AJ4CO OBSERVATORY

26211 W US Hwy 27
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OBSERVATORY OUTLINE
18 JUN 2017

Location: 29° 50′ 13″ N 29.8369° N EL89qu
82° 37′ 17″ W 82.6214° W
53 ft (16 m) MSL

TFD Array: Two square arrays on a NS line, eight 30-foot TFD elements, beam steering in 5° increments NS and 15° increments EW.

16 MHz HPBW at zenith: 18° NS x 40° EW
20 MHz HPBW at zenith: 15° NS x 35° EW, D ≈ 14 dBic
24 MHz HPBW at zenith: 12° NS x 30° EW
32 MHz HPBW at zenith: 8° NS x 20° EW

Receivers: 1 x Dual Polarization Spectrograph (DPS)

24 x 7 x 365 unattended operation
16–32 MHz, simultaneous (correlated) RCP and LCP
300 channels per polarization (600 total)
Swept frequency, selectable 7.5, 15, 30, 60 kHz pre-detection BW
~ 6.7 sweeps/sec, integration time = 500 μs per sample
Frequency resolution = 53 kHz, Δt = 150 ms

1 x Tunable Wideband Receiver (TWB) Mark III

Attended operation only
Tunable from 16 to 32 MHz, RCP or LCP
2 MHz IF BW direct to high speed digitizer
FFT post-processing, RBW = 4.88 kHz, Δt = 205 μs

1 x FS-200B radio spectrograph

24 x 7 x 365 unattended operation
16–26 MHz, RCP or LCP, 200 channels
Swept frequency, 30 kHz pre-detection BW
~ 10 sweeps/sec, integration time = 500 μs per sample
Frequency resolution = 53 kHz, Δt = 150 ms

2 x Radio Jove receivers

24 x 7 x 365 unattended operation
~ 20.1 MHz, uncorrelated RCP and LCP
7 kHz RF BW folded via direct conversion into
a baseband 3.5 kHz pre-detection audio BW
Integration time = 100 ms per sample

Sensitivity: Formal sensitivity calculations and measurements have not been made. A rough estimate considering only the number of dipoles is a 20 MHz on-axis and at zenith 3σ sensitivity on the order of 100 kJy. In the upper HF band, system noise is dominated by the galactic background emission. All receivers presently in use have noise figures between 6 and 8 dB, making their internal noise of little concern given the modest losses between the TFD array and the receivers.

Timing: All radio telescope data collection systems use a PC's internal clock to apply timestamps to the data. Each PC runs a service, Meinberg NTP daemon, to keep its system clock within a few milliseconds of UTC using Network Time Protocol (NTP). The NTP server is a GPS-ntp-pi stand-alone unit using GPS and GLONASS signals to determine and provide the correct time on the local network. Future work includes upgrading the spectrographs to a GPS-based hardware system with firmware modification to keep the start of each frequency sweep disciplined to within a hundred nanoseconds of UTC.

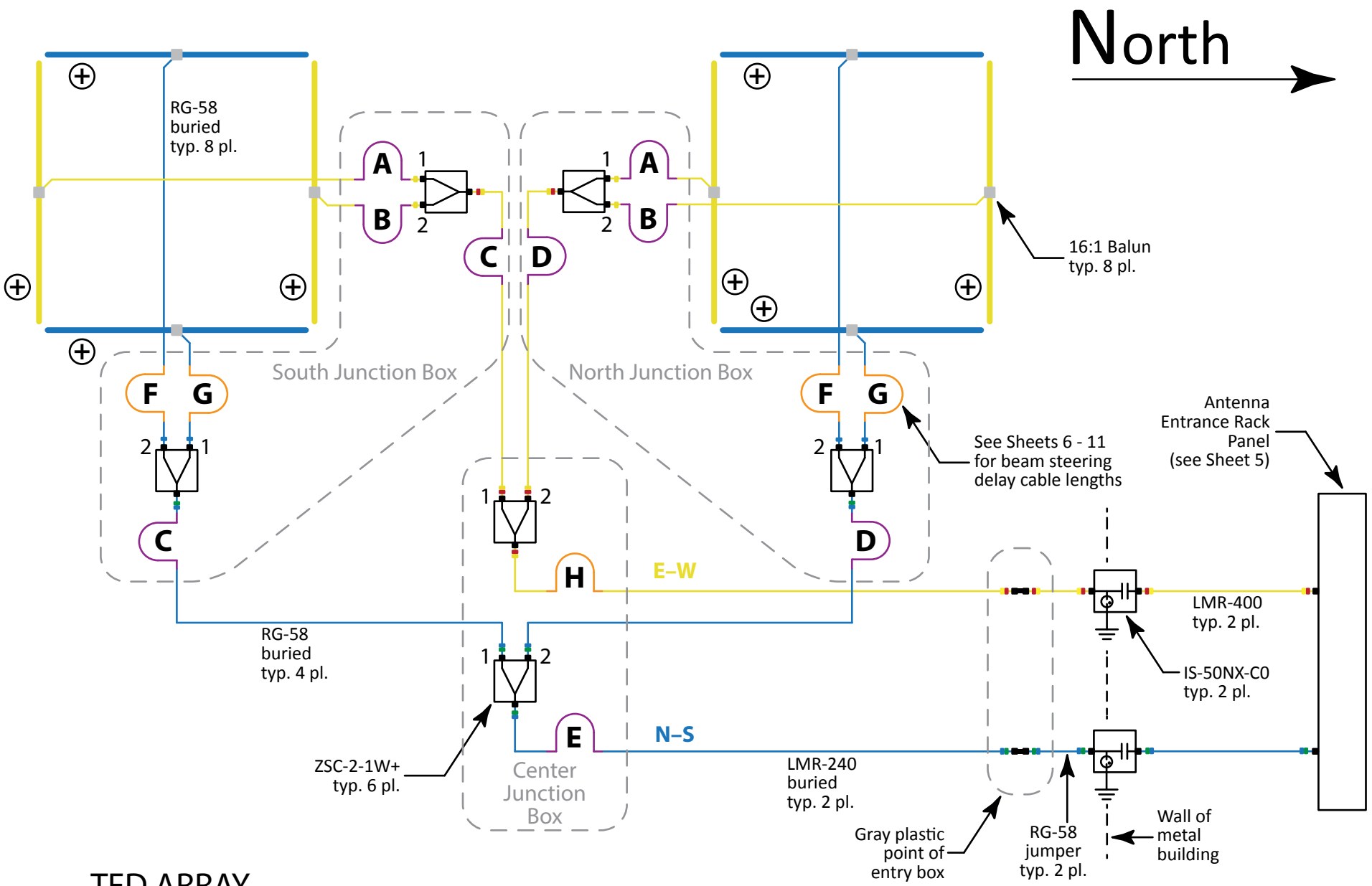
Calibration: All radio telescope systems are calibrated in terms of antenna temperature using a noise source of known temperature calibrated against a 5722 noise diode. An automatic calibrator runs a step calibration on all receivers a fixed number of hours before and after Jupiter transit (usually 3 hours when Jupiter's elongation is < 90° and 4.5 hours when Jupiter's elongation is > 90°), every day. The step cal runs in 17 steps of 5 seconds each separated by 3 dB, ranging from 4.3 kK to 250 MK equivalent antenna temperature.

Computers: Three identical PCs are used to record data from the receivers. Each has a 2.4 GHz AMD Opteron dual-core processor, 4 GB RAM, and a 1 TB hard drive. All run Windows XP SP3. All are connected to the observatory LAN.

Internet: The observatory has internet access via a 6 Mbps DSL connection. This connection allows the Radio Sky Pipe (RSS) and Radio Sky Spectrograph (RSS) software to serve data to interested remote observers.

Power: The receivers, computers, and network hardware are fed by three 1.5 kVA battery backup units providing at least 15 minutes of power if the AC mains fail.

Operations: Several radio telescopes operate all day, every day (see "Receivers" above). Useful Jupiter observations are made any time Jupiter is within 3.5 hours of transit.



