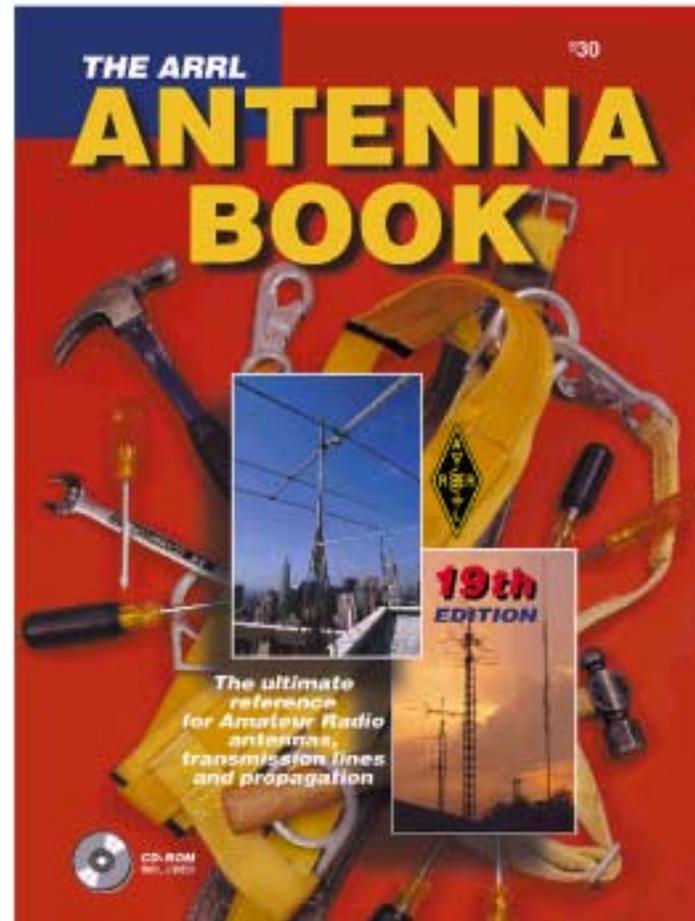# What's New in the 19th Edition of *The ARRL Antenna Book*?

By R. Dean Straw, N6BV
Senior Assistant Technical
Editor, ARRL

Dayton, May 2001

Major Changes

Nine chapters were greatly upgraded or even completely rewritten -- About 40% of the book changed materially.

The material in the book + augmented software/data is available on CD-ROM also.

I received tremendous help from the following contributors:

Rudy Severns, N6LF -- Chap 8, Multielement Arrays

Frank Witt, AI1H -- Chap 9, Broadband Antenna Matching

LB Cebik, W4RNL -- Chap 10, LPDAs

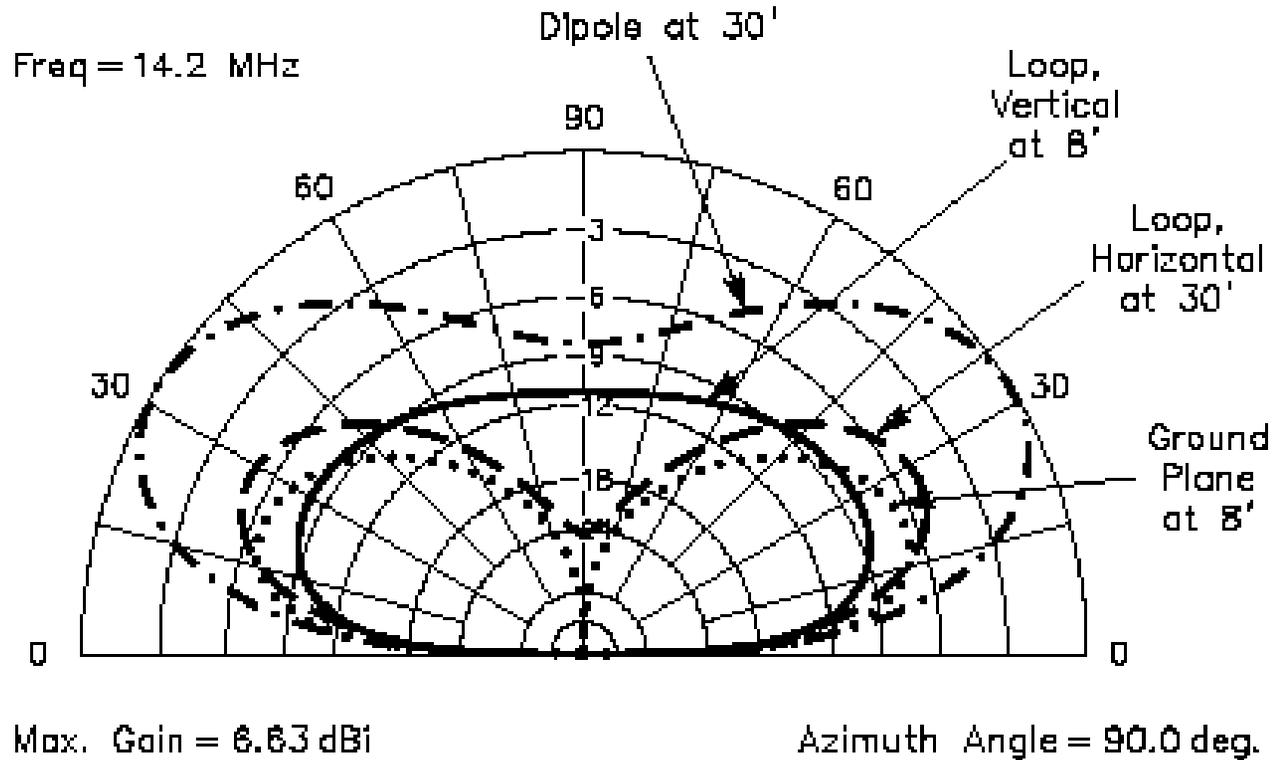Kurt Andress, K7NV -- Chap 22, Antenna Supports

Major Changes

Here are some examples of the kind of changes you'll find in the paper book.

You'll find lots of comparisons of antennas thanks to the latest computer modeling software.
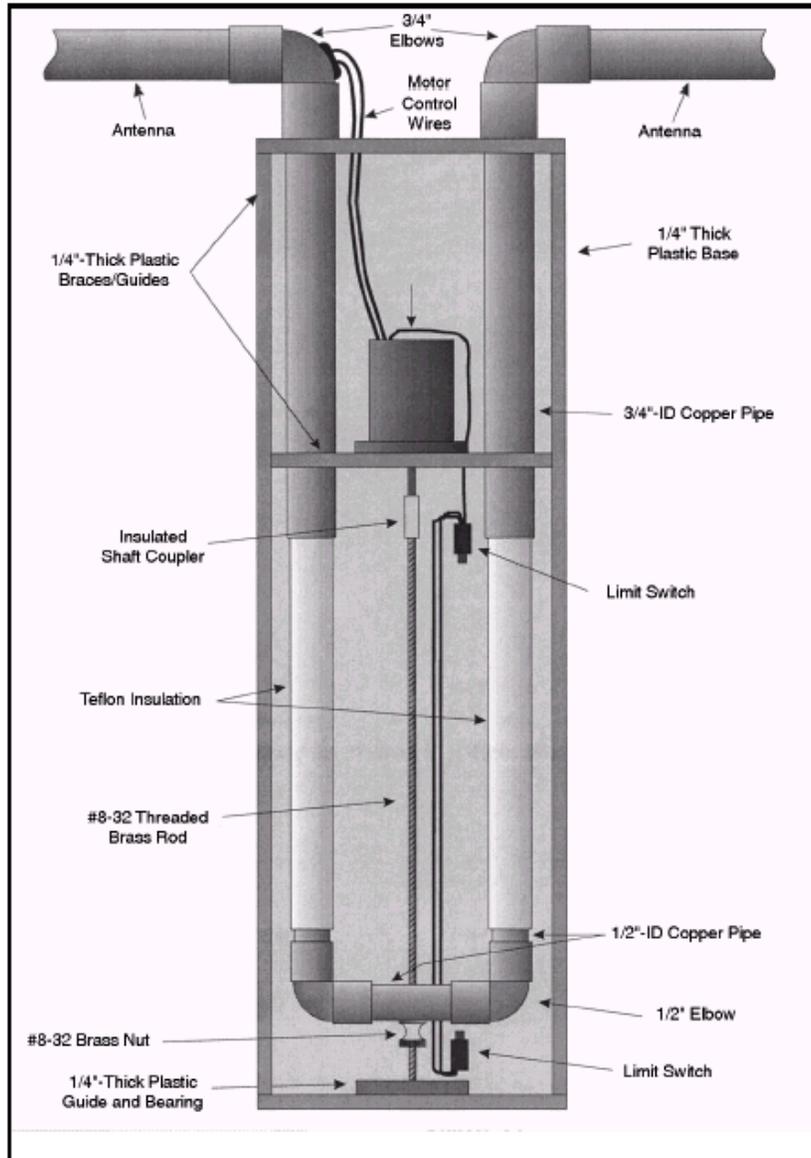
Chap 5, Loops

Freq = 14.2 MHz

Dipole at 30'

Loop, Vertical at 8'

Loop, Horizontal at 30'

Ground Plane at 8'

Max. Gain = 6.63 dBi   Azimuth Angle = 90.0 deg.

