

Microwaves: Not Just for Leftovers

My Journey in Getting on the Bands

Wayne Yoshida, KH6WZ



N6RMJ Photo

Why the Microwave Bands?

- Originally, I looked for a multiplier or “something different” for Field Day 2003
- Home-brewing: Building your own creation and putting it on the air
- Contesting!
- Using weird and strange parts
- Building!
- Antenna restrictions
- You can be loud with “little antennas”
- Contesting!

Searching for Answers. . . .

- Searching the Internet
 - Google-search: Microwave ham radio
 - SBMS
 - Mike King, KM0T
- Microwave and VHF-plus club meetings
- Reading the books
- Microwave Update events
- Just “doing it!”

Operating Opportunities: Contests

- ARRL VHF and Up Contests
 - January, June, August, September
 - More points for higher frequencies
 - Field Day, “just another band”
- SBMS 2GHz and Up Contest
 - April
 - Club competition
- Off-season means distance record breaking attempts

Which Band?

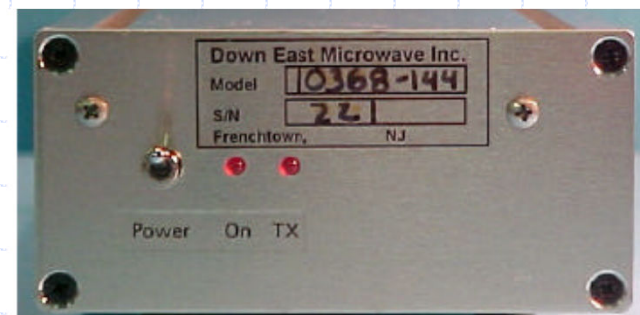
- Check past VHF and Up contest write-ups to see who is doing what in your area
- Beacon availability
- Club and contest activity
- The decision: 10GHz!



N6RMJ Photo

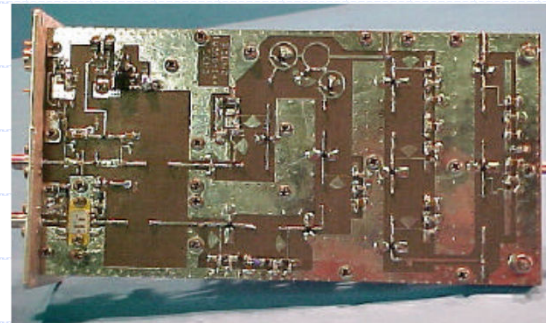
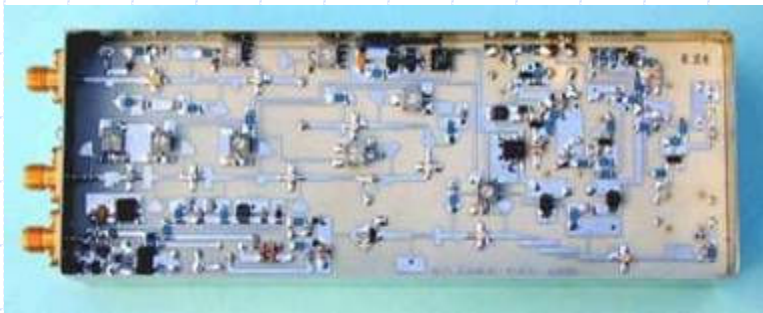
Buy It or . . . ?

- Build it or buy it, getting on the bands still requires some building
- A “store-bought” transverter must be
 - Guaranteed, proven, customer support
 - Faster, all or most all parts available

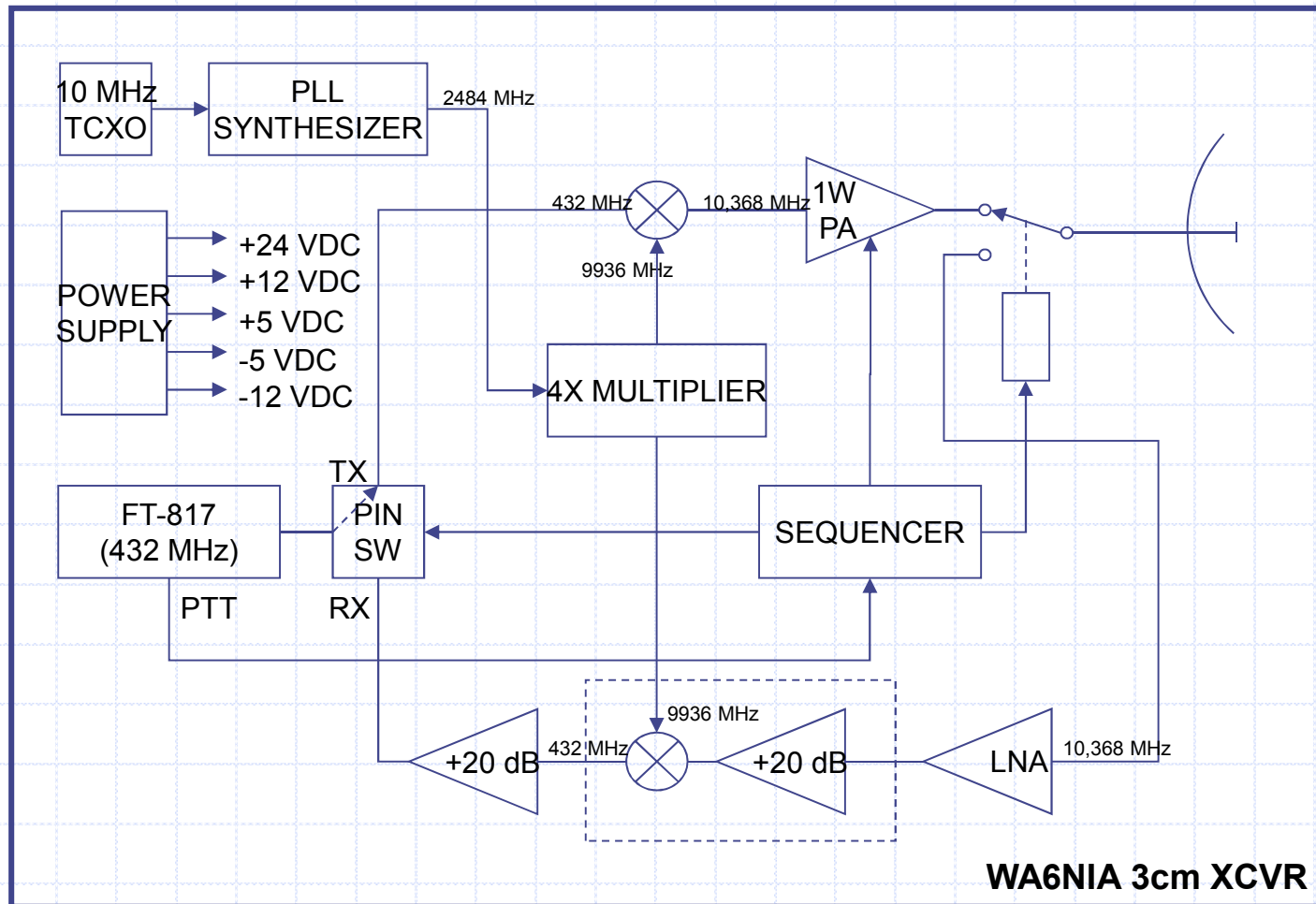


. . . Build It?

- Commercial microwave ham-specific kits
 - Guaranteed, proven, customer support
- Surplus commercial bits & pieces
 - Not usually guaranteed functional
 - Takes time to find what you need
 - No after-sale support
- Used gear?
 - Make sure the unit works
 - Check to see if the seller's callsign appears in contest results to verify the rig "really" works



What Does a Microwave Rig Look Like?



What Does a Microwave Rig Look Like?



What Does a Microwave Rig Look Like?



