

The EchoStar RV-750 “Umbrella” (Collapsible) 7.5ft TVRO Antenna

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I’ve been planning ahead to the day when I retire, my girls live on their own, and my wife and I can finally take the big-RV roadtrip that we’ve been talking about forever. Not being one for sitting by a campfire, I’m always collecting equipment to take along, and some time ago my ongoing eBay® search for a collapsible parabolic antenna hit gold. It was for an EchoSphere 7.5 ft TVRO folding dish in mint condition. It even came with an extra (slightly damaged) reflector assembly to boot! My plan is to build feeds for 1296 MHz EME and S-Band DSN. Sadly, 10 GHz EME and X-band DSN are out of range for the reflector’s fabric.

Finding information on this dish has been much more difficult than I had anticipated. This whitepaper summarizes my literature and experimental findings.

About EchoStar

EchoStar is best known for its “DISH Network” DBS business, which was launched in 1996 and quickly became the fastest growing satellite TV service in the United States.

However, its origins are much more modest. In 1980 Charles Ergen, his future wife Candy McAdam, and Jim DeFranco started a new business called “EchoSphere Corporation,” purchasing two C-Band systems. They drove around the Denver metro area on a small budget, selling satellite dishes from the back of their

truck. The operation became a small retail store that sold direct-to-home satellite television products and services.

By the mid-1980s, Echosphere Corp. had grown into a leading supplier of direct-to-home TVRO hardware and services worldwide.

In 1987, Ergen and DeFranco applied for a direct broadcast satellite (DBS) license under the EchoStar company name with the FCC. EchoStar was granted access to orbital slot 119° west longitude in 1992, and on December 1995 it launched its first satellite, EchoStar I. On March 4, 1996, EchoStar established the “DISH Network” brand name to market its home satellite TV system. Today, DISH Network has 10 satellites in space, almost 14 million customers and over 22,000 employees.

The RV-750 Folding Dish

I searched high and low on the Internet for any mention of the EchoStar RV-750 without success. The first mention of EchoStar equipment was in Coop’s Satellite Digest 2 (CSD-2) of August 15, 1985, Page 5, whereby Echosphere introduced the EchoStar system as an under-\$1,000 TVRO package as shown in the following figure:

Echosphere Corporation (1925 West Dartmouth Ave., Englewood, Co. 80110; 303/761-4782 for headquarters; outlets in Tn, Tx, Ca and Arizona as well) has introduced **EchoStarTM**, an under \$1,000 (retail price) package created to help dealers penetrate the bottom end of the marketplace. The system has been designed for quick and easy installation, lending itself to semi-permanent residents of apartments for example. The system includes a six foot dish with ring mount (polar mount available as extra), tripod-feed support system with polarization rotation, a receiver, LNA and 10 foot pigtail of LNA to downconverter cable.



ECHOSTARTM Headed for Low End

Figure 1 – First mention of an EchoStar unit by Echosphere was a low-end TVRO system consisting of a 6 ft dish, LNA, and receiver. Source: Coop’s Satellite Digest 2 (CSD-2) of August 15, 1985, Page 5. http://bobcoopertv.tv/assets/25_august-1985.compressed.pdf

Still, nothing like the RV-750. The first clue came when I spotted some pictures of a dish that looks like mine posted by Pieter Ibelings (N4IP) on Twitter:



Figure 2 – Collapsible dish used by Pieter Ibelings for GOES-16 reception with Inmarsat backfire helix feed. Source: <https://twitter.com/ibelings/status/962699524392267777>

Pieter told me that his antenna was made by “Toki”. Searching Coop’s Satellite Digest (CSD-2, February 15, 1985, page 5), I found the following:

“TOKI/Canada (#18-11151 Horseshow Way, Richmond, BC V7A4S5, Canada; 604/272-5282) announces the availability of their new 'Toki-Luly' 9 foot Portable (TVRO) antenna. The TA:900 antenna collapses into an easy to carry 'umbrella' format like the original Luly antennas introduced to the industry in July of 1980. The antenna assembles to a movable tripod mount, uses a durable reflective-mesh reflective material and a Cassegrain type feed. The primary market for the product, according to Toki, is recreational vehicles and TVRO dealer demonstrations/site testing. Weight is approximately 25 pounds.”

