A Manual Elevation Mount for the 6M8GJ Yagi

By
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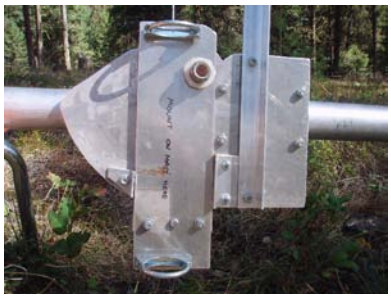
INTRODUCTION

With the use of a 6m yagi with free space gain over 12 dBD, it has become possible to complete contacts with other single yagi stations using JT65A mode, even if one of the stations is elevating their antenna. The portable 6M8GJ yagi has sufficient gain to complete such EME contacts when elevated, making it an ideal antenna for portable EME operation. In order to take full advantage of EME opportunities while in the field, I designed a mount for the 6M8GJ which could be elevated manually. While first using this mount during the E51SIX operation, the large majority of my 6m EME contacts were made while the moon was elevated. I have built four of these mounts, and am providing details so anyone interested could easily duplicate one for their own use.



The mount was designed to be strong enough to withstand high winds, and provide safe, reliable service through multiple DXpeditions. The fabrication was done with hand tools using locally available materials. As depicted in this article, the mount will permit the 6M8GJ antenna to be elevated between 50 and 60 degrees.

This capability was determined to be high enough to cover a large percentage of operational requirements. In practice, it is very difficult to elevate such a yagi much above 45 degrees anyway, because of interference problems with the guy lines used to secure the mast or tower supporting the antenna. Fortunately, the free-space pattern of the 6M8GJ yagi is relatively broad, and I experienced good success with it from E51SIX even when I was aiming substantially below the moon.

PRINCIPLES OF OPERATION

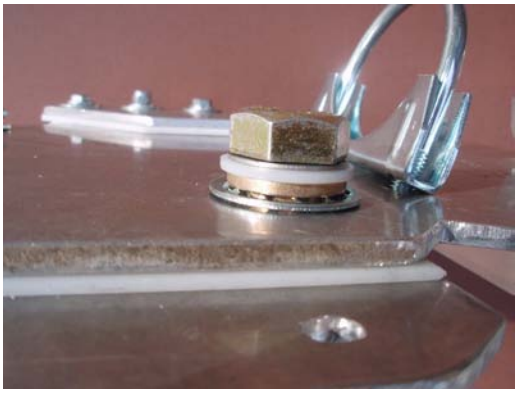
Since the free space pattern of an 8 element yagi is quite broad, it is not necessary to adjust the elevation very often. Therefore, it was concluded that a manually adjusted elevation mount would be quite adequate for portable operations. In fact, the azimuth is also adjusted manually by using the same strings that are used to aim the antenna in elevation. Note that the mount must be mounted at the top of the mast, in order to permit clearance for operation. Additional information and photographs are shown here:

http://www.bigskyspaces.com/w7gj/6M8GJassembly.htm

The mount was designed to be as lightweight as possible without compromising on strength and durability. In addition, the mount had to use materials and parts that would not be degraded by rain, snow, ice or salt air, and that could be easily transported with the least bulk.

The arrangement chosen was to hang the yagi on a single heavy duty pivot. A hardened ¾" diameter bolt forms the pivot between a thick aluminum plate secured to the vertical mast, and another upon which the antenna boom is mounted. In order to provide smooth operation without wear on the aluminum plates, the bolt is run through bronze flanges which are secured to the plates with lockwashers. .The pivoting movement is between the bushings and the 3/4" x 2.5" hardened bolt that runs through them..

