

Amateur Radio

aka Ham Radio

A Lifelong Hobby
that promotes
Lifelong Learning



Larry Banks, W1DYJ

Licensed: 1962 (KN1VFX)

W1DYJ since 1966

Amateur Extra

33 Blueberry Hill Road

Woburn MA

W1DYJ ~ Larry Banks



INDEXA

Ham Radio ~ Agenda

- **Some Ham History**
- **The FCC – Why We Have These Frequencies**
- **Some Aspects of the Hobby**
 - **Science and STEM Education**
 - **Propagation and the Sun**
 - **Radiosport and “DXing”**
 - **Public Service and Emergency Communications**
- **Some Final Thoughts**



Ham Radio ~ History

Marconi: 1874 – 1937

First radio transmission – 1894

First Transatlantic transmission – 1901

Nobel Prize – 1909



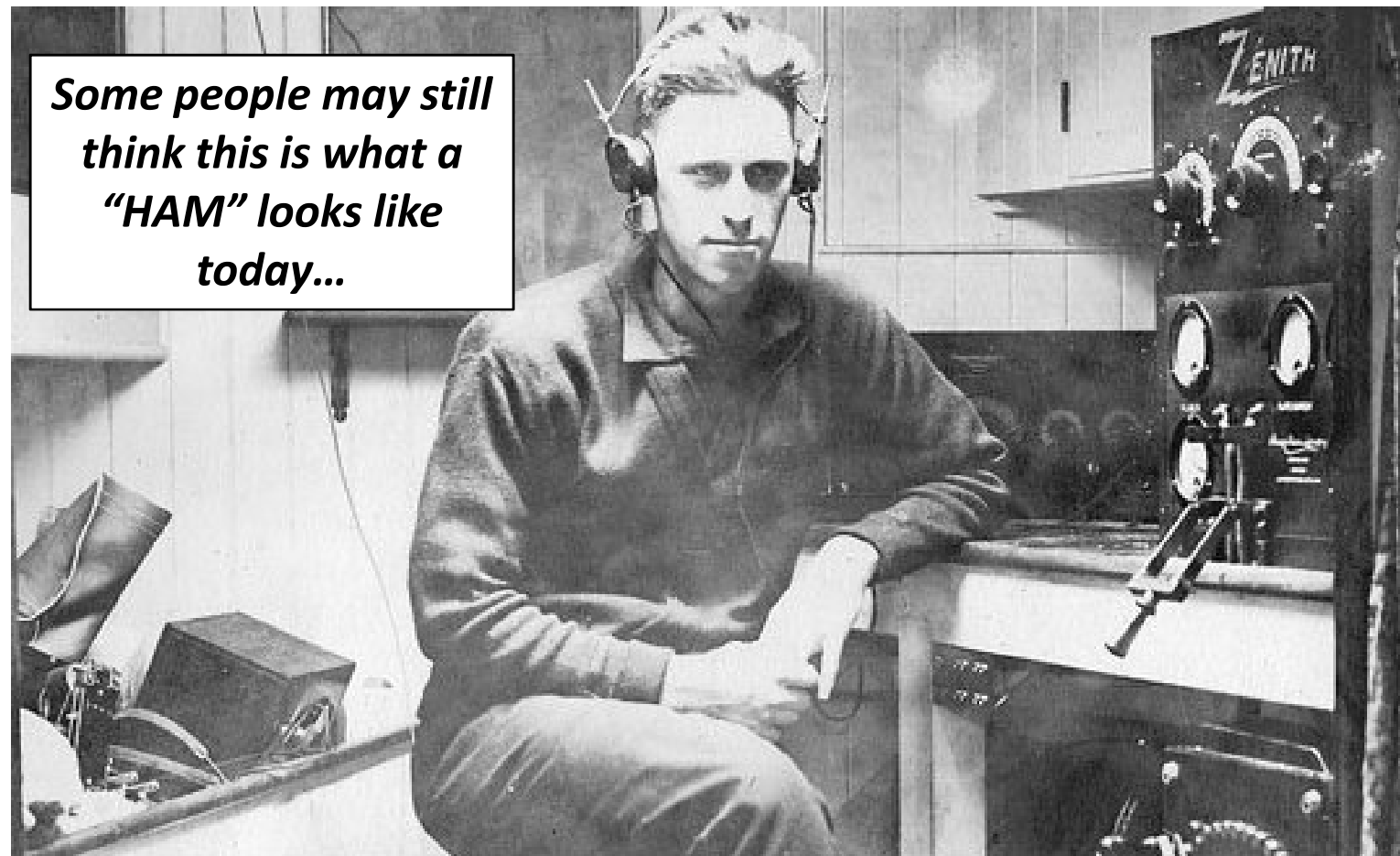
📷 Marconi with typical apparatus, including 10-inch induction coil spark transmitter (right), morse inker and grasshopper key in center. Print Collector / Getty Images



Ham Radio ~ History

- Morse Code [CW]

Note: Morse Code is no longer required for a ham license



Ham Radio ~ History

**In this day and age, why would
anyone care about Ham
Radio???**

I hope to answer this question.



Ham Radio ~ History

- Marconi: 1874 – 1937 -- The original DIY radio “Maker”!
- Morse Code [CW] The first digital communications method
an on/off sequence of bits for each letter
→ same as the 1s & 0s of modern communications



1940s Typical Shipboard Radio Room

Skógar Museum of
Transportation and Communication

Skógar Iceland



Ham Radio ~ History

Today – My Woburn “Ham Shack”



Ham Radio ~ History

Today – Some of my Woburn antennas



Ham Radio ~ FCC

**Why does the FCC allow Hams to
use these very valuable frequencies
for free
when many communications
companies want them too?**



Ham Radio ~ FCC

- **FCC Part 97: Ham Radio Reason for Being**

Title 47 CFR Part 97: Establishes the amateur service as a
"voluntary, noncommercial communications service"

devoted to **advancement of the radio art**

the **skills (technical and communications)** associated with it

expansion of the reservoir of **trained operators, technicians, and electronics experts**

and **international goodwill**

especially with regard to the provision of **emergency communications.**



Ham Radio ~ FCC

Ham Radio does require an FCC License:

