

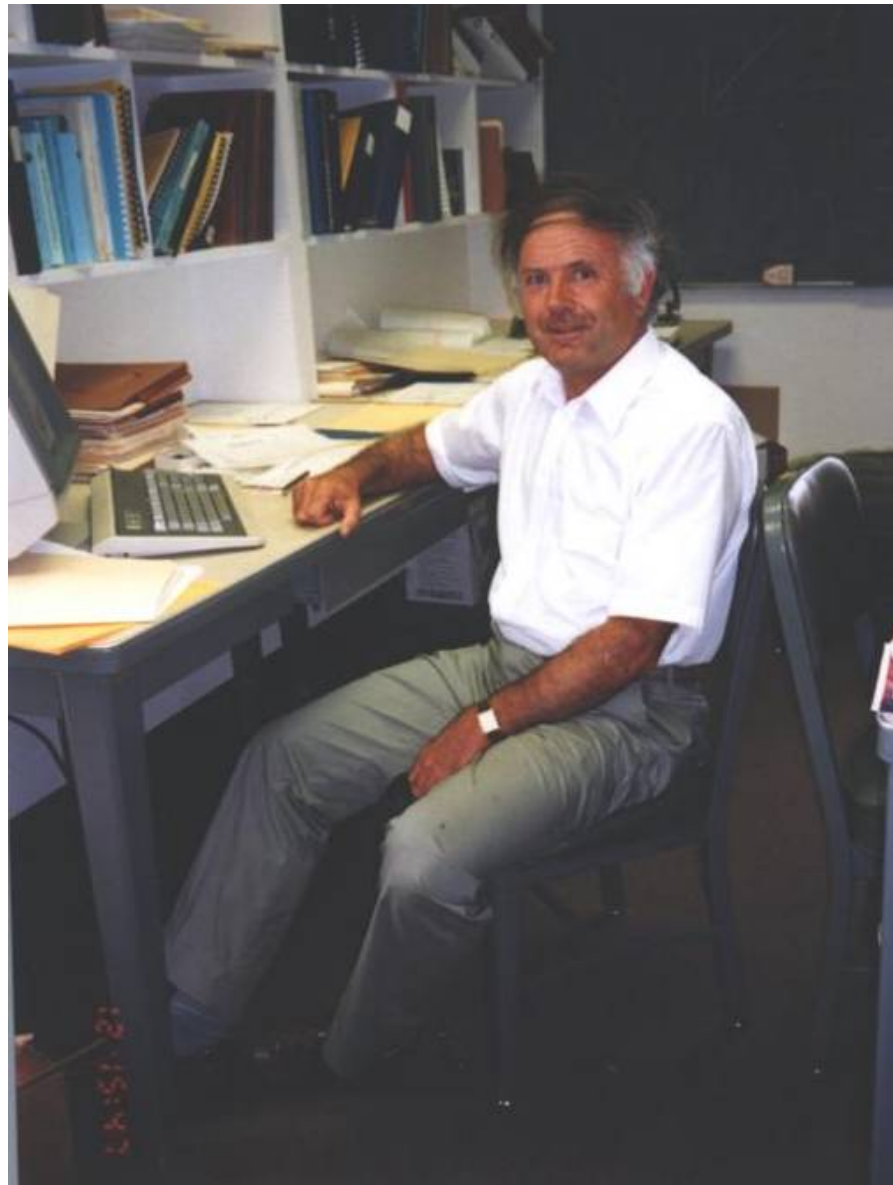
Some Thoughts on John Payne's Contributions to Radio Astronomy

Larry R. D'Addario
Charlottesville, Virginia
26 October 2006

About this talk...

- I have found John
 - Creative
 - Innovative
 - Bold
 - Visionary
- Here I'll talk about some of John's technical contributions
 - Not necessarily the most important ones
 - With a few personal anecdotes
- At the end I'll mention a couple of outside-work activities

John Payne, #707



2006 October 26

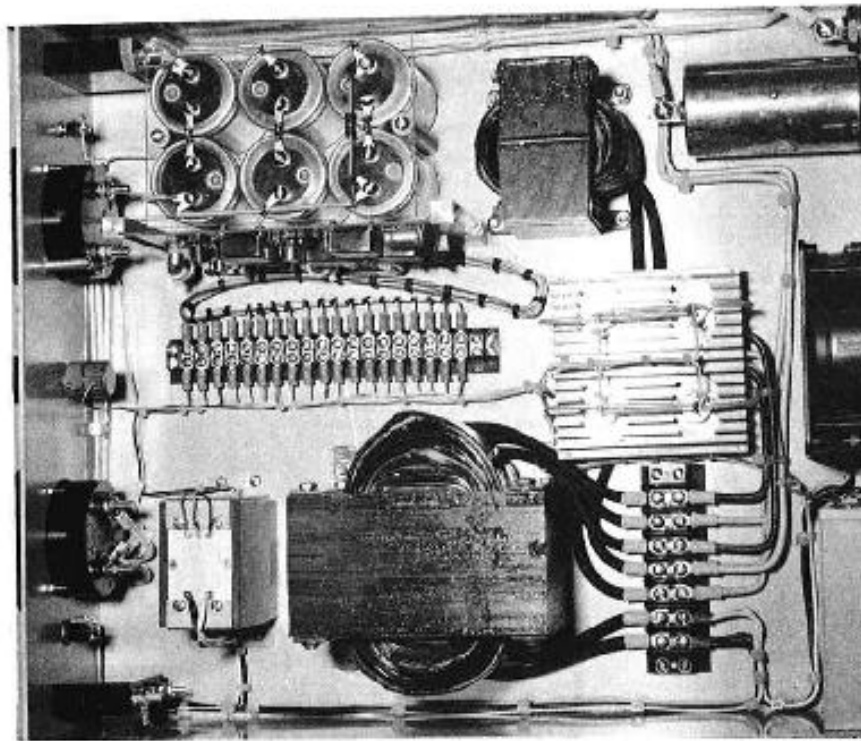
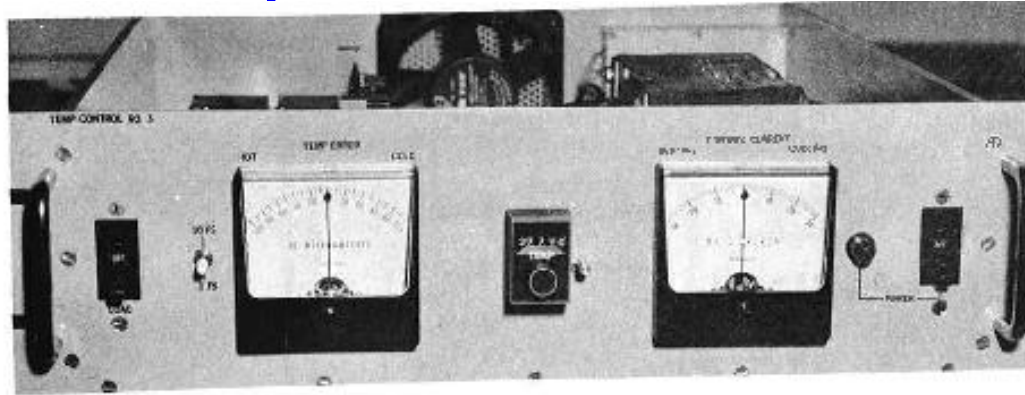
John Payne Tribute Day