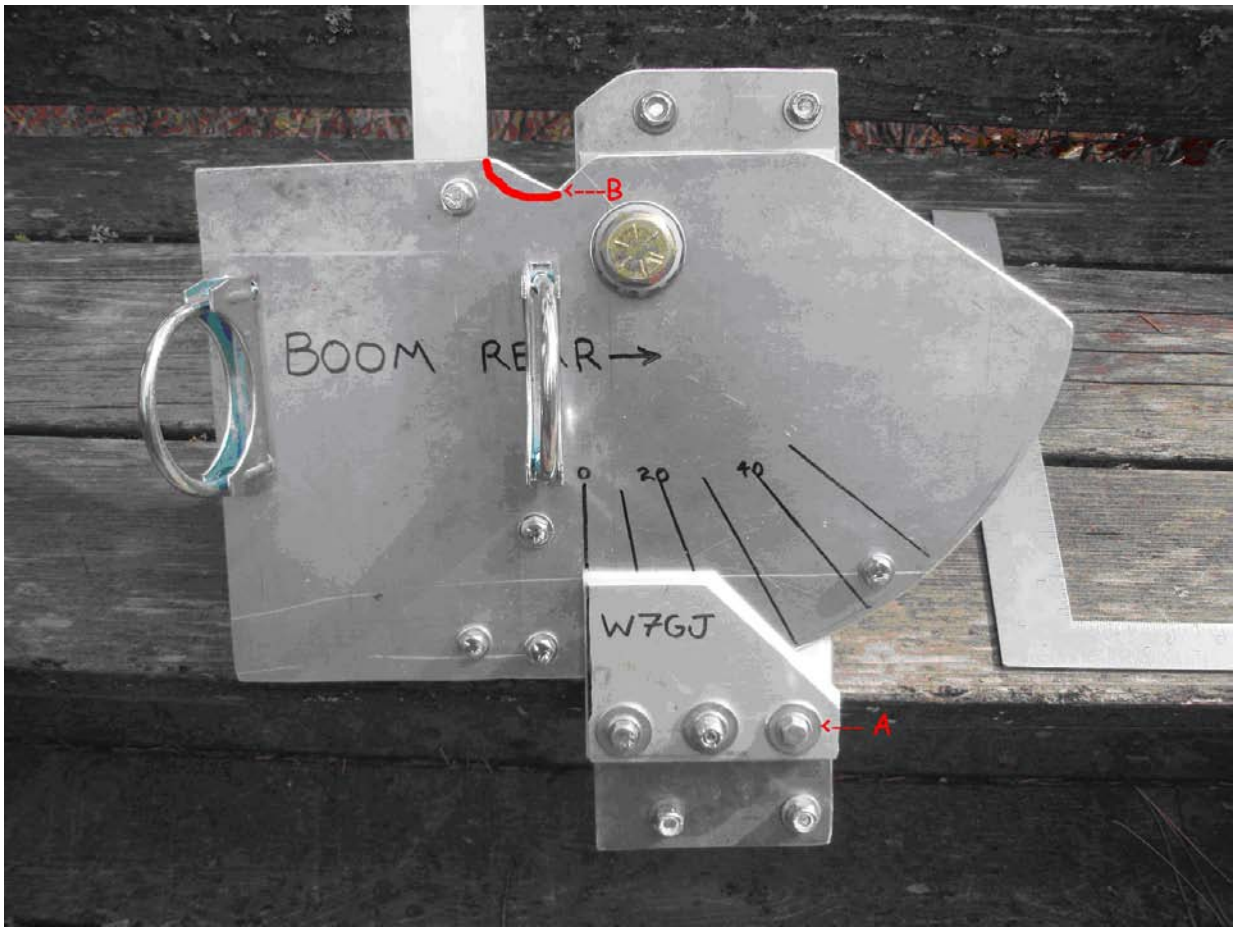
The shafts on the bronze flanges have been cut down so they just touch each other in the center of the center HDPE sheet when the pivot bolt is tightened down so the lockwashers secure the bronze flanges to the ¼" thick aluminum plates.



The plates pivot smoothly with respect to each other by virtue of a sheet of high density polyethylene (HDPE) sheet sandwiched between them. The HDPE sheet can be clearly seen in the right photo above. In the following photo, you can clearly see that the pivot bolt is assembled so that the head of the bolt is on the side where the boom is mounted. This ensures adequate clearance for the boom after the bolt, is installed with the steel washers, nylon washers, bronze bearing flanges, lockwashers and locking nut.

The pivoting movement is between the bushings and the 3/4" x 2.5" hardened bolt that runs through them.. The entire assembly is kept tight by a bearing plate (the piece shown with W7GJ on it) with an additional piece of HDPE under it to provide smooth operation. A spacer made from two 1/8" pieces of HDPE is substituted for the thickness of the ¼" thick pivoting aluminum boom plate. The ease of tilting the antenna upward is determined by adjusting tightness of the three bolts holding the pressure plate against the pivoting boom plate. The approximate elevation of the yagi can be marked on the boom plate, using the pressure plate as an indicator.

