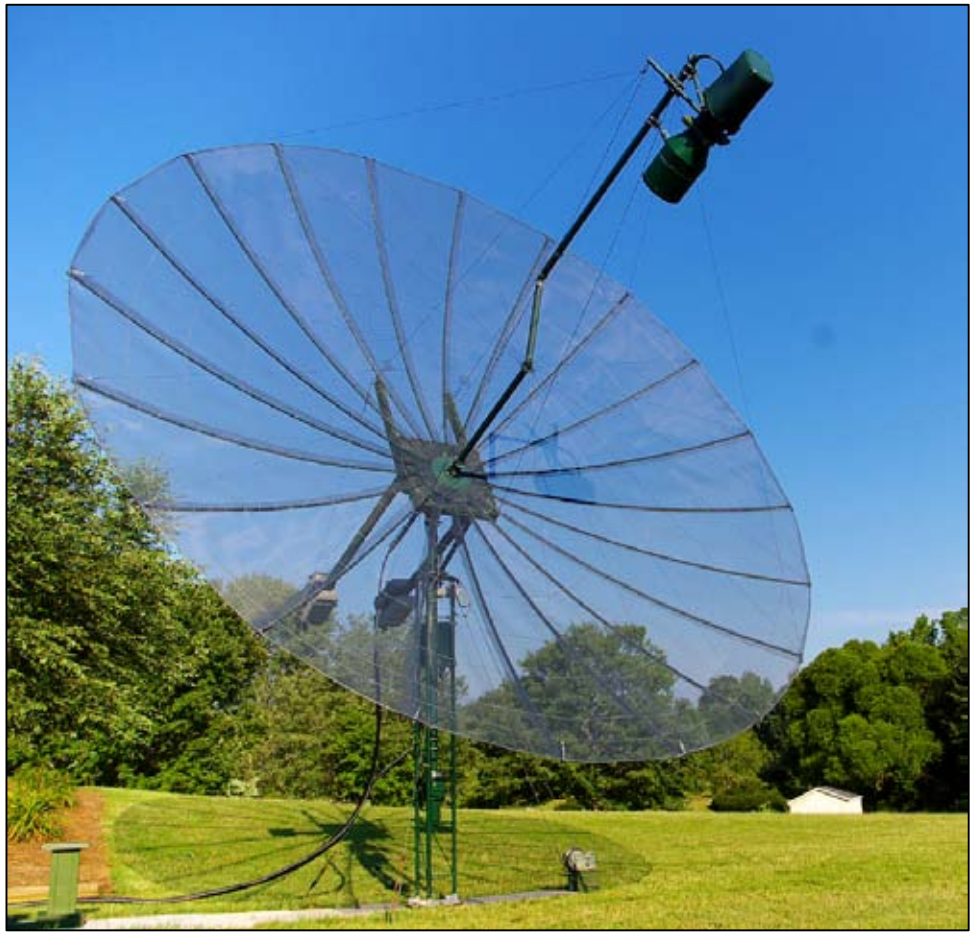
A lightweight 20 foot stressed dish for 1296 MHz EME



Marc Franco, N2UO

Outline

- Motivation
- Design criteria
- Mount design & construction
- Reflector structure design & construction
- Reflector surface construction
- Feed support
- Counterweight and raising mechanism
- Performance
- Conclusion

Motivation

- After 9 years of using a 10’ stressed dish, it was time to build a new, larger one

- Goals
  - 1296 MHz operation
  - 6 dB gain improvement
  - Very high Performance/Cost ratio
  - Strong wind survival (in spite of the low cost)

Design criteria

- 20’ diameter
- Stressed design
  - Light weight, low cost
- Ability to buy materials locally or ordered at reasonable cost
- F/D of 0.5 for best performance with W2IMU-style feed

