

---

# **KLM 2M-16LBX ASSEMBLY MANUAL**

---

# MIRAGE 2M-16LBX

/KLM 13938

COMMUNICATIONS EQUIPMENT, INC.

The 2M-16LBX utilizes the latest in ultra high gain, low side lobe design. The parasitic elements are pseudo log tapered in length and spacing to produce wide usable bandwidth with low sidelobes. This structure is coupled with KLM's proven multidriven element assembly to produce unbeatable performance.

Because of its light weight and low windload it is perfect for use in higher gain arrays. Used singularly of course, it is just the answer for crowded masts where high gain and clean pattern are still a must. The multidriven log-cell with its characteristic high efficiency and built-in front to back ratio eliminates the need for bulky, heavy multiple reflector structures.

The use of a tapered boom again provides minimum windload and maximum strength. This makes array construction simpler and cleaner. We expect to see a lot of DXpeditions utilizing 4 or 8 of these antennas because of their light weight, guaranteed high performance and quick setup and takedown.

KLM has stacking frameworks available to allow stacking up to 8 antennas. Upgraded 2 and 4 port power dividers and ultra/low loss phase-matched phasing cables are also available.

## PRELIMINARY SPECIFICATIONS

### ELECTRICAL SPECIFICATIONS

Spec. Freq. Range:	144-146	F/S	20 db min
Usable " " :	143-148	F/S	30 db min

#Gain:		1st Lobes	-17 db
144 "	.....14.5 "	E Plane Beamwidth	26 degrees
145 "	.....14.5 "	H Plane Beamwidth	29 degrees
146 "	.....14.4 "	Feed Impedance using	4:1
147 "	.....14.3 "	RG303 Silver/teflon balun	
148 "	.....13.2 "	50 ohms unbalanced	

### MECHANICAL

Boom length	28 ft 1" (337") 4.08 wave lengths
Driven Elements	2, Dual Driven 3/8" diameter tube
Parasitics	14, 3/16" Rod insulated
Weight	10 lbs.
Turning Radius	185"
Wind Load:	Horizontal polarity 1.75 sq.ft. Vertical polarity 2.44 sq.ft.

To provide a more accurate and consistent gain figure, performance of this KLM antenna has been carefully measured and correlated in accordance with national Bureau of Standards Note #688. This gain figure may appear somewhat conservative when compared with others commonly found in conventional industry literature and based on older, less exacting rating methods.

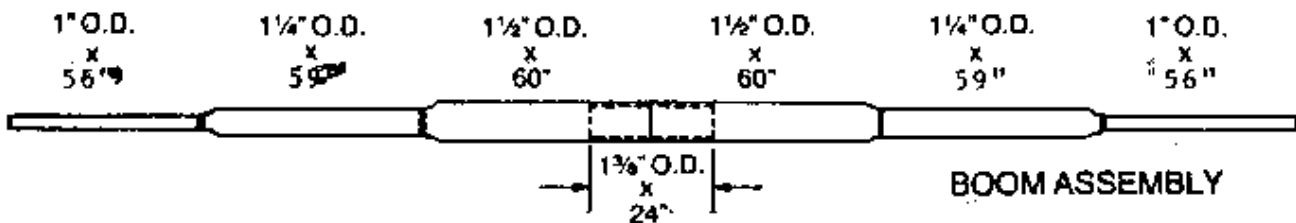
7/19/85

P.O. BOX 1000

MORGAN HILL, CALIFORNIA 95037

(408) 779-7363

Assembly of the 2M-16LDBX antenna is easy and quick but as with any high performance antenna, close attention to dimensions and centering is extremely important if top performance is to be realized. This unique design uses continuously tapering directors so each element is a different length. The first director in front of the driven element (D1) is the longest director and the directors progressively get shorter to the end (D13).



