A 5M portable stress dish

K6MG

Gary Lauterbach

A stress dish partial History

- K2UYH in 1966: CQ magazine article on wooden dish
- K2RIW in 1972: QST magazine article on 12’ aluminum tubing dish
  - I was there at the ECVHFS meeting where the QST cover photo was taken
  - I was 16
  - Republished in ARRL handbook since
- N2UO in 2013: described his 20’ stress dish using steel emt tubing:
  - http://www.ntms.org/eme/presentations/w5lua/N2UO_A%20lightweight%2020%20foot%20stressed%20dish%20for.pdf
- K2UYH IN 2016: published several papers on his recent use of portable stress dishes.
  - http://www.eme2016.org/wp-content/uploads/2016/08/EME-2016-K2UYH-Presentation.pdf

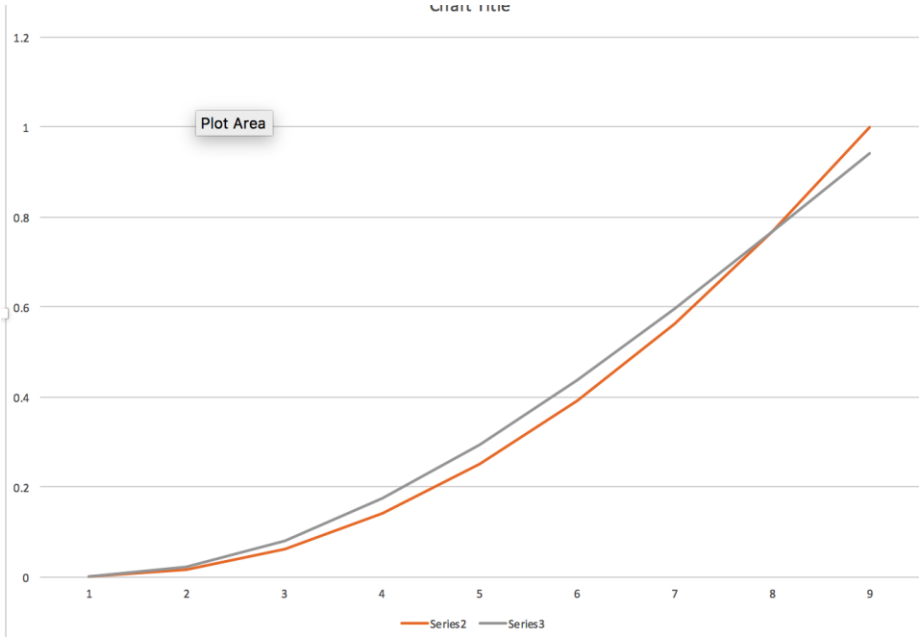
Why a stress dish?

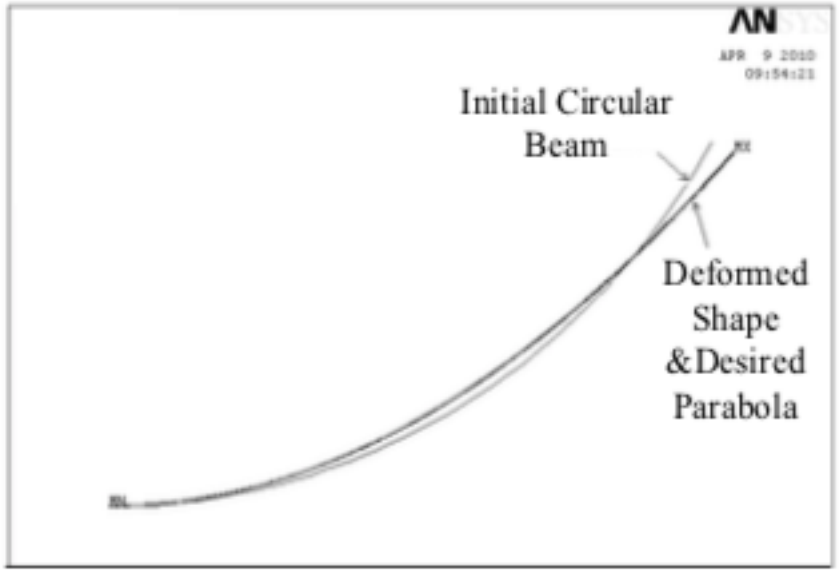
- Fast setup
  - About 1 hour
- Low weight
  - <100 pounds
- Large aperture
  - 5M – Easy CW QSOs on 23cm
- Low cost: about $300 in materials

