National Radio Astronomy Observatory
Socorro, NM

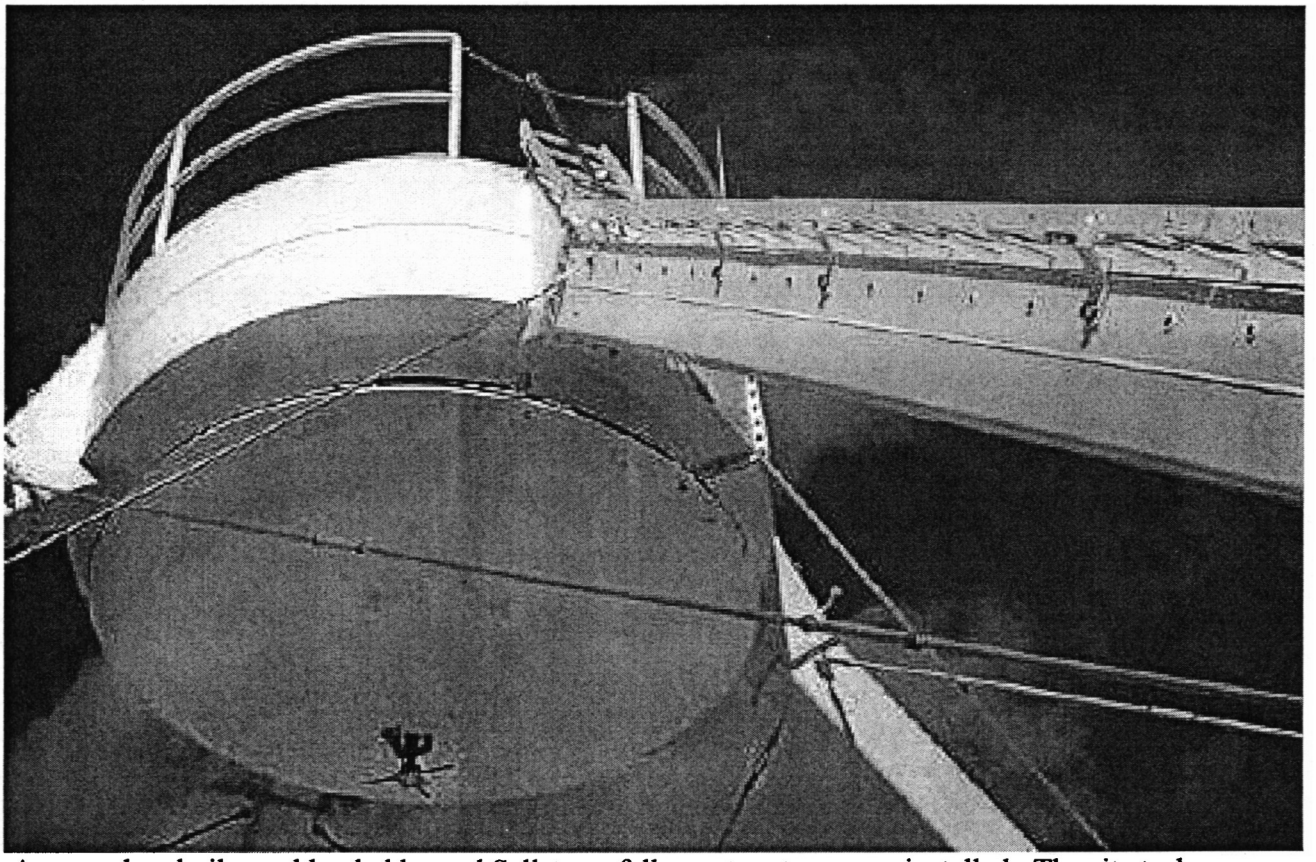
VLBA Antenna Memo Series #34

Brewster Maintenance Visit
July 23rd through 30th, 2001

Jim Ruff
8/2/01

Attachments: Azimuth Rail Survey, Servo Trip Report, Electronics Trip Report, Task Schedule

The team consisted of Steve Aragon, Ramon Gutierrez, Doug Scott, Steve Tenorio, Steve Troy and Jim Ruff. Site Techs Bob Sanderson and Mark Hofmann assisted throughout.



An apex handrail, quad leg ladder and Sellstrom fall arrest system were installed. The site techs were treated to a training session on use of the Sellstrom system and general fall protection.

The FRM INA bearing clearance measured 0.002".

No structural cracks were found.

