Ham Radio 101

Jeff Schmidt N5MNW

AARC Meeting 6 Nov 2018

CAUTION!
Ham Radio Zone
Turn Off -All-
Blasting Equipment

Ham Radio 101 DE N5MNW

A Basic Overview/Intro of Amateur Radio

Very Informal, please feel free to ask questions

Short Intros(If time allows):

Name, Call(if any),

How Started, Main Interest

Who The Heck Is N5MNW?

First interest at age 11(ckts/AM-FM b'cast)

Semiconductor Engineering(T2,Mot,FSL,NXP)

KB5FSE-N5MNW- 5wpm Novice in 1988!

Upgraded to Tech soon afterward

General w/13WPM code- barely

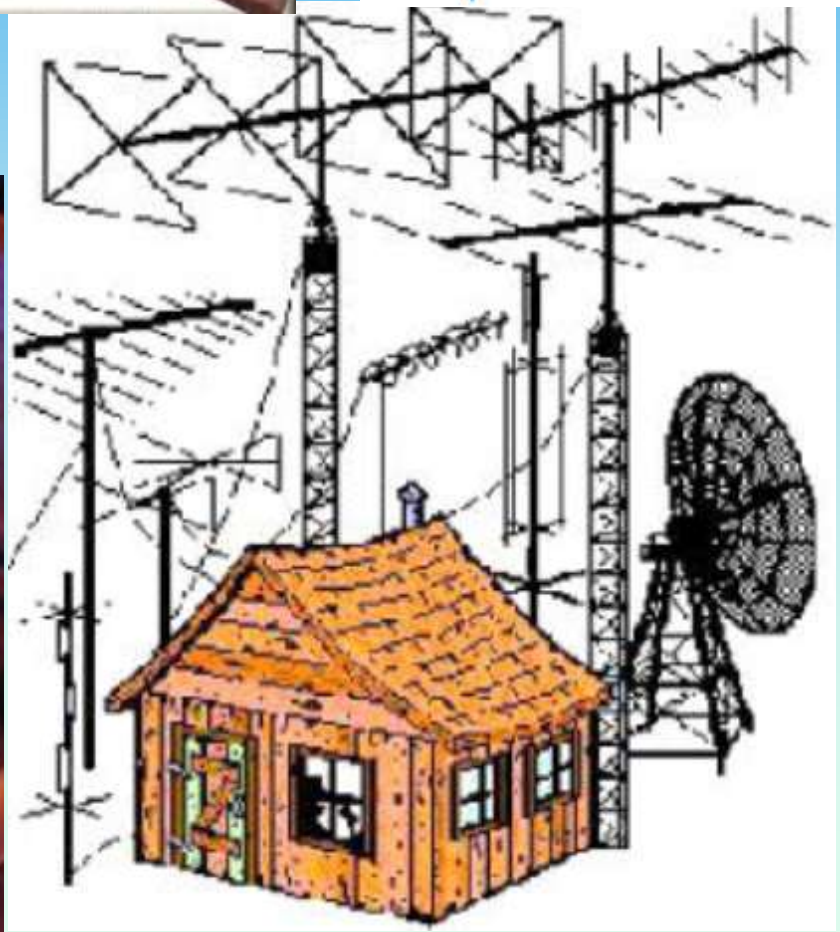
Advanced by 88's year's end

Stagnated there until KM5MQ's 20wpm Extra…

OK, so I'm a Slow-Code Extra…

A Little Ham History...

ARRL 100 YEARS



Origins of the word “HAM”

- No One –Really- Knows…
- "Ham-fisted" or "Ham-handed" indicating non-optimized CW sending skills
- A self-effacing term (As in “Ham Actor”)
- The acronym "Home Amateur Mechanic“

  (Early Publication like today’s- MAKE: Magazine)
- And, considering the investment one could make in the hobby“: Hardly Any Money"

Acronyms- Electronics is Absolutely -FULL- of Them!