- Technician Basic test of regulations and radio theory
Limited Frequency Privileges – VHF+
- General In the middle
Most Frequency Privileges
- Extra Advanced test
All Frequency Privileges

Multiple choice tests are given by volunteer hams



Ham Radio ~ FCC

Advancement of the Radio Art

Hams are “free” to follow our curiosity, and experiment without caring about profit

- **Hardware Receiver Architecture:**

- **Edwin Armstrong [1890-1954]** Superheterodyne (~1919)
Wide-band FM (~1933)
- **Software Defined Radio [SDRs]** Ulrich Rohde, N1UK (1982)
 - *Now: Wide-band ADC at the antenna input, all else is digital*

- **Modulation Techniques**

- **CW [Morse Code]** (Marconi)
- **AM and FM** (Armstrong)
- **WSJT family (77 bit word)** (2001 – present)
 - Developed by another Nobel Prize winner: Joe Taylor, K1JT
 - Receiving under the noise level [-24 dB s/n]



Ham Radio ~ One Aspect of the Hobby

Science and STEM Education



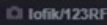
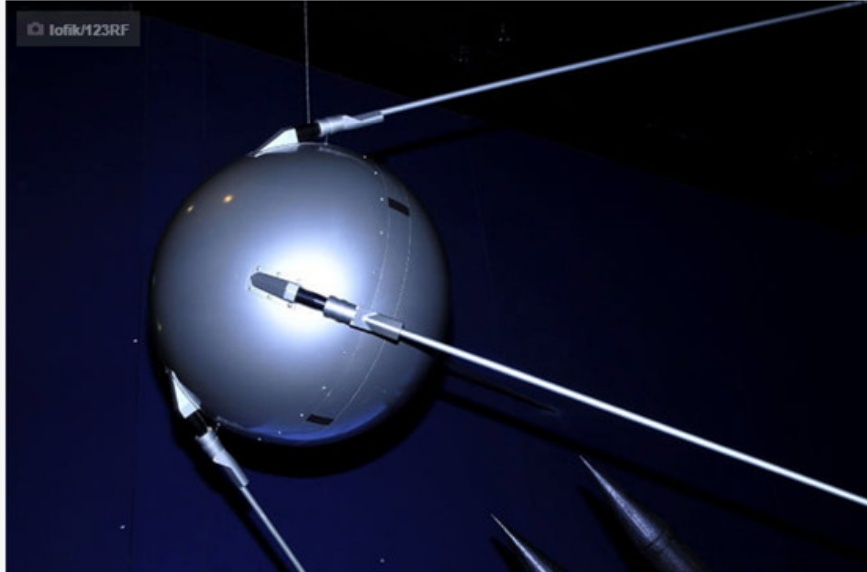
Ham Radio ~ Science and STEM Education

What happened 67 years ago on 4 Oct. 1957?

