NATIONAL RADIO ASTRONOMY OBSERVATORY

Socorro, New Mexico

VLBA Antenna Memo Series No.23

Brewster, Washington – Wheel/Axle Repair, October 21 - 23, 1999 - Trip Report

J. E. Thunborg

October 29, 1999

ATTACHMENTS: WHEEL ALIGNMENT WORKSHEET

In September of 1998 a team traveled to Brewster WA to replace a drive wheel assembly with a newly designed axle/wheel assembly (See VLBA Test Memo No. 15). After approximately 13 months of service, the axle broke due to fatigue at a stress concentration near the outside bearing. A new axle was redesigned and fabricated from 4140 Steel. This memo records the details of the installation of the redesigned wheel/axle assembly.

10/21/99- Team (S. Aragon, R. Gutierrez and J. Thunborg) arrived on site and inspected damage. The axle was broken at the inside edge of the outermost bearing. The gearbox was unbolted at the axle coupling and inspected for runout, feel and sound. The gearbox was found to be undamaged. The outside pillow block and then the wheel assembly were unbolted and removed.

The new wheel/axle assembly was lifted into place and it was found that the wheel was too far outboard to clear the wheel wells on the antenna. The assembly was then removed and taken to Omak, WA, Where approximately ¾ of an inch was cut off the hub and shaft. The wheel/axle assembly was then installed on the antenna and checked for alignment.

10/22/99- The theodolite was set up and wheel measurements taken. It was found that the wheel/axle assembly was poorly aligned and that the wheel was also slipping on the axle. The wheel bolts were then tightened which secured the wheel to the axle. Shims were added under the pillow blocks and the axle was aligned with the gearbox hub. The wheel was also aligned horizontally and vertically. The antenna was then slewed from limit to limit several times to make sure that the assembly was secure.

10/23/99- Final adjustments to the wheel/axle alignments were made by adding 0.003" of shim under the inner pillow block and 0.005" shim under the outer pillow block. The antenna was then slewed from limit to limit several times and the following final alignment parameters were measured.

	Measured	**Specified**
Conic radius	299.93"	300" +/- ¼
Coupling	0.004 TIR	Not Specified
Axle Vertical Slope	93° 29' 00"	93° 26' 23" +/- 1.4'
Axle Horizontal error	40"	< 1.4'

The Vertical slope was slightly out of tolerance but we decided to leave it as it was since the other parameters were so good.

Oct 23, 94

WHEEL ALIGNMENT (Antenna Center Calculation)
Equal distance method

Procedure: Set up theodolite 3 to 5 feet away from axle. Rotate antenna until the meausurement point is 100 inches from theodolite and record ACU and theodolite(az and el) readings. Rotate in opposite direction untill measuring point is 100 inches on other side of theodolite. Record ACU and Theodolite readings. Measure and record distance from wheel center to measuurement point.

A 249.7755

Worksheet:

Wheel # AZ P #2

Set distance (d) 138 3/16

Theo1 Elevation 91. 10' 37"

Theo1 Azimuth 200 26' 11"

Theo2 Azimuth 103 54 23

ACU1 Azimuth 268.806

ACU2 Azimuth 230.745

Offset 16.25

Theo1 el degrees	91.177
Theo1 az degrees	200.4364
Theo2 az degrees	103.9064
Thoedolite difference	96.53 48.265
ACU difference	38.061 19.0305
R	316.183
Radius	-0.067
ACU_center	249.7755

Final

EXAMPLE

$d := 100 \cdot in$	Distance from Theodolite to measuring point (~100 inches)
$Theo\_el := 92.6599 \cdot deg$	Elevation angle of theodolite (either side)
$Theo1 := 100 \cdot deg$	First Theodolite Reading
$Theo2 := 196.2289 \cdot deg$	Second Theodolite Reading
$ACU1 := 180 \cdot deg$	First ACU Reading
$ACU2 := 207.1904 \cdot deg$	Second ACU Reading
$Offset := 16.375 \cdot in$	Distance from measuring point to wheel center

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$Theo\_hor := Theo2 - Theo1$ $\quad Theo\_hor = 96.229 \cdot deg$

VERTical HAIF - 152 10 17" / 152 10 57"

ERROR 40"

$ACU := ACU2 - ACU1$ $\quad ACU = 27.19 \cdot deg$

$$R := d \cdot \sin(Theo\_el) \cdot \frac{\sin\left(\frac{Theo\_hor}{2}\right)}{\sin\left(\frac{ACU}{2}\right)} \quad R = 316.377 \cdot in$$

134.154 .32607

Horizontal

Front 93 28 22

INVERT 266 30 22 / 266 29 60

93 29 38

AVR 93 29 30

$Radius := R - Offset$ $\quad Radius = 300.002 \cdot in$

$$ACU\_center := ACU1 - \frac{ACU}{2} \quad ACU\_center = 166.405 \cdot deg$$

GBox Runout 0.004" Tir

93 26 23

ERROR 2' 37"