TFD ARRAY CONFIGURATION C CP MODE

See Sheet 5 for XY to CP 90° Hybrid

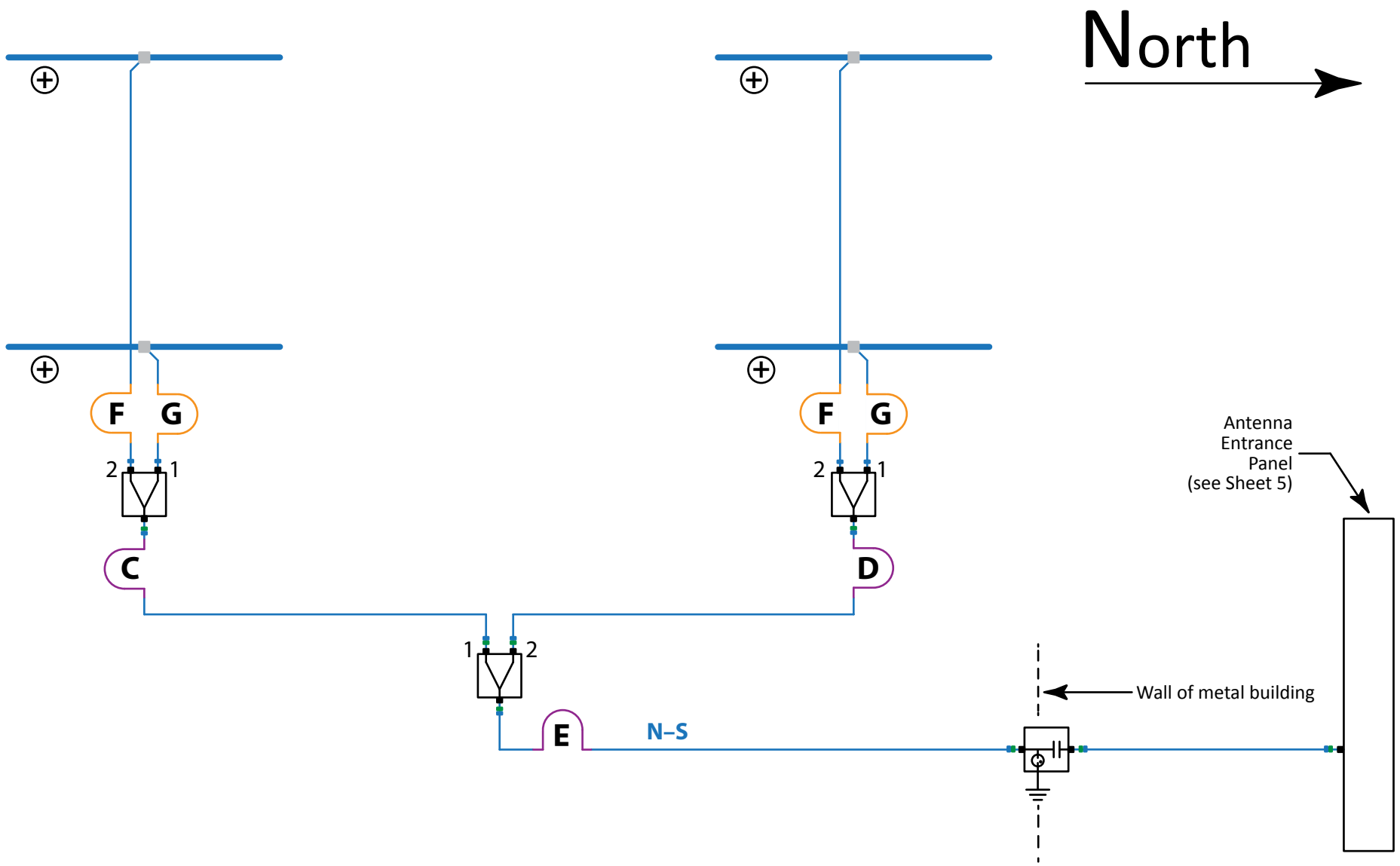
30’ folded dipoles, top wire 9’2” height,
8” wire spacing, 32’ element spacing,
800 Ω termination resistors, 16:1 baluns.

See Sheet 4 for feed system measured losses.

AJ4CO OBSERVATORY

AJ4CO Observatory Diagram

SIZE	DATE	PART NUMBER	REV
A	28 MAR 2015	N/A	
SCALE	NONE	DRAWN BY DAVE TYPINSKI	SHEET 1 OF 11



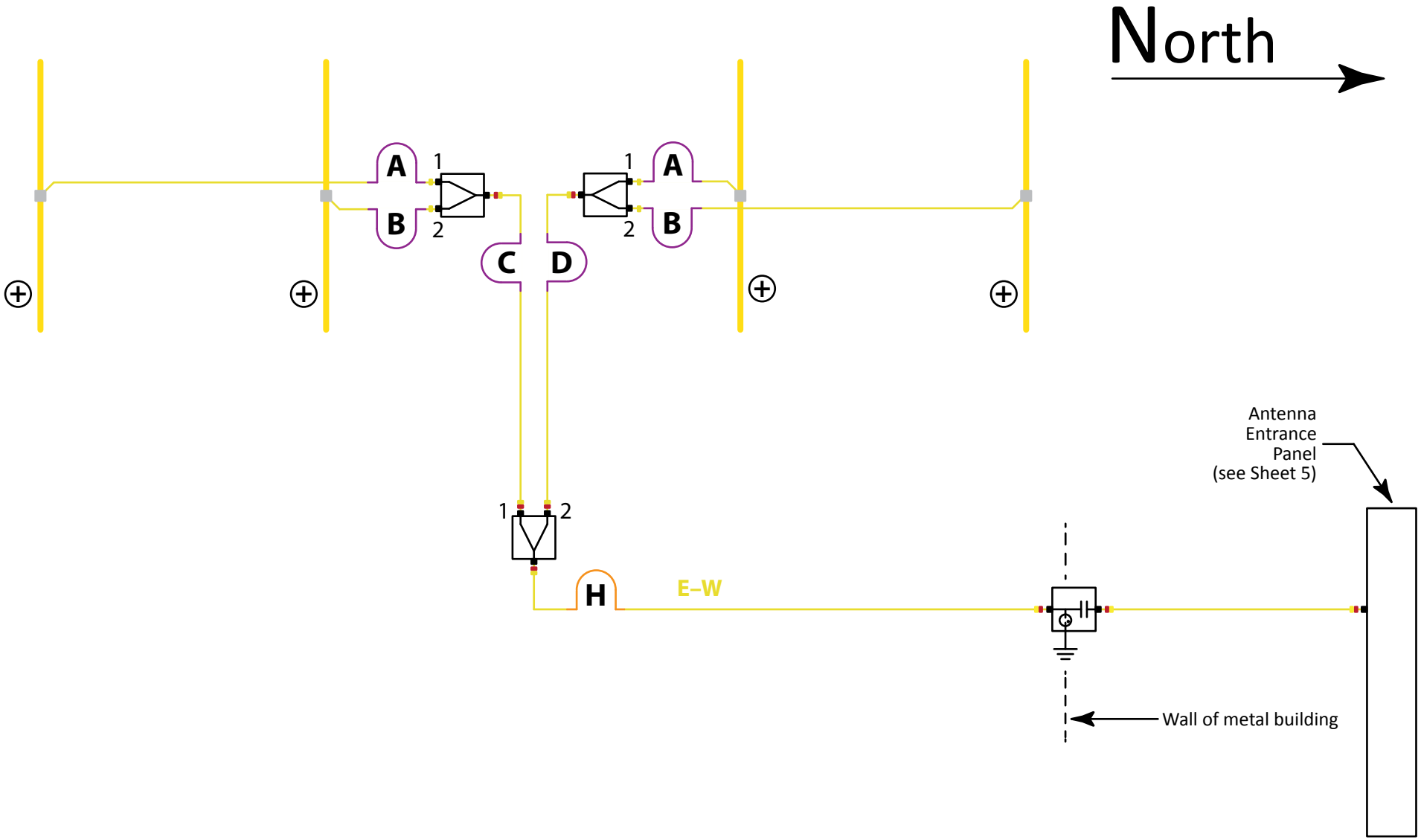
North-South Elements Only

AJ4CO OBSERVATORY

AJ4CO Observatory Diagram

SIZE	DATE	PART NUMBER	REV
A	28 MAR 2015	N/A	

SCALE	DRAWN BY	SHEET
NONE	DAVE TYPINSKI	2 OF 11



East-West Elements Only

AJ4CO OBSERVATORY

AJ4CO Observatory Diagram

SIZE	DATE	PART NUMBER	REV
A	28 MAR 2015	N/A	

SCALE	DRAWN BY	SHEET
NONE	DAVE TYPINSKI	3 OF 11

TFD Array Feed System Losses

Feed line loss sweeps performed 28 Mar 2015 | **Device sweeps performed 11 Aug 2013**

Freq (MHz)	Rack panel to gray point of entry box LMR-400 One Way Loss (dB)	Gray box to center J-box LMR-240 One Way Loss (dB)	Center J-box to outer J-box RG-58 One Way Loss (dB)	Outer J-box to element balun RG-58 One Way Loss (dB)	AJ4CO BALUN16-1A 16:1 Balun (one) Loss (dB)	Mini-Circuits ZSC-2-1W+ Combiners (two) Loss (dB)	Loss Between Element Feed Points and Hybrid Inputs (CAL PLANE) (dB)	Synergy DQK-701B 90° Hybrid (one) Loss (dB)
16	-0.99	-0.94	-0.75	-0.33	-0.52	-0.40	-3.9	-0.21
18	-1.04	-0.99	-0.79	-0.35	-0.54	-0.41	-4.1	-0.26
20	**-1.09**	**-1.03**	**-0.84**	**-0.37**	**-0.55**	**-0.42**	**-4.3**	**-0.29**
22	-1.15	-1.07	-0.89	-0.39	-0.57	-0.43	-4.5	-0.32
24	-1.20	-1.11	-0.93	-0.40	-0.58	-0.44	-4.7	-0.34
26	-1.24	-1.16	-0.97	-0.42	-0.59	-0.45	-4.8	-0.34
28	-1.28	-1.20	-1.00	-0.45	-0.60	-0.47	-5.0	-0.32
30	-1.32	-1.23	-1.04	-0.46	-0.61	-0.49	-5.2	-0.30
32	-1.36	-1.27	-1.09	-0.46	-0.62	-0.50	-5.3	-0.27