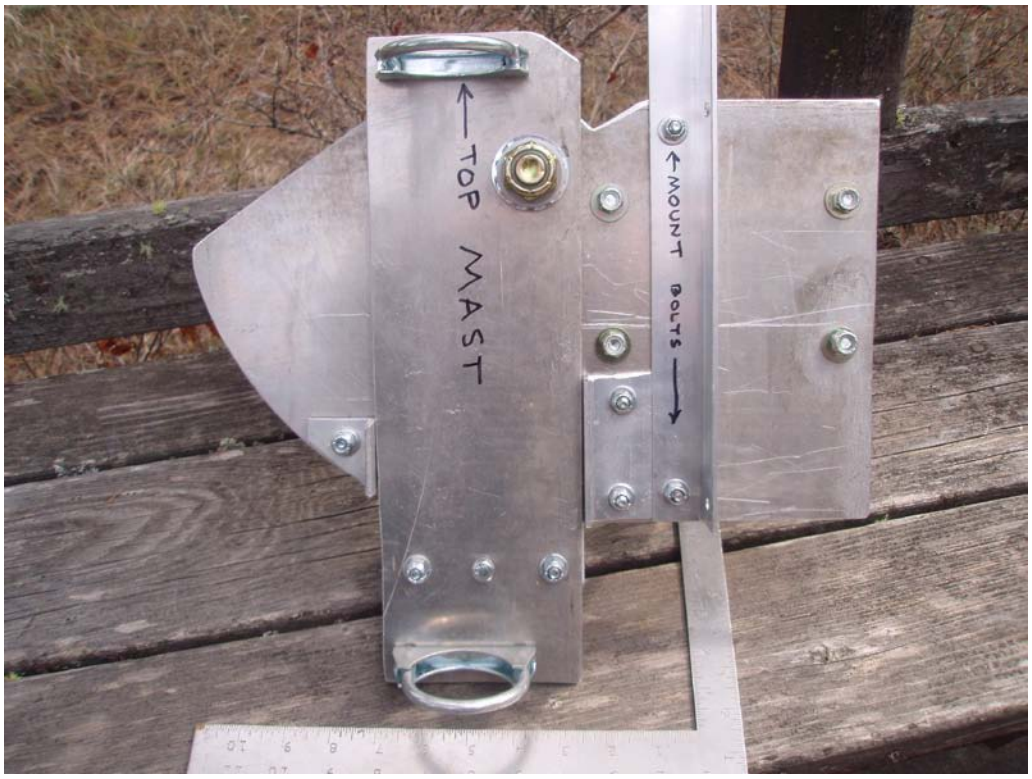
Note that the bolt head that is shown between the 40 and 50 degree lines would prevent the plate from pivoting. If you look at the photo of the mount from the reverse side, you will notice that this is a temporary bolt holding the small elevation stop, which will keep the antenna from elevating at all. This stop and the bolt are removed when elevated operation is anticipated.



NOTE – By removing the bolt shown in the pressure plate at **A** and filing out the main plate as shown at **B**, the antenna can be raised to 65 degrees elevation.

By mounting the yagi such that it is slightly front-heavy (even with the coaxial feedline attached), the pivoting section can be pulled against the main stop so the antenna rest position can be zero degrees elevation. With my mount and LMR-600 UF coax, I mounted the boom so that the front plate of the mount (right side in above photo) was 13.5" from the center of D3.

Because the antenna will be elevated, the boom trusses must be supported by a mast that moves with the antenna. This extension mast was made from angle aluminum which was bolted to the pivoting plate attached to the antenna boom, forward of the pivot, and aligned up against the main stop. The space between the extension mast and the mast plate is used to tighten the rear boom mounting U bolt.

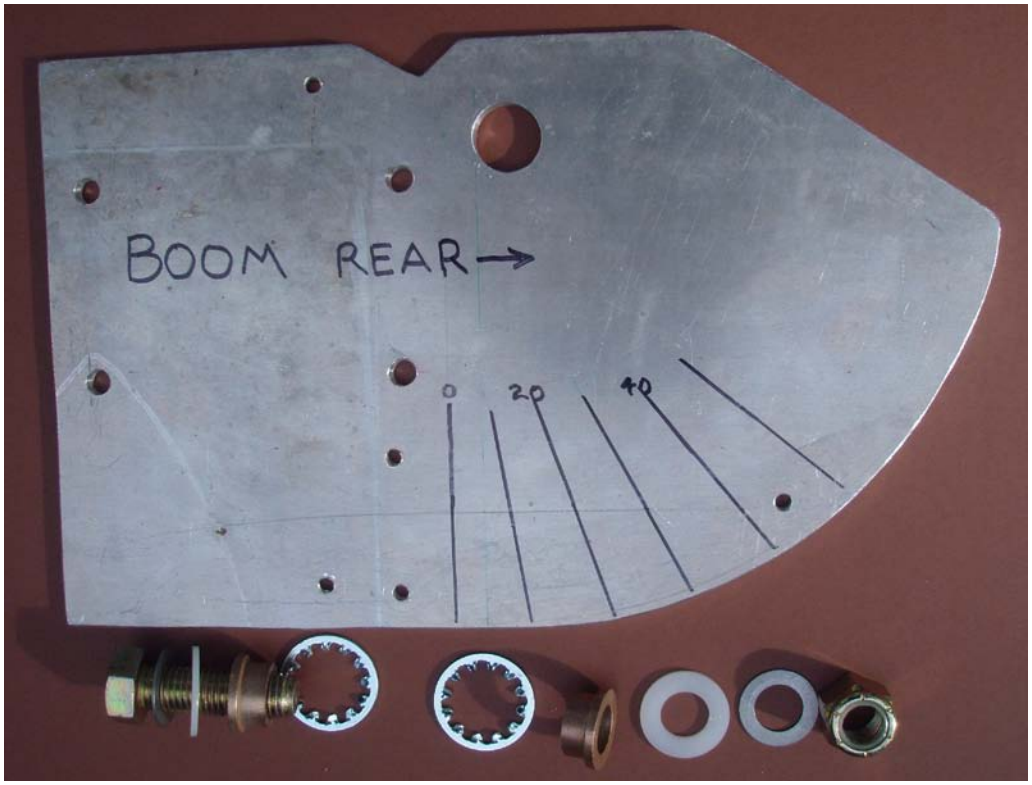


It was found that a system of dual truss lines was much more effective in holding the boom straight, so it was necessary to employ a fiberglass spreader on top of the extension mast to support the turnbuckles and non-conductive Kevlar truss lines (available from Radio Works) that run to the boom. In order to evenly truss the boom, the center of the fiberglass spreader (shown by a black piece of plastic tape in the photos below) needs to be mounted over the center of the boom.