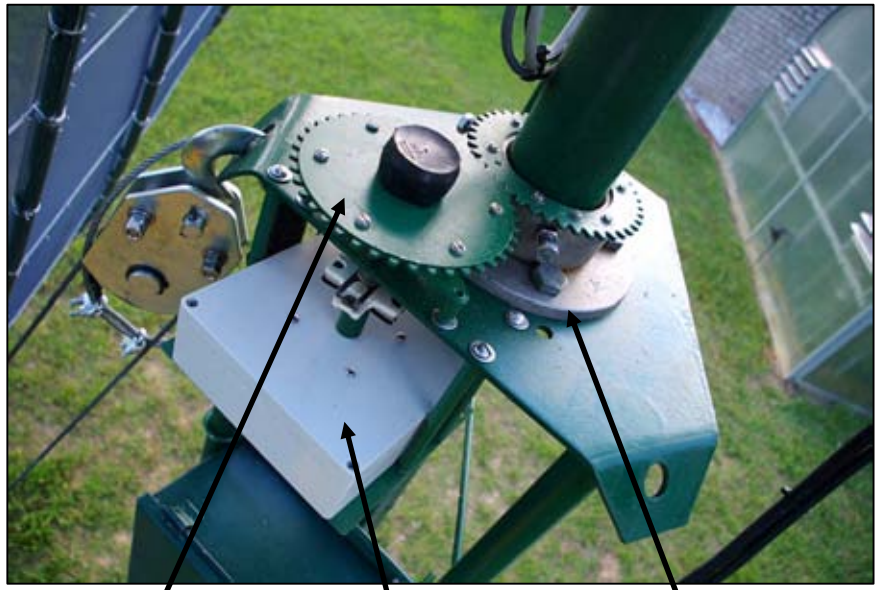
Mount design & construction

- Rohn 25 flat top cap 8’ tower section
  - 3 inch weatherproof thrust bearing at the top
  - Hinged base (R-BPH25G)
- Prop pitch motor circa 1945 for azimuth
- 24” linear actuator for elevation
- Homemade 10 bit optical encoders for position control