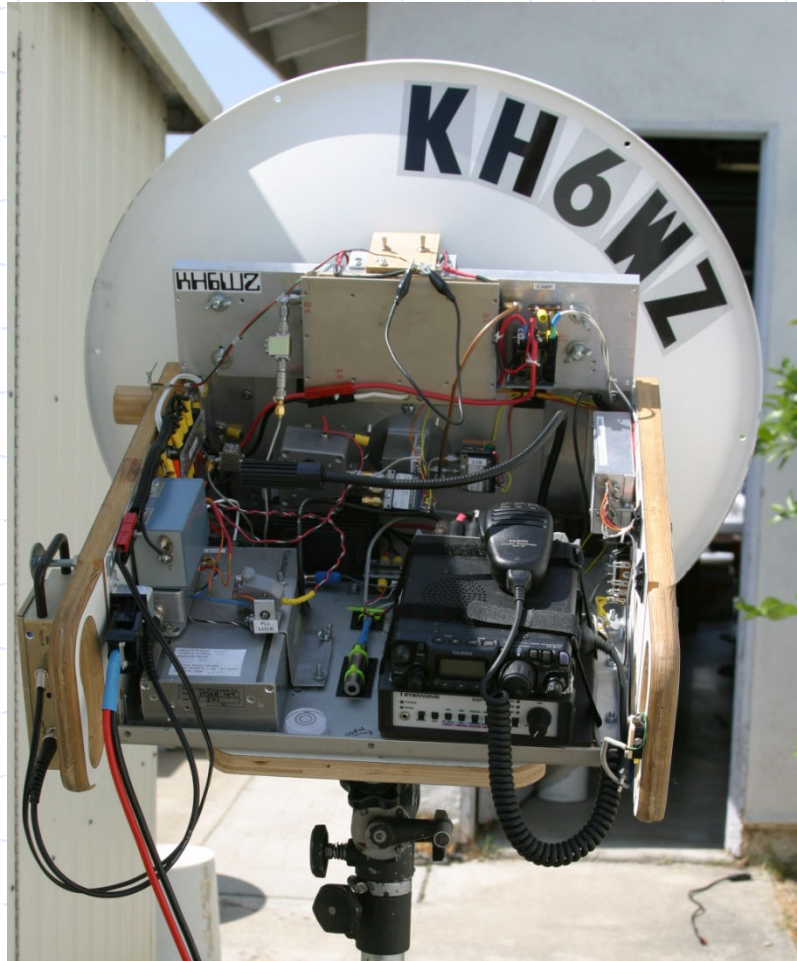
**Morpheus (AKA, "Successful Failure")
KH6WZ**

What Does a Microwave Rig Look Like?



Morpheus II
KH6WZ

What Does a Microwave Rig Look Like?



**Morpheus III
KH6WZ**

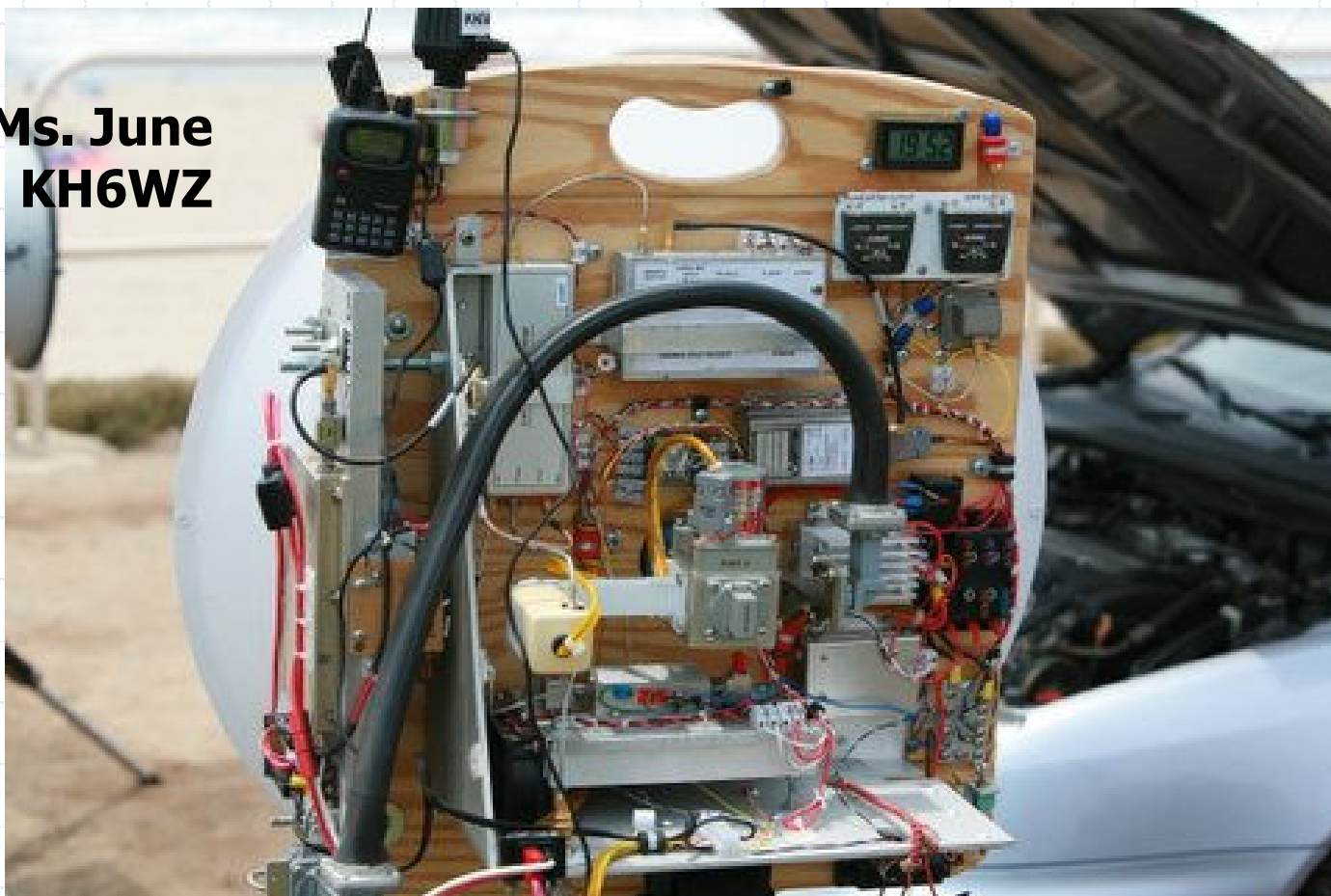
What Does a Microwave Rig Look Like?



**FrankInspired2
KH6WZ**

What Does a Microwave Rig Look Like?

**Ms. June
KH6WZ**



What Does a Microwave Rig Look Like?



**Wiki-Wiki Transverter
KH6WZ**

What Does a Microwave Rig Look Like?



**Basket Case
KE6HPZ**

What Does a Microwave Rig Look Like?