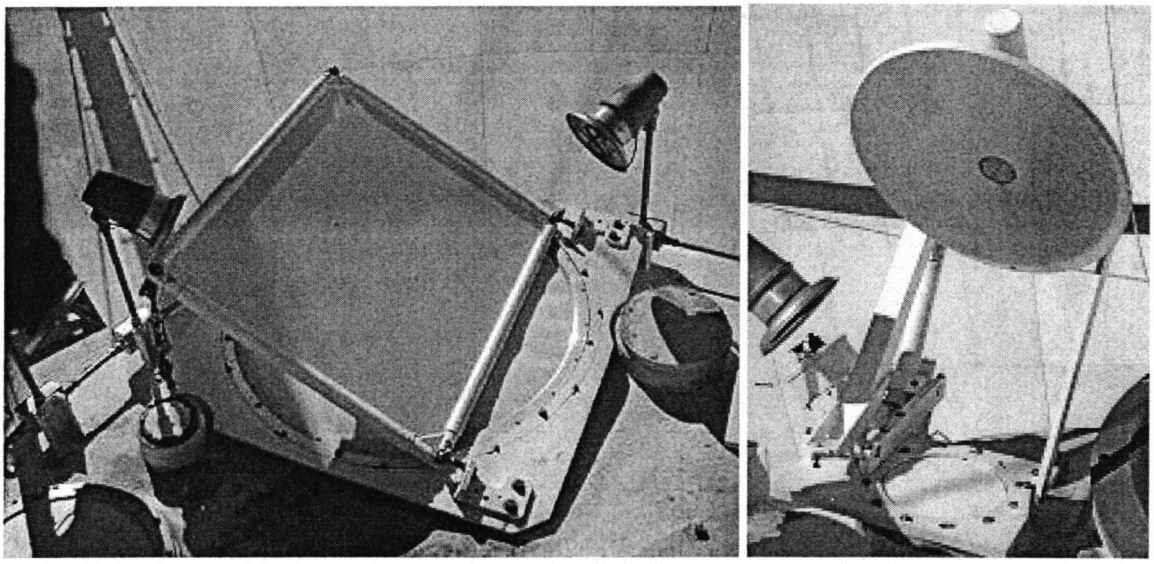
Kellum grips were installed on the azimuth cable wrap cables.

The elevation pillowblocks were outfitted with button grease fittings. No metal was found in the grease.

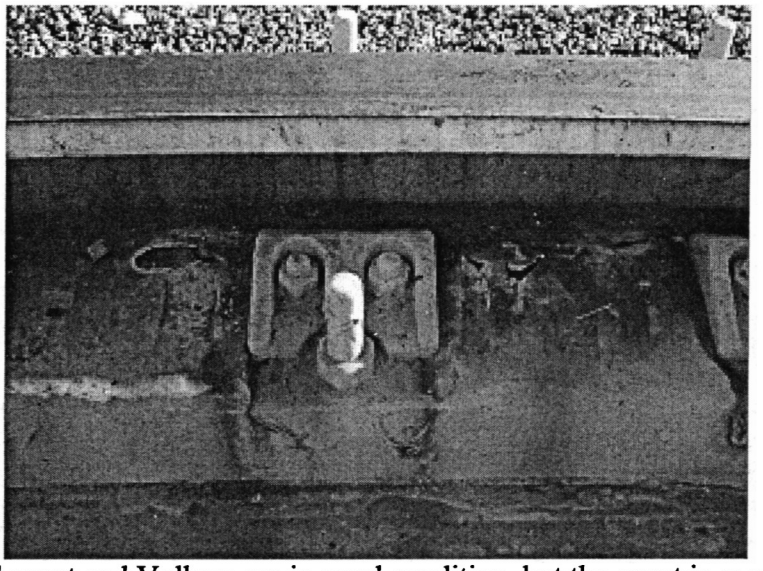
The azimuth bearings were inspected. No bearings needed replacing. The outer races had been rotated previously, so we didn't do it.
Note the four arcmin vertical error on D1. This is twice the amount allowed by the spec. We loosened the bolts in the rigid coupling and found a 4.2 arcmin tilt in the same direction as the shaft misalignment. This can not be corrected without replacing the wheel assembly, as there is no shim under the pillowblocks. Since the wheel has been like that for about 10 years, with no popping or wheel/axle sliding, I recommend leaving it alone.