Foundation

Hinged base

Azimuth control



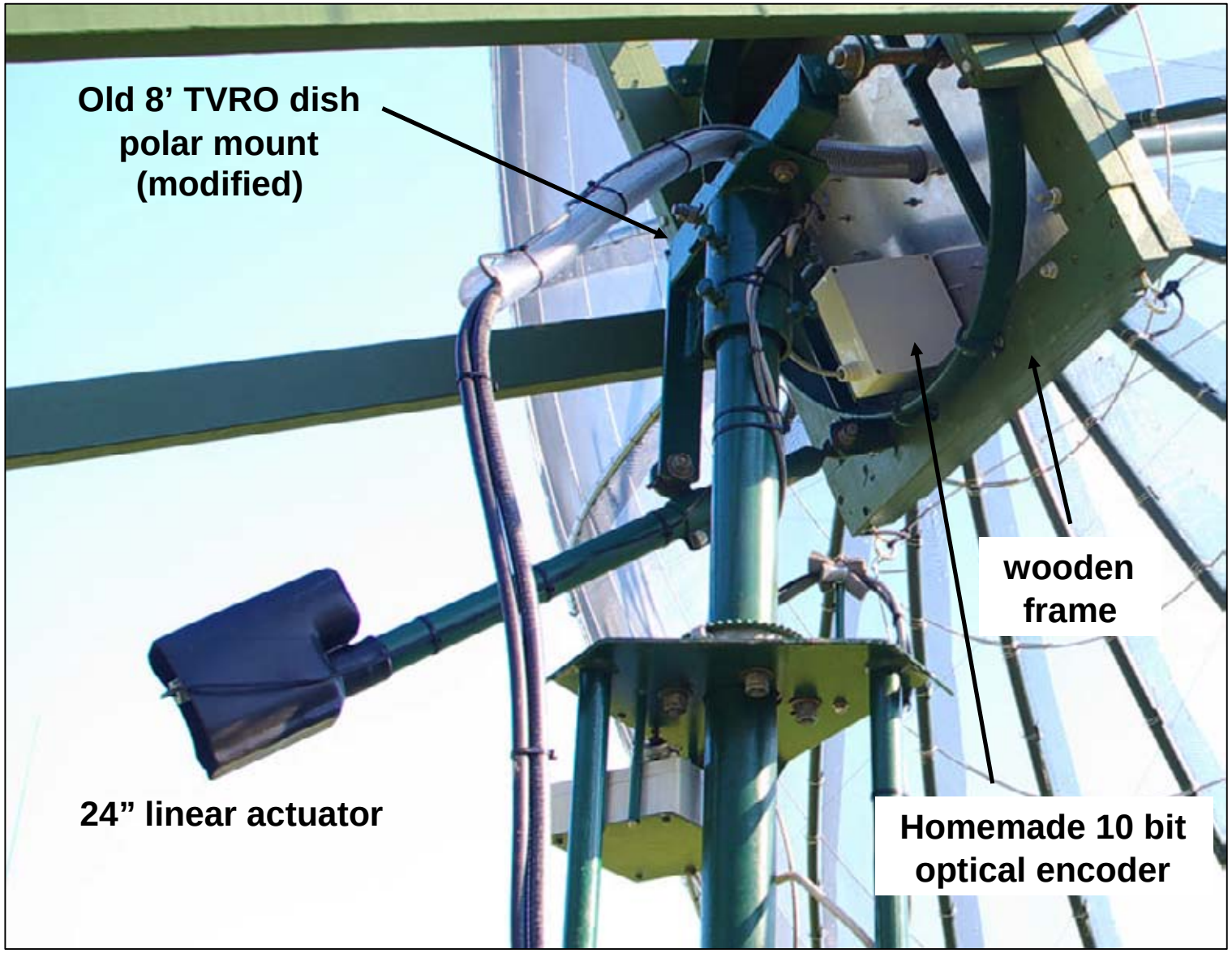
Sprockets from old winch

Homemade 10 bit optical azimuth sensor