ONE OF THE ORIGINAL SPUTNIK-1 PROTOTYPES SELLS FOR NEARLY \$850K

By Luke Dormehl — Posted on September 27, 2017 2:41 pm

f 15 + Subscribe > Share

 **LG** 

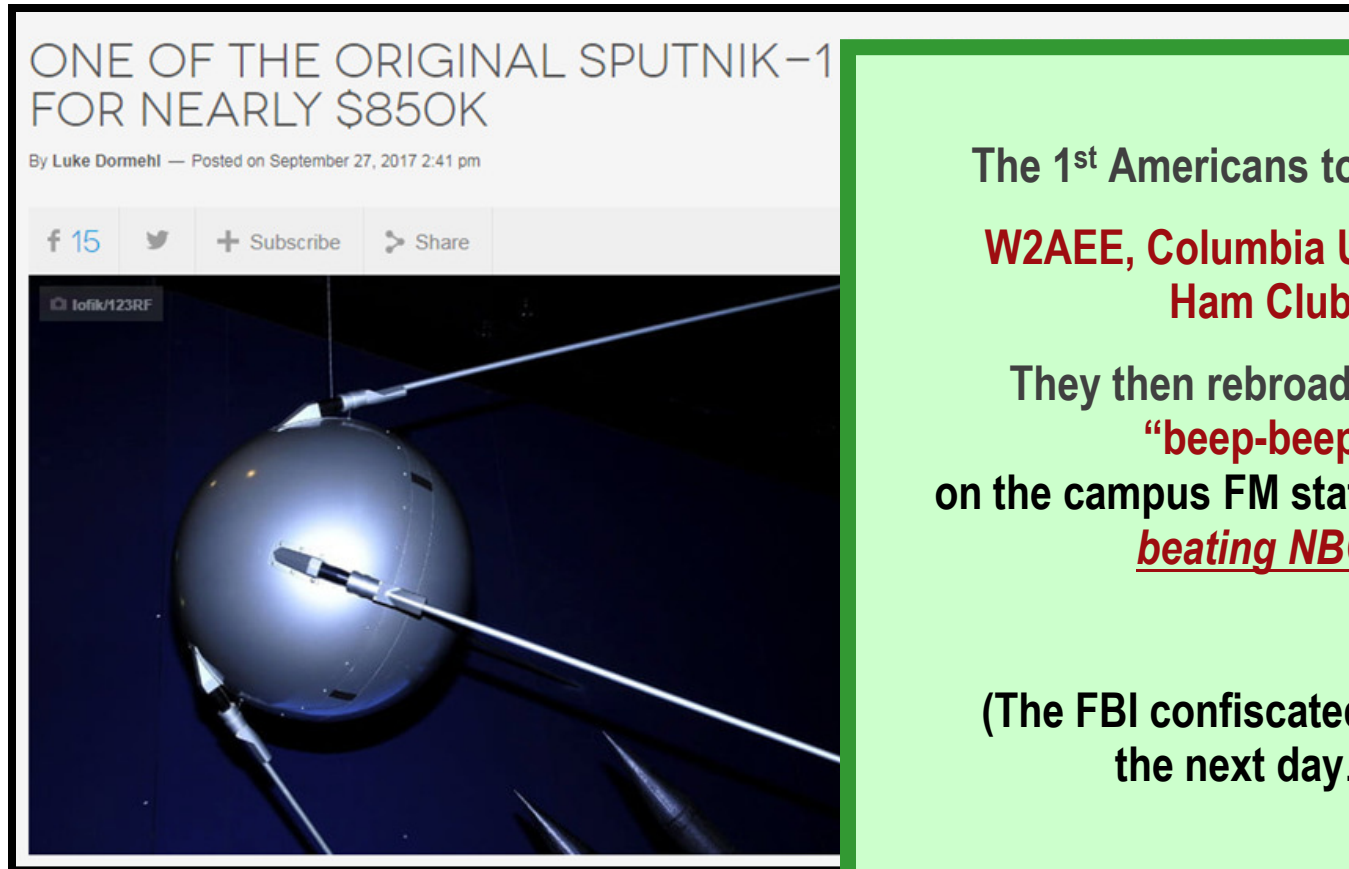
 The 50 best NES games of all time

 Why have 1 room when you can have 2? Our favorite transforming homes



Ham Radio ~ Science and STEM Education

What happened 67 years ago on 4 Oct. 1957?



The 1st Americans to record it:

**W2AEE, Columbia University
Ham Club**

They then rebroadcast the
"beep-beep"
on the campus FM station: WKCR,
beating NBC!

(The FBI confiscated the tape
the next day...)

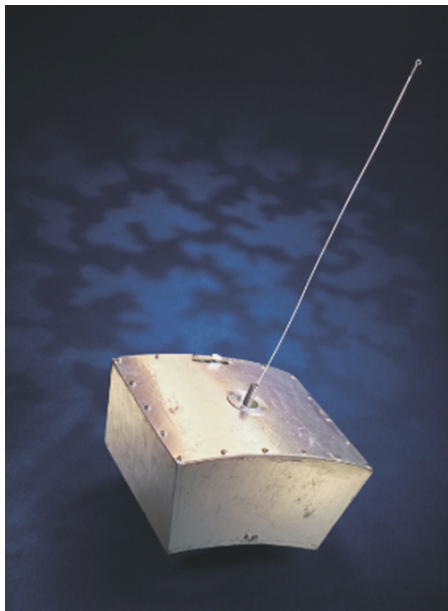


Ham Radio ~ Science and STEM Education

What happened 63 years ago on 12 Dec. 1961?

OSCAR 1

*Orbital Satellite Carrying
Amateur Radio*



Designed and built by Hams

The world's 1st piggyback satellite

The world's 1st private
non-governmental spacecraft

*"For me this project is symbolic of the type of
freedom for which this country stands – freedom of
participation on the part of individuals throughout
the world."*

VP Lyndon B. Johnson



Ham Radio ~ Science and STEM Education

A list of the 28 Currently Active Ham Satellites (21 Jan '24)

AMSAT Live OSCAR Satellite Status Page

This web page was created to give a single global reference point for all users in the Amateur Satellite Service to show the most up-to-date status of all satellites as reported by users around the world. Please help others and keep it current every time you access a bird.

Transponder/Repeater active	Telemetry/Beacon only							No signal	Conflicting reports	ISS Crew (Voice) Active
Name	Jan 21	Jan 20	Jan 19	Jan 18	Jan 17	Jan 16				
AO-123	13	1	2 2 1 1 1	1 3 1	1 3 1	2 2	1			
AO-73	1	2 1	1 1 2 1	1 1	1	1	2			
AO-7[A]			1 1 2	1						
AO-7[B]	1 1 1 1 1	1 1 1 1 2	1 1 1 1 2 2	1 1 1 2 3 1 1	1 1 1 1 1	3 2	1 1 2 3 3	3 2 1 1 1	1 1 2	
AO-91	2 1	2 1	1 2 1	1 1	1 1	2 1	1	1	1	2
DSTAR1	1		1							
FO-118[V/u]			1 1		1					
FO-29	1 1 1	1 1	1	1 3	2 1 1	2 1	2	1 1 1	1	1 1 1
HO-113			1			1				
IO-86	1	1	1 1 1 1	1	1	1 1 3 1				
ISS-DATA	2 1 2	2 2 3 3	1	1 1 2 1 2	1	2 2 1	1 2 2	1 2 3	2	1 1 1 1
ISS-FM	7 1 4 4 3	1 2 1 1 2 3 4 6 8 1 1	1 3 2	1 6 3 3 7 2 1 1 5 3 3 1 2 7 3 6 4	3 3 1 1 1 1 7 4 7	2 2	2 2	2 3 1	3 1	2 1 2 2 4
ISS-SSTV		1								
JO-97	1 4 1	1 1 2 1 5 2 1	1	1 1 1 1 6 1 1 2 1	1 3 1 3 1	1 1	2 1 2 3 1	2	1	1 1 3 1 2 1 1
LilacSat-2			1							1
MO-122	1	1	1 1 1 2 1	1	3 1	2 1	2 1 1	1 1	2	2 1 1
NO-44				1	1			1		
PO-101[F]	2	1	2	1 2	1 1 1	1	1 1	1 1 2	1 2 2	3 1
QO-100_NB	1 2 5 2 4 2 1	3 3 2 1	3 1 3 1 5 3	1 6 6 3 3 5 2 1 2	1 4 6 5 2 2 6 7 1	6 1	2 2 2			
QO-100_WB			1							
RS-44	1 1 1 3 5 1	1 1	4 4 6 4 3 2 1	1	4 2 3 3 2 3 4	3	1 1 3 4 6 4 3	1 1	1 1 4 3 3 3	2 1
SO-50	1 4 6 2 5 2	1 4	2 2 1 6 1	1	3 3 5 4 6 3 1	1	1 3 4 1 7 5	1	3 1	3 2 4 6 1
SONATE-2APRS		3	1 1	1			1		1	
TO-108	2			1			1	1		
UO-11[B]	1	1	1	1	1	2				1 2
XI-IV			1							
XI-V							1			
XW-2C				1				1		