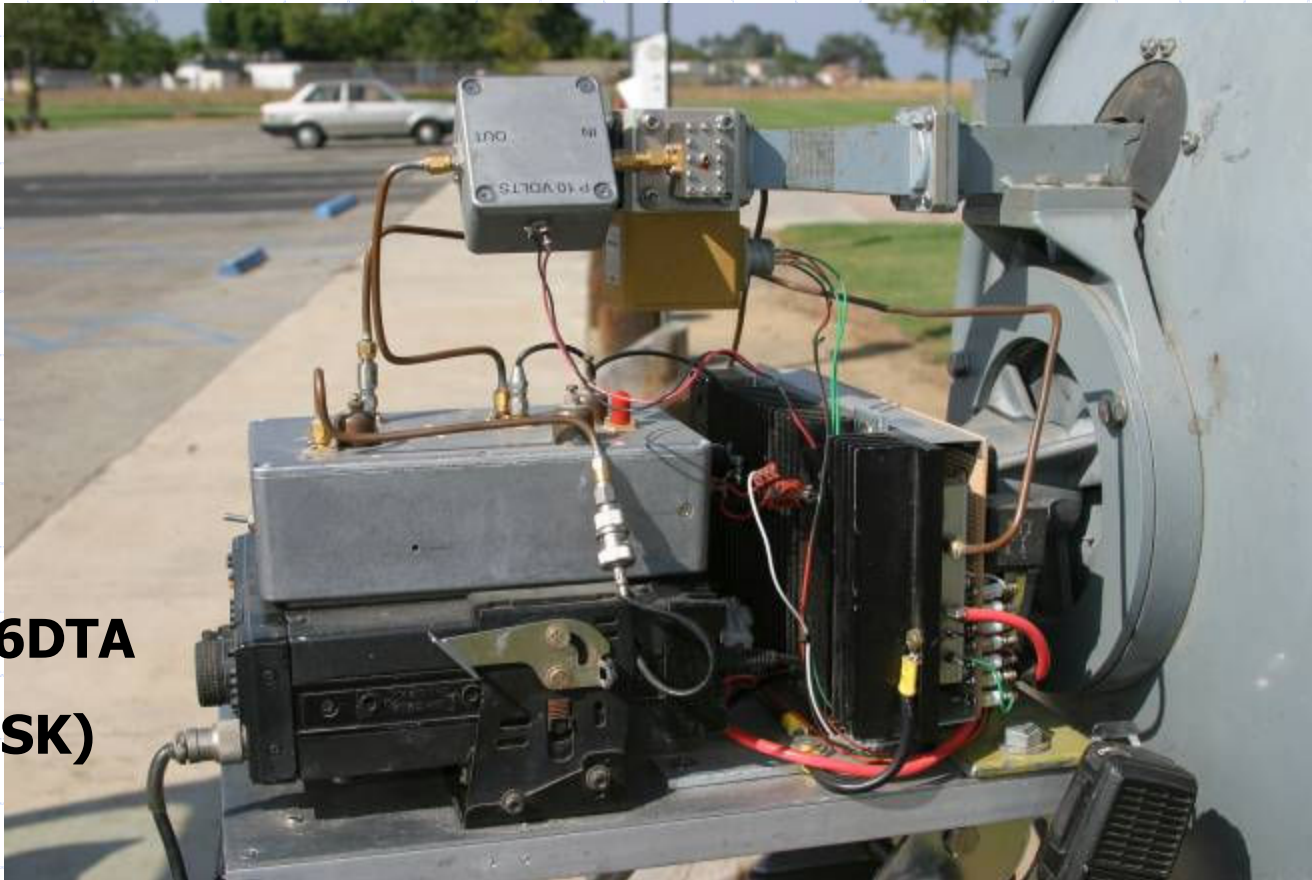
**Lazarus The
Next Generation
N6RMJ**

What Does a Microwave Rig Look Like?



**Milkman
N6XQ**

What Does a Microwave Rig Look Like?



**W6DTA
(SK)**

What Does a Microwave Rig Look Like?



WB6DJI

What Does a Microwave Rig Look Like?



What Does a Microwave Rig Look Like?



What Does a Microwave Rig Look Like?



What Does a Microwave Rig Look Like?

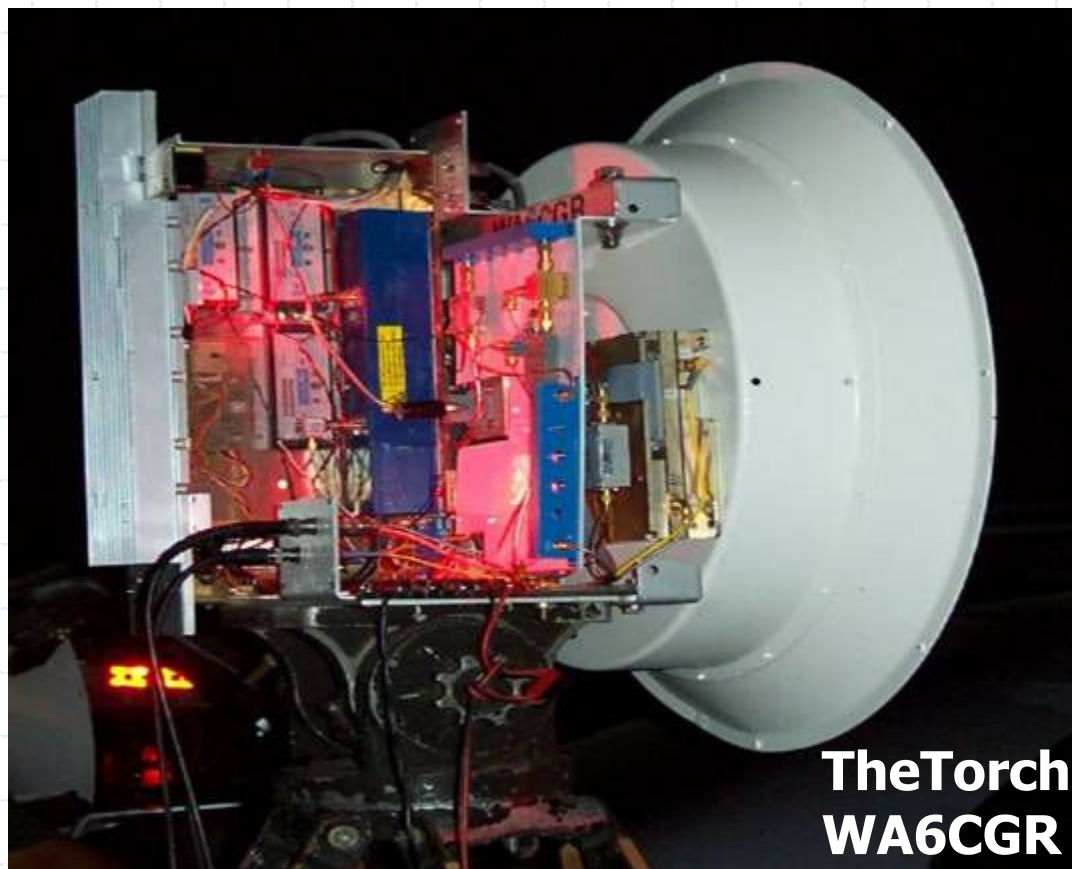


What Does a Microwave Rig Look Like?



WA6MEM
24GHz

What Does a Microwave Rig Look Like?



N6RMJ Photo

What Does a Microwave Rig Look Like?



What Does a Microwave Rig Look Like?



**LightShow
(24GHz)
KH6WZ**



Let's Build It!

- When getting on the Microwaves, your fancy VHF/UHF all-mode rig becomes an "IF unit"
- There are many stages and sub-systems to get from a "pile of parts" to a working rig. If you get stuck, move on to another section, rather than just stop working on the rig.



Words of Encouragement. . .

- "A rig will never be completed if you stop working on it."
- "Shoot the engineer, and just build it!"
- If you need help, ask! Most microwavers are willing to help new people, because new operators means more contacts in the next contest!

The Building Stages: Highly Emotional

- A complex project broken down into separate modules
 - RF: Microwave section
 - IF: Transforming to audio
 - Multiple-voltage power supplies
 - Control circuits
 - Antenna & feed system
 - Housing and support structure
- Test & verify along the way
- Integration of systems

The Successful Failure

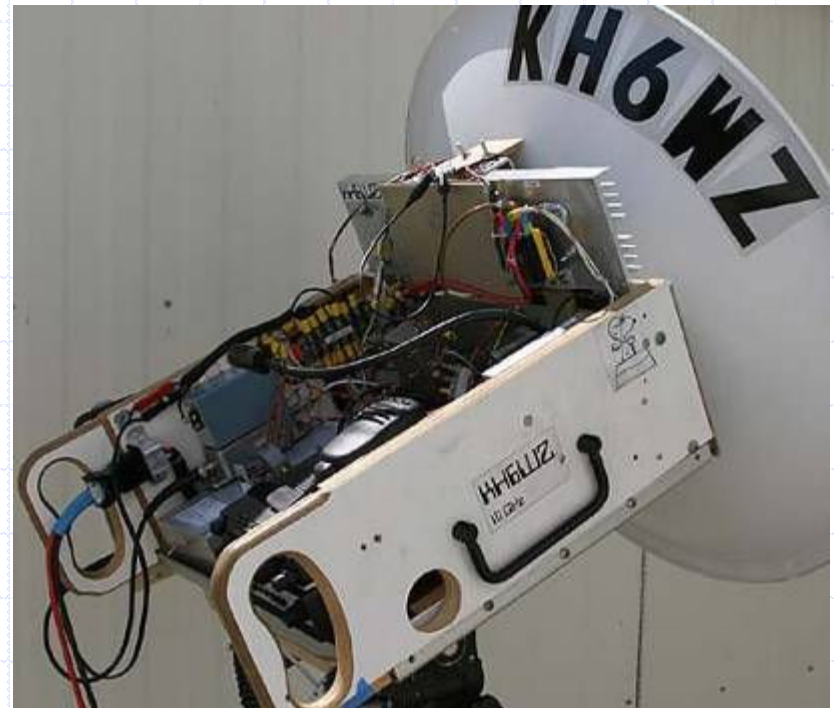


Morpheus

- A “Seinfeld” version – it’s “made from nothing”
- Lots of guessing
- Plenty of mistakes
- Building and re-building
- RX OK, TX not so OK (power too low)
- No QSOs
- See *CQ* magazine, December 2003 and January 2004 for the complete story. . . .

