

1 November 1991


TECHNICAL MANUAL

OPERATION AND MAINTENANCE INSTRUCTIONS

CSA "LONGSHOT" TACTICAL LONG RANGE
HF ANTENNA KIT
PART NUMBER 3SK/10636

ANTENNA GROUP, AN/TSC-107 & AN/TRC-181

5985-01-347-2835ZX

The logo for C&S ANTENNAS features a circular icon on the left with a stylized antenna or wave pattern.

C&S ANTENNAS
An Amphenol Company
1123 Industrial Drive SW
Conover, NC 28613

IDENTIFYING TECHNICAL PUBLICATION SHEET
FOR
COMMERCIAL MANUAL/SUPPLEMENTAL DATA

THIS PUBLICATION SUPERCEDES ANY INTERIM OR PACKUP DATA AVAILABLE

i. IDENTIFICATION DATA

1. PURPOSE: This technical publication is issued for the purpose of identifying and authorizing the following commercial manual for Air Force use and for providing supplemental information thereto:

MANUFACTURER: C&S Antennas Inc.
1501 Moran Road
Sterling, VA 20166

CONTRACT NO. Various

EQUIPMENT: Antenna Group, AN/TSC-107 & AN/TRC-181, P/N 3SK/10636

FEDERAL STOCK NUMBER: 5985-01-347-2835ZX

TITLE: Technical Manual Operation and Maintenance Instructions, TM-33284
CSA "LONGSHOT" Tactical Long Range HF Antenna Kit, Part Number
3SK/10636, Date: 1 Nov. 1991"

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ii. SUPPLEMENTAL DATA:

1. LIST OF AFFECTED PAGES IN BASIC MANUAL:

Inside Cover (Warranty Policy) is supplemented by the information provided below:

Section 7 - Page 2 is included for reference only and is replaced by Table 1.0.

2. SUPPLEMENTARY INFORMATION: The information contained in the above identified commercial manual is supplemented as follows:

a. Inside Cover (Warranty Policy)

The warranty covers the repair of the HF Antenna Kit, Part Number 3SK/10636. CSA antenna equipment has a 1 year warranty from the date of shipment. Date of Manufacture Validation for the start of the warranty period is obtained by checking the serial number (printed on the Transit Bag Identifying Label) against the Delivery Notice and/or DD 250.

Table 1.0 of this ITPS provides manufacturer's part numbers and National Stock Numbers for all field replaceable parts and assemblies for the 3SK/10636.

Defective recoverable parts and assemblies are to be returned directly to C&S Antennas and are not to be processed into normal supply for warranty repairs. Defective expendable items covered under warranty are to be obtained directly from C&S Antennas.

BEFORE returning any items to C&S Antennas Inc. for repair or replacement, whether within the Warranty Period or not, the User Unit is to complete a "Return Authorization Request" proforma in as much detail as possible (see page 5). This should be forwarded to C&S Antennas (fax number (703) 430-7075)). On receipt, C&S Antennas will contact the user unit and will provide shipping instructions and an "Authorization Number" when appropriate.

Note that the warranty does NOT provide for free of charge repair or replacement of items that have been damaged as a result of improper use or under environmental conditions outside of those specified at page 1-1.

No product will be accepted for repair or replacement consideration unless C&S Antennas Inc. has consented to the return prior to shipment and has assigned an "Authorization" number to be marked on the shipping papers. Any claim of warranty must be accompanied by the User Unit's complete rejection report, supporting data and photographs (if available).

All such products returned will be evaluated by C&S Antennas' technical and quality assurance staff. A fee will be charged to cover the cost of such evaluation if the evaluation shows that the products meet their electrical and mechanical specifications and/or are defective for reasons not covered by this warranty.

Transportation costs for items to be returned under warranty is the responsibility of the owning unit or agency. Government transportation, U.S. Postal Service and private carriers can be utilized where appropriate.

AFTO 350/DD1577 forms are required for return of an item for repair under warranty. The following information must be provided on all return documentation.

- (1) Part No. of item being returned
- (2) Serial No. and Model No. of item that defective part/assembly was removed from
- (3) Date of request
- (4) Requested action
- (5) Return shipping instructions

Items returned under provisions of the warranty should be sent to:

C&S Antennas Inc.
1501 Moran Road
Sterling, VA 20166

- b. Section 7 - Page 2 is included for reference only and is replaced by Table 1.0 which identifies all field replaceable parts and assemblies:

Usable on Codes:

(1) 3SK/10636	(2) LFH 230/1	(3) CTM15J
5985013472835ZX	5985013429592ZX	5985013428778ZX

Warranty Codes:

- (1) The item is to be returned directly to C&S Antennas for repair or replacement under the provisions of the warranty.

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- (2) The item is to be requisitioned directly from C&S Antennas and does not require the failed item to be returned. DD Form 1348-() is to be used for ordering non-exchange items.
- (3) Non-warranty item: The item should be obtained through normal DOD supply procedures.

TABLE 1.0
REPAIR PARTS LIST, 3SK/10636

<u>C&S Part No.</u>	<u>Description</u>	<u>National Stock Number</u>	<u>Useable on Code</u>	<u>Units/ Assembly</u>	<u>Warranty Code</u>
SL33150	Reel Assembly	5985-01-371-5739	1,2,3	2	1
SL33299	Aerial Wire Assembly, 117 ft.	5985-01-371-5740	1	2	1
SL33288D1	Aerial Wire Assembly, 163 ft.	5985-01-371-5741	1	2	1
SL33288D2	Aerial Wire Assembly, 220 ft.	5985-01-372-4097	1	2	1
SL33289	Load Assembly	5985-01-371-5742	1	2	1
SL33292	Ground Peg Assembly, 23 inch	5985-01-372-4414	1	2	1
SL31992 SH3	Balun	5985-01-371-5900	1	1	1
DG31172	Coupling Piece	5985-01-371-5743	1,2	4	2
SL31343	Coaxial Feed Wire	5995-01-372-3229	1	1	1
SL33291	Balun Stake	4030-01-372-4415	1	1	1
DG33871	Support Rod	5985-01-371-5806	1	8	2
DG33869	Transit Bag	5985-01-371-5888	1	1	1
SL33283	Stay Assembly	4010-01-371-7408	1	2	1
SL32223	Ground Peg, 15 inch steel	4030-01-371-9460	1,3	4	2
F209	Foot Plate	5985-01-371-5805	1	2	2
AR31EF	Mast Tube	5985-01-371-5881	1	4	1
Q86	Ground Spike	4030-01-372-4416	1	4	2
Q88	Hammer	Not Stock Listed	1,3	1	3
DG33287	Bag, Mast Kit		1	1	1

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RETURN AUTHORIZATION

Instructions

Before shipment of damaged or unserviceable items (whether or not these items are covered by the manufacturer's warranty), this Return Authorization is to be completed in as much detail as possible. Fax (or mail) a copy of this Return Authorization to C&S Antennas Inc., 1501 Moran Road, Sterling, VA 20166, Fax (703) 450-7075. You will receive an Authorization Number from C&S Antennas. Enter this number in Field 2 of the form and return a copy of the completed form, together with a completed AFTO350/DD1577, with the item being returned.

1. Unit	2. Return Authorization Number (Obtain from C&S Antennas)
3. Mailing Address	
4. Point of Contact	5. Telephone Number
7. Contract Number	6. Fax Number
8. Model Number	9. Serial Number
10. Part Number(s)	
11. Description of Problem	
12. Relevant Circumstances	
13. Weather Conditions	
13a. Wind Speed	mph
13b. Temperature	°F
13c. Precipitation	
13d. Icing Present?	
14. Is this a Warranty claim?	Yes/No*

* Delete as appropriate.



PRODUCT WARRANTY

1. Seller warrants that the products are free from defects in material and workmanship and that, if properly used, they will perform in accordance with their applicable specifications for a period of 12 months after first shipment to the original purchaser. Any products that Seller finds not to meet the warranty will be repaired or replaced without charge, as described below, except for components that have given normal service. Seller makes no warranty concerning components or accessories not manufactured by it. However, in the event of failure of such a part, Seller will give reasonable assistance to purchaser in obtaining from the manufacturer whatever adjustment is reasonable in light of the manufacturer's own warranty.
2. This warranty is void under the following circumstances:
 - a. If the products have been partially or completely disassembled, or if any attempt has been made to disassemble them prior to their return to Seller, or
 - b. If the products have been improperly used, either electrically or mechanically, or
 - c. If the products have been damaged by the carrier (unless Seller has assumed responsibility for safe delivery to the first destination).
3. No product will be accepted for repair or replacement consideration unless Seller has consented to the return prior to shipment, and has assigned an "Authorization" number to be marked on the shipping papers. Any claim of warranty must be accompanied by the purchaser's complete rejection report, supporting test data, and photographs (if available).
4. All such products returned will be evaluated by our technical and quality assurance staff. A fee will be charged to cover the cost of such evaluation if the evaluation shows that the products meet their electrical and mechanical specifications and/or are defective for reasons not covered by this warranty.
5. Transportation charges for products returned to Seller are to be prepaid to the Seller factory or, if directed by Seller, to Seller's sister or parent company in the U.S.A. Seller will bear the transportation charges to return repaired or replaced products covered by this warranty.
6. This warranty does not obligate Seller to evaluate, inspect, test, replace, or correct its products "in place" in the field, but Seller may elect to correct the product "in place."
7. **THIS WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND OF ANY OTHER TYPE, WHETHER EXPRESS OR IMPLIED. IN NO EVENT SHALL SELLER BE LIABLE FOR CONSEQUENTIAL DAMAGES, NOR SHALL SELLER'S LIABILITY ON ANY CLAIMS FOR DAMAGES ARISING OUT OF OR CONNECTED WITH THE SALES CONTRACT OR THE MANUFACTURE, SALE, DELIVERY OR USE OF THE PRODUCTS EXCEED THE PURCHASE PRICE OF THE PRODUCTS.**

1 November 1991

The information disclosed herein includes proprietary rights of C&S Antennas, Inc. and is provided exclusively for the maintenance, service and repair of the equipment referred to herein and is not to be used for any other purpose except as specifically authorized in writing by C&S Antennas, Inc.

TECHNICAL MANUAL

OPERATION AND MAINTENANCE INSTRUCTIONS

CSA "LONGSHOT" TACTICAL LONG RANGE HF ANTENNA KIT PART NUMBER 3SK/10636

ANTENNA GROUP, AN/TSC-107 & AN/TRC-181

5985-01-347-2835ZX

CHANGES
PAGE ISSUE STATUS

Page No.	Comment	Date of Issue	Issue #
All Pages	Original Issue	1 November 1991	1
2, 6	Warranty Classification	1 October 1993	2
5	NSNs for parts added	1 October 1993	2
3-2, 5-3, 5-4, 5-5, 5-6, 6	End Fed terminated Wire details amended	1 October 1993	2
4-6, 4-7, 5-2, 5-4, 5-6, 5-9, 5-15, 5-18, 5-20	Diagram amended to show correct orien- tation of guy ropes	1 October 1993	2
iia	Addition to Table of Contents	14 March 1994	3
8-1	Additional Optional Equipment	14 March 1994	3

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FOREWORD

HOW TO USE THIS MANUAL

This manual provides instructions for configuration selection, assembly, deployment and tear down of the LONGSHOT tactical long range HF antenna kit, together with performance information, maintenance procedures and an illustrated parts breakdown.

LONGSHOT may be deployed in a variety of antenna configurations to satisfy wide ranging HF skywave communications needs. In most of these configurations, the length of element wire used may be reduced in two or more steps from the optimum to enable a useable antenna to be deployed when space is limited. Thus, the theoretical number of ways the system may be deployed is very large. To ensure this manual does not grow unmanageably lengthy, instructions are presented in the following way:

- Section 1 describes the purpose and capabilities of the system and provides a detailed description of the equipment supplied. Users are encouraged to acquaint themselves fully with this section - preferably with the equipment laid out in front of them - before proceeding further, since the rationale for many of the detailed design features is discussed. Familiarity with Section 1 will be amply rewarded by safe, straight forward, error free and rapid antenna deployments.
- Section 2 provides guidance on antenna configuration selection. For the user with little or no prior experience with HF communications, an "antenna selector", laid out in tabular form, leads rapidly to the optimum configuration for the particular communications scenario with a "second best" alternative also suggested where appropriate.
- Section 3 details antenna layout, real estate requirements and radiation patterns for each configuration.
- Section 4 provides general assembly instructions for the antenna components and includes safety warnings and precautions applicable to the erection and tear down of all configurations.
- Section 5 provides detailed assembly and deployment instructions for each configuration.
- Section 6 provides tear down instructions for the equipment.
- Section 7 details maintenance procedure and includes a parts breakdown.

SECTION 1

EQUIPMENT DESCRIPTION

1.1 INTRODUCTION

LONGSHOT is a lightweight, transportable HF wire antenna system intended primarily for long range skywave communications. Supplied in rapidly assembled kit form, the antenna may be erected in a wide variety of long wire configurations (including a low profile, jam resistant mode) for optimal performance in differing scenarios. The antenna is intended for use with the AN/TSC-107 Quick Reaction Package (QRP) and other contingency HF communications systems. The antenna system is supplied in two transit bags whose combined weight is under 70 pounds and is designed for use with the 5985-01-342-8778ZX, Mast, CTM15J. When erected on one of these 50 foot masts, any LONGSHOT configuration may be set up by two people in less than 30 minutes.

1.2 OPERATIONAL CHARACTERISTICS

For transmit and receive operation, the antenna may be deployed in five conventional mast mounted configurations. The antenna balun, with antenna elements and coaxial cable attached, is hauled up the mast by means of a halyard after the mast has been fully deployed. Consequently, antenna azimuth or configuration may be changed very rapidly without the need to lower the mast and the mast head mounting point is freed up for use with UHF or VHF line-of-sight antennas. All configurations are rated for 1 kilowatt continuous operation and all are broadband with VSWR not exceeding 2.5:1 from 2 to 30 MHz. An antenna coupler is unnecessary.

For receive only operation, the antenna may be deployed as a Beverage antenna exhibiting exceptionally good side and back lobe performance. The resulting low susceptibility to interference is extremely useful when separate transmit and receive antennas are operated simultaneously in close proximity. This configuration is also ideal for use in a jamming environment and presents a very low visual signature. Since a mast is not required when deploying the antenna in this configuration, deployment and tear down is very rapid - typically only 10 minutes for one person.

1.3 MECHANICAL AND ENVIRONMENTAL SPECIFICATIONS

Maximum Transit Dimensions	1 Transit Bag 26 x 12 x 12 inches 1 Transit Bag 72 x 6 x 6 inches
Maximum Weight	70 pounds
Maximum Single Package Weight	42 pounds
Survival Wind Speed	90 mph
Temperature Range (Operational)	-40°F to +155°F
Temperature Range (Storage)	-60°F to +160°F
Humidity	96% at 95°F
Salt Fog	Withstands exposure to salt fog without corrosion.
Fungus	Fungus resistant materials only, per MIL-STD-454, Requirement 4.

1.4 DESCRIPTION OF EQUIPMENT

The LONGSHOT antenna system consists of two primary components, the Antenna Kit and the Minimast Kit, both supplied in individual transit bags. Maximum packed weight of each kit does not exceed 42 pounds for a safe one person carry. See Figure 1-1.

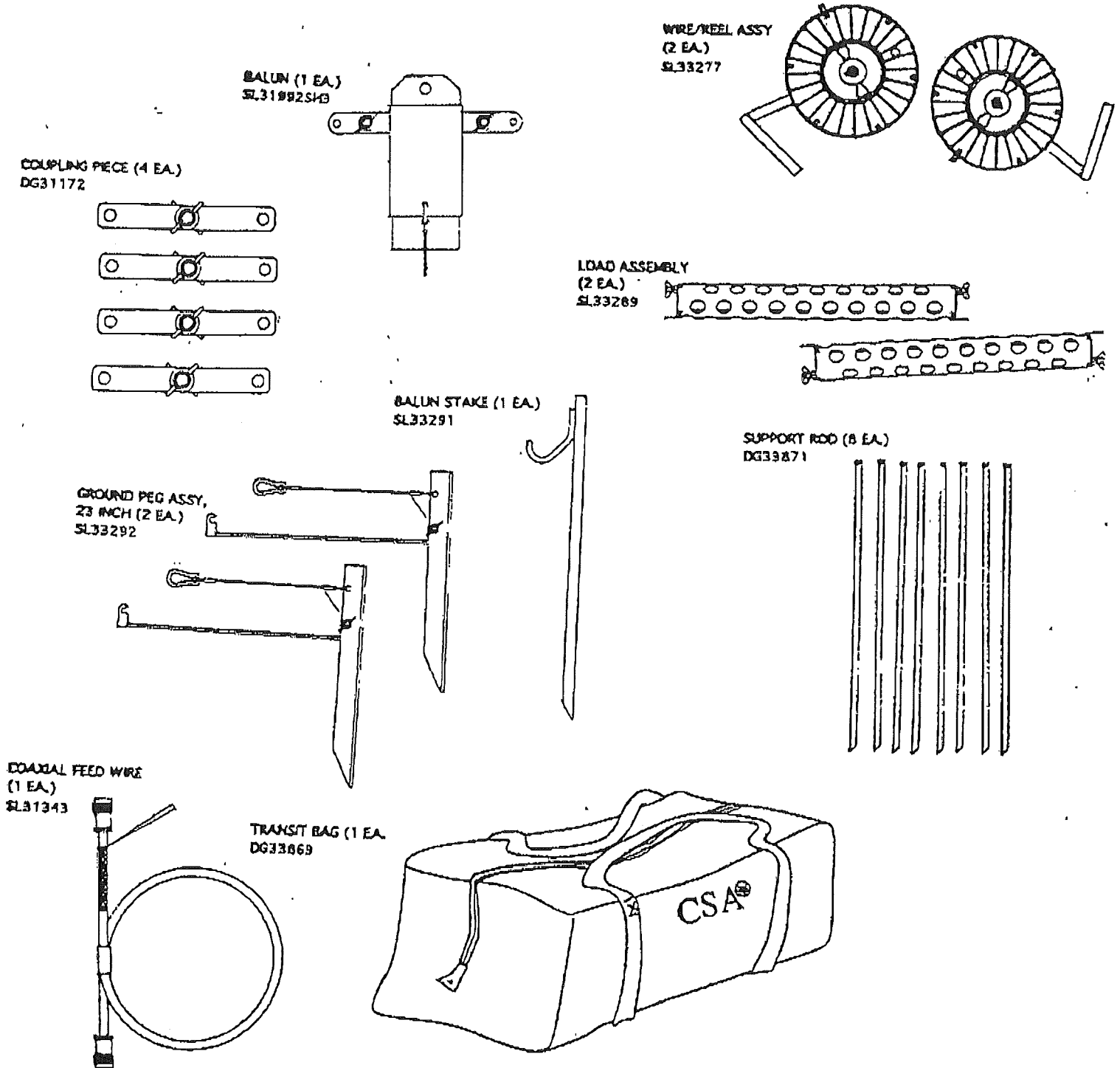
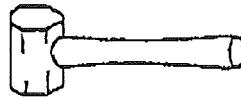


Figure 1-1a LONGSHOT Components - Antenna Kit

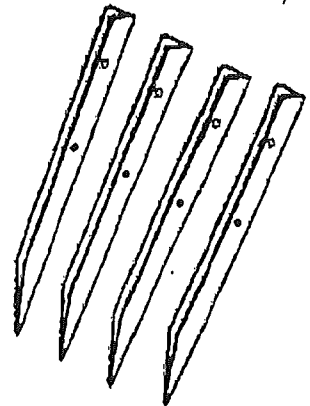
GROUND SPIRE (4 EA.)
Q86



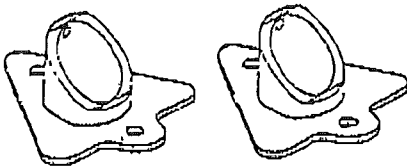
HAMMER (1 EA.)
Q88



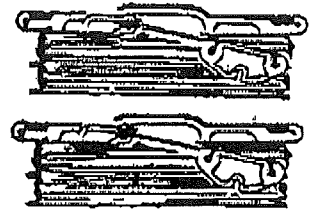
GROUND PEG, 15 INCH
STEEL (4 EA.)
SL32223



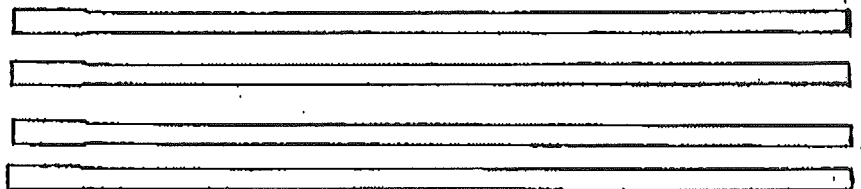
FOOT PLATE (2 EA.)
F209



STAY ASSEMBLY
(2 EA.)
SL33283



MAST TUBE (4 EA.)
AR31EF



BAG, MAST KIT (1 EA.)
DG33287

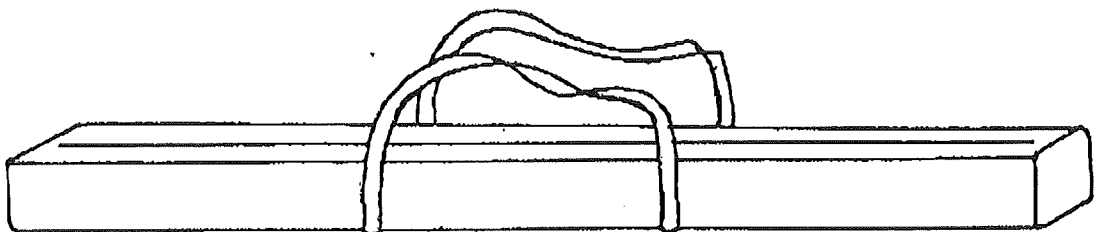


FIGURE 1-1b LONGSHOT Components-MiniMast Kit

1.4.1 Antenna Kit

The Antenna Kit contains all of the electrical components of LONGSHOT, together with the necessary ground anchoring items and the Technical Manual.

1.4.1.1 Wire/Reel Assembly

LONGSHOT radiating element wires are supplied on two reels (500 feet of wire per reel) for rapid two person deployment. Each reel houses three Aerial Wire Assemblies of unequal length - 117, 163 and 220 feet. For easy identification, all wire ends are labeled to show the length of the wire in feet. The three Aerial Wire Assemblies from each reel may be interconnected to produce various element lengths up to 500 feet maximum. The Aerial Wire Assemblies are supplied from the factory wound on the reels so that the shortest is available first and the longest last. This simplifies the assembly of the longest practical antenna (to obtain best antenna efficiency) when deploying the equipment in a confined space. See Figure 1-2.

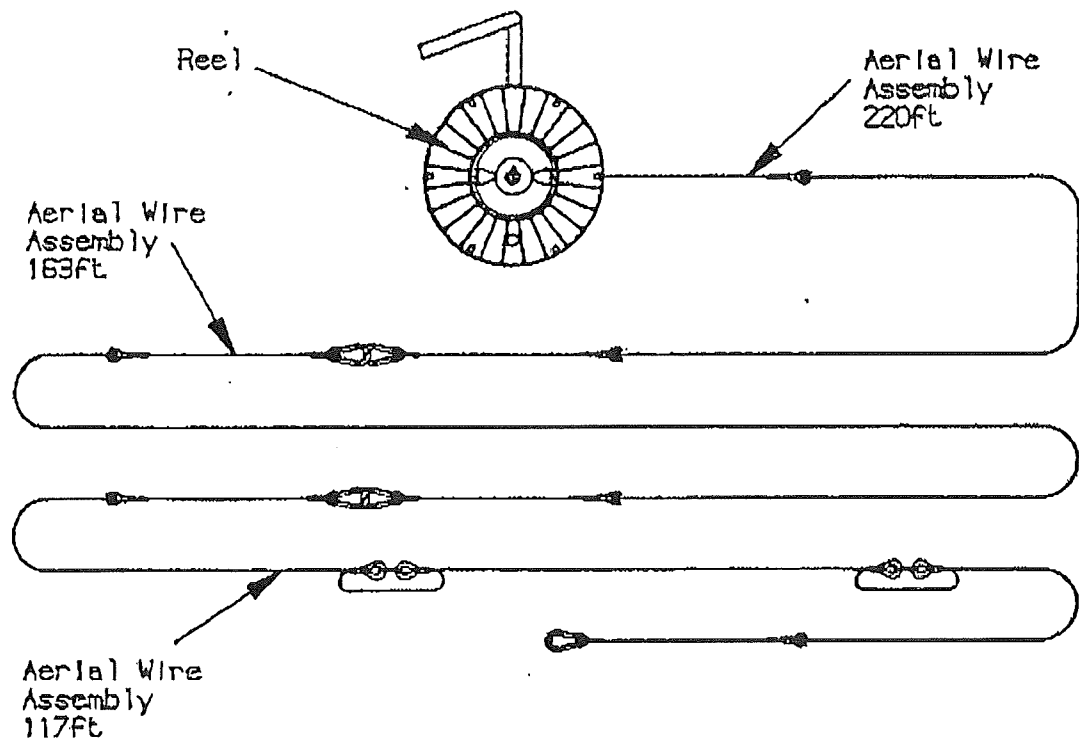


Figure 1-2. Wire Reel Assembly

1.4.1.2 Aerial Wire Assemblies

LONGSHOT radiating elements consist of Kevlar cored copper braided wire with a green plastic insulating coating. This provides a very strong lightweight wire which resists kinking. The wire weighs less than one pound per 100 feet; breaking load is 200 pounds. The green coloring of the wire insulation is effective camouflage and makes the element wire exceptionally difficult to see. To prevent accidental collision with the wire, it is important to mark the deployed antenna site clearly unless operational considerations dictate otherwise.

Wire ends are provided with a mechanical snap hook and a separate spade terminal to eliminate noisy connections. The snap hooks are used to mechanically link the wires together or to the strong points on the Balun, Load Assemblies or Ground Anchors. The terminal is prevented from becoming loose and hitting the operator's knuckles as the wire is wound off or on to the reel by means of sliding O-ring which ties the terminal to the element wire. This O-ring must be slid all the way towards the snap hook to free up the terminal prior to making an electrical connection and slid back again before the wire is wound back on to the reel.

The shortest Aerial Wire Assembly (117 feet) has small steel rings let into the wire at approximately 50 feet from each end. Either of these rings is used as the element suspension point for those antenna configurations where the balun is mounted at ground level and the element wire is taken up to the mast head. The wire is attached to the ring by means of two thimbles which are free to slide around the ring. The angle made between the wire as it arrives at and leaves the ring may thus be varied to produce the required antenna geometry without inducing any localized strain on the antenna wire. See Figure 1-3.