Comparing 16.2" wide loops at 14.2 MHz
to dipole and ground plane.

Chap 5, Loops

3/4"
Elbows

Motor
Control
Wires

Antenna

Antenna

1/4"-Thick Plastic
Braces/Guides

1/4" Thick
Plastic Base

3/4"-ID Copper Pipe

Insulated
Shaft Coupler

Limit Switch

Teflon Insulation

#8-32 Threaded
Brass Rod

1/2"-ID Copper Pipe
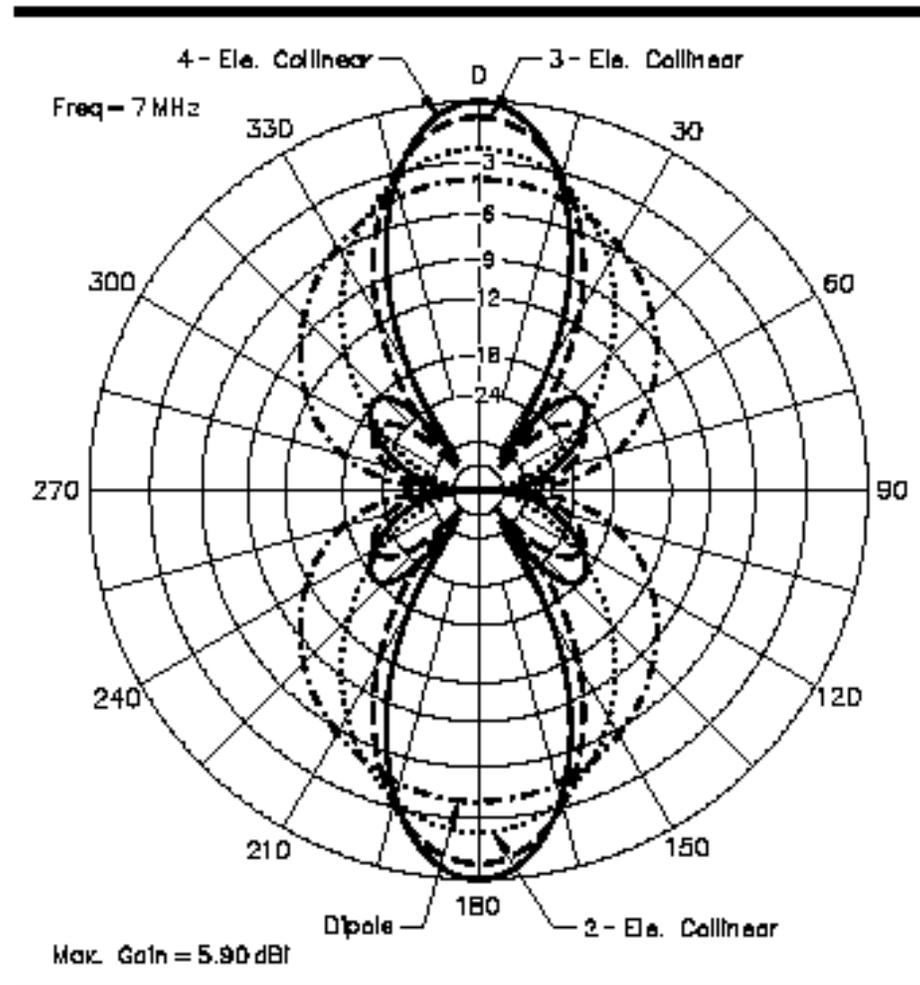
#8-32 Brass Nut

1/2" Elbow

1/4"-Thick Plastic
Guide and Bearing

Limit Switch

A neat high-voltage "trombone" variable capacitor, made of 3/4" and 1/2" copper pipes and Teflon tape insulation.
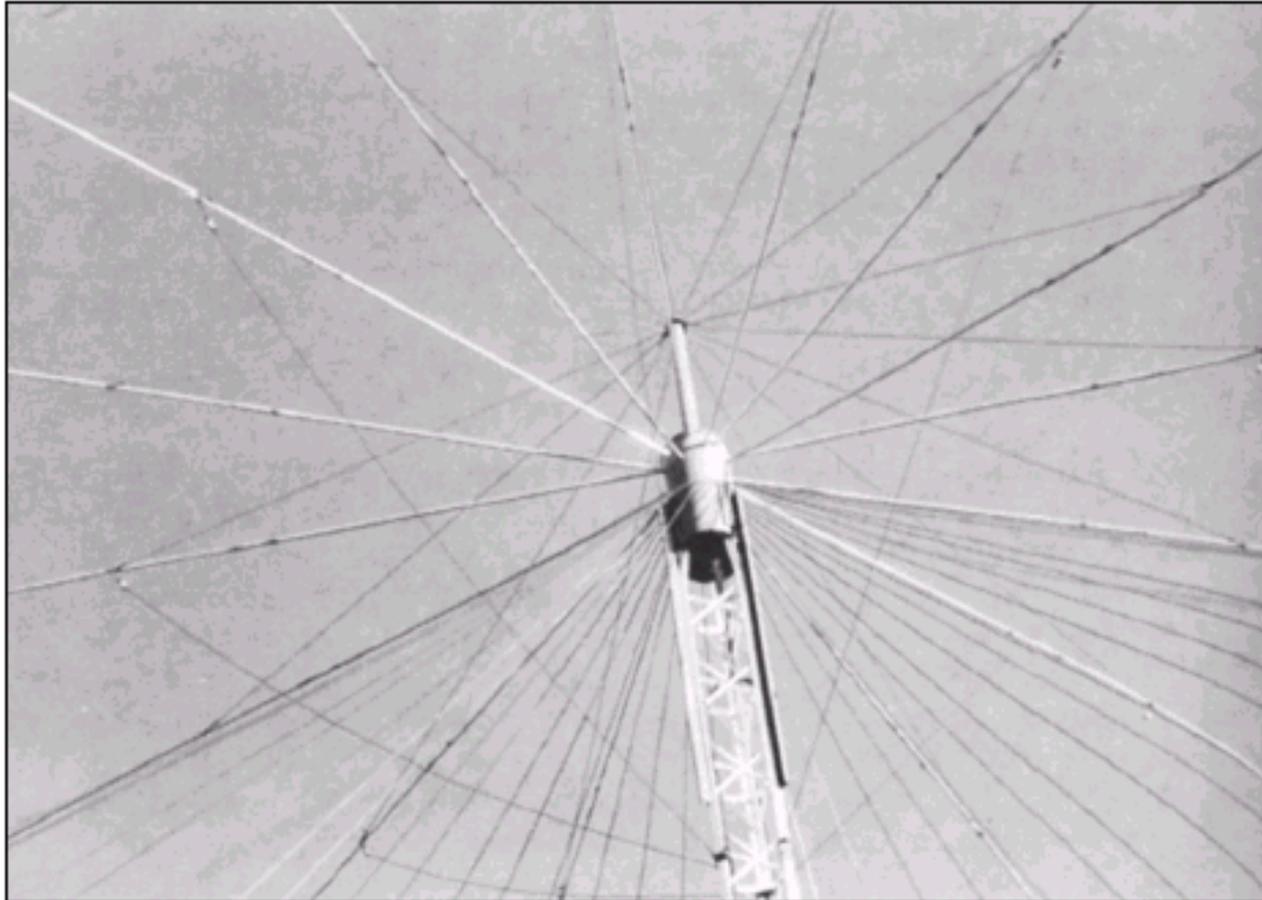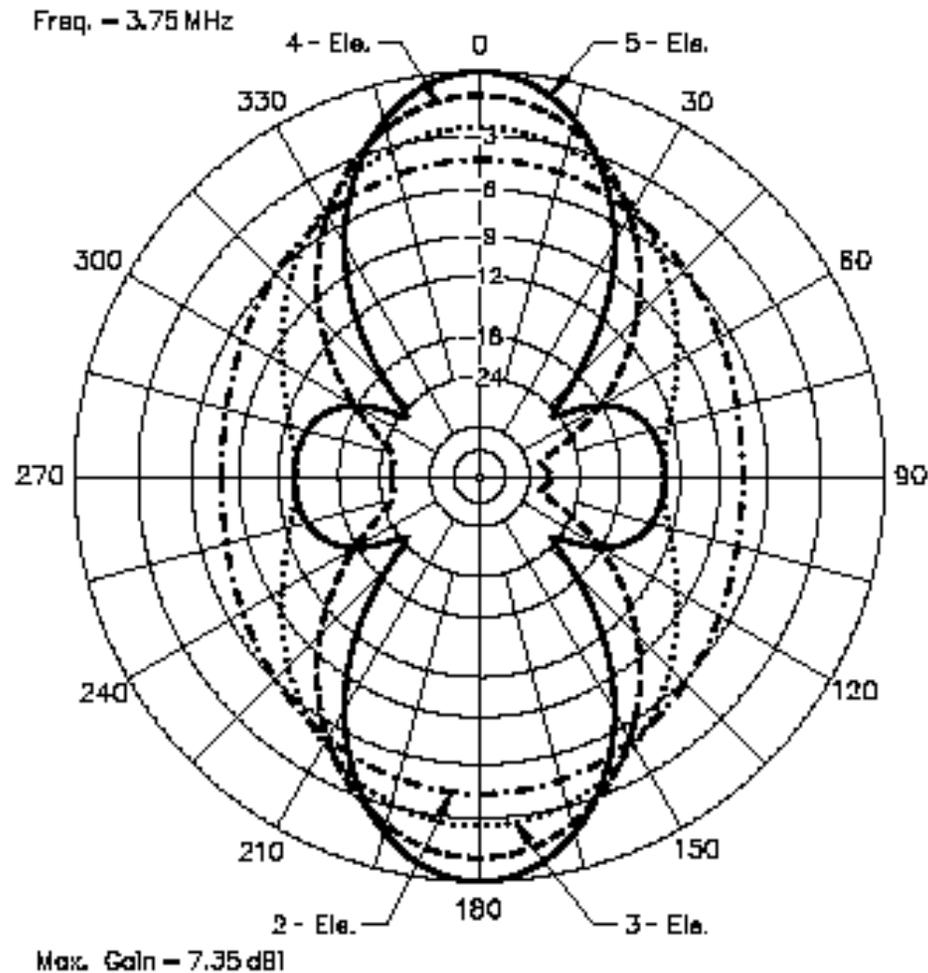
A *really* big Discone at W8NWF!