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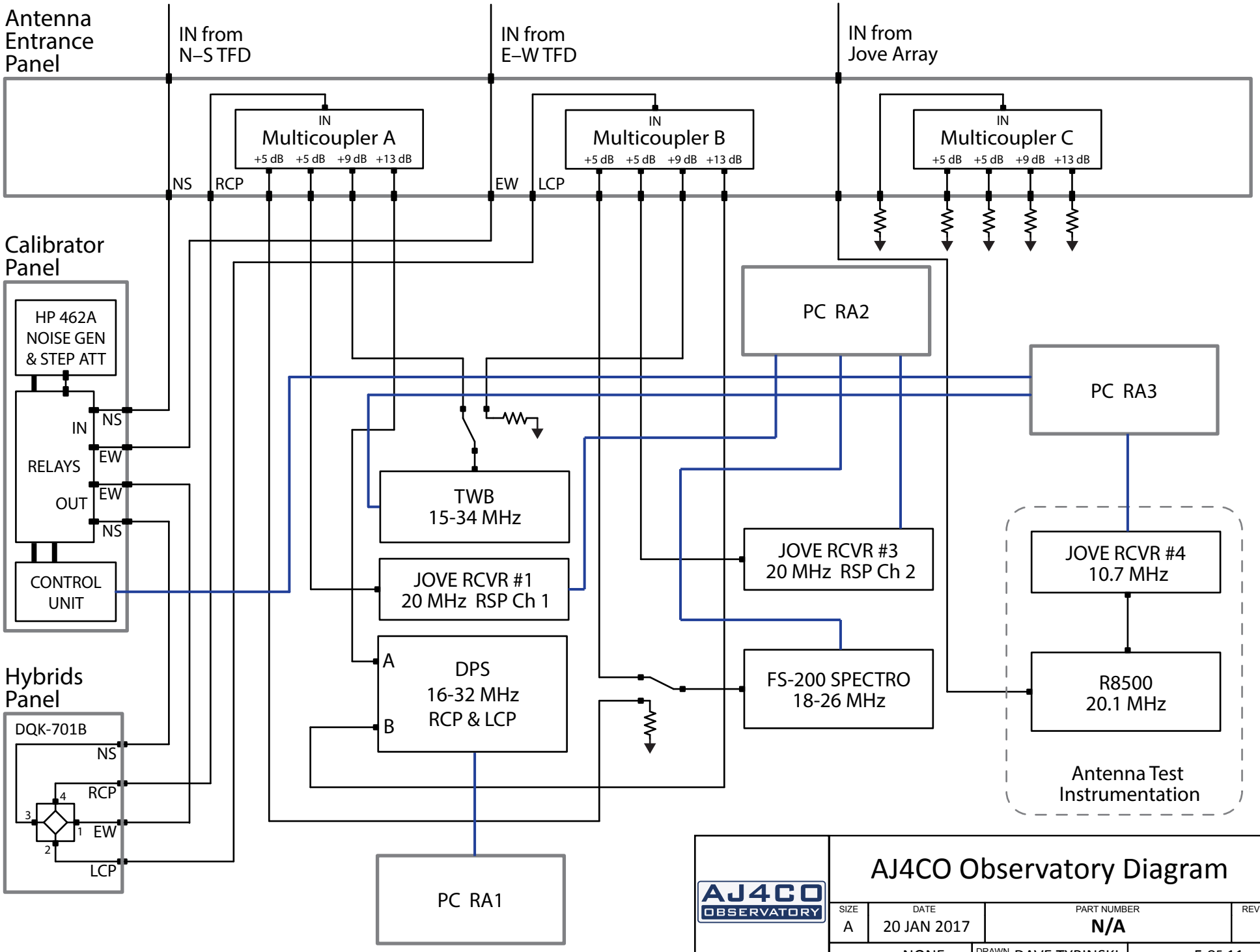
AJ4CO Observatory Diagram

SIZE	DATE	PART NUMBER	REV
A	25 FEB 2017	N/A	

SCALE	DRAWN BY	SHEET
NONE	DAVE TYPINSKI	4 OF 11


Antenna Entrance Panel
IN from N–S TFD
IN from E–W TFD
IN from Jove Array
IN
Multicoupler A
+5 dB +5 dB +9 dB +13 dB
IN
Multicoupler B
+5 dB +5 dB +9 dB +13 dB
IN
Multicoupler C
+5 dB +5 dB +9 dB +13 dB
NS
RCP
EW
LCP
Calibrator Panel
HP 462A NOISE GEN & STEP ATT
IN
RELAYS
OUT
NS
EW
EW
NS
CONTROL UNIT
Hybrids Panel
DQK-701B
NS
RCP
EW
LCP
1
2
3
4
PC RA2
PC RA3
TWB
15-34 MHz
JOVE RCVR #1
20 MHz RSP Ch 1
JOVE RCVR #3
20 MHz RSP Ch 2
JOVE RCVR #4
10.7 MHz
DPS
16-32 MHz
RCP & LCP
A
B
FS-200 SPECTRO
18-26 MHz
R8500
20.1 MHz
Antenna Test Instrumentation
PC RA1
AJ4CO OBSERVATORY
AJ4CO Observatory Diagram
SIZE A
DATE 20 JAN 2017
PART NUMBER N/A
REV
SCALE NONE
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SHEET 5 OF 11

Automatic Calibrator Temperatures – HP 462A, S/N 421-00472 + Kay 4450, S/N 9-5

T_0 (K)	290	
Noise Source Temperature (MK)	46.1	
Splitter Loss @ 20 MHz (dB)	0.2	
Effective Noise Source Temp (MK)	22.1	(after splitter)
Antenna Feed Loss @ 20 MHz (dB)	4.3	
DPS Noise Figure @ 20 MHz (dB)	3.4	= 344 K @ HYBRID INPUTS

Reference Plane: between entrance panel TFD array feeds and hybrid ring inputs.

Nom. Att. (dB)	Meas. Att. (dB)	Ref Plane Temp. (K)	Equivalent Antenna Temp. (K)
0.00	0.56	19,400,000	52,200,000
1.00	1.52	15,500,000	41,700,000
2.00	2.56	12,200,000	32,800,000
4.00	4.57	7,700,000	20,700,000
8.00	8.55	3,080,000	8,290,000
16.00	16.58	486,000	1,310,000
32.00	32.50	13,000	33,600
64.00	64.65	642	310

Nom. Att. (dB)	Meas. Att. (dB)	Ref Plane Temp. (K)	Equivalent Antenna Temp. (K)
0.00	0.56	19,400,000	52,200,000
3.00	3.43	10,000,000	26,900,000
6.00	6.47	4,970,000	13,400,000
9.00	9.45	2,500,000	6,730,000
12.00	12.58	1,220,000	3,280,000
15.00	15.48	625,000	1,680,000
18.00	18.55	309,000	830,000
21.00	21.50	157,000	421,000
24.00	24.55	78,000	209,000
27.00	27.51	39,800	106,000
30.00	30.58	19,900	52,100
33.00	33.49	10,500	26,800
36.00	36.54	5,530	13,500
39.00	39.55	3,080	6,870
42.00	42.55	1,860	3,590
45.00	45.59	1,240	1,920
48.00	48.55	943	1,120

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AJ4CO Observatory Diagram

SIZE	DATE	PART NUMBER	REV
A	03 OCT 2015	N/A	

SCALE	DRAWN BY	SHEET
NONE	DAVE TYPINSKI	6 OF 12

TFD Array Beam Steering

Time Delay Cable VoP: **66%** **ray elements N-S baseline spacing (feet):** **32**

Array elements E-W baseline spacing (feet): **32**

N-S Offset (degrees)	E-W Offset (degrees)	Delay Cable Lengths (feet & inches) A (S) / B (N)	C (S) / D (N)	E	F (W) / G (E)	H	AZ (degrees)	EL (degrees)
20 N	60 E	7' 2-3/4"	14' 5-1/4"	3' 7-1/4"	18' 3-1/2"	9' 1-3/4"	78	29
20 N	45 E	7' 2-3/4"	14' 5-1/4"	3' 7-1/4"	14' 11-1/4"	7' 5-1/2"	70	43
20 N	30 E	7' 2-3/4"	14' 5-1/4"	3' 7-1/4"	10' 6-3/4"	5' 3-1/4"	58	56
20 N	15 E	7' 2-3/4"	14' 5-1/4"	3' 7-1/4"	5' 5-1/2"	2' 8-3/4"	36	66
20 N	0	7' 2-3/4"	14' 5-1/4"	3' 7-1/4"	0"	0"	0	70
20 N	15 W	7' 2-3/4"	14' 5-1/4"	3' 7-1/4"	5' 5-1/2"	2' 8-3/4"	324	66
20 N	30 W	7' 2-3/4"	14' 5-1/4"	3' 7-1/4"	10' 6-3/4"	5' 3-1/4"	302	56
20 N	45 W	7' 2-3/4"	14' 5-1/4"	3' 7-1/4"	14' 11-1/4"	7' 5-1/2"	290	43
20 N	60 W	7' 2-3/4"	14' 5-1/4"	3' 7-1/4"	18' 3-1/2"	9' 1-3/4"	282	29
15 N	60 E	5' 5-1/2"	10' 11-1/4"	2' 8-3/4"	18' 3-1/2"	9' 1-3/4"	81	30
15 N	45 E	5' 5-1/2"	10' 11-1/4"	2' 8-3/4"	14' 11-1/4"	7' 5-1/2"	75	44
15 N	30 E	5' 5-1/2"	10' 11-1/4"	2' 8-3/4"	10' 6-3/4"	5' 3-1/4"	65	58
15 N	15 E	5' 5-1/2"	10' 11-1/4"	2' 8-3/4"	5' 5-1/2"	2' 8-3/4"	45	69
15 N	0	5' 5-1/2"	10' 11-1/4"	2' 8-3/4"	0"	0"	360	75
15 N	15 W	5' 5-1/2"	10' 11-1/4"	2' 8-3/4"	5' 5-1/2"	2' 8-3/4"	315	69
15 N	30 W	5' 5-1/2"	10' 11-1/4"	2' 8-3/4"	10' 6-3/4"	5' 3-1/4"	295	58
15 N	45 W	5' 5-1/2"	10' 11-1/4"	2' 8-3/4"	14' 11-1/4"	7' 5-1/2"	285	44
15 N	60 W	5' 5-1/2"	10' 11-1/4"	2' 8-3/4"	18' 3-1/2"	9' 1-3/4"	279	30
10 N	60 E	3' 8"	7' 4"	1' 10"	18' 3-1/2"	9' 1-3/4"	84	30
10 N	45 E	3' 8"	7' 4"	1' 10"	14' 11-1/4"	7' 5-1/2"	80	45
10 N	30 E	3' 8"	7' 4"	1' 10"	10' 6-3/4"	5' 3-1/4"	73	59
10 N	15 E	3' 8"	7' 4"	1' 10"	5' 5-1/2"	2' 8-3/4"	57	72
10 N	0	3' 8"	7' 4"	1' 10"	0"	0"	360	80
10 N	15 W	3' 8"	7' 4"	1' 10"	5' 5-1/2"	2' 8-3/4"	303	72
10 N	30 W	3' 8"	7' 4"	1' 10"	10' 6-3/4"	5' 3-1/4"	287	59
10 N	45 W	3' 8"	7' 4"	1' 10"	14' 11-1/4"	7' 5-1/2"	280	45
10 N	60 W	3' 8"	7' 4"	1' 10"	18' 3-1/2"	9' 1-3/4"	276	30