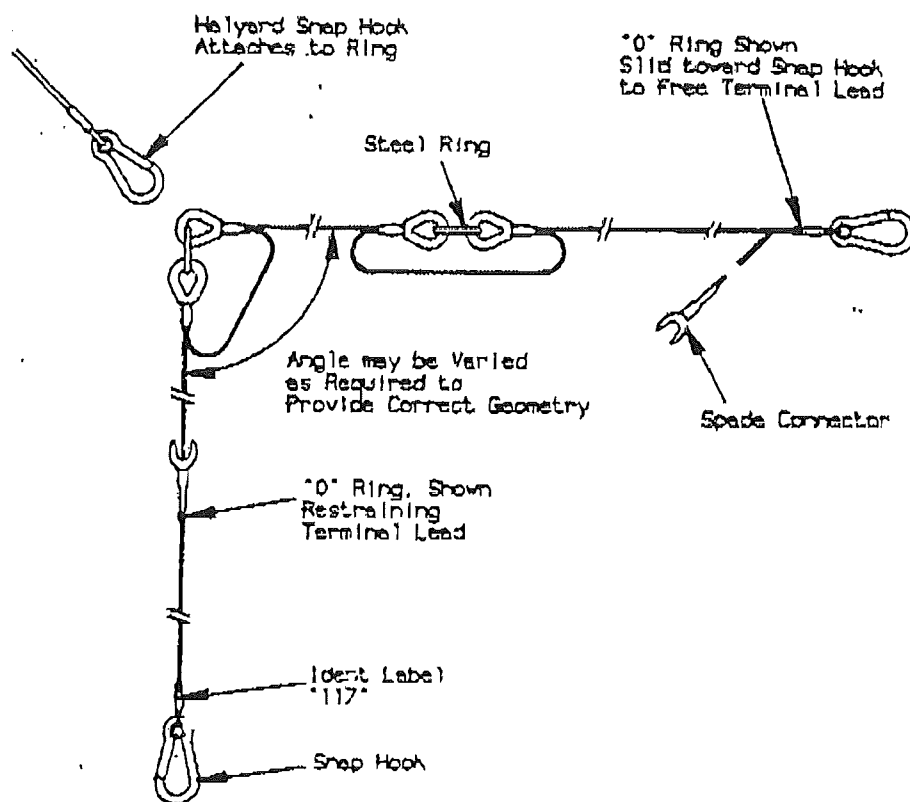


Figure 1-3. Aerial Wire Assembly, 117 Feet

1.4.1.3 Coupling Piece

Four Coupling Pieces are used to interconnect the Aerial Wire Assemblies as required to obtain the optimum antenna element length. The Aerial Wire Assembly snap hooks attach to the holes at both ends of the Coupling Piece. The element electrical spade connector is placed around the coupling piece stud and held secure by tightening the wing nut. This method of achieving a separate mechanical and electrical connection is the standard practice when assembling various components in the LONGSHOT kit. See Figure 1-4.



Figure 1-4. Coupling Piece

1.4.1.4 Balun

The high performance tactical lightweight Balun is rated for 1 kilowatt continuous duty (key down) across the frequency range 2-30 MHz. The function of the Balun is to provide impedance matching between the antenna and the coaxial transmission line. The Balun (ratio 50:600) is designed for suspension at the mast head by means of a halyard and snap hook (standard equipment supplied with 5985-01-342-8778ZX) or by means of a Balun Stake (see paragraph 1.3.1.6) at ground level.

A separate mechanical attachment point and electrical terminal is provided on each arm of the balun for hook up of element wires.

An annular housing around the base of the Balun protects the N type socket coaxial connector from accidental damage and rough handling. A captive dust cap attached by a chain to a strong point on the side of the Balun is also supplied. See Figure 1-5.

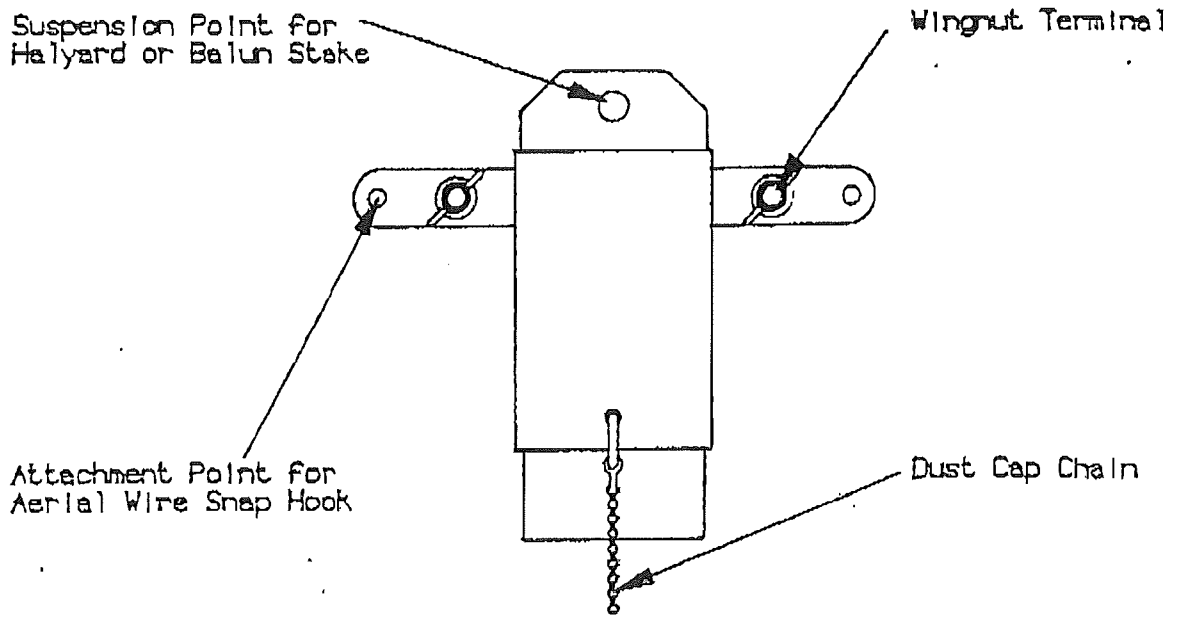


Figure 1-5. Balun

1.4.1.5 Coaxial Feed Wire

The antenna kit contains 18 meters (59 feet) of coaxial cable (RG213U-USA/URM67-UK) terminated with two (2) N type plug connectors. The upper end of the cable is fitted with a strain relief stocking which should be attached by its dog clip to the Balun strong point. See Figure 1-6.

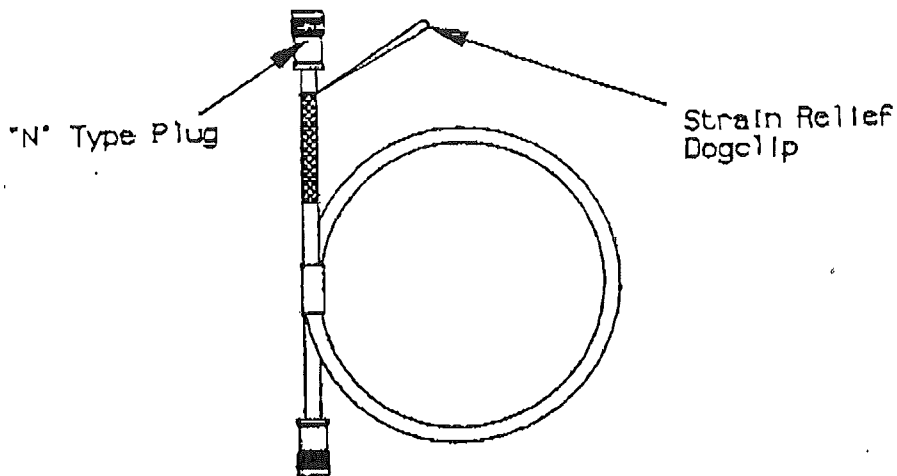


Figure 1-6. Coaxial Feed Wire

1.4.1.6 Balun Stake

In some configurations, it is necessary to mount the Balun close to ground level. The Balun may be suspended from the "cup hook" at the top of the 25 inch long Balun Stake. The stake is long enough to ensure that the coaxial cable connection at the base of the Balun is well above ground level to prevent the ingress of water or dirt. Tension in the element wire connected to the Balun is relieved by a separate anchor, the Ground Peg Assembly. The possibility of the Balun Stake being loosened or pulled out by wire tension is thereby precluded. See Figure 1-7.

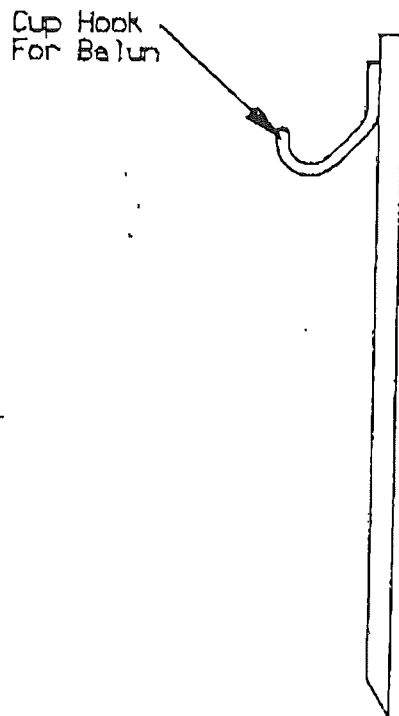


Figure 1-7. Balun Stake

1.4.1.7 Ground Peg Assembly, 23 Inches

Two 23 inch long Ground Peg Assemblies are used to anchor the element ends and to provide a path to ground where required. Provision is made to enable the Ground Peg Assemblies to be connected to Government furnished copper clad steel grounding rods. See Figure 1-8.

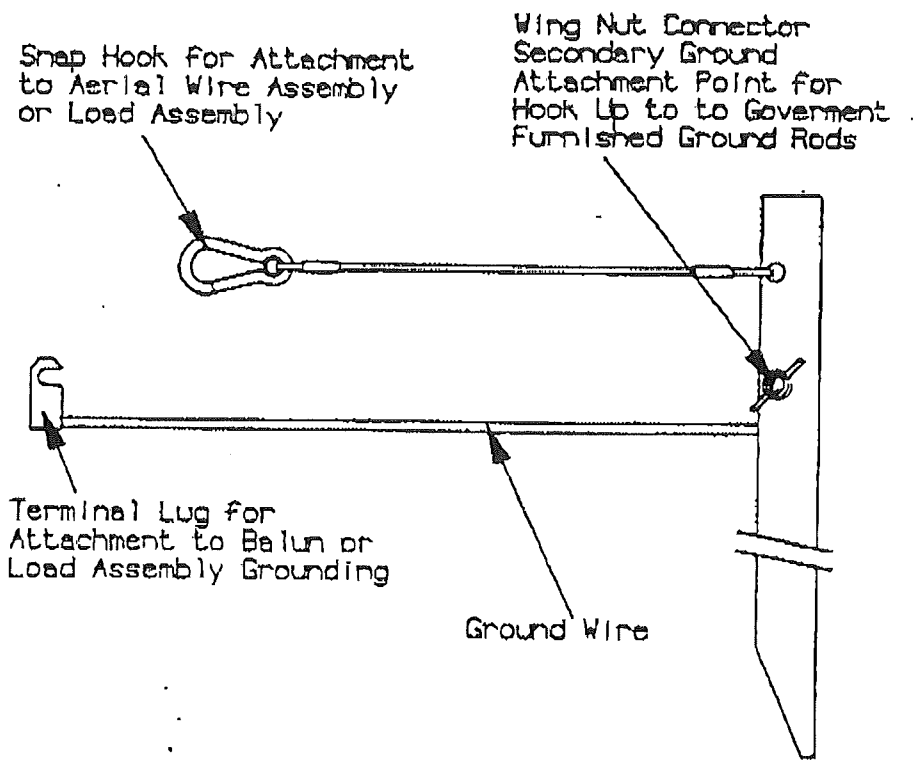


Figure 1-8. Ground Peg Assembly, 23 Inches

1.4.1.8 Load Assembly

Two Load Assemblies are supplied. Each assembly consists of a black anodized aluminum housing containing two 180 ohm wire wound resistors in series. The Load Assemblies are each rated for 1 kilowatt continuous operation. Their function is to absorb reflected power from the transmitter so as to broaden the operating band of the antenna. See Figure 1-9.

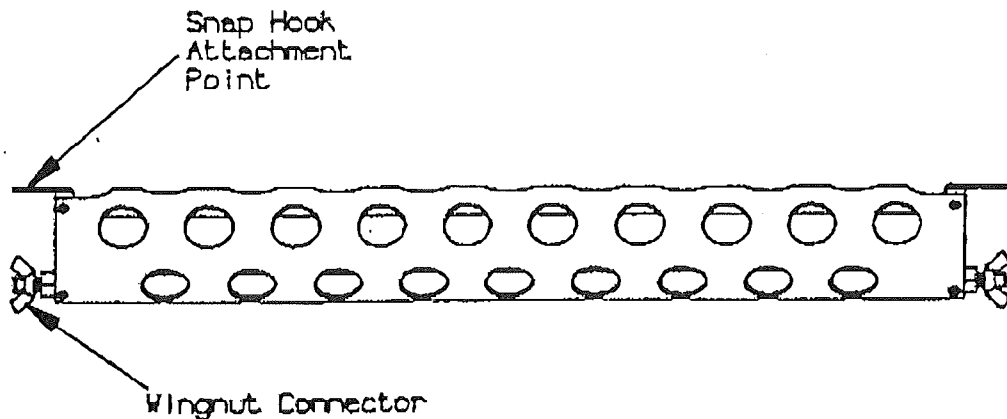


Figure 1-9. Load Assembly

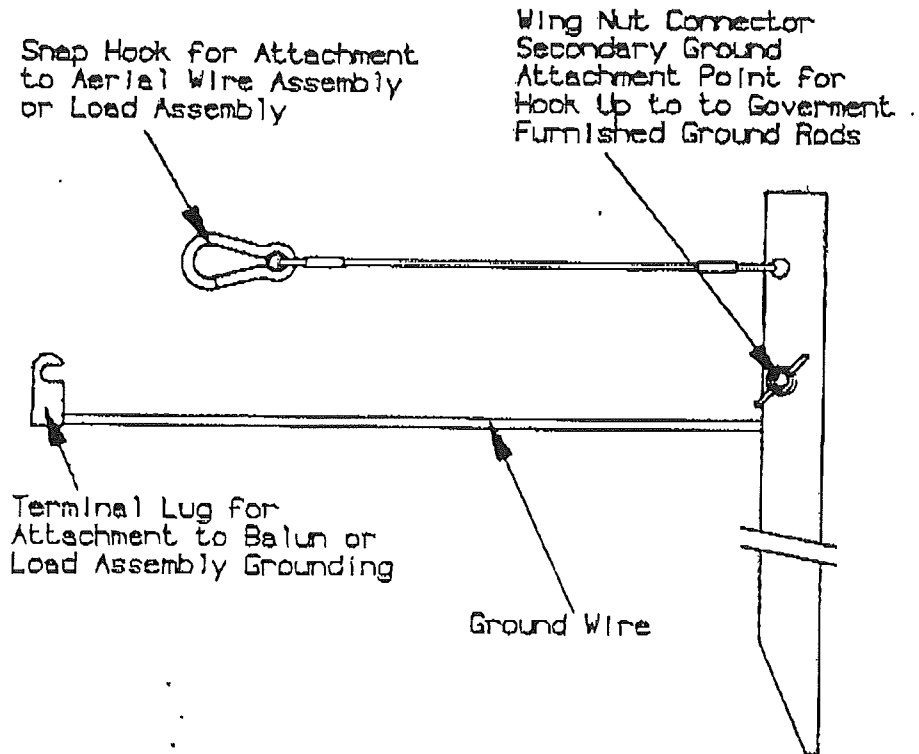


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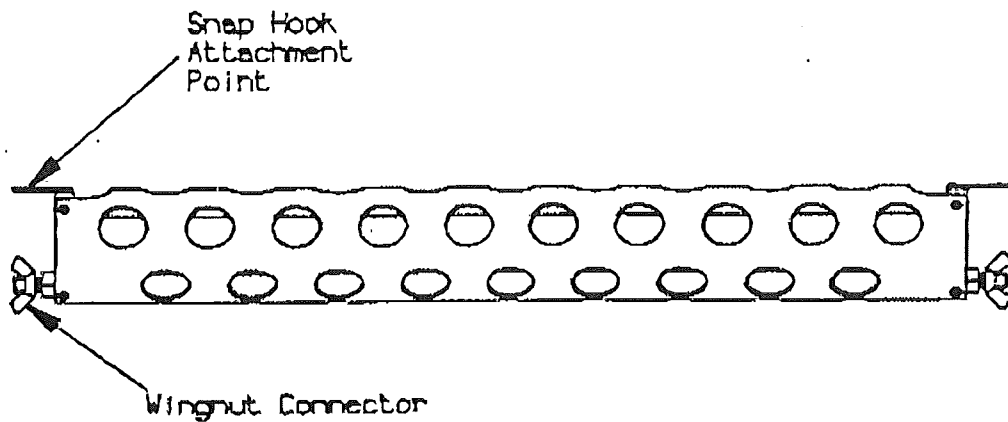


Figure 1-9. Load Assembly

1.4.1.9 Support Rods

Eight twenty inch long nonconducting rods are used to support the antenna element twelve inches above the ground in the receive only Beverage configuration. See Figure 1-10.



Figure 1-10. Support Rods

1.4.1.10 Transit Bag

A rot proof hold all style transit bag is supplied for transportation and storage of all items of the antenna kit. Closure is by a full length military style zipper.

1.4.2 Minimast Kit

The Minimast Kit is a self-contained package whose components may be assembled into two 10'6" high masts. These Minimasts are used to support the element ends of some LONGSHOT antenna configurations. The Minimasts serve two functions: they reduce stresses acting on the 50 foot mast by sharing some of the loads and they also raise the antenna elements away from the ground so that antenna performance is improved.

The Minimasts are not connected mechanically or electrically to the antenna wire elements; if the priority is to deploy the antenna as quickly as possible, the Minimasts may be deployed at a later time to improve antenna performance and to assure structural integrity up to the maximum design wind speed (90 mph).

1.4.2.1 Mast Tubes

Four identical 2 inch diameter socketed aluminum tubes are assembled to form the Minimasts. The tubes are 5 feet 6 inches long; the lower six inches of each tube are belled to form a socket so that two tube sections may be joined together to form a 10 foot 6 inch high mast. The tubes are anodized black to prevent corrosion and to reduce their visual profile.

1.4.2.2 Foot Plate

The Minimasts are prevented from sinking into soft ground by the triangular Foot Plates on which they rest. The base of the masts locate in a heel shaped socket on the upper surface of the Foot Plate. The shape of this socket facilitates raising the mast "Two Jima" style and prevents mast base movement once the mast is erect. Two holes in the Foot Plate are provided to pin it to the ground. See Figure 1-11.

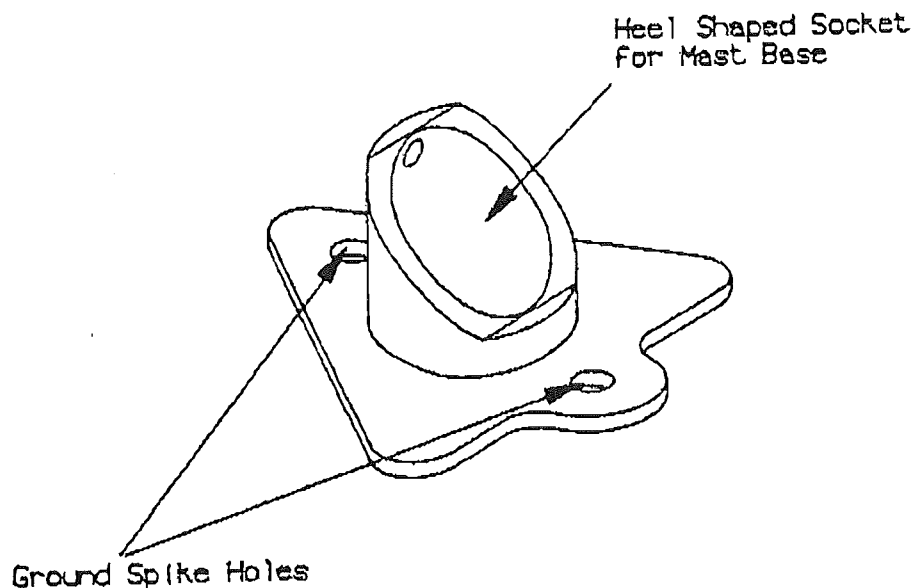


Figure 1-11. Foot Plate

1.4.2.3 Ground Spike

Four steel Ground Spikes are supplied; two are used to anchor each Foot Plate. See Figure 1-12.



Figure 1-12. Ground Spike

1.4.2.4 Stay Assembly

A winder for each Minimast contains a Stay Assembly which comprises an insulating mast Top Cap, two Guy Ropes and their associated self-locking Tensioners. The combination of the antenna wire element passing over the Minimast Top Cap and the two Guy Ropes provides a stable support system for the Minimast. See Figure 1-13.

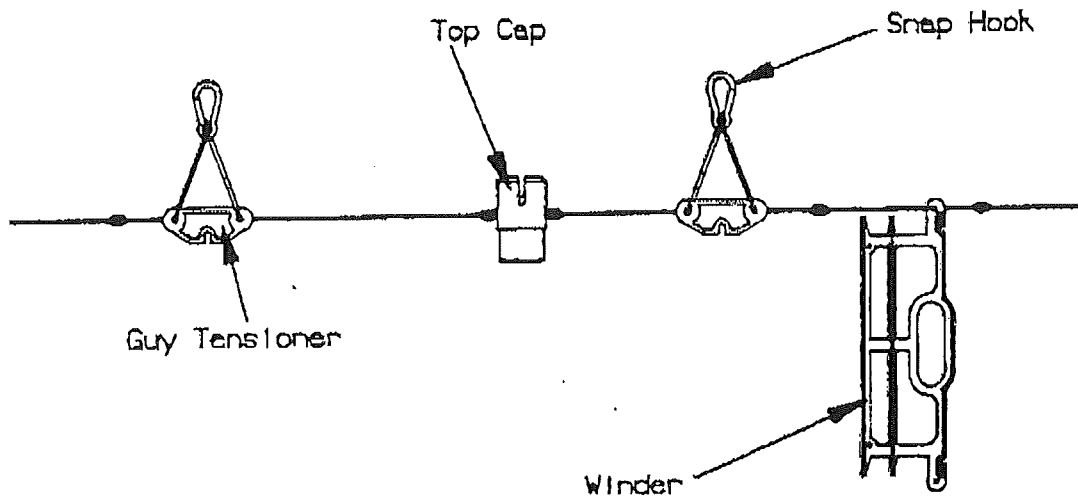


Figure 1-13. Stay Assembly

1.4.2.5 Ground Peg, 15 inch Steel

1-14. The Minimast Guy Ropes are anchored by 15 inch long steel Ground Pegs. See Figure

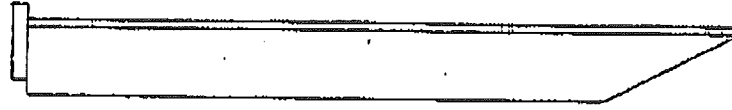


Figure 1-14. Ground Peg, 15 inch Steel

1.4.2.6 Hammer

A Hammer is provided to drive the various ground anchors used in the LONGSHOT system.

1.4.2.7 Bag, Mast Kit

A rot proof transit bag is supplied for transportation and storage of all items of the Minimast Kit.

SECTION 2

CONFIGURATION SELECTION

2.1 INTRODUCTION

A large number of factors may have an influence on the selection of antenna configuration for a particular mission. Frequently, some of these factors will conflict with one another, so that the final choice will be a compromise. Fortunately, High Frequency communications tend to be reasonably forgiving so that it will usually be found that when the "ideal" LONGSHOT configuration is impractical (usually due to space limitations), alternatives are available which will produce acceptable results.

2.2 CONFIGURATION SELECTION

The primary selection factors which determine the configuration best suited for a particular application are:

- Range to distant station
 - Allocated frequencies
 - Deployment space available
 - Size and complexity of configuration
 - Configuration bandwidth
 - Vertical and horizontal radiation pattern
 - Gain
 - Directivity and sidelobe performance
- a. The range to the distant station will dictate the ideal Take Off Angle (TOA), which is the vertical angle of maximum radiation. This angle marks the center line of the lobe of radiation. The required TOA also depends on the height of the ionospheric layer and the mode of propagation. Table 2-1 shows the approximate TOA in degrees above the horizon for single hop day time and night time operation. Although these values vary greatly with differing conditions, their accuracy is sufficient for use with the broad beamwidths of the various LONGSHOT configurations.
- b. Allocated Frequencies. The range of allocated frequencies determines the required bandwidth of the antenna configuration. Computer based propagation analysis is usually performed before a mission to determine optimum traffic frequencies (FOT) for the paths involved. As a guide, Table 2-2 may be used to select the correct band of operating frequencies for various path lengths.

It should be noted that nearly all LONGSHOT configurations are broadband; however, since their radiation patterns vary with frequency, merely being broadbanded does not in itself assure good connectivity.

TABLE 2-1. TOA VS. PATH LENGTH

Takeoff Angle (Degrees)	Path Length	
	Day Time mi	Night Time mi
0	2000	2800
5	1500	2300
10	1200	1800
15	900	1400
20	700	1100
25	600	1000
30	450	825
35	400	700
40	350	600
45	275	500
50	250	425
60	160	275
70	95	180
80	50	90

TABLE 2-2. FREQUENCY VS. PATH LENGTH

Frequency (MHz)	Path Length (mi)
2-7	(0 - 200)
3-8	(200 - 400)
4-11	(400 - 800)
5-18	(800 - 1500)
7-28	(1500 +)

- c. Deployment Space Available. Ideally, a full duplex tactical long range HF antenna site needs more than 7 acres. However, LONGSHOT has been specifically developed for use where real estate is limited. The receive only Beverage configuration has a very low side lobe radiation pattern. This means that it is relatively insensitive to transmit antennas situated to the side, so that a pair of transmit and receive antennas can be set up within 100 yards of one another. In addition, a large number of LONGSHOT configurations are available, so that when space is limited, an acceptable arrangement can be deployed.
- d. Size and Complexity of Configuration. LONGSHOT configurations vary in size and complexity. For instance, compare the 500 foot Sloping Vee which occupies 1.5 acres and is the most time consuming antenna to erect (30 minutes for 2 persons) to the simple Beverage, which requires a straight line as little as 280 feet long and only 10 minutes for 1 person to deploy (no mast is required). Details of these and all other configurations are given in Section 3.
- e. Vertical and Horizontal Radiation Pattern. For all antennas, best service is obtained when the direction to the distant station is within the beamwidth of the antenna. The beamwidth, sometimes known as the "half power beamwidth" is taken to be the twice the angle subtended from the boresight to the point on the beam where gain is 3 dB below the peak gain. See Figure 2-1. Because HF skywave antennas use the ionosphere as a "reflector", the required Take Off Angle (see Table 2-1) must be within the vertical half power beamwidth of the antenna configuration at the operating frequency. Similarly, the azimuth of the distant station must be within the horizontal half power beamwidth of the antenna configuration at the operating frequency. Net operation will usually require a broad or omnidirectional radiation pattern. However, LONGSHOT is primarily intended for point-to-point circuits over long range where narrow beam, high gain, directional antennas are most effective. Vertical and horizontal radiation patterns for LONGSHOT configurations are given in Section 3. CSA recommends that all long range configurations of LONGSHOT are aimed "on azimuth", i.e. directly at the distant station and not 10° to one side as has been the practice in the past. Better connectivity will result on most occasions.