LRD 3

Electronics Division Internal Reports

62	Noise Tube Power Supply	09-01-67
63	Thermal Calibration Unit	09-01-67
72	A Remote Positioning Servo System	06-01-68
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84	The 6 cm VLB Receiver	04-01-69
90	The 3 cm VLB Receiver	01-01-70
92	The 13 cm VLB Receiver	05-01-70
98	Antenna Measuring Instrument	11-01-70
101	The 108-Channel Multiplexer for use with the Honeywell 316 Spectral Line Processor	05-01-71
103	Mark II Thermal Calibrator, w/J. W. Findlay	08-01-71
119	A Laser Distance Measuring Instrument	06-01-72
127	The 45-Foot Antenna Drive System	03-01-73
134	A 512-Channel Integrator and Multiplexer, w/ C. Pace	10-01-73
136	An Antenna Measuring Instrument and Its Use on the 140-ft Telescope, w/J. W. Findlay	01-01-74
137	Nutating Subreflector for 36-ft Telescope	02-01-74
152	First Tests of An Antenna Measuring Instrument on the 36-ft Telescope, w/ J. M. Hollis, J. W. Findlay	12-01-74

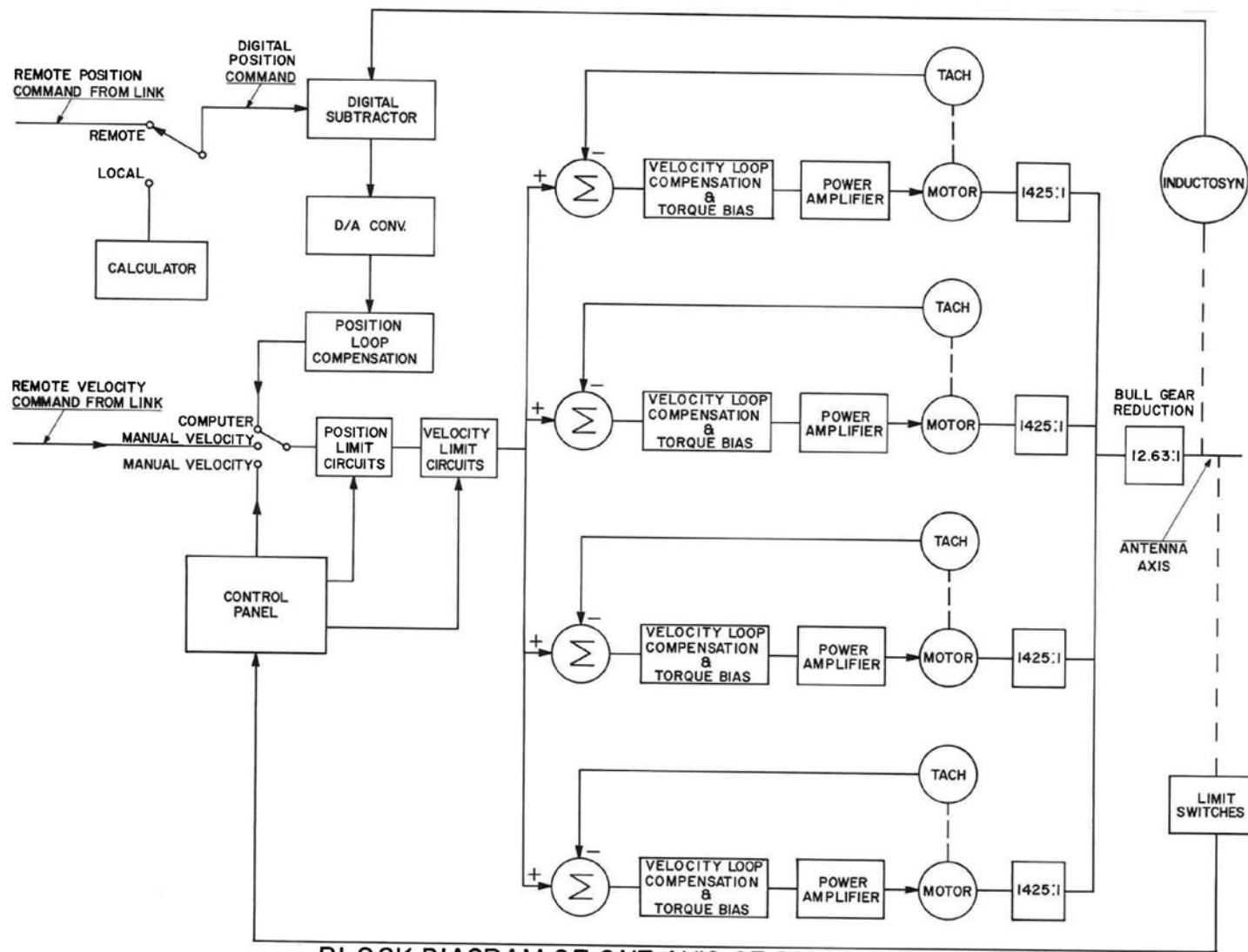
Temperature Controller



45 Foot Antenna

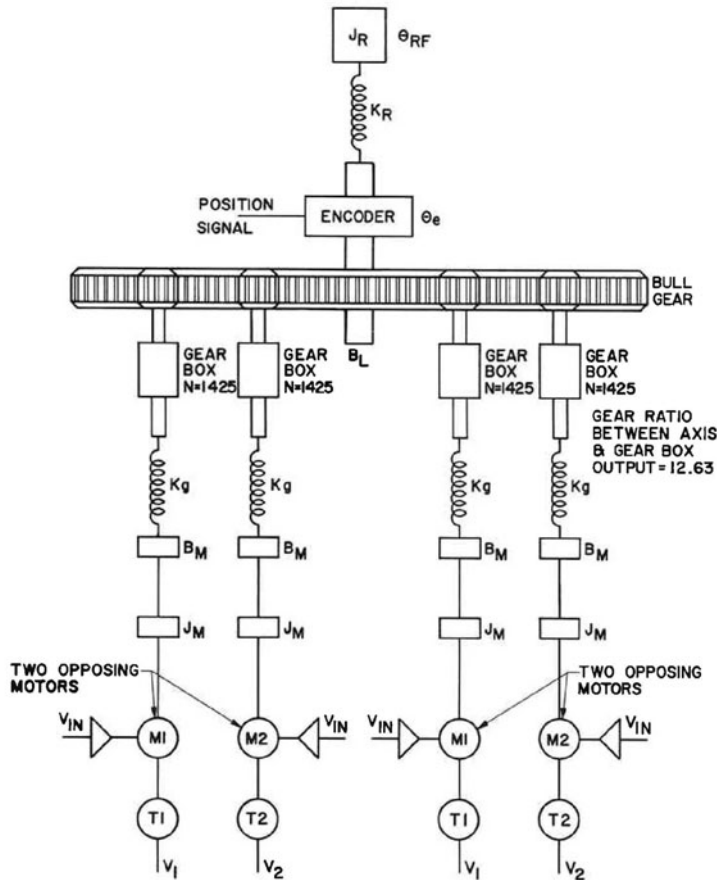


45 Ft Controller – Axis Block Diagram



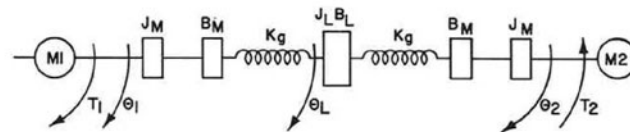
BLOCK DIAGRAM OF ONE AXIS OF CONTROL SYSTEM
FIG. 1

45 Ft Controller – Dynamic Model



MODEL OF ONE AXIS OF DRIVE SYSTEM
FIG. 3

J_R = INERTIA OF REFLECTOR
 K_R = STIFFNESS OF REFLECTOR
 θ_e = ANGLE TURNED BY RF AXIS
 θ_L = ANGLE TURNED BY BULL GEAR
 B_L = VISCOUS FRICTION OF MAIN BEARING
 K_g = STIFFNESS OF GEAR BOX
 B_M = VISCOUS FRICTION OF MOTOR & GEAR BOX
 J_M = MOTOR INERTIA



SIMPLIFIED MODEL OF ONE AXIS
FIG. 4

T_1 = TORQUE FROM MOTOR 1
 T_2 = TORQUE FROM MOTOR 2
 θ_1 = ANGLE TURNED BY MOTOR 1
 θ_2 = ANGLE TURNED BY MOTOR 2
 θ_L = ANGLE TURNED BY LOAD
 B_L = VISCOUS FRICTION OF LOAD (REFERRED TO MOTOR)
 B_M = VISCOUS FRICTION OF MOTOR
 J_L = LOAD INERTIA (REFERRED TO MOTOR)
 J_M = GEARBOX STIFFNESS (REFERRED TO MOTOR)