AJ4CO OBSERVATORY

AJ4CO Observatory Diagram

SIZE	DATE	PART NUMBER	REV
A	01 OCT 2014	N/A	

SCALE	DRAWN BY	SHEET
NONE	DAVE TYPINSKI	7 OF 12

TFD Array Beam Steering

Time Delay Cable VoP: **66%**

Array elements N-S baseline spacing (feet): **32**

Array elements E-W baseline spacing (feet): **32**

N-S Offset (degrees)	E-W Offset (degrees)	Delay Cable Lengths (feet & inches) A (S) / B (N)	C (S) / D (N)	E	F (W) / G (E)	H	AZ (degrees)	EL (degrees)
5 N	60 E	1' 10"	3' 8-1/4"	11"	18' 3-1/2"	9' 1-3/4"	87	30
5 N	45 E	1' 10"	3' 8-1/4"	11"	14' 11-1/4"	7' 5-1/2"	85	45
5 N	30 E	1' 10"	3' 8-1/4"	11"	10' 6-3/4"	5' 3-1/4"	81	60
5 N	15 E	1' 10"	3' 8-1/4"	11"	5' 5-1/2"	2' 8-3/4"	72	74
5 N	0	1' 10"	3' 8-1/4"	11"	0"	0"	360	85
5 N	15 W	1' 10"	3' 8-1/4"	11"	5' 5-1/2"	2' 8-3/4"	288	74
5 N	30 W	1' 10"	3' 8-1/4"	11"	10' 6-3/4"	5' 3-1/4"	279	60
5 N	45 W	1' 10"	3' 8-1/4"	11"	14' 11-1/4"	7' 5-1/2"	275	45
5 N	60 W	1' 10"	3' 8-1/4"	11"	18' 3-1/2"	9' 1-3/4"	273	30
0	60 E	0"	0"	0"	18' 3-1/2"	9' 1-3/4"	90	30
0	45 E	0"	0"	0"	14' 11-1/4"	7' 5-1/2"	90	45
0	30 E	0"	0"	0"	10' 6-3/4"	5' 3-1/4"	90	60
0	15 E	0"	0"	0"	5' 5-1/2"	2' 8-3/4"	90	75
0	0	0"	0"	0"	0"	0"	180	90
0	15 W	0"	0"	0"	5' 5-1/2"	2' 8-3/4"	270	75
0	30 W	0"	0"	0"	10' 6-3/4"	5' 3-1/4"	270	60
0	45 W	0"	0"	0"	14' 11-1/4"	7' 5-1/2"	270	45
0	60 W	0"	0"	0"	18' 3-1/2"	9' 1-3/4"	270	30
5 S	60 E	1' 10"	3' 8-1/4"	11"	18' 3-1/2"	9' 1-3/4"	93	30
5 S	45 E	1' 10"	3' 8-1/4"	11"	14' 11-1/4"	7' 5-1/2"	95	45
5 S	30 E	1' 10"	3' 8-1/4"	11"	10' 6-3/4"	5' 3-1/4"	99	60
5 S	15 E	1' 10"	3' 8-1/4"	11"	5' 5-1/2"	2' 8-3/4"	108	74
5 S	0	1' 10"	3' 8-1/4"	11"	0"	0"	180	85
5 S	15 W	1' 10"	3' 8-1/4"	11"	5' 5-1/2"	2' 8-3/4"	252	74
5 S	30 W	1' 10"	3' 8-1/4"	11"	10' 6-3/4"	5' 3-1/4"	261	60
5 S	45 W	1' 10"	3' 8-1/4"	11"	14' 11-1/4"	7' 5-1/2"	265	45
5 S	60 W	1' 10"	3' 8-1/4"	11"	18' 3-1/2"	9' 1-3/4"	267	30

AJ4CO OBSERVATORY

AJ4CO Observatory Diagram

SIZE	DATE	PART NUMBER	REV
A	01 OCT 2014	N/A	

SCALE	DRAWN BY	SHEET
NONE	DAVE TYPINSKI	8 OF 12

TFD Array Beam Steering

Time Delay Cable VoP: **66%**

Array elements N-S baseline spacing (feet): **32**

Array elements E-W baseline spacing (feet): **32**

N-S Offset (degrees)	E-W Offset (degrees)	Delay Cable Lengths (feet & inches) A (S) / B (N)	C (S) / D (N)	E	F (W) / G (E)	H	AZ (degrees)	EL (degrees)
10 S	60 E	3' 8"	7' 4"	1' 10"	18' 3-1/2"	9' 1-3/4"	96	30
10 S	45 E	3' 8"	7' 4"	1' 10"	14' 11-1/4"	7' 5-1/2"	100	45
10 S	30 E	3' 8"	7' 4"	1' 10"	10' 6-3/4"	5' 3-1/4"	107	59
10 S	15 E	3' 8"	7' 4"	1' 10"	5' 5-1/2"	2' 8-3/4"	123	72
10 S	0	3' 8"	7' 4"	1' 10"	0"	0"	180	80
10 S	15 W	3' 8"	7' 4"	1' 10"	5' 5-1/2"	2' 8-3/4"	237	72
10 S	30 W	3' 8"	7' 4"	1' 10"	10' 6-3/4"	5' 3-1/4"	253	59
10 S	45 W	3' 8"	7' 4"	1' 10"	14' 11-1/4"	7' 5-1/2"	260	45
10 S	60 W	3' 8"	7' 4"	1' 10"	18' 3-1/2"	9' 1-3/4"	264	30
15 S	60 E	5' 5-1/2"	10' 11-1/4"	2' 8-3/4"	18' 3-1/2"	9' 1-3/4"	99	30
15 S	45 E	5' 5-1/2"	10' 11-1/4"	2' 8-3/4"	14' 11-1/4"	7' 5-1/2"	105	44
15 S	30 E	5' 5-1/2"	10' 11-1/4"	2' 8-3/4"	10' 6-3/4"	5' 3-1/4"	115	58
15 S	15 E	5' 5-1/2"	10' 11-1/4"	2' 8-3/4"	5' 5-1/2"	2' 8-3/4"	135	69
15 S	0	5' 5-1/2"	10' 11-1/4"	2' 8-3/4"	0"	0"	180	75
15 S	15 W	5' 5-1/2"	10' 11-1/4"	2' 8-3/4"	5' 5-1/2"	2' 8-3/4"	225	69
15 S	30 W	5' 5-1/2"	10' 11-1/4"	2' 8-3/4"	10' 6-3/4"	5' 3-1/4"	245	58
15 S	45 W	5' 5-1/2"	10' 11-1/4"	2' 8-3/4"	14' 11-1/4"	7' 5-1/2"	255	44
15 S	60 W	5' 5-1/2"	10' 11-1/4"	2' 8-3/4"	18' 3-1/2"	9' 1-3/4"	261	30
20 S	60 E	7' 2-3/4"	14' 5-1/4"	3' 7-1/4"	18' 3-1/2"	9' 1-3/4"	102	29
20 S	45 E	7' 2-3/4"	14' 5-1/4"	3' 7-1/4"	14' 11-1/4"	7' 5-1/2"	110	43
20 S	30 E	7' 2-3/4"	14' 5-1/4"	3' 7-1/4"	10' 6-3/4"	5' 3-1/4"	122	56
20 S	15 E	7' 2-3/4"	14' 5-1/4"	3' 7-1/4"	5' 5-1/2"	2' 8-3/4"	144	66
20 S	0	7' 2-3/4"	14' 5-1/4"	3' 7-1/4"	0"	0"	180	70
20 S	15 W	7' 2-3/4"	14' 5-1/4"	3' 7-1/4"	5' 5-1/2"	2' 8-3/4"	216	66
20 S	30 W	7' 2-3/4"	14' 5-1/4"	3' 7-1/4"	10' 6-3/4"	5' 3-1/4"	238	56
20 S	45 W	7' 2-3/4"	14' 5-1/4"	3' 7-1/4"	14' 11-1/4"	7' 5-1/2"	250	43
20 S	60 W	7' 2-3/4"	14' 5-1/4"	3' 7-1/4"	18' 3-1/2"	9' 1-3/4"	258	29