Az Bearing Grease Inspection				
	Drive 1	Drive 2 (new style)	I1	I2
Inner	OK	OK	OK	a few metal flakes
Outer	OK	OK	OK	OK

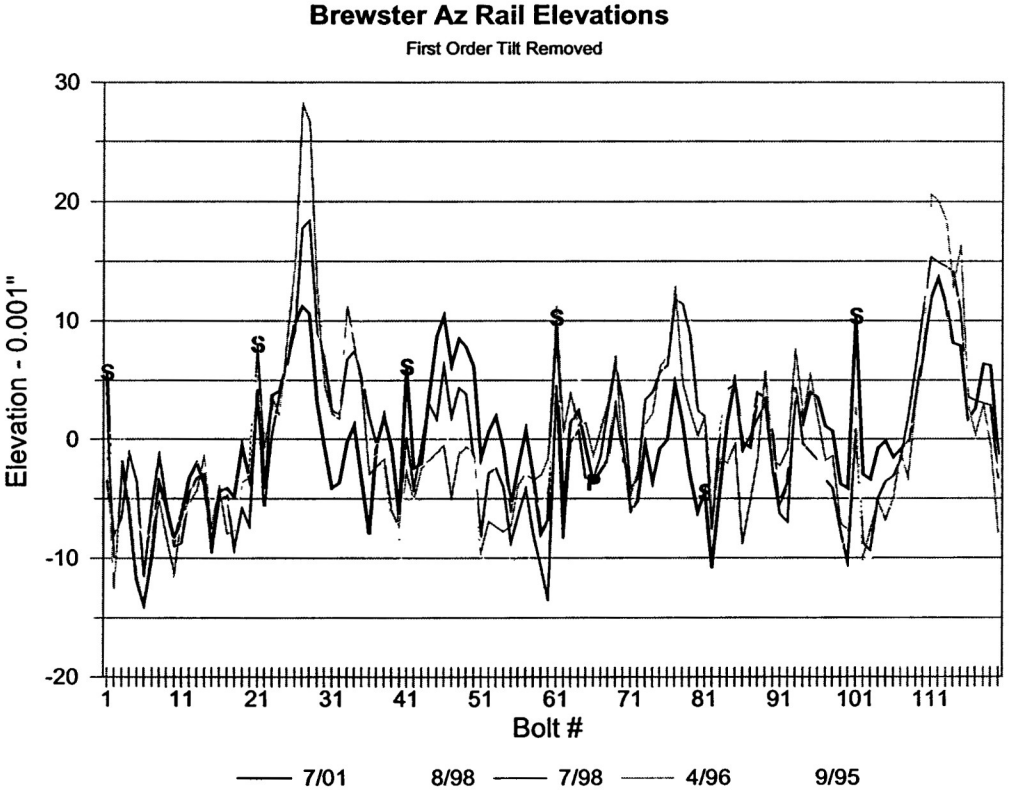
Drive Wheel Alignment			
Wheel #	Horizontal Error	Vertical Error	Radius Error
D1	0° 0' 30"	**0° 3' 59" (too flat)**	0.134" (out)
D2	Not checked		



The dichroic panel is in good condition. The dish tipper overtravel springs were replaced because they were showing some rust.

