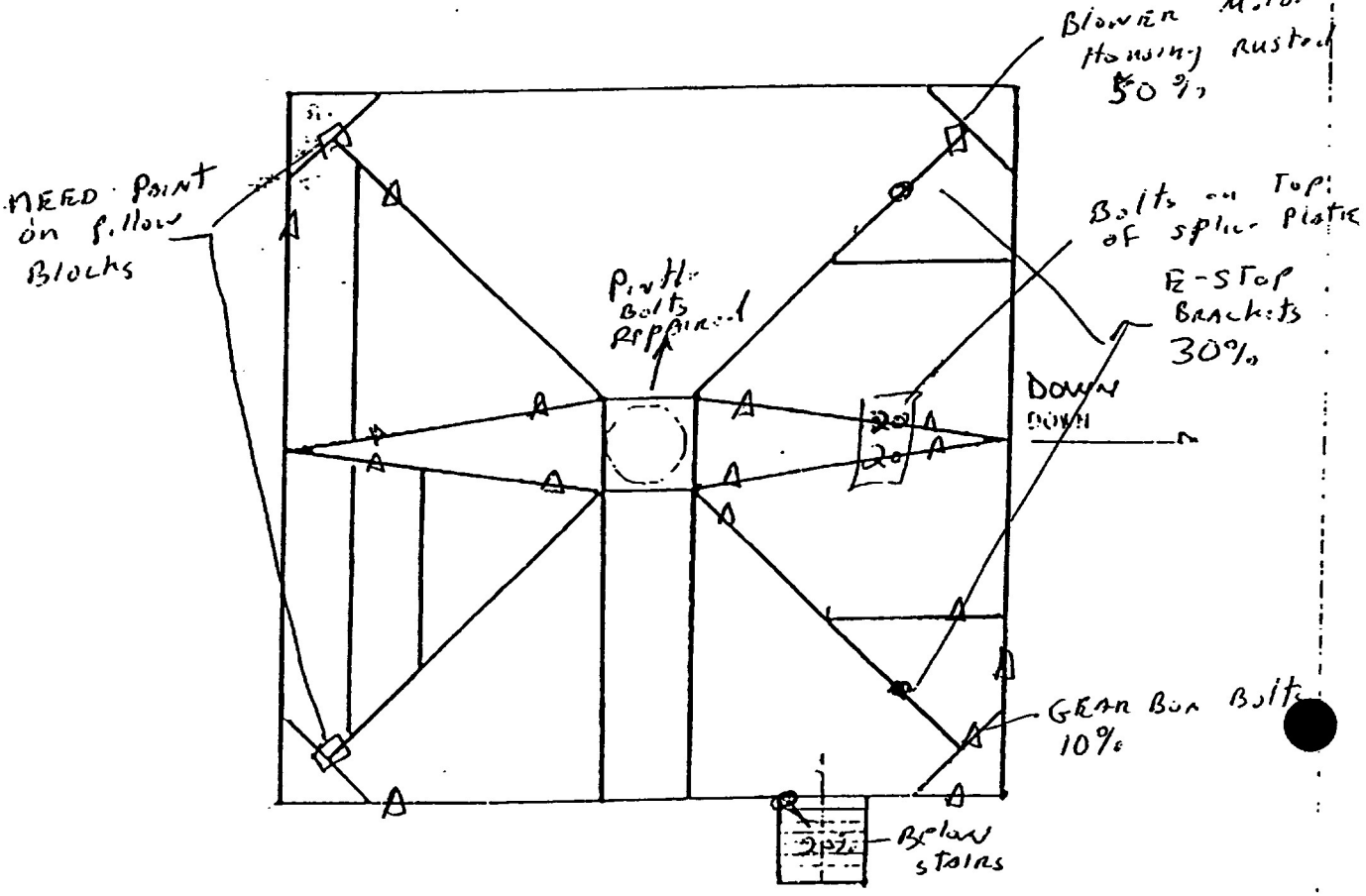
The antenna is in reasonable shape structurally. With the exception of the guardrails and stairs, almost all of the rust on the structure is superficial. The rust is only severe in places that trap water. Drain holes have been drilled in most of these areas, but the damage already done is irreversible. It is my opinion that the structure is not going to fall over in the near future from excessive corrosion. However, the site techs need to be diligent in their efforts to identify areas that are being compromised by the rust.