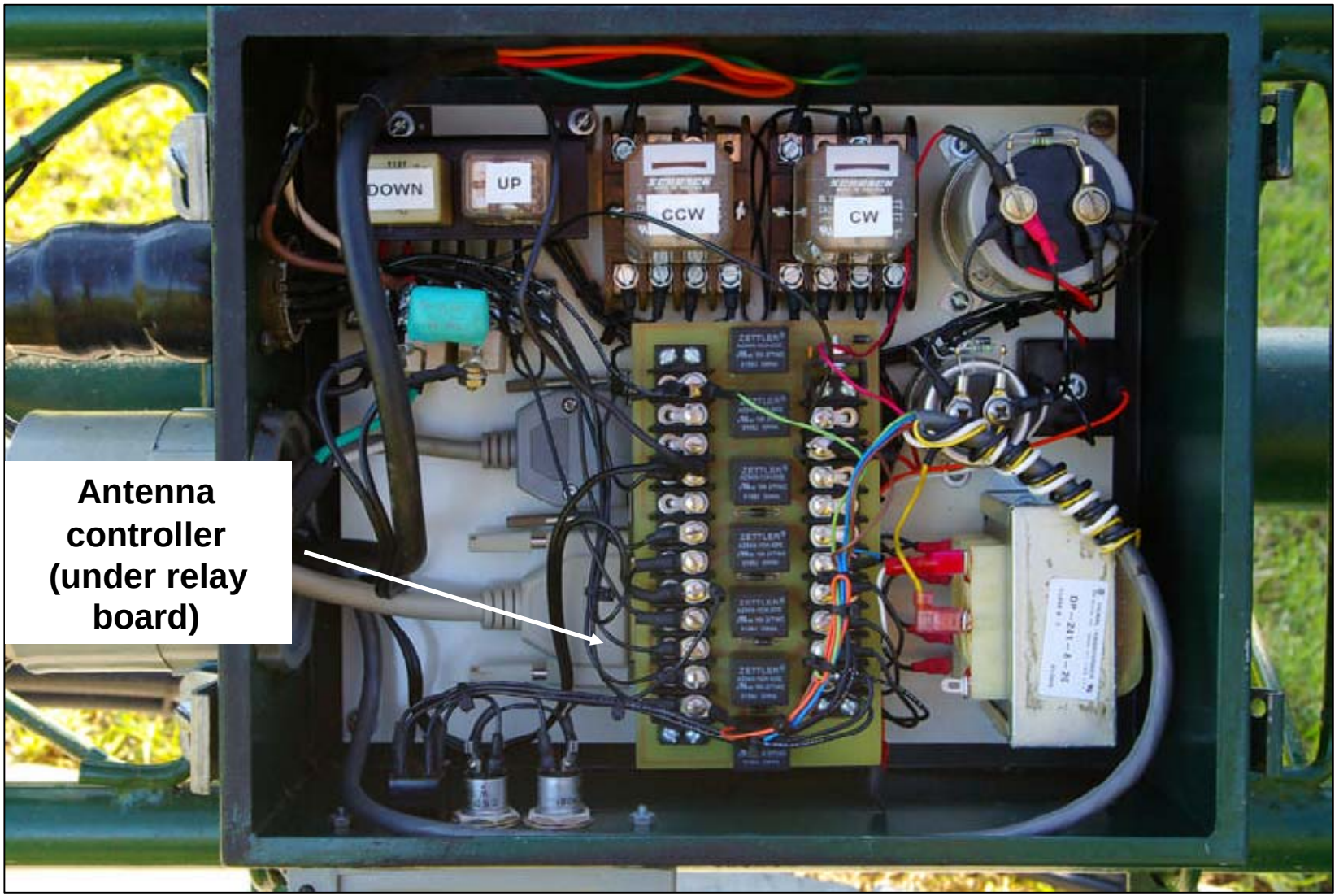
3” weatherproof thrust bearing

Prop pitch motor

Elevation control