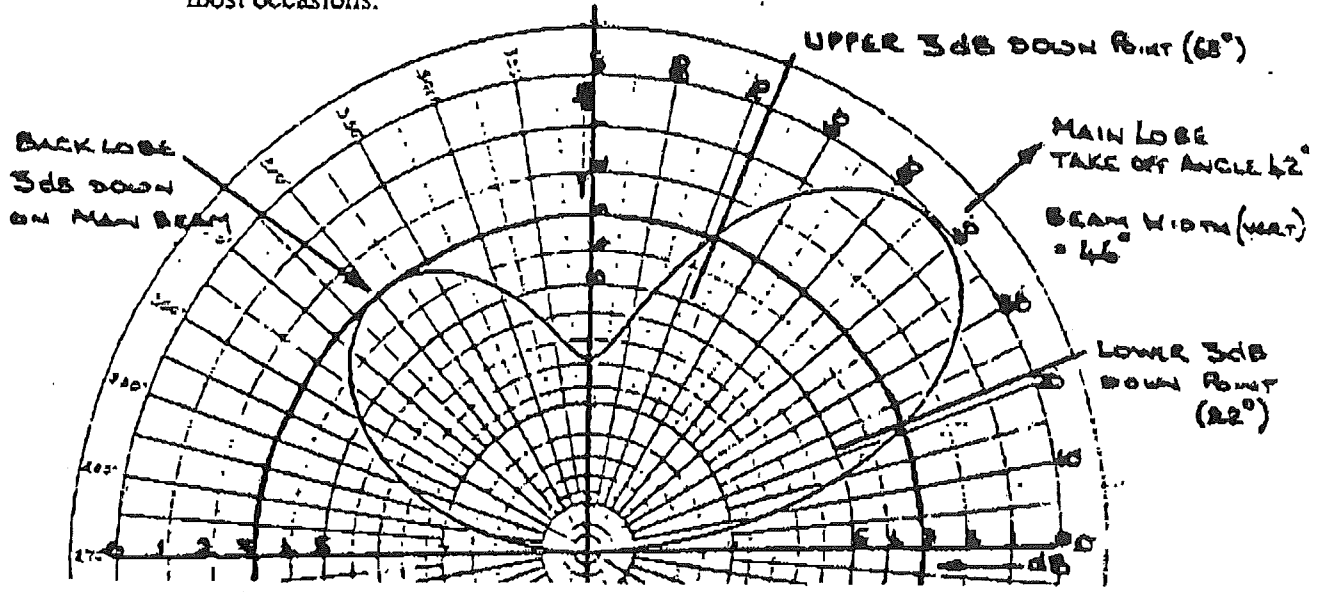


Figure 2-1. An Idealized Antenna Beam, Showing Half Power Beamwidth

- f. Power Gain. Transmit antenna selection should be based on the LONGSHOT configuration giving the highest power gain in the required direction (horizontally and vertically) which will meet the other constraints previously discussed.
- g. Directivity and Sidelobe Performance. When considering which configuration to use for receive operations, it should be remembered that it is a high directivity and a low sidelobe/back lobe pattern which decides performance. The goal is to pull out the one wanted signal at the expected azimuth and elevation angle while being insensitive to noise and spurious signals in all other directions.

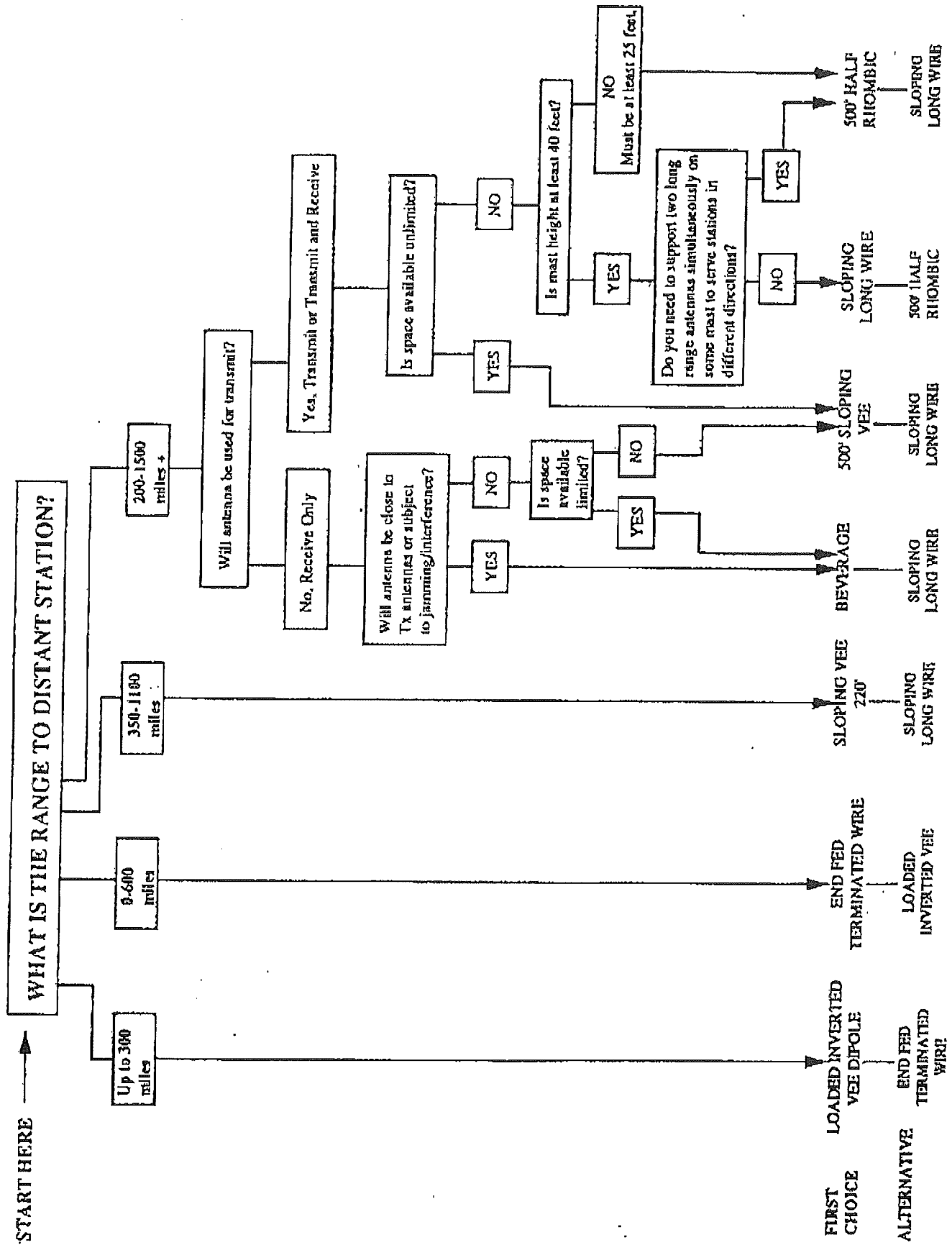


TABLE 2-3. CONFIGURATION SELECTION

SECTION 3

CONFIGURATION DETAILS

3.1 INVERTED VEE DIPOLE

A short range omnidirectional antenna for Near Vertical Incidence Skywave (NVIS) operation. Horizontal polarization.

3.1.1 Characteristics

Range	Optimum Frequency/Typical Gain	Deployed Dimensions
0-300 miles	2 to 9 MHz -5 dBi	210 x 66 ft.

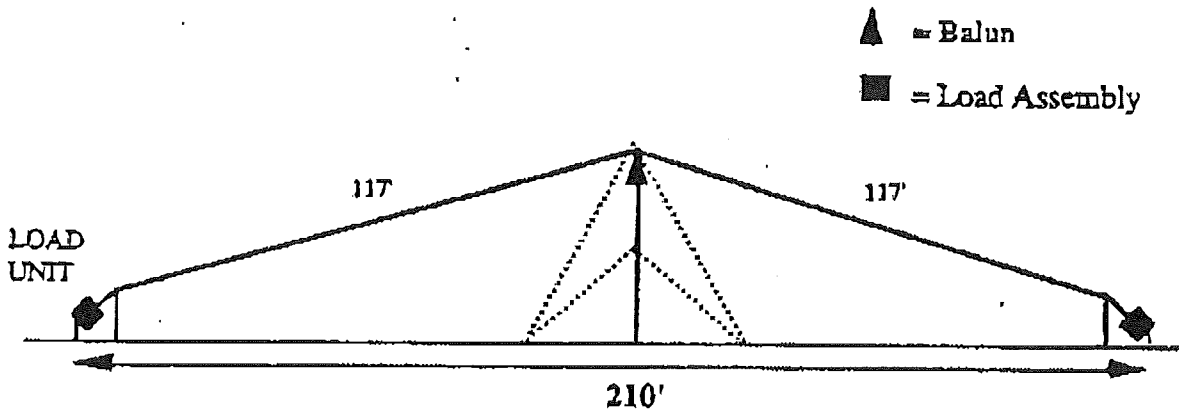


Figure 3-1. Inverted Vee Dipole Site Layout

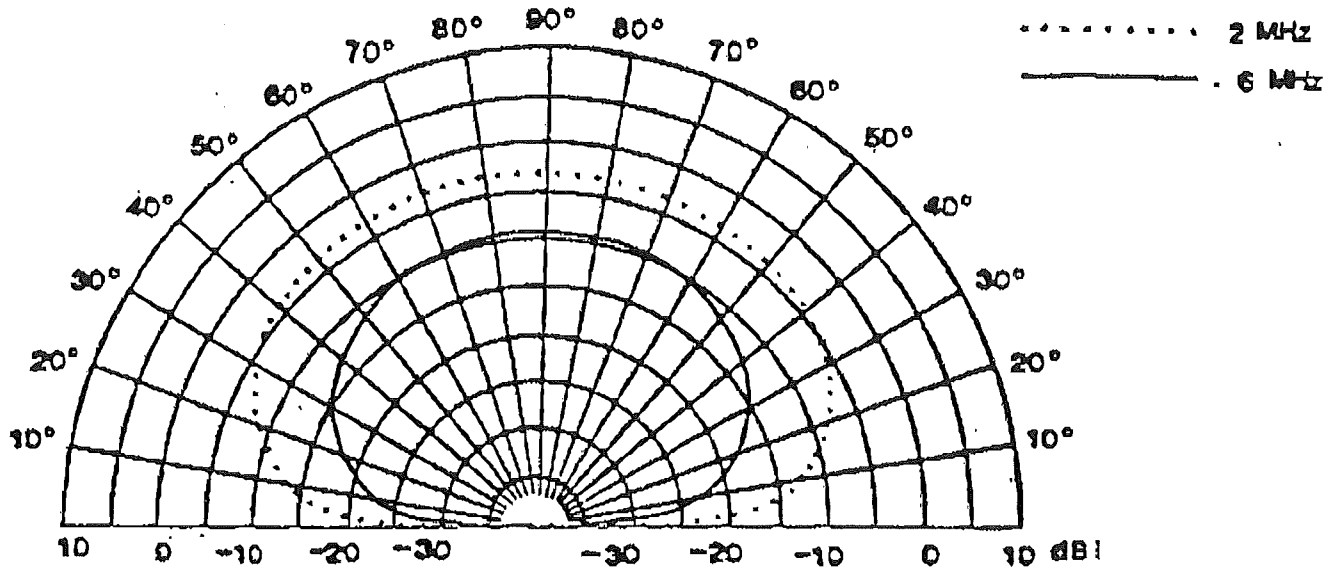


Figure 3-2. Vertical Radiation Patterns of Vee Dipole

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3.2 END FED TERMINATED WIRE

A short/medium range antenna with vertical polarization.

3.2.1 Characteristics

Range	Optimum Frequency/Typical Gain	Deployed Dimensions
0-600 miles	3 to 18 MHz -3 dBi	110 x 20 ft.

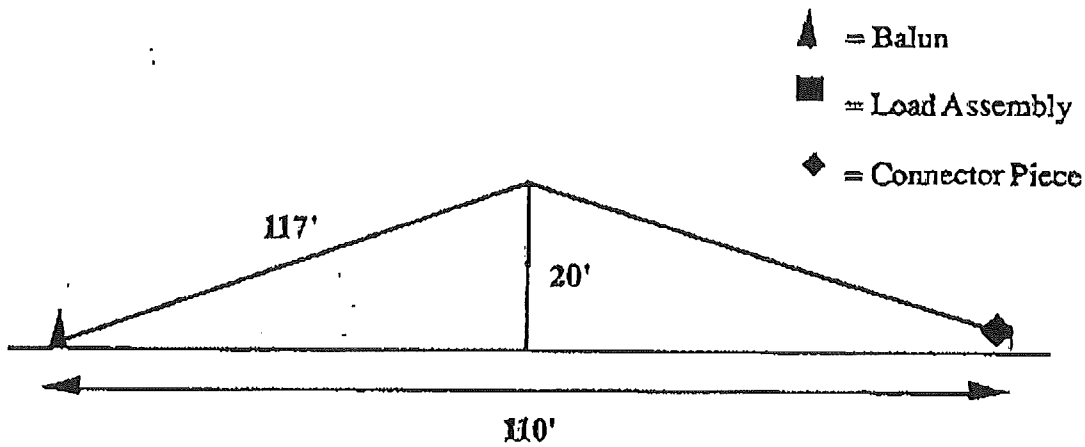


Figure 3-3. End Fed Terminated Wire Site Layout

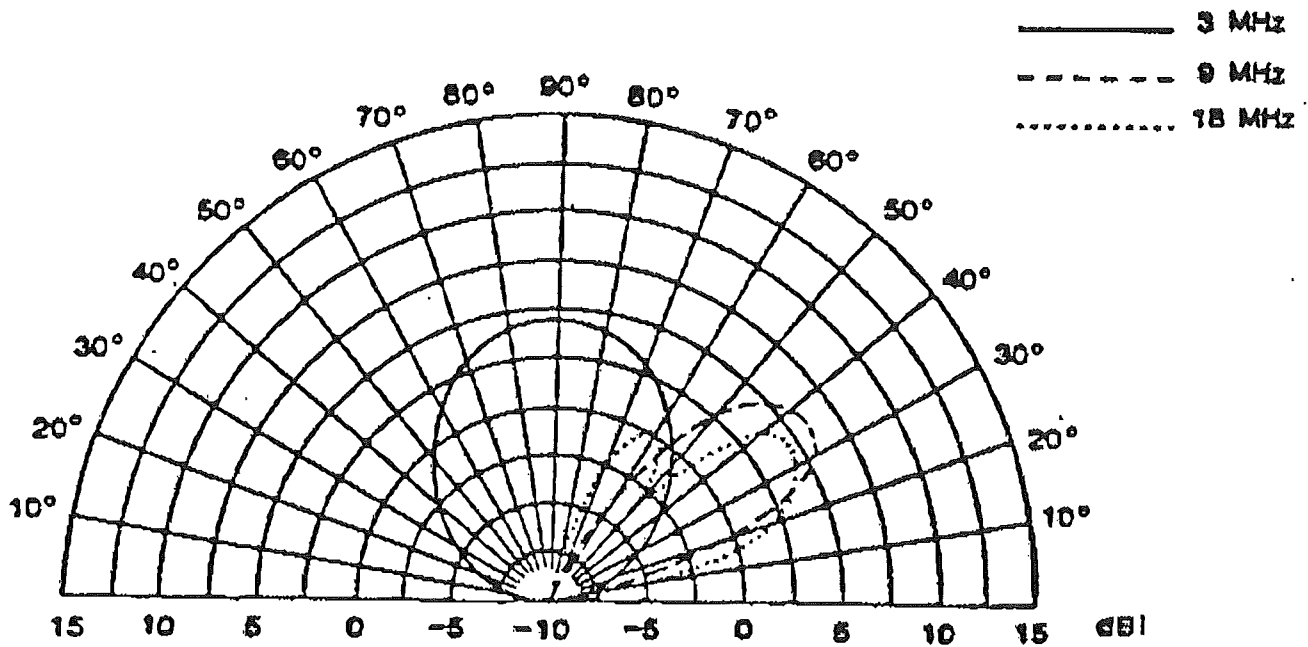


Figure 3-4. Vertical Radiation Patterns of End Fed Terminated Wire

3.3 SLOPING VEE, 220'

A good mid-range directional receive antenna across HF band; useful only above about 10 MHz for transmit. Horizontal polarization.

3.3.1 Characteristics

Range	Optimum Frequency/Typical Gain	Deployed Dimensions
350-1100 miles	12 to 30 MHz +4.5 dBi	180 x 180 ft.

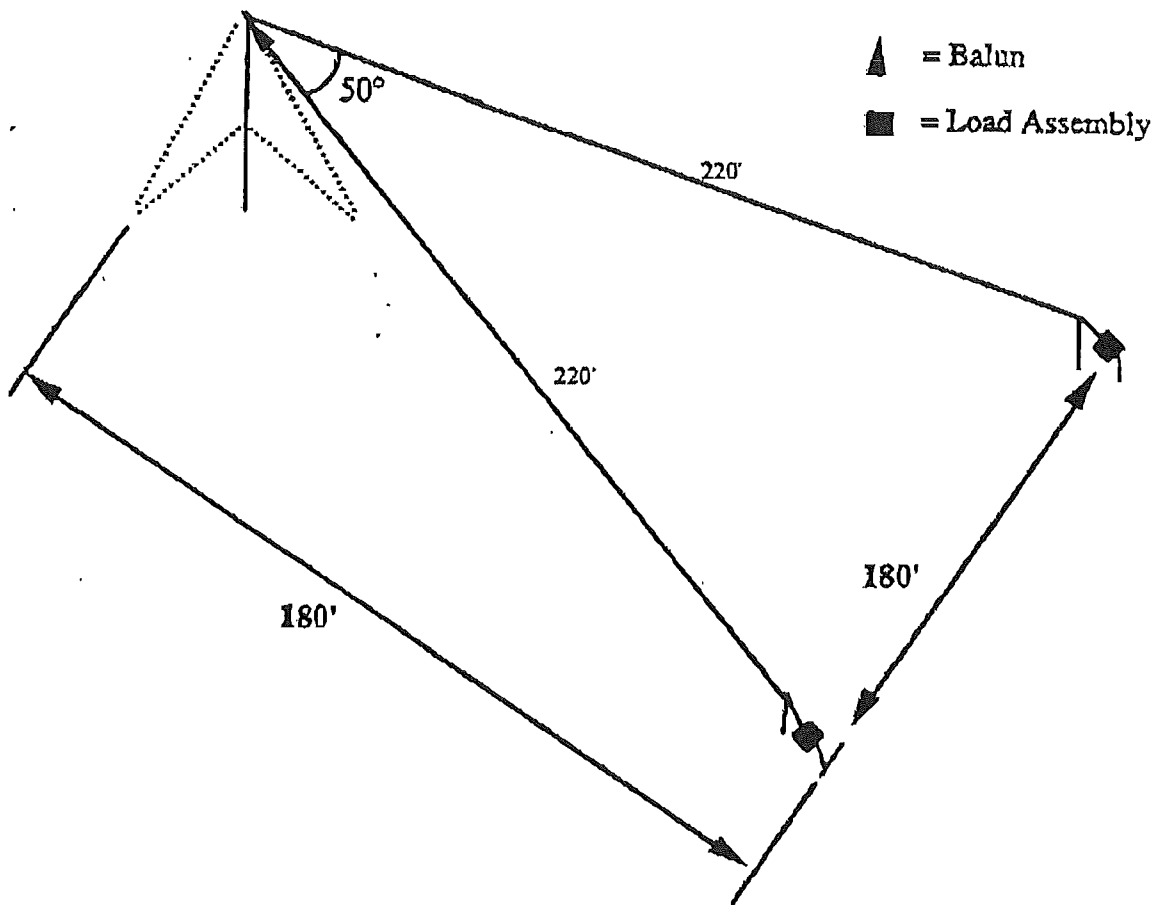


Figure 3-5. Sloping Vee, 220' Site Layout

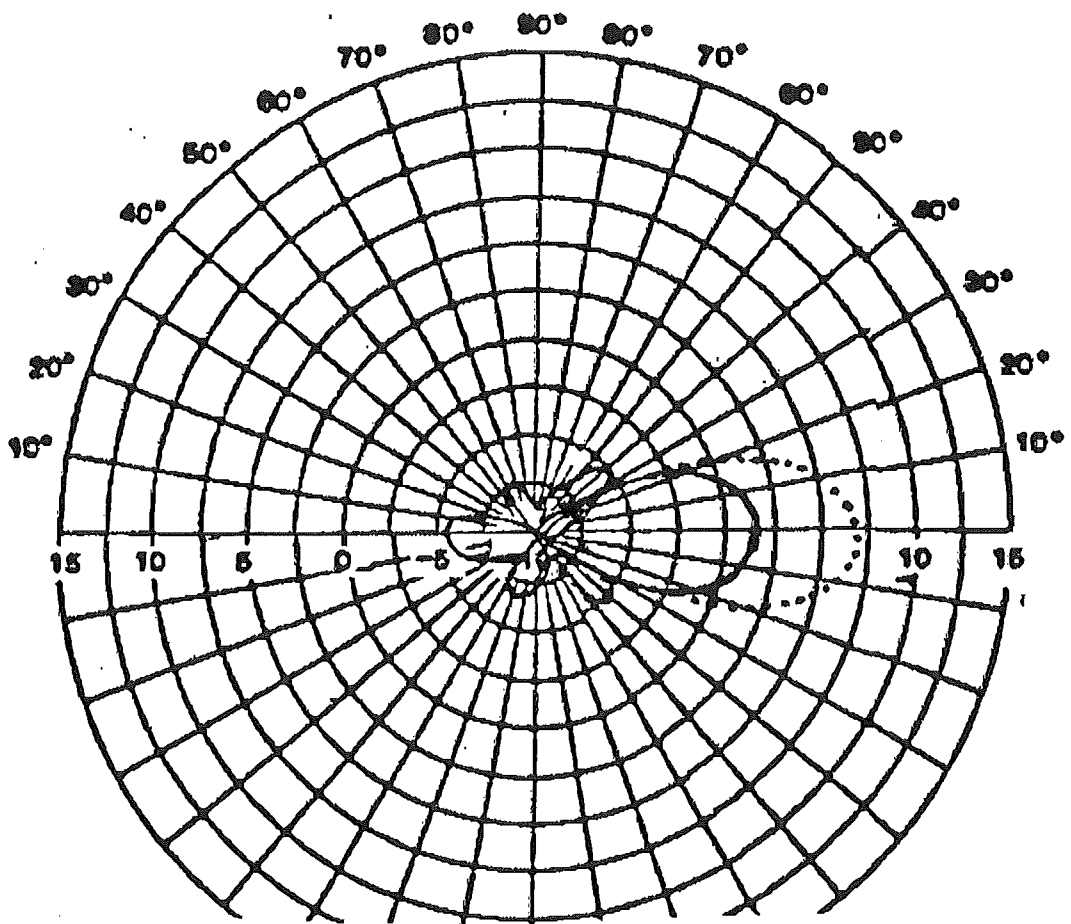
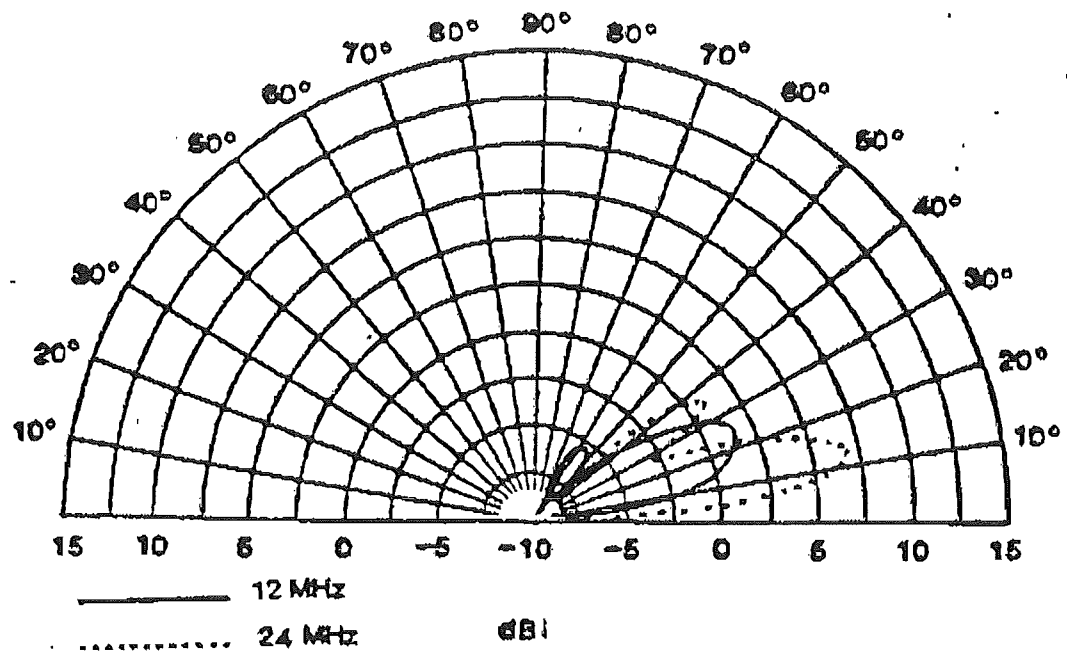


Figure 3-6. Horizontal and Vertical Radiation Patterns of 220' Sloping Yee

3.4 BEVERAGE - Receive Only

A rapidly deployed low profile directional antenna with good sidelobe suppression and high directivity. Not recommended for transmit due to low efficiency. Vertically polarized.