The supplementary hardware (bolts, air conditioners, Pipe hangers and etc.) on the antenna have been severely compromised by corrosion. The maintenance team makes every effort to identify and replace corroded items, however their time on location is too limited to replace all of the corroded hardware. As a whole, I see that the hardware on the antenna is slowly deteriorating. The additional tasks presented by the corrosion are not being adequately addressed. This site requires greater effort than others because of its proximity to the ocean. Additional manpower may be required to bring the mechanical maintenance up to an adequate level.

Maintaining the paint system on this antenna is critical. It was very evident that in areas where the paint was compromised the corrosion started attacking the structure almost immediately. These areas will continue to rust even if painted over unless they are properly prepared before painting.

AZIMUTH LEVEL: PAINT CONDITIONS — HINT DATE:

VIEW FROM SKY — PERFORMED BY:



notes

1. Wheel Bolts 20%
2. MAIN Tube flanges some Bolts 10 - 20%
3. STAIRS To elevation 10% on connection Bolts
4. GRATING at knuckle 10%

KEY

10% yellowing = Δ

20% Beginning to Flake

50% VERY SWELLED

0% completely Failed

SYMBOL KEY

SURFACE AREA DEGRADATION

■ RUST □ NO RUST

SPLICE PLATE DEGRADATION

● RUST ○ NO RUST

WELDED SEAM DEGRADATION

RUST NO RUST

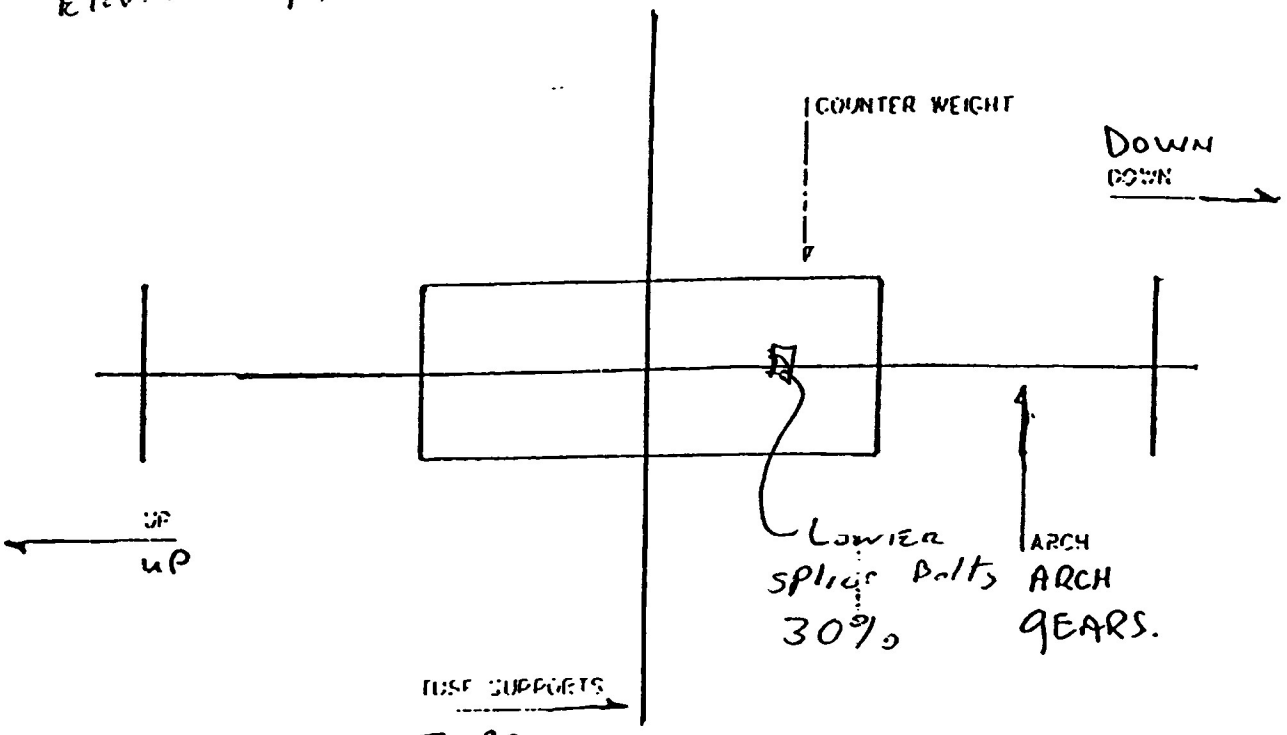
T-TOP B-BOTTOM S-SIDE

* -PREVIOUSLY REPAIRED

COUNTERWEIGHT PAINT CONDITIONS WEIGHT DATE:

VIEW-FROM-SKY- PERFORMED BY.

Elevation Platform



NOTES

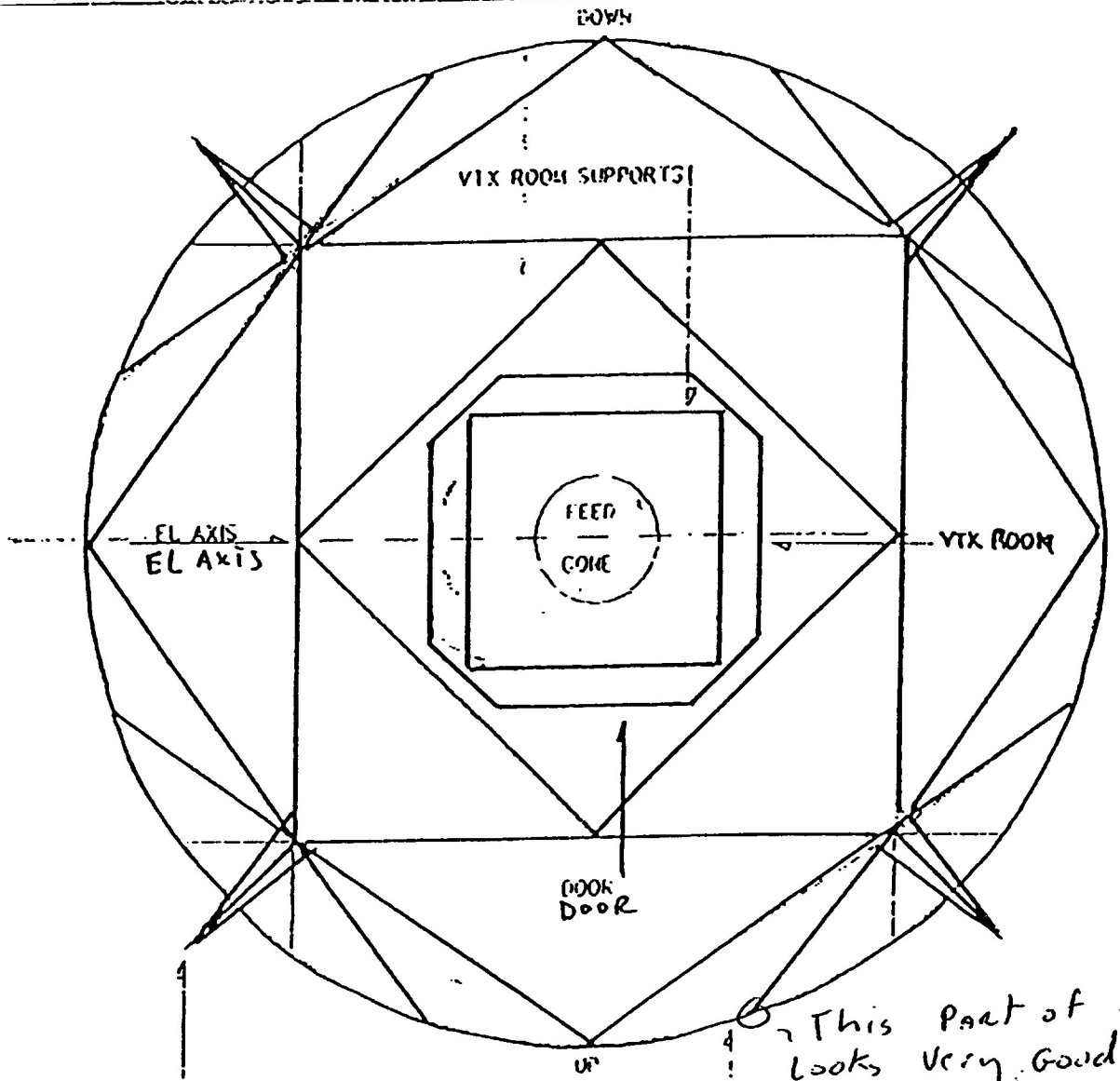
1. Tubes and splices Look Good - only slight discoloration on Bolts
2. STAIN Gratings 10 - 30 % in spots
3. Vertex Room Condensor in very poor condition mount needs Repair Also.
4. Hoist Bolts Replaced - need Painting
5. Severe Rust in Elevation platform corners where WATER WAS TRAPPED