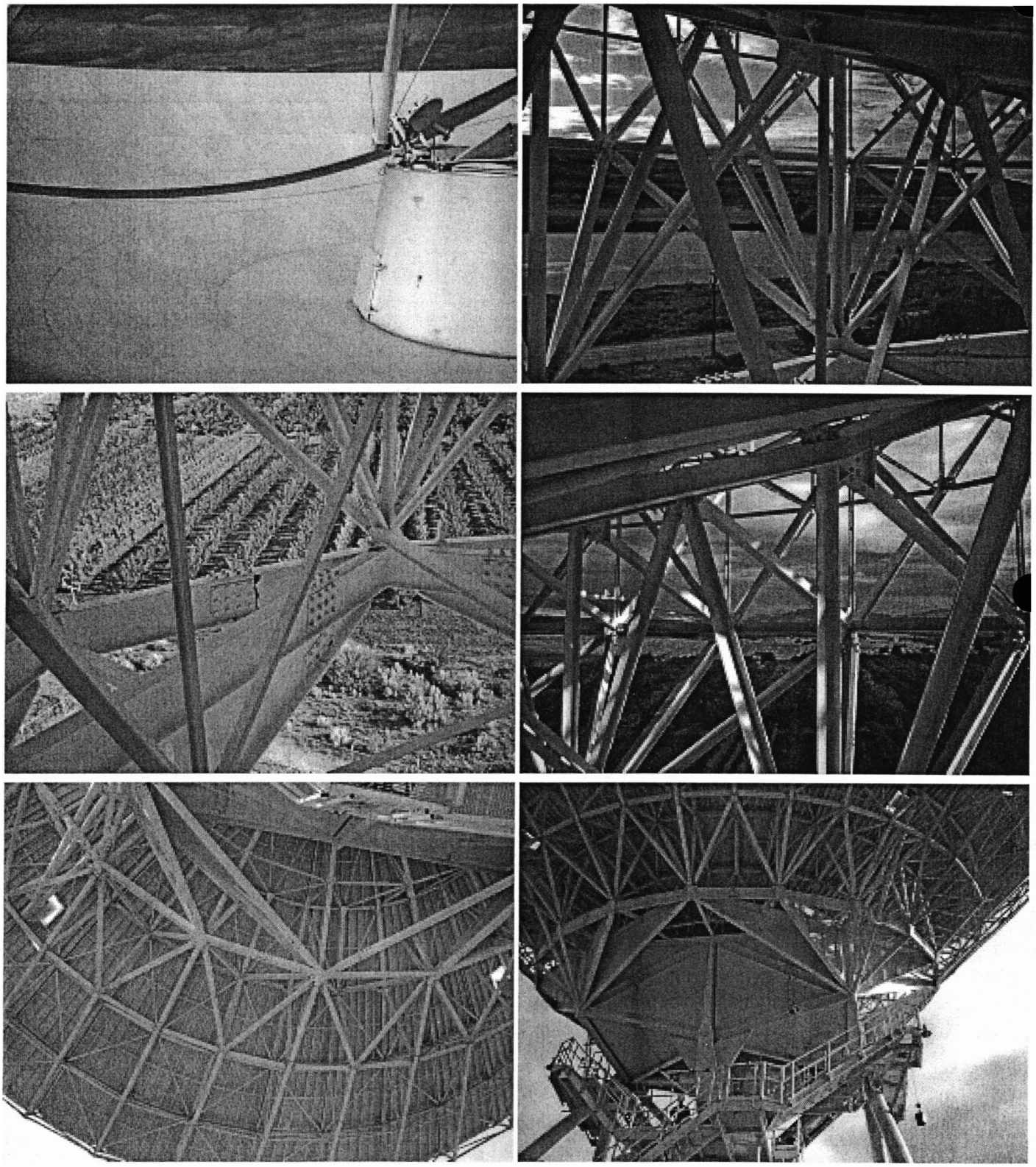


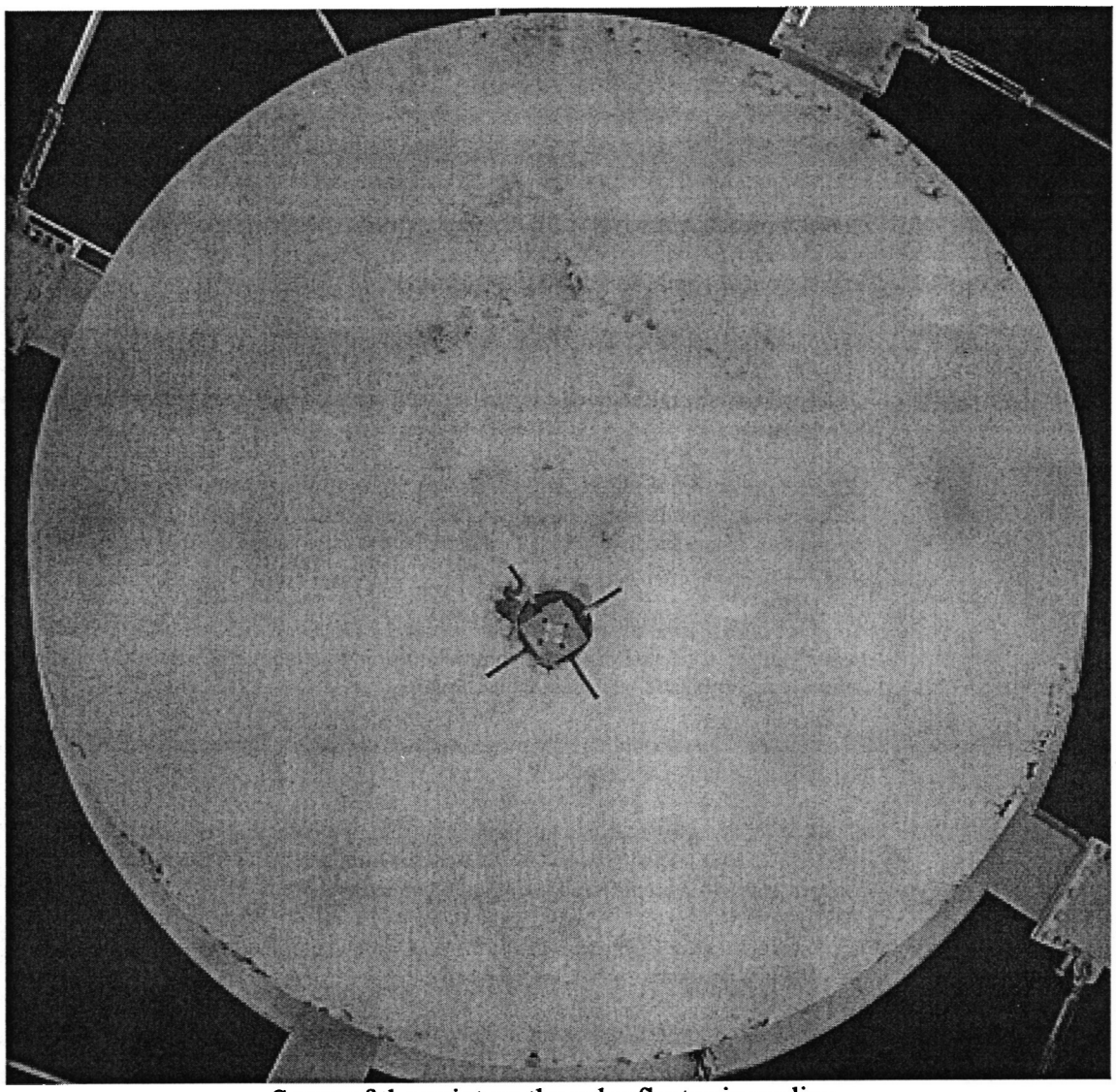
The azimuth rail grout and Vulkem are in good condition, but the grout is crumbling in a few areas.



