

3-Element SteppIR Rebuild

VE7TK – 2025

Rick Williams – August 2025

Background

In the spring of 2006 I replace my 2-element Cubex Quad with a 3 element SteppIR yagi. The “home” for both antennas was a 48 foot Delhi freestanding tower. The Cubex had served me well BUT maintaining it was a problem. In the windy environment at my location, it seemed like I was always up the tower replacing or repairing the quad’s wire elements. I finally made the decision to update my antenna and purchased a 3 element SteppIR.

For those unfamiliar with the SteppIR yagi, it was introduced to the ham world in the early 2000s. The design is a basic yagi covering 20 through 6 metres. What is unique about the antenna are the elements. From the ground the antenna is made up of 3 equal length elements. However, what is visible are actually hollow equal length fibreglass tubes. Inside these tubes are copper/beryllium tapes. The lengths of the tapes are frequency dependent. As the transmit frequency is changed a computer based controller in the shack controls the movement of 3 stepper motors in the element housing units (EHUs) on the antenna boom and moves the elements in and out to predetermined lengths stored in the controller’s computer memory.

Another unique feature of the SteppIR is its ability to quickly reconfigure the elements and configure the yagi to point completely in the opposite direction. For example, let’s say you’re talking with a friend in New Zealand (ZL) on a beam heading of 223 degrees. Suddenly you hear a faint signal from a Malawi (7Q) station on the back of the beam at a heading of 36 degrees. Normally to work the 7Q you would rotate the beam about 180 degrees. However, with the SteppIR you just push the 180/Reverse button on the controller and the SteppIR quickly configures itself as a 3 element yagi pointing at 43 degrees (close enough to likely work Malawi)!

Yes there are a lot of moving parts BUT this antenna has been virtually trouble free for well over 19 years. More than 5 years ago the fibreglass elements were showing serious signs of wear. It was likely past time to bring down the antenna and give them a light sanding and a repaint. But somehow life got in the way and I kept putting off the routine maintenance.

Things caught up with me in mid-May this year (2025). I noticed that my SWR had changed slightly on all bands and, in addition, it was completely out to lunch when I went into 180/reverse mode. Something was not right. A little research suggested that the reflector element was not moving. I was unsure if it was retracted, extended or somewhere in between. It was time to bring the SteppIR down to ground level. It looked like an rebuild was needed and some on-line browsing took me to an excellent starting point:

<https://www.aa5au.com/hamradio/antennas/2018-refurb/>

The Damage

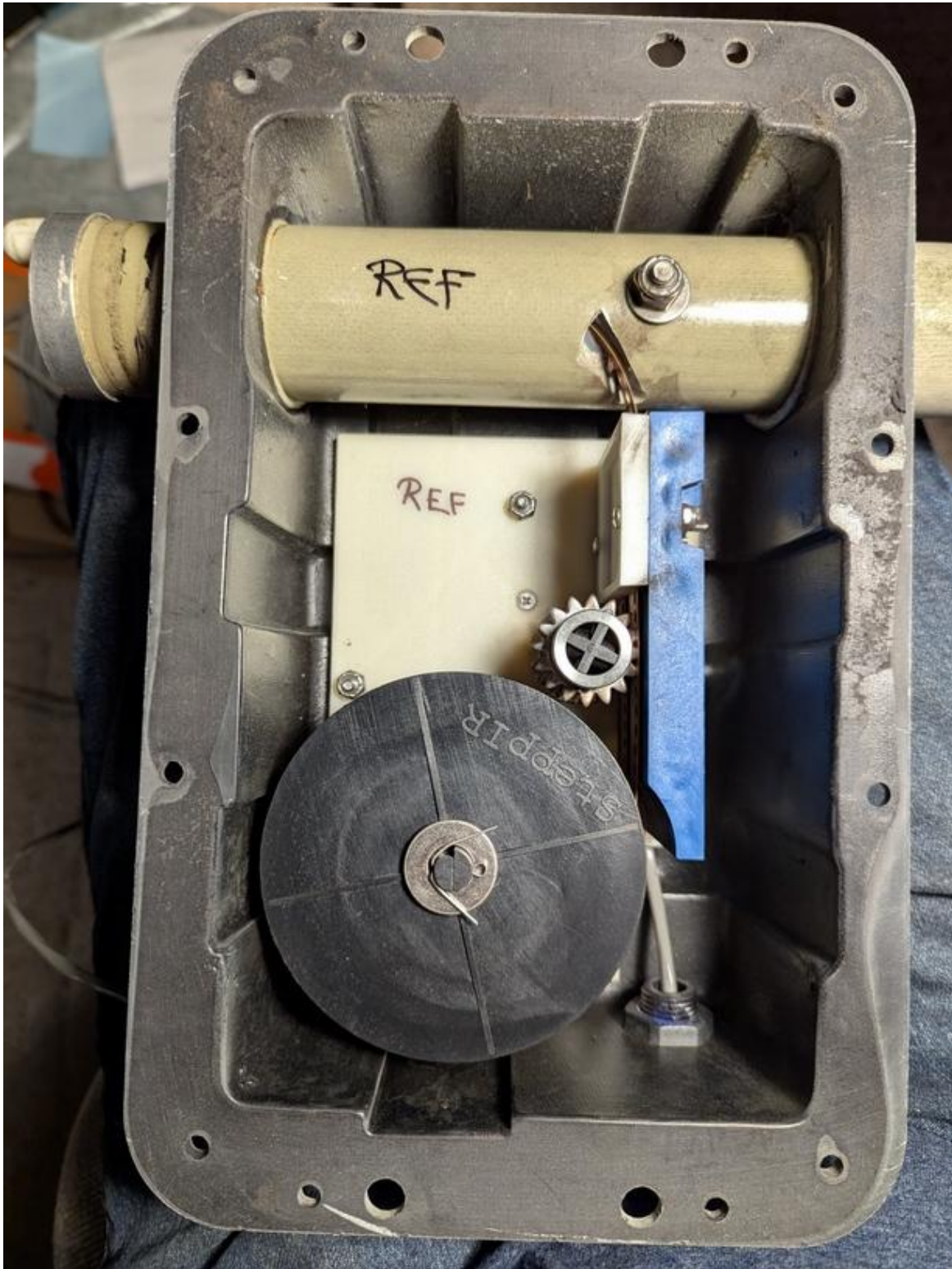
With the antenna on the ground it was becoming more and more obvious that maintenance was long overdue! One of the first things I noticed when the antenna was finally on the ground was how naked the tower looked!!