#### BOOM ASSEMBLY

This antenna has been designed with a tapered boom to maximize strength where needed and minimize wind load. Locate the two 1-1/2 inch diameter sections and the 1-3/8 inch diameter center coupling section. Note the markings on the ends. Slide the splice section into the matching un-swaged end of the 1-1/2 inch diameter section. Align the #8 size screw holes and add the 1-3/4 inch stainless screws, nuts and lockwashers. Slide on the other 1-1/2 inch diameter boom section and install the hardware as before.

Next, matching the markings of the partly assembled boom to the 1-1/4 inch diameter sections, insert the sections and secure with 1-3/4 inch stainless screws, nuts and lockwashers.

Now add the matching 1 inch diameter sections and secure with 1-1/2 inch stainless screws, nuts and lockwashers.

Now add the matching 1 inch diameter sections to each end and secure with 1-1/2 inch stainless screws, nuts and lockwashers.

Lay the semi-completed boom flat and straight and tighten the hardware with a 11/32 nut driver and screwdriver.

#### DRIVEN ELEMENT ASSEMBLY

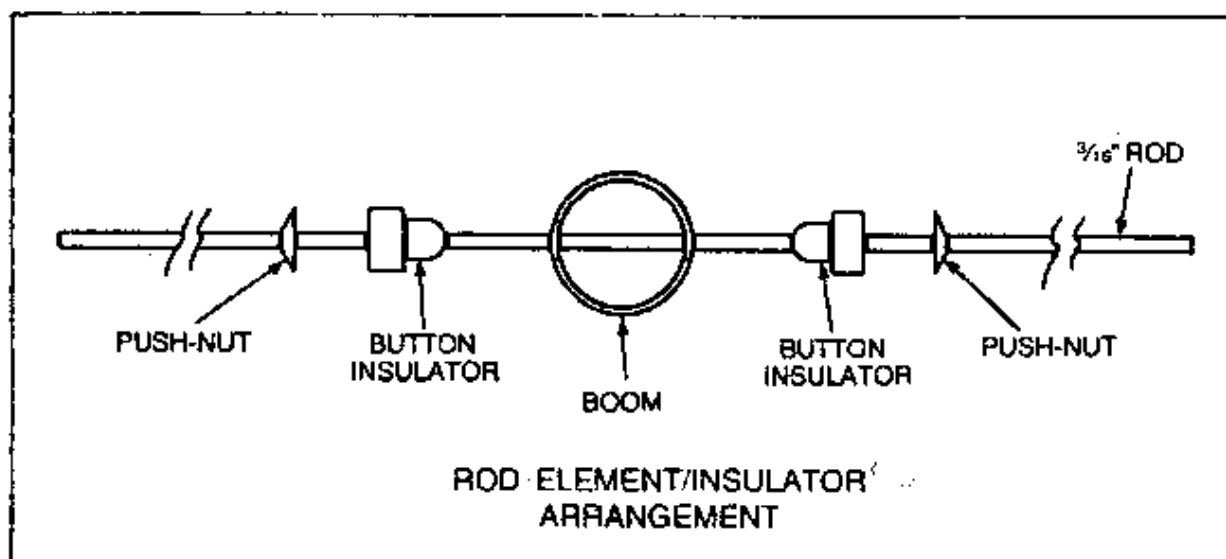
This antenna utilizes KLN's unique, efficient DUAL DRIVEN element. Near one end of the boom locate two #8 screw holes about 10 inches apart. Mount the two black insulators on the boom at this point using 2 inch screws, nuts and lockwashers.

NOTE: The screw head rests on the boom and the insulator slips over the screw on the opposite side of the boom. Place the insulator so the mounting hole is closest to the center of the boom. Tighten the hardware.

Locate the long and short driven element halves. Insert the plastic peanut shaped reinforcing slugs so the holes in the slugs match the element mounting holes. Place one of the short element halves into the insulator closest to the boom center. Pass a 1-1/4 inch screw up through the insulator first then through the element. Place a 1/2 inch wide phasing strap over the screw stud and add a nut and lockwasher. Repeat for the other element half.

Slide a phasing strap spacer onto the two straps with the curved end of the spacer toward the boom. Center the spacer and proceed to mount the longer, rear driven elements. Tighten all hardware.