45 Ft Controller: Modeled Response

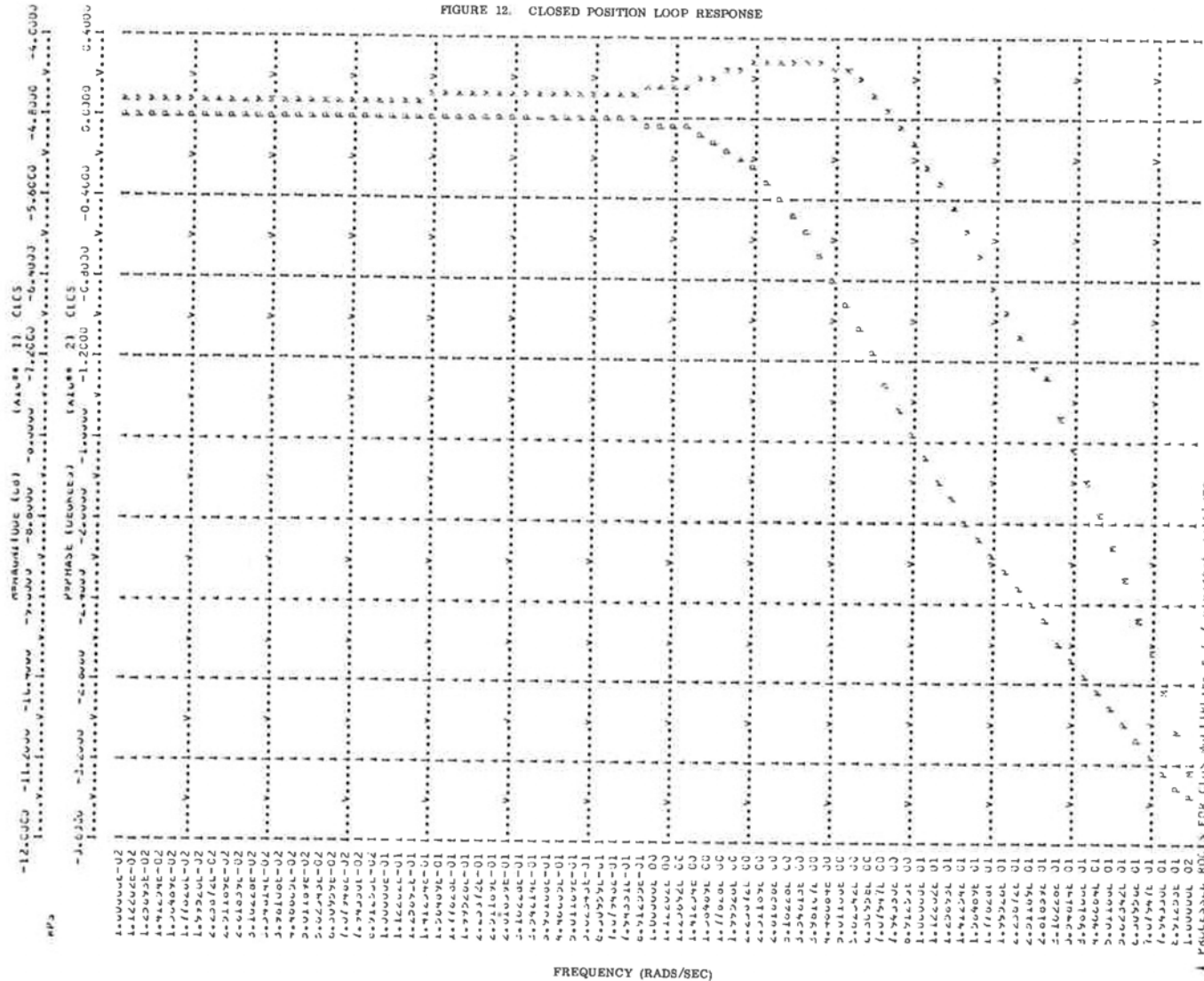
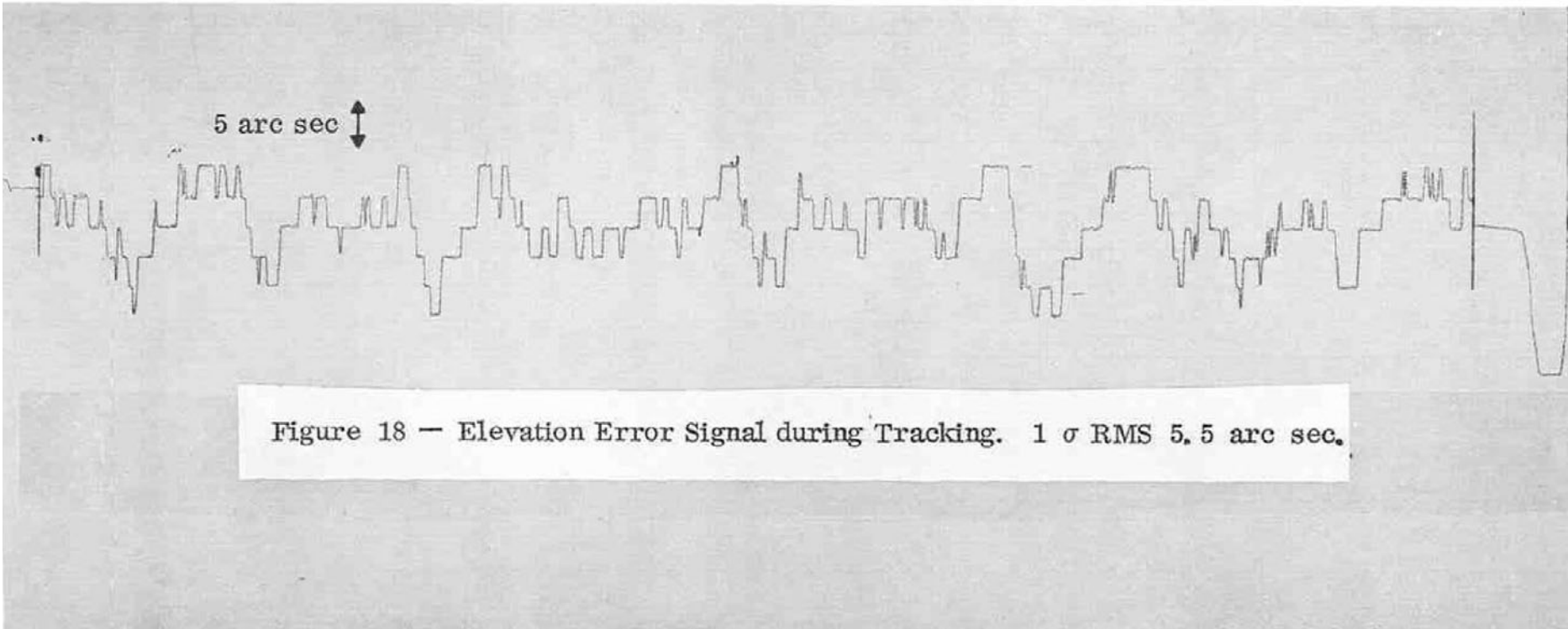