The left photo shows the spreader and extension mast as viewed from the front end of the yagi. The rear photo (on the right) shows how the parts are assembled to keep the spreader level and well supported. The square top end of the extension mast is combined with the 3/16" mounting plate to form a sturdy platform upon which the angle aluminum is tightly bolted. From the photos, you can see how the hose clamps are run through slots cut in the angle aluminum to secure the spreader to the elevation mount assembly.

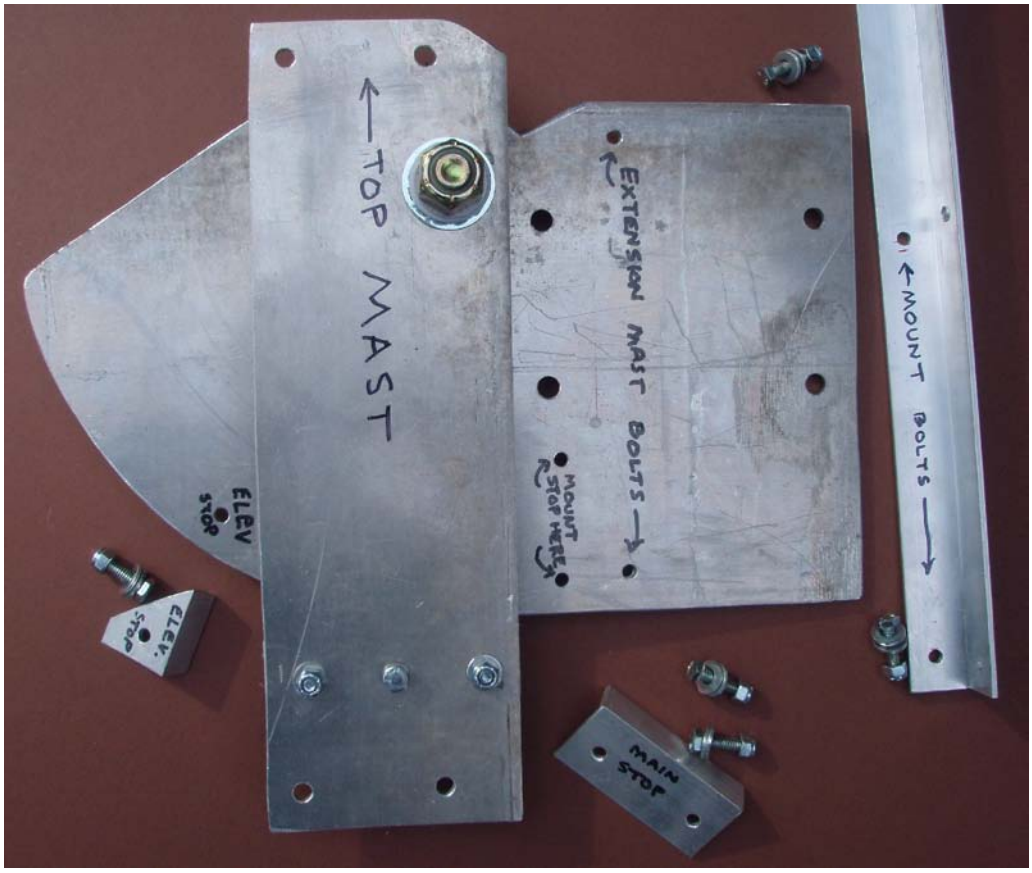
FABRICATION OF INDIVIDUAL PARTS

In summary, two sizes of angle aluminum (both 1/8" thick) were used, along with two thicknesses of aluminum plates (1/4" and 3/16"). 1/8" thick sheet was used for all the pieces requiring HDPE. A complete parts list is provided for the mount as described here. All materials were obtained from local materials suppliers and hardware stores. The main boom plate along with the pivot bolt and its parts are shown below:



The pivoting boom plate is 9" high and the overall length from the flat front/left end to the tip on the rear is 14.75". The 1" diameter hole for the pivot bolt bearing flanges is located 7.5" from the flat front end, 1.5" down from the top edge. As you can see from the photo, the rear bottom of the plate is cut out with a saber saw

to follow a 7.5" radius from the center of the pivot hole. Note the notch in the top surface to provide clearance for the nut on the top mast U bolt. The top rear of the plate was tapered simply to reduce unnecessary weight. The boom clamp U bolt holes were spaced 5" apart, and were started .725" in from the front flat side and 2" down from the top of the plate.

