

GRAMPA'S

BROWNS CORNER

BLAB

5-15-21

**NASA
JACK**

Good morning, Campers.

I hope you will all forgive me for being delinquent in Blabbing about Lila and Elle's successes as herpetologists and catching many frogs and tadpoles (and crawdads). And also about Tyler's adventures with a chain saw. And about the New Tree House Design Competition. You will be able to read about all these things soon I promise.

Let me explain the reason for the delay. After our wonderful Mothers' day gathering, nana and I had to take care of a few chores and get ready for a visit from SPEEDO. Yes, the Speedo after whom Speedo's Boys were named. The Speedo whom was my high school running coach and under whose expert coaching The Westwood High School Cross Country team became New Jersey State Champions four years after being founded.

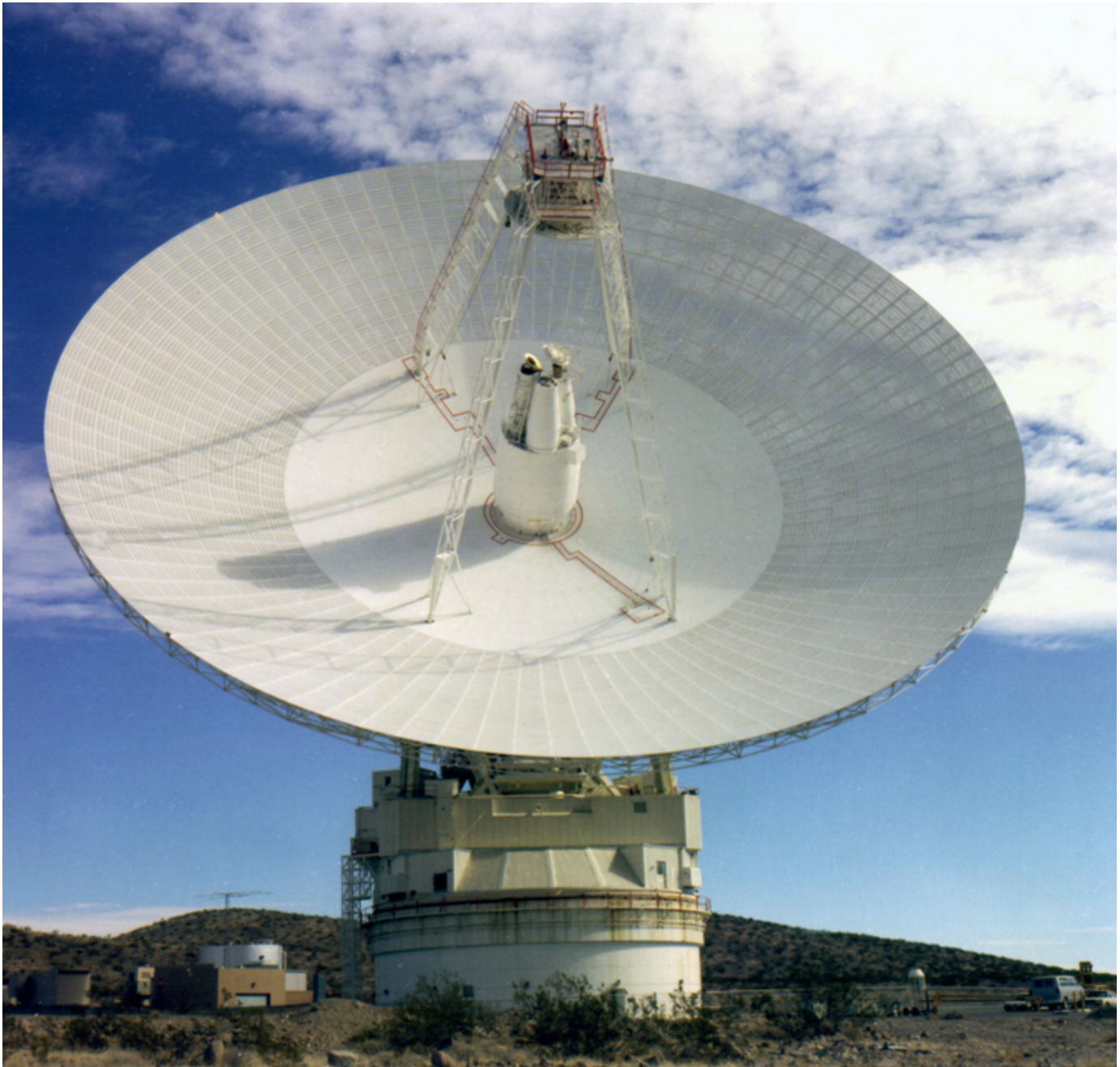
And to make it even better, Steve Hatfield, teammate from that team, whom I had not seen for about eight years, agreed to come join us. We had a little fun with Speedo because I did not tell him Steve was coming so when he pulled in and got out of the car to be greeted by someone he wasn't expecting it was a fun surprise.