FIGURE 13. RESPONSE TO A 16 MINUTE STEP POSITION COMMAND

45 Ft Controller -- Performance



GBT Memos

3	First Meeting of the Active Surface Group	Payne, J.	(8-09-89)
9	100-m Structure	Payne, J.	(8-24-89)
10	Actuators	Payne, J.	(8-30-89)
12	Primary or Secondary Compensation	Payne, J.	(9-07-89)
14	High-Frequency Performance of GBT	Payne, J.	(9-22-89)
36	Pointing and Surface Control of GBT	Payne, J.	(2-27-90)
42	Fine Pointing for the GBT	Payne, J.	(3-13-90)
57	The Laser Ranging System for the GBT		
	Payne,J.; Parker,D.		(7-20-90)
59	The GBT's Adjustable Optics		
	Fisher, R.,Norrod,R. & Payne,J.		(10-10-90)
73	A Rangefinder With Fast Multiple Range Capability		
	Payne, J., et als.		(2/92)
84	Pointing the GBT	Payne, J. M.	(9/92)
127	GBT Dynamic Pointing Meeting	Payne,J.	(4/95)

GBT Memos, continued

- 133 Active Damping for the GBT ARM
Payne, J.M., Emerson, D.T. (7/95)
- 140 Optical Electronic Distance Measuring Apparatus with Movable
Mirror - U.S. Patent Payne, J.M., Parker, D., Bradley, R. (10/95)
- 144 Monitoring the GBT Arm Movement Payne, J. (1/96)
- 149 First Tests of a Quadrant Detector
Payne, J.M. & Schiebel, D. (3/96)
- 158 Slant Range Tests of Quadrant Detector (9/96)
Payne, J.M. & Schiebel, D. (9/96)
- 159 Dynamic Tests on the GBT (9/96)
Payne, J.M. & Schiebel, D. & Schwab, F.R. (9,96)
- 162 Rangefinder Metrology for the Green Bank Telescope (2/97)
Goldman, M.A. & Creager, R.E. & Parker, D.H. & Payne, J.A. (2,97)
- 167 Initial Passive Vibration Measurement on the GBT (6/97)
Schwab, F. & Payne, J.M. & Schiebel, D. (6/97)

The Shaker (GBT Memo 159)

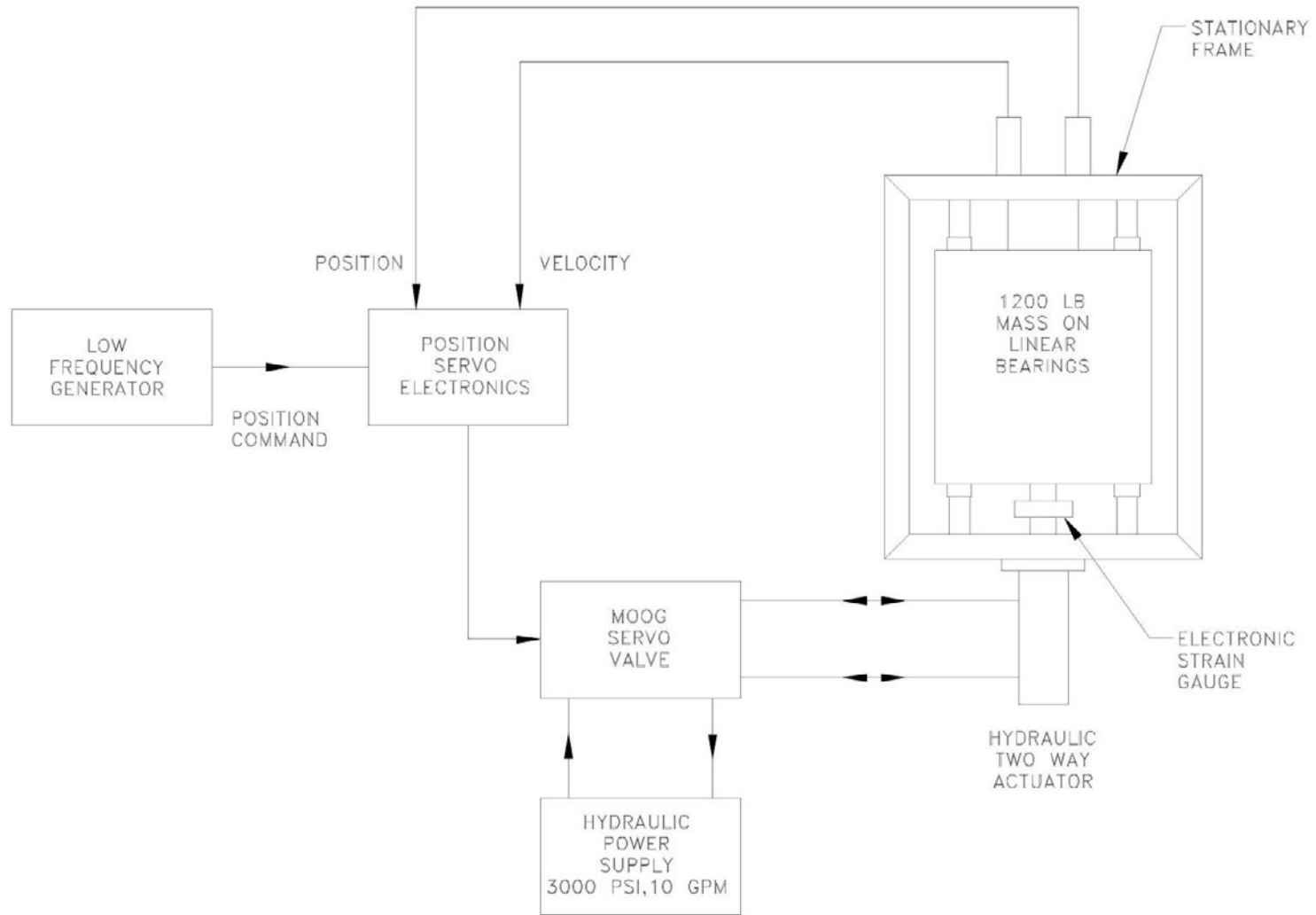


Figure 1. Block diagram of the “shaker”.

