

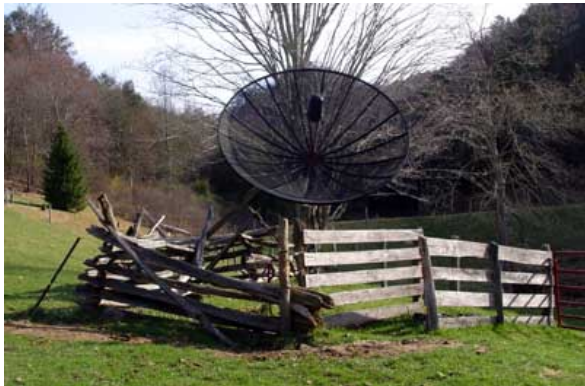
Dish Extension - 3m to 4m Parabola-Stress Hybrid Construction Techniques

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North America & 3m Dishes

- North American is the birth place the 3m TVRO
- 2.6 Million 3m dishes were installed in the USA.
- Abandoned 3m dishes are usually available for free
- EME Amateur should move fast before they are gone



Lots of 3m Dishes - but few larger

- The vast majority of US C-band dishes are 3m (10 ft.)
- 3.7m (12 ft.) C-band dishes were used but rarely.
- I wanted to extend my 3m dish to 4m.
- The extension needed to be cheap, light and effective.
- I'll use this dish on 432 and 1296 MHz bands.



3m dish

Compare 3m vs 4m Dish

- The gain of a dish is related to its size or effective aperture area. A bigger dish has more gain.
- Extending from 3m to 4m nearly doubles performance.
- 3m dish = 4.2 sq. m and 4m dish = 7.5 sq. m
- At 432 MHz / 3m = 20.5 dB gain / 4m = 23 dB gain
- At 1296 MHz / 3m = 30 dB gain / 4m = 32.5 dB gain
- A bigger dish has a more narrow beam width and reduced noise pickup.

3m Dish extended to 4m



3m Dish



4m Dish (extended)

Total Project Cost - \$100 (approx.)

Parabola – Stress Dish Hybrid

- My extension is not a true parabola
- My extension follow the curve of a “stressed” rib.
- K2UYH Stress Dish Design -
[http://www.nitehawk.com/432 MHz EME/
stress_dish.pdf](http://www.nitehawk.com/432_MHz_EME/stress_dish.pdf)
- The 3m to 4m extended dish is a hybrid design.
- True parabola for the first 3 meters
- Stress dish from 3m to 4m
- A stressed rib deflection at the edge of a dish is very close to a true parabola.

Stress Extension Design

- The circumference of a 3m dish is 30.9 ft.
- The circumference of a 4m dish is 41.2 ft.
- My rib extension were sized to support a new 41.2 ft. circumference outer edge of the dish
- The 3m dish had an $f/d = .37$
- The focus point of the dish does not change.
- The 4m dish has an $f/d = .28$
- The bigger dish is now much deeper.
- The deeper dish is nicely illuminated by a Patch Feed.

Extension Rib Materials

- Kevlar String
- Notched End-caps
- 6mm 36" arrow shaft
- Battery terminal lug
- 5mm aluminum rod
- Aluminum-clad Mylar



99 % Aluminum-clad Mylar



NASA ECHO-1
Passive-reflector
Satellite

Radiant
Attic
Insulation



99% Aluminum-clad
Mylar (rip-stop)
White Color (one-side)



Extension Rib Installation

- 36" arrow shaft
- Glue on terminal lug
- Cable clamp
- Battery terminal lug

Each dish designs may require a different rib attachment technique.



Outer Perimeter String Installation

Attach the 40.2 ft. of Kevlar Perimeter String to end caps

Maintaining an accurate circumference is required

Use UV stable duct tape to attach Qty. 18 sections of 5mm aluminum rod to stiffen the outer edge.



3m dish with 4m framework – no Mylar covering.

Aluminum-clad Mylar Panel Installation

Mylar is cut with scissors
into panels – Qty. 18.

Each panel is attached to
the stress frame with tape

Gorilla Glue-brand tape is
waterproof, UV-stable and
really sticky and strong

I installed all 18 panels
in about six hours.



3m dish with 4m framework – partial Mylar covering.

Completed 4m Dish (extended)

Total construction time
16 hours over several days
and I remained QRV.

Weight Increase – 6 lbs.

Wind load - Yes. The solid
panels do increase wind-
load. But the arrow shafts
flex and shed the wind.

The dish survived the FN20
winter of 2019 with no
problems.



Completed 4m dish with completed stress extension.

4m Hybrid Dish Performance

- 1296 MHz sun noise increased from 10 to 12 dB
- 432 MHz sun noise increased from 5 to 7 dB
- 1296 MHz JT65 signal reports are very good
- Completed 432 MHz WAC with loop feed and 180w.
- Can worked a 1296 MHz single Yagi with 120w.
- Dish pointing on 1296 MHz is more critical.
- 432 MHz receive performance is exceptional.
- Removed BFR from 1296 MHz Patch for better illumination
- Removed cake pan baffle from 432 MHz loop feed

Credits To my Elmers

- K2UYH – Stress Dish Design

[http://www.nitehawk.com/432 MHz EME/stress dish.pdf](http://www.nitehawk.com/432_MHz_EME/stress_dish.pdf)

- SM6FHZ / SM6PGP – 23cm Patch Feed

[http://moonbouncers.org/
Circularly%20polarized%20patch%20feed%20for%201296%20MHz
_A.pdf](http://moonbouncers.org/Circularly%20polarized%20patch%20feed%20for%201296%20MHz_A.pdf)

- OK1DFC – 70cm Loop Feed

<http://www.ok1dfc.com/eme/technic/432feed/432feed.htm>

Summary & Next Steps

- My initial goal was to improve 432 MHz performance, but I see good benefits on 432 & 1296 MHz
- The biggest single improvement was 432 MHz receive
- Measurable sun noise increase on both 432 & 1296 MHz
- Fast, Cheap and Effective dish upgrade
- The upgrade can be completely reversed in a couple hours

- Try to build a portable dish using Aluminum-clad Mylar
- Try 144 MHz EME with a 4m dish