A Total Re-Build. . .

- Morpheus was totally ripped apart, and re-packaged a week before the contest.
- Morpheus II: Open tray/chassis helps service-ability.



Testing and Proving



A well-equipped lab helps – call fellow club members!

The SDMG/SBMS “Tune Up Picnic” before the big contest

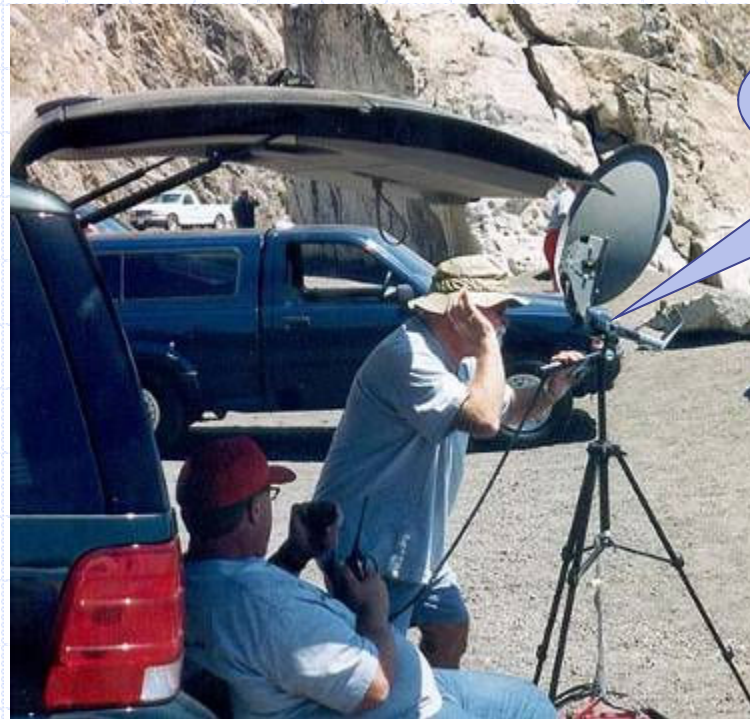
Listen to the beacons

Get on the air and talk to someone!



The Final Test

Plug it in, light it up, and get it on the air!

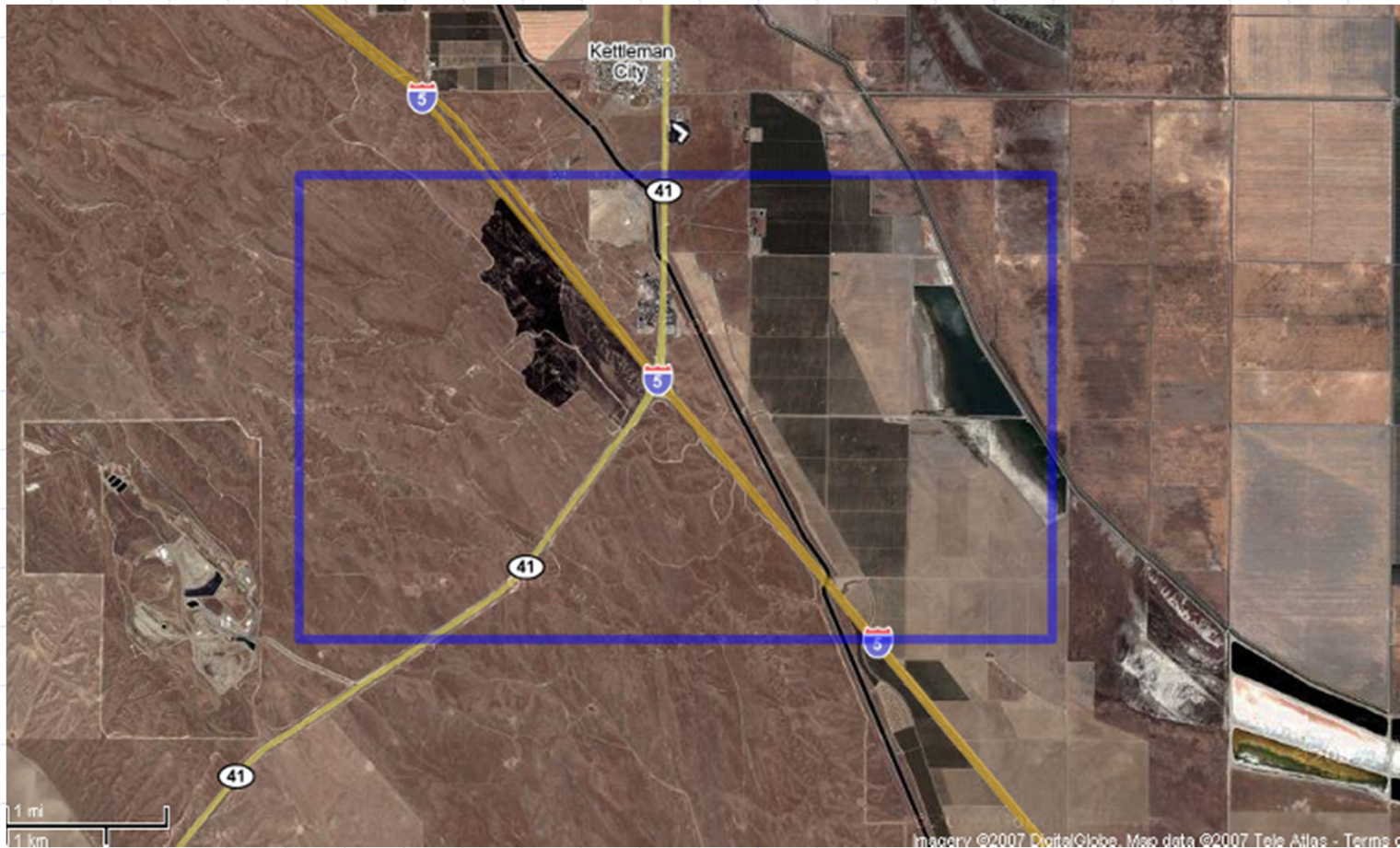


Can you hear
me now?

Where to Go?

- Microwaves = Limited to Line-of-Sight
 - NOT necessarily so!
- Is Higher Better?
 - NOT necessarily so!
- Microwavers very shortly discover that signals are enhanced and propagate much farther than L-O-S
- Weather affects signals, inversion layers and humidity impact propagation
- Behavior is like light: Reflected, refracted or absorbed

