

## **Modified Aluminum Dual Band J Pole ('Arrow') Antenna for Fiberglass Body Mini RV By KK6VLV.**

Before I built any home-brew mobile VHF antennas, the only VHF mobile antenna I had was an [MFJ-1724B](#) Magnet Mount Mobile antenna.

The first one of MFJ-1724B Magnet Mount Mobile antenna burned-out the capacitor in the loading coil within the first hour with less than 50 Watts on 2m.

MFJ did replace it at no cost to me, "NoMatterWhat" as their warranty policy states, so I do not have any gripes or negative things to say about their response to the antenna 'failure'.

But, after that, I had little trust of the replacement MFJ-1724B antenna after the first one went bad.

Also, I did not have any mobile radio installed in the RV yet. I just had the Mag Mount antenna for emergencies and the occasional camping trips to National Forests and BLM lands so I could more likely be able to get into a repeater system somewhere with 50 Watts on 2m or 20 Watts on 70cm when rolling on down the road (My first Ham Radio after getting my first Amateur call-sign from FCC was a [Yaesu FT-857D](#))...

...I built a 2 element dipole that worked on 2m and 70cm for the base station location and when parked at campsites etc..



**After I got and finally installed my ICOM 2300A 2m mobile, I needed at least a 2m 'mobile' antenna:**

I made a Dual Band 2m 70cm "***Slim-Jim***" (modified version of; I also wanted to use it for 70cm on the Yaesu FT-857D when parked at home or camping)

The Slim Jim antenna was constructed with 3/4" PVC and Stranded # 14 THHN wire for the 2m element.

I also but a horizontal piece of about 6" long x1/8 inch diameter brass welding rod

The problem with that antenna is that when it got wet in the rain, the SWR went very high (Between 1.8:1 with about 0.75 MHz bandwidth and was not centered in the part of the band I was using and went to 2.5:1 and higher!)... ..***NOT*** good enough.



**The White spring mounted antenna to the right of the brown pvc is not part of the Slim-Jim antenna**

## **I found the Arrow antenna build instructions on the internet**

<http://www.kc7hxc.us/links/radio/jpole/build-jpole.html>

I decided to build the Dual Band for 2m and 70cm.

It worked as the article said it should.

I had been using it as either mobile or base station antenna (When at home or at a campsite I extended the mast up to ~ 20' high and used another length of coax to reach it.

It worked well on 2m and 'good enough' on 70cm.

In the 'mobile configuration' (low as practical, mounted on the re-purposed PVC part of the Slim-Jim), it was too high up with the 3/8 inch diameter x 57 1/2 inch long solid aluminum rod because the aluminum rod was not flexible enough for my liking. It had been getting slightly bent from hitting low branches at low speeds, at the Food Max and Walmart Parking Lots in Ukiah for example.

I had bent it back to almost straight a few times. I am sure the 57 1/2 inch aluminum rod has been weakened from the back and forth bending.

I am certain that it would have eventually broke-off and would become a danger to other motorists or other innocent bystanders, especially on the freeway, in traffic, at 70 MPH !

I decided that something sooner rather than later had to be done to prevent the potential disastrous consequences of not changing the situation.

## **Change 57 1/2" aluminum to a commercial whip?**

### **I asked for a old CB whip on the Mendocino County ('and beyond') Swap Net:**

...The the Mendocino County ('and beyond') Swap Net is held on Thursdays after YL net, usually ~ 7:30 pm...

I asked; if anyone had a **fiberglass** whip antenna with 3/8' x 24 thread that was about 60 inches or longer. No one had one to offer.

There were a couple of Stainless steel CB whips offered but I think those would also be too ridged and would not have enough flexibility, and would cause too much stress on the mounting.

**Another serious thing to consider** is the fact that the distances between the outer edges of the driven element and the 'stubs' (the 57 1/2 inch element is a 'stub') is critical to the tuning of the 'Arrow' antenna!