The theory of stress dishes

- Parabolic curve:
  - $Y = X^2/4F$
- Cantilevered elastic beam: where M/P force, l length of beam, E - elasticity
  - $Y = MX^2/2El$ - Couple Moment M at free end
    - If $F = 0.5EL * M$ we have a perfect fit
  - $Y = PX^2/6El * (3l-X)$ - Perpendicular force P at beam end
  - Many materials are elastic at reasonable forces:
    - Steel tube, Aluminum tube, wood, fiberglass tube

Deviation from Parabola





Optimized Bands: A New Design Concept for Concentrating Solar Parabolic Mirrors

Lifang Li[1]
Ph.D. Candidate, ASME Student Member
School of Mechatronics Engineering
Harbin Institute of Technology
150001 Harbin, China.
lilifang2008@gmail.com

Andres Kecskemethy
Professor
Department of Mechanical Engineering
University of Duisburg-Essen
47057 Duisburg, Germany.
andres.kecskemethy@uni-due.de

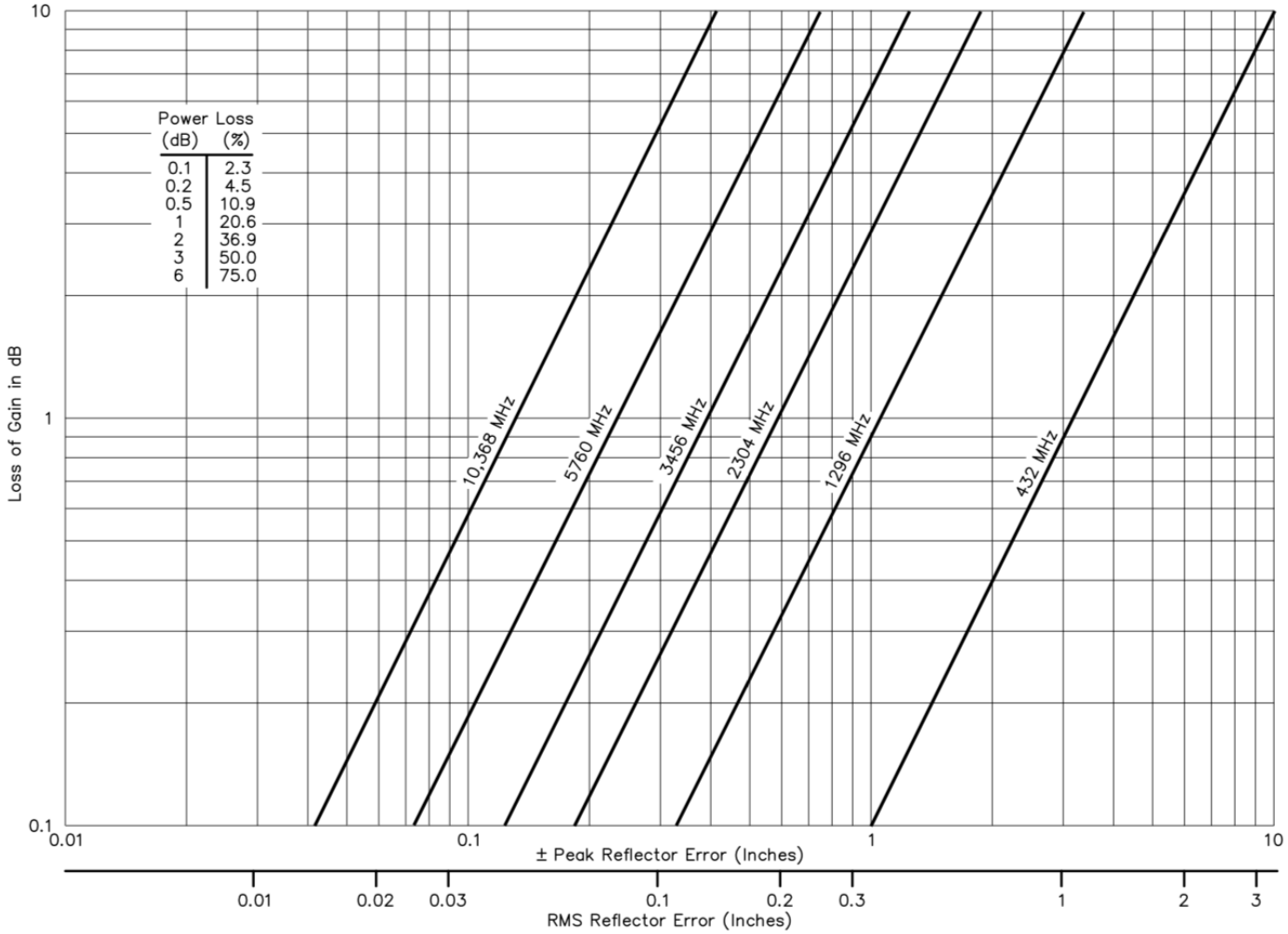
A. F. M. Arif
Professor, Member of ASME
Department of Mechanical Engineering
King Fahd University of Petroleum & Minerals
31261 Dhahran, Saudi Arabia.
afmarif@kfupm.edu.sa