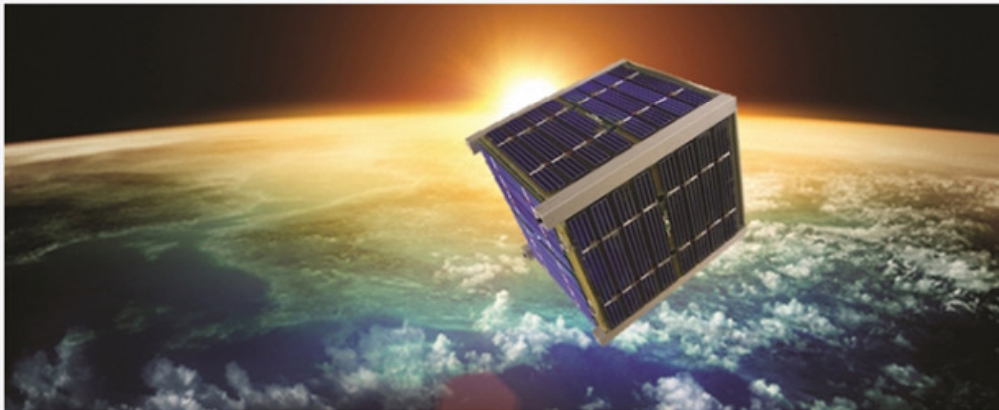


Ham Radio ~ Science and STEM Education

CubeSats

February 1, 2016

Many colleges are designing and building CubeSats



United Launch Alliance has announced a new program for launching the nation's CubeSats as secondary payloads free of charge on its Atlas V rockets. For more information, please visit ULA's website.



Ham Radio ~ Science and STEM Education



Cubes in Space

Cubes in Space™ is the only program in the world to provide students (ages 11-18) with a free opportunity to design experiments to be launched into space on a NASA rocket or balloon!

Local participant: New England SciTech, Natick



Ham Radio ~ Science and STEM Education

Space Station



Astronaut Sunita Williams, KD5PLB, talking to students from the ISS ham radio station in 2017.

...She's still up there! (as of 6 March 2025)



- International Partnership of the IARU
- Started with the Shuttle in 1983
- School Program / Ham TV / Recreation