Chap 8, Multielement Arrays

Dipole compared to 2-, 3- and 4-element Collinear arrays

Patterns for various Bruce arrays

Transmission Line Resonator

Chap 10, LPDAs
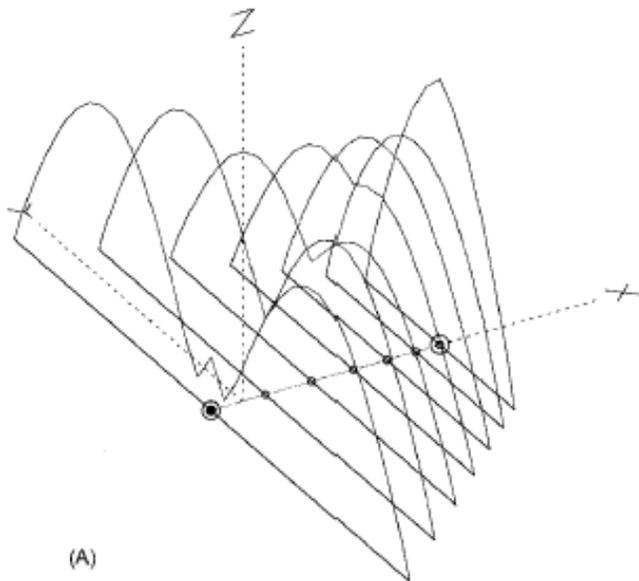
Sample LPDAs: Free-Space Gain
With and Without Corrective Stub
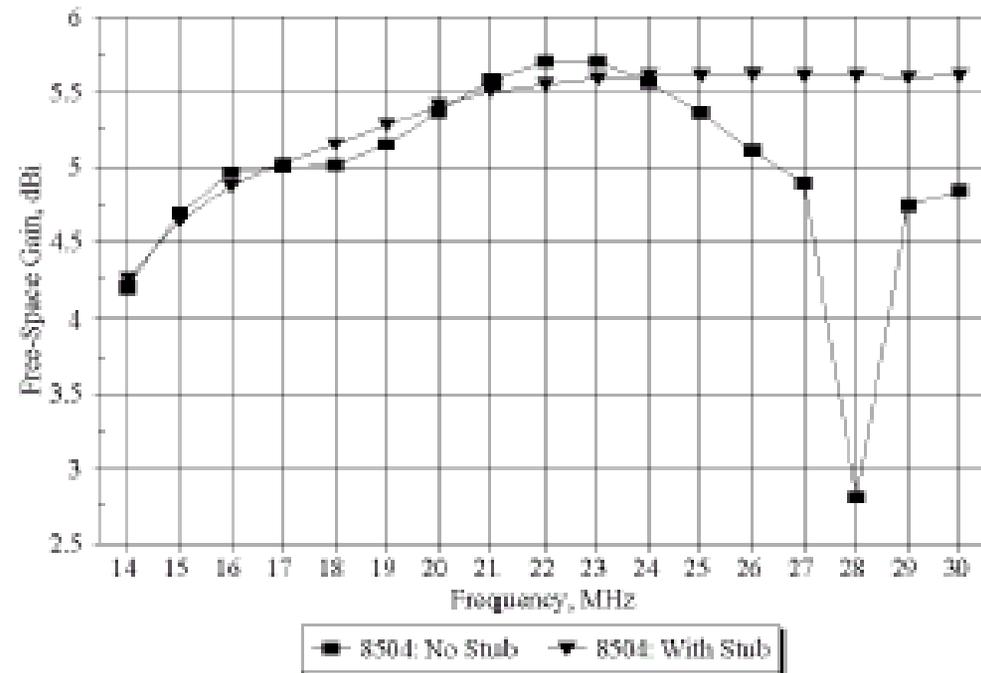
Correcting performance problems with a stub

Chap 10, LPDAs

Special Corrections: 14 to 30 MHz LPDA
Stub, Circularization, Extra Director
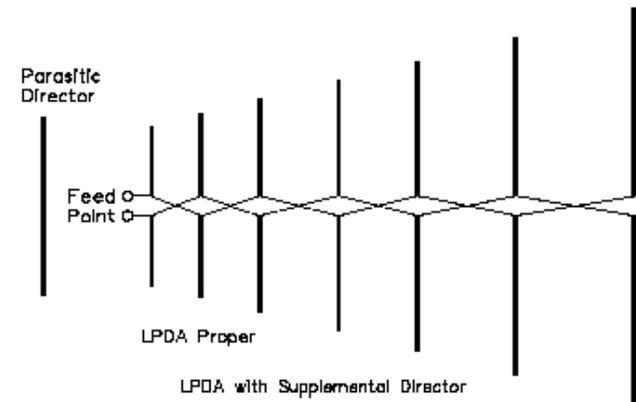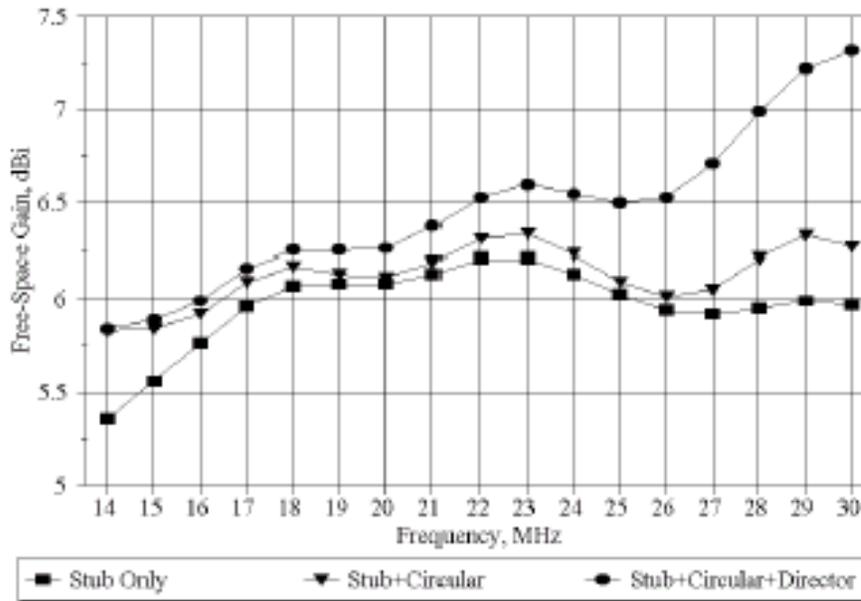
Adding a stub, retuned elements and a director