AJ4CO OBSERVATORY

AJ4CO Observatory Diagram

SIZE	DATE	PART NUMBER	REV
A	01 OCT 2014	N/A	

SCALE	DRAWN BY	SHEET
NONE	DAVE TYPINSKI	9 OF 12

TFD Array Beam Steering

Time Delay Cable VoP: 66%

Array elements N-S baseline spacing (feet): 32

Array elements E-W baseline spacing (feet): 32

N-S Offset (degrees)	E-W Offset (degrees)	Delay Cable Lengths (feet & inches) A (S) / B (N)	C (S) / D (N)	E	F (W) / G (E)	H	AZ (degrees)	EL (degrees)
25 S	60 E	8' 11"	17' 10-1/4"	4' 5-1/2"	18' 3-1/2"	9' 1-3/4"	105	29
25 S	45 E	8' 11"	17' 10-1/4"	4' 5-1/2"	14' 11-1/4"	7' 5-1/2"	115	42
25 S	30 E	8' 11"	17' 10-1/4"	4' 5-1/2"	10' 6-3/4"	5' 3-1/4"	129	53
25 S	15 E	8' 11"	17' 10-1/4"	4' 5-1/2"	5' 5-1/2"	2' 8-3/4"	150	62
25 S	0	8' 11"	17' 10-1/4"	4' 5-1/2"	0"	0"	180	65
25 S	15 W	8' 11"	17' 10-1/4"	4' 5-1/2"	5' 5-1/2"	2' 8-3/4"	210	62
25 S	30 W	8' 11"	17' 10-1/4"	4' 5-1/2"	10' 6-3/4"	5' 3-1/4"	231	53
25 S	45 W	8' 11"	17' 10-1/4"	4' 5-1/2"	14' 11-1/4"	7' 5-1/2"	245	42
25 S	60 W	8' 11"	17' 10-1/4"	4' 5-1/2"	18' 3-1/2"	9' 1-3/4"	255	29
30 S	60 E	10' 6-3/4"	21' 1-1/2"	5' 3-1/4"	18' 3-1/2"	9' 1-3/4"	108	29
30 S	45 E	10' 6-3/4"	21' 1-1/2"	5' 3-1/4"	14' 11-1/4"	7' 5-1/2"	120	41
30 S	30 E	10' 6-3/4"	21' 1-1/2"	5' 3-1/4"	10' 6-3/4"	5' 3-1/4"	135	51
30 S	15 E	10' 6-3/4"	21' 1-1/2"	5' 3-1/4"	5' 5-1/2"	2' 8-3/4"	155	58
30 S	0	10' 6-3/4"	21' 1-1/2"	5' 3-1/4"	0"	0"	180	60
30 S	15 W	10' 6-3/4"	21' 1-1/2"	5' 3-1/4"	5' 5-1/2"	2' 8-3/4"	205	58
30 S	30 W	10' 6-3/4"	21' 1-1/2"	5' 3-1/4"	10' 6-3/4"	5' 3-1/4"	225	51
30 S	45 W	10' 6-3/4"	21' 1-1/2"	5' 3-1/4"	14' 11-1/4"	7' 5-1/2"	240	41
30 S	60 W	10' 6-3/4"	21' 1-1/2"	5' 3-1/4"	18' 3-1/2"	9' 1-3/4"	252	29
35 S	60 E	12' 1-1/4"	24' 2-3/4"	6' 0-3/4"	18' 3-1/2"	9' 1-3/4"	112	28
35 S	45 E	12' 1-1/4"	24' 2-3/4"	6' 0-3/4"	14' 11-1/4"	7' 5-1/2"	125	39
35 S	30 E	12' 1-1/4"	24' 2-3/4"	6' 0-3/4"	10' 6-3/4"	5' 3-1/4"	140	48
35 S	15 E	12' 1-1/4"	24' 2-3/4"	6' 0-3/4"	5' 5-1/2"	2' 8-3/4"	159	53
35 S	0	12' 1-1/4"	24' 2-3/4"	6' 0-3/4"	0"	0"	180	55
35 S	15 W	12' 1-1/4"	24' 2-3/4"	6' 0-3/4"	5' 5-1/2"	2' 8-3/4"	201	53
35 S	30 W	12' 1-1/4"	24' 2-3/4"	6' 0-3/4"	10' 6-3/4"	5' 3-1/4"	220	48
35 S	45 W	12' 1-1/4"	24' 2-3/4"	6' 0-3/4"	14' 11-1/4"	7' 5-1/2"	235	39
35 S	60 W	12' 1-1/4"	24' 2-3/4"	6' 0-3/4"	18' 3-1/2"	9' 1-3/4"	248	28

AJ4CO OBSERVATORY

AJ4CO Observatory Diagram

SIZE	DATE	PART NUMBER	REV
A	01 OCT 2014	N/A	

SCALE	DRAWN BY	SHEET
NONE	DAVE TYPINSKI	10 OF 12

TFD Array Beam Steering

Time Delay Cable VoP: **66%**

Array elements N-S baseline spacing (feet): **32**

Array elements E-W baseline spacing (feet): **32**

N-S Offset (degrees)	E-W Offset (degrees)	Delay Cable Lengths (feet & inches) A (S) / B (N)	C (S) / D (N)	E	F (W) / G (E)	H	AZ (degrees)	EL (degrees)
40 S	60 E	13' 7"	27' 1-3/4"	6' 9-1/2"	18' 3-1/2"	9' 1-3/4"	116	27
40 S	45 E	13' 7"	27' 1-3/4"	6' 9-1/2"	14' 11-1/4"	7' 5-1/2"	130	37
40 S	30 E	13' 7"	27' 1-3/4"	6' 9-1/2"	10' 6-3/4"	5' 3-1/4"	145	44
40 S	15 E	13' 7"	27' 1-3/4"	6' 9-1/2"	5' 5-1/2"	2' 8-3/4"	162	49
40 S	0	13' 7"	27' 1-3/4"	6' 9-1/2"	0"	0"	180	50
40 S	15 W	13' 7"	27' 1-3/4"	6' 9-1/2"	5' 5-1/2"	2' 8-3/4"	198	49
40 S	30 W	13' 7"	27' 1-3/4"	6' 9-1/2"	10' 6-3/4"	5' 3-1/4"	215	44
40 S	45 W	13' 7"	27' 1-3/4"	6' 9-1/2"	14' 11-1/4"	7' 5-1/2"	230	37
40 S	60 W	13' 7"	27' 1-3/4"	6' 9-1/2"	18' 3-1/2"	9' 1-3/4"	244	27
45 S	60 E	14' 11-1/4"	29' 10-1/2"	7' 5-1/2"	18' 3-1/2"	9' 1-3/4"	120	27
45 S	45 E	14' 11-1/4"	29' 10-1/2"	7' 5-1/2"	14' 11-1/4"	7' 5-1/2"	135	35
45 S	30 E	14' 11-1/4"	29' 10-1/2"	7' 5-1/2"	10' 6-3/4"	5' 3-1/4"	150	41
45 S	15 E	14' 11-1/4"	29' 10-1/2"	7' 5-1/2"	5' 5-1/2"	2' 8-3/4"	165	44
45 S	0	14' 11-1/4"	29' 10-1/2"	7' 5-1/2"	0"	0"	180	45
45 S	15 W	14' 11-1/4"	29' 10-1/2"	7' 5-1/2"	5' 5-1/2"	2' 8-3/4"	195	44
45 S	30 W	14' 11-1/4"	29' 10-1/2"	7' 5-1/2"	10' 6-3/4"	5' 3-1/4"	210	41
45 S	45 W	14' 11-1/4"	29' 10-1/2"	7' 5-1/2"	14' 11-1/4"	7' 5-1/2"	225	35
45 S	60 W	14' 11-1/4"	29' 10-1/2"	7' 5-1/2"	18' 3-1/2"	9' 1-3/4"	240	27
50 S	60 E	16' 2-1/4"	32' 4-1/4"	8' 1"	18' 3-1/2"	9' 1-3/4"	125	25
50 S	45 E	16' 2-1/4"	32' 4-1/4"	8' 1"	14' 11-1/4"	7' 5-1/2"	140	33
50 S	30 E	16' 2-1/4"	32' 4-1/4"	8' 1"	10' 6-3/4"	5' 3-1/4"	154	37
50 S	15 E	16' 2-1/4"	32' 4-1/4"	8' 1"	5' 5-1/2"	2' 8-3/4"	167	39
50 S	0	16' 2-1/4"	32' 4-1/4"	8' 1"	0"	0"	180	40
50 S	15 W	16' 2-1/4"	32' 4-1/4"	8' 1"	5' 5-1/2"	2' 8-3/4"	193	39
50 S	30 W	16' 2-1/4"	32' 4-1/4"	8' 1"	10' 6-3/4"	5' 3-1/4"	206	37
50 S	45 W	16' 2-1/4"	32' 4-1/4"	8' 1"	14' 11-1/4"	7' 5-1/2"	220	33
50 S	60 W	16' 2-1/4"	32' 4-1/4"	8' 1"	18' 3-1/2"	9' 1-3/4"	235	25