I am not sure that either a fiberglass or Stainless Steel whip would have been able to be tuned at all. The bandwidth would certainly have been narrowed at best.

## **I was thinking that I was going to have to somehow install an antenna on the fiberglass roof:**

On the weekly local Mendocino Tech Net (that starts every Tuesday @ 7:pm local time, and is on the countywide repeater system), I asked George, K7WWA about what antenna system ground-plane could be made on a fiberglass body; in particular on the top of a fiberglass roof.

George was quite informative and had good advise. He showed me how he used metal screen material on the underside of his fiberglass camper shell roof for the 'ground plane' that he used for his VHF and UHF antennas.

George also showed me what kind of [antenna connectors](#) would have to be used for the

thicker than most through-hole type automotive antenna mounts.

I was seriously considering drilling the hole, and installing a metallic screen or other metallic ground plane material on my mini RV's roof like the one George showed me, but, after looking more closely at my camper roof, I realized that it was just not a viable option for me at this time for several reasons I won't elaborate here.

### **What about an NGP Antenna?:**

I also considered just buying a commercially available NGP (No Ground Plane) 1/2 or 5/8 wavelength antenna plus the antenna mount and mounting hardware for the particular antenna... ..too much money for my budget to go that route, (\$60 - over \$100 by the time all parts would be purchased.

Another less expensive way to use an NGP type antenna is to get a [CB radio type NGP mount](#) that is available for about \$16 plus shipping. Then get a whip that has the 3/8" x 24 threads and cut it to ~ 1/2 wavelength for 146 MHz...

**...BUT...**

**...There are a couple of very limiting issues that exist with an NGP antenna setup:**

The main "issue" is that the total coax cable length from antenna to radio is absolutely critical and must be strictly adhered to.

The velocity factor of any and all coax has to be known to determine the length of coax for the NGP antenna.

Also, if I want to attach an SWR / Watt meter, the velocity factor of both meter and coax jumper cable lengths both have to be summed so, the coax would have to be made correct to be able to use the SWR / Watt meter; Furthermore... ..Just for that particular meter; another meter may need a different coax length!

Therefore, if there were a suspected antenna or coax problem, it is not a simple task to use a meter to check SWR or Watt output.

The NGP antenna is just not viable enough of an option for my situation.

### **I was trying to think of what I could do to make a road worthy 2m or Dual Band 2m / 70cm antenna:**

I already had the 'Arrow' and it works well on 2m... ..So what to do?...

### **...Len's suggestion:**

Len, WA6KLK suggested shortening the 57 1/2" stub and clamping a small diameter whip onto it... ..VEOLA!!!...

...Attaching a small diameter whip to the 'Arrow' antenna I already have seemed to me be the best option I had so far.

Len had a long enough small diameter whip to use and be able to adjust the length for tuning if necessary.