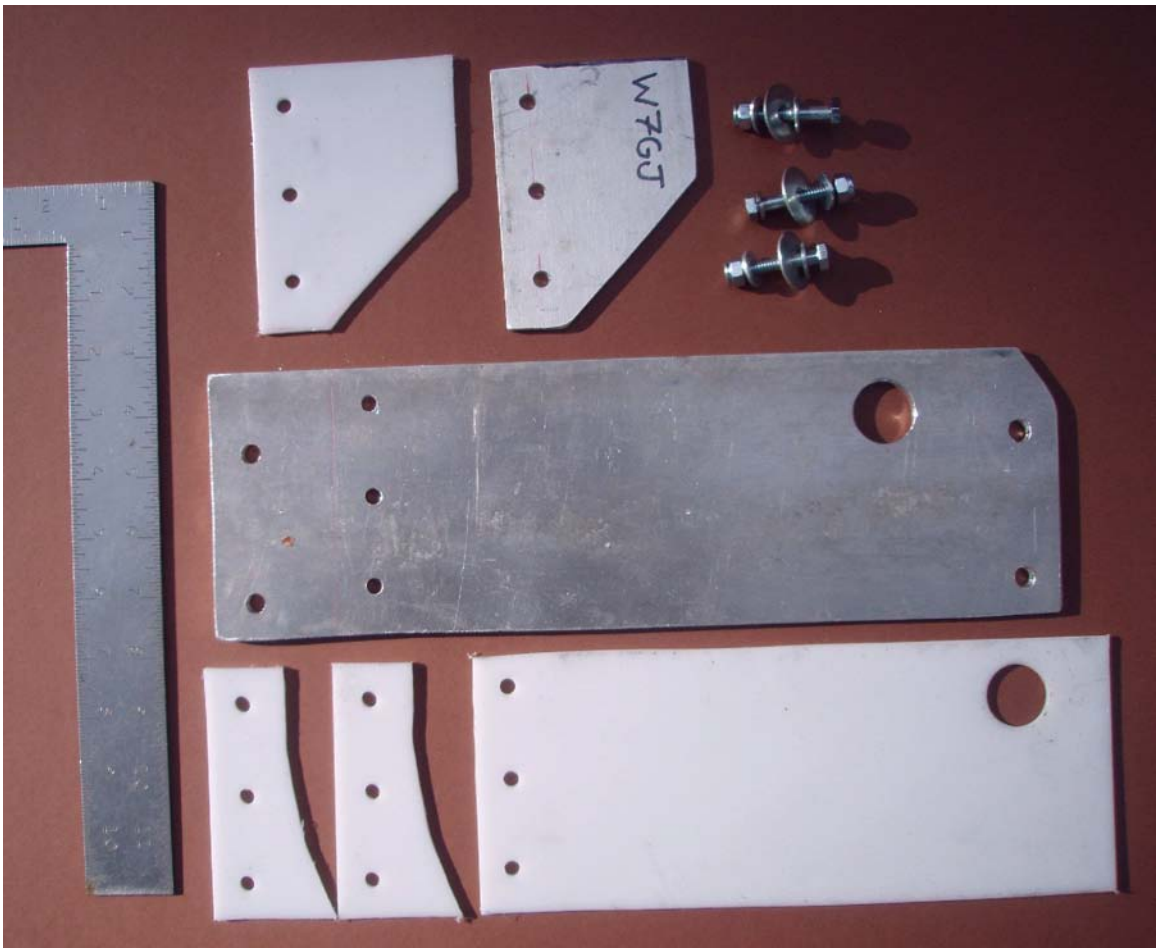


The above photo shows the mast plate mounted on the back side of the boom plate, along with the main stop, elevation stop, and extension mast. Hole locations for the extension mast, elevation stop and main stop can be scaled off the drawing or simply located after the mast plate is mounted together with the boom pivot plate.

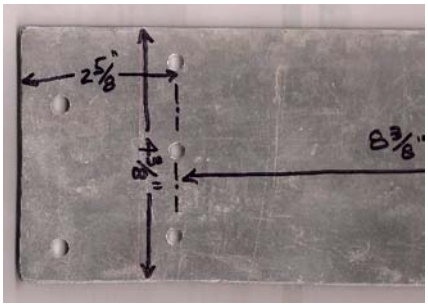
¾" x 1.5"x 1/8" thick angle aluminum parts are used for the stops bolted to the boom plate. The main stop is 3.25" long and the elevation stop is 1.75" long and tapered so it does not protrude past the edge of the curved boom plate.