AJ4CO OBSERVATORY

AJ4CO Observatory Diagram

SIZE	DATE	PART NUMBER	REV
A	01 OCT 2014	N/A	

SCALE	DRAWN BY	SHEET
NONE	DAVE TYPINSKI	11 OF 12

TFD Array Beam Steering

Time Delay Cable VoP: **66%**

Array elements N-S baseline spacing (feet): **32**

Array elements E-W baseline spacing (feet): **32**

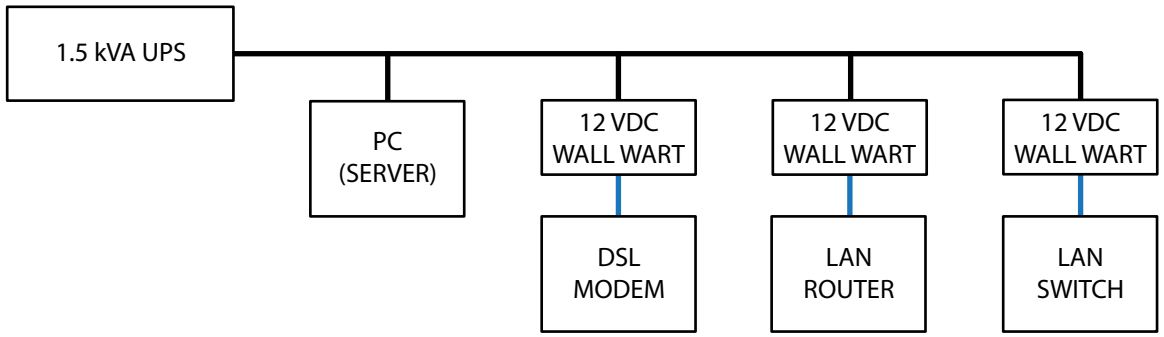
N-S Offset (degrees)	E-W Offset (degrees)	Delay Cable Lengths (feet & inches)					AZ (degrees)	EL (degrees)
		A (S) / B (N)	C (S) / D (N)	E	F (W) / G (E)	H		
55 S	60 E	17' 3-1/2"	34' 7-1/4"	8' 7-3/4"	18' 3-1/2"	9' 1-3/4"	130	24
55 S	45 E	17' 3-1/2"	34' 7-1/4"	8' 7-3/4"	14' 11-1/4"	7' 5-1/2"	145	30
55 S	30 E	17' 3-1/2"	34' 7-1/4"	8' 7-3/4"	10' 6-3/4"	5' 3-1/4"	158	33
55 S	15 E	17' 3-1/2"	34' 7-1/4"	8' 7-3/4"	5' 5-1/2"	2' 8-3/4"	169	35
55 S	0	17' 3-1/2"	34' 7-1/4"	8' 7-3/4"	0"	0"	180	35
55 S	15 W	17' 3-1/2"	34' 7-1/4"	8' 7-3/4"	5' 5-1/2"	2' 8-3/4"	191	35
55 S	30 W	17' 3-1/2"	34' 7-1/4"	8' 7-3/4"	10' 6-3/4"	5' 3-1/4"	202	33
55 S	45 W	17' 3-1/2"	34' 7-1/4"	8' 7-3/4"	14' 11-1/4"	7' 5-1/2"	215	30
55 S	60 W	17' 3-1/2"	34' 7-1/4"	8' 7-3/4"	18' 3-1/2"	9' 1-3/4"	230	24
60 S	60 E	18' 3-1/2"	36' 7"	9' 1-3/4"	18' 3-1/2"	9' 1-3/4"	135	22
60 S	45 E	18' 3-1/2"	36' 7"	9' 1-3/4"	14' 11-1/4"	7' 5-1/2"	150	27
60 S	30 E	18' 3-1/2"	36' 7"	9' 1-3/4"	10' 6-3/4"	5' 3-1/4"	162	29
60 S	15 E	18' 3-1/2"	36' 7"	9' 1-3/4"	5' 5-1/2"	2' 8-3/4"	171	30
60 S	0	18' 3-1/2"	36' 7"	9' 1-3/4"	0"	0"	180	30
60 S	15 W	18' 3-1/2"	36' 7"	9' 1-3/4"	5' 5-1/2"	2' 8-3/4"	189	30
60 S	30 W	18' 3-1/2"	36' 7"	9' 1-3/4"	10' 6-3/4"	5' 3-1/4"	198	29
60 S	45 W	18' 3-1/2"	36' 7"	9' 1-3/4"	14' 11-1/4"	7' 5-1/2"	210	27
60 S	60 W	18' 3-1/2"	36' 7"	9' 1-3/4"	18' 3-1/2"	9' 1-3/4"	225	22

AJ4CO OBSERVATORY

AJ4CO Observatory Diagram

SIZE	DATE	PART NUMBER	REV
A	01 OCT 2014	N/A	

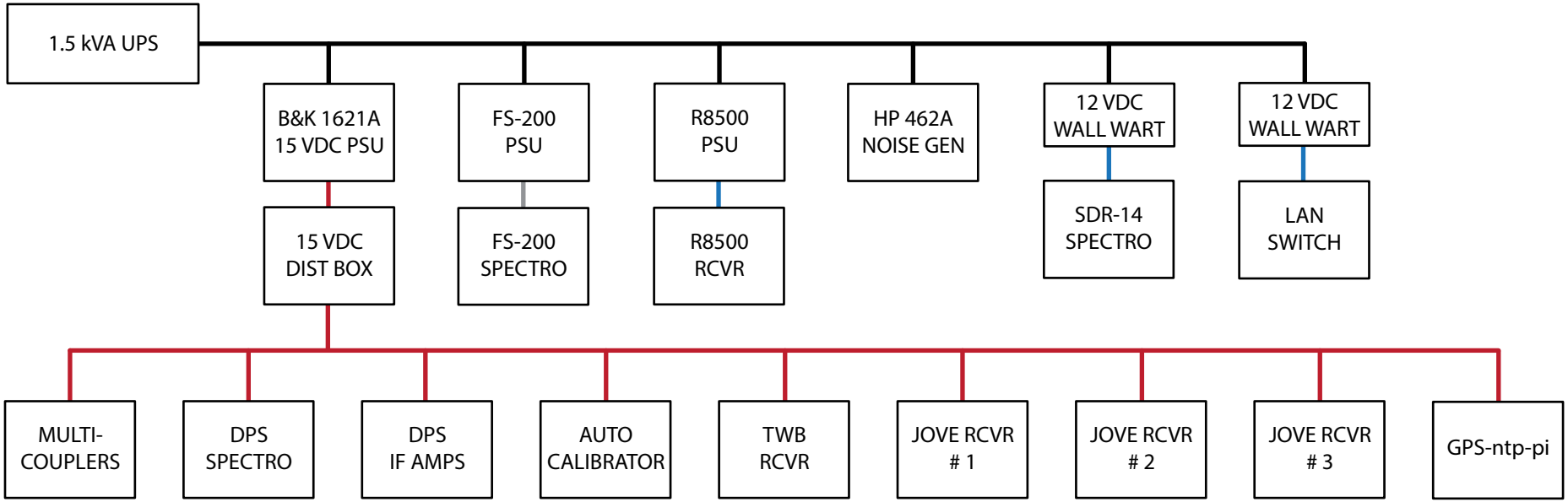
SCALE	DRAWN BY	SHEET
NONE	DAVE TYPINSKI	12 OF 12

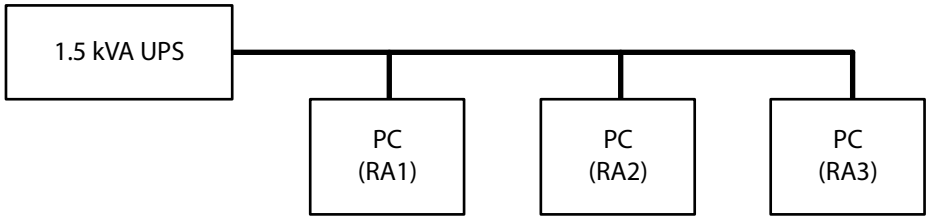


15 VDC Power Requirement

Equipment	Draw (mA)	
Multicouplers	330	110 mA/ea
DPS Spectro	720	
DPS IF Strips	570	95 mA each
Calibrator	710	7 Kay pads @ 80 mA/ea + 2 Ant Ry's @ 75 mA/ea
TWB Rcvr	250	
Jove Rcvrs	240	80 mA/ea
GPS-ntp-pi	120	