Place the premade silver plated, teflon coax balun over the three studs at the front driven element (closest to the boom center). Lugs have been provided for feed line attachment. Follow the Assembly Pictorial, page 6, carefully. Alternately the lugs can be used to attach a connector directly to the feedpoints and the feedline can be screwed onto this connector if desired. Attach the feedline in the desired manner and tighten the hardware. Route the feedline away from the feedpoint to the boom balance point (180 inches from driven element end) and attach with black nylon ties or tape if desired.



#### REFLECTOR-DIRECTOR ASSEMBLY

Locate the longest 3/16 inch diameter element (REFLECTOR). Slide on one of the "button" mounting insulators, small end first. Push the insulator to the element balance point. DON'T WORRY ABOUT THE EXACT LOCATION AT THIS POINT. Repeat this operation for each of

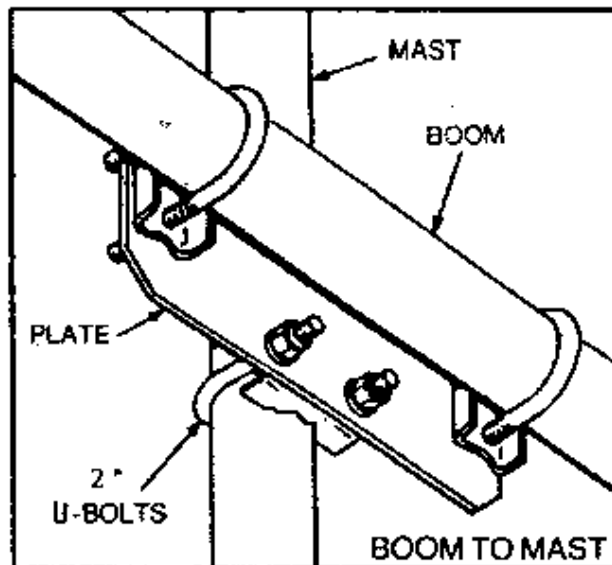
the remaining rod elements.

Pick up all the rod elements and settle them in your grasp on a flat, smooth surface. Starting with the longest rod, insert it through the end hole in the boom near the driven elements. Next move to the hole directly in front of the driven elements and insert the next longest element. Continue inserting the next longest rod director in the next hole, and the next, and the next, until all the rod directors are in place.

Now return to the reflector and slide on the second button insulator from the opposite side of the boom. Visually center the element in the boom. Consult the antenna dimension sheet and using a tape measure set the element position so the element is centered in the boom. THIS CENTERING OPERATION IS VERY CRITICAL FOR PROPER PERFORMANCE OF THE ANTENNA.

Move to the next rod director and repeat the second button insulator installation and centering operation. Continue until each rod director is fully mounted and centered.

Return to the reflector now and install the element keeper washers on each side. BEFORE PUSHING THEM TIGHTLY UP AGAINST THE BUTTON INSULATORS, CHECK FOR PROPER CENTERING ONE MORE TIME. Proceed by adding the keeper washers to the rest of the rod directors until all have been center-checked and have the keepers installed.