Chap 12, Quad Arrays

Comparing monoband 3-ele. quad
and 4-ele. Yagi, 26' booms

Chap 12, Quad Arrays

10-M Optimized Monoband Quad vs Yagi

5-Ele. Quad/5-Ele. Yagi -- 26' Booms
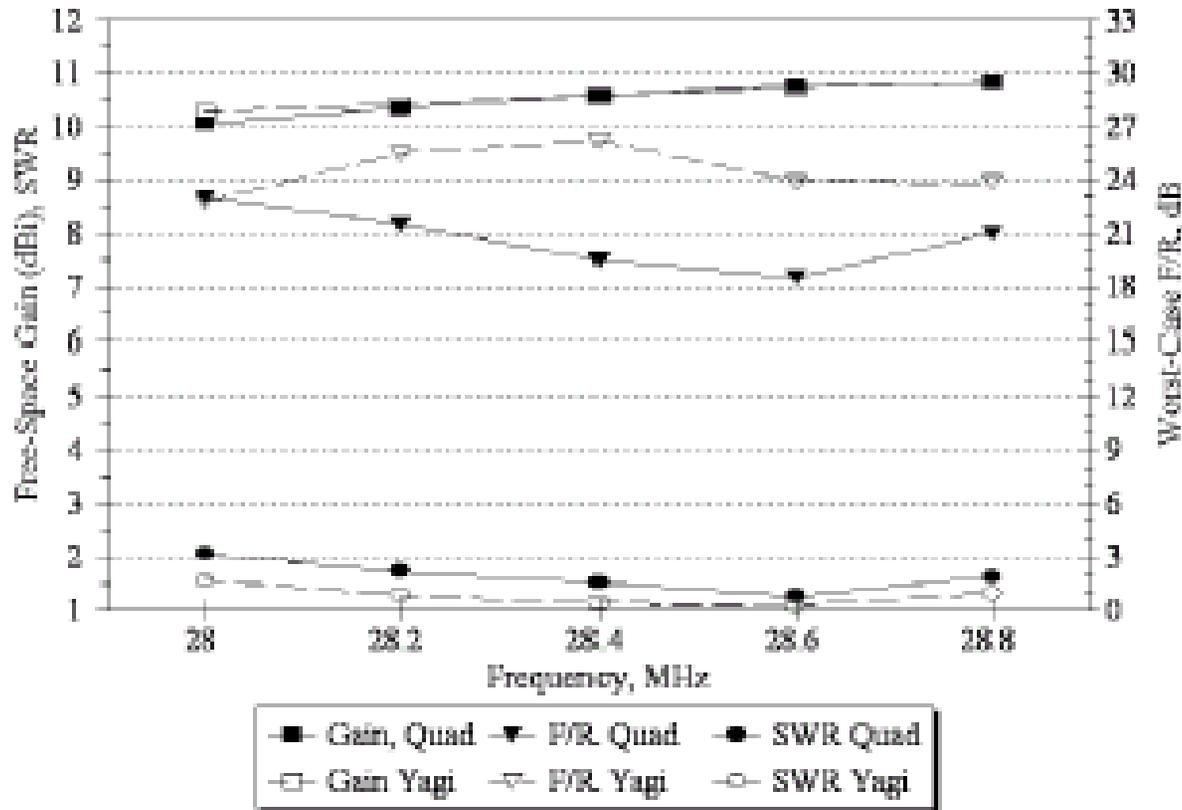
Comparing monoband 5-ele. quad and
5-ele.Yagi, 26' booms -- More elements help!

Chap 13, Long-wire and Traveling-Wave Antennas
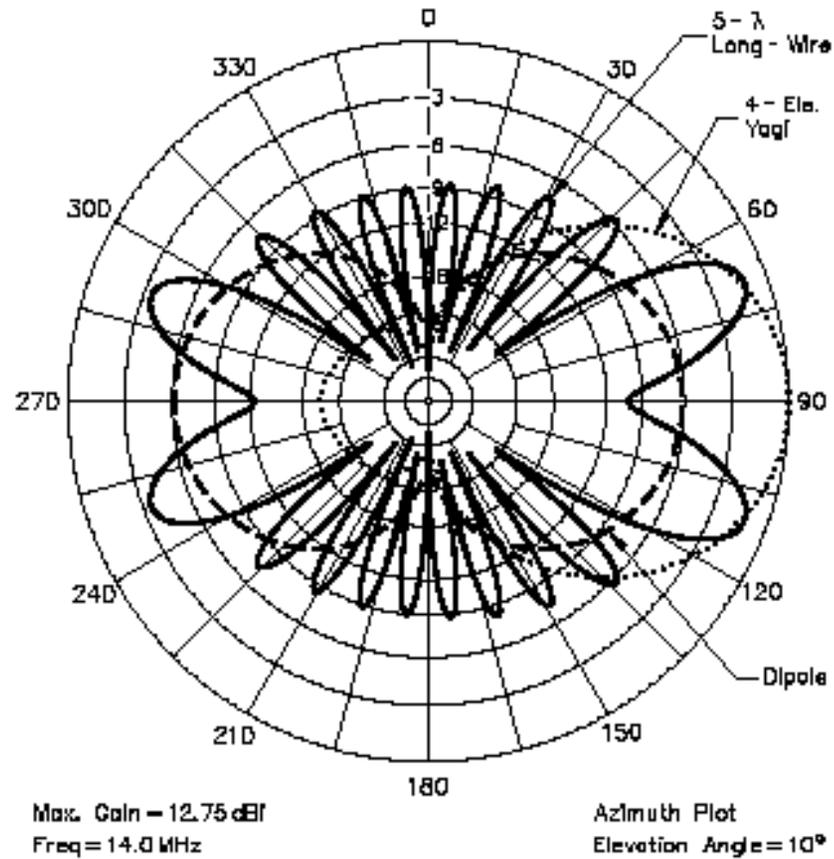
Comparing 5-wavelength Long-Wire to a
4-element Yagi and a dipole

Chap 13, Long-wire and Traveling-Wave Antennas
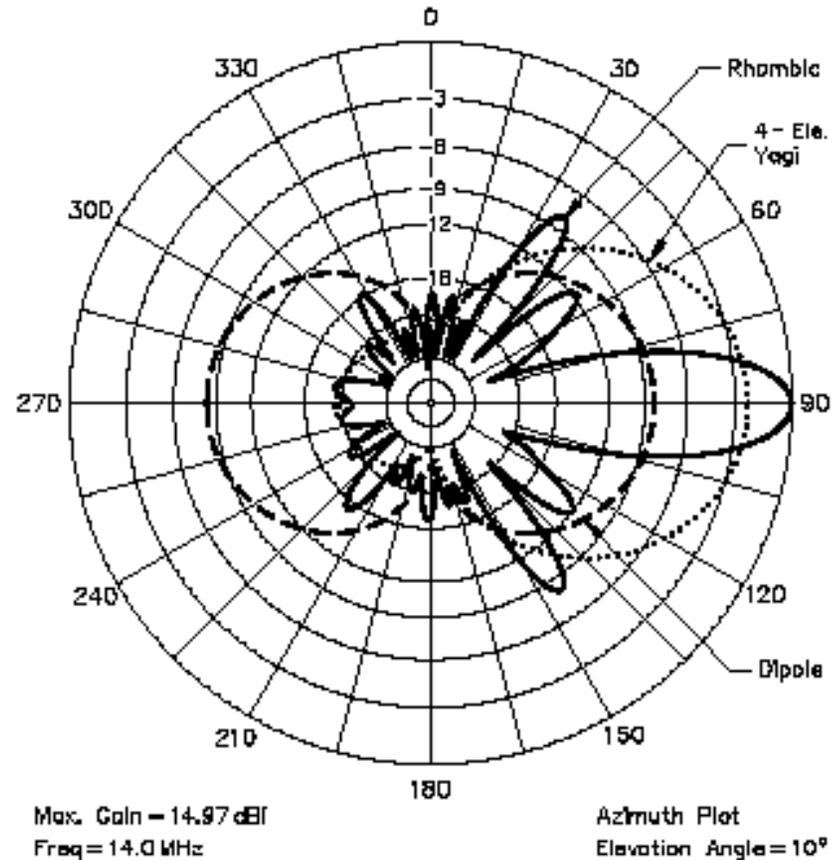
Comparing 3-wavelength terminated Rhombic to a
4-element Yagi and a dipole

Chap 22, Antenna Supports

$$F_c = AP\ SIN^2(Angle)\ COS(Angle)$$

$$F_r = AP\ SIN^2(Angle)$$

Wind

(A)