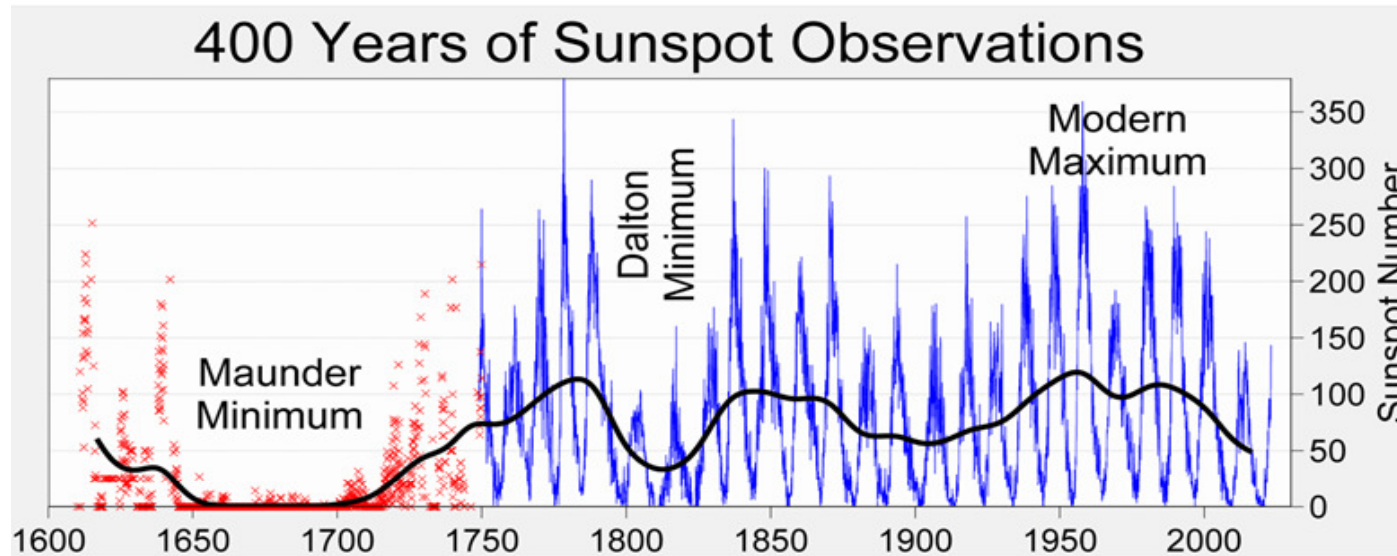


Ham Radio ~ Another Aspect of the Hobby

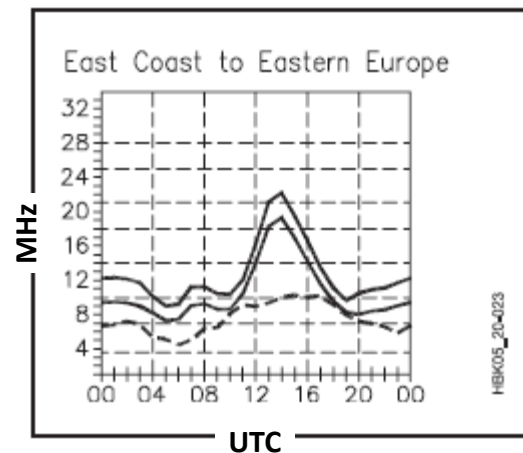
Propagation and the Sun



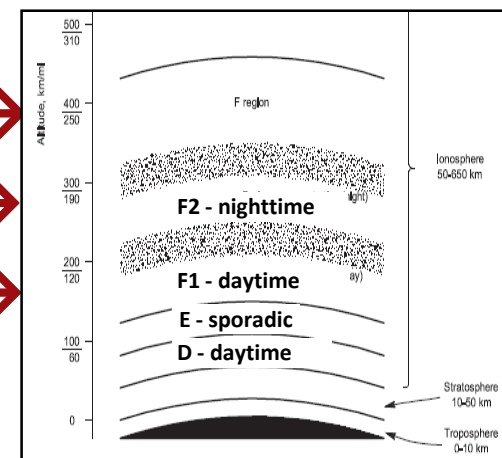
Ham Radio ~ Propagation and the Sun



The
Sunspot
Cycle



The
Diurnal
Cycle



The
Ionosphere



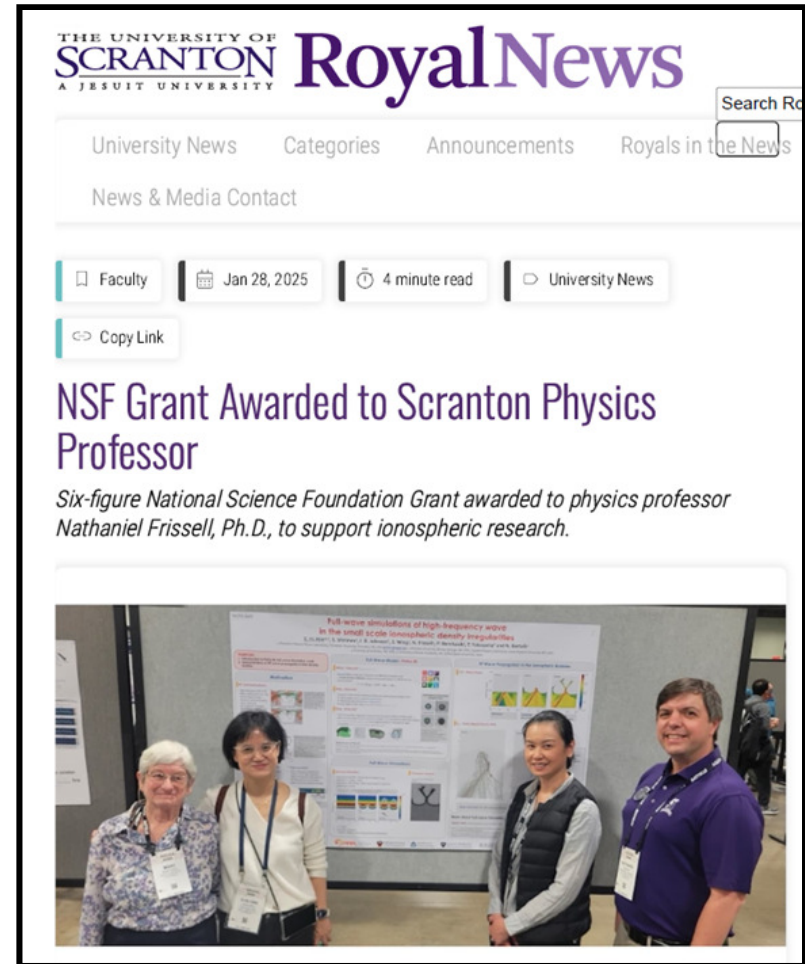
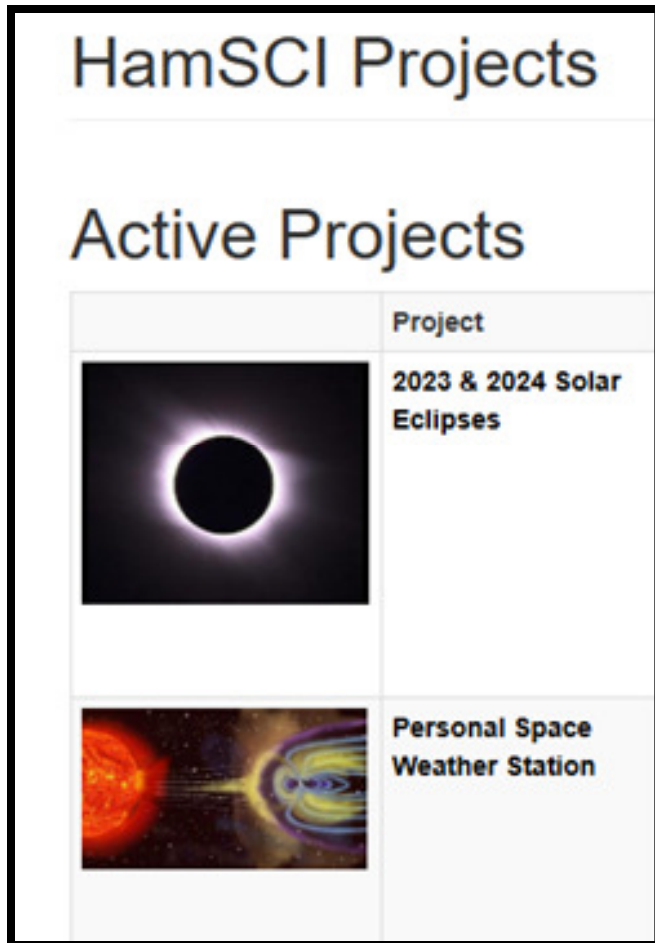
Ham Radio ~ Propagation and the Sun