Total: 2.94 Amps





AJ4CO OBSERVATORY

Power Distribution

SIZE	DATE	PART NUMBER	REV
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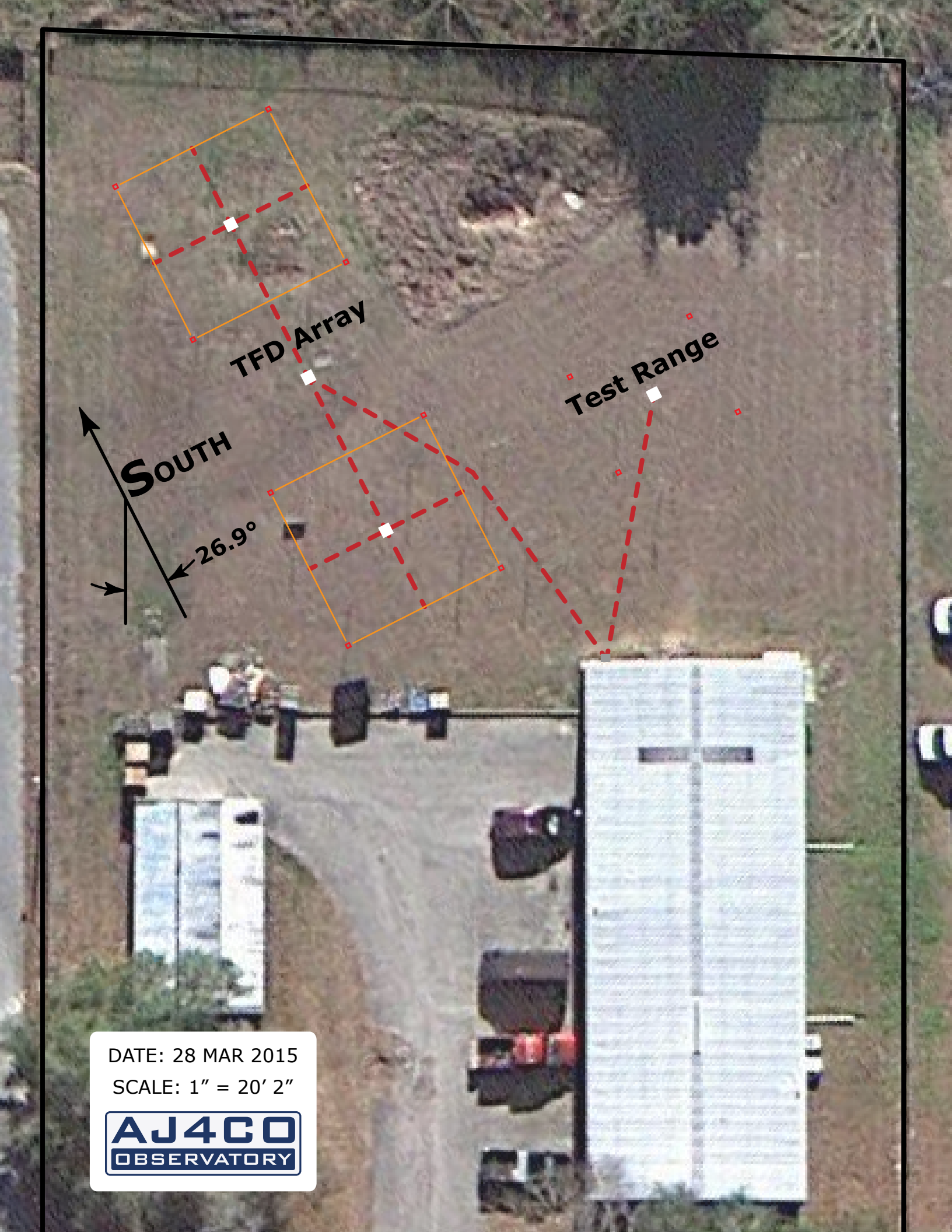
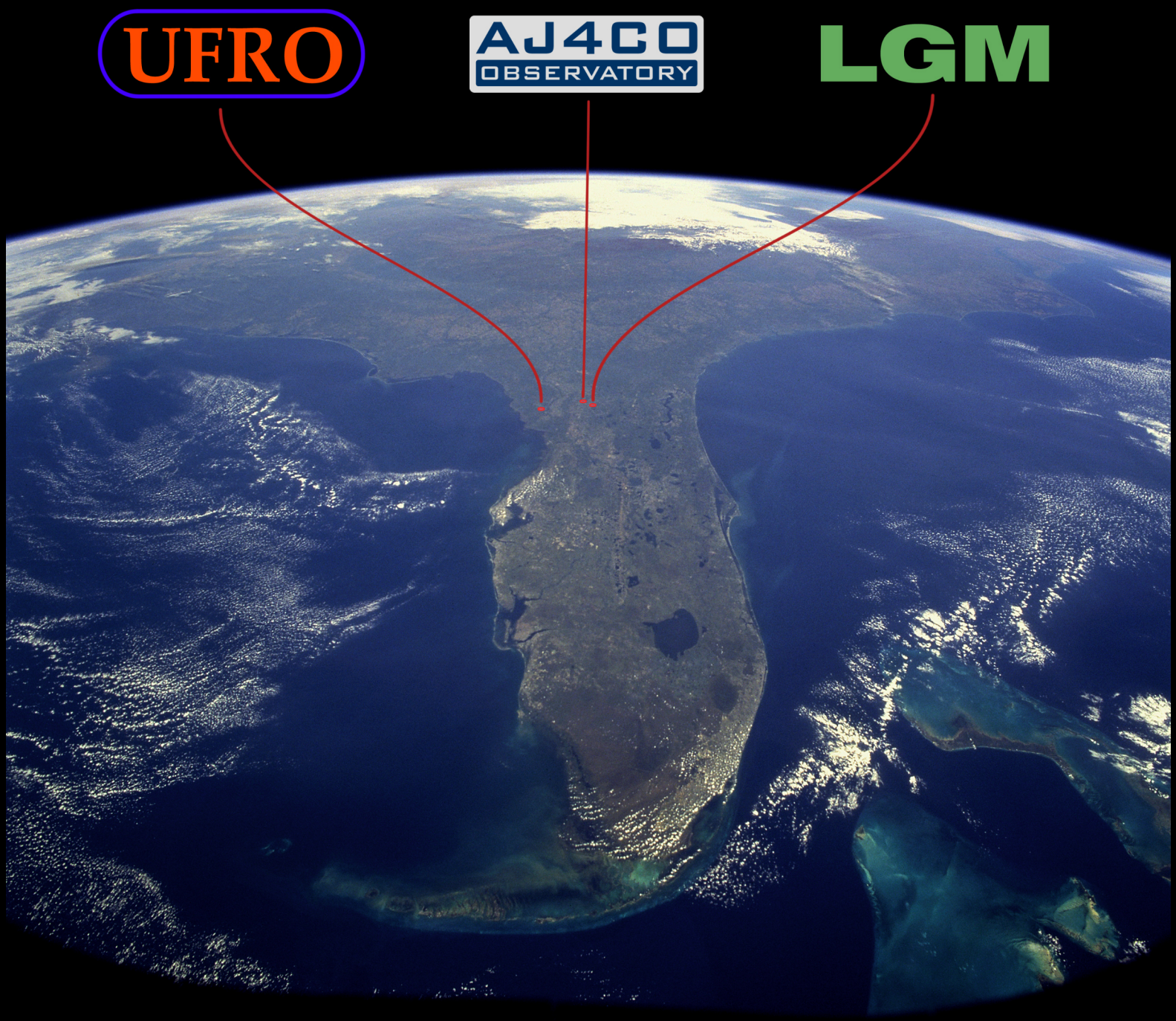
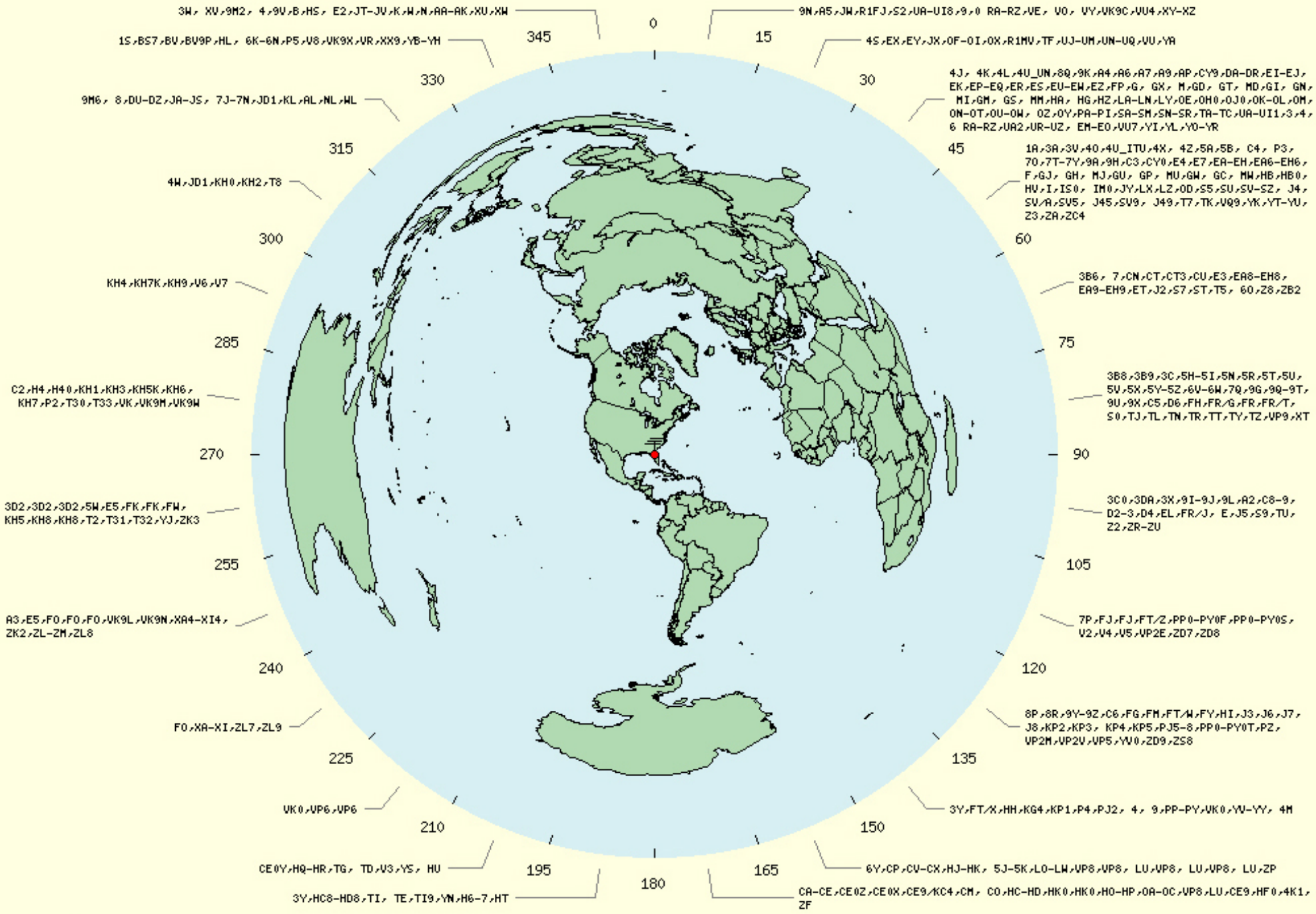
NONE	DAVE TYPINSKI	1 OF 1


TFD Array
Test Range
SOUTH
26.9°
DATE: 28 MAR 2015
SCALE: 1” = 20’ 2”
AJ4CO
OBSERVATORY