Angle

$$F_d = AP\ SIN^3(Angle)$$

(B) Wind

Fe1 Fe2 Fe3 Fe4

Fb1 Fb2

Ae Ab

Antenna Area vs Azimuth

Projected Area (SqFt)

10.0
8.0
6.0
4.0
2.0
0

0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90

Azimuth Angle (Deg)

············Elements (Ae) – – – –Boom (Ab) ———Total

(C)
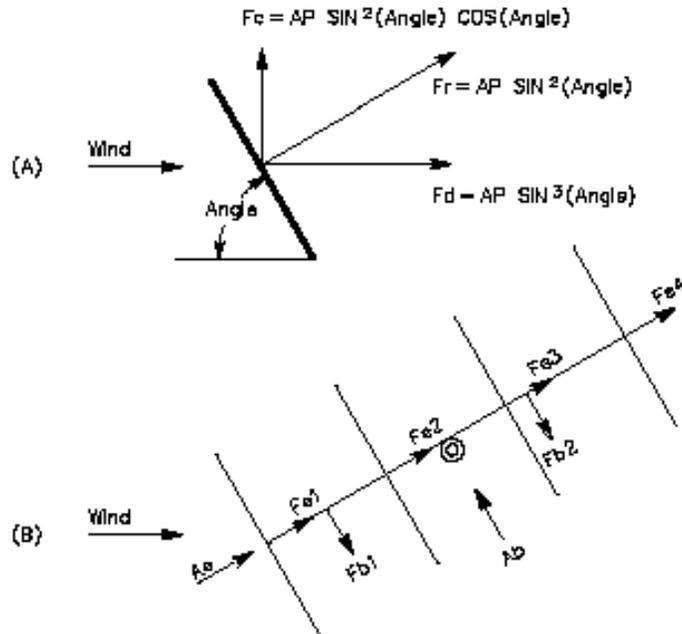
Wind in the Yagis!
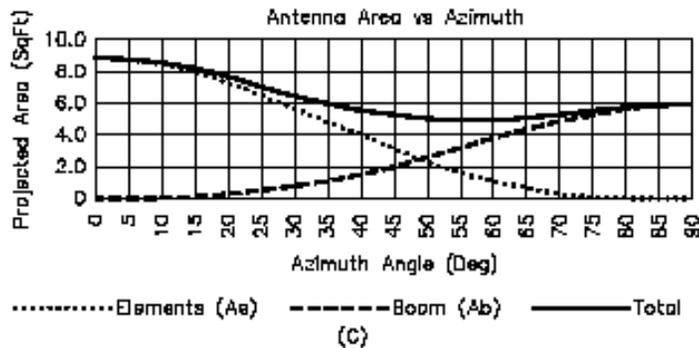
Chap 22, Antenna Supports
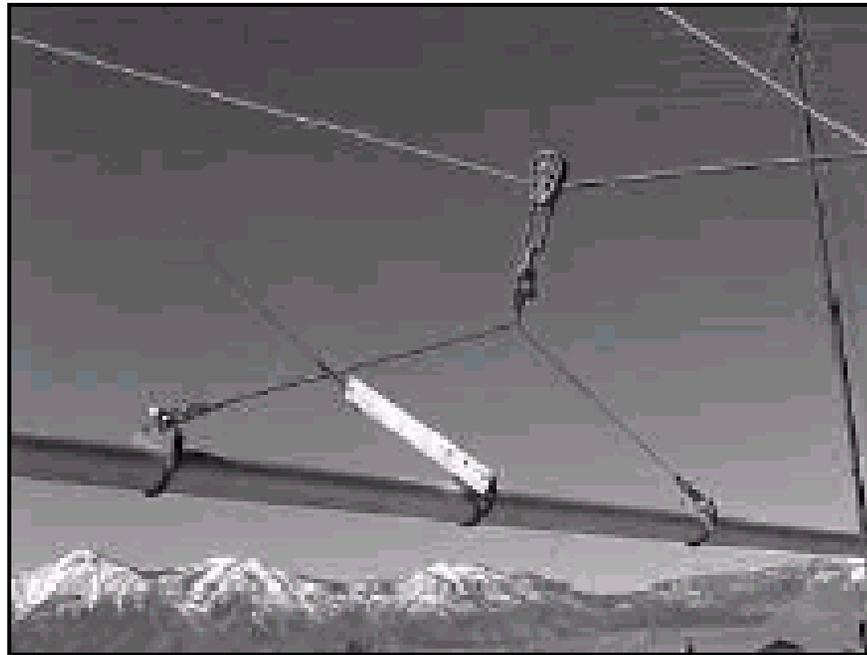
K7NV's tram system for big Yagis
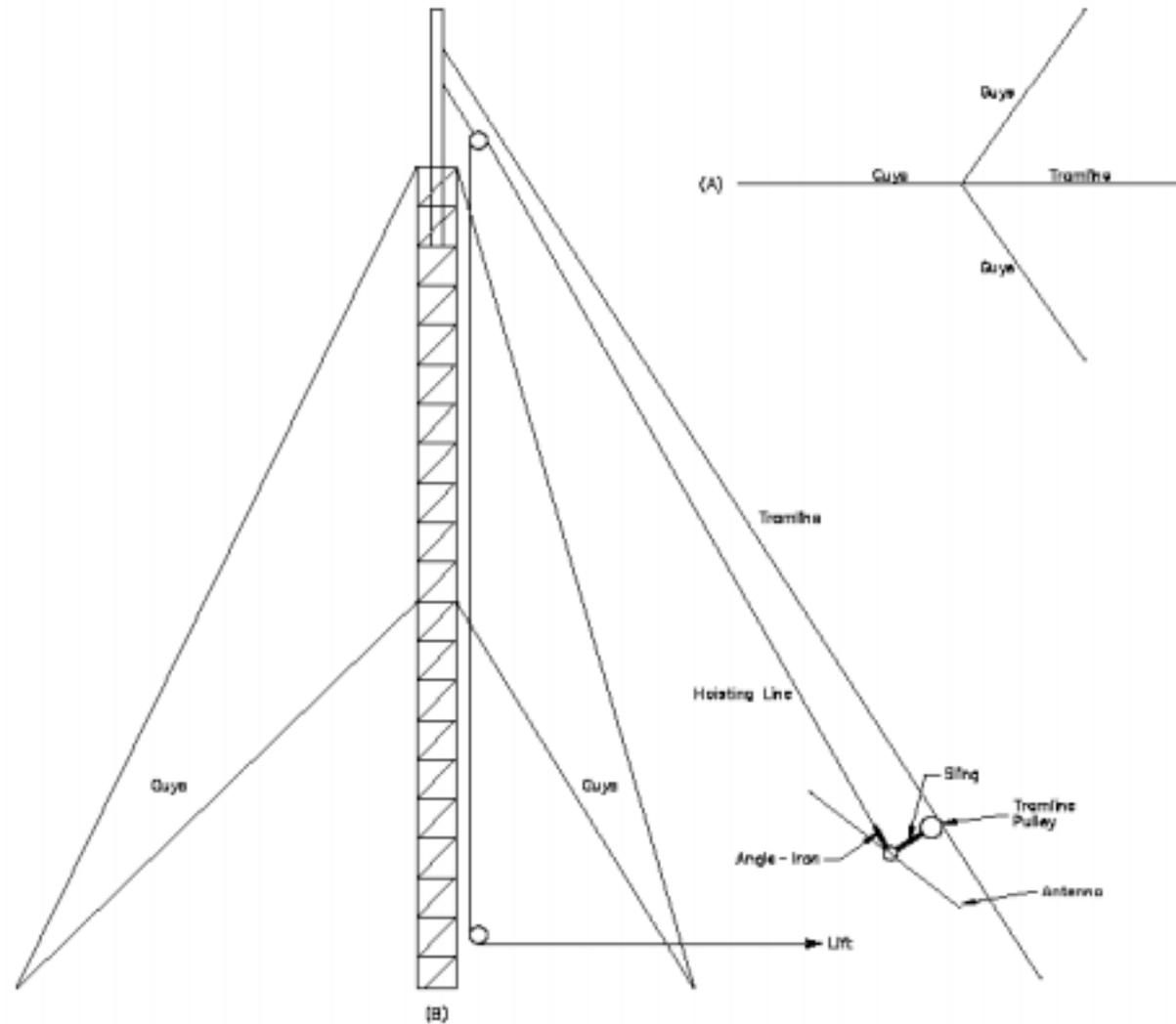
Tram system schematic

Software Included with the 19th Edition of *The ARRL Antenna Book*

Windows Software:

***TLW** -- Transmission Line for Windows*

***YW** -- Yagis for Windows*

GeoClock (by Joe Ahlgren)

Active Beacon Wizard (by Jim Tabor, KU5S)