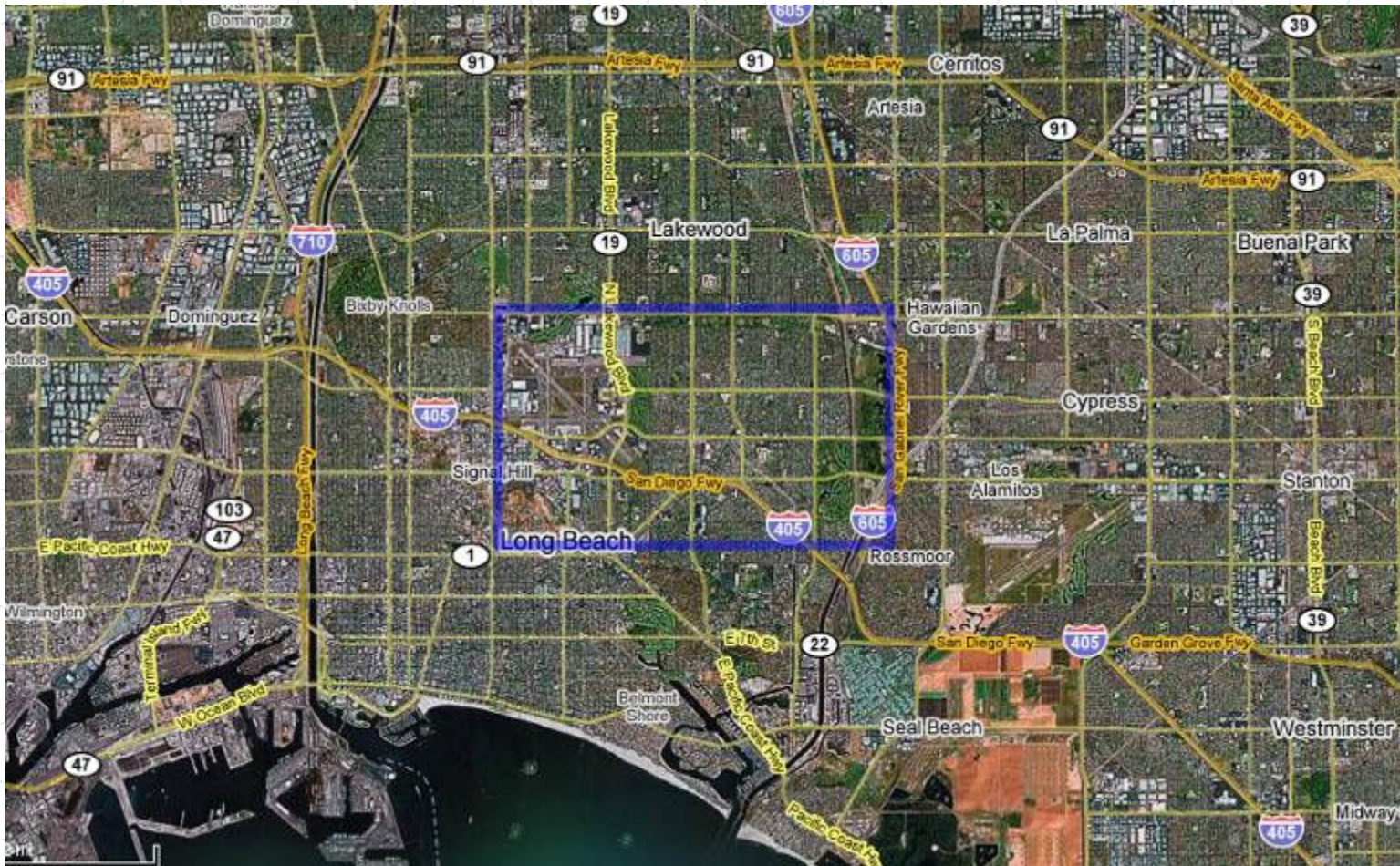
CM96wa: Kettleman City, CA



CM96wa: Kettleman City, CA



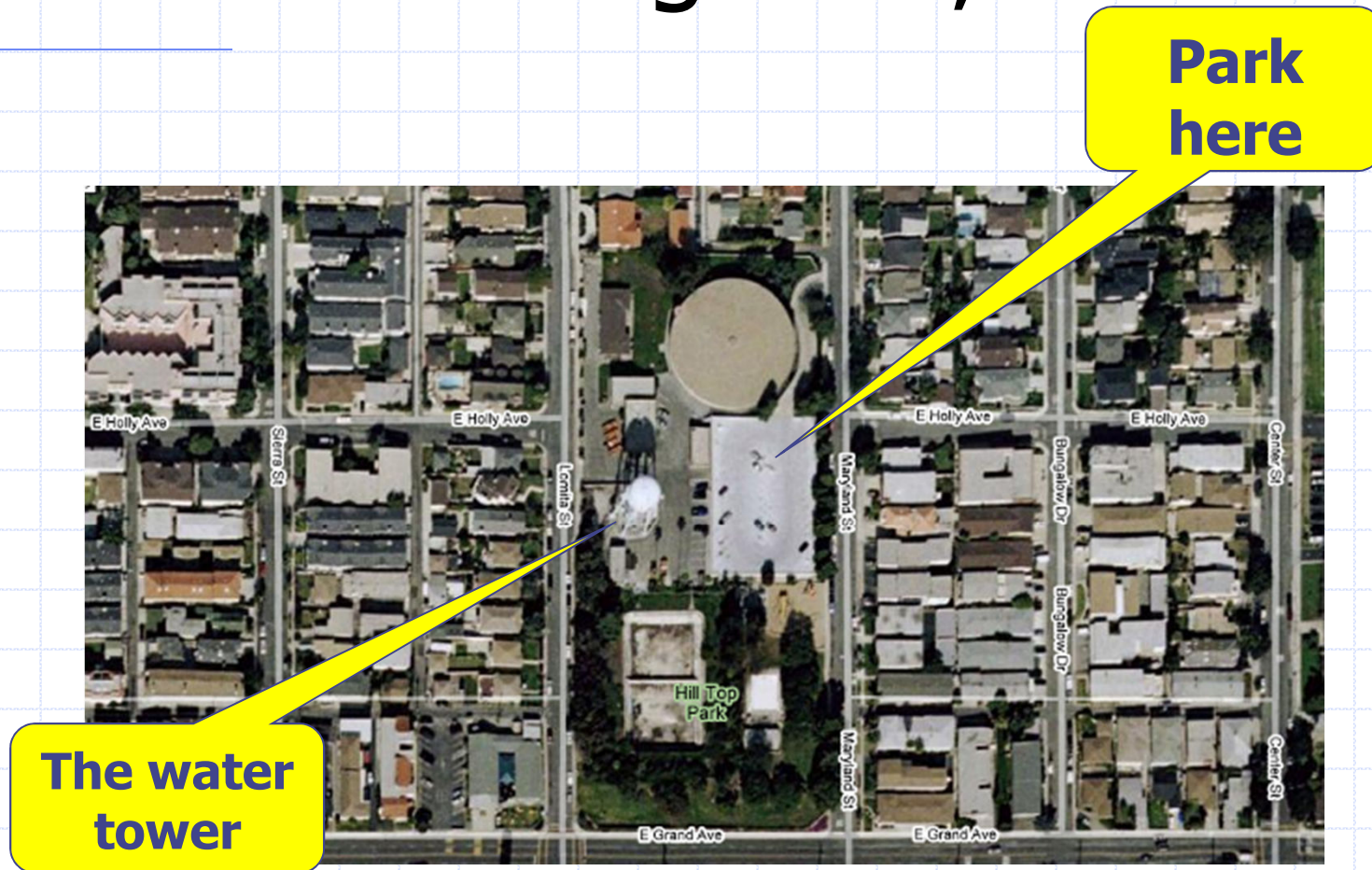
DM03wt: Signal Hill, CA



DM03wt: Signal Hill, CA