- AF= Audio Frequency
- RF= Radio Frequency
- HF/SW= High Freq/ShortWave 3-30 MHz
- VHF= Very High Frequency 30-300 MHz
- UHF= Ultra High Frequency 300 MHz-3GHz
- UV= Ultra Violet
- CW= Continuous Wave(Morse Code)
- RTTY= Radio TeleTYpe
- DMR= Digital Mobile Radio

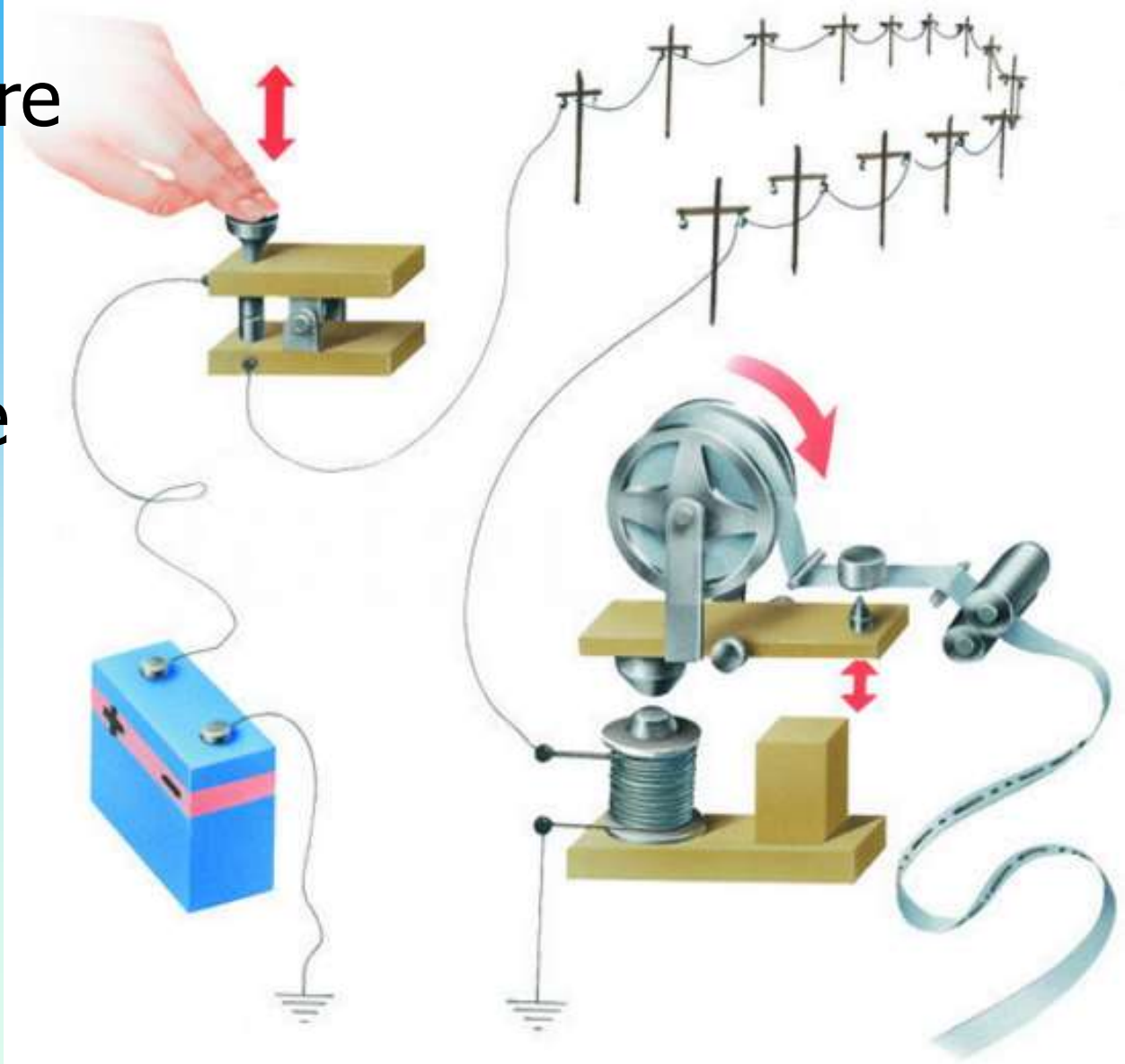
Amateur Radio History

- Many Abbreviations & Jargon came from Morse Code ops shortening sending time
- "R" in Morse Code=Received, hence "Roger"
- 73=Best Regards(rhythmic clap, too)
- 88=Love And Kisses
- DE=From
- Q-Signals i.e. QTH = Location, etc
- SOS(CW) MAYDAY(Voice)=Emergency
- "Break"- Morse Code Stations Were in Series