Shaking the GBT

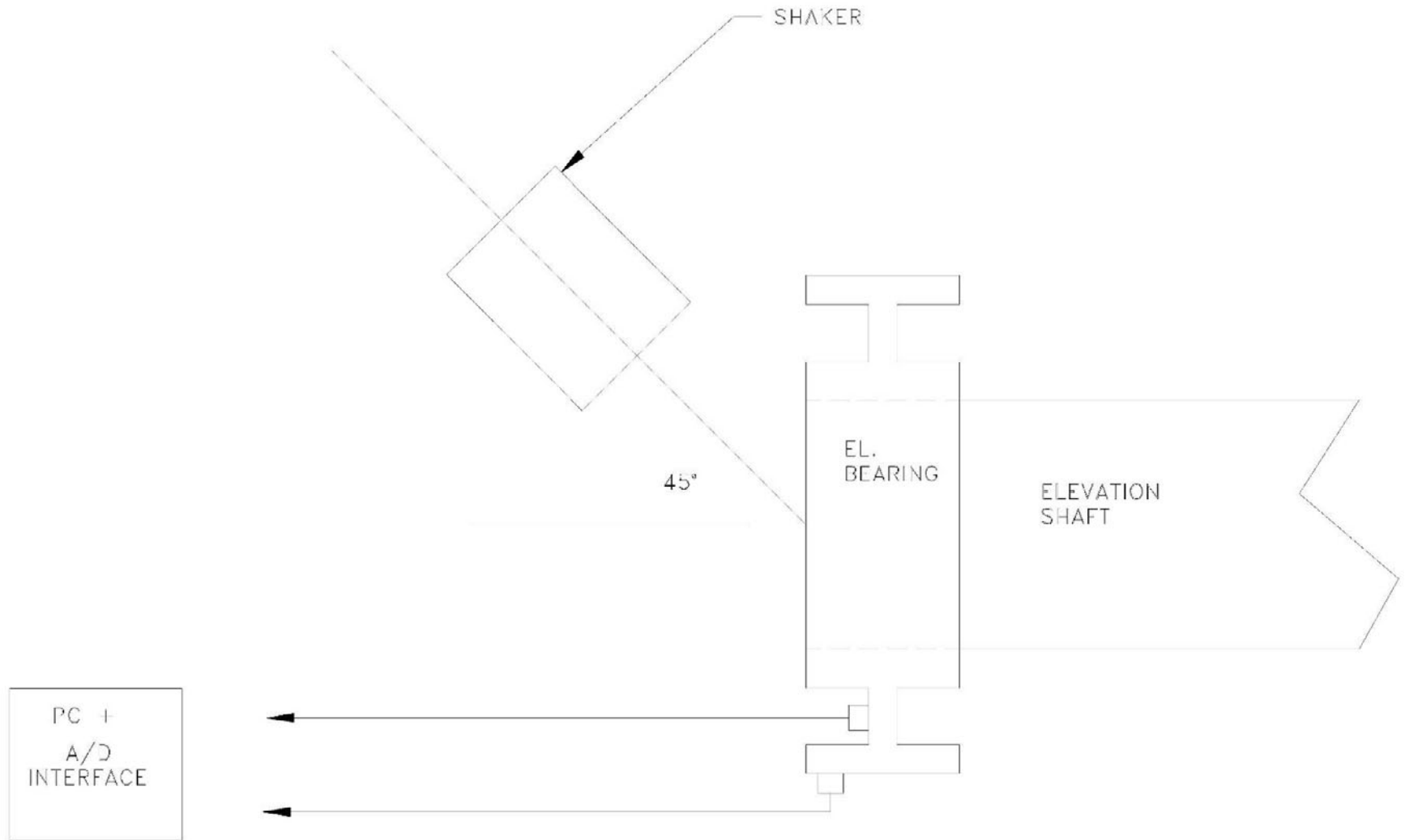


Figure 2. Experimental setup on the GBT.