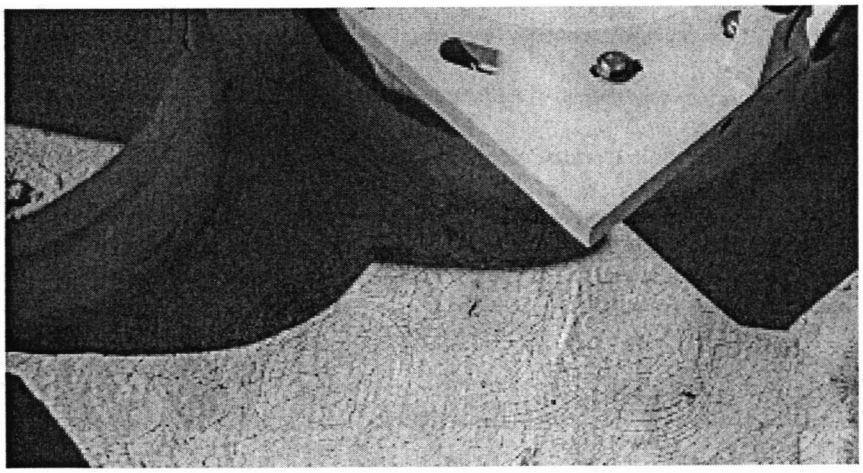
The rail at Brewster is very flat, with less than 0.030" deviation in elevation after the tilt is removed. The first order tilt is only 6 arcsec.

The paint on this antenna is in excellent condition.





Some of the paint on the subreflector is peeling.