Software Included with the 19th Edition of *The ARRL Antenna Book*

Software Included with the 19th Edition of *The ARRL Antenna Book*

Software Included with the 19th Edition of *The ARRL Antenna Book*

DOS Software:

YT -- *Yagi Terrain analysis,* with elevation-angle statistics for QTHs around the world

SCALE for scaling Yagis to other frequencies/tapers

AAT -- *Analyze Antenna Tuner*

LPDA (by Roger Cox, WB0DGF)

MOBILE (by Leon Braskamp, AA6GL)

GAMMA

Software Included with the 19th Edition of *The ARRL Antenna Book*
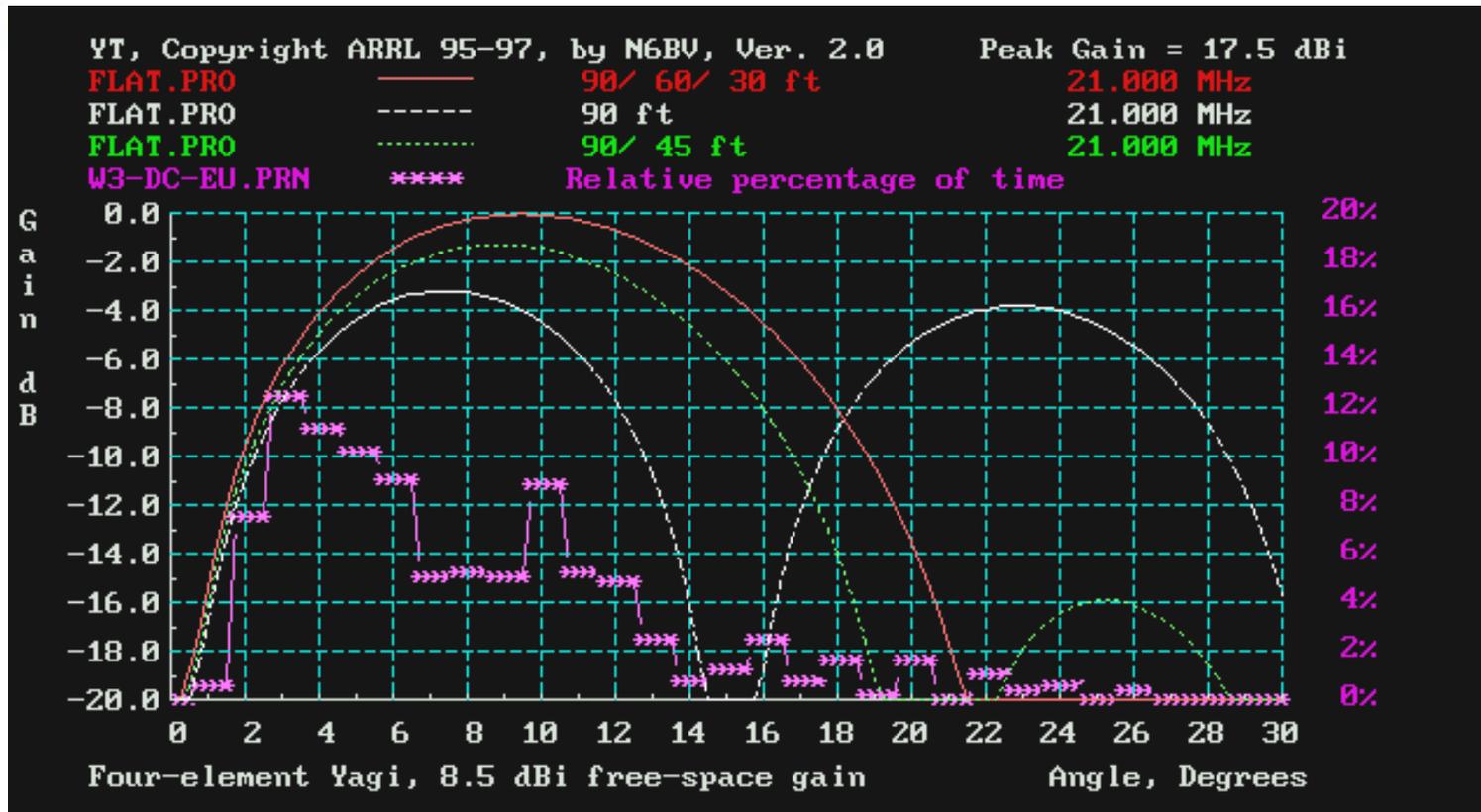
YT, Yagi Terrain analysis

YT and Elevation Statistics:

Pete Smith, N4ZR, wrote an interesting article in Jan/Feb 2001 *NCJ,* entitled "Scoring Your Antenna System." He described a metric for ranking stacked Yagis using *YT* as the computing engine.

Pete speculated that the elevation-angle statistics provided with the *Antenna Book* might be "too inclusive" -- because they do cover all portions of the 11-year solar cycle.

Elevation-Angle Statistics

15 M Elev. Angles, W3 (DC) to Europe
Comparing Low SSNs with All SSNs

Elevation-Angle Statistics
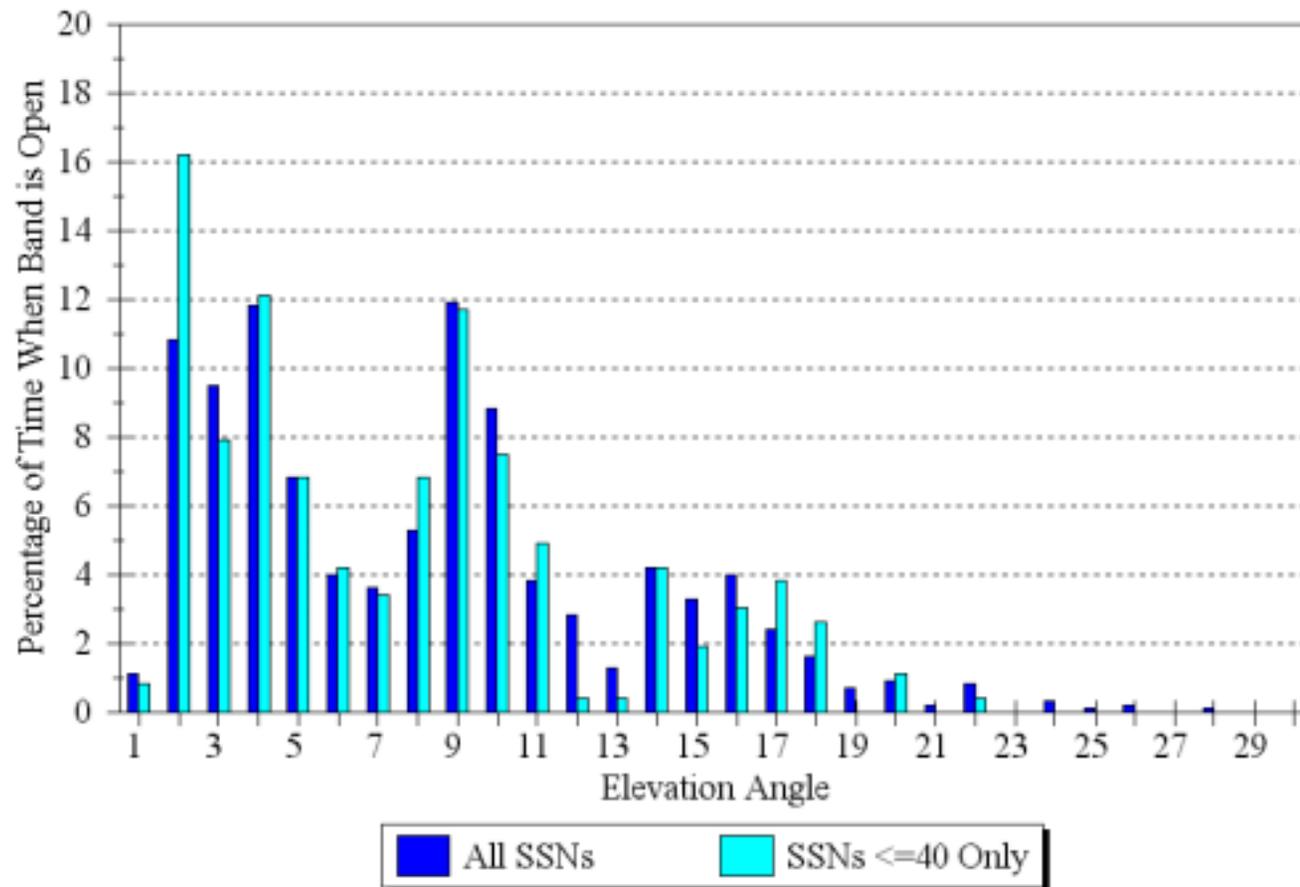
Other Software in the 19th Edition of
The ARRL Antenna Book

Data:

HF Propagation Forecasts (Summary only in printed book; Summary and Detailed on CD-ROM version)--144 QTHs around the world.