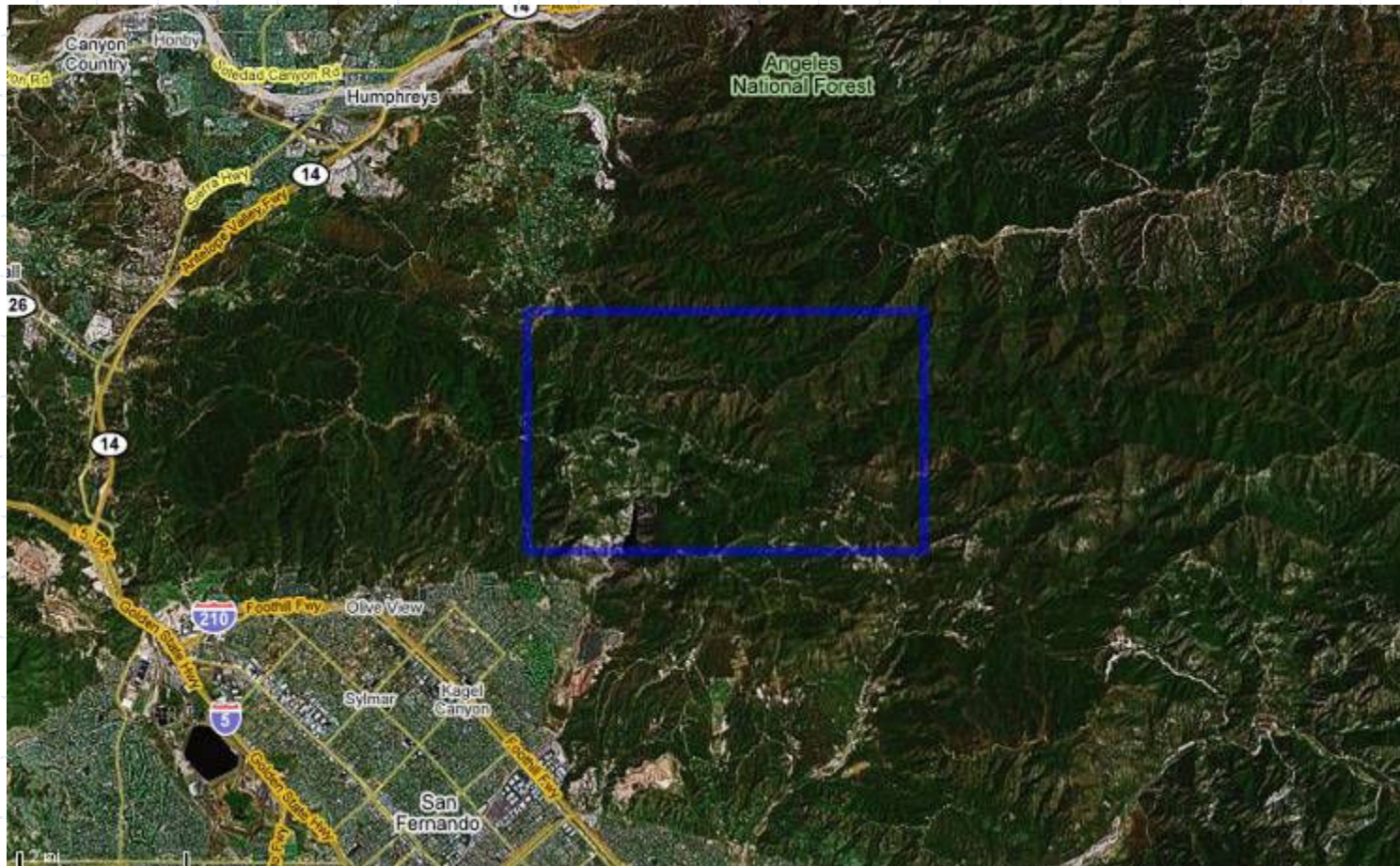
DM03tw: El Segundo, CA



DM03tw: El Segundo, CA



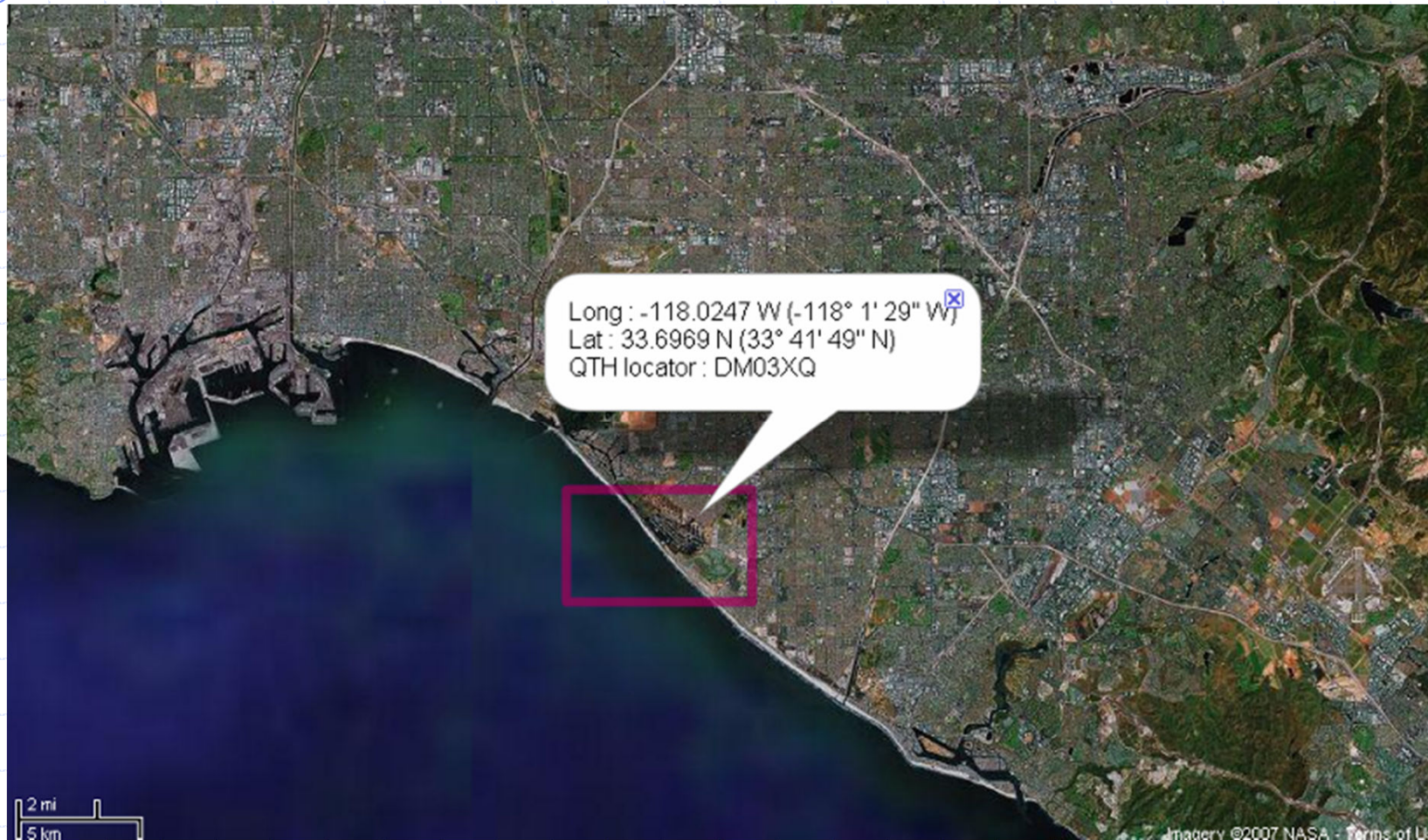
DM04ti: "Secret Site 51"



DM04ti: "Secret Site 51"