3.4.1 Characteristics

Range	Optimum Frequency/Typical Gain	Deployed Dimensions
200-1500 miles +	3 to 30 MHz 13 dBi (directivity)	337 ft. long

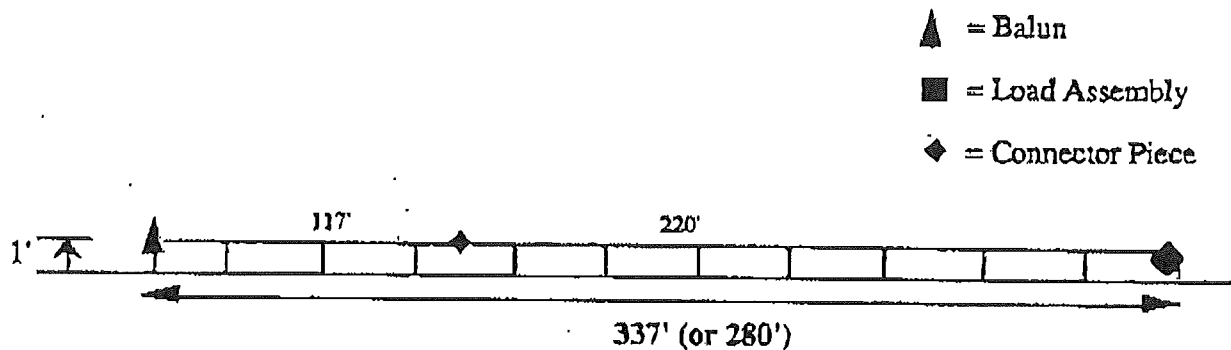


Figure 3-7. Beverage Site Layout

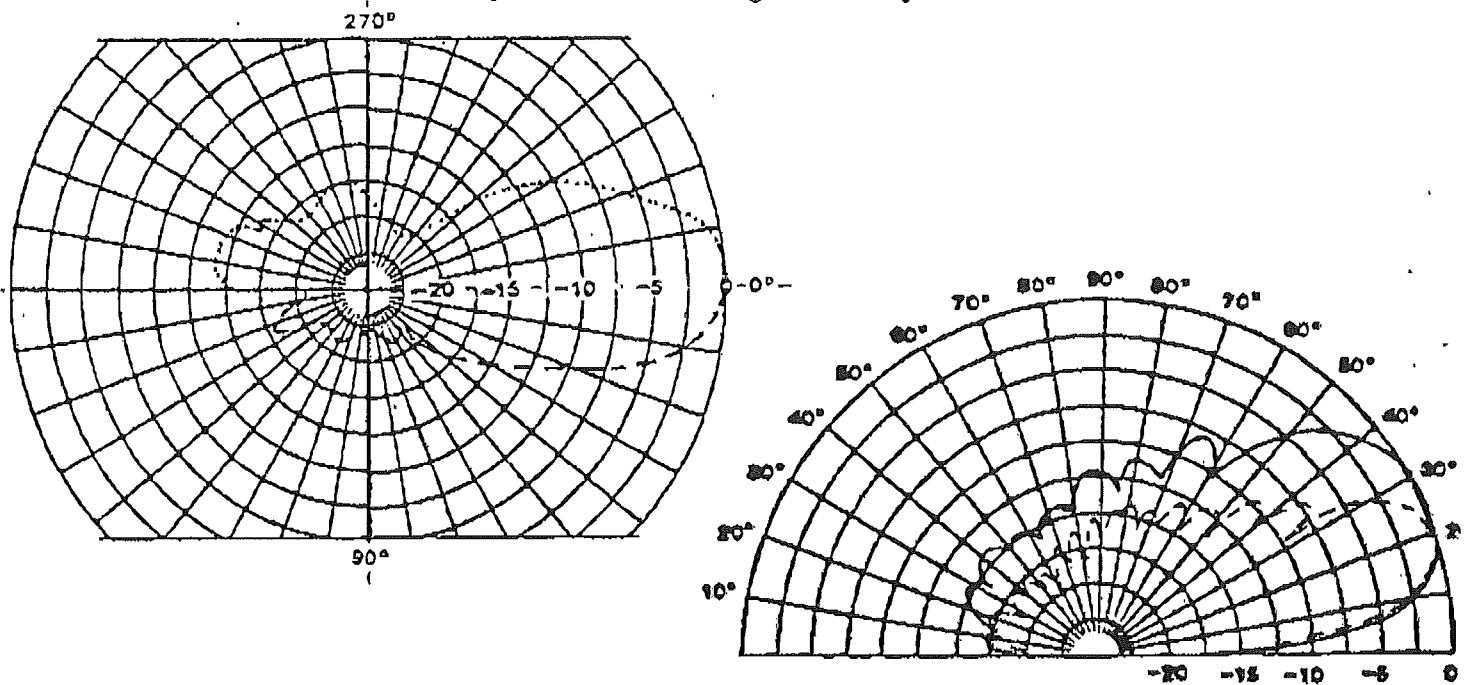


Figure 3-8. Horizontal and Vertical Radiation Patterns of Beverage Antenna

3.5 SLOPING VEE, 500'

A long range antenna providing a low angle narrow beam over a wide frequency range. The LONGSHOT configuration providing the best transmit performance provided there is enough space at the deployment site. The configuration is horizontally polarized.

3.5.1 Characteristics

Range	Optimum Frequency/Typical Gain	Deployed Dimensions
500-2000 miles +	8 to 25 MHz 8 dBi	510 x 250 ft.

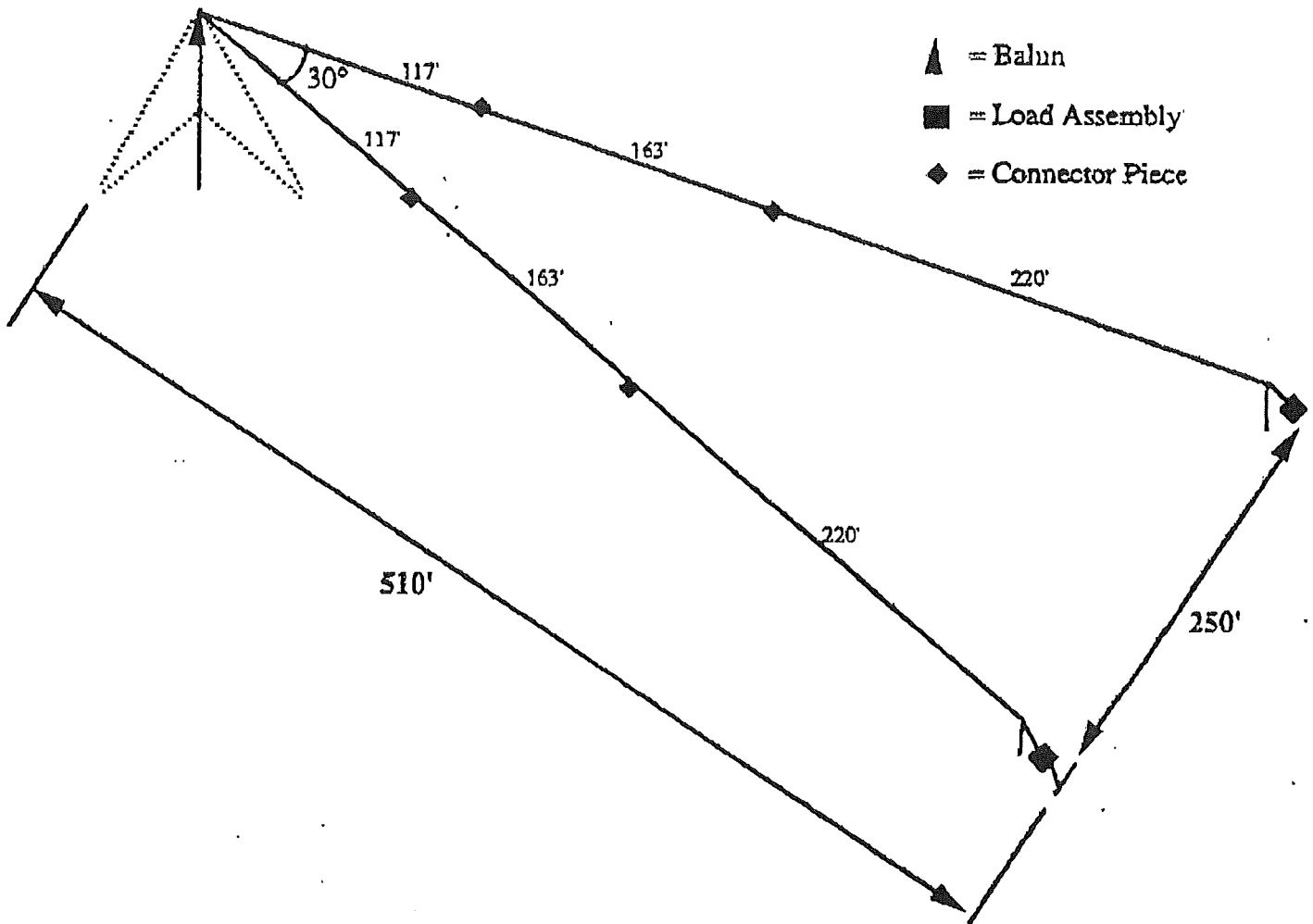


Figure 3-9. Sloping Vee, 500' Site Layout

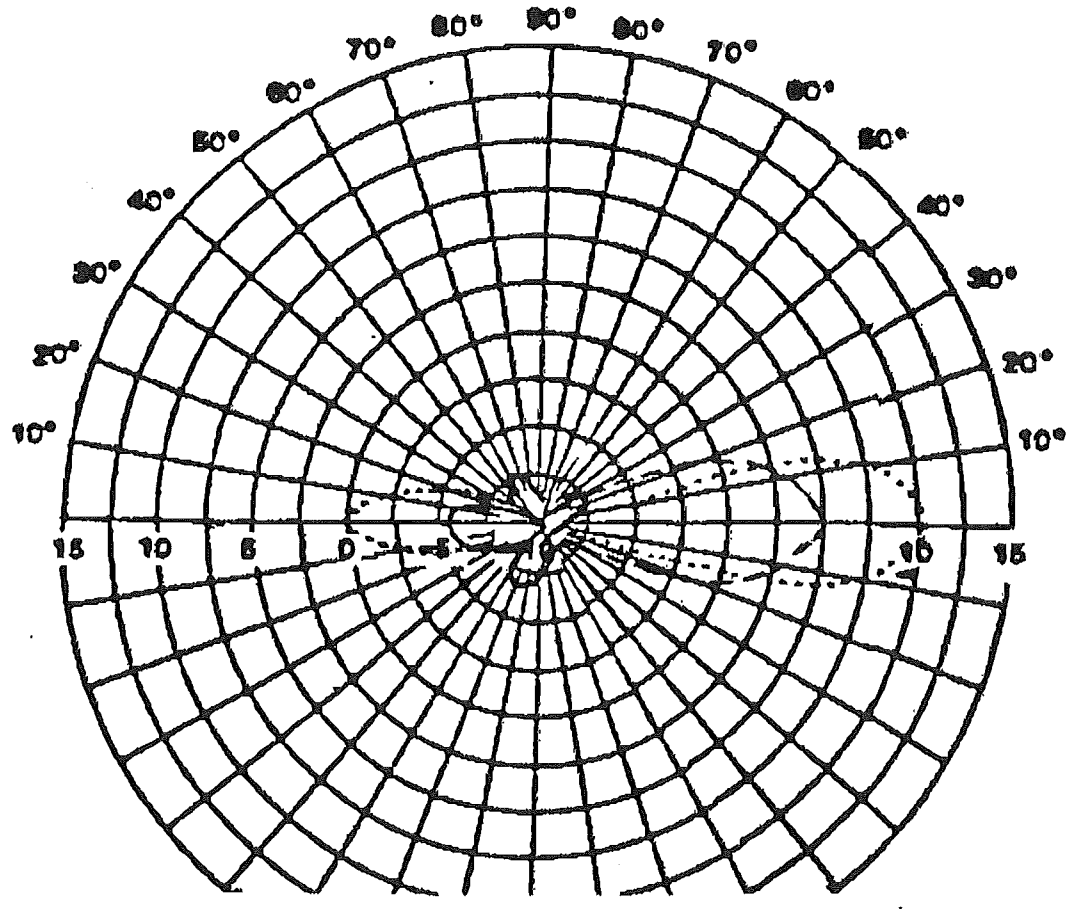
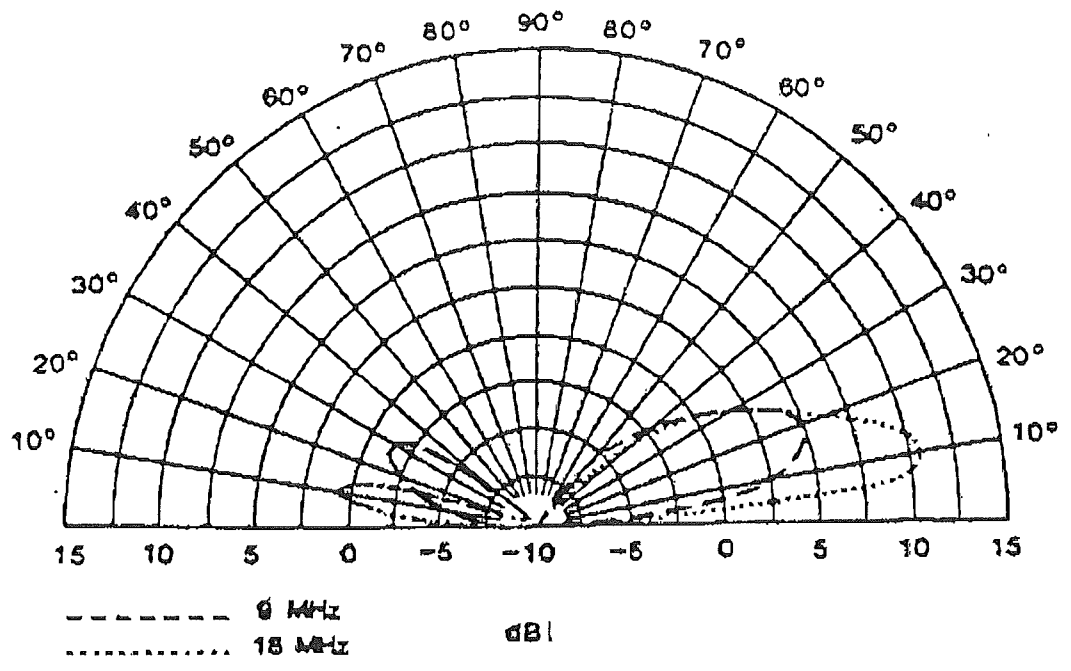


Figure 3-10. Horizontal and Vertical Radiation Patterns of 500' Sloping Vee

3.6 SLOPING LONG WIRE ("AFWONXX")

A rapidly deployed simple long wire configuration providing a good overall performance over most of the HF band. A good choice for most tactical situations when space is somewhat limited.

3.6.1 Characteristics

Range	Optimum Frequency/Typical Gain	Deployed Dimensions
600-1500 miles +	6 to 22 MHz and 20 to 30 MHz	485 x 66 ft. 384 x 66 ft.

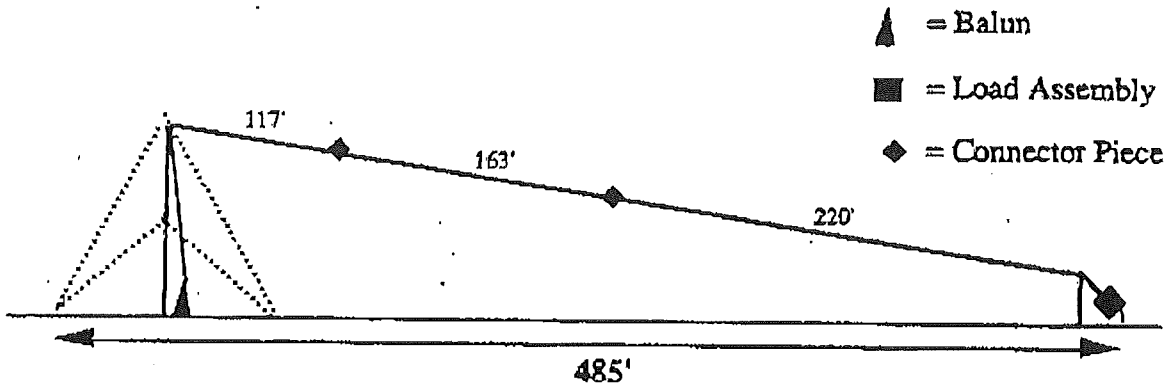


Figure 3-11. Sloping Long Wire Site Layout

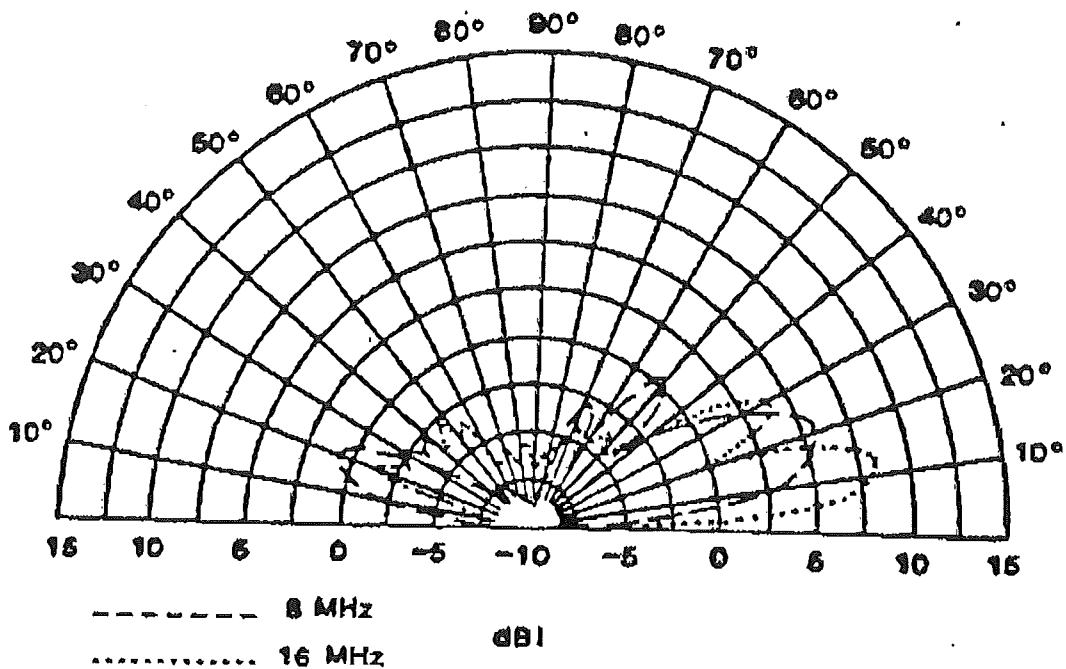


Figure 3-12. Vertical Radiation Pattern of Sloping Long Wire

3.7 HALF RHOMBIC, 550'

A broadband vertically polarized antenna which imposes symmetrical loads on the mast. Wider bandwidth than sloping long wire. Two half rhombics may be mounted on one mast simultaneously to cover two stations on widely separated azimuths.

3.7.1 Characteristics

Range	Optimum Frequency/Typical Gain	Deployed Dimensions
500-2000 miles +	6 to 30 MHz 5 dBi	550 x 66 ft.

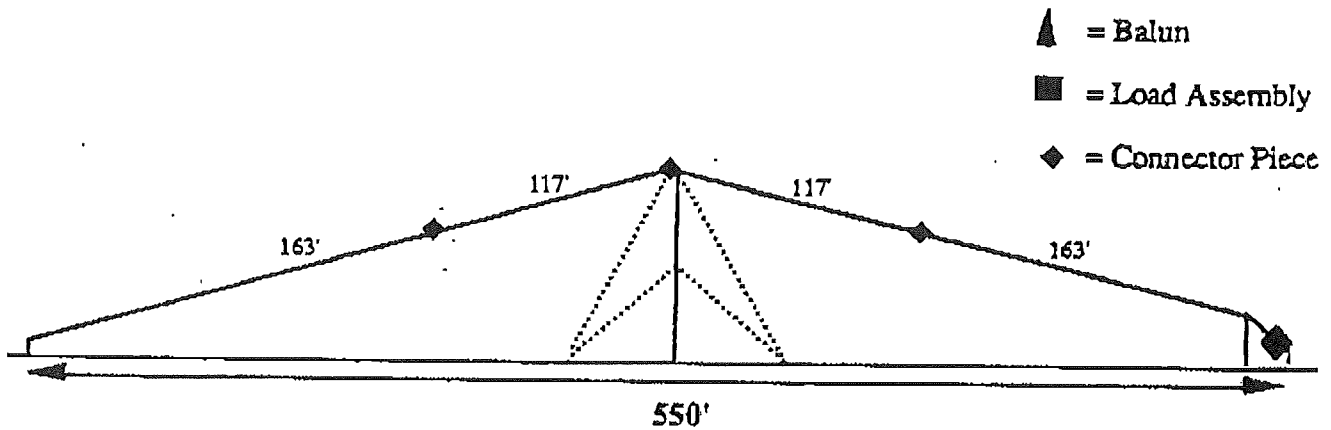


Figure 3-13. Half Rhombic Site Layout

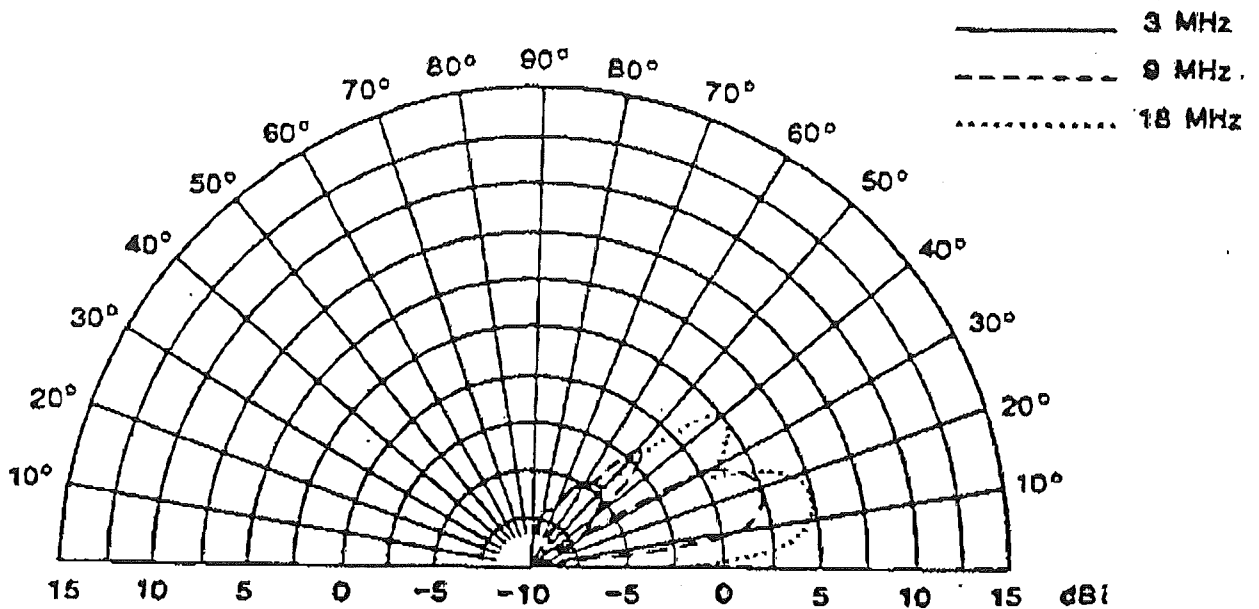


Figure 3-14. Vertical Radiation Pattern of Half Rhombic, 550'

SECTION 4

GENERAL INSTRUCTIONS

4.1 SITE SAFETY PRECAUTIONS

HF radio sites are potentially dangerous areas. A number of hazards exist during the deployment, operation and tear down of tactical antenna systems, and it is important that a safety program be implemented in accordance with MIL-STD-882 and the safety section of MIL-STD-1472. The following hazards are particularly associated with tactical HF antennas, including LONGSHOT:

- Electrical Shock
- RF Burns
- Collision
- Radiation Hazards
- Construction Hazards

4.1.1 Electrical Shock

Make certain that the deployment site is free of overhead wires, which must be considered dangerous electrical shock hazards. Ensure that no overhead wire comes closer than 100 feet to the mast or antenna.

4.1.2 RF Burns

Contact with the transmitting antenna can cause painful injury from RF burns. Ensure all power is "OFF" or isolated before deployment, tear down or during maintenance operations.

4.1.3 Collision

The mast, guy ropes and antenna element wires are deliberately toned down to make them difficult to see. There is a very real collision risk from personnel, vehicles and low flying aircraft (especially helicopters). When the tactical situation permits, ensure the guy ropes and antenna elements are clearly marked to prevent personnel injuries and equipment damage; also ensure that the selected deployment site is well clear of helicopter landing zones.

4.1.4 Radiation Hazards

At only one kilowatt, the radiation from the antenna is not considered to be of sufficient intensity that a hazard to personnel is likely. However, a potential hazard exists to nearby ordnance and fuel. Generally, a transmit antenna should not be deployed within 7000 feet of explosive devices or within 170 feet of a fuel handling site.

4.2.4 Radiation Hazards

At only one kilowatt, the radiation from the antenna is not considered to be of sufficient intensity that a hazard to personnel is likely. However, a potential hazard exists to nearby ordnance and fuel. Generally, a transmit antenna should not be deployed within 7000 feet of explosive devices or within 170 feet of a fuel handling site.

4.2.5 Construction Hazards

To reduce the possibility of injury, mast and antenna deployment should normally be conducted in daylight during dry, windless weather. The construction team leader must emphasize the increased risks when conditions are less than ideal. All team members should wear hard hats during mast and antenna deployment/tear down.

4.2.6 Lightning Risk

Antenna masts tend to act as lightning conductors, posing a potentially serious hazard to personnel during thunderstorms. Antenna set-up and tear down should not be attempted during thunder storms due to the lightning risk.

4.3 GENERAL INSTRUCTIONS

4.3.1 Alignment of Directional Antennas

Most LONGSHOT configurations are directional. For best performance on most occasions, the center line of the "main lobe" should be aimed straight at the distant station. This means the end of the antenna which is terminated with a Load Assembly must be pointed in the required direction. In the case of the Sloping Vee, the vee legs are laid out equally either side of the required bearing. If using a magnetic compass, do not forget to allow for magnetic deviation (REMEMBER: "Deviation West, Compass Best").

4.3.2 Mast Deployment (Except Beverage Configuration)

Decide on the location for the antenna mast. Ensure you have sufficient coaxial cable to reach the mast base from the communications van. Align one set of mast guy ropes in the opposite direction to the pull of the Sloping Vee or Sloping Long Wire antennas to simplify deployment and to oppose the tension of the antenna wire. Remember to attach a halyard to the top of the mast before raising it. Erect the mast in accordance with instructions.