EZNEC **models** from various chapters (Loops, LPDAs, Quad and Long Wires)

Propagation-Prediction Tables

Summary Propagation Tables

USA

W1B Boston, MA
W2A Albany, NY
W2N Buffalo, NY
W3D Washington, DC
W4A Montgomery, AL
W4F Miami, FL
W4G Atlanta, GA
W4K Louisville, KY
W4N Raleigh, NC
W4T Memphis, TN
W5A Little Rock, AR
W5H Houston, TX
W5L New Orleans, LA
W5M Jackson, MS
W5N Albuquerque, NM
W5O Oklahoma City, OK
W5T Dallas, TX
W6L Los Angeles, CA
W6S San Francisco, CA
W7A Phoenix, AZ
W7I Boise, ID
W7M Helena, MT
W7N Las Vegas, NV
W7O Portland, OR
W7U Salt Lake City, UT
W7W Seattle, WA
W7Y Cheyenne, WY
W8M Detroit, MI
W8O Cincinnati, OH
W8W Charleston, WV
W9C Chicago, IL
W9I Indianapolis, IN
W9W Milwaukee, WI
WØC Denver, CO
WØD Bismarck, ND
WØI Kansas City, MO
WØK Middle of US, KS
WØM St. Louis, MO
WØN Omaha, NE
WØS Pierre, SD

Other, North America

6Y Kingston, Jamaica
HP Panama City, Panama
KL7 Anchorage, Alaska
KP2 Virgin Islands
TI San Jose, Costa Rica
V3 Belmopan, Belize
VE1 Halifax, Nova Scotia
VE2 Montreal, Quebec
VE3 Toronto, Ontario
VE4 Winnipeg, Manitoba
VE5 Regina, Saskatchewan
VE6 Calgary, Alberta
VE7 Vancouver, BC
VE8 Yellowknife, NWT
VO1 St. John's, NFL
VP2 Anguilla
VP5 Turks & Caicos
XE1 Mexico City, Mexico

Europe

CT Lisbon, Portugal
DL Bonn, Germany
EA Madrid, Spain
EI Dublin, Ireland
ER Kishinev, Moldava
F Paris, France
G London, England
I Rome, Italy
JW Svalbard
OH Helsinki, Finland
OK Prague, Czech Republic
ON Brussels, Belgium
OZ Copenhagen, Denmark
SV Athens, Greece
TF Reykjavik, Iceland
UA3 Moscow, Russia
UA6 Rostov, Russia
UR Kiev, Ukraine
YO Bucharest, Romania
YU Belgrade, Yugoslavia

South America

CE Santiago, Chile
CP La Paz, Bolivia
FY Cayenne, French Guiana
HC Quito, Ecuador
HC8 Galapagos Islands
HK Bogota, Columbia
LU Buenos Aires, Argentina
OA Lima, Peru
P4 Aruba
PY1 Rio de Janeiro, Brazil
PY0 Fernando de Noronha
YV Caracas, Venezuela
YV0 Aves Island
ZP Asuncion, Paraguay

Asia

1S Spratly Islands
3W Ho Chi Minh City, Vietnam
4J Baku, Azerbaijan
4S Columbo, Sri Lanka
4X Jerusalem, Israel
9N Katmandu, Nepal
AP Karachi, Pakistan
BY1 Beijing, China
BY4 Shanghai, China
BY0 Lhasa, China
HS Bangkok, Thailand
HZ Riyadh, Saudi Arabia
JA1 Tokyo, Japan
JA3 Osaka, Japan
JA8 Sapporo, Japan
JT Ulan Bator, Mongolia
TA Ankara, Turkey
UA9 Perm, Russia
UA0 Khabarovsk, Russia
UN Alma-Ata, Kazakh
VR2 Hong Kong
VU New Delhi, India
VU7 Andaman Islands
XZ Rangoon, Myanmar

Oceania

3D2 Fiji Islands
DU Manila, Philippines
FO Tahiti
H4 Honiara, Solomon Islands
KH0 Saipan, Mariana Islands
KH6 Honolulu, Hawaii
KH8 American Samoa
V7 Kwajalein, Marshall Islands
VK2 Sydney, Australia
VK6 Perth, Australia
VK8 Darwin, Australia
YB Jakarta, Indonesia
ZL1 Aukland, New Zealand
ZL3 Christchurch, New Zealand

Africa

3B9 Rodrigues
3C Bata, Equatorial Guinea
5N Lagos, Nigeria
5R Antananarivo, Madagascar
5U Niamey, Niger Republic
5Z Nairobi, Kenya
6W Dakar, Senegal
7Q Lolongwe, Malawi
7X Algiers, Algeria
9J Lusaka, Zambia
9L Freetown, Sierra Leone
9X Kigali, Rwanda
C9 Maputo, Mozambique
CN Casablanca, Morroco
D2 Luanda, Angola
EA8 Canary Islands
J2 Djibouti
ST Khartoum, Sudan
SU Cairo, Egypt
VQ9 Chagos, Diego Garcia
XT Burkina Faso
ZS1 Capetown, So. Africa
ZS6 Johannesburg, So. Africa

Summary Propagation-Predictions

Nov., Morocco (Casablanca), for SSN = Very High, Sigs in S-Units. By N6BV, ARRL..

UTC	80 Meters EU FE SA AF AS OC NA	40 Meters EU FE SA AF AS OC NA	20 Meters EU FE SA AF AS OC NA	15 Meters EU FE SA AF AS OC NA	10 Meters EU FE SA AF AS OC NA	UTC
0	9+ - 9 9+ 9 - 9+	9+ 8 9+ 9+ 9+ - 9+	9 9+ 9+ 9+ 9+ 9+ 9+	- 8 9+ 9+ 3 9+ -	- 4* 9+ 9 - 6 -	0
1	9+ - 9 9+ 9 - 9+	9+ 7 9+ 9+ 9+ - 9+	9 9+ 9+ 9+ 9+ 9 8	- 7 9+ 9+ - 9+ -	- 2* 9+ 8 - 7 -	1
2	9+ - 8 9+ 9 - 9+	9+ - 9+ 9+ 9+ - 9+	9 9 9+ 9+ 9+ 8 9	- 4 9+ 9+ - 8 -	- 1* 9+ 8 - - -	2
3	9+ - 8 9+ 9 - 9+	9+ - 9+ 9+ 9+ 5 9+	8 9 9+ 9+ 9 9 9+	- - 9+ 9+ - - -	- - 8 5 - - -	3
4	9+ - 9 9+ 6 - 9+	9+ - 9+ 9+ 9+ 7 9+	5 5 9+ 9+ 8 9 9+	- - 9 8 - - -	- - - - 5 - - -	4
5	9+ - 9 9+ 2 5 9+	9+ - 9+ 9+ 9 8 9+	6 5 9+ 9+ 9+ 4 9+	- - - 6 1 1 -	- - - - 5 - - -	5
6	9+ - 9+ 9+ - 5 9+	9+ - 9+ 9+ 5 9 9+	9+ 8 8 9+ 9+ 4 6	- 8 1* 8 9+ 7 -	- 2 - 7 2 6 -	6
7	9+ - 9 9+ - - 9+	9+ 3 9+ 9+ 3 8 9+	9+ 9 9+ 9+ 9 7 9	9+ 9 4 9+ 9+ 8 -	- 9 - 7 9+ 9 -	7
8	9 - 7 9+ - - 9	9+ 2 9+ 9+ 1 7 9+	9+ 9 9+ 9+ 9 9+ 9+	9+ 9+ 9+ 9+ 9+ 8 -	9 9 8 9+ 9+ 9 -	8
9	4 - 3 9+ - - 6	9 - 9 9+ - - 9	9+ 9 9+ 9+ 9 9+ 9	9+ 9 9+ 9+ 9+ 9+ 4	9+ 9 9 9+ 9+ 9 -	9
10	- - - 9+ - - 1	9 - 5 9+ - - 8	9+ 9 9+ 9+ 9 9 9+	9+ 9 9+ 9+ 9+ 9+ 7	9+ 9 9 9+ 9 9 1	10
11	- - - 9+ - - -	8 - 1 9+ - - 5	9+ 8 9 9+ 8 7 9+	9+ 9 9+ 9+ 9+ 9 9	9+ 9 9+ 9 9+ 9 8	11
12	- - - 9+ - - -	7 - - 9+ - - 1	9+ 8 8 9 9 8 9	9+ 9 9+ 9+ 9+ 9 9+	9+ 9 9+ 9 9+ 9 9	12
13	- - - 9+ - - -	7 - - 9+ - - -	9+ 8 2 9+ 9 8 9	9+ 9 9 9+ 9+ 9 9+	9+ 9+ 9 2 9+ 9 9	13
14	- - - 9+ - - -	8 - - 9+ 4 - -	9+ 9 3 9+ 9+ 9 9	9+ 9+ 9 9+ 9+ 9 9+	9+ 9+ 9 2 9+ 9 9+	14
15	2 - - 9+ - - -	9 - - 9+ 7 - 2	9+ 9 5 9+ 9+ 9 9+	9+ 9+ 9 9+ 9+ 9+ 9+	9+ 9+ 9 9+ 9+ 9 9+	15
16	9 - - 9+ 2 - -	9+ 7 - 9+ 9 4 4	9+ 9+ 8 9+ 9+ 9+ 9+	9+ 9+ 9+ 9+ 9+ 9+ 9+	9+ 9+ 9+ 1 9+ 8 9+	16
17	9+ - - 9+ 6 - -	9+ 8 - 9+ 9+ 8 7	9+ 9+ 9 9+ 9+ 9+ 9+	9+ 9+ 9+ 9+ 9+ 9+ 9+	6 9+ 9+ 6* 8 7 9+	17
18	9+ 7 - 9+ 8 3 2	9+ 9 1 9+ 9+ 9 8	9+ 9+ 9+ 9+ 9+ 9+ 9+	9+ 9+ 9+ 9+ 9+ 9+ 9+	- 9+ 9+ 1 4* 9 9	18
19	9+ 7 - 9+ 8 6 6	9+ 9 5 9+ 9+ 9 9+	9+ 9+ 9+ 9+ 9+ 9+ 9+	9+ 9+ 9+ 9+ 9+ 9 9+	- 9 9+ 9+ 2* 4 9	19
20	9+ 8 1 9+ 9 6 8	9+ 9 8 9+ 9+ 9 9+	9+ 9+ 9+ 9+ 9+ 9+ 9+	4 9+ 9+ 8 9+ 9 9	- 7 9+ 4 - 3* 4	20
21	9+ 8 6 9+ 9 6 9	9+ 9 9 9+ 9+ 9 9+	9+ 9+ 9+ 9+ 9+ 9+ 9+	- 9+ 9+ 8 9 8 9	- 1 9+ 8 - 3* 2*	21
22	9+ 7 8 9+ 9 1 9+	9+ 9 9+ 9+ 9+ 9 9+	9 9+ 9+ 9+ 9+ 9+ 9+	- 9 9+ 9+ 6 8 7	- 6 9+ 9 - 4* 2*	22
23	9+ 8 9 9+ 9 - 9+	9+ 9 9+ 9+ 9+ 8 9+	9 9+ 9+ 9+ 9+ 9+ 9+	- 9 9+ 9+ 5 9 -	- 4 9+ 9 - 4* 1*	23
	EU FE SA AF AS OC NA	EU FE SA AF AS OC NA	EU FE SA AF AS OC NA	EU FE SA AF AS OC NA	EU FE SA AF AS OC NA	