SYMBOL KEY
SURFACE AREA DEGRADATION
■ RUST □ NO RUST
SPLICE PLATE DEGRADATION
● RUST ○ NO RUST
WELDED SEAM DEGRADATION
RUST NO RUST
T-TOP, B-BOTTOM, S-SIDE
✳ =PREVIOUSLY REPAIRED

VERTEX LEVEL PAINT CONDITIONS & DEGRADATE

VIEW FROM SKY

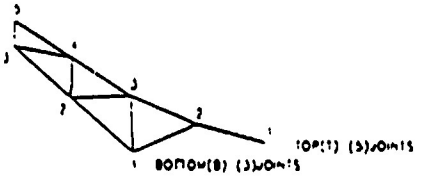
PERFORMED BY:



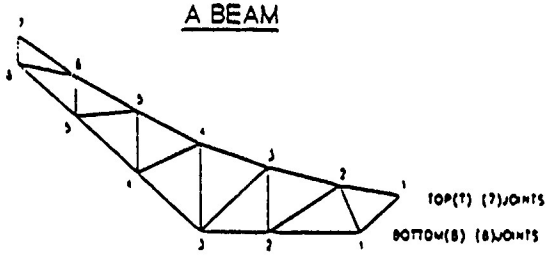
This Part of Structu
Looks Very Good
some Bolts 10%

Vertex Room door
Needs Replaced 50%
Rust on Bottom

SYMBOL KEY
SURFACE AREA DEGRADATION
RUST NO RUST
SPLICE PLATE DEGRADATION
RUST NO RUST
WELDED SEAM DEGRADATION
RUST NO RUST
T-TOP, B-BOTTOM, S-SIDE
* =PREVIOUSLY REPAIRED