The feed cone finish is checked

Servo Trip Report

From: Steve Tenorio

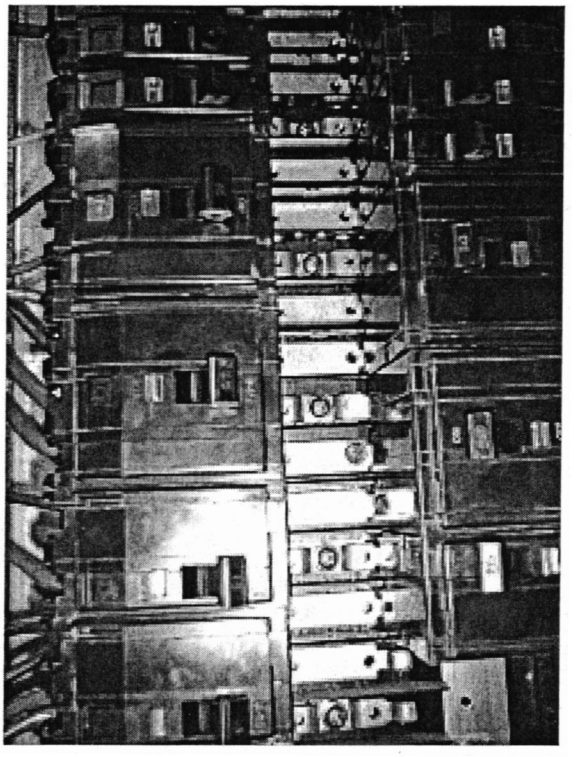
Subject: Trip report Brewster

Date: 20mar99

20jul01	Day # 1	Travel from San Antonio NM. To Colorado Springs CO.
21jul01	Day # 2	Travel from Colorado Springs to Butte Montana.
22jul01	Day # 3	Travel from Butte Montana to Okanogan Washington.
23jul01	Day # 4	Unloaded container. Removed apex ladder, and installed new apex ladder with new fall arrest system.
24jul01	Day # 5	Checked brake torque on Az. And El. Brakes. Recorded parameters on ACU. Changed ACU. Installed cards from original ACU into shop ACU. Re-entered original parameters. Completed ACU pm. Completed Drive cabinet pm. Completed ped. Room grounding checks.
25jul01	Day # 6	Completed IR thermometer checks on Electrical Panels in ped. Room. Checked Gear box heater current. Cleaned Az. Motor commutators and seated Az. Brushes. Completed El. Motor pm. Completed servo test fault checks.
26jul01	Day # 7	Changed El. Motor coupling spiders. Completed servo test. Completed Az. And El. Synchro alignment procedure.
27jul01	Day # 8	Checked lightning protection and grounding from pintle bearing room to apex. Power washed Az. Motors and gear boxes. Helped Aragon install new Stow pin tray and re-located stow pin switch. Helped Aragon repair antenna hoist.
28jul01	Day #9	Helped Gutierrez & Ruff grease El bearings. Changed ant. Hoist switch. Helped check Az. Wheel alignment.
29jul01	Day #10	Changed Az. And El. Gearbox oil. Helped install new 86 GHz feed.
30jul01	Day #11	Helped index new feed mount. Looked for El. Motor lube pump leak. Loaded and checked out truck, and drove to Yakama Washington.
31jul01	Day #12	Drove from Yakama Washington to Twin Falls Idaho.
01aug01	Day #13	Drove from Twin Falls Idaho to Cortez Colorado.
02aug01	Day #14	Drove from Cortez Colorado to San Antonio NM.

Conclusion: Brewster sites looks good except for the intermittent problems that they were having when we got there. I changed out the ACU body but left their original cards in that ACU so we can verify that the problem is actually in the ACU body and not the cards. The problem doesn't show up for up to six months sometimes so it could be a while before we know for sure.

Also while I was doing the IR. Thermometer checks in the ped. Room electrical panels, Steve Troy noticed that the buss for the breakers is a screw in type and the breakers themselves are not the screw in type. So the breakers will pop out if the panel cover is off. Steve Troy notified Tom Baldwin of the problem and Tom will follow up on it.



Ped Room Breakers

Electronics Trip Report

August 2, 2001

From: Doug Scott
To: Clint Janes
Cc: J. Ruff
P. Rhodes

Electronics Division Tiger Team Report
For VLBA Brewster WA, July 23-29
Site Manager: Robert Sanderson
Site Technician: Mark Hoffman
Tiger Team Leader: Jim Ruff

General.

The VLBA Brewster Site reflects the tremendous effort of Bob and Mark in keeping on top of all aspects of running this site. The grounds and surrounding fencing are uncluttered and clear of debris. The station signs are legible and information pamphlets are in ample supply for the public.

Inside the site reflects Bob's abilities as a cabinetmaker. He has made many functional shelves and cabinets for the site but his desk/cover for the UPS shows creativity. Tools and technical documentation are arranged in a clear and organized manner.

Many thanks are in order for Bob and Mark's assistance. They were always lending a hand and available for questions and suggestions. Their cooperation was invaluable.

Item List.

My inspections took me from the antenna apex to the bottom of the pintel bearing room. Listed below are the areas in which some action was taken or action is still required. This is not in any order of priority.