So, the original design was by Bob Luly (KA6KBU, SK). From Coop’s Satellite Digest of August 1980:

“The single most exciting technology item at San Jose had to be Robert Luly's "Umbrella Antenna"; Featured on our front cover this month. Can you imagine a 12 pound ten foot antenna that folds into a package about 6 feet long by 9 inches wide and high? Or a 15 foot of the same design that weighs 15 pounds? We got Luly to show us a private demonstration of his wonder July 4th and then we broke the antenna to the attendees in our Saturday morning 'Today At SPTS' TV show. Luly was mobbed Saturday and well he-might have been at \$495 single lot pricing for the 10 foot (\$750 for the 15 footer). I don't know what others are doing but I'm packing his 15 footer with a Sat-Tec receiver I have built into a Sony 8 inch battery operated color TV. I plan to spend September flying about the Caribbean putting on 'airport satellite TV shows'. A fellow can hit the ground and be showing off satellite TV in ten minutes, all on battery power, with a package you can carry under your arm in a two-seater airplane thanks to Luly's creative genius”



Figure 3 – Bob Luly’s “umbrella” antenna on the cover of the August 1980 issue of Coop’s Satellite Digest.

Searching then for Toki, I found the following by W2HRO:



Figure 4 – W2HRO’s Toki TA550 portable dish antenna. Source: <https://www.qrz.com/db/W2HRO>

User “Titanium” also posted an information request in the Satellite Guys forum for a similar collapsible antenna:



Figure 5 – Collapsible dish belonging to Satellite Guys user “Titanium.” Source: <https://www.satelliteguys.us/xen/threads/help-identify-this-unique-folding-satellite-dish.375951/>

Titanium’s dish seems to be the one that was disclosed by Robert Luly in his US Patent Number 4,608,571 of August 26, 1986:

(<https://patentimages.storage.googleapis.com/b7/df/f8/75b82377363166/US4608571.pdf>):