**The mod:**

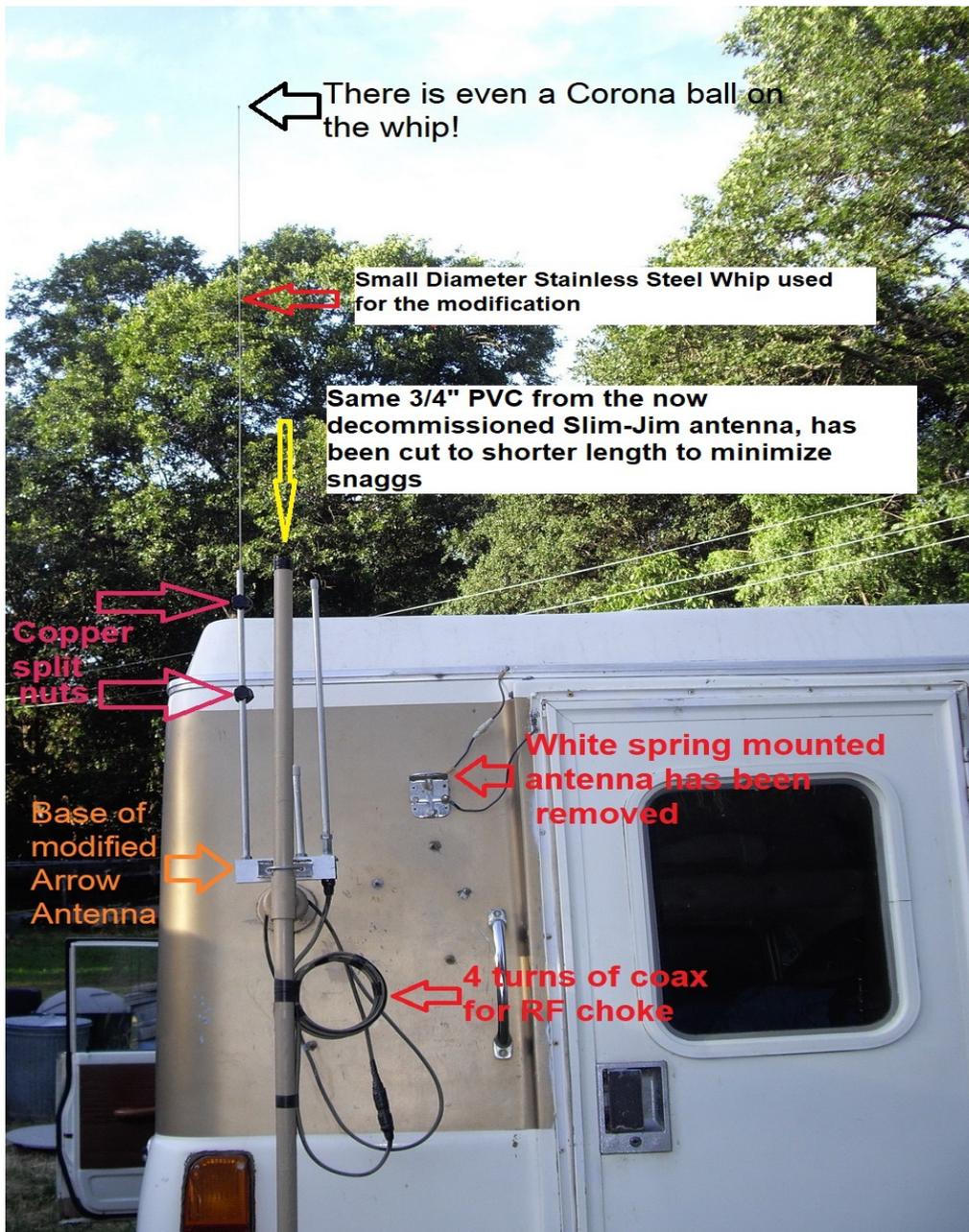
I cut the 57 1/2" stub to be 1 inch longer than the 19 1/4 inch 'driven element' to 20 1/4 inches. I had to decide how to attach the small diameter whip to the now 20 1/4 inches long x 3/8" diameter aluminum rod.

I decided to use 2 electrical connectors called '[split bolt connectors](#)' to clamp the small diameter stainless steel whip to the 3/8" diameter aluminum rod 'stub'. I left the 70cm stub in place.

I measured to keep the original 57 1/2 inch length and tightened the clamps.

Len, (WA6KLLK), helped me with his antenna analyzer to see where the SWR and Impedance is.

The 2m SWR is below 1.5:1 and impedance is between 43 and 56 within the whole 2m band. On 70cm, it is not so 'flat' SWR / impedance match as 2m, but, is tolerable.