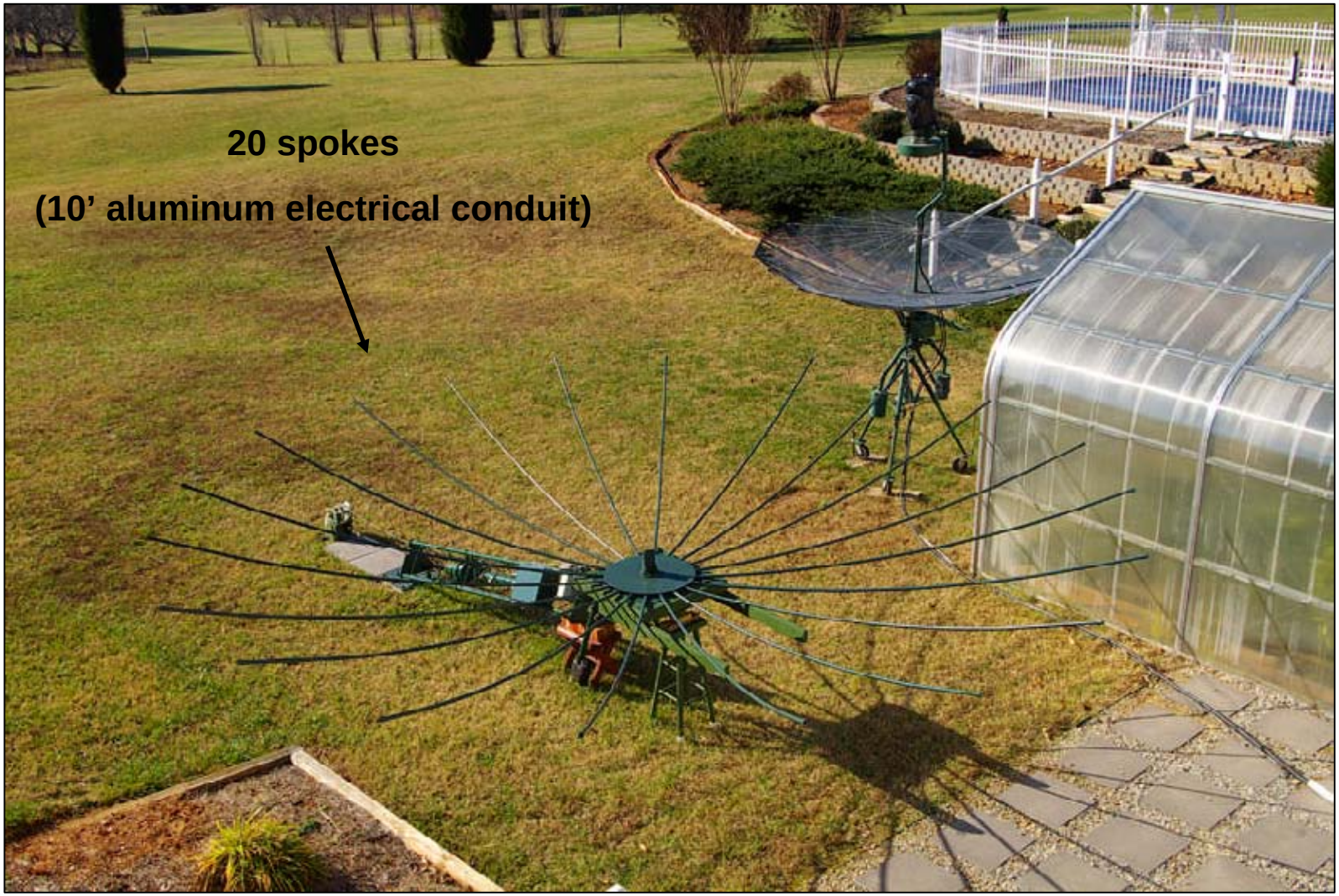


Outdoor tracking control unit

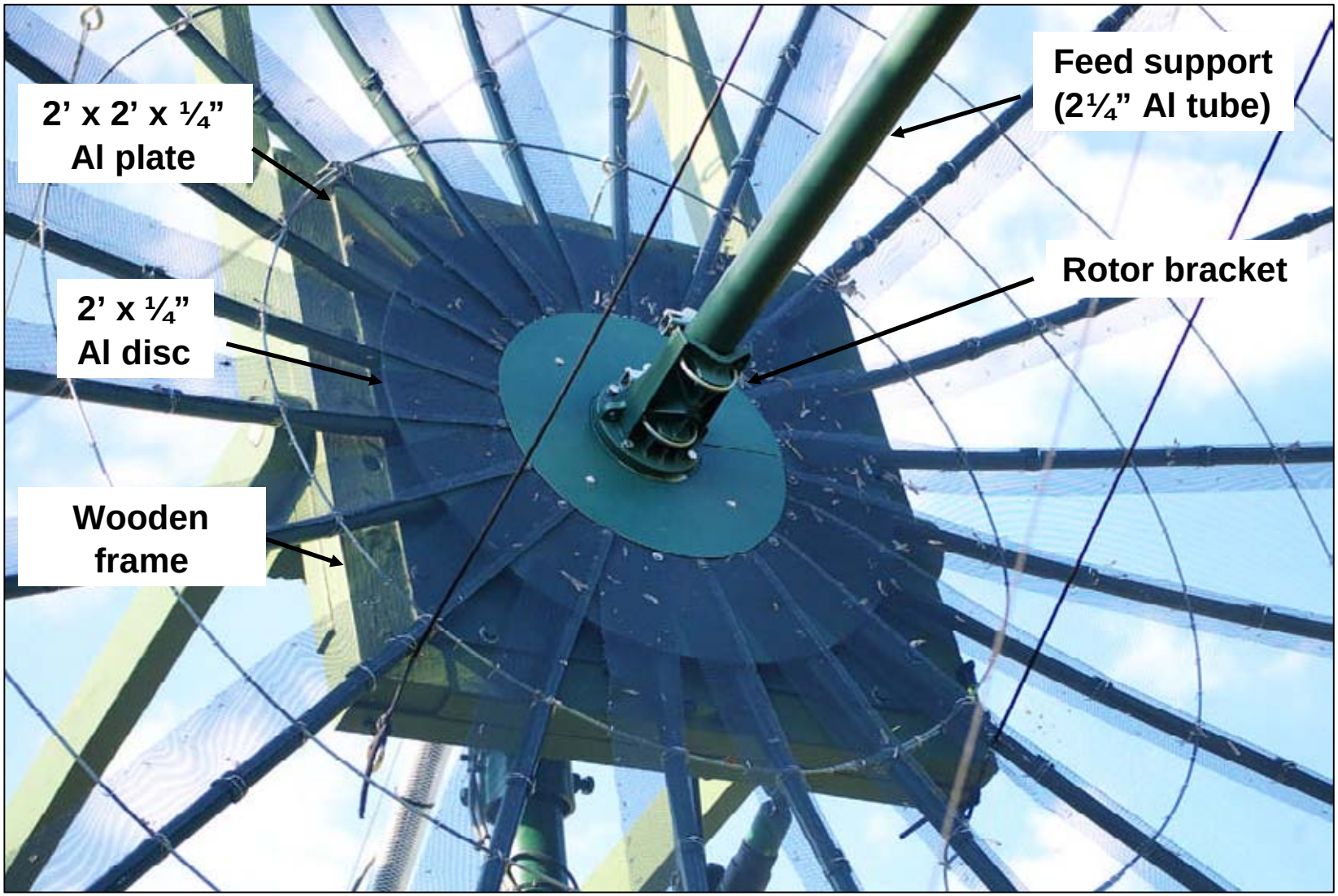


Wooden dish: failed attempt