Morse Code, the first Digital Mode

Key Switch Closure

Causes Solenoid "Click" at Receive Site, Inking or Punching Holes In "Ticker Tape"



Morse Code, the first Digital Mode

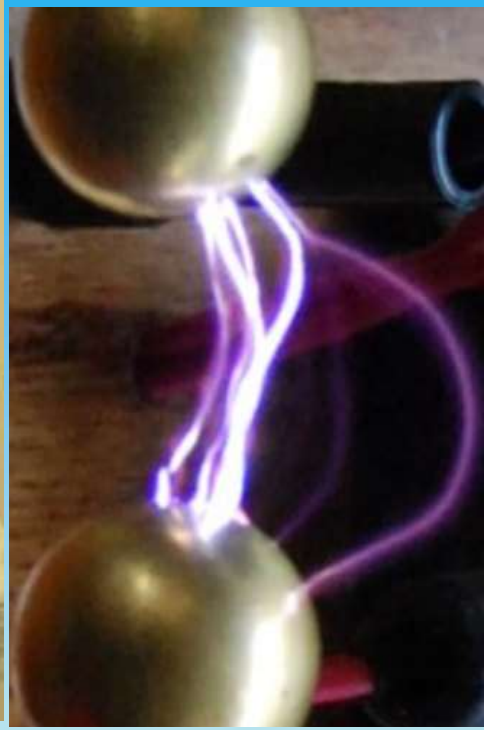
Initially not Meant to be "Heard"
But Read from Tape Reels

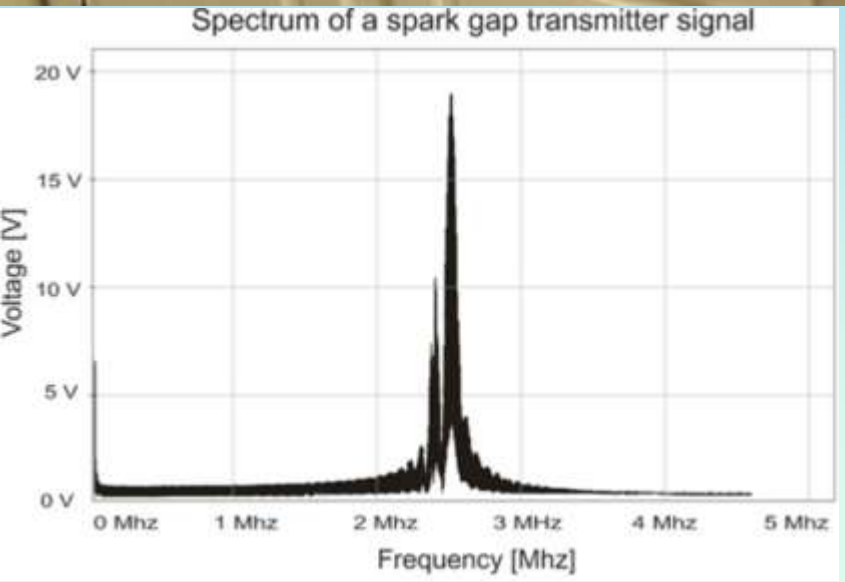
Operators Began to Decode
Clicks, saving Tape and $

Employed Vulnerable Wires

Wireless Radio History-1880-1900's

- Scientists & Experimenters Developed Techniques That Led To Wireless Signaling
- Employed Spark Gap Technology
- Wavelength Conceptualized
- Marconi Demonstrated Wireless Worked Across Atlantic Ocean
- Spark Gap Replaced Wireline Telegraphy
- Controlled Constant Wave(CW)Replaced Spark





Harry Hyder, W7IV, while taking a nostalgic trip backward from solid state to vacuum tubes to spark, wrote in March, 1992 QST: “REAL radios glow in the dark. The REALEST real radios Whined, Roared and Hurled Blue Lightning.”