4.3.3 Antenna Assembly

Unpack the Antenna Kit components required to build the antenna and lay them out on the ground ready for use close to the mast (except the Beverage configuration where no mast is used).

As each component is assembled, ensure that all "electrical tails" are connected and clamped securely using the wing nuts. Remember that before attempting to connect the element wires, the O-ring which holds the electrical tail secure must be slid towards the snap hook. For all mast mounted configurations, the antenna curtain must be raised to the desired mounting height before being tensioned. Therefore, first complete all assembly and connection operations for those items which remain close to the mast. Then attach the halyard snap hook to the correct strong point for the selected configuration and haul the antenna up the mast before running out and terminating the element wires.

4.3.4 How to Avoid Snagging Guy Ropes When Hauling Antenna Up Mast

Untie the Halyard from the mast cleat: move one good pace away from the mast so that the halyard down line is clear of the mast clamps. Carefully haul the Balun up the mast, ensuring that the various cables attached to it do not get trapped behind the mast clamps. Look upwards as you haul; it is helpful if a second crew member pays out the coaxial cable while standing off a little to the side so that the Balun is kept away from the mast. Upwards progress will be interrupted at intervals by the guy ropes. As each guy rope is reached, secure the halyard down line. Then slacken off and disconnect the lower end of the guy rope from its guy anchor and pass it around and underneath the wire element(s) on one side. See Figure 4-1.

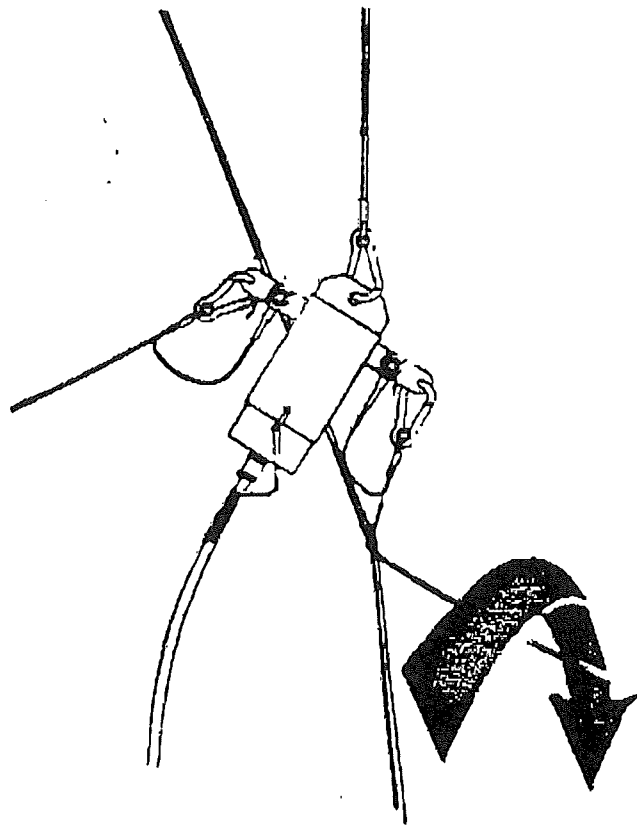


Figure 4-1. "Snagging" of Antenna Element by Guy Rope

When you are sure that the offending guy rope is under the antenna elements so that the Balun is again free to be raised, reattach the rope snap hook to its ground anchor and retension the guy. Return to the mast and recommence hauling the Balun upwards. Repeat as required but only release one guy rope at a time and ensure it is secured and properly tensioned before releasing the next. When the payload has reached the top of the mast, secure the halyard to the cleat.

4.3.5 Division of Far End Equipment

For those configurations requiring the erection of two Minimasts, and when more than one person is in the crew, open the Minimast Kit Bag and divide the contents equally between each team member. Borrow one additional hammer from the mast accessories. Half of the Minimast items are then replaced in the Minimast Kit Bag; the remainder are transferred to the Antenna Kit Bag so that each team member has a convenient means to carry the required items to the far end of the antenna while running out the antenna wire (mast tubes can be laid between the Antenna Kit Bag handles).

4.3.6 Running Out the Antenna Wire

Find an object on the horizon in line with the correct azimuth for each antenna element and use this as a guide when running out the antenna wire. With two Coupling Pieces and a Load Assembly in your pocket, pick up the Minimast Kit in one hand and the Wire/Reel Assembly in the other. Walk out in the required direction unreeling the wire as you go. As each wire junction is reached, connect the Aerial Wire Assemblies using a Coupling Piece. See Figure 4-2.

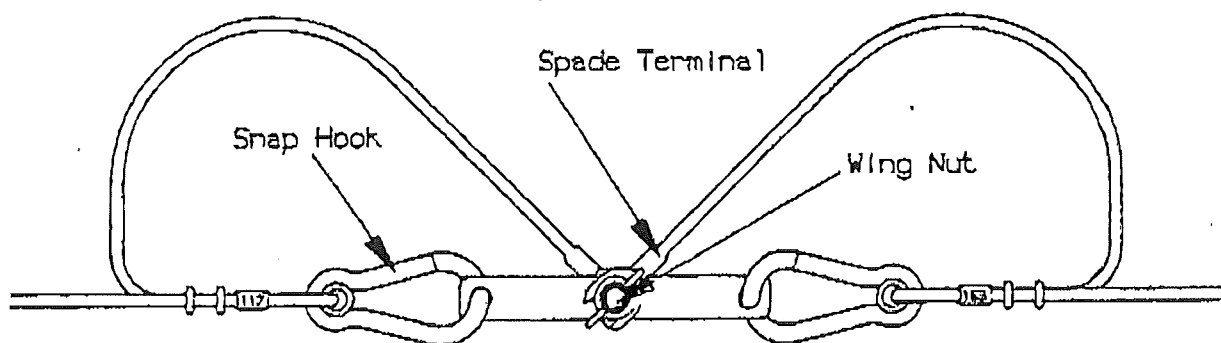


Figure 4-2. Interconnection of 2 Aerial Wire Assemblies

4.2.7 Terminating the Wire

Attach the snap hook of the final Aerial Wire Assembly to the lug on the Load Assembly and connect the terminal. Take the Ground Peg Assembly, 23 inches, and attach its snap hook to the lug on the other end of the Load Assembly. Attach the Grounding Wire to the Load Assembly. See Figure 4-3.

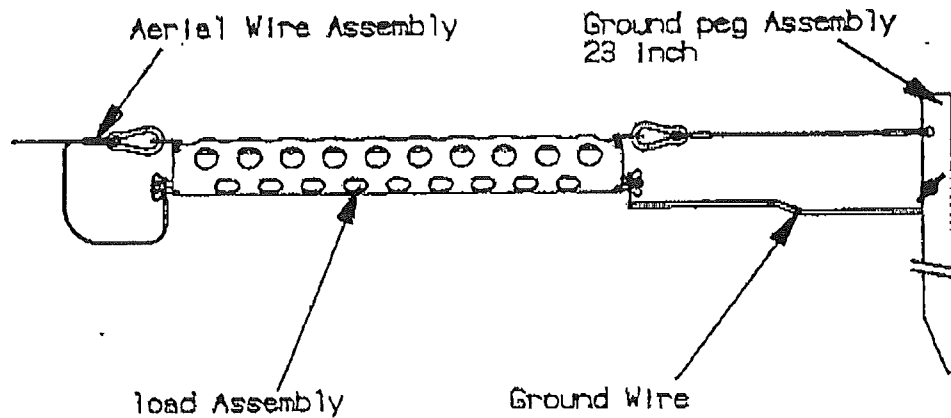


Figure 4-3. Terminating the Wire

4.3.8 Initial Tensioning of Antenna Wire

Walk away from the mast with the Ground Peg Assembly in hand at chest height until you feel that the entire length of wire is just off the ground. Lower the Ground Peg at that point and drive it into the ground with the hammer.

WARNING

DO NOT OVER TENSION THE ANTENNA WIRE. THIS PUTS UNDUE STRAIN ON THE EQUIPMENT AND DOES NOT IMPROVE ANTENNA PERFORMANCE. SOME SAG IS TO BE EXPECTED.

4.3.9 Minimast Ground Anchor Geometry

Assemble two Minimast Tubes to act as a measuring guide for the correct radius of the ground anchors (10 feet, 6 inches). Locate the Foot Plate in line with the element wire, one Minimast length back down the wire from the Ground Peg Assembly. The apex of the triangle should point toward the Ground Peg Assembly so that the lowest part of the "heel" opening faces back down the antenna wire towards the 50 foot mast. Anchor the Foot Plate with the two Ground Spikes. Then use the Minimast to establish the correct radius for the guy anchors (Ground Pegs, 15 inch steel). Use the two base corners of the triangular Foot Plate to establish the correct 120° spacing between the two Ground Pegs, 15 inch steel, and the Ground Peg Assembly. Drive the two guy anchors into the ground at their correct locations. The anchors should be driven in so that they lean about 20° away from the final position of the erected Minimast. Finally, lay the Minimast along the element wire with the socketed end resting in the heel of the Foot Plate. See Figure 4-4.

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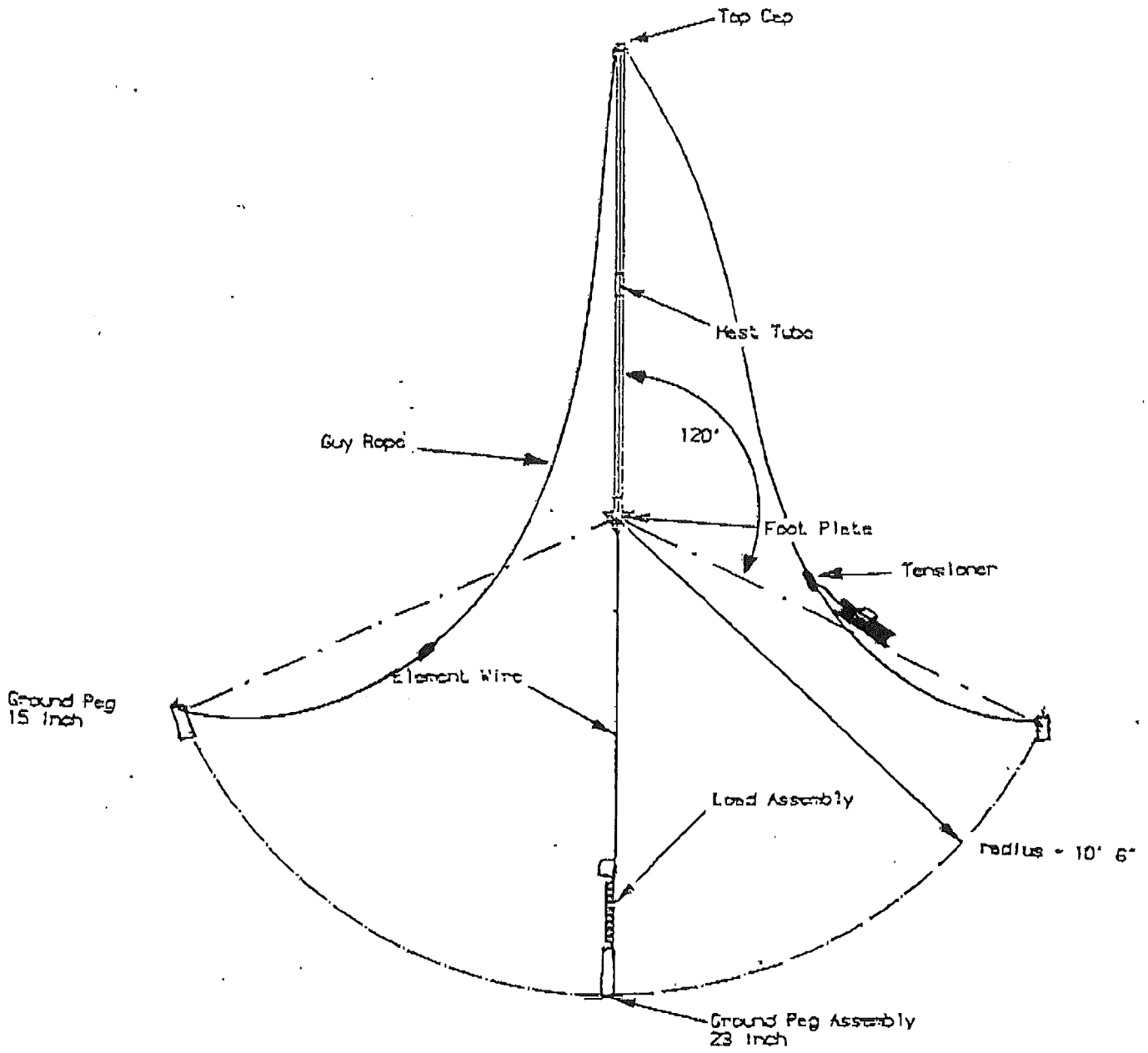


Figure 4-4. Minimast Ground Anchor Geometry

4.3.10 Minimast Final Assembly and Erection

Unwind the guy rope fully from the Stay Assembly. Plug the Top Cap into the mast head so that the groove is in line with the antenna wire and the two guy ropes are at right angles to it. Ensuring both guy ropes are underneath the element wire, lay them out and attach their snap hooks to the Ground Pegs, 15 inch steel. Now raise the mast two Jima style, with the element wire sliding over the groove in the Top Cap until the mast is just past the vertical; tension in the wire will increase to a point where the mast is held firm. Finally, adjust the tensioner in each guy rope to take out the slack. Lock off the tensioner. See Figure 4-5.

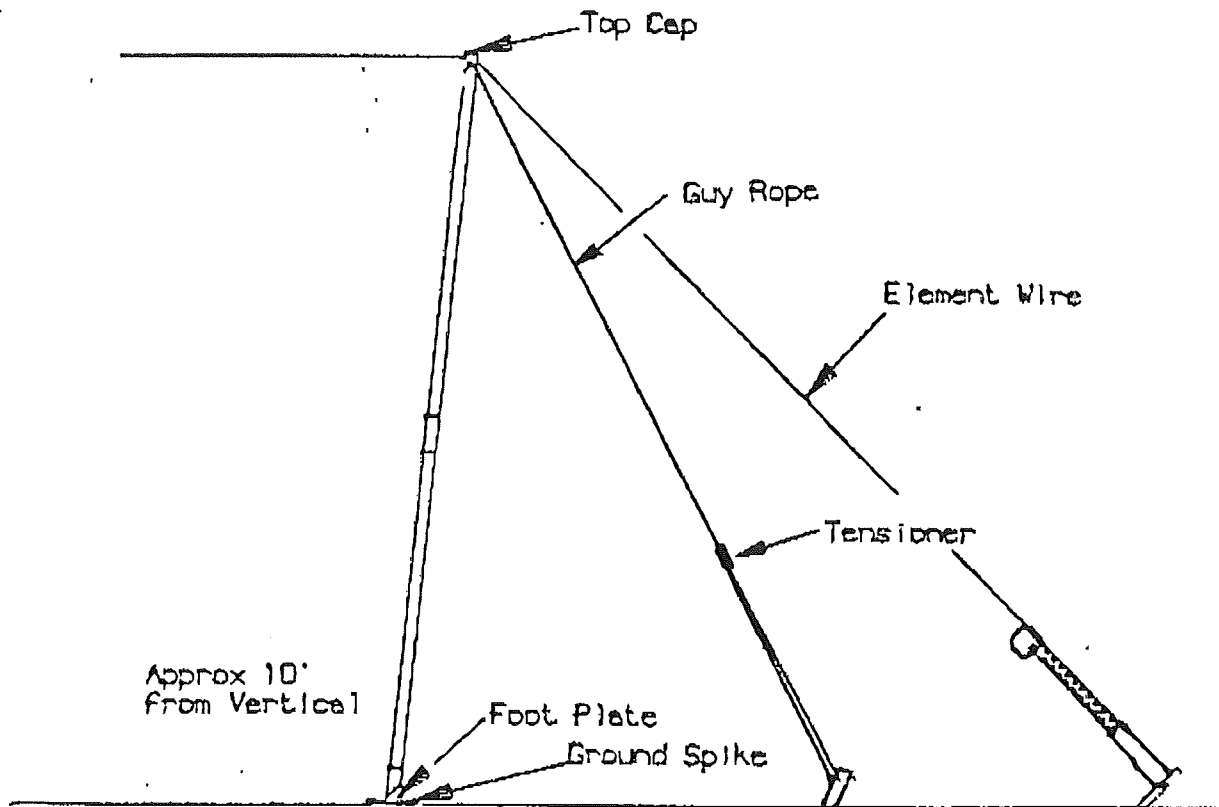


Figure 4-5. Erected Minimast

SECTION 5 DETAILED DEPLOYMENT INSTRUCTIONS

5.1 INVERTED VEE DIPOLE (For dimensions, see Paragraph 3.1.1)

5.1.1 Items Required

<u>Antenna Kit</u>	<u>Qty</u>	<u>Minimast Kit</u>	<u>Qty</u>
Balun	1	Mast Tubes	4
Coaxial Cable Assembly	1	Base Plate	2
117' Aerial Wire Assembly	2	Ground Spike	4
Load Assembly	2	Steel Ground Peg, 15"	4
Ground Peg Assembly, 23"	2	Stay Assembly	2
Hammer	1 (+1)		

5.1.2 Assembly Steps

- Step 1 Haul on Halyard until hook is at head height. Secure halyard on mast cleat or carrying handle.
- Step 2 Attach Halyard snap hook to Balun.
- Step 3 Attach Coaxial Cable connector to Balun connector and secure strain relief dog clip to Balun hook.
- Step 4 Attach the snap hook of a 117 foot Aerial Wire Assembly to the Balun strong point. Connect the spade terminal.
- Step 5 Unreel about 50 feet of the element wire (until the steel ring is reached).
- Step 6 Place reel and loose loops of antenna wire neatly on the ground about 10 feet away from the mast base in the direction that you intend to lay out that element.
- Step 7 Repeat Steps 4, 5 and 6 with the other reel for the second dipole element. (See Figure 5-1.)

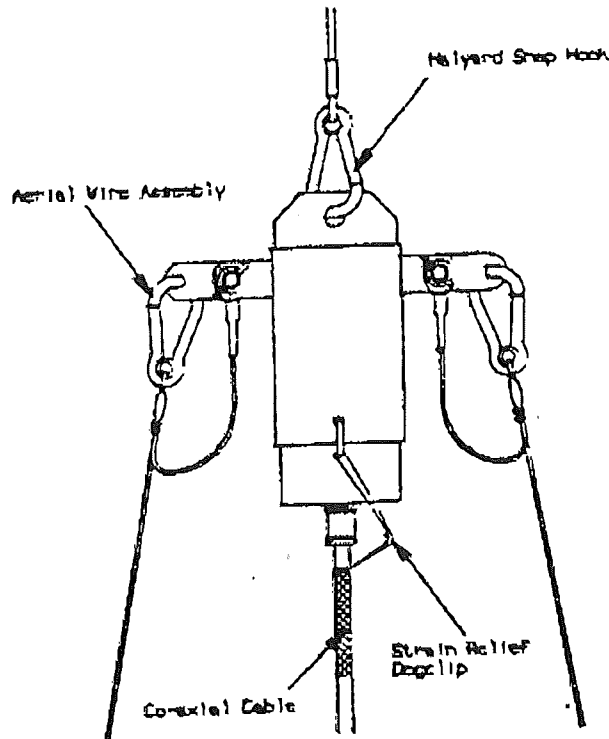


Figure 5-1. Inverted Vee Dipole Balun Connections

Step 8 Untie the Halyard from the mast cleat: move one good pace away from the mast so that the halyard down line is clear of the mast clamps. Refer to paragraph 4.3.4 to avoid snagging the guy ropes. Carefully haul Balun to the mast head, ensuring that the various cables attached to it do not get trapped behind the mast clamps. Look upwards as you haul; it is helpful if a second crew member pays out the coaxial cable while standing off a little to the side so that the Balun is kept away from the mast. When the payload has reached the top of the mast, secure the halyard to the cleat.

WARNING

DO NOT CONTINUE TO PULL ON HALYARD DOWN LINE IF ANY CABLE BECOMES LODGED BEHIND A MAST CLAMP LEVER. IF YOU DO SO, YOU MAY ACCIDENTALLY UNLOCK THE MAST CLAMP, CAUSING THE MAST TO TELESCOPE. RELEASE THE TRAPPED CABLE BY ROTATING THE WHOLE MAST BODY.

- Step 9 If the crew has more than one person, equally divide the contents of the Minimast Kit. If available, take a second hammer from the mast erection kit.
- Step 10 With half of the Minimast Kit and a Load Assembly each, walk out on the desired line of the antenna elements holding the wire reel. As you go, unwind the remainder of the 117 foot Aerial Wire Assembly.
- Step 11 Disconnect the Aerial Wire Assembly from the reel and terminate it with a Load Assembly and Ground Peg Assembly. Pretension the wire, drive in the Ground Peg Assembly, and assemble and erect the Minimast. See paragraphs 4.2.7, 4.2.8, 4.2.9 and 4.2.10. (See Figure 5-2.)

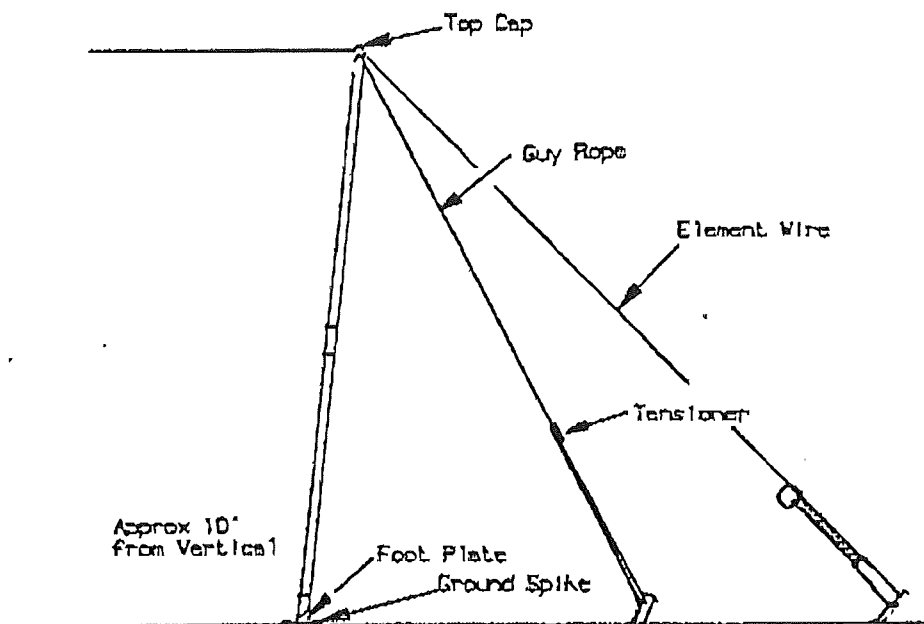


Figure 5-2. Inverted Vee Dipole Termination

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5.2 END FED TERMINATED WIRE (For dimensions, see Paragraph 3.2.1)

5.2.1 Items Required

<u>Antenna Kit</u>	<u>Qty</u>	<u>Minimast Kit</u>	<u>Qty</u>
Balun	1	Mast Tubes	4
Coaxial Cable Assembly	1	Foot Plate	1
117' Aerial Wire Assembly	1	Ground Spike	2
Load Assembly	1	Steel Ground Peg, 15"	2
Ground Peg Assembly, 23"	2	Stay Assembly	2
Balun Stake	1		
Hammer	1 (+1)		

5.2.1 Assembly Steps

NOTE

Mast height required for this configuration is between 15 and 25 feet. The antenna may therefore be suspended either from the 20 foot level (black guy ring) of the 50 foot CTM15 mast or may be strung over a 20 foot sectional mast assembled from the minimast kit. These instructions assume that the antenna is to be supported by a mast using minimast tube sections.

- Step 1 Decide on the best location for the minimast. From the minimast bag, unpack all required mast components.
- Step 2 Lay the Foot Plate on the ground with its apex pointing in the direction of the distant station. Secure by driving two ground stakes through the holes in the plate.
- Step 3 Assemble four Minimast tubes to make a mast 20 feet, 6 inches long. Lay the mast horizontally on the ground in line with the desired azimuth. Place the lower end adjacent to the Foot Plate, with the top of the mast pointing AWAY from the distant station.
- Step 4 Drive 2 Steel Ground Pegs, 15 inches, at a radius of 20 feet (6 paces) from the Foot Plate, so that a straight line through the two pegs and the Foot Plate is at 90° to the Minimast.
- Step 5 Unpack the two Stay Assemblies. Untie the two half hitches either side of the Top Cap on each assembly. Taking one assembly, find the end furthest from the winder. Slide the tensioner and Top Cap as close to the snap hook on that end as possible. Tie a half hitch in the rope to prevent the Top Cap sliding back towards the center of the rope again.

NOTE

Step 5 has changed a stay assembly designed for use as 2 guy ropes of the 10 foot Minimast to a single guy rope for use with a 20 foot Minimast.

- Step 6 Insert the Top Cap of the Stay Assembly into the top tube of the mast. Run the guy rope towards the steel Ground Peg on the same side and attach the guy rope to the peg with its snap hook.

- Step 7 Repeat Step 5 for the second Stay Assembly, but this time slide only the tensioner as close to the snap hook as possible. Slide the Top Cap towards the other end of the Stay Assembly (the lower end).
- Step 8 Attach the top hook of the second Stay Assembly to the top hook of the first Stay Assembly. Attach the lower hook of the second guy rope to the second steel Ground Peg. Take out most of the slack in both guy ropes by using the tensioner adjusters adjacent to the ground pegs. Leave some slack so that the mast may be maneuvered upright when required. See Figure 5-3.