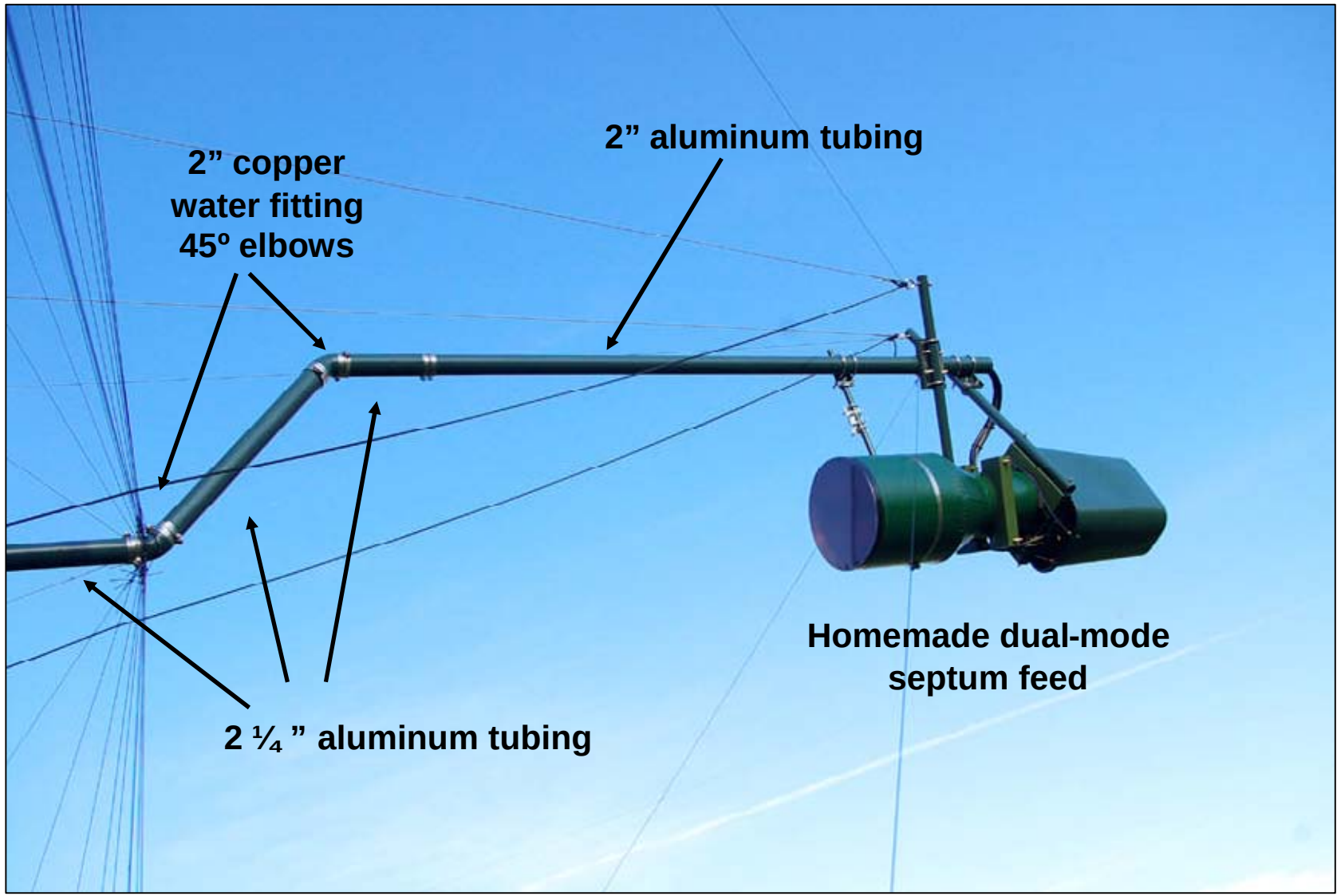
Spokes



Hub


2’ x 2’ x ¼”
Al plate
2’ x ¼”
Al disc
Wooden
frame
Feed support
(2¼” Al tube)
Rotor bracket