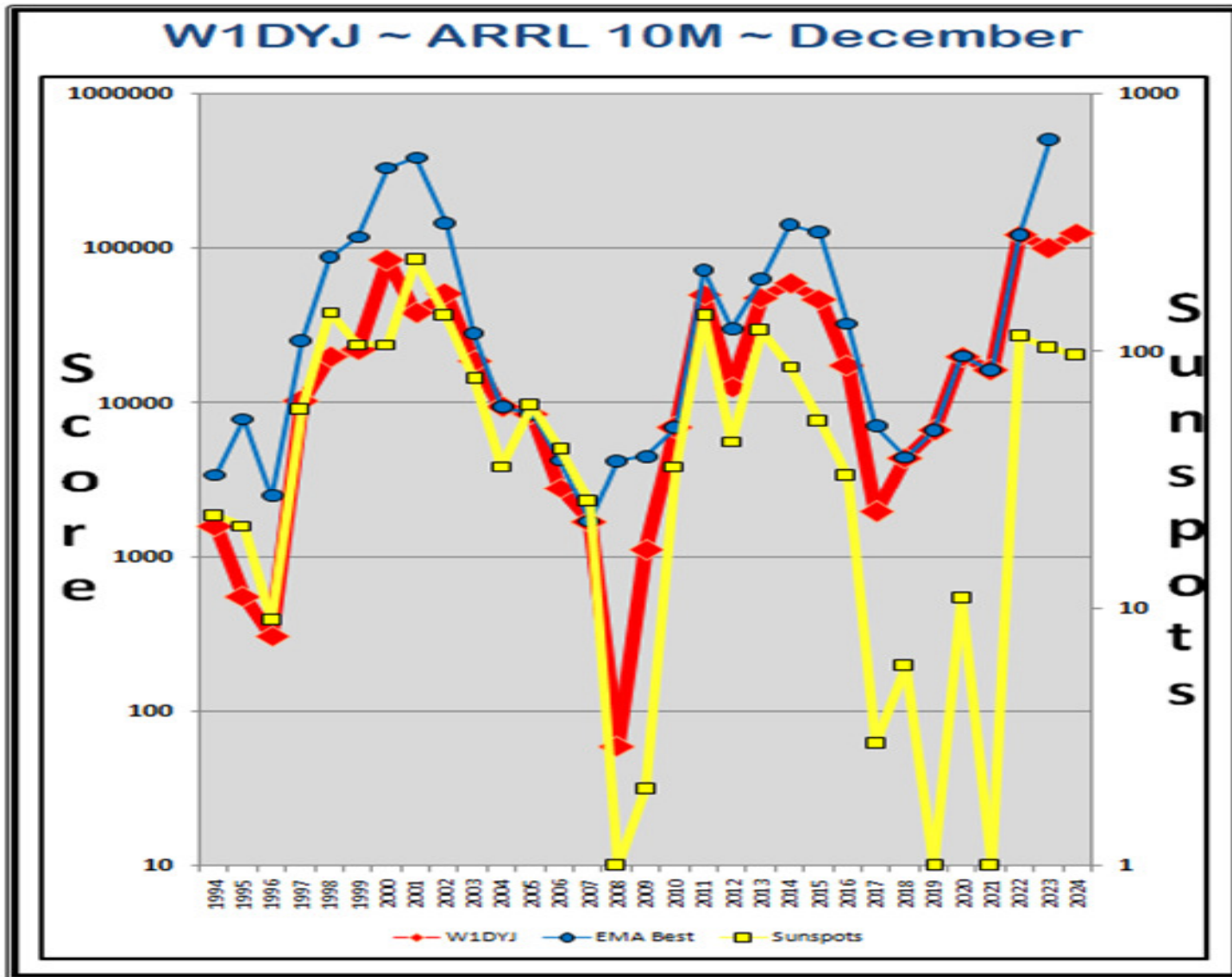
The screenshot shows the HamSCI website. The header has the HamSCI logo and a navigation menu with links: About, Get Involved, Projects, Meetings, People, Resources, Publications and Presentations, Data, and a Search icon. The main content area features a large banner for "HamSCI 2025" with the text "HamSCI Workshop March 14-15" on the left and "NJIT Newark, NJ" on the right. Below the banner is a section titled "Ham Radio Science Citizen Investigation" with three bullet points: "Advance scientific research and understanding through amateur radio activities.", "Encourage the development of new technologies to support this research.", and "Provide educational opportunities for the amateur community and the general public."



Ham Radio ~ Propagation and the Sun



Ham Radio ~ Propagation and the Sun



The
Sunspot
Cycle

...and
contest
scores



Ham Radio ~ Another Aspect of the Hobby

Radiosport and “DXing”



Ham Radio ~ Radiosport and “DXing”

Radiosport

Formal competition among and between ham operators

*How many other hams can I communicate with
(given a specific “exchange”)
in how many different places
in a given amount of time?*

One of my favorite ham activities – I compete in from 25-30 each year.

These contests range from local four-hour contests to world-wide 48-hour contests, culminating in the “Olympics” of Radiosport, the

World Radiosport Team Championship

where (every 4 years) the top 50 testers in the world compete.



Ham Radio ~ Radiosport and “DXing”

DXing

DX: Short for Distance

Another type of long-term competition.

I equate it to Bird Watching – with its “Lifelists,” etc.

The granddaddy of awards: **DXCC – DX Century Club**

Basic Level: 100 **Entities** confirmed, any mode/frequency

Endorsements: by mode and frequency

Honor Role: 331 of the 340 total world-wide entities

There are MANY OTHER DX awards: **WAS** [Worked All States]

“DXpeditions”: groups travel to weird places



Ham Radio ~ Radiosport and “DXing”

DXing

DXCC for W1DYJ as of 28 January 2025

Overall = 296

Band	160	80	60	40	30	20	17	15	12	10	6
MHz	1.9	3.6	5.3	7.1	10.1	14.1	18.1	21.1	24.9	28.3	50.1
Overall	92	141	106	193	198	260	223	248	213	227	86
Phone	7	74	0	118	na	186	50	155	25	177	27
CW	59	96	0	145	90	171	36	153	33	139	13
Digital	67	109	106	139	156	151	187	175	170	108	78

All done with low power and modest antennas.