### Antenna Analyzer Results For 2m:

144.049 SWR= 1.2, Impedance = 43 Ohm, X= 6

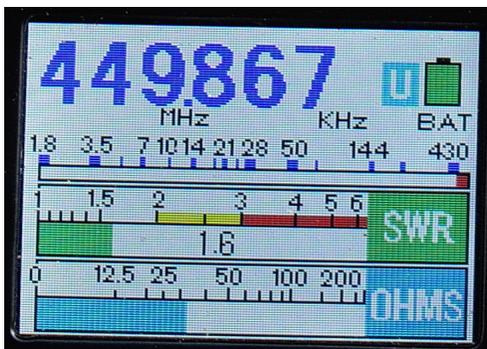
146.032 SWR= 1.2, Impedance = 56 Ohm, X= 12

147.997 SWR= 1.4, Impedance = 52 Ohm, X= 18



### Antenna Analyzer Results For 70cm:

432.345 SWR= 1.7, Impedance = 69 Ohm  
436..890 SWR= 2.1, Impedance = 41 Ohm  
440.548 SWR= 1.5, Impedance = 39 Ohm  
445.195 SWR= 1,8, Impedance = 60 Ohm  
449.867 SWR= 1.6, Impedance = 32 Ohm



## Conclusions:

### First and foremost:

I needed a good quality 2m antenna that I could depend on not to burn-out a capacitor or loading coil at 65 Watts, and is reasonably robust; a mobile antenna that would perform well mounted on a motor vehicle that has a nonmetallic body; IE: my fiberglass bodied mini RV. The modified DIY 'Arrow' seems to be the answer to those... ...BUT, there was one more thing that has to be addressed the 'Arrow' antenna design does not have which is very important for mobile use, [In My Opinion]... ...**DC Grounding**; or some other way to protect the radio from static or other high voltage electrical discharge getting into the radio's sensitive electronics, directly from the the center coax / antenna connection at the antenna. See "**Final note**" below for the pricy but effective solution I came up with for that.

I have recently driven over 400 miles, most of which was over 65 MPH on I-5.

The whip has not come loose. I was at the car wash (the DIY pressure wash in Willits, **NOT** the drive-through type!); I flexed the whip with the pressure-washer hose a few times and it held up to that quite well; if it were a mag-mount like the MFJ-1724B, and were flexed with a pressure-washer hose the same way, I am sure the 'magnetic base would have been knocked loose from the sheet metal.

It did not have excessive flutter (picket-fencing) on receive on the trip. As far as I could tell it was about the same with the small diameter whip as the solid 3/8 inch aluminum rod was.

### ***The modified for mobile 'Arrow' antenna as compared to the PVC / stranded # 14 THHN wire Slim-Jim antenna:***

- 1- it has wider bandwidth on both bands (2m and 70cm),
- 2- It does not change SWR when it gets wet.
- 3- it is more durable, ( Aluminum and flexible stainless steel whip vs PVC and THHN electrical wire... ...The fastening nuts are stainless steel). Note: I do not live on the coast where aluminum would tend to rapidly corrode from the salt in the air without some sort of protective coating.
- 4- I have not tested either antenna using more than 65 Watts. I am sure modified 'Arrow' can handle much more transmit power than the PVC / # 14 THHN Wire Slim Jim.

### Final note:

The 'Arrow' antenna is **NOT** a DC 'Grounded' antenna!

Because of that, I decided to use a [PolyPhaser Coaxial Lightning Protector model IS-50UX-C0](#) just before the coax gets to the Radio because I regularly travel and stay in the very dry desert where static discharges are more common on a daily basis than not. (the shielding part of the 'PolyPhaser' circuit is '**grounded**' to the metal part of the RV's body inside the cab and is connected to the coax the same as it would be for a base station).

When I have been in the Mojave Desert it has not been uncommon for me to have 3/4 inch long discharge spark from my finger to the screws that are on the light switch covers in my friend's house!... ...Yes there is a 'sharp SNAP sound and even though I am aware of it, I still get startled.

I am sure that driving around in the desert in such dry conditions or dust storms even when parked that there would be enough static buildup in the atmosphere and antenna to be capable of causing damage to any mobile radios that are connected to the 'Arrow' antenna, be it modified or not.