Amateur Radio History ~1900-Today

- Spark Gap(the First Broadband HamNet) gave way to controlled narrowband oscillators
- American Morse to International Morse Code
- Morse Code competed w/ New "Phone" Modes
- AM gave way to SSB & FM
- Digital Modes & Internet entered the scene…
- Higher and Higher frequencies
- Each of these milestones heralded:

"The End Of Ham Radio As We Know It"

MNW says- GOOD!!!

Inside Look at Tube Operation

Orange to whitehot Filaments and blue emissions make

"real radios"

"glow in the dark"

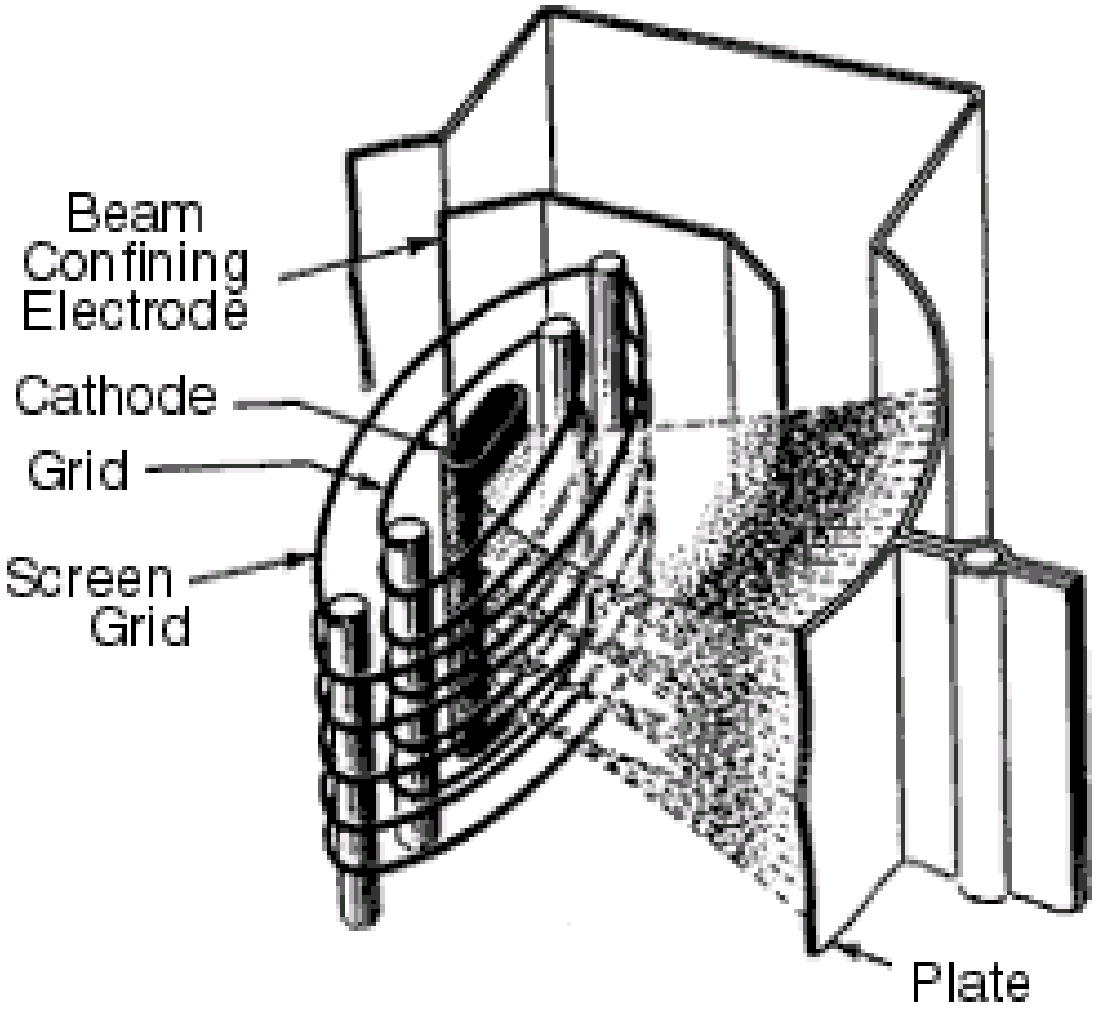