Confirmations: QSL Cards or Electronic DB (Logbook of the World)



Ham Radio ~ Radiosport and “DXing”



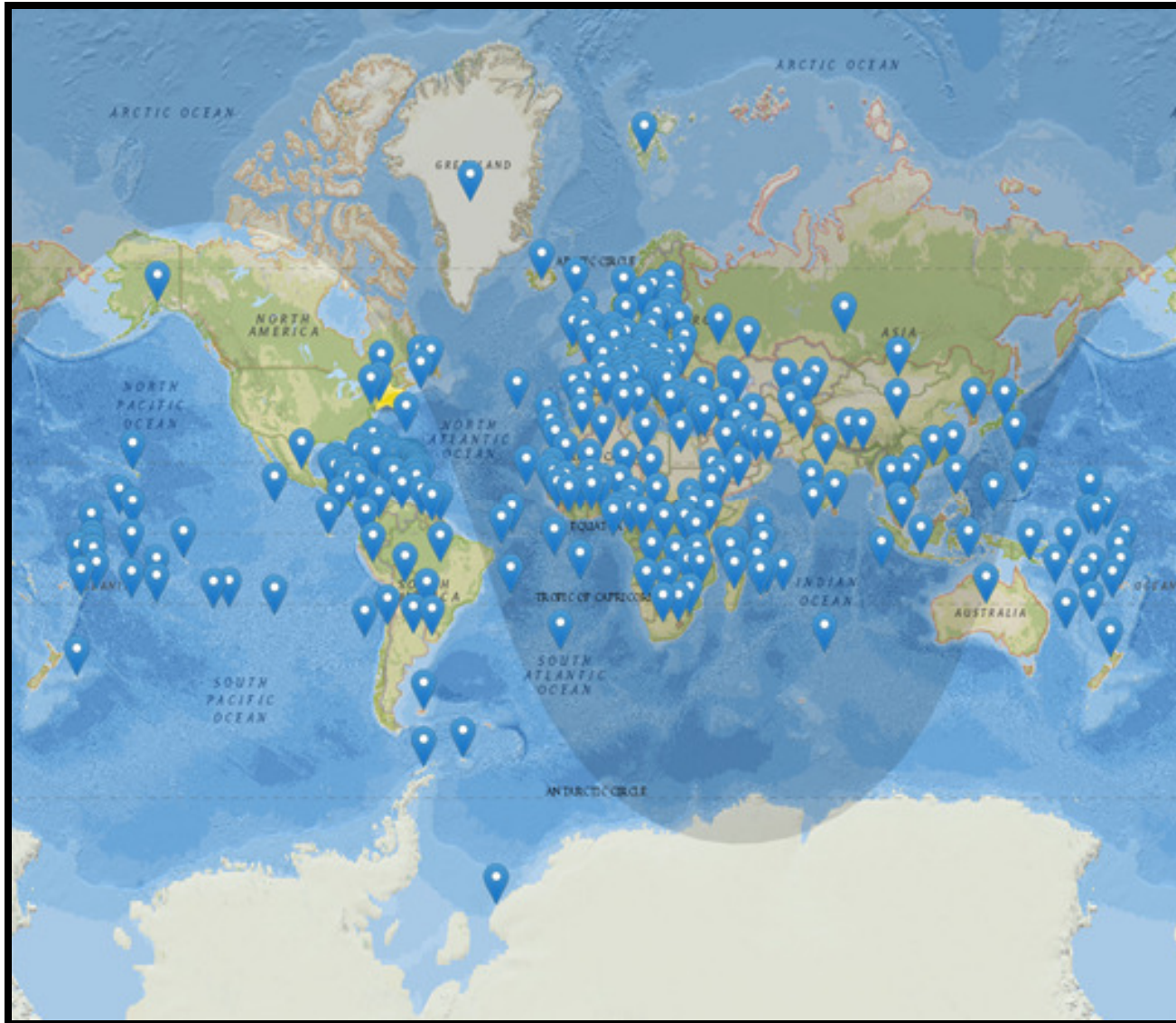
Ham Radio ~ Radiosport and “DXing”



Ham Radio ~ Radiosport and “DXing”

Geography

The 296
“Entities”
I have
confirmations
from.



Ham Radio ~ Radiosport and “DXing”

Geography

The 44
“Entities” left



Ham Radio ~ Another Aspect of the Hobby

Public Service and Emergency Communications [EmComm]



Ham Radio ~ Public Service and EmComm

Many hams help their communities in good times and bad, through community events, disaster response, and various programs.

- The Boston Marathon
- Head of the Charles
- Working with
 - American Red Cross
 - FEMA
 - Civil Air Patrol
 - local agencies – police, fire...
 - etc...
- SKYWARN



Ham Radio ~ Public Service and EmComm

Minuteman Repeater Association

The Minuteman Repeater Association is a non-profit organization providing communications infrastructure and volunteers for community and emergency events.

“Nets” on the MMRA System

Technical Information & Other Stuff Net

Tuesday night at 8:00 pm local.