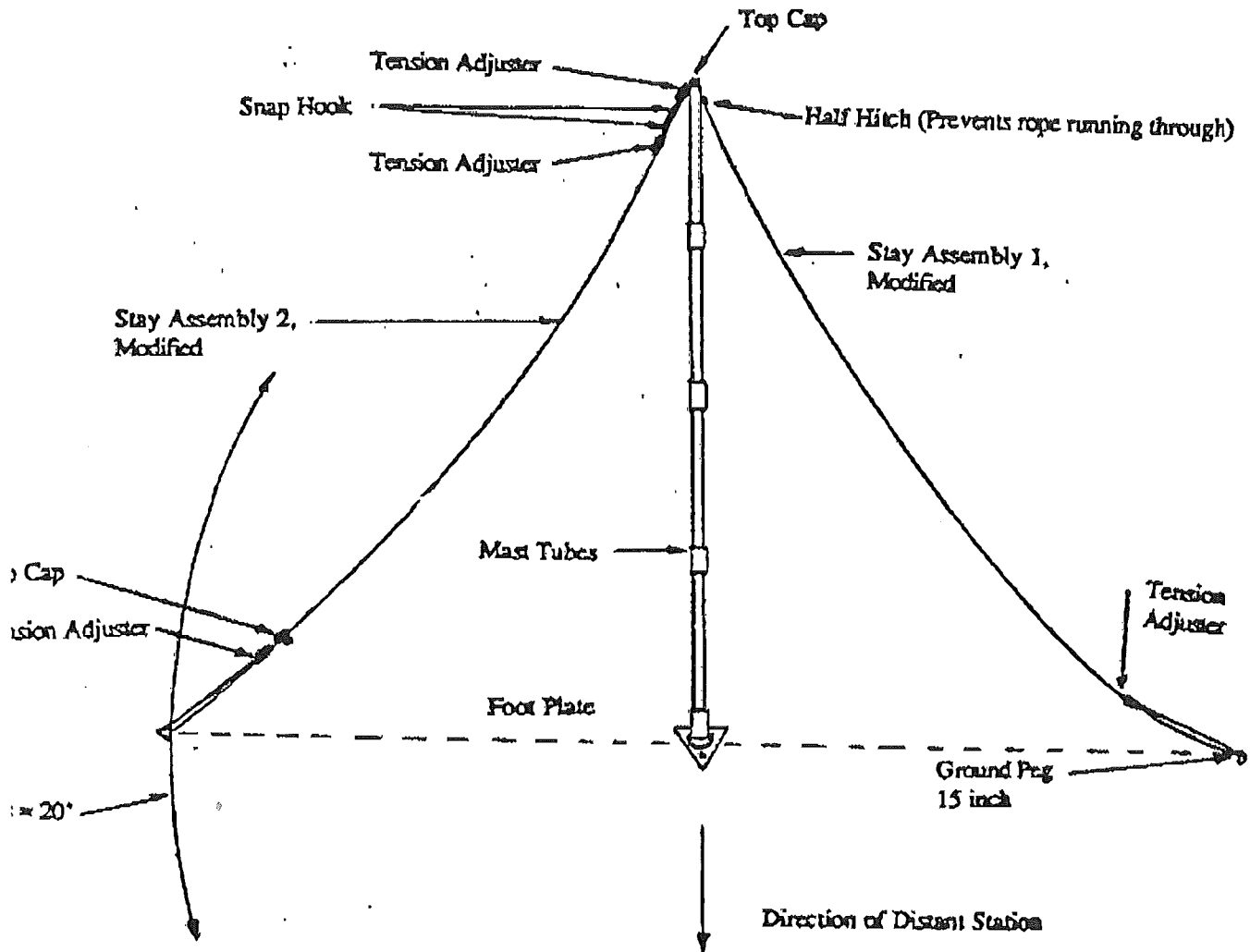


Figure 5-3. Geometry of 20° Minimast

- Step 9 Place the hammer in the antenna transit bag and take out one of the LONGSHOT wire element reels.

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- Step 7 Repeat Step 5 for the second Stay Assembly, but this time slide only the tensioner as close to the snap hook as possible. Slide the Top Cap towards the other end of the Stay Assembly (the lower end).
- Step 8 Attach the top hook of the second Stay Assembly to the top hook of the first Stay Assembly. Attach the lower hook of the second guy rope to the second steel Ground Peg. Take out most of the slack in both guy ropes by using the tensioner adjusters adjacent to the ground pegs. Leave some slack so that the mast may be maneuvered upright when required. See Figure 5-3.

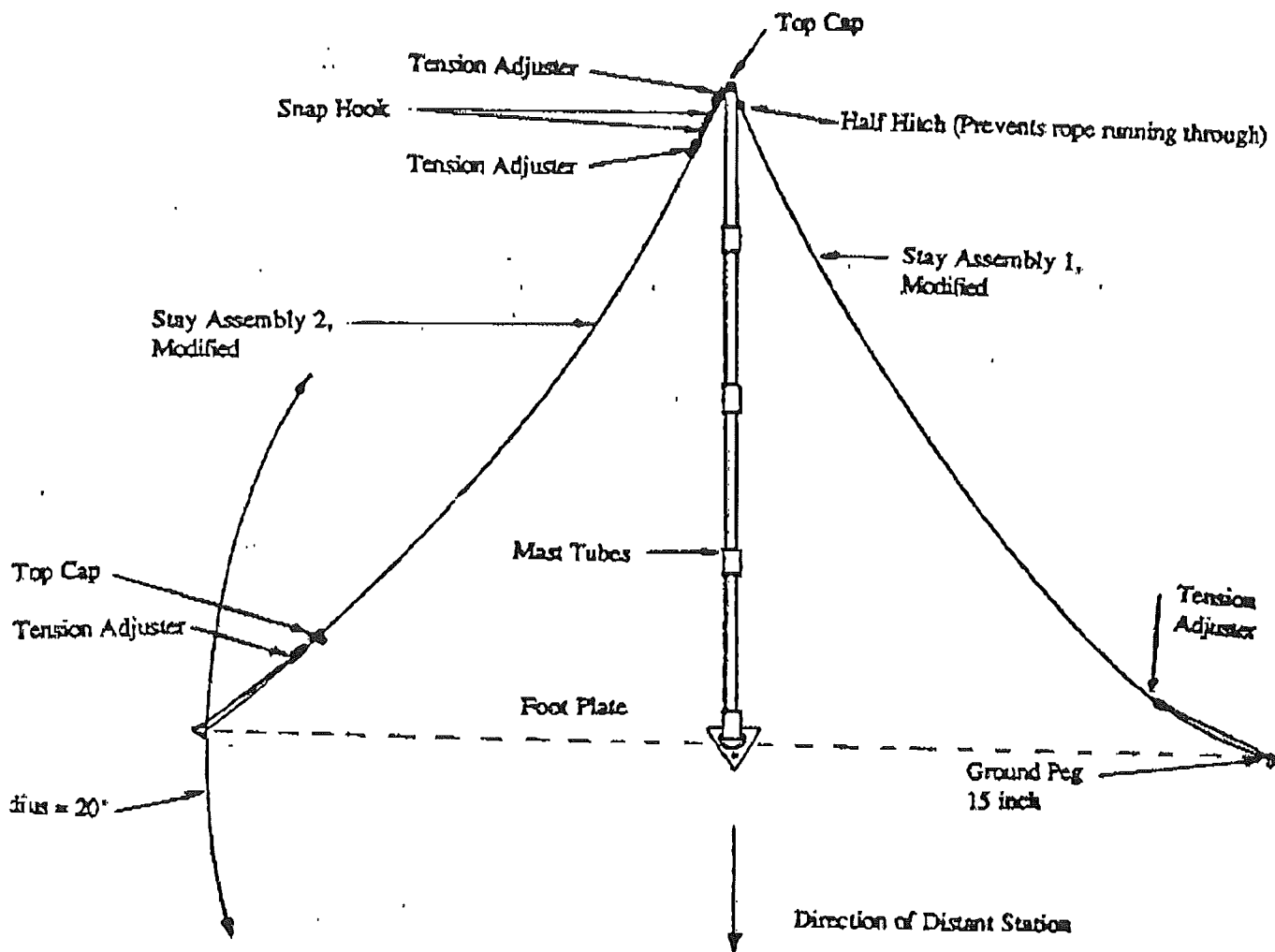


Figure 5-3. Geometry of 20° Minimast

- Step 9 Place the hammer in the antenna transit bag and take out one of the LONGSHOT wire element reels.

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- Step 10 While one person holds the reel by its carrying handle and stands adjacent to the mast Foot Plate, the second person walks in the direction of the distant station, taking the antenna transit bag and the end of the 117 foot wire element with him, uncoiling the wire as he goes. The person holding the reel calls when the first steel ring on the 117 foot element wire has been reached. Continue another 4 paces. Half of the element wire will now be layed out on the azimuth of the distant station.
- Step 11 Terminate the end of the wire using a Load Assembly and Ground Peg Assembly, 23 inches (see Figure 5-4a). Drive in the Ground Peg.
- Step 12 If space permits, lay out a ground mat in front of the antenna. Attach the unused wire element to the wing nut terminal on the Ground Peg Assembly. Run out the wire in a straight line along the ground towards the distant station. Check back to see that you are lined up properly with the antenna wire and mast.

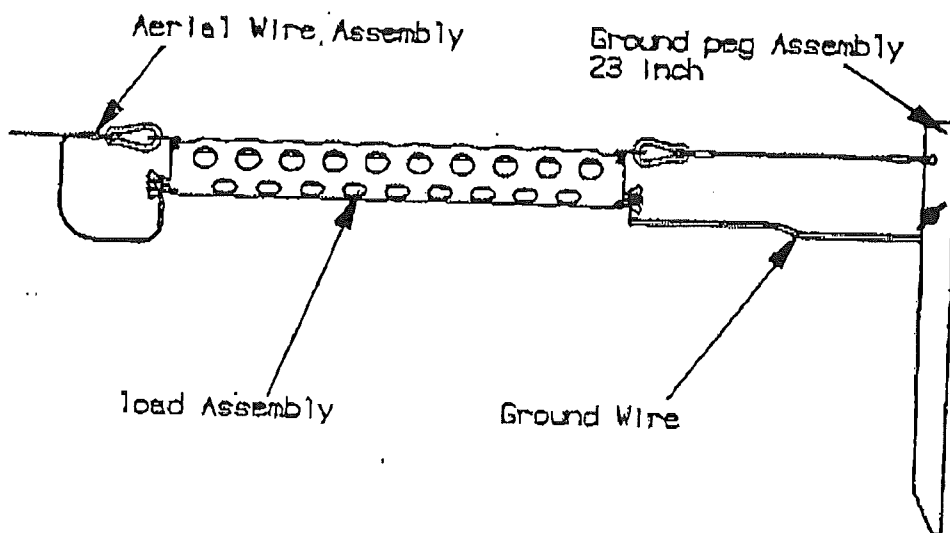


Figure 5-4a. End Fed Terminated Wire, Termination

- Step 13 Return to the mast. Run the rest of the 117 foot element wire off the reel in the opposite direction.
- Step 14 Locate the center point of the element wire (midway between the two steel rings). Reverse the direction of the mast so that the top cap is over the Foot Plate and the lower end points away from the distant station. Run the mid point of the element wire over the groove in the Top Cap of the mast. Raise the top end of the mast while walking the mast base towards the Foot Plate until the mast is upright with the base seated in the Foot Plate. One person should continue to hold the mast upright until the Balun end is secure.

- Step 15 Return to the free end of the element wire, attach the snap hook at the end of the wire to the snap hook of the second Ground Peg Assembly, 23 inches. Pull on the Ground Peg to produce a reasonable tension on the wire. When the mast is upright, drive the peg into the ground.
- Step 15 Drive the Balun Mounting Stake into the ground close enough to the end of the 117 foot element wire to enable the terminal to reach it.
- Step 17 Attach the coax to the Balun. Hang the Balun on the Balun Mounting Stake and hook up the element wire and ground connection. See Figure 5-4b.
- Step 18 Adjust the guy rope tensions as necessary to ensure the mast is upright.

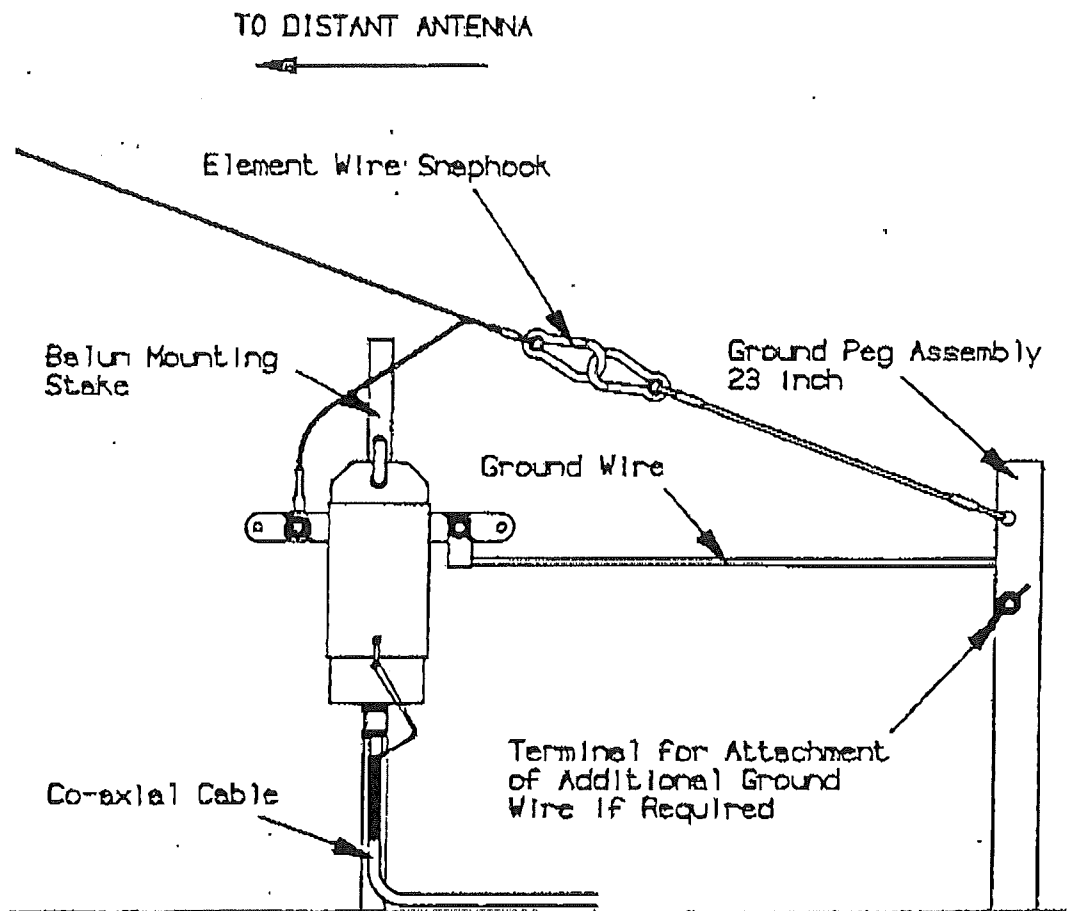


Figure 5-4b. End Fed Terminated Wire, Balun Connections

5.3 SLOPING VEE, 220' (For dimensions, see Paragraph 3.3.1)

5.3.1 Items Required

<u>Antenna Kit</u>	<u>Qty</u>	<u>Minimast Kit</u>	<u>Qty</u>
Balun	1	Mast Tubes	4
Coaxial Cable Assembly	1	Foot Plate	2
220' Aerial Wire Assembly	2	Ground Spike	4
Load Assembly	2	Steel Ground Peg, 15"	4
Ground Peg Assembly, 23"	2	Stay Assembly	2
Hammer	1 (+1)		

5.3.2 Preparation

The 220 foot Aerial Wire Assemblies are the last off the reel. It will therefore be necessary to unwind the first two wires off each reel before deploying the antenna. Proceed as follows:

Attach the first wire snap hook off the reel to a convenient strong point on the 50 foot mast. Holding the reel, walk away from the mast on the correct azimuth for one of the sloping vee legs (i.e., 25° off the correct bearing to the distant station). Pay out the antenna wire as you proceed. At the second pair of snap hooks, disconnect the reel with its 220 foot Aerial Wire Assembly and return to the mast. Leave the 117 and 163 foot wires laid out on the ground. Repeat with the other reel on the azimuth of second vee leg.

NOTE

If you find that you are able to lay out all 280 feet (i.e., 117 and 163) of both vee legs in the space available, use this size antenna in preference to 220 feet (better performance). 50° between elements is the correct separation to use for sloping vee leg length from 117 feet (minimum) to 337 feet.

5.3.3 Assembly Steps

- Step 1 Haul on Halyard until hook is at head height. Secure halyard on mast cleat or carrying handle.
- Step 2 Attach Halyard snap hook to Balun.
- Step 3 Attach Coaxial Cable connector to Balun connector and secure strain relief dog clip to Balun hook.
- Step 4 Attach the snap hook of the 220 foot Aerial Wire Assembly to the Balun strong point. Connect the spade terminal.
- Step 5 Unreel about 50 feet of the element wire.
- Step 6 Place reel and loose loops of antenna wire neatly on the ground about 10 feet away from the mast base in the direction that you intend to lay out that element. (The elements should be laid out 25° either side of the bearing to the distant station, i.e. 50° apart.)
- Step 7 Repeat Steps 4, 5 and 6 with the other reel for the second vee leg. (See Figure 5-6.)

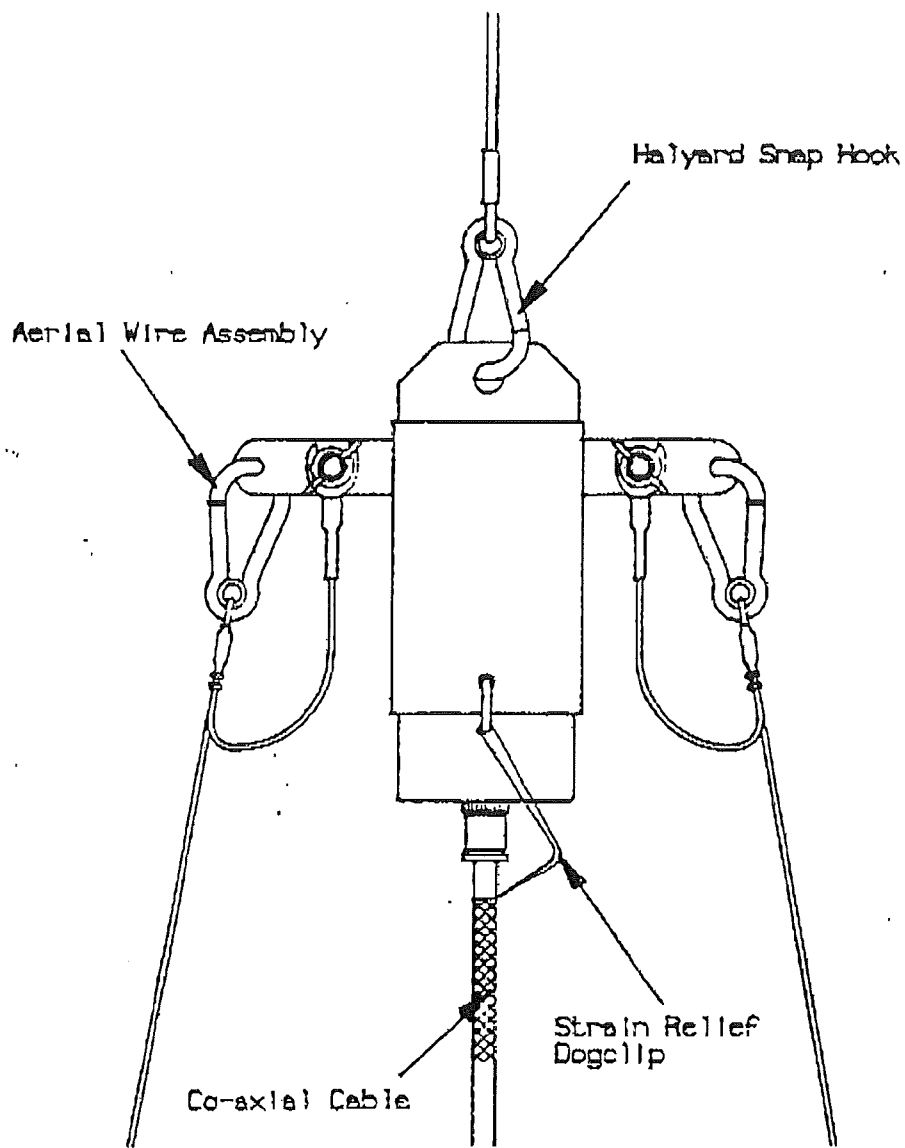


Figure 5-6. Sloping Vee Balun Connections

Step 8 Untie the Halyard from the mast cleat: move one good pace away from the mast so that the halyard down line is clear of the mast clamps. Carefully haul Balun to the mast head, ensuring that the various cables attached to it do not get trapped behind the mast clamps. Look upwards as you haul; it is helpful if a second crew member pays out the coaxial cable while standing off a little to the side so that the Balun is kept away from the mast. When the payload has reached the top of the mast, secure the halyard to the cleat.

WARNING

DO NOT CONTINUE TO PULL ON HALYARD DOWN LINE IF ANY CABLE BECOMES LODGED BEHIND A MAST CLAMP LEVER. IF YOU DO SO, YOU MAY ACCIDENTALLY UNLOCK THE MAST CLAMP, CAUSING THE MAST TO TELESCOPE. RELEASE THE TRAPPED CABLE BY ROTATING THE WHOLE MAST BODY.

Step 9 If the crew has more than one person, equally divide the remaining contents of the Antenna Kit (except the Support Rods) and the Minimast Kit, so that each crew member has the following equipment to complete the assembly of their vee leg:

Reel with 220' Aerial Wire Assembly	1
Load Assembly	1
Ground Peg, 23"	1
Connector Pieces	1 - only required if deploying 280' vee
Hammer*	1
Mast Tubes	2
Foot Plate	1
Ground Spike	2
Steel Ground Peg, 15"	2
Stay Assembly	1

Step 10 With half of the Minimast Kit and Antenna Kit each, walk out on the desired line of the antenna elements holding the wire reel. As you go, unwind the remainder of the 220 foot Aerial Wire Assembly from the reel.

Step 11 Disconnect the Aerial Wire Assembly from the reel and terminate it with a Load Assembly and Ground Peg Assembly. Pretension the wire, drive in the Ground Peg Assembly, and assemble and erect the Minimast. Repeat this on the second element of the vee. (See paragraphs 4.2.7, 4.2.8, 4.2.9 and 4.2.10) (See Figure 5-7.)

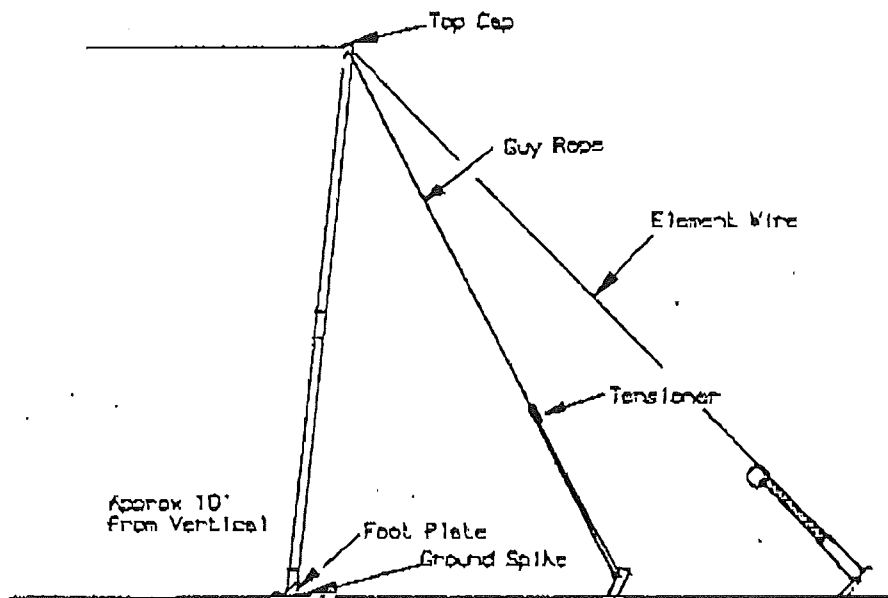


Figure 5-7. Sloping Vee Termination

*Note: If available, take a second hammer from the 50' mast accessory kit.

5.4 **BEVERAGE - RECEIVE ONLY** (337 feet or 280 feet)

5.4.1 **Items Required**

<u>Antenna Kit</u>	<u>Qty</u>	<u>Minimast Kit</u>	<u>Qty</u>
Balun	1	(Ground Spike - Hard Ground Only)	2
Coaxial Cable Assembly	1		
117' Aerial Wire Assembly	1		
220' Aerial Wire Assembly	1		
Load Assembly	1		
Ground Peg Assembly, 23"	2		
Balun Stake	1		
Connector Piece	1		
Support Rods	8		
Hammer	1 (+1)		

5.4.2 **Assembly Steps**

- Step 1 Drive one of the Ground Peg Assemblies, 23 inches, into the ground.
- Step 2 Extend the tension rope of the Ground Peg Assembly on the correct azimuth toward the distant station. Drive the Balun Stake into the ground along this line at the point at which you reach the Snap Hook.
- Step 3 Attach the Coaxial to the N type connector on the base of the Balun.
- Step 4 Suspend the Balun on the hook of the Balun Stake.
- Step 5 Attach the snap hook connector of the 117' Aerial Wire Assembly to the snap hook of the Ground Peg Assembly tension rope. See Figure 5-8.