Feed support



Feed support

Mounting the feed

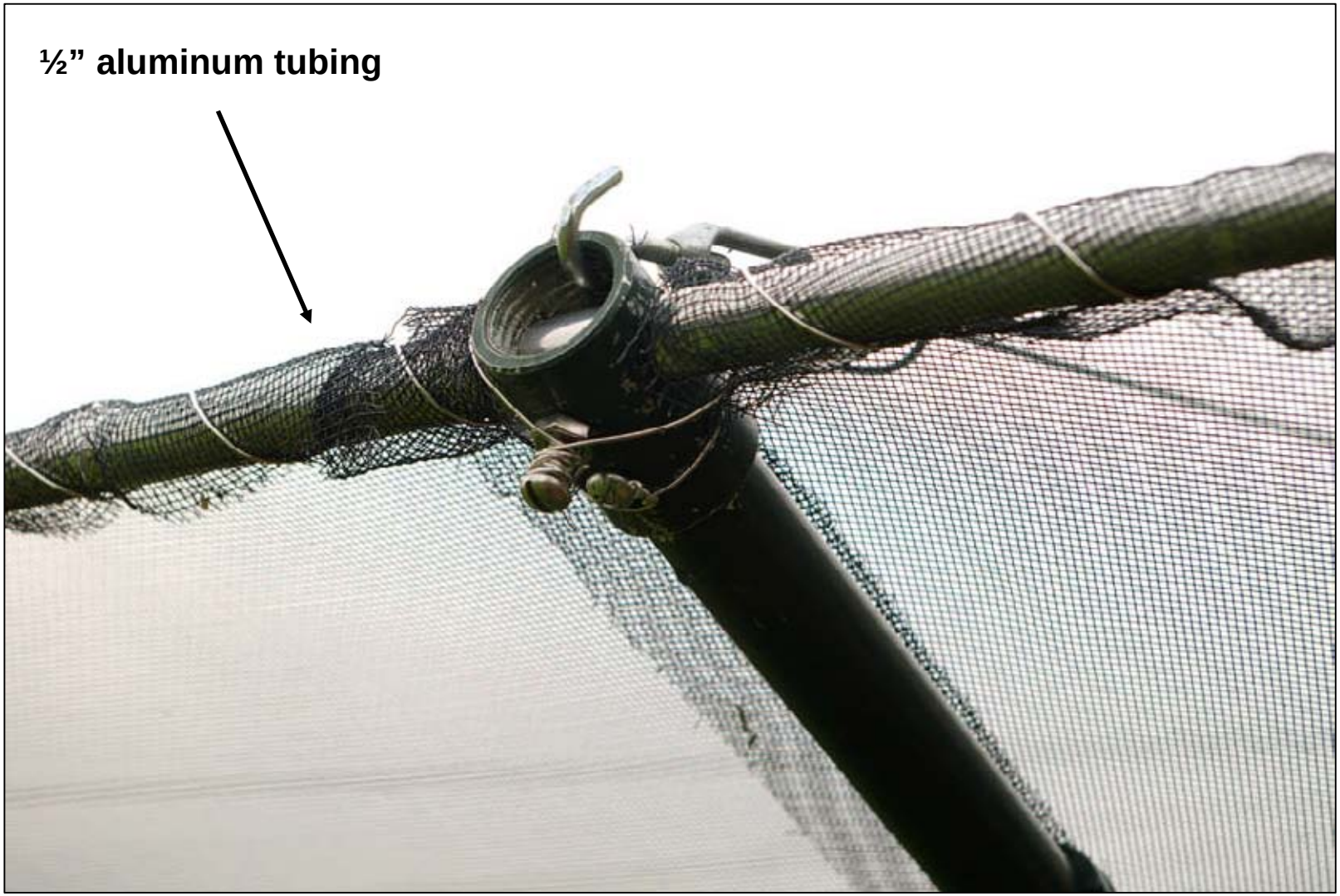
Wire rings

Rings made of
galvanized fencing wire

Installing the mesh

Installing the mesh

Outer ring



Antenna support

Counterweight

Raising mechanism

Heavy duty winch and pulley

Performance

- Measurements show that the antenna gain on 1296 MHz is close to 1 dB below the theoretical maximum
- 1 dB loss makes the antenna perform like a perfect 18’ dish (few dishes are “perfect” though)
- Reasons for the loss are mostly due to surface imperfections, but scatter from the dish support also contributes to a higher antenna temperature when measuring sun noise
- Still, 35.5 dBi of gain is an impressive figure for a lightweight stressed dish
  - SSB echoes are solid copy 100% of the time with 300 W at the feed

Conclusion

- A very low cost, light weight, 20’ stressed dish for 1296 MHZ EME was presented

- The dish is mounted on a special mechanism that allows the antenna to be lowered very close to the ground when not in use for wind survival and to keep it out of sight

- The total cost of the project was significantly less than alternative approaches for the achieved antenna gain – a hard to beat dB/$ ratio!

Thank you