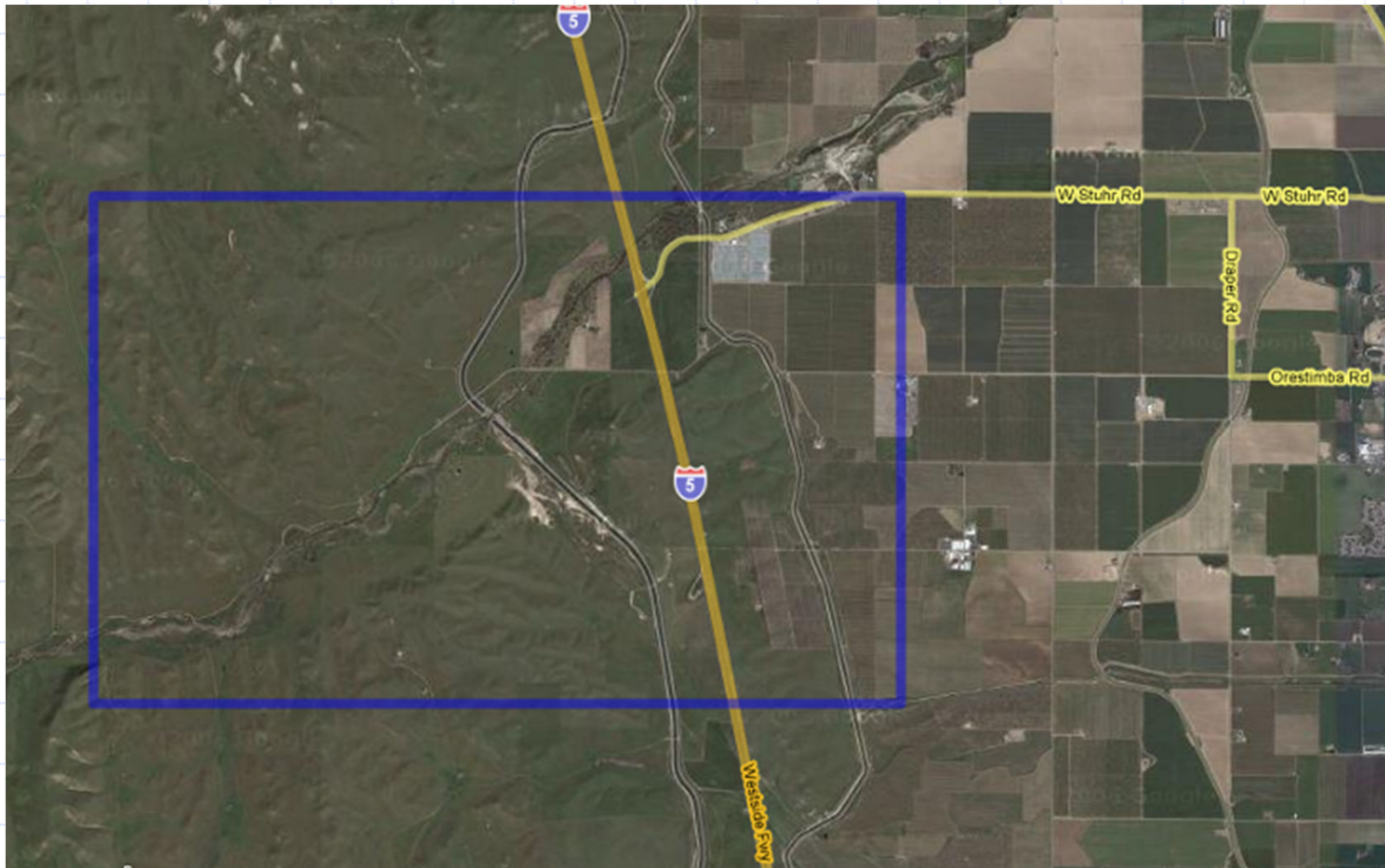
DM03xq: Huntington Beach, CA



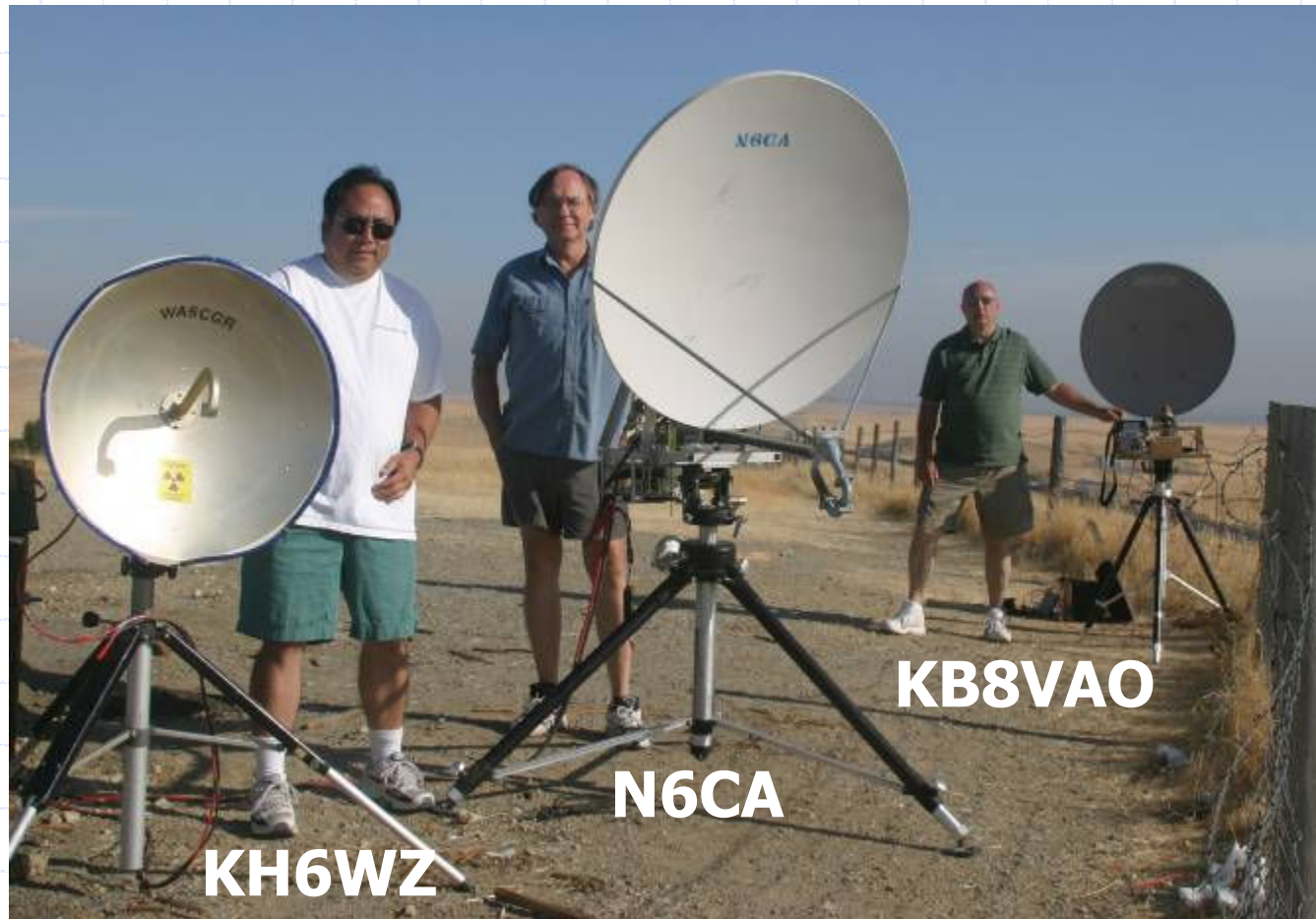
DM03xq: Huntington Beach, CA



CM97kh: A Scenic Overlook

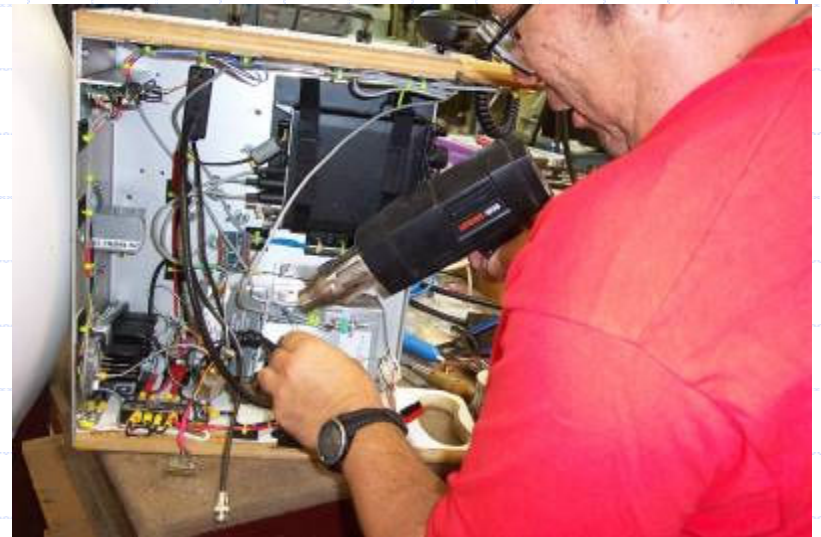


CM97kh: A Scenic Overlook



The Fear that Drives Us: Rule Number 5.5

- "A transmitter used to contact one or more stations may not be used subsequently under any other call during the contest period"
- When your rig breaks, you pack up and go home. . .
- Or do you? Be prepared to trouble-shoot your rig in the field and get back on the air, because you can be a long way from home. . . .



You are NOT Allowed to Give Up

- Remember, most of the time we are hundreds of miles away from home
- If something breaks, we have to fix it
- Every microwave contester needs a field tool kit
 - Most important is a cordless soldering iron
 - Vise-Grips®
 - Clip leads
 - Etc



A broken interface cable killed this radio in a recent contest. Clip leads jumpered the broken wires, and the rig was functional again!