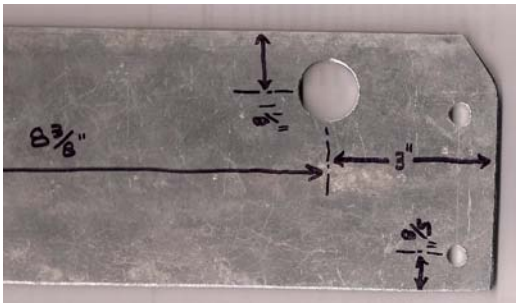
6M8GJ Manual Elevation Mount Parts List

QTY	MATERIAL	DESCRIPTION	APPLICATION
1	Hardened steel	.75” diameter x 2.5” long bolt	Pivot bolt
1	3/16” aluminum	2.75” H x 6”W tapered plate for alignment and bracing	Spreader support atop Extension Mast
1	3/16” aluminum	3.375” x 4.5” tapered pressure plate	Holds sandwiched pivoting plates tight together
2	Plated steel	1” internal tooth lockwashers	Secure bushings to main plates
2	Bronze bushings	.75” ID x 1” OD x 7/16” long with 1.25” diameter lip	Bearings for pivot bolt
2	Steel	Thin .75” ID washers 1/32” thick and 1.25” OD	For pivot bolt
2	Nylon	.75” ID washers 3/32” thick and 1.5” OD	For pivot bolt
1	Steel with nylon	.75” Locknut	For pivot bolt
1	1/8” thick HDPE	4.25”W x 10.5”L bearing sheet	Between sliding aluminum plates
2	1/8” thick HDPE	2”H x 4.25”W contoured spacers	Under pressure plate
1	1/8” thick HDPE	3.5” x 4.5” tapered bearing sheet	Under pressure plate
1	1/4” thick aluminum	4.375”W x 14”H plate	Mast mounting plate
1	1/4” thick aluminum	14.75”W x 9”H plate with rear cut for 7.5” radius from pivot	Boom mounting plate (pivots)
3	Plated steel	1/4-20 bolt x 1.5” long	Securing pressure plate
3	Plated steel	1/4”ID x 1”OD fender washers	Securing pressure plate
5	Plated steel	1/4” washers	Securing pressure plate
1	Stainless steel	Lockwasher	Securing pressure plate center bolt (under mast)
1	.75”x1.5”x.125” alum angle	1.5” long tapered	Elevation stop
1	.75”x1.5”x.125” alum angle	3.25” long	Main stop
2	Stainless steel	.5”W x 1.5”DIA hose clamps	Spreader atop Extension Mast
5	Plated steel	1/4-20 bolts x 1” long	Mounting to Boom plate
10	Plated steel	1/4” washers	Mounting to Boom plate
5	Plated steel with nylon	1/4” locknuts	Mounting to Boom plate
1	Plated steel	1/4-20 bolt x 1” long	Mounting spreader support to extension mast
1	Plated steel	1/4-20 bolt x 3/4” long	Mounting spreader support to extension mast
2	Plated steel	1/4” washers	Mounting spreader support to extension mast
2	Stainless steel	Lockwashers	Mounting spreader support to extension mast
1	1.5”x1.5”x.125” alum angle	43” long	Extension mast to support spreader
1	Fiberglass	40”L x 1.125” OD with 1/8” wall	Spreader support for boom trusses
2	Black rubber	Rubber tips for spreader end caps	Hold turnbuckles to brace boom
2	Plated steel	5/16” Screw eyes	Mounted in spreader end caps to hold turnbuckles
4	Plated steel	5/16”ID x 7/8”OD washers	Mounting screw eyes in spreader end caps
2	Plated steel	5/16”ID x 1.5”OD fender washers	Mounting screw eyes in spreader end caps
2	Plated steel with nylon	5/16” locknut	Mounting screw eyes in spreader end caps
1	.75”x1.5”x.125” alum angle	10.5” long with .75” deep kerf in the wide face at the angle for hose clamps to be attached	Spreader support atop Extension Mast