Steven Dubowsky
Professor, ASME Fellow
Department of Mechanical Engineering
Massachusetts Institute of Technology
Cambridge, 02139 MA.
dubowsky@mit.edu

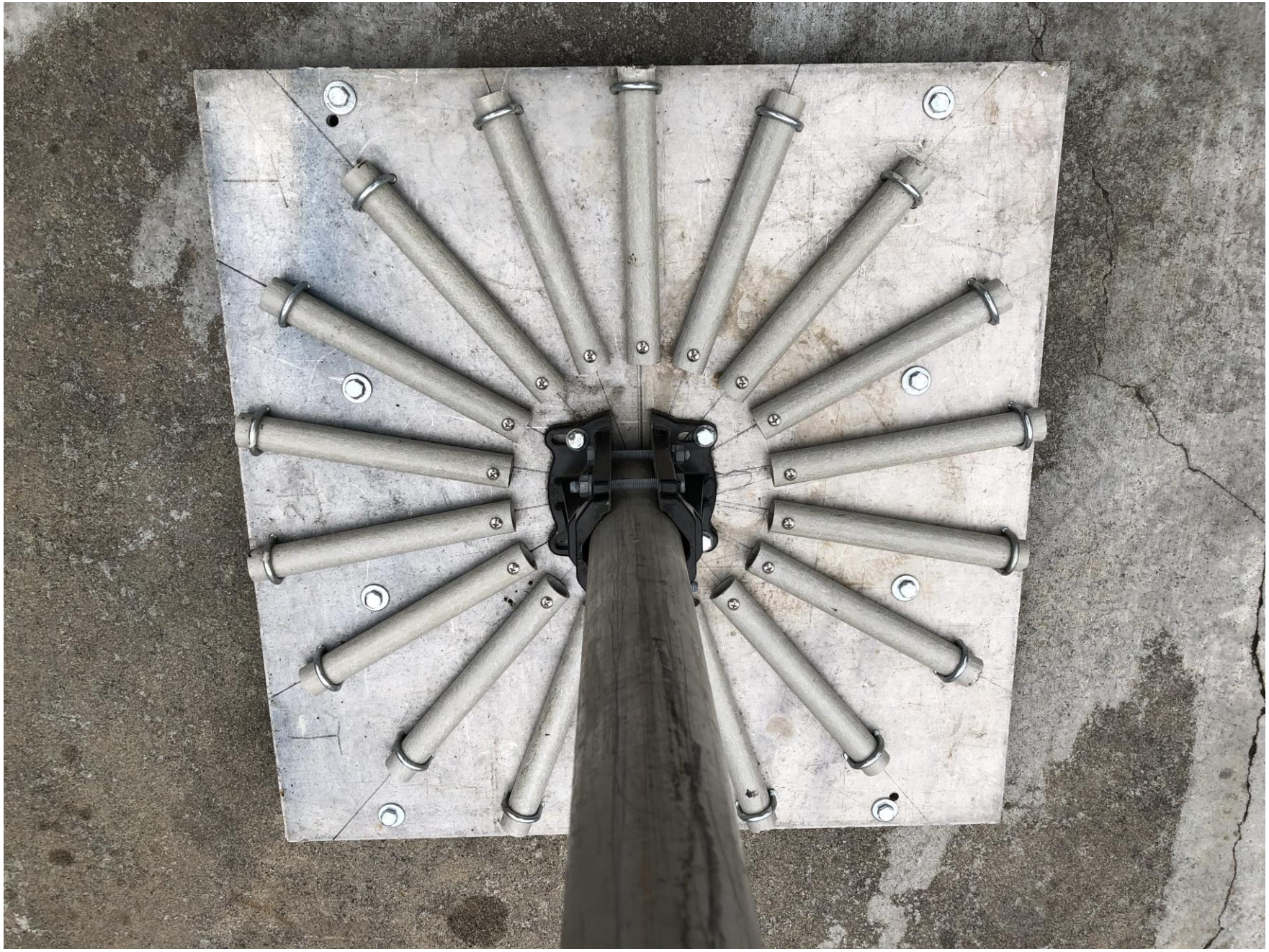
Dish design parameters

- 16 feet diameter
  - Uses 8’ rib tubing, can be shipped UPS
- Shallow parabola:
  - 0.5 F/D
  - Higher gain feed: dual mode horn
  - Less force required to deflect ribs
  - Smaller absolute error from parabolic curve, less than 1” peak

Gain decrease due to error

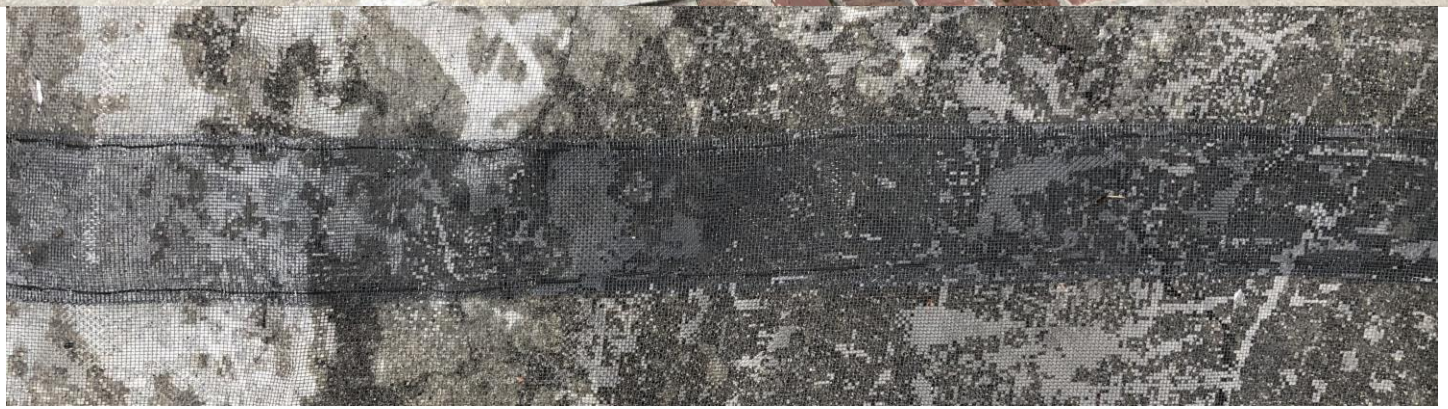


Hub



Ribs

Surface



Feed Support

1296 Feedhorn

- N2UO design dual mode feed horn
  - http://ok1dfc.com/EME/technic/septum/N2UO%20opt.pdf
- Soldered copper construction
- 0.032 flashing
- Copper septum for circular polarization

Materials

- 18 - ¾”x8’ fiberglass tube ribs
- 18 - 1”x1’ fiberglass tube receivers at hub
- 2’x2’ ¼” aluminum hub plate
- 2” diameter aluminum feed support
  - 2 - 2” steel exhaust 45 degree
- Yaesu rotator bracket feed support
- 18 - Kevlar Kite cord rib stress elements: no stretch
- 200 ft^2 of Aluminum window screen

Sources

- Fiberglass tubing: MAXGAIN Systems
- Aluminum plate and tube, copper flashing: Alan Steel
- Steel 45’: O’Reilly Auto
- Yaesu rotor clamp: HRO
- Kevlar cord and window screen: Amazon
- Hardware: Amazon, Los Altos ACE Hardware, Home Depot
  - Ubolts, perimeter cable, bolts, hooks ….

Results

- 1st weekend: Reno NV
  - Only 6 QSOs, all CW, one EU moon window
  - Tracking and dish surface both problematic
- Changed from ½” poultry netting to Aluminum window screen
  - Better conformance to rib curvature
- Finished auto tracking code
- 2nd weekend: Ashland OR
  - 52 QSOs over 2 EU moon windows
  - About half CW and half JT
  - Most JT stations easy copy by ear

Additional Photos (First version, Nevada)

Additional Photos (Second version, Oregon)