Detailed Propagation Predictions

10 Meters: Nov., Morocco (Casablanca), for SSN = Very High, Sigs in S-Units. By N6BV, A

Zone		00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
KL7 =	01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	4	-	-	-	-	-
VO2 =	02	-	-	-	-	-	-	-	-	-	-	1	8	1	2	3	3	1	3	4	5	1*	-	-	-
W6 =	03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	9	9	9	4	-	-	-	-
W0 =	04	-	-	-	-	-	-	-	-	-	-	-	-	-	8	9	9+	9+	9+	9	8	1	-	-	-
W3 =	05	-	-	-	-	-	-	-	-	-	-	-	-	9	9	9+	9	9	9	9	8	3*	2*	2*	1*
XE1 =	06	-	-	-	-	-	-	-	-	-	-	-	-	1	9	9	9	9	9	9	9	4	-	-	-
TI =	07	-	-	-	-	-	-	-	-	-	-	-	2	9	9	9	9	9	9	9	9	9	6	1	-
VP2 =	08	-	-	-	-	-	-	-	-	-	-	8	9+	9+	9	9	9	9	9+	9+	9+	8	1	-	-
P4 =	09	-	-	-	-	-	-	-	-	-	-	-	9+	9+	9	9	9	9+	9+	9+	9	9	6	-	-
HC =	10	1	-	-	-	-	-	-	-	-	-	-	7	9	9	9	9	9	9	9	9+	9	9	6	4
PY1 =	11	9+	9	8	8	-	-	-	-	-	9	9	9	9	9	9	9	9	9	9	9+	9+	9+	9+	9+
CE =	12	9+	9+	9	6	-	-	-	-	8	-	9	9	9	8	8	9	8	9	9	9+	9	9+	9+	9+
LU =	13	9+	9+	9+	8	-	-	-	-	-	-	2	9	9	9	9	9	9	9	9	9+	9+	9+	9+	9+
G =	14	-	-	-	-	-	-	-	-	-	7	9+	9+	9+	9+	9+	9+	9+	9+	6	-	-	-	-	-
I =	15	-	-	-	-	-	-	-	-	-	9	9+	9+	9+	5	6	6	9+	5	1	-	-	-	-	-
UA3 =	16	-	-	-	-	-	-	-	-	-	6	9+	9+	9+	9+	9+	9+	6	-	-	-	-	-	-	-
UN =	17	-	-	-	-	-	-	-	7	8	9	9	8	8	6	8	-	-	-	-	-	-	-	-	-
UA9 =	18	-	-	-	-	-	-	-	4	9	9	9	9	8	7	1	-	-	-	-	-	-	-	-	-
UA0 =	19	2*	2*	1*	-	-	-	-	-	9	9	5	-	-	-	-	-	-	-	-	-	-	-	-	2*
4X =	20	1	-	-	-	-	-	7	2	9+	9+	9+	2	2	4	9+	9+	2*	1*	-	9	8	7	4	1
HZ =	21	-	-	-	-	-	-	-	9+	9+	9+	9	9+	9+	9+	9+	9+	9+	8	4*	2*	-	-	-	-
VU =	22	-	-	-	-	-	-	2	9	9	9	9	9	9	9+	8	5	-	-	-	-	-	-	-	-
JT =	23	-	-	-	-	-	-	-	5	9	9	9	9	7	-	-	-	-	-	-	-	-	-	-	-
VS6 =	24	-	-	-	-	-	-	-	9	9	9	9	9	9	9	4	-	-	-	-	-	-	-	-	1*
JA1 =	25	4*	2*	1*	-	-	-	-	1	9	8*	4*	3*	1*	1*	-	-	-	-	-	-	-	-	2*	2*
HS =	26	-	-	-	-	-	-	2	9	9	9	9	9	9	9+	9	9+	9+	9+	6	2	-	-	-	-
DU =	27	-	-	-	-	-	-	-	9	9	9	9	9	9	9	9	8	2	-	-	-	-	-	-	1*
YB =	28	-	-	-	-	-	-	2	8	9	9	9	9	9	9	9+	9+	9+	9+	9+	9	7	1	6	4
VK6 =	29	6	7	-	-	-	-	6	7	8	8	7	7	6	1	-	3	4	3	1	-	-	-	-	1
VK3 =	30	5	4	-	-	-	-	3	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2
KH6 =	31	2*	2*	-	-	-	-	-	5*	2*	1*	1*	-	-	-	-	-	-	7	9	3*	3*	3*	1*	1*
KH8 =	32	4*	3*	-	-	-	-	-	1*	-	7	8	6	7	5	1	-	-	7	9	4	1*	2*	4*	4*
CN =	33	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
SU =	34	2	1	-	-	-	-	7	-	9+	9+	9+	4	3	6	9	9+	4	5*	9	9+	9	9	7	4
6W =	35	9	8	6	2	-	-	-	-	9+	1*	2	-	-	-	-	-	-	-	-	5	4	9	9	9
D2 =	36	6	7	8	-	-	-	-	7	5	2	2	1	2	2	2	1	2*	1*	7	6	-	-	1	5
5Z =	37	9	8	2	-	-	-	5	9+	9+	9+	9+	6	6	9+	9+	6	1	6*	1	1	4	8	9	9
ZS6 =	38	9	8	5	-	-	-	1	9	9	9	8	9	9	9	9+	9+	9+	9+	9+	9+	9+	9+	9+	9
FR =	39	8	4	1	-	-	-	5	9	9	8	9	9	9	9	9+	9+	9+	9+	9+	9+	9+	9+	9+	8
FJL =	40	-	-	-	-	-	-	-	-	-	2	8	9	9	9+	9	5	-	-	-	-	-	-	-	-
Zone		00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23

Expected signal levels using 1500 W and 4-element Yagis at 60 feet at each station.