A BEAM



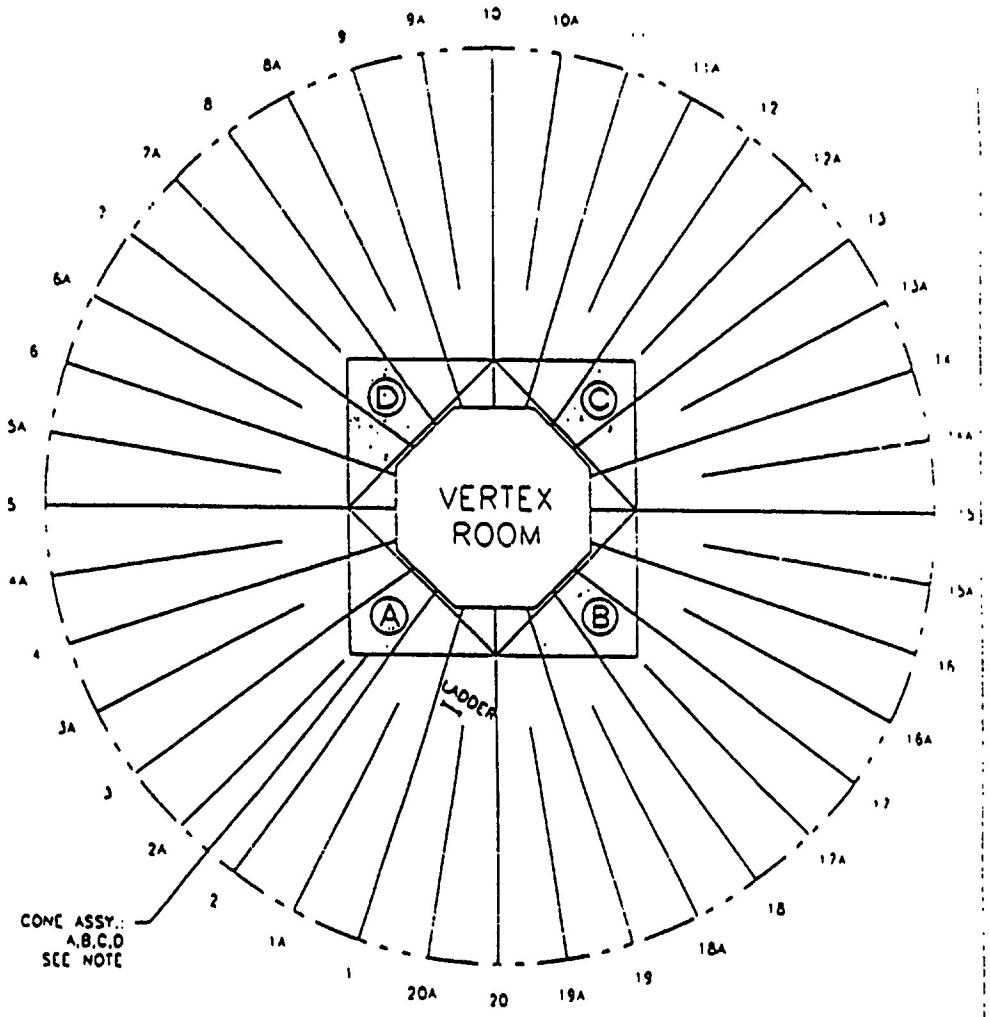
MAIN BEAM

JOINT LISTING REQUIRING; REPAIR
(NOT INCLUSIVE)

Backup structure looks good
Painters have made progress
Some Bolts 10%(slightly discolored
More discolored Bolts on outside
edges of structure.