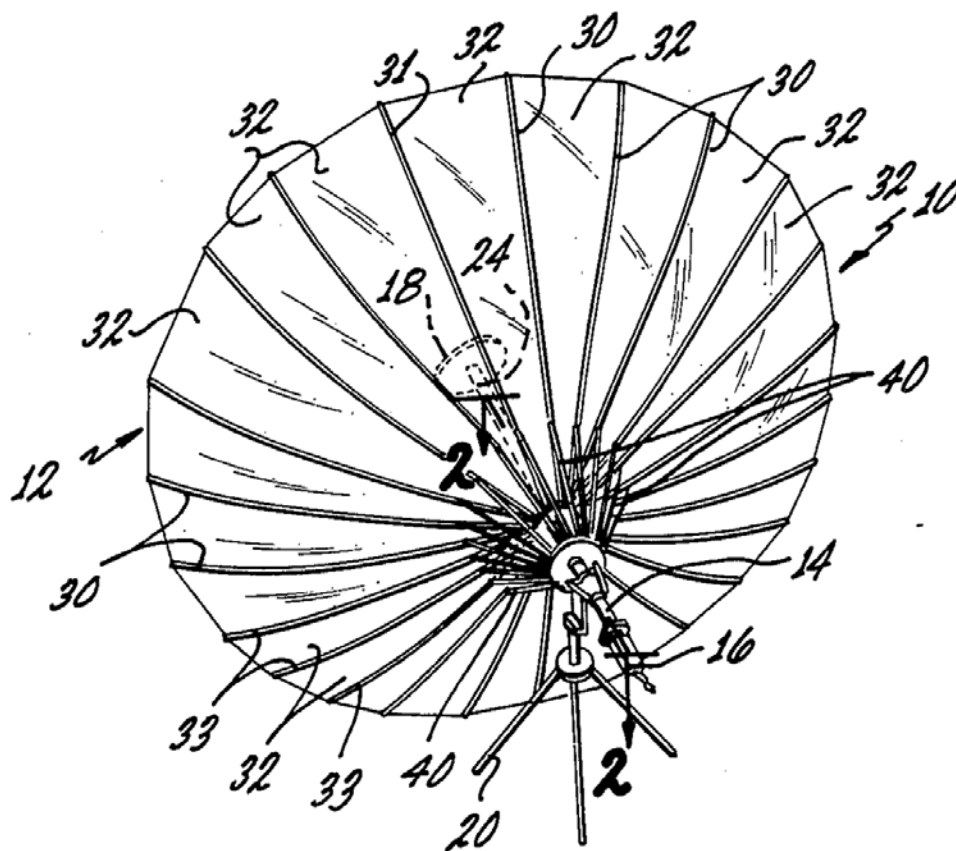


Figure 6 – “Collapsible Parabolic Reflector” disclosed by Robert Luly in his US Patent Number 4,608,571 of August 26, 1986

Smaller antennas with the same concept were made by MTI (Mobile Telesystems, Inc) for use in Inmarsat terminals. N4IP probably owns all the remaining surplus dishes 😊:



Figure 7 – Pieter Ibelings' collection of collapsible Inmarsat dishes. Source: <https://twitter.com/ibelings/status/601586743293431809>

In the end, the literature search on the EchoStar RV-750 revealed the inventor (Bob Luly) and possible manufacturer (Toki Satellite Systems), but no useful technical data.

Assembling the RV-750



Figure 8 – The EchoStar RV-750 packs very compactly inside its bag

The RV-750 is very easy to assemble. How to do so is quite obvious, so no instructions are needed. The base assembles from two leg square profiles and a mast using eight $\frac{1}{4}$ "-20 butterfly-head screws (Figure 8). The Az/El mount is then placed on the mast, and the reflector's bracket fits into the Az/El's square

profile (Figure 9). The antenna is then deployed with two lever handles, and the feed arm can then be inserted onto the boom (Figure 11). Total assembly time is less than 10 minutes.



Figure 9 – Components of the EchoStar RV-750 collapsible antenna. Top: base and Az/EI mount. Center: folded reflector. Bottom: Feed arm.



Figure 10 – Reflector assembly of the RV-750 attached to Az/EI mount

Engaging two hooks and pulling on the two handles fully deploys the reflector into its correct shape:

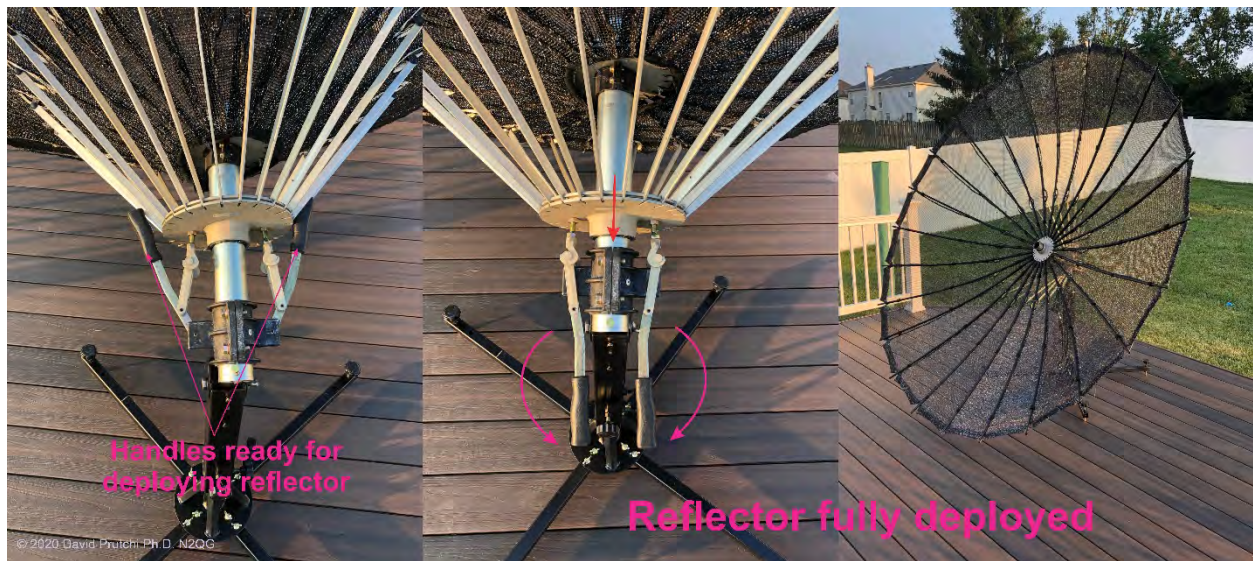


Figure 11 – Pulling on the handles deploys reflector into shape



Figure 12 – The feed arm is simply inserted into the center hub. The EchoStar RV-750 assembles in less than 10 minutes.