Steve, like Grampa, spent his working career as an engineer. I started my career designing and building nuclear submarines. Steve worked in design and maintenance of nuclear power plants. Pretty tricky stuff. So when I was showing him my messy mechanical room, he took an interest in a keepsake I have down there. A 1,200 Ton hydraulic jack which I have been using as a table for many years. Here is a file photo from back when we lived in Mohegan Lake, NY. (next page)

The legs are something I added. The actual jack is only one inch high. An ultra-thin 1,200 ton hydraulic Jack. I had an important role in the manufacture of this jack. I designed it.



You can read a fairly accurate description of the project on the next pages.



Lightweight Jack

Originally published in 1996

Richard Dudgeon, Inc. (RDI), Bridgeport, Connecticut supplies hydraulic jacking equipment, along with engineering and technical support, for heavy lifting projects. The company rents and sells standard jacks and also designs and manufactures custom jacks for specific applications. Among the company's products are a line of high pressure jacks/load cells that evolved from a prototype system developed for a NASA heavy lifting project.

The project involved lifting segments of giant antennas in NASA's Deep Space Network (DSN), which is managed by Jet Propulsion Laboratory. The DSN is composed primarily of three communication complexes located at Goldstone, California; Madrid, Spain; and Canberra, Australia; they are about 120 degrees of longitude apart to permit continuous tracking of a spacecraft by at least one station at all times, despite Earth's rotation. Key facilities are three giant antennas, one at each location, that support deep

space (interplanetary) missions; each measures 70 meters in diameter, is 22 stories high and weighs some 8,000 tons.

In 1990, JPL discovered that modifications to the antennas over the years had redistributed weight to the point where bearing failure-and possible collapse of the antenna-was threatened. JPL asked RDI to devise a solution for simultaneous measurement of several key load points within the bearing housings of the 70-meter antennas, an initial step in correcting the alignment.

The job called for a heavy lifting load cell system of extraordinary capability. It had to be ultralight for portability (it had to be carried to the bearing housing level 120 feet above ground via narrow ladders); it had to be extremely powerful to lift the weight of the structure above the bearings; and it had to be thin enough to fit between load points that measure as little as .025 inches. Additionally, it had to be developed within a tight time frame.

RDI assembled a project team composed of its own experts * augmented by those of a number of Connecticut firms that assisted in the design, development and ultimately the manufacture of a complete synchronous load cell system. Prototype development took only six weeks and the system was used successfully in the DSN project.

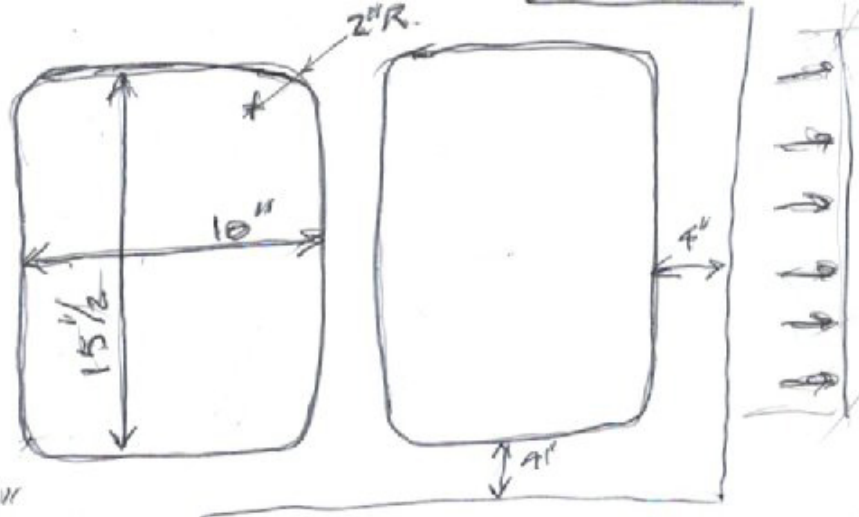
RDI subsequently commercialized the technology with its Dudgeon High Pressure Ultrathin Pancake Jacks/Hydraulic Load Cells, which are designed for applications requiring minimal lift but high portability. They are ultralight as well as ultrathin; a system capable of lifting 700 tons weighs only 79 pounds, where a conventional jack of similar lift capability might weigh half a ton. Available in a capacity range from 50 to 2,000 tons, they are intended for such applications as bridge weighing/lifting, heavy industrial and turbine weighing/positioning, and weighing/positioning of utilities and power plant equipment.