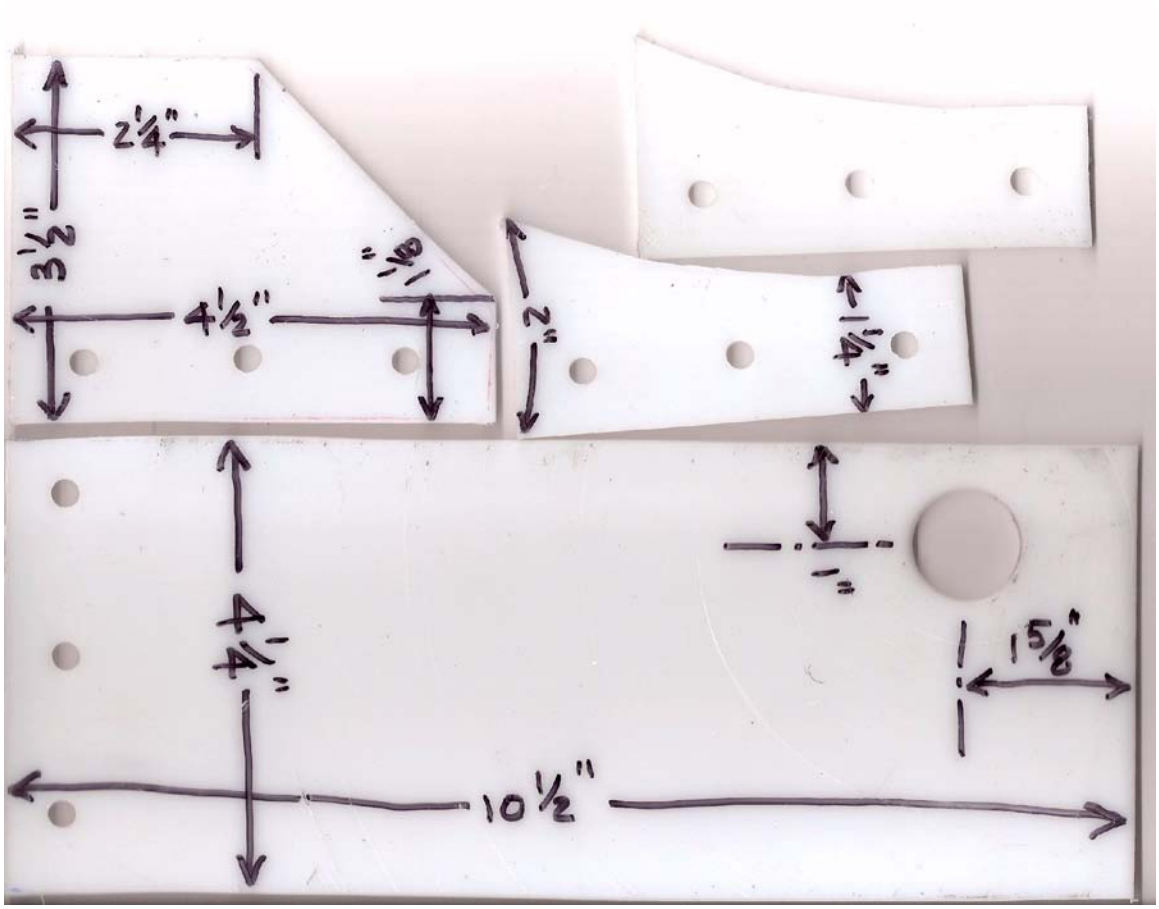


The above photo shows the pieces bolted the mast plate. The overall dimensions of the mast plate are 4.375" wide and 14" high. The 1" hole for the pivot is centered 1.125" from the front edge of the plate, and 3" down from the top. The U bolt holes for the mast are started .625" in from the top,bottom and rear of the plate. The three holes for mounting the bearing plate are located 8.375" down from the centerline of the pivot hole, with one in the center of the plate, and one on either side, .625" in from the front and rear sides of the plate. You can drill the mast plate first and then drill the matching holes in the HDPE and aluminum bearing plate.





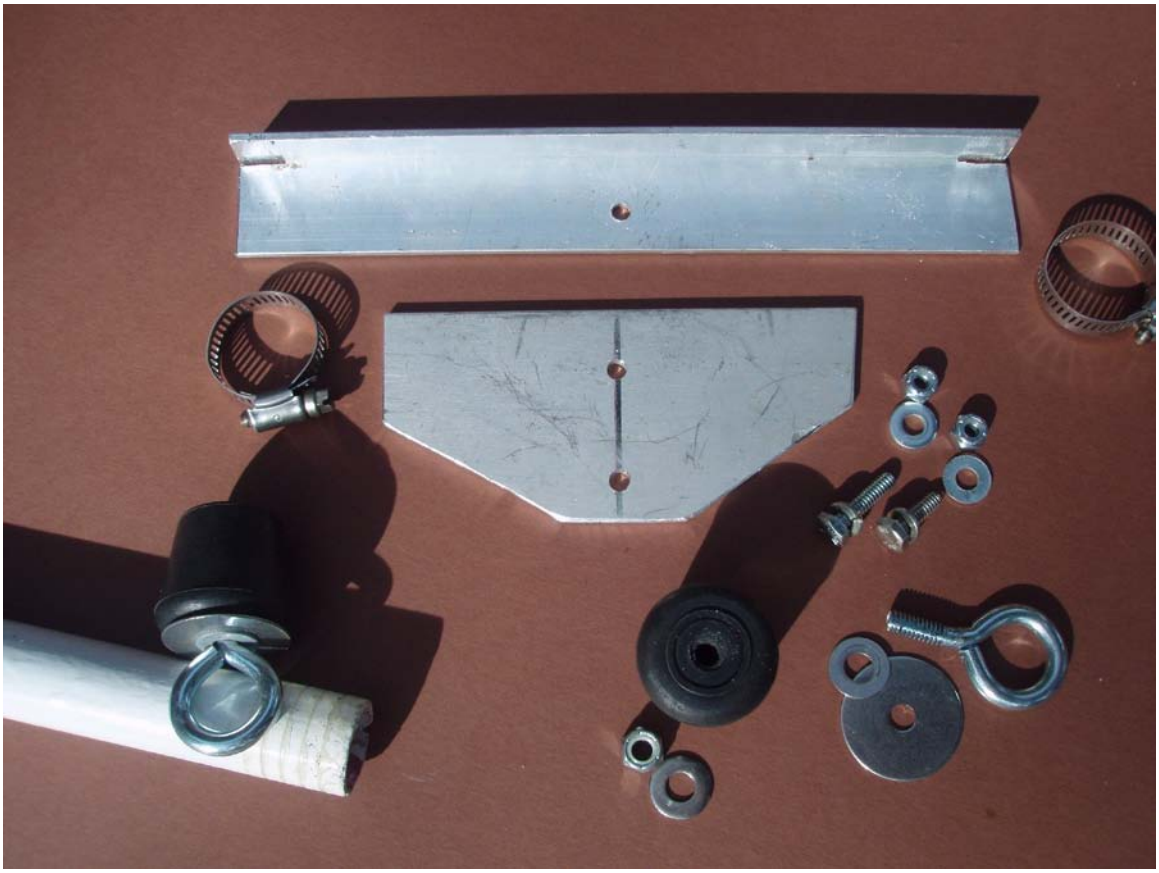
The following scan shows all four parts made from the 1/8" thick HDPE sheet, along with their dimensions. Note that the two smaller pieces are simply used together as a spacer between the other two larger pieces. The pivoting aluminum boom plate then simply slides in between the middle of the sandwich. The aluminum bearing plate completes the top of the sandwich and the bottom is the mast plate. The 4.5"x10/5" piece of HDPE is held in place on the mast plate by the 1" pivot hole as well as the three bolts through the bearing plate.