UFRO
AJ4CO
OBSERVATORY
LGM



QTH : EL89QU
http://ok2pbq.host.sk

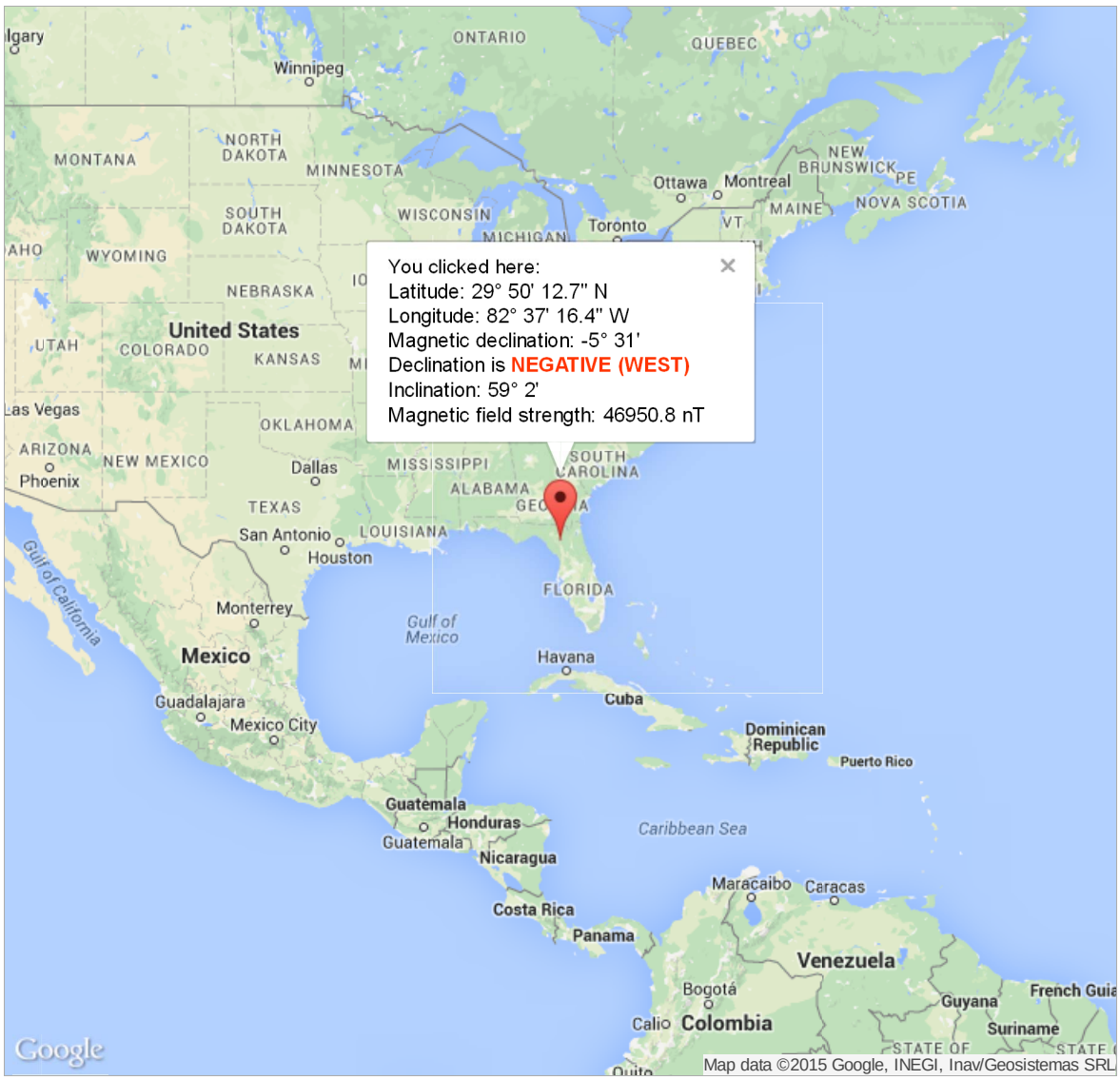
Find the magnetic declination at your location

Find your location or click on the map to display your magnetic declination

Browse countries What is Magnetic Declination?

Sites of Interest
Real Time Cinema
Satellite tracking
Radio Astronomy

Find your location
high springs
USA
FLORIDA
::SEARCH MAP::
Browse countries
1 HIGH SPRINGS FL



SHARE

Questions? webmaster@magnetic-declination.com

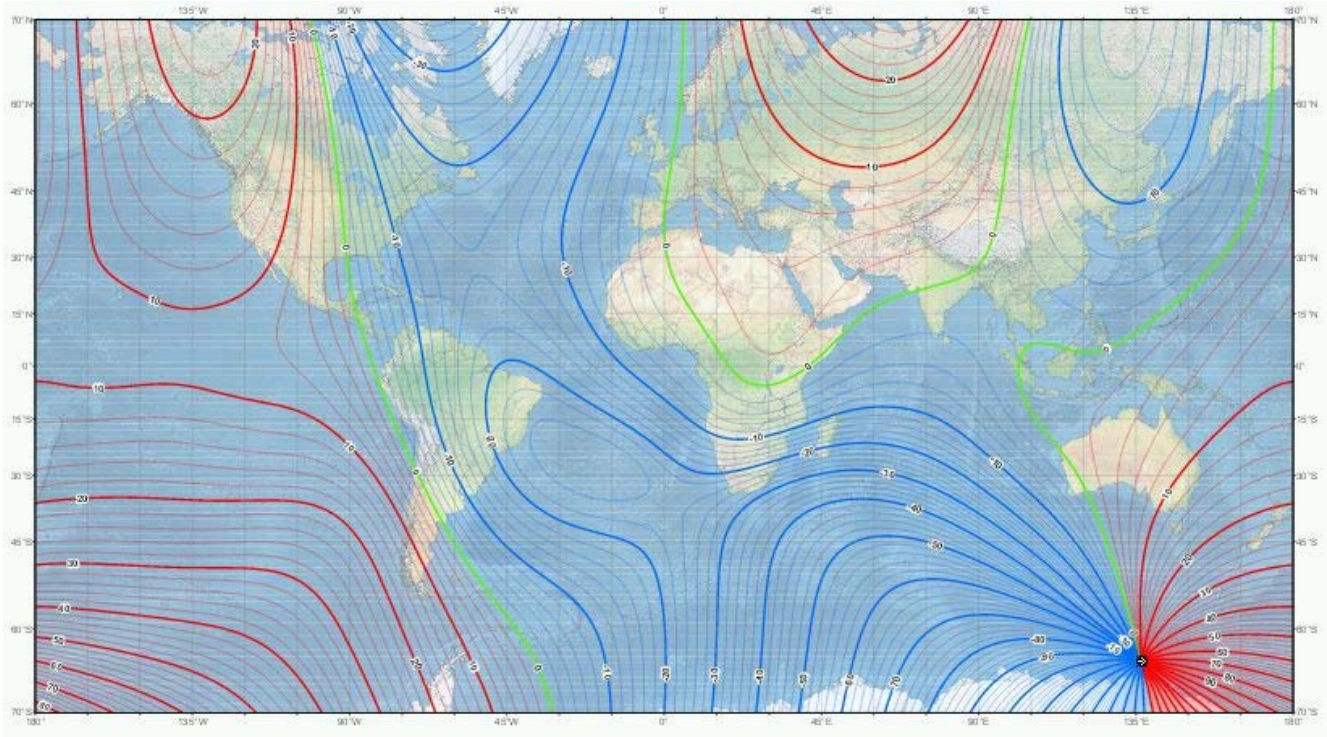
Check your declination

Find the magnetic declination at your location

What is Magnetic Declination?

Did you know that magnetic compass does not always point to North? Actually, there are only a few locations on Earth where it points exactly to the True (geographic) North. The direction in which the compass needle points is known as Magnetic North, and the angle between Magnetic North and the True North direction is called **magnetic declination**.

Magnetic declination varies both from place to place, and with the passage of time. As a traveller cruises the east coast of the United States, for example, the declination varies from 20 degrees west (in Maine) to zero (in Florida), to 10 degrees east (in Texas), meaning a compass adjusted at the beginning of the journey would have a true north error of over 30 degrees if not adjusted for the changing declination. The magnetic declination in a given area will change slowly over time, possibly as much as 2-25 degrees every hundred years or so, depending upon how far from the magnetic poles it is. Complex fluid motion in the outer core of the Earth (the molten metallic region that lies from 2800 to 5000 km below the Earth's surface) causes the magnetic field to change slowly with time. This change is known as secular variation. Because of secular variation, declination values shown on old topographic, marine and aeronautical charts need to be updated if they are to be used without large errors. Unfortunately, the annual change corrections given on most of these maps cannot be applied reliably if the maps are more than a few years old since the secular variation also changes with time in an unpredictable manner.



If the compass at your place is pointing **clockwise** with respect to the True North, declination is **positive** or **EAST**

If the compass at your place is pointing **counter-clockwise** with respect to the True North, declination is **negative** or **WEST**

Negative declination (WEST)

Positive declination (EAST)

How can we calculate declination at any given place?

One way would be to use declination maps. Unfortunately because of secular variation, declination values are constantly changing. When printed maps were the only way of getting this information, the declination values were somewhat out of date by the time the maps got to the general public.

Another way would be to perform a prediction. This should be based on a world-wide empirical model of the deep flows. This web page operated by the National Geophysical Data Center (NDGC) offers a pretty good value for declination. The model reflects a highly predictable rate of change, and will usually be more accurate than a map, and almost never less accurate.

The best way however is to use **the current web site**, which offers in a graphical format using Google Maps API the computed declination for any place on Earth. The algorithm implements the World Magnetic Model WMM2015.