Heavy Hitters Traffic Net

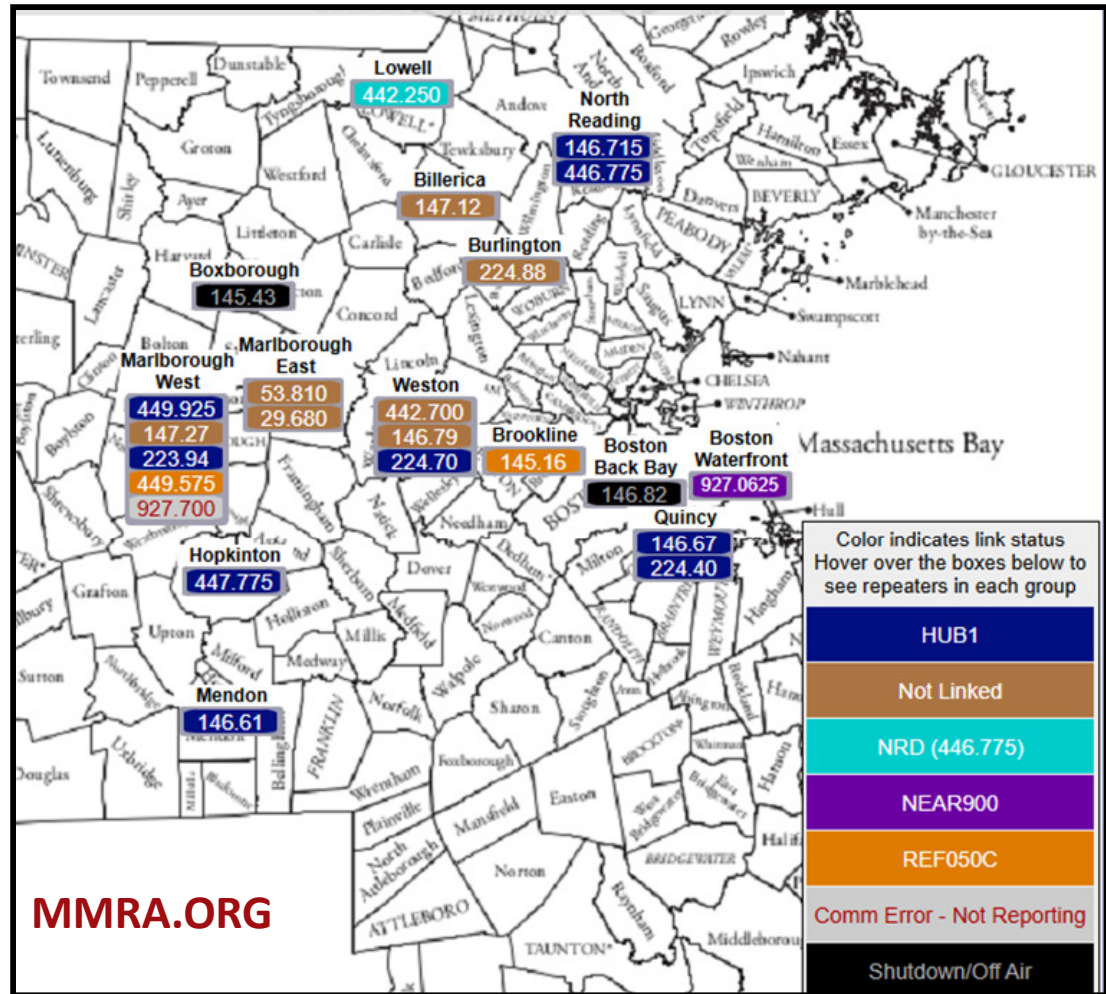
Evenings from 9:45—11 PM

Coast Guard Auxiliary Net

Sundays at 11:00 AM local

Amateur Radio Emergency Service Net

First Monday at 8:30 PM local.



Ham Radio ~ Public Service and EmComm

9-11

When All Else Fails

Katrina

**Recent
Hurricanes**

**Recent
Wildfires**

Because Ham Radio operators build stations that are independent of infrastructure, and “off-the-grid” in many cases, they can be the communicators of last resort.



Ham Radio ~ A Lifelong Hobby

A Few Other “sub-Hobbies”

- Radio Control: Model Airplanes, Boats, Cars...
- Radio Direction Finding – “Foxhunting”
- “*EME*” – earth-moon-earth communications
- Restore and operate vintage radios
- POTA, SOTA, IOTA, LOTA...



Ham Radio ~ A Lifelong Hobby

Some Final Thoughts

Ham Radio Organizations

International: IARU

International Amateur Radio Union - 1925
Subgroup of ITU, under UN
165 Member Societies

National: ARRL

Amateur Radio Relay League - 1914

Regional: YCCC , NEWS

Yankee Clipper Contest Club
North East Weak Signal Group

**Local: MMRA [eastern MA]
Local ["city/town"]**



Ham Radio ~ A Lifelong Hobby

Some Final Thoughts

Ham Radio brings people together.

**During COVID I had just as much interaction
with PEOPLE as normal – due to contests, and
DXing – as they are done “remotely.”
(And clubs went to ZOOM.)**

**Relationships with PEOPLE is a key element in
staying healthy while aging.**



Ham Radio ~ A Lifelong Hobby

My Personal View of Ham Radio

**A Lifelong “*Maker*” Hobby
that fosters Science, promotes Relationships,
encourages Lifelong Learning
and is an essential link in
Emergency Communications**

A four-pronged approach to lifelong learning:

Projects Peers Passion Play

Joi Ito, ex-Director, MIT Media Lab



Thank You!

<https://www.qsl.net/w1dyj/>



Abstract

Amateur “Ham” Radio is a hobby that attracts people with a wide range of interests. Many amateurs begin with a fascination with radio communication and then combine other personal interests to make the hobby rewarding. Some of these areas include technical experimentation, radio propagation and solar weather, radio contesting, and public service communication. Larry will discuss some ham radio history and then highlight the above areas.

Bio

Larry became a ham in High School in 1961. He then earned three degrees in EE from MIT. Hired by Hewlett-Packard Medical's cardiac lab in 1969, Larry was an engineer and then a manager in Waltham and Andover MA. He moved to HP Medical Education in 1993, responsible for technical and project management training. When Agilent split out of HP in 1999, Larry became Agilent Technology's global program manager for their Learning Management System. "Retiring" in 2005, he then consulted for Avago (now Broadcom) on eLearning technologies through 2012. Larry now spends his time “playing” ham radio in Woburn, traveling with his wife Maren, and attending or streaming jazz and classical concerts.



Ham Radio ~ Who Am I?

- Mom was a high School cafeteria worker. Dad was an electrician and had a dual workshop: woodworking and electronics (my two continuing favorite hobbies). They both highly valued education.
- As a kid: I “played” in his workshop, had an erector set, and read all the **Tom Swift** books...
- Built a **crystal radio** when I was 12 (1958) –the first station heard was the BBC and I was **hooked on radio**.
- Obtained my ham radio license at 15 in 1961 (a junior in HS).
- Went to MIT (SBEE’67, SMEE’69, EE’70)
in part because of my ham radio experience.
- Hired (1969) by HP Medical (Waltham/Andover) developing hospital cardiac instrumentation (electrocardiographs, then real-time cardiac ultrasound)
in part because of my practical experience with ham radio.
- Moved to HP/Agilent Corp Ed (project management experience) in 1993
- “Retired” in 2005; then part-time consulted for Avago (now Broadcom) as their eLearning platform WW PM
- Finally retired (for real) in 2012 – **now play with ham radio**