Once I was over the change in the view I started to look over the antenna. Obviously the elements needed a light sanding and repaint (I used **Brightside Interlux Polyurethane Topside**). I was quite surprised to see how deteriorated the wiring on the boom had become. The 4-conductor shielded wires from the junction box to the reflector and director element housing units (EHU) had suffered badly. The exterior jacket was gone in several places and many of those locations had lost the underlying foil shield as well. The biggest problem was, as expected, at the reflector. One of the wires in the cable was broken, disabling the Reflector stepper motor.



Removing the fibreglass tubes brought some better news as ALL copper tapes had been retracted into the EHU housings. When I opened the reflector housing the inside was pristine!



It was, however, obvious that ALL 3 of the EHUs needed rewiring. While looking over the cabling I noticed that the RG-213 coax from the antenna feedpoint to the LMR-400 was badly burned/abraded. Surprisingly there was no evidence of water intrusion. The length of RG-213 too was replaced.



While removing the fibreglass tubes from the EHUs I encountered an additional problem. The 6 flexible couplings that secure the 6 element tubes to the EHUs had begun to split. These couplings had been covered with PVC tape to protect them from UV but they still had deteriorated badly.



Luckily the appropriate Fernco fittings (Part #P1-056-150/125) were available at the local Home Hardware (not to be confused with Home Depot)!

In checking over the attachment of the reflector EHU to the boom mounting plate I found another problem. The EHUs are attached to the boom plate with 8 – 10x32 stainless steel screws. On the reflector mount only 7 screws made it through 19+ years up the tower and another was loose. Examination of the aluminum mounting plate revealed that several of the mount holes were elongated and showed significant wear.



In an effort to reduce this type of movement as well as eliminate flex in the housing I fabricated a base reinforcement of 3/16th inch aluminum. To distribute the load across the mounting screws and the fibreglass EHU cover a top rail of 1/16th x 1 inch aluminum angle was also added.



The underside reinforcement was epoxied to the bottom of the EHU mounting plate. The upper angle aluminum ensured that the EHU load at the bolt holes was more evenly distributed across the fibreglass housing. This modification was done to both the reflector and director. Only the top-side modification was done on the driven element. In addition, all new stainless steel hardware was used to attach the EHUs to the mounting plates.



The reconditioned fibreglass tubes were ready to be attached to the EHUs. New bug screen end caps were ordered from SteppIR and installed.



Prior to raising the antenna the EHU control cables were all wrapped in white PVC tape in an effort to reduce cable deterioration while exposed to the elements. In addition, bends in the RG-213 coax cable at the driven element as well as the 12-conductor control cable to the shack were further protected with flexible split conduit at both the boom and the tower attachment points.



Finally it was time (June 22, 2025) to raise the antenna into its final position. The installation went well and the antenna seemed to work. But, things had changed.