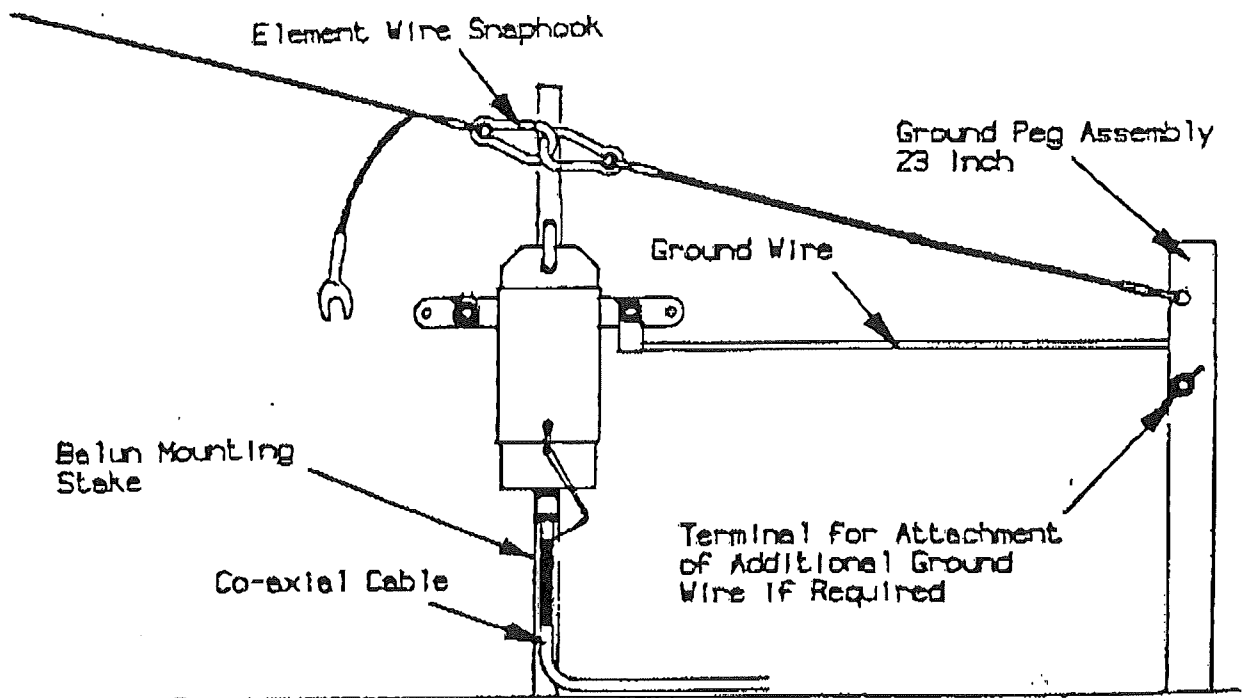


Figure 5-8. Beverage Configuration, Initial Set-Up

- Step 6 Carrying the Antenna Kit Bag, walk out on the desired line of the antenna element holding the wire reel. As you go, unwind the remainder of the 117 foot Aerial Wire Assembly.
- Step 7 If space permits, best performance is obtained when the antenna is assembled from the 117 foot and 220 foot antenna wires (i.e., total of about 330 feet). Therefore, the middle wire on the "active" reel (163 feet) should be wound onto the second reel for temporary storage. If two people are available, simply hook up the 163 foot Aerial Wire Assembly to the snap hook of the 117 foot Aerial Wire Assembly on the "inactive" reel. The second crew member can then wind the 163' wire straight onto the "inactive" reel.
- Step 8 Using a Connector Piece, attach the 220 foot Aerial Wire Assembly to the 117 foot Aerial Wire Assembly. Continue walking out along the correct azimuth, unreeling the wire until you reach the end.
- Step 9 Terminate and pretension the wire (see paragraphs 4.2.7 and 4.2.8).
- Step 10 If space permits, lay out a ground mat in front of the antenna. Attach the unused wire element to the wing nut terminal on the Ground Peg Assembly. Run out the wire in a straight line along the ground towards the distant station. Check back to see that you are lined up properly with the antenna wire and mast.
- Step 11 Push one of the Support Rods about 8 inches into the ground approximately 5 feet from the Ground Peg Assembly, ensuring the groove at the top of the rod is in line with the wire. The top of the Support Rod should be about 12 inches above ground level. If the ground is hard, use the Hammer and Ground Spike (from the Minimast Kit) to drive a "pilot hole".

CAUTION

DO NOT USE THE HAMMER DIRECTLY ON THE SUPPORT RODS - THESE ARE NON-CONDUCTING FIBERGLASS AND WILL SPLINTER IF ILL TREATED.

- Step 12 Lift the element wire onto the support rod so that it rests in the groove. See Figure 5-9.

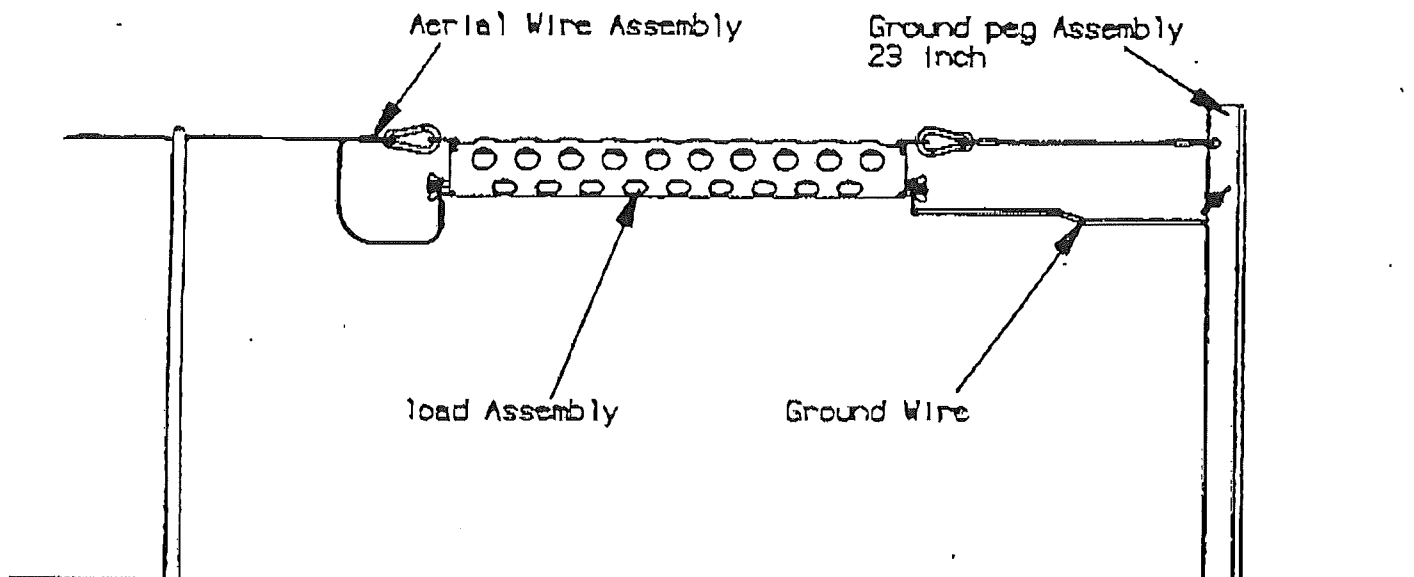


Figure 5-9. Beverage Configuration - Termination

- Step 13 Return back towards the Balun, inserting Support Rods as required to keep the wire about 12 inches above ground. The distance between rods will vary depending on terrain and vegetation; for level ground with low vegetation, use about 50 feet between rods. One rod should be inserted about 3 feet from the Balun.

NOTE

Best sidelobe and back lobe suppression is achieved when the wire is 12 inches above ground. At 3 feet above ground, noise level from the side and rear will increase by as much as 15 dB. Therefore do not let wire rest on brush etc. higher than about 12 inches above ground.

- Step 14 Connect the 117 foot Aerial Wire Spade terminal to the Balun and hook up the Ground Wire (see Figure 5-10).

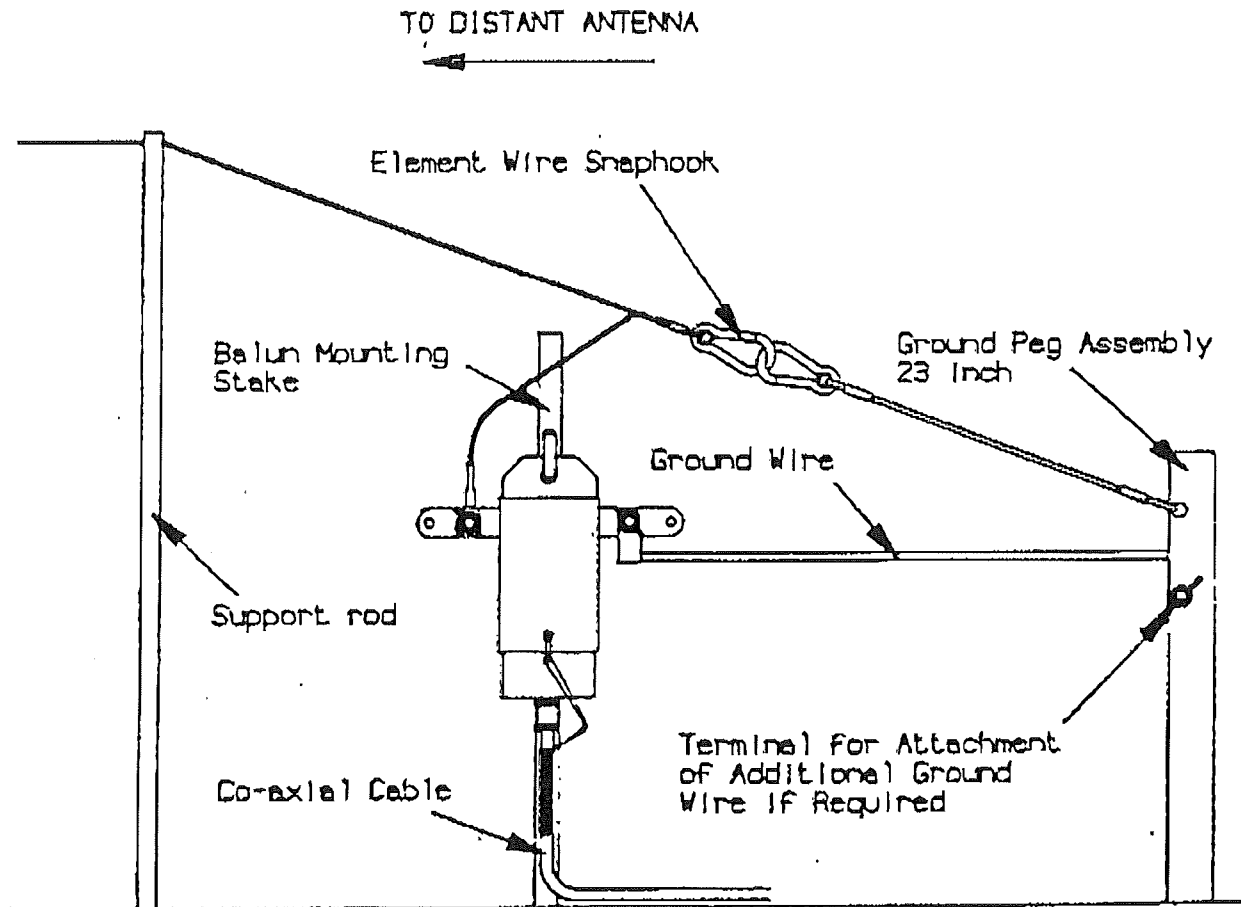


Figure 5-10. Beverage Configuration - Balun Connections

5.5 SLOPING VEE, 500' (For dimensions, see Paragraph 3.5.1)

5.5.1 Items Required

<u>Antenna Kit</u>	<u>Qty</u>	<u>Minimast Kit</u>	<u>Qty</u>
Balun	1	Mast Tubes	4
Coaxial Cable Assembly	1	Foot Plate	2
117' Aerial Wire Assembly	2	Ground Spike	4
163' Aerial Wire Assembly	2	Steel Ground Peg, 15"	4
220' Aerial Wire Assembly	2	Stay Assembly	2
Connector Pieces	4		
Load Assembly	2		
Ground Peg Assembly, 23"	2		
Hammer	1 (+1)		

5.5.2 Assembly Steps

- Step 1 Haul on Halyard until hook is at head height. Secure halyard on mast cleat or carrying handle.
- Step 2 Attach Halyard snap hook to Balun.
- Step 3 Attach Coaxial Cable connector to Balun connector and secure strain relief dog clip to Balun hook.
- Step 4 Attach the snap hook of a 117 foot Aerial Wire Assembly to the Balun strong point. Connect the spade terminal.
- Step 5 Unreel about 50 feet of the element wire (until the steel ring is reached).
- Step 6 Place reel and loose loops of antenna wire neatly on the ground about 10 feet away from the mast base in the direction that you intend to lay out that element. (The elements should be laid out 15° either side of the bearing to the distant station, i.e. 30° apart.)
- Step 7 Repeat Steps 4, 5 and 6 with the other reel for the second element. See Figure 5-11.

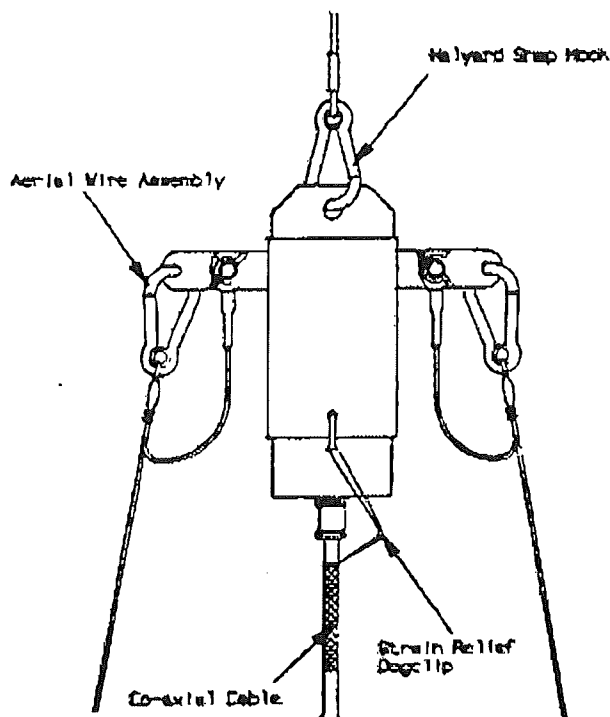


Figure 5-11. Sloping Vee Balun Connections

Step 8 Untie the Halyard from the mast cleat: move one good pace away from the mast so that the halyard down line is clear of the mast clamps. Refer to paragraph 4.3.4 to avoid snagging the guy ropes. Carefully haul Balun to the mast head, ensuring that the various cables attached to it do not get trapped behind the mast clamps. Look upwards as you haul; it is helpful if a second crew member pays out the coaxial cable while standing off a little to the side so that the Balun is kept away from the mast. When the payload has reached the top of the mast, secure the halyard to the cleat.

WARNING

DO NOT CONTINUE TO PULL ON HALYARD DOWN LINE IF ANY CABLE BECOMES LODGED BEHIND A MAST CLAMP LEVER. IF YOU DO SO, YOU MAY ACCIDENTALLY UNLOCK THE MAST CLAMP, CAUSING THE MAST TO TELESCOPE. RELEASE THE TRAPPED CABLE BY ROTATING THE WHOLE MAST BODY.

Step 9 If the crew has more than one person, equally divide the remaining contents of the Antenna Kit (except the Support Rods) and the Minimast Kit, so that each crew member has the following equipment to complete the assembly of their vee leg:

Reel with Aerial Wire Assemblies	1
Load Assembly	1
Ground Peg, 23"	1
Connector Pieces	2
Hammer**	1
Mast Tubes	2
Foot Plate	1
Ground Spike	2
Steel Ground Peg, 15"	2
Stay Assembly	1

Step 10 With half of the Minimast Kit and Antenna Kit each, walk out on the desired line of the antenna elements holding the wire reel. As you go, unwind the remainder of the element wire from the reel. Use the Connector Pieces to joint the three Aerial Wire Assemblies.

Step 11 Disconnect the Aerial Wire Assembly from the reel and terminate it with a Load Assembly and Ground Peg Assembly. Pretension the wire, drive in the Ground Peg Assembly, and assemble and erect the Minimast. Repeat this on the second element of the vee. (See paragraphs 4.2.7, 4.2.8, 4.2.9 and 4.2.10) (See Figure 5-12.)

**Note: If available, take a second hammer from the 50' mast accessory kit.

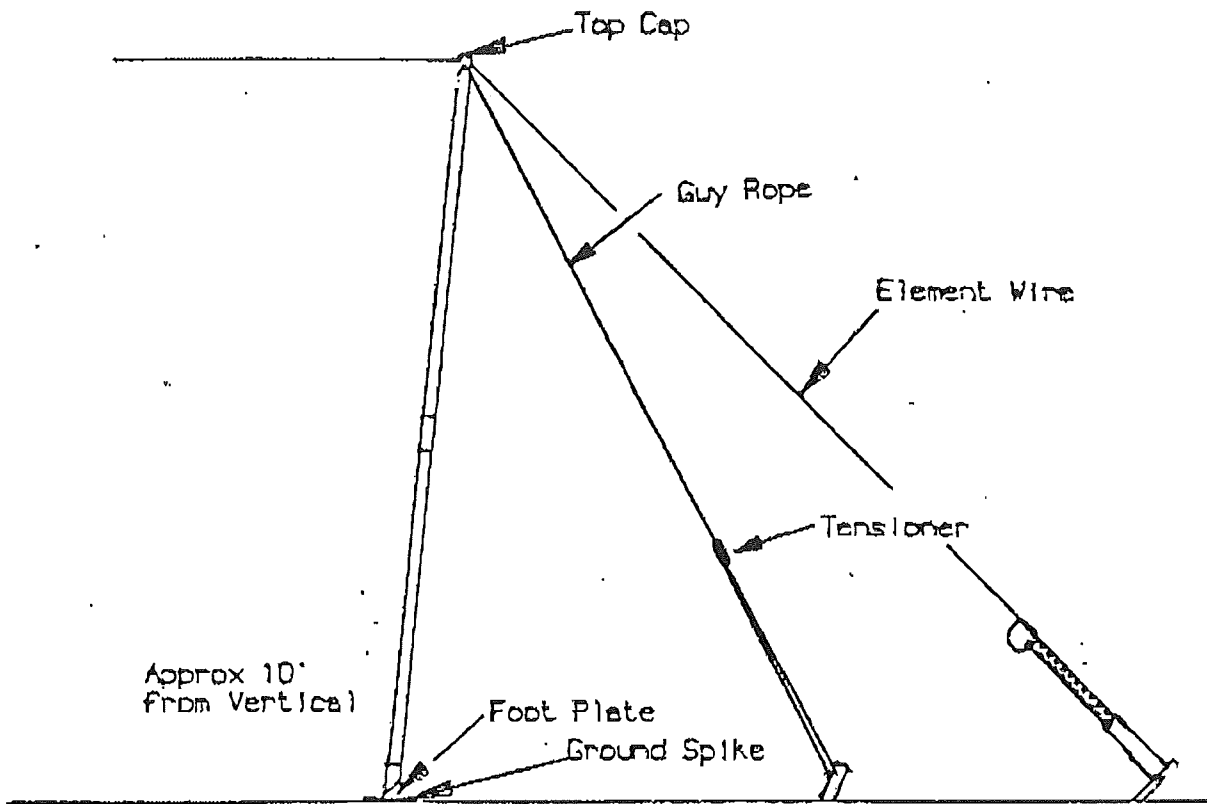


Figure 5-12. Sloping Vee Termination

5.6 **SLOPING LONG WIRE** (For dimensions, see Paragraph 3.6.1)

5.6.1 **Items Required**

<u>Antenna Kit</u>	<u>Qty</u>	<u>Minimast Kit</u>	<u>Qty</u>
Balun	1	Mast Tubes	2
Coaxial Cable Assembly	1	Foot Plate	1
117' Aerial Wire Assembly	1	Ground Spike	2
163' Aerial Wire Assembly	1	Steel Ground Peg, 15"	2
220' Aerial Wire Assembly	1	Stay Assembly	1
Connector Pieces	2		
Load Assembly	1		
Ground Peg Assembly, 23"	2		
Hammer	1 (+1)		

5.6.2 **Assembly Steps**

- Step 1 Drive Balun Stake into ground 6 feet from the base of the mast in line with the distant station.
- Step 2 Drive one of the Ground Peg Assemblies, 23 inches, into the ground adjacent to the Balun Stake.
- Step 3 Attach the Coaxial Cable to the N type connector on the base of the Balun.
- Step 4 Suspend the Balun on the hook of the Balun Stake.
- Step 5 Connect the snap hook of one of the 117 foot Aerial Wire Assemblies to the hole in the Balun arm and attach the wire spade terminal on the same side. Tighten the wing nut.
- Step 6 Attach the Ground Strap from the Ground Peg Assembly to the free terminal of the Balun. Coil the loose tension rope around the Ground Peg Assembly to prevent it getting trampled into the dirt and attach its snap hook to the Balun arm.
- Step 7 Walk out about 35 feet in the direction of the distant station. Rapidly unwind the 117 foot Aerial Wire Assembly off the reel as you do so, so that as you pass the outer guy stake of the mast, you reach the pair of snap hooks marking the end of the first wire and the beginning of the 163 foot Aerial Wire Assembly. Set the reel on the ground.
- Step 8 Return to the mast base. When you reach the second 117 foot Aerial Wire Assembly steel ring (i.e., the one closest to the Balun), pick it up and bring it back to the mast. Attach the halyard snap hook to it.
- Step 9 Carefully haul the element wire to a point 2 feet short of the mast head (use the 5 foot exposed length of the top mast tube to judge this. The vertical element wire will still be slack at this stage (see Figure 5-13).

WARNING

DO NOT CONTINUE TO PULL ON HALYARD DOWN LINE IF ELEMENT WIRE BECOMES LODGED BEHIND A MAST CLAMP LEVER. IF YOU DO SO, YOU MAY ACCIDENTALLY UNLOCK THE MAST CLAMP, CAUSING THE MAST TO TELESCOPE. RELEASE THE TRAPPED CABLE BY ROTATING THE WHOLE MAST BODY.

NOTE

For operations in frequency band 4.5 to 23 MHz, use 117, 163, and 220 ft. Aerial Wire Assemblies (i.e. total length of wire = 500 feet). For operations in frequency band 20 to 30 MHz, use 2 x 117 ft. and 1 x 163 ft. Aerial Wire Assemblies (i.e. total length of wire = 397 feet).

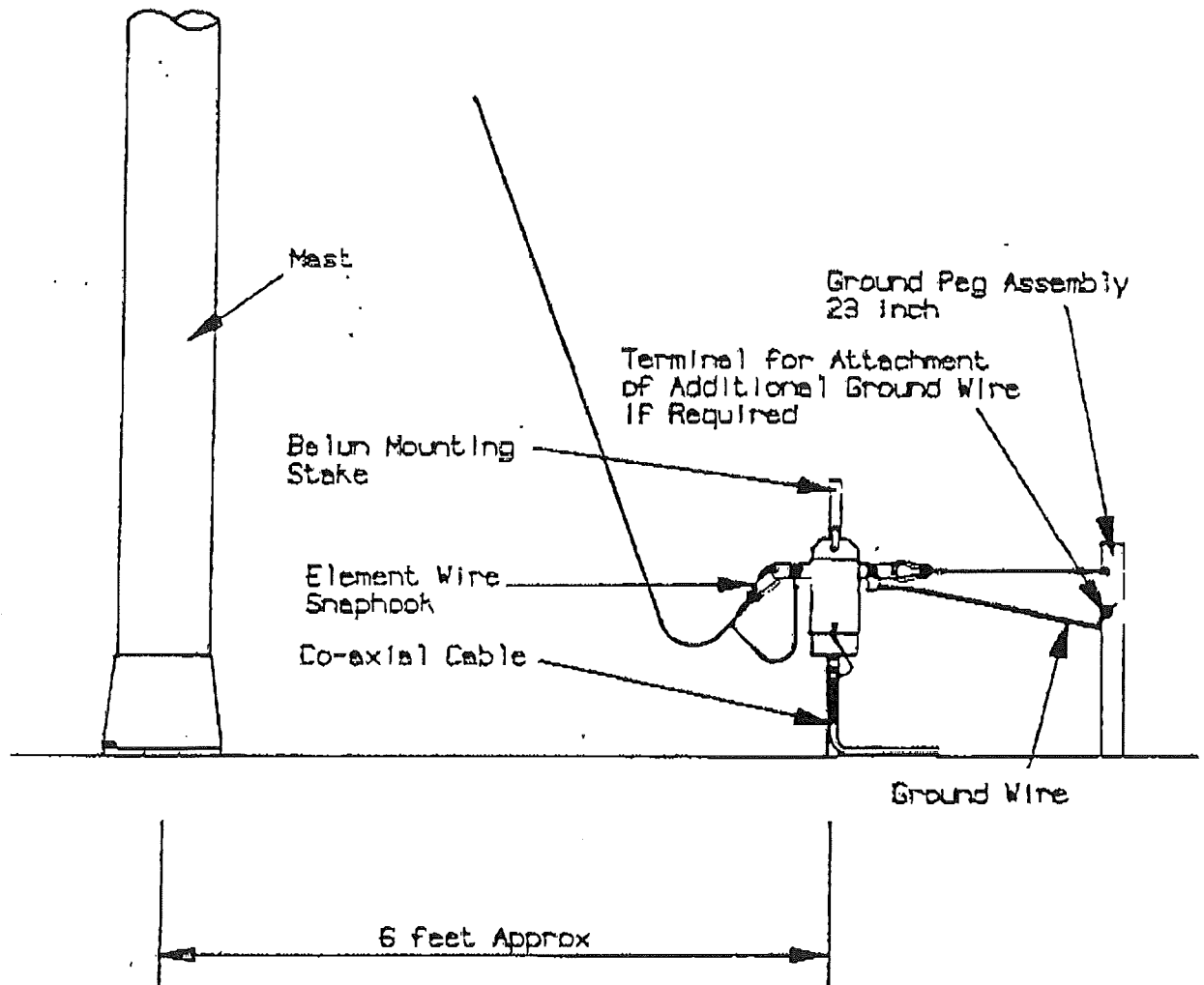


Figure 5-12. Sloping Long Wire, Balun Connections

- Step 10 Pick up the Minimast Kit Bag and Antenna Kit Bag. Walk out in the direction of the distant station. When you reach the reel, connect the 117 foot and 163 foot Aerial Wire Assemblies with the Connector Piece. Then continue on the correct azimuth until all the wire is run off the reel. Use a second Connector Piece to join the second two Aerial Wire Assemblies.

- Step 11 Disconnect the Aerial Wire Assembly from the reel and terminate it with a Load Assembly and Ground Peg Assembly. Pretension the wire, drive in the Ground Peg Assembly, and assemble and erect the Minimast. (See paragraphs 4.2.7, 4.2.8, 4.2.9 and 4.2.10.) (See Figure 5-14.)
- Step 12 If space permits, lay out a ground mat in front of the antenna. Attach the unused wire element to the wing nut terminal on the Ground Peg Assembly. Run out the wire in a straight line along the ground towards the distant station. Check back to see that you are lined up properly with the antenna wire and mast.