1. UPS's, located in the building and antenna pedestal room, were briefly taken off line and given a light cleaning. Batteries are in good condition and should not need to be replaced within the next two years.
2. Ground Fault Circuit Interrupter (GFCI) electrical outlets were installed in two locations. The first is outside the building for the external telephone ringer. The second is in the kitchen area.
3. Antenna hoist switch had a broken spring. The switch was replaced and relabeled.
4. Apex barrel access is restricted due to location of the barrel's cutout ladder, relative to hatch. Supplemental steps are being researched.
5. Requested tape recorders be labeled (No.1/No.2) as well as tape storage areas (climitizing / not prepassed / prepassed). This is for the benefit of visiting technicians.
6. Cable strain reliefs were hung and attached atop the pintle bearing room.
7. Some technical reports were not on file. These are being collected and are to be shipped shortly.

I would also like to thank the rest of the team for their assistance, cooperation and patience.
As one of the junior members, I have growing respect for their talents and experience.

Brewster Task List

	SERVO		
	SAFETY TESTS		Recordings
	MULTIPLE FAULT STATUS		EL System Response Test
	MANUAL MODES TEST		Implement test setup
	INDIVIDUAL FAULT STATUS		Calculate acceleration
	REMOTE BOX TESTS		Locked rotor resonance, AZ/EL
	AZ Travel Limit Switch Tests		AZ System Response Test
	AZ Clockwise tests		Implement test setup
	AZ Counter-Clockwise tests		Calculate acceleration
	EL Travel Limit Test		Locked rotor resonance, AZ/EL
	Elevation up tests		AZ Position Loop Tests
	Elevation down tests		Small signal step response
	BRAKE HOLDING-TORQUE TESTS		Large signal step response
1	Troubleshoot -drops DPM/MCB errors		Single motor step response
	Motor Inspections		EL Position Loop Tests
2	Install stainless steel j-boxes on drive motors (4)		Small signal step response
	Motor and Tach Couplings		Large signal step response
	Drive motors wiring orientation		Single motor step response
	Commutator & Brush Inspection		Auto Modes Test
	Servo PM		Check stow commands
	~~Replace SCR EL cooling fan~~		Synchro feedback operation
	ACU PM		Test AUI COMM DEAD
	Lightning Grounding		
	EL Bearing Ground Cables		***moved stow pin switch***
	EL Motor Platform to Pintle Turret		
	Pedestal Room Grounding		
	AZ Wheel Ground Straps		
	Pintle Bearing Room Grounding		
	Detailed Test		
	System and Axis Faults		
	Motor Fault Status		
	Measure EL Velocity		
	~~EL counterweight balance measurements~~		
	Measure AZ Velocity		
	Record 1st Limits EL/AZ		
1	***Changed ACU***		
2	***Skipped per Bob S.***		

HVAC			
	Antenna		Control Building
	Pedestal room A/C inspection		Building A/C System
	Provide Site Techs w/manual and hold Q&A session		Perform operational checks
			Inspect indoor & outdoor units
	Vertex Room A/C		Correct deficiencies as needed.
	Inspect air handler		Stand-By Contempo
	Inspect condenser unit		Indoor Unit
	inspect lines & bulkhead fittings		Install primary unit interface relay board
	Repair/replace damaged line insulatiion		Instal Hoffman SCR's
	Replace any suspect bulkhead fitting		Install auxillary terminal block
	~~Evacuate & place unit back in service~~		Replace V-belt & adjust pully to maximum
	Install ROC & set to (C1, set 135, Dif.30)		Perform operational checks
	Check PCtool to DDC connection @computer		Condensing Unit
	Make hard copy of program parameters		Inspect for leaks & clean oil
	Check programing, save program file to disk.		Inspect electrical connections
	Hold Q&A session w/ Site Tech's		Perform operational checks
			Primary Contempo
			Indoor Unit
			Install auxillary terminal block
			Install utility interface auxillary switch & cable
			Install wiring to stand-by unit
			Install upgraded interface
			Install UPS transformer & cable to DDC
			Replace control transformers
			~~Replace humidity sensor~~
			Condensing Unit
			Inspect for leaks & clean oil
			Inspect electrical connections
			Peform operational checks
			Check PCtool to DDC connection at computer
			Make hard copy of program parameters
			Check program & save program file to disk
			Schedule and perform hard test of emergency power interface for both Contempo units.
			Hold Q&A session w/ Site Tech's
			Review site documentation with site techs
			Inspect site utilities
			Water supply & distribution
		1	Propane system
			Sewer/septic system
		1	***site techs will replace sch 40 propane pipe with sch 80 this fall.***