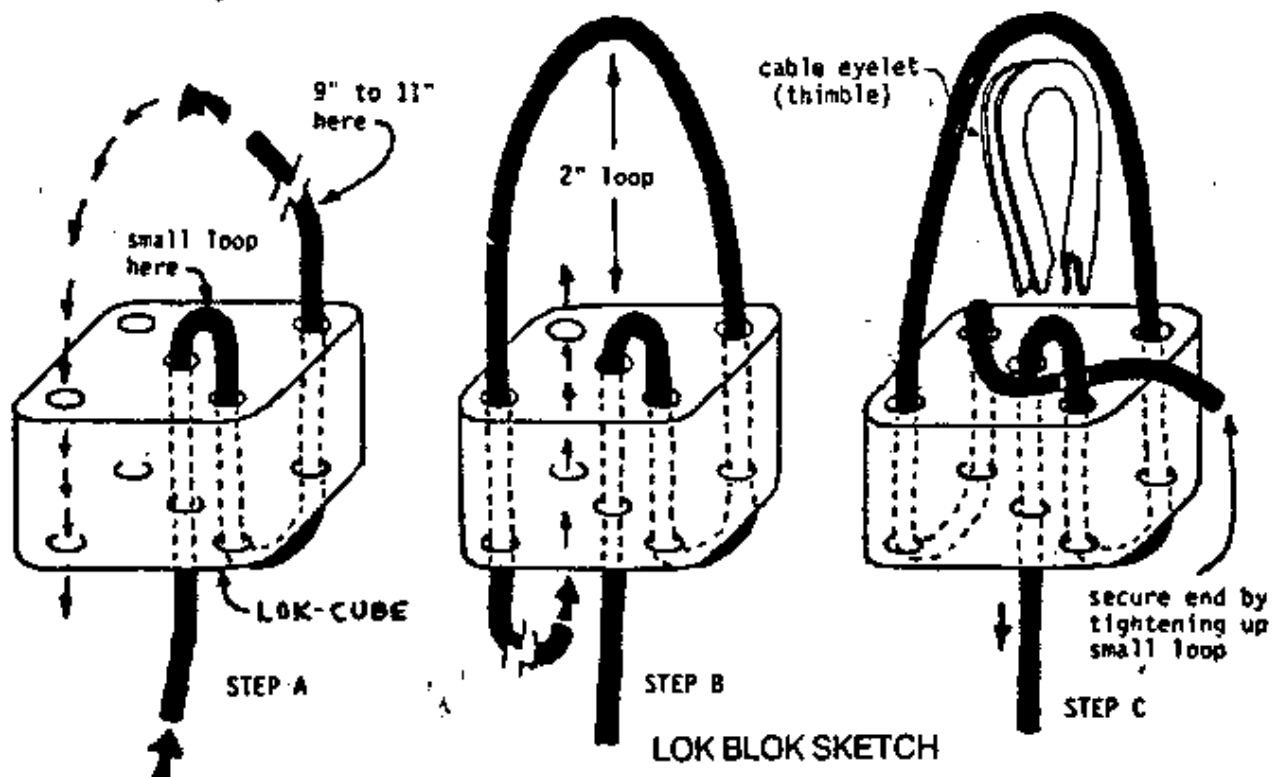
#### BOOM TO MAST PLATE MOUNTING

Locate the balance point of the completed antenna. This should be done with the feedline mounted on the antenna as it will be in its final mounting position as the weight of the feedline can affect the physical balance point. Typically the balance point is 150 inches from the rear of the boom. Install the boom-to-mast plate to the boom using the 1-1/2 inch U-bolt and cradles provided. Two-inch U-bolts and cradles have been provided for mast mounting. This size U-bolt will mount to mast diameters between 1-1/2 inches and 2-1/8 inches.

### BOOM SUPPORT CABLE MOUNTING

HPTG-1200 Phyllistran non-conductive cable has been supplied with this kit. Mount the two eyebolts through the boom with the eyes on the top side of the boom. THE DRIVEN ELEMENT ASSEMBLY MAY BE MOUNTED SO IT IS ON THE UNDERSIDE OF THE BOOM IN ITS FINAL CONFIGURATION. Install the cable eyes through the eyebolts. Square, cube lok-bloks secure the cable at the eyebolts and at the center turnbuckles. Refer to the lok-blok sketch for attachment details. Install the cables at each eyebolt and route it back to the turnbuckle assembly. Loosen and center the turnbuckle itself until just one thread shows on each side inside the turnbuckle body. Install the two remaining cable eyes in the turnbuckles. Center the turnbuckle assembly over the boom to mast plate and attach the cables to the turnbuckles using the lok-blok as described before. The height of the turnbuckle assembly over the boom need not exceed one foot (.3 meters) and can be as little as 4 inches (10cm).