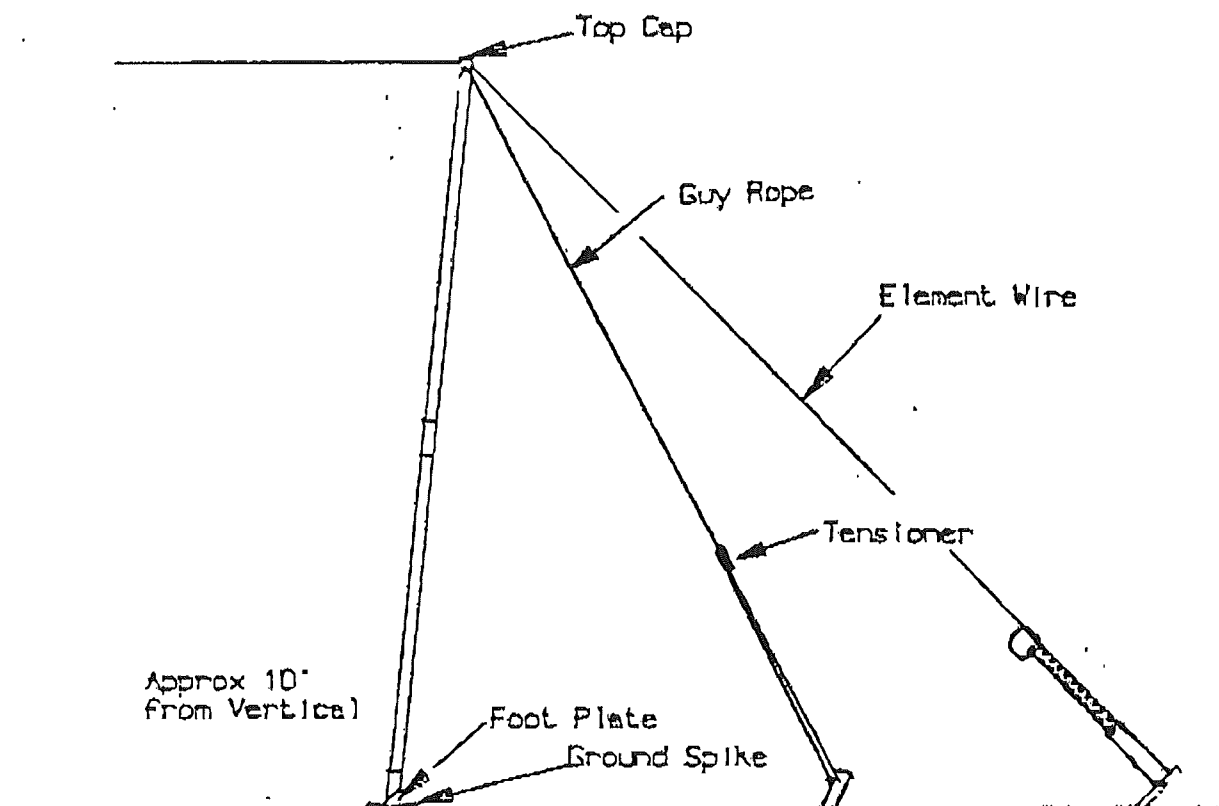


Figure 5-14. Sloping Long Wire Termination

NOTE

When space is limited, a shorter version of this antenna may be constructed using 2 x 117' and 1 x 163' Aerial Wire Assemblies, optimum frequency range becomes 30 to MHz.

5.7 HALF RHOMBIC, 550 FT. (For dimensions, see Paragraph 3.7.1)

5.7.1 Items Required

<u>Antenna Kit</u>	<u>Qty</u>	<u>Minimast Kit</u>	<u>Qty</u>
Balun	1	Mast Tubes	2
Coaxial Cable Assembly	1	Foot Plate	1
117' Aerial Wire Assembly	2	Ground Spike	2
163' Aerial Wire Assembly	2	Steel Ground Peg, 15"	2
Connector Pieces	1	Stay Assembly	1
Load Assembly	1		
Ground Peg Assembly, 23"	2		
Balun Stake	1		
Connector Piece	3		
Hammer	1 (+1)		

5.7.2 Assembly Steps

- Step 1 Attach the snap hook of one 117 foot Aerial Wire Assembly to a convenient strong point at the 50 foot mast.
- Step 2 Walk out about 35 feet in the direction of the distant station. Rapidly unwind the 117 foot Aerial Wire Assembly off the reel as you do so, so that as you pass the outer guy stake of the mast, you reach the second steel ring. Set the reel on the ground.
- Step 3 Return to the mast.
- Step 4 Repeat Steps 1 and 2 with the second reel in the opposite direction.
- Step 5 Return to the mast.
- Step 6 Disconnect the Aerial Wire Assemblies from the strong point on the mast. Carry the end of one wire around the outer guy rope of the mast.

NOTE

This will prevent the element wires being trapped under the guy ropes when you haul them up with the halyard.

- Step 7 Use a Connector Piece to join the ends of the two 117 foot Aerial Wire Assemblies.
- Step 8 Secure the Halyard snap hook to one of the snap hooks of the two interconnected wires. Move one good pace away from the mast so that the halyard down the line is clear of the mast clamps. Carefully haul the element wires to the mast head, ensuring that they do not get trapped behind the mast clamps. Look upwards as you haul. Refer to paragraph 4.3.4 to avoid snagging the guy ropes. When the payload has reached the top of the mast, secure the halyard to the cleat.

WARNING

DO NOT CONTINUE TO PULL ON HALYARD DOWN LINE IF ELEMENT WIRE BECOMES LODGED BEHIND A MAST CLAMP LEVER. IF YOU DO SO, YOU MAY ACCIDENTALLY UNLOCK THE MAST CLAMP, CAUSING THE MAST TO TELESCOPE. RELEASE THE TRAPPED CABLE BY ROTATING THE WHOLE MAST BODY.

- Step 9 Take a Connector Piece, Load Unit, Ground Peg Assembly and Hammer from the Antenna Kit Bag and place it in the Minimast Kit Bag.
- Step 10 Carrying the Minimast Kit Bag, return to the reel which you left in line with the distant station in Step 2. Pick it up and continue walking on the correct line to the distant station, pulling the slack out of the wire as you go. Once the slack has been taken up, unwind the wire until you reach the first set of snap hooks. Interconnect the 117 foot and 163 foot Aerial Wire Assemblies with the Connector Piece. Continue out along the correct bearing unwinding the wire until you reach the second set of snap hooks. Disconnect the 163 foot Aerial Wire Assembly from the reel.
- Step 11 Terminate the end of the wire with a Load Assembly and Ground Peg Assembly. Pretension the wire, drive in the Ground Peg Assembly, and assemble and erect the Minimast. (See paragraphs 4.2.7, 4.2.8, 4.2.9 and 4.2.10.)

NOTE

If the team consists of 2 persons or more, carry out final tensioning with the erection of the Minimast simultaneously with the tensioning at the other end of the wire - see Step 17.

- Step 12 If space permits, lay out a ground mat in front of the antenna. Attach the 220 foot Aerial Wire Assembly to the wing nut terminal on the Ground Peg Assembly. Run out the wire in a straight line towards the distant station. Check back to see that you are lined up properly with the element wire and mast. (See Figure 5-14.)

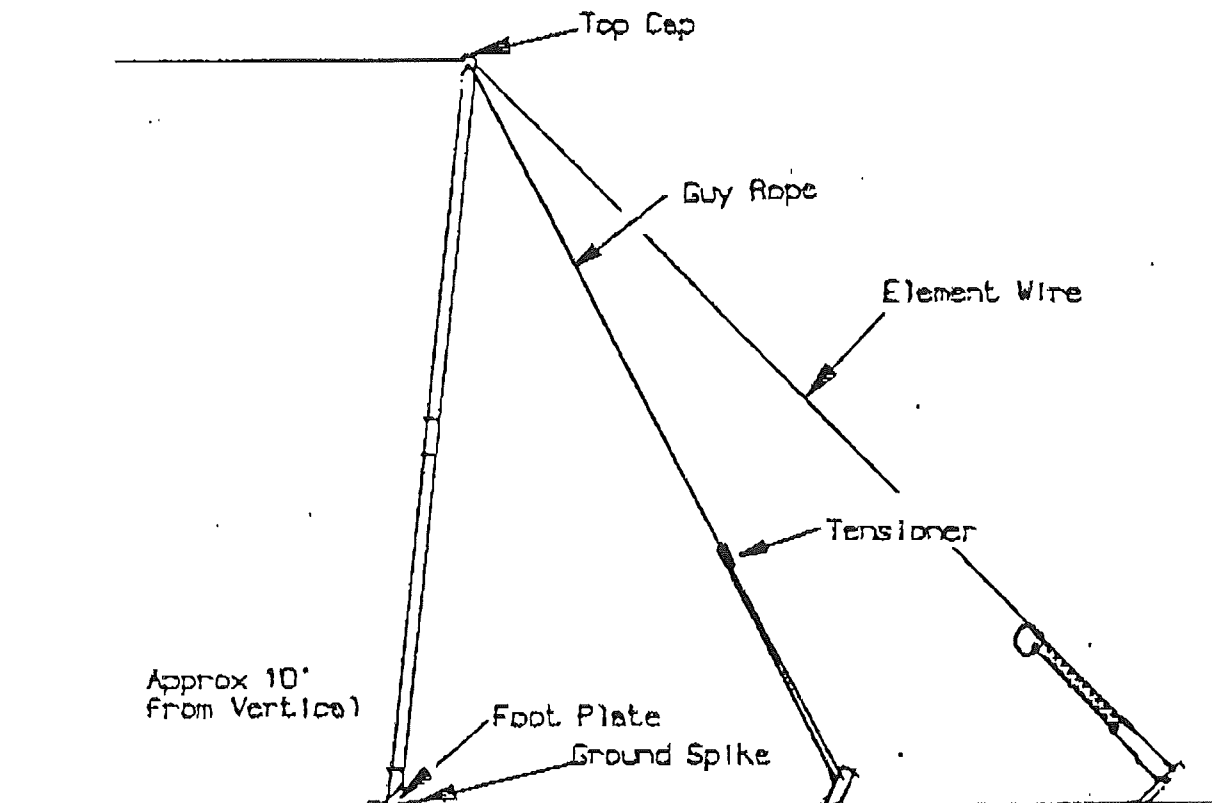


Figure 5-14. Half Rhombic Termination

- Step 13 Return to the 50 foot mast with the Minimast Kit Bag and the remaining contents. Collect the Antenna Mast Bag.
- Step 14 Walk to the second reel. Pick this up and fully run out the remainder of the 117 foot and 163 foot Aerial Wire Assemblies on the reciprocal bearing to the distant station. Interconnect the two wires with a Connector Piece.
- Step 15 As you reach the second set of snap hooks, disconnect the 163 foot Aerial Wire Assembly from the reel.
- Step 16 Take the remaining Ground Peg Assembly, 23 inches, from the Antenna Kit Bag. Attach the tensioning snap hook to the snap hook at the end of the Aerial Wire Assembly.
- Step 17 Hold the Ground Peg Assembly and walk away from, and in line with, the mast to tension up the wire. Ensure that you are lined up with the element wire on the far side of the mast.

NOTE 1

If the team consists of 2 persons or more, tensioning at Step 17 and raising of the Minimast at the far end should be carried out simultaneously.

NOTE 2

Do not over tension the antenna wire. This puts undue strain on the equipment and does not improve performance. Some sag is to be expected.

- Step 18 Drive the Balun Stake into the ground immediately adjacent to the snap hook of the 117 foot Aerial Wire Assembly.
- Step 19 Attach the Coaxial Cable to the N type connector on the base of the Balun.
- Step 20 Suspend the Balun on the hook of the Balun Stake.
- Step 21 Attach the spade terminal of the 117 foot Aerial Wire Assembly to one of the Balun terminals. Tighten the wing nut.
- Step 22 Attach the Ground Strap from the Ground Peg Assembly to the free terminal of the Balun. See Figure 5-15.

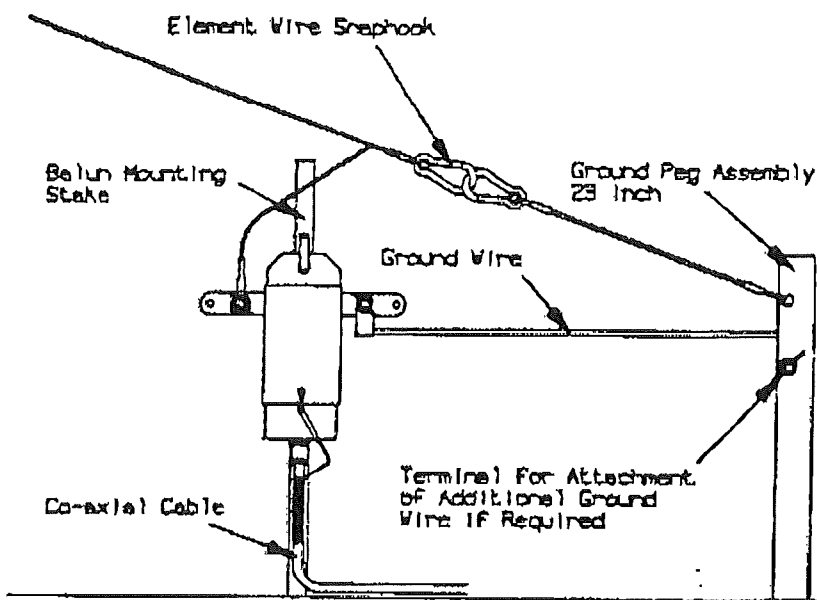


Figure 5-15. Half Rhombic Balun Connections

SECTION 6

TEAR DOWN INSTRUCTIONS

WARNING

DO NOT TEAR ANTENNA DOWN DURING THUNDER-STORMS - RISK OF ELECTROCUTION BY LIGHTNING STRIKE.

6.1 MAST MOUNTED CONFIGURATIONS

- 6.1.1 Switch off or isolate all electrical power.
 - 6.1.2 Taking both the Antenna Kit Bag and the Minimast Kit Bag, walk out to the far end of the element wire. Take down the Minimast by pushing it back down the wire towards the 50 foot mast. Disassemble the Minimast and remove the anchor hardware and base plate. Use a hammer to loosen anchors before attempting to pull them out of the ground. Pack the items in the Minimast Kit Bag.
 - 6.1.3 Disconnect electrical leads on both sides of the Load Assembly. Slide "O"-rings along both wires to secure Aerial Wire Assembly electrical lead.
 - 6.1.4 Disconnect snap hooks from the Load Assembly.
 - 6.1.5 Use a hammer to loosen the Ground Peg Assembly, 23 inch, and then pull it out of the ground.
 - 6.1.6 Pack the Load and Ground Peg Assembly in the Antenna Kit Bag.
 - 6.1.7 Attach the snap hook of the Aerial Wire Assembly to the hole in the center of one of the reels.
 - 6.1.8 Keeping a little tension on the wire as you go, wind the wire onto the reel. Remove the Connecting Piece(s) as you reach them.
 - 6.1.9 Wind in the wire as far as you conveniently can.
 - 6.1.10 Untie the halyard and carefully lower the antenna curtain. It will be helpful if a second team member pulls the coaxial cable clear of the wires and halyard as the Balun descends.
 - 6.1.11 When the Balun reaches the ground, disconnect all attached cables.
 - 6.1.12 Inventory all items before packing them in appropriate transit bag. See Section 7 for a list of equipment.
- #### 6.2 BEVERAGE CONFIGURATION
- 6.2.1 Carrying the Antenna Kit Bag, walk to the far end of the antenna.

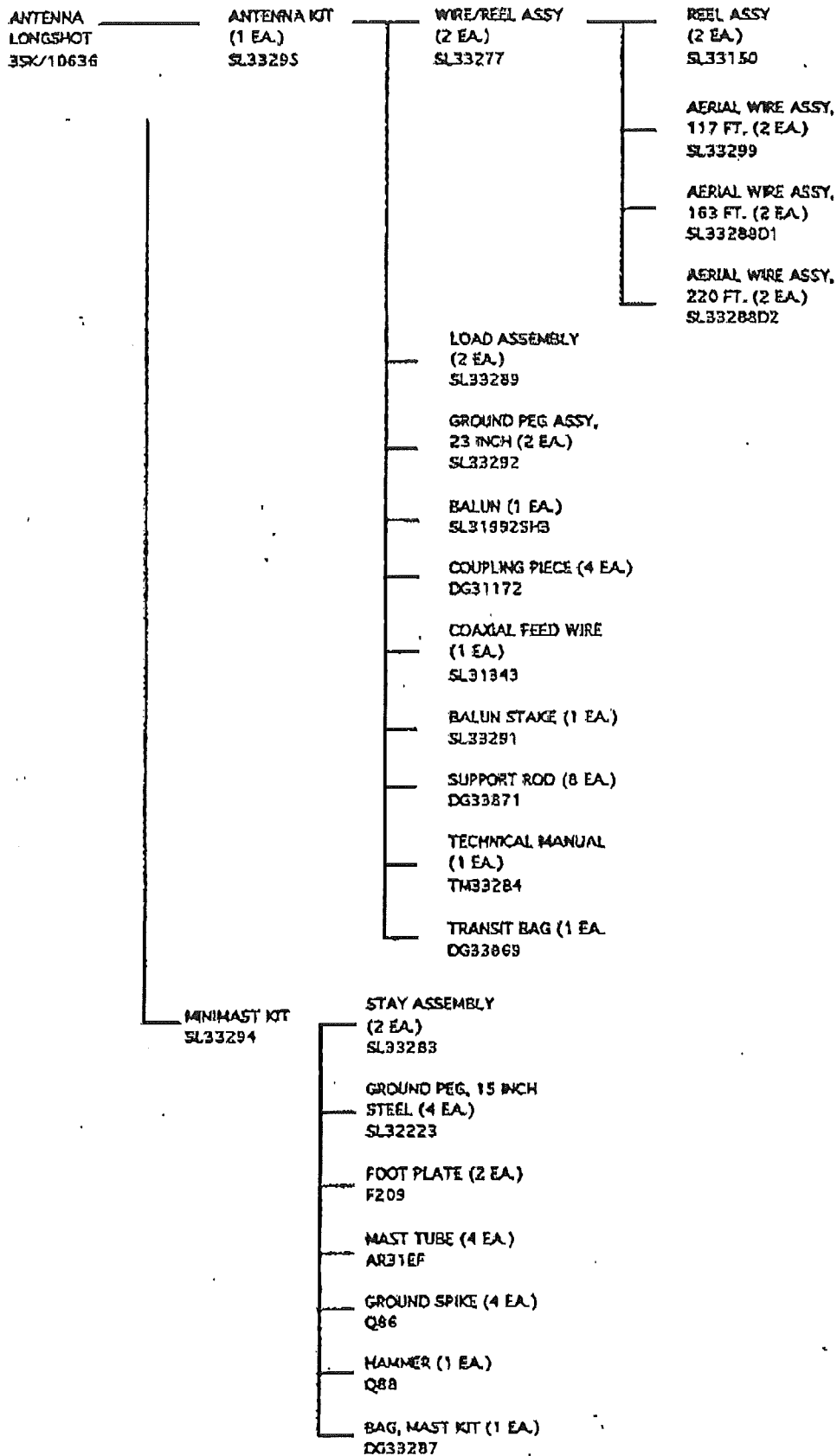
SECTION 7

MAINTENANCE PROCEDURES

7.1 MAINTENANCE PROCEDURES

- 7.1.1 The antenna is maintenance free during normal service except as follows.
- 7.1.2 Visually check the antenna components for damage during tear down after each deployment. Any excess dirt should be washed off using clean water.
- 7.1.3 Following prolonged exposure to a salt laden environment, clean the wire elements off with a wet sponge and allow to dry before winding onto the reels.

PARTS BREAKDOWN



SECTION 8

OPTIONAL EQUIPMENT

8.1 LIGHTNING PROTECTION KIT

8.1.1 Introduction

Most antenna systems tend to attract lightning strikes since they contain good conductors and rise above surrounding obstructions. The energy in a lightning strike is frequently sufficient to severely damage or destroy radio equipment connected to the antenna system. CSA's Lightning Protection Kit is designed to divert the strike energy to earth via a deliberate and controlled path so that no radio equipment damage is incurred. Note, however, that it is not possible to prevent damage occurring to the antenna or mast.

8.1.2 Description of Equipment

The Lightning Protection Kit consists of a Lightning Protector Assembly, two conventional copper clad steel Ground Rods, a Grounding Rod Connector and a stainless steel Grounding Rod Driving Cap (CSA Part Number JH 14).

The Lightning Protector Assembly (CSA Part Number JH 10) consists of a Polyphaser Corporation proprietary broadband coaxial protector mounted onto an aluminum block which is screwed directly onto the Grounding Rod. Lightning energy from both outer and inner conductors of the coaxial cable are transferred from the coaxial protector via the aluminum block to the Grounding Rods.

The Upper and Lower Grounding Rods (CSA Part Number JH 11 and JH 12) may be joined together in the field using the Grounding Rod Connector (CSA Part Number JH 13).

8.1.3 Assembly Steps

- Step 1 Identify the Lower Grounding Rod by the lack of screw thread on its lower end. Screw on the Grounding Rod Driving Cap and drive the rod into the ground. Unscrew the Grounding Rod Driving Cap and replace it with the brass Grounding Connector.
- Step 2 Connect the two Grounding Rods together by screwing the Upper Grounding Rod into the upper end of the Grounding Rod Connector. Screw the Driving Cap onto the top of the rod and continue driving the rod into the ground until the top is about 12 inches above the level of the dirt.
- Step 3 Unscrew the Driving Cap.
- Step 4 Screw the Lightning Protector Assembly onto the top of the exposed rod.
- Step 5 Connect the antenna coaxial connector to the UPPER N connector of the Lightning Protector Assembly.
- Step 6 Connect the radio cable connector to the LOWER N connector of the Lightning Protector.

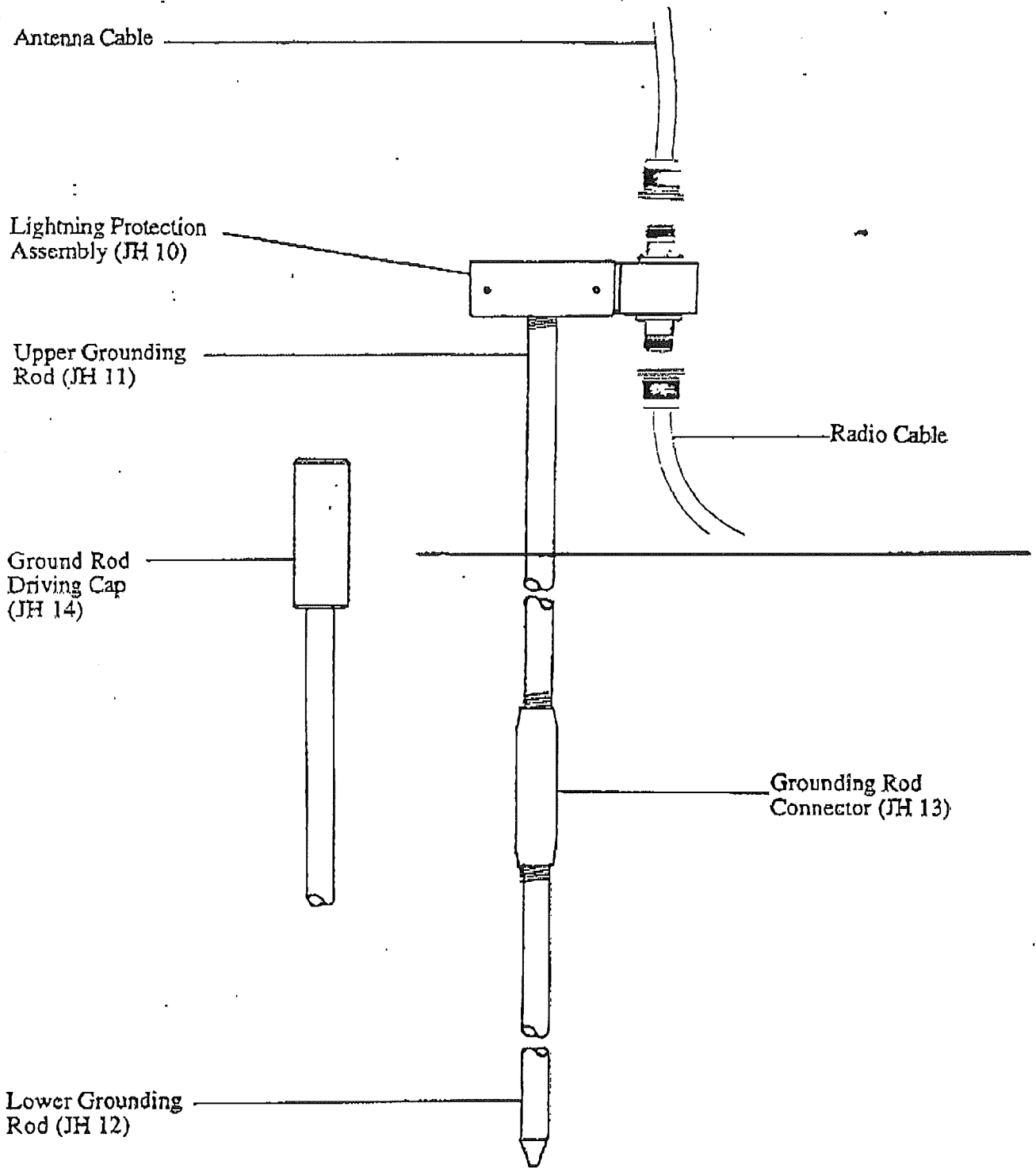


Figure 8-1. Lightning Protection Kit

SECTION 9

ORDERING INFORMATION

9.1 ORDERING INFORMATION

A complete range of CARRYMAST lightweight, quick erect telescopic masts is available from CSA for a wide variety of applications (see specification table below). For more information on these masts and a wide range of other tactical antenna products, or to order spare parts for your "LONGSHOT" Tactical HF Antenna Kit, contact Tim Price at (703) 430-7073, or write:

C&S ANTENNAS, INC.

730 21st Street Drive, SE
Hickory, NC 28602

PH 828-324-2454
FAX 828-324-2072

TABLE 9-1. CARRYMAST RANGE SPECIFICATIONS

Nominal Height	25 ft (8m)	30 ft (9m)	34 ft (10m)	38 ft (12m)	50 ft (15m)
Model Number	CTM8	CTM9	CTM10	CTM12	CTM15
Height extended	25ft tin (7.65m)	29ft 7ins (9m)	33ft 6ins (10.2m)	38ft 3ins (11.65m)	50ft (15m)
Truss Length	5ft 8ins (1.73m)	5ft 8ins (1.73m)	5ft 8ins (1.73m)	5ft 8ins (1.73m)	5ft 8ins (1.73m)
Deployment Time (one man)	6 mins	6 mins	7.5 mins	8 mins	12 mins
Weight Mast Body	19lbs (8.6kg)	21lbs (9.5kg)	23lbs (10.5kg)	24lbs (10.8kg)	30lbs (13.6kg)
Weight Deployment Accessories	19lbs (8.6kg)	19lbs (8.6kg)	19lbs (8.6kg)	19lbs (8.6kg)	30lbs (13.6kg)
Max Head Load	35lbs (15.9kg)	35lbs (15.9kg)	35lbs (15.9kg)	35lbs (15.9kg)	35lbs (15.9kg)
Maximum Wind Speed	90mph (145km)	90mph (145km)	90mph (145km)	90mph (145km)	90mph (145km)
Max Wind during deployment	30mph (48km)	30mph (48km)	30mph (48km)	30mph (48km)	30mph (48km)
Low Temperature (operational)	-50°F (-45°C)	-50°F (-45°C)	-50°F (-45°C)	-50°F (-45°C)	-50°F (-45°C)
High Temperature (operational)	+160°F (+71°C)	+160°F (+71°C)	+160°F (+71°C)	+160°F (+71°C)	+160°F (+71°C)

SALT FOG Per MIL STD 883C, Method 509.1 Procedure 1

SAND & DUST Per MIL STD 883C, Method 501.1 Procedure 1

NOTE: US National Stock Number for the CTM15: 5985-01-342878 ZX