ANTENNA MECHANICS

- Apex Safety
  - Install new ladder & fall arrest system
  - Install apex guardrail
  - Fall Protection training (sign-in sheet)
- FRM
  - 2-year PM ***cablewrap springs a bit rusty***
  - INA bearing check

FRM INA Bearing Check	
50# pull on primary side	
Pr'y Travel: +.002"	Sec'y Travel: -.002
50# pull on secondary side	
Pr'y Travel: -.002	Sec'y Travel: +.002

- Subreflector
  - Check for peeling, delam. ***5% of area peeled***
  - Check cover
- Quad Legs, Guy Wires Etc..
  - Inspect guywires & turnbuckles
  - Inspect quadleg flange bolts
- Anemometer
  - Inspt mounts/chk operation
  - Install Baldwin bracket parts
- Feeds & Dichroic
  - Inspect feeds, mounts, heaters, etc.
  - Check dish tipper
  - Check Dichroic reflector
  - Check feedcone exterior ***finish checked***
  - Replace hatch latches as req'd ***none***
- Dish Surface & Panels
  - Inspect for damaged panels
  - Spot check panel bolts-looseness
- Elevation Hoist/Swing Platform ***replaced drum sw***
  - Instl hoist safety mods
  - Checkout swinging platform
  - Instl condensor platform toe guard
- Structural
  - Spot check structural bolts
  - Inspect structural welds
  - Inspt ant backup/lower struct
  - Inspect EL axle for cracks
- El Bull and Pinion Gears
  - Inspt bull/pinion gears
  - Lub bull gear as req
  - Check stow pin
- El Motors & Gearboxes
  - Inspect pumps, seals & couplings
  - Check gearbox heater enclosures
- El Bearings
  - Inspect EL bearings lip seals
  - Clean off excess grease
  - Install El bearing grease trays ***done previously***
  - Grease

El Bearing Grease Inspection	
Encoder Side	OK
Tach side	OK

- Az Bearings
  - Open, clean & Inspect pillowblocks

Az Bearing Grease Inspection/Bearing Replacement		
	Inner	Outer
D1	OK	OK
D2	OK	OK, hub OK
I1	OK	OK
I2	A few flakes	OK

  - Rotate outer races ***done previously***
  - Close pillowblocks and grease
- Az Wheels
  - Check wheel to struct clearances
  - Check axle bolt tightness

AZ wheel radii and alignment		
	D1	D2
Horiz. Error	30 arcsec	
Vert. Error	**4 arcmin**	
Radius	.134" out	

- Az Motors & Gearboxes
  - Inspect pumps, seals & couplings
  - Check gearbox heater enclosures
- Paint & Insulation Inspection
  - Inspect ant paint ***some peeling. Almost no rust***
  - Inspect & repair ant insulation as needed
- Pintle Bearing
  - Inspect seals
  - Check pocket level ***done previously***
  - Check for loose bolts
  - Lubricate
  - Close gap in grease catcher ***done previously***
- Az Rail Inspection
  - Inspect ant foundation, grout and Vulkem
  - Inspect for excessive rail movement
  - Inspect joint bars & clips
  - Rail level measurements
  - Check for popping wheel

	ELECTRONICS		
	Antenna Maintenance & Inspections		
	Apex/FRM inspections		
	Feedcone/Receiver system inspections		
	Activate & test feed heaters		
	Vertex Room/Racks & cable inspections		
	Vertex to pintle bearing inspection		
	Replace tie wraps on antenna cabling with metal type		
	Install cable wrap strain reliefs		
	Inspect pintle bearing rm bulkhead, cablewrap, etc.		
	Inspect pedroom UPS, FRM controller, dry air sys, etc.		
	Install breaker for air comp & hydraulic wrench		
	Station Building Inspections		
	100 - Check electrical, UPS and test operation		
	103 - Chatter/supervisory boxes, alarms, etc.		
	104 - Bulkhead, underfloor, maser, etc		
	Check tools, test equip, manuals, wtr sys, UIS, etc		
	Outside Building and Misc. Inspections		
	Run and inspect site generator		
	Inspect weather station ***mild corrosion on circuit boards. Decided to leave alone.***		
	Check gates, fence, signs, grounds, etc		
	Inspect lightning protection for antenna & bldg		
	Check safety items/hazmat storage, etc.		
	hard-wired outdoor phone ringer		
	installed GFCI duplex outlets outside & at sink		
	FINAL INSPECTIONS		
	Spot check critical PM's		
	Review problem areas with site tech's		
	Site Inspections for Oversights		
	Site clean-up		
	Contact VLBA Operations for Station Startup Verification Tests		