NOTE: Once the cable is routed through the lok-blok put as much tension as possible by hand on the assembly to pull out any looseness in the assembly and prevent long term boom sag from loosening cables. These cables don't stretch but they do take a set so some relaxation may be noted.



This completes the assembly. If this antenna is to be part of several in an array of identical antennas the assembly procedures may be modified as required as far as feedline mounting, boom mounting and cable assembly mounting.

If desired, when used in an array, this antenna can be fed directly with high impedance balanced feedline. If 200 ohm feedline is not used, then multiples for half wavelengths with the appropriate velocity factor figured in, is a must to maintain the 200 ohm feedpoint impedance at the junction points. If balanced line is used the halfwave baluns provided are not needed and the feedline can be attached directly to the front driven elements. Balanced line has the advantage of low cost, low loss and low weight. In an array it can be used to eliminate conventional baluns and coaxial power dividers. Its disadvantage is, that it is affected some by rain, ice or snow. A good balanced line for most purposes is Belden 8275 (300 ohm, 1.2 db/100 ft at 100MHz).

Spacing for two or more 2m-16LBX antennas is as follows:

1. Two antennas stacked one above the other horizontally polarized or side by side vertically polarized.  
12 to 12.5 feet (3.65 to 3.81 meters).
2. Two antennas stacked side by side horizontally polarized or one above the other vertically polarized.  
12.5 to 13 feet (3.81 to 3.96 meter).

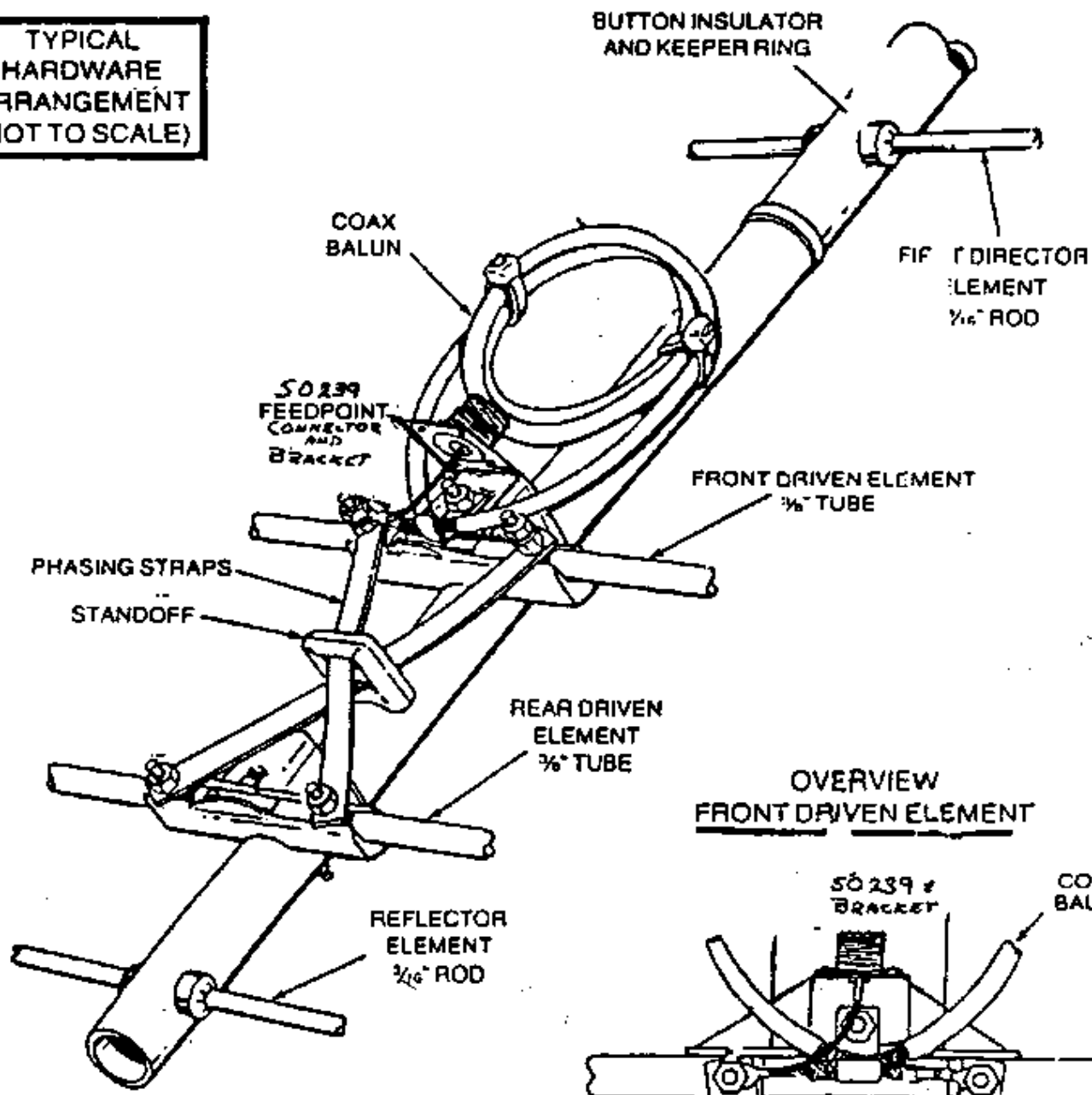
KLM also manufactures high quality low loss coax phasing cables for any array as well as power dividers to couple and match various antennas combinations together. The new Belden 9913 (1.1db/100 ft at 150 MHz) is used with AMP crimp-on "N" connectors.