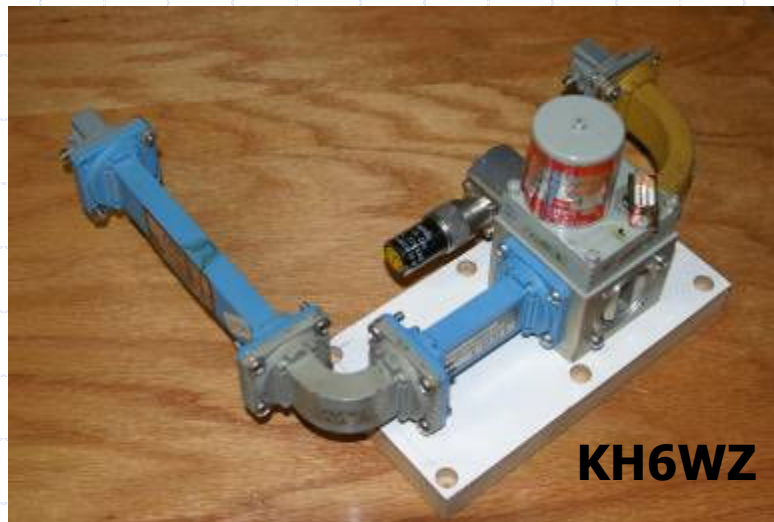
Enhancements

- A microwave rig is still just a radio: “You can’t work ‘em if you can’t hear ‘em!”
- Microwavers usually go thru stages of continuous improvement
 - Receiver noise figure & gain
 - Antenna & feed system
 - Frequency stability & accuracy
 - Support and aiming
 - Transmit power

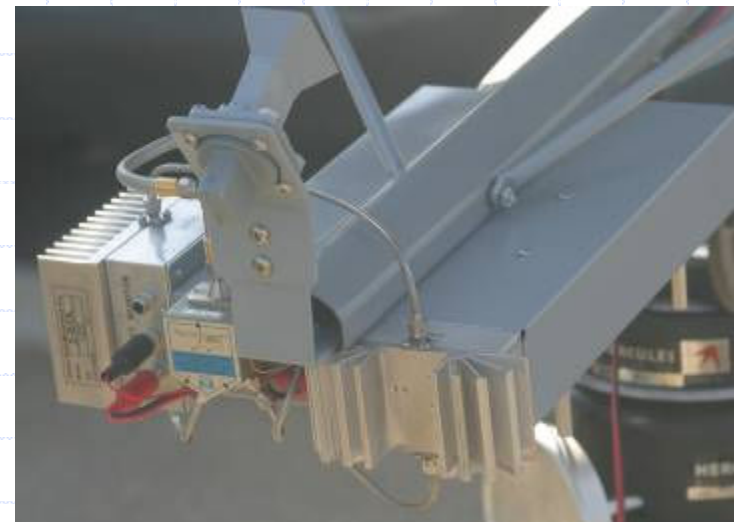


Receiver Improvements

- Noise Figure: Lower is better
- Minimize feedline loss
- No feedline = No feedline loss!



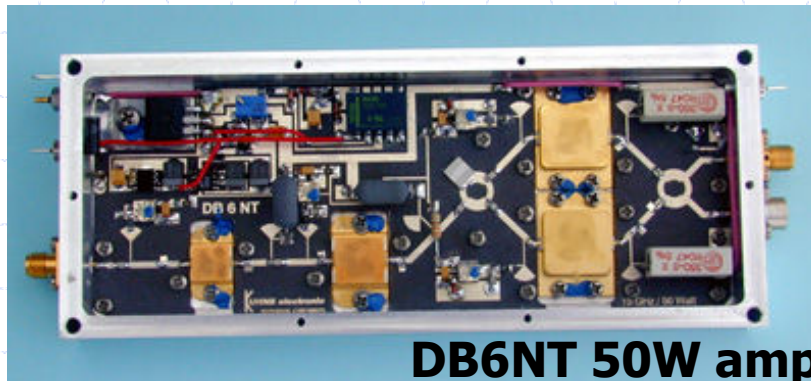
**Waveguide antenna feed and
T/R relay in FrankInspired 2**



**Close-up of W6QIW's 10GHz
rig. Less than 12-in. of UT-141!**

More Power!

- Amplifiers from the data and communications industries: Surplus!
 - Solid state power amplifiers (SSPA)
 - Replacing TWTA's
 - Travelling wave tube amplifiers (TWTA)
 - Used in satellite and terrestrial communications links
- Commercial ham-band units: Costly!



DB6NT 50W amplifier for 10GHz

Microwave Ham Radio Sources

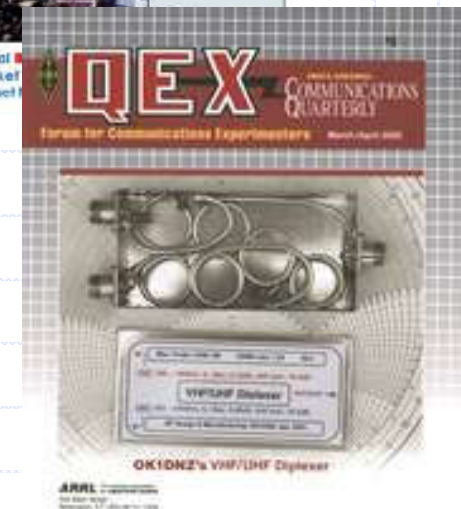
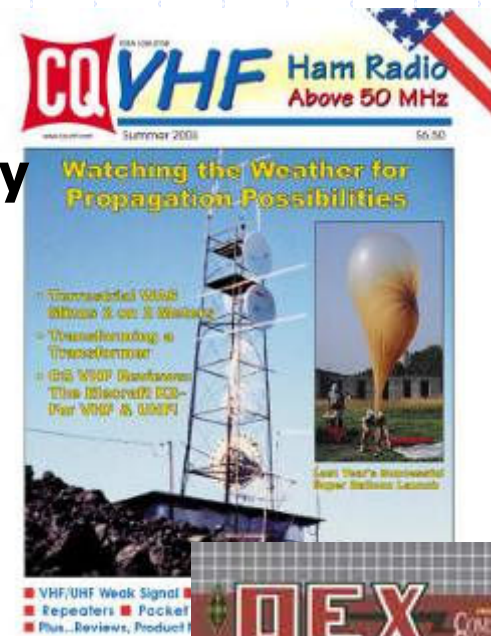
- Down East Microwave
- Kuhne Electronics (DB6NT, Germany)
- SSB Electronic
- JWM Engineering Group
- Reactance Labs
- Club meetings and e-mail reflector posts
 - SBMS
 - WA1MBA
 - 50 MHz and Up Group
- eBay

References & More Information

The San Bernardino Microwave Society
www.ham-radio.com/sbms/

***CQ and
CQ-VHF*** magazine
www.cq-amateur-radio.com/

QST & QEX
www.arrl.org/



Recent Articles. . .

- Lau, Zack KH6CP, "Home-Brewing a 10GHz SSB/CW Transverter, Part 1," *QST*, May 1993, p.21
- Lau, Zack KH6CP, "Home-Brewing a 10GHz SSB/CW Transverter, Part 2," *QST*, June 1993, p.29
- Yoshida, Wayne KH6WZ, "A Simplified Path to a High-Performance 10GHz Transverter System," *CQ-VHF*, Summer 2007, p.22
- Yoshida, Wayne KH6WZ, "Getting On 24GHz," *QST*, July 2007, p. 28
- Yoshida, Wayne KH6WZ, "A Successful Failure," *CQ*, December 2003, p. 78
- Yoshida, Wayne KH6WZ, "Microwaves: Not Just for Leftovers," *CQ*, January 2004, p. 68

Join us!



- Loaner rigs
- Roving partners
- Technical help
- Social events



What will your rig look like?

The San Bernardino Microwave Society

Founded in 1955, the San Bernardino Microwave Society (SBMS) is a non-profit technical organization dedicated to the advancement of communications above 1000MHz with a membership of over 90 amateurs from Hawaii and Alaska to the East coast and beyond.

Visit their website at <http://www.ham-radio.com/sbms/>

Wayne Yoshida, KH6WZ

- Licensed since 1976
- Amateur Extra Class ham radio license
- Contributing Editor, *CQ* magazine ("The Beginner's Corner," since January 2003, now "The Ham Notebook" since March 2010)
- Huntington Beach RACES Public Information Officer
- ARRL Hq. Public Information Officer
- Past president, UCLA Amateur Radio Group, W6YRA
- HF contester and DXpeditioner (W1AW, NK7U, W5RRR, 8P6BBS, 8P4B, 8P9BB, 7J1AFZ, J68DX, J68WZ . . .)
- Most memorable ham radio experience: Working in the Press Room at the NASA-Johnson Space Center (Mission Control, Houston, TX) during the first manned ham-in-space mission, STS-9/SpaceLab-1 (Dr. Owen Garriott, W5LFL, 1983)