* ANGLE PEELING
** WF BEAM AROUND VERTEX TOUCHUP
*** SMALL RUST SPOTS

NOTE: INSPECT CONE ASSY INTERNALLY REPAIR/PAINT AS REQUIRED



UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES
MATERIAL

HANCOCK PAINT REPORT

LOCATION OF DELAMINATIONS

NATIONAL RADIO ASTRONOMY OBSERVATORY

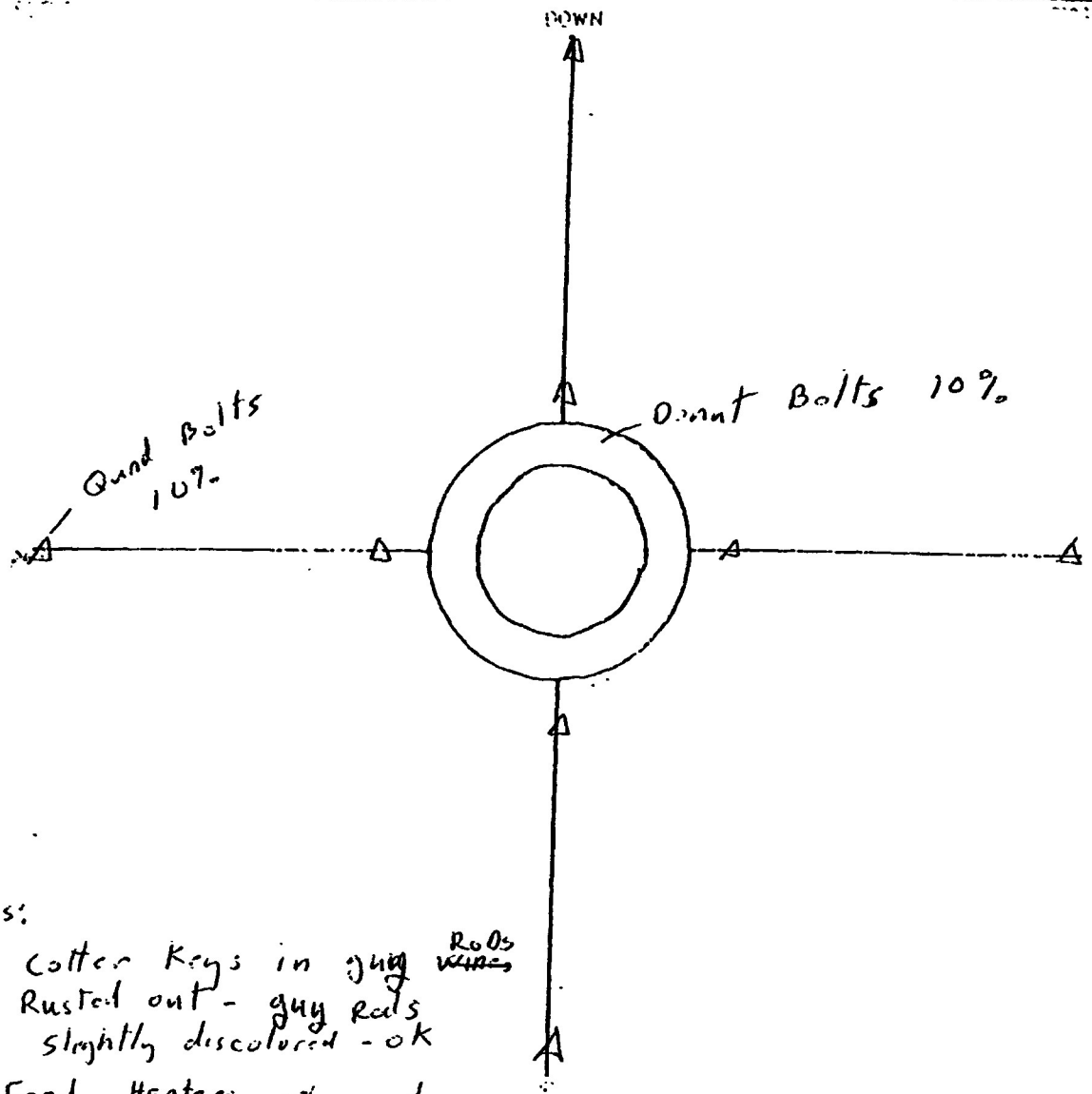
C. GARCIA

QUADRUPED PAINT CONDITIONS

VIEW FROM SSS

PERFORMED BY

DATE



notes:

1. Cotter Keys in guy Rods
   Rusted out - guy Rods
   slightly discolored - ok
2. Feed Heaters 0% need
   Replaced
3. Several Feed Bolts 50%
4. DI Chassis Rod Ends 20 - 30%
5. Elipsoid actuator shows some
   Rust - needs work - springs replaced
6. FRM Remote control Box 20 - 30%
   needs Replaced
7. Steel washers on Lightning Rods 50%
8. Gore Track Bolts 30 - 40%