Testing the EchoStar RV-750



Figure 13 – The RV-750 joins its permanent siblings for testing at the N2QG antenna garden

The first thing to note is that the reflector's fabric is made of threads that incorporate some metallic filaments. The approximate hole size is 3.75mm, or a pitch of about 6.5 threads per inch. Assuming that openings in the mesh can be as large as 0.05λ without allowing much ground noise to feed through the surface¹, the shortest wavelength for this dish would be around 7.5cm or 4GHz. I thus expect this dish to work up to the TVRO C-band (3.7 to 4.2GHz) but not beyond that.

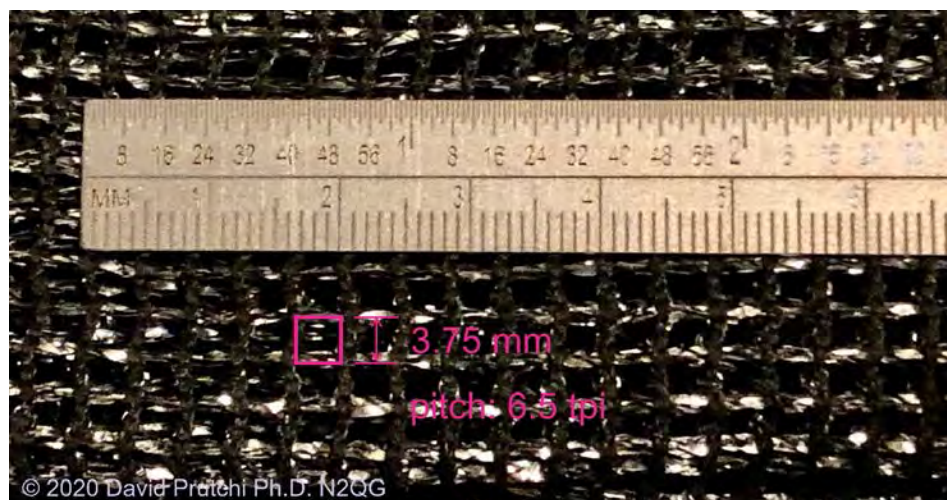


Figure 14 – The RV-750 reflector's fabric has an approximate pitch of 6.5 threads per inch, so reflector wires are separated by approximately 3.75mm.

¹ EME 2010 Handbook by Joe Taylor, K1JT, http://physics.princeton.edu/pulsar/K1JT/EME_2010_Hbk.pdf

To test this, I installed an inexpensive C/Ku combo LNB and gave it a try. The F/d for the antenna was confirmed at 0.4. Signal strength from Galaxy 16 was decent on C-band. I could see the satellite on my meter on Ku, but as expected, the S/N was too low for decoding at those frequencies.



Figure 15 – Signal strength from Galaxy 16 is pretty good on C-band, but Ku band signal is so weak that it cannot be decoded.

Conclusions

The EchoStar RV-750 looks very promising as a portable antenna for weak-signal 23 cm operations, including CW and JT65 EME, as well as for L-band reception (e.g. GOES, Inmarsat), and S-band satellite/DSN.

Interesting Links

- Two Axis PTZ Control of a Fabric Satellite Dish: <https://youtu.be/qcxFqXna2Ro>
- Bob Cooper's magazines (including Coop's Satellite Digest): <http://bobcoopertv.tv/library.html>
- Paul Andrews' (W2HRO) site: <https://www.qrz.com/db/W2HRO> Look for his entry of March 4, 2017 discussing his first 1296MHz JT65 EME QSO using his Toki antenna.