National Radio Astronomy Observatory
Socorro, NM

VLBA Antenna Memo Series #42

Los Alamos Az Drive #1

July 2nd and 3rd, 2002

Jim Ruff
7/8/02

The site techs reported a popping noise in their Az #1 wheel assembly. The noise started during the weekend of June 29th & 30th. This is a new-design wheel that had been installed two weeks earlier, during the week of June 17th. This wheel replaced an original-design assembly that had broken its axle. (See VLBA Antenna Memo #39)

Ramon Molina, John Wall and Jim Ruff went to LA Monday evening and started at the site early Tuesday morning. The assembly was 'popping', but we couldn't tell where the noise came from. It popped about 15 times per wheel revolution, in both directions, either single motor or both motors. The popping stopped when the wheel was lifted. The wheel turned smoothly.

We removed the outer bearing cover plate and found a few small metal flakes in the grease. (These are probably normal for a new bearing.) We tightened the bearing locknut one tang and added 0.04" of shim to insure the fixed bearing really was.

We then checked the inner bearing and gear hub grease and found no metal.

Re-greased the gear hub and bearings. No change in the popping.

Tightened the RBC coupling bolts ½ to ¾ turn. No change.

Measured wheel location:

Horizontal Error	Vertical Error	Radial Error
0	1' 58" (steep)	0.165 out

Unbolted the gear hub and found the following runout (wheel down, rotating the gearbox):

Horizontal TIR	Vertical TIR
+0.005 right	+0.049 up

We then ran the antenna on Az #2, with the Az #1 gear hub disconnected. The popping persisted.

With the wheel down, we indicated the gear hub while rotating the antenna. The indicator was mounted at the top of the gearbox hub. There was 0.007 TIR in the axle, indicating the shaft was bent, cracked, or not concentric. We then repeated the runout measurement and got the following:

(wheel down, rotating the gearbox)

Horizontal TIR	Vertical TIR
+0.011 right	+0.059 up

Something moved between the first and second measurements, even though we had not loosened anything.

If the axle was cracked, we reasoned the 0.007 TIR would disappear if the indicator was mounted horizontally. So we repeated the measurement with the indicator horizontal and measured 0.006 TIR.

The change in runout was bothersome, so we repeated the measurement:

(wheel down, rotating the gearbox)

Horizontal TIR	Vertical TIR
+0.010 right	+0.060 up

(wheel down, rotating the gearbox)

Horizontal TIR	Vertical TIR
+0.009 right	+0.060 up

Moved the wheel one revolution CW:

(wheel down, rotating the gearbox)

Horizontal TIR	Vertical TIR
+0.004 right	+0.052 up

Moved back to the lifting position:

(wheel down, rotating the gearbox)

Horizontal TIR	Vertical TIR
+0.017 right	+0.058 up

Added 0.031" shim to the inner bearing and 0.046" to the outer.

(wheel **lifted**, rotating the gearbox)

Horizontal TIR	Vertical TIR
+0.004 left	+0.017 down

(wheel **down**, rotating the gearbox)

Horizontal TIR	Vertical TIR
+0.005 right	+0.011 up

Lowered the antenna and moved it on Az #2:

(wheel down, rotating the gearbox)

Horizontal TIR	Vertical TIR
+0.010 right	+0.009 up

Moved ½ wheel revolution:

(wheel down, rotating the gearbox)

Horizontal TIR	Vertical TIR
+0.002 right	+0.007 up

Re-shot wheel position:

Horizontal Error	Vertical Error	Radial Error
3' 10"	2' 18" (flat)	0.017 in

Re-checked mirror/axle squareness. It was off. Re-squared the mirror.

Horizontal Error	Vertical Error	Radial Error
3' 0"	2' 7" (flat)	0.023 out

At this point we called it a day!

Ramon took the theodolite back to the motel and re-set the vertical.

7/3/02

We figured it was going to be necessary to consider the 0.006 axle TIR when making adjustments. We also noticed a hysteresis when reversing directions. We measured from the inner pillowblock to the shaft between pillowblock and wheel and saw hysteresis. Measured from the antenna frame to the pillowblock and again saw it. We checked the gearbox-to-antenna bolts and found them to be tight. Conclusion: The drag of the (unpowered) wheel causes this.

Re-shot wheel position, keeping the wheel in the same rotational position and approaching from right to left each time:

Horizontal Error	Vertical Error	Radial Error
2' 17"	1' 50" (flat)	na

Hub TIR:

(wheel down, rotating the gearbox)

Horizontal TIR	Vertical TIR
+0.014 right	+0.011 up

Moved the outer pillowblock 0.027" left and removed 0.012" of shim. The inner pillow block was moved 0.014" left & shims left alone.

(wheel **up**, rotating the gearbox)

Horizontal TIR	Vertical TIR
+0.010 left	+0.027 down

(wheel **down**, rotating the gearbox)

Horizontal TIR	Vertical TIR
+0.009 left	+0.005 up

Re-shot wheel position, keeping the wheel in the same rotational position and approaching from right to left each time:

Horizontal Error	Vertical Error	Radial Error
4' 18"	0' 19" (flat)	na

We went the wrong way!

Moved the outer pillowblock 0.040" right. The inner pillow block was moved 0.016" right.

(wheel down, rotating the gearbox)

Horizontal TIR	Vertical TIR
+0.001 right	+0.0035 up

Re-shot wheel position, keeping the wheel in the same rotational position and approaching from right to left each time:

Horizontal Error	Vertical Error	Radial Error
1' 7"	0' 3" (flat)	0.039 out

Reconnected the gear hub. Torqued the pillowblock bolts with the electric impact driver.

Before leaving, we listened to the wheel and found it to be popping 14-15 times per wheel revolution. There was no discernable pattern to the pops, but we noticed there were no pops for 120˚ of wheel rotation after reversing direction.

Thanks to Paul and Gene for all their help during our long days on site!