Shaker Measurement

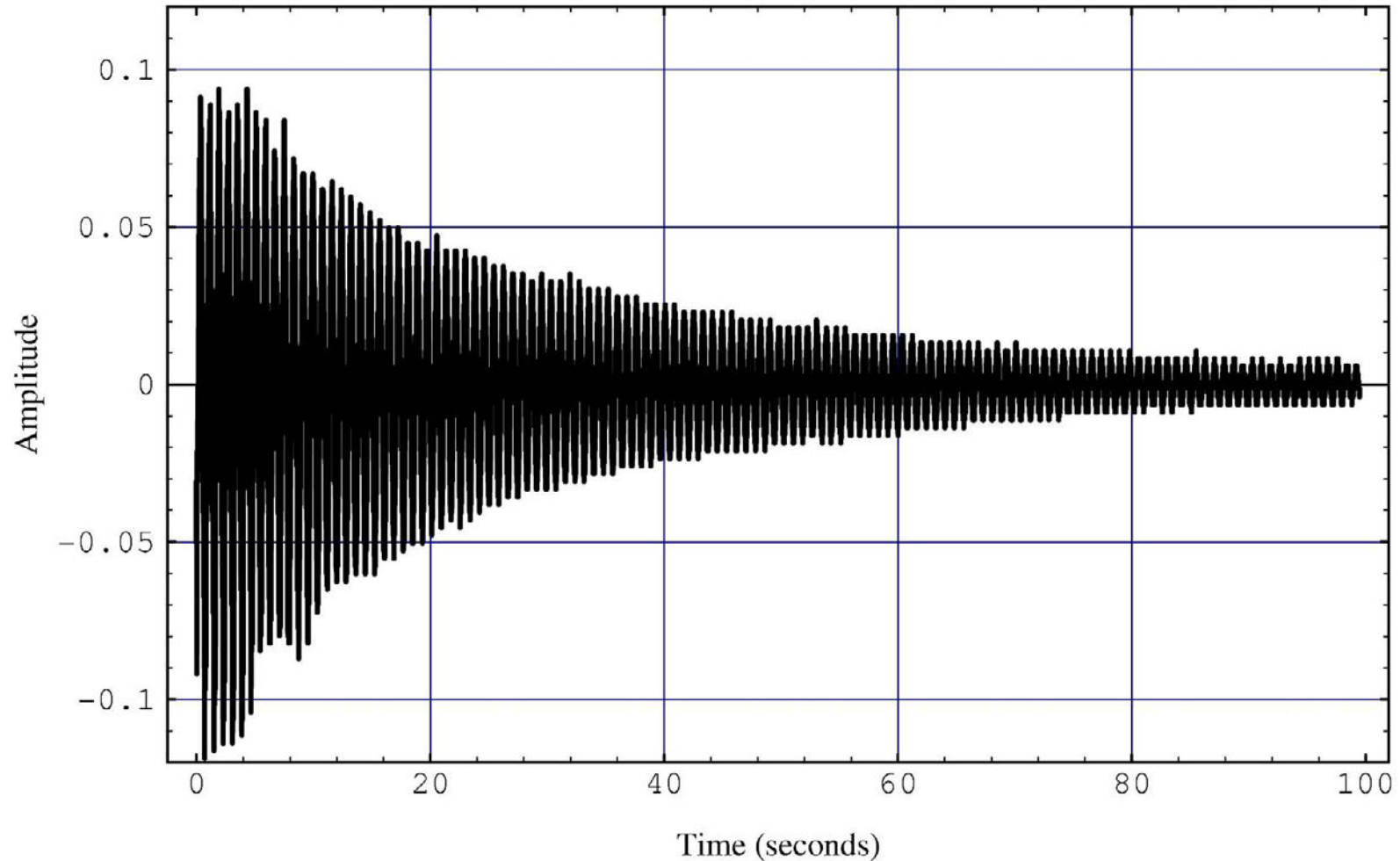


Figure 3. Time series of modal resonance decay, as measured by the accelerometer that was mounted parallel to the elevation axle.

ALMA Memos

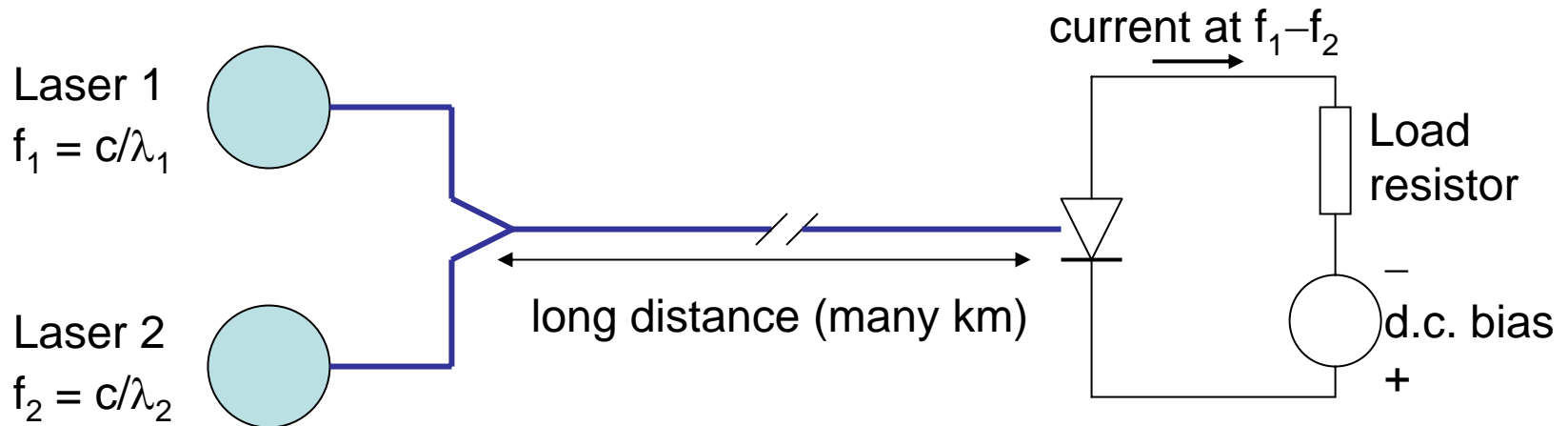
- 449 *Noise Evaluation of Hybrid Photonic Local Oscillator at 500 GHz*
Y. Sekimoto, A. Ueda, T. Okuda (NAOJ), E. Bryerton (NRAO), M. Sugimoto,
.Matsuo, S. Yokogawa, T. Noguchi, M. Ishiguro (NAOJ), H. Ito, T. Nagatsuma,
A. Hirata (NTT), and J. Payne (NRAO) 03/03
- 440 *Photonic Techniques for Local Oscillator Generation and Distribution in
Millimeter-Wave Radio Astronomy*
John M. Payne, William P. Shillue (NRAO Tucson) 10/02
- 439 *Millimetre Wave Generation Using an Optical Comb Generator with Optical
Phase-Locked Loops* Pengbo Shen and Phillip A. Davies (U. of Kent),
William P. Shillue, Larry R. D'Addario, and John M. Payne (NRAO) 10/02
- 435 *A Hybrid Option for the First LOs using Direct Photonic LO Driver*
M. Ishiguro, Y. Sekimoto, A. Ueda, S. Iguchi, T. Noguchi (NAOJ),
J. M. Payne, L. R. D'Addario, W. Shillue (NRAO Tucson)
- 396 *A Photonic MM-Wave Reference and Local Oscillator Source*
P. G. Huggard & B. N. Ellison (Rutherford Appleton Laboratory, Chilton),
P. Shen, N. J. Gomes & P. A. Davies (U. of Kent), W. P. Shillue, A. Vaccari,
W. Grammer & J. M Payne (NRAO, Tucson)
- 324 *Proposal for ALMA Front End Optics*
W. Grammer, B. Shillue, L. D'Addario, J. Payne 09/00
- 267 *Photonic Techniques for Use on the Atacama Large Millimeter Array*
J. Payne, B. Shillue, A. Vaccari 06/99