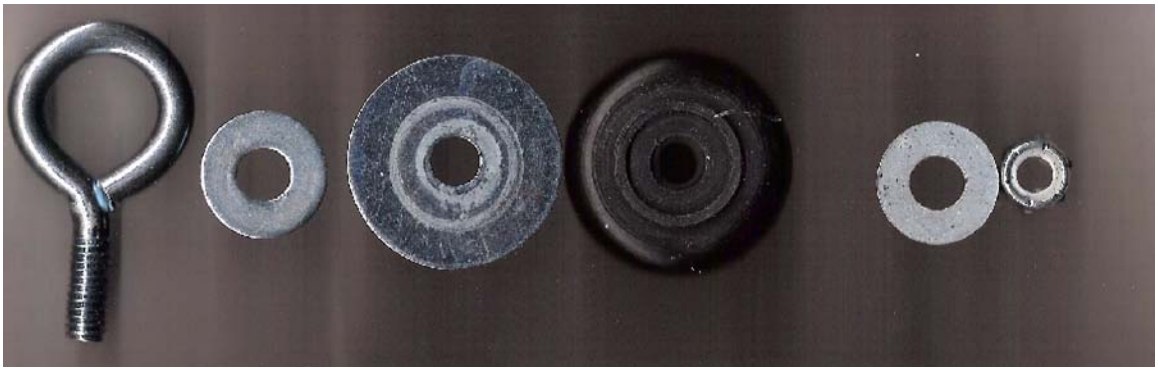
The two 3/16” thick aluminum pieces are shown below. On the left is the pressure plate, which 4.25” wide and 3.25” high. The taper across the right corner starts 2” from the upper left corner, and ends 1” up from the bottom right corner. The 2.75” high x 6” wide piece to the right is the support plate for the spreader. The bottom of the plate is 1.5” wide, and the sides taper up to 1.5” below the upper right and left corners. Locate the upper mounting hole so it will also go through the angle aluminum mounting piece. The lower mounting hole attaches only through the support plate to the extension mast, and should be only ½” up from the bottom.

The spreader mounting piece is .75” x1.5” x 1/8” thick angle aluminum 10.5” long. As can be seen in the scan below, a 5/8” deep saw kerf is made in the wide face of the angle aluminum, right at the angle. The ½” wide hose clamps will be inserted into those slots to secure the fiberglass spreader to the entire elevation mast.

The photo below illustrates the parts that are mounted on top of the extension mast. One of the end assembled end caps is shows they are fitted over each end of the 1.125” OD fx 40” long fiberglass spreader. The other end cap is shown in pieces so it is clear how to assemble them. The 5/16” screw eyes mounted in the end of each end cap is used to support a pair of small turnbuckles holding the Kevlar truss lines running to the front and rear attachment points on the 6M8GJ boom.



The 40" long piece of 1-1/8" diameter fiberglass spreader pole was (a remnant from the local University pole vaulting department of the Track and Field. These poles are used at the bars that are used at the top of the jumps. The “rubber tips” (rubber feet to fit over a walking cane) were purchased at the local hardware store and used as end caps for the fiberglass spreader. The spreader needs to be painted with three coats of marine fiberglass epoxy paint to protect it from UV degradation.



I hope this information is helpful to you in participating successfully in 6m EME during portable and DXpedition operations.