*** The “team of experts” was me, Grampa. I worked around the clock for 36 hours doing iterations of the design before finding a set of dimensions that would meet all the requirements and also could lift 1,200 tons. That’s equal to the weight of 800 Toyota Corolla Hybrid cars like nana and Grampa drive.**

So my old friend Steve Hatfield sent me an email after he got home with a highly technical question. I will spare you all the details, I'll just paste in a little sketch I made up which I am certain will make sense to nobody in the world except Steve and a couple of photos which likewise will be meaningless to everybody else.

See next page for sketch.





LATERAL FORCE:
 $7917 \text{ PSI} \times 15.5" \times .75"$
 $= 92,038 \text{ \#}$

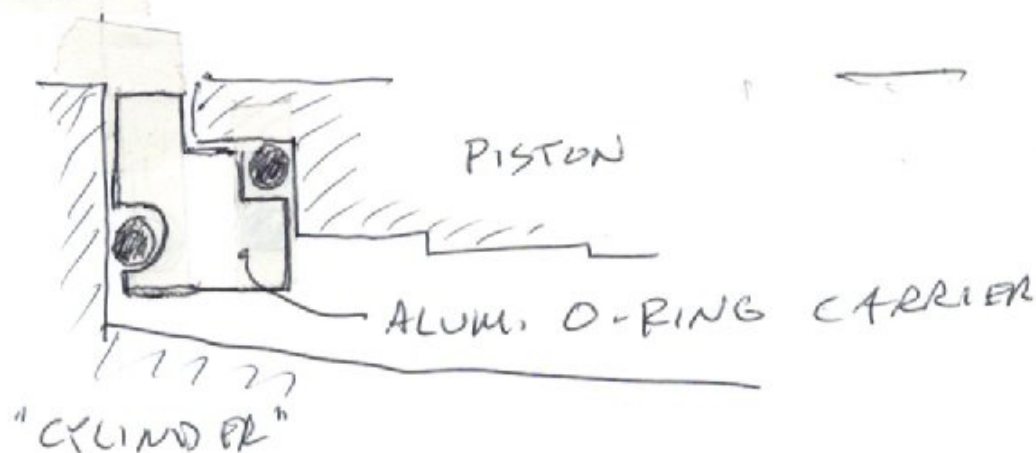
STEVE - IT'S BEEN THIRTY YEARS BUT AS I RECALL, LATERAL FORCES AND RESULTING COMBINED SHEAR + BENDING STRESSES WERE THE BIG CONCERN



PRODUCT:
 $4" \times 4" \times [1-.7854] = 3.4336$

$$A = [(10 \times 15.5) - 3.4336] \times 2 = 303.13 \text{ IN}^2$$

$$\text{PRESSURE} = \frac{1200 \text{ T} \times 2000 \frac{\text{\#}}{\text{T}}}{303.13 \text{ IN}^2} = 7917 \text{ PSI}$$



BY DESIGN, THE O-RING CARRIER EXPANDS OUTWARD AND LOCATES UNTIL LIMITED BY METAL-TO-METAL BEARING ON "CYLINDER" WALL.

OK, Campers, I PROMISE the next Blab will be more interesting.

Love to all,

, *Grampa*