ALMA Memos, continued

- 215 *A Strawman Optics Layout for the MMA Antenna--version 2*
J. Lugten P. Napier, J. Bieging, J. Cheng, D. Emerson, M. Fleming, M. Holdaway,
J. Kingsley, J. Lamb, J. Mangum, J. Payne, W. Welch, D. Woody 06/98
- 200 *Photonic local oscillator for the Millimeter Array*
J.M.Payne, L.D'Addario, D.T.Emerson, A.R.Kerr, B.Shillue 02/98
- 181 *Notes on Possible Sensors for Improving the Pointing of MMA Antennas*
J. M. Payne 8/97
- 163 *A Strawman Optics Layout For The MMA Antenna*
P.Napier, J. Bieging, J. Cheng, D. Emerson, M. Gordon, M. Holdaway,
J. Kingsley, J. Lugten, J. Payne, D. Woody 11/96
- 145 *Antennas for the Millimeter Wave Array*
P. J. Napier, J. Cheng, D. T. Emerson, M. A. Gordon, J. B. Lugten,
J. M. Payne, W. J. Welch, D. P. Woody 10/95
- 143 *Report of the Receiver Committee for the MMA* Jack Welch, John Carlstrom,
Darrel Emerson, Phil Jewell, Tony Kerr, Steve Padin, John Payne,
Dick Plambeck, Marian Pospieszalski, Dave Woody 09/95
- 78 *Report on Visit to Hat Creek* J. Lamb, J. Payne 01/92
- 52 *Preliminary Optics Design for the Millimeter Array Antennas*
J. Lamb, J. Payne 12/88

Origins of Photonic LO Ideas

- Party at Parkers' in Green Bank, circa 1995
- “Photomixing”



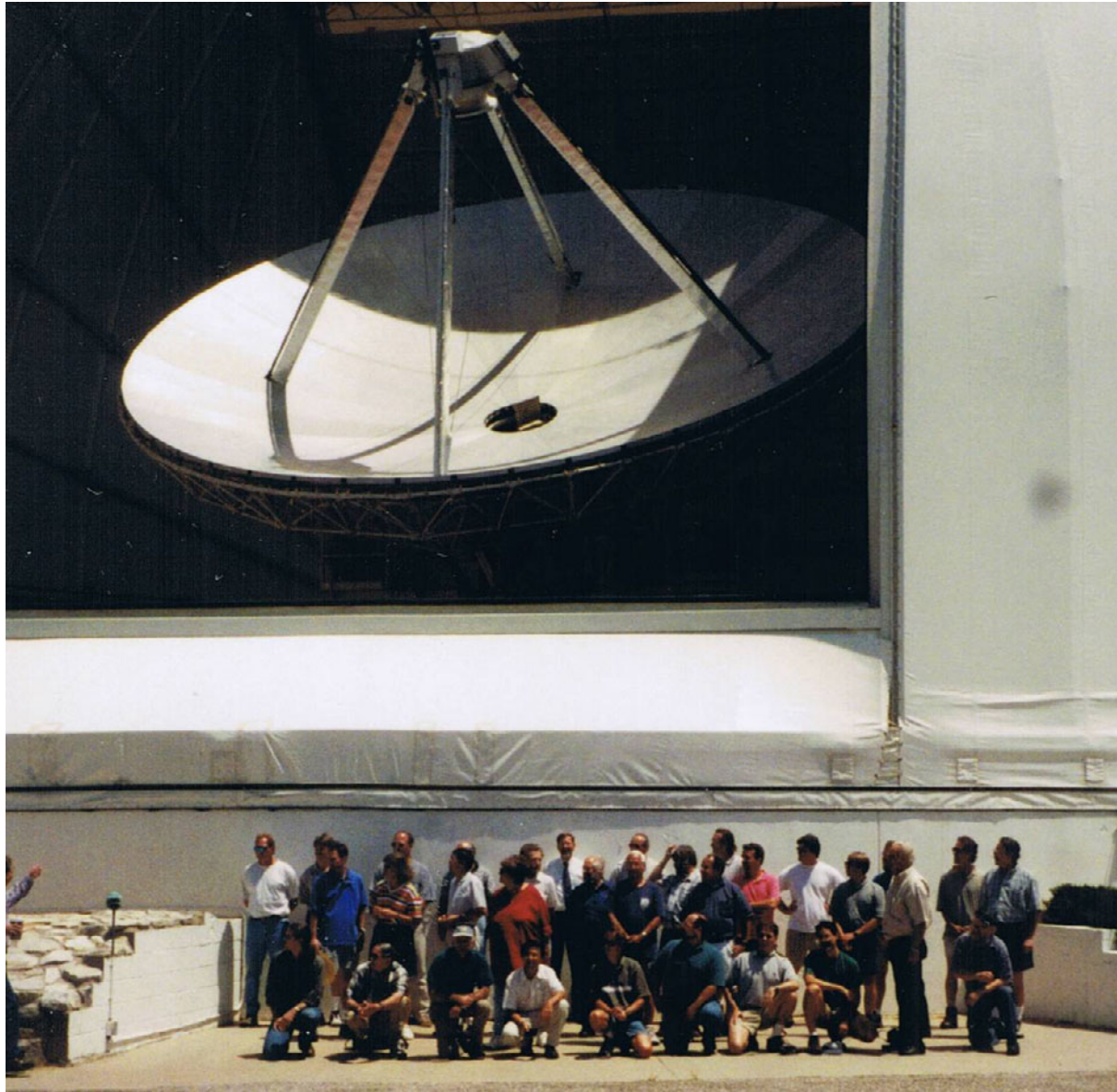
$$\lambda_1 = 1550 \text{ nm} \rightarrow f_1 = 193,412.903 \text{ GHz}$$

$$\lambda_2 = 1551 \text{ nm} \rightarrow f_2 = 193,288.201 \text{ GHz}$$

$$f_1 - f_2 = 124.702 \text{ GHz}$$

12m Telescope and Friends

July 27, 2000



2006 October 26

John Payne Tribute Day

LRD 19

Atop Mt Wrightston, AZ; Sept. 2000



2006 October 26

John Payne Tribute Day

LRD 20

KTUS-KOSH, July 2000