Stacking frameworks and a new elevation drive mechanism for large arrays are also available.

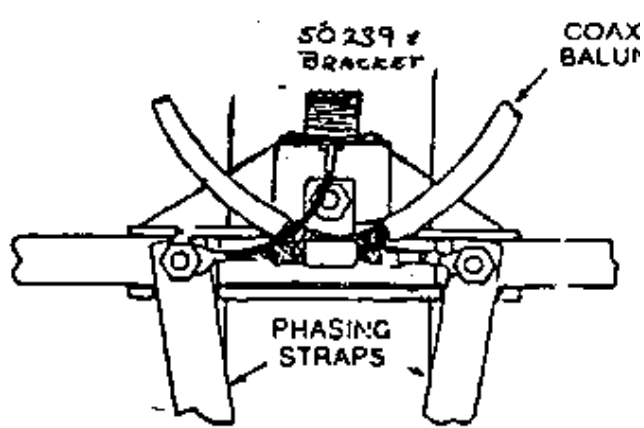
# ASSEMBLY PICTORIAL

2M-16LBX

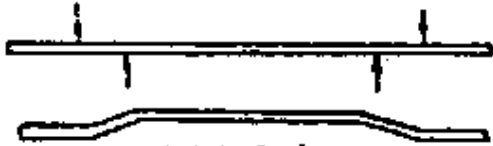
TYPICAL  
HARDWARE  
ARRANGEMENT  
(NOT TO SCALE)



## OVERVIEW FRONT DRIVEN ELEMENT















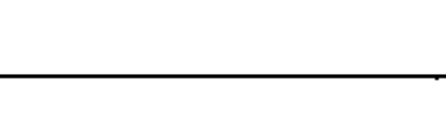



5° bend phasing straps before installing





# DIMENSION LAYOUT 2M-16LBX

ELEMENT POSITION (FROM REAR OF BOOM)	ELEMENT LENGTH	CENTER POINT
336"		17 9/32" ✓
304 1/8		17 11/32" ✓
272 13/16"		17 7/16" ✓
242 1/8"		17 17/32" ✓
212 5/8"		17 23/32" ✓
184 1/4"		17 25/32" ✓
157 1/16"		17 29/32" ✓
131 1/16"		18" ✓
106 1/4"		18 1/32" ✓
83 1/16"		18 3/16" ✓
62 1/2"		18 5/16" ✓
44 3/4"		18 7/16" ✓
30"		18 5/8"
23"		15 (HALF LENGTH)
13"		19 1/4" (HALF LENGTH)
1"		20 5/16"