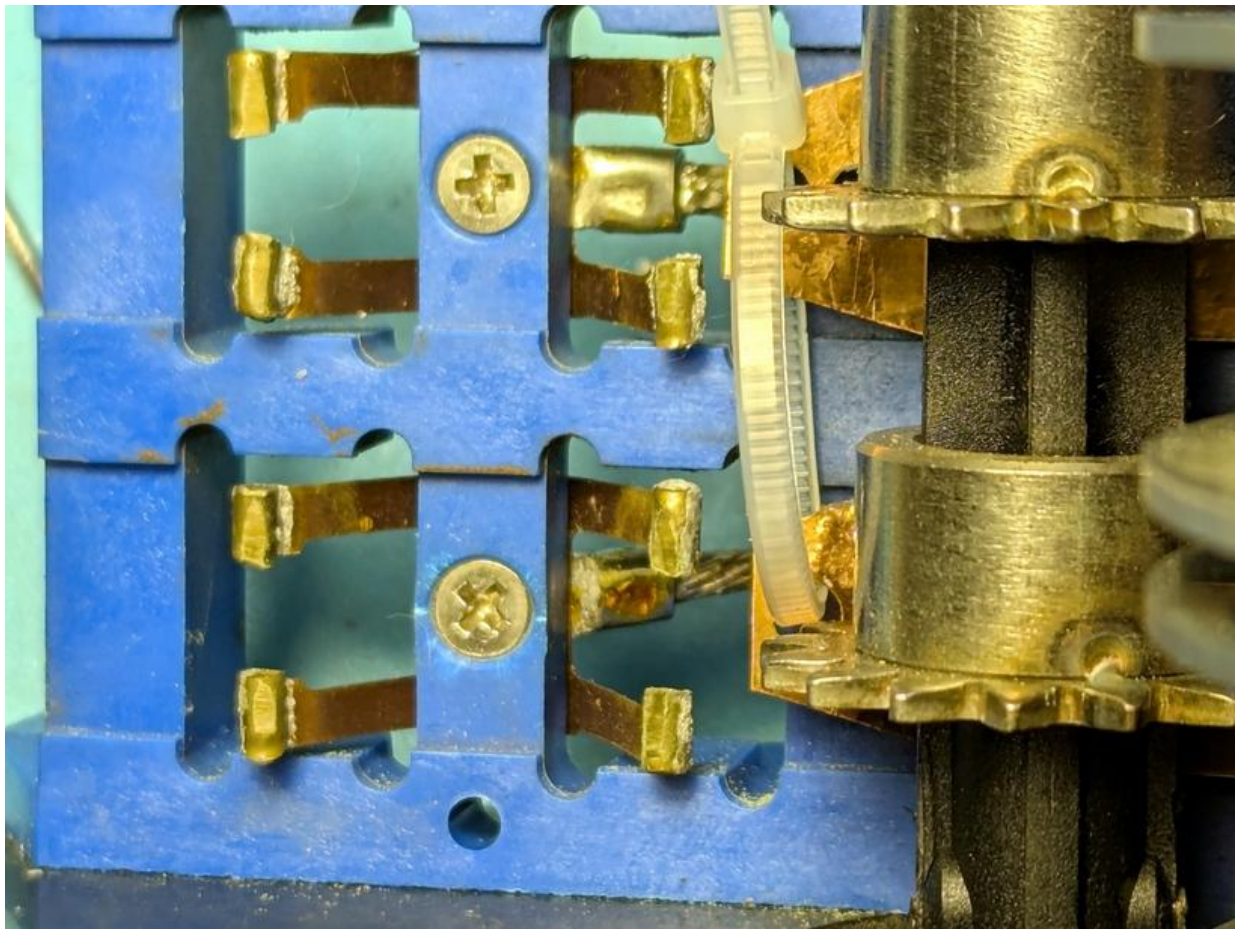
More Damage

After about 10 days things got quite bad and the SWR of the antenna went crazy. Worried that I might have an open coax I climbed the tower and measured the SWR at the antenna feedpoint. Sadly, the coax was not the problem

After further analysis it became evident that the driven element was the problem. On July 3, 2025 the driven element (EHU and fibreglass tubes) was removed from the boom and lowered to the ground.

To further complicate matters, in the brief period that the antenna was on the tower, SteppIR announced that they were getting out of the ham radio antenna business.

Examination of the driven element revealed the problem. The brushes that carry the RF to the copper/beryllium tapes were worn and had a significant ridge built up. It was possible that after rewiring the EHU the brushes were not making a good contact with the tape surface.



New brushes were needed. However, by this time SteppIR EHU parts were no longer available! So I decided to salvage the existing parts. The brushes were gently ground down with a sharpening stone and polished with 2000 Grit Wet/Dry paper. The tapes were then fully extended and wiped down with 99% isopropyl alcohol. With the tapes rewound, the brushes were given a final alcohol cleaning before sealing up the driven element EHU.

Finally, on July 14th the driven element was taken up the tower, bolted into place and rewired into the circuit. Hopefully we're good for another 19+ years!!

UPDATE

With parts availability a problem, I was fortunate enough to find another 3-element SteppIR (in need of some work) for sale locally. So I should have enough spare parts to make it through for many years!



It's good to have my old SteppIR antenna at the top of the tower again. As I write this (mid-August 2025) testing at various power levels and bands continues. So far all is well.

73, Rick
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