REAR

xx = Feedpoints 200 ohms balanced.  
Fed with KLM 144-148 4:1 2KW.  
Coax Balun for 50 ohm unbalanced feed

PARTS LIST  
2M-16LBX

PART DESCRIPTION	KLM PN	QUANTITY
Aluminum Boom , Swaged, 1-1/2" x 60"	T1120	2
Aluminum Insert, Spliced, 1-3/8" x 24"	T1380	1
Aluminum Boom , Swaged, 1-1/4" x 59"	T1140	2
Aluminum Boom , 1" x .049 x 56"	T1000	2
Driven Element , Drilled, 3/8" x 19 1/2"	T0380	2
Driven Element , Drilled, 3/8" x 15"	T0380	2
Aluminum Rod, 3/16" x 40-5/8"	R0316	1
Aluminum Rod, 3/16" x 37-1/4"	R0316	1
Aluminum Rod, 3/16" x 36-7/8"	R0316	1
Aluminum Rod, 3/16" x 36-5/8"	R0316	1
Aluminum Rod, 3/16" x 36-3/8"	R0316	1
Aluminum Rod, 3/16" x 36-1/16"	R0316	1
Aluminum Rod, 3/16" x 36.00"	R0316	1
Aluminum Rod, 3/16" x 35-13/16"	R0316	1
Aluminum Rod, 3/16" x 35-9/16"	R0316	1
Aluminum Rod, 3/16" x 35-7/16"	R0316	1
Aluminum Rod, 3/16" x 35-1/16"	R0316	1
Aluminum Rod, 3/16" x 34-7/8"	R0316	1
Aluminum Rod, 3/16" x 34-11/16"	R0316	1
Aluminum Rod, 3/16" x 34-9/16"	R0316	1
Phasing Straps, 1/2" x .063 x 10.75"	S0120	2
Plate Assembly, 2" x 4" x 1/8" (with 2 turnbuckles)	PA204	1
Phyllistran Cable, 22' HPTG 1200	H1200	1
Boom-to-Mast Plate, 4" x 6" x .188	P0406	1
Coax Balun with Lugs, 2M-4:1	B7303	1
Hardware Bag #1:		
Screws, 8-32 x 1-1/4"	28014	4
Screws, 8-32 x 1-1/2"	28015	5
Screws, 8-32 x 1-3/4"	28016	8
Screws, 8-32 x 2"	28017	3
Nut, 8-32	28202	23
Lockwashers, #8	28352	20
Flatwashers, #8	28302	2
Peanut Inserts	66106	4
Phasing Strap/Spacer, 1" x 1-1/4"	66121	1
Nuts, 5/16"	28206	10
Lockwashers, 5/16"	28356	10
Nuts, 1/4-20	28204	2
Lockwashers, 1/4"	28354	2

PARTS LIST - cont'd  
2M-16LBX

PART DESCRIPTION	KLM PN	QUANTITY
<b>Hardware Bag #2:</b>		
Thimbles, 1/8"	28707	4
Driven Element Insulator, 1" Type 2	66113	2
U-Bolts & Cradles, 1-1/2"	28401	2
U-Bolts & Cradles, 2"	28402	3
Eye Bolts, 1/4-20 x 2"	28527	2
Large Black Nylon Ties	66119	4
Lok Cubes	66128	4
<b>Hardware Bag #3:</b>		
Button Insulators	66125	28
Pushnuts, 3/16"	28218	32
Assembly Manual - 10 Pages	M4064	1

11/86  
TOF

# **MIRAGE** /KLM COMMUNICATIONS EQUIPMENT, INC.

October 1, 1986

USE THE PIECE OF 3/8" TUBING SUPPLIED IN THIS KIT FOR  
INSTALLING THE BUTTON INSULATORS AND THE PUSHNUTS. THIS  
PIECE OF TUBING IS NOT PART OF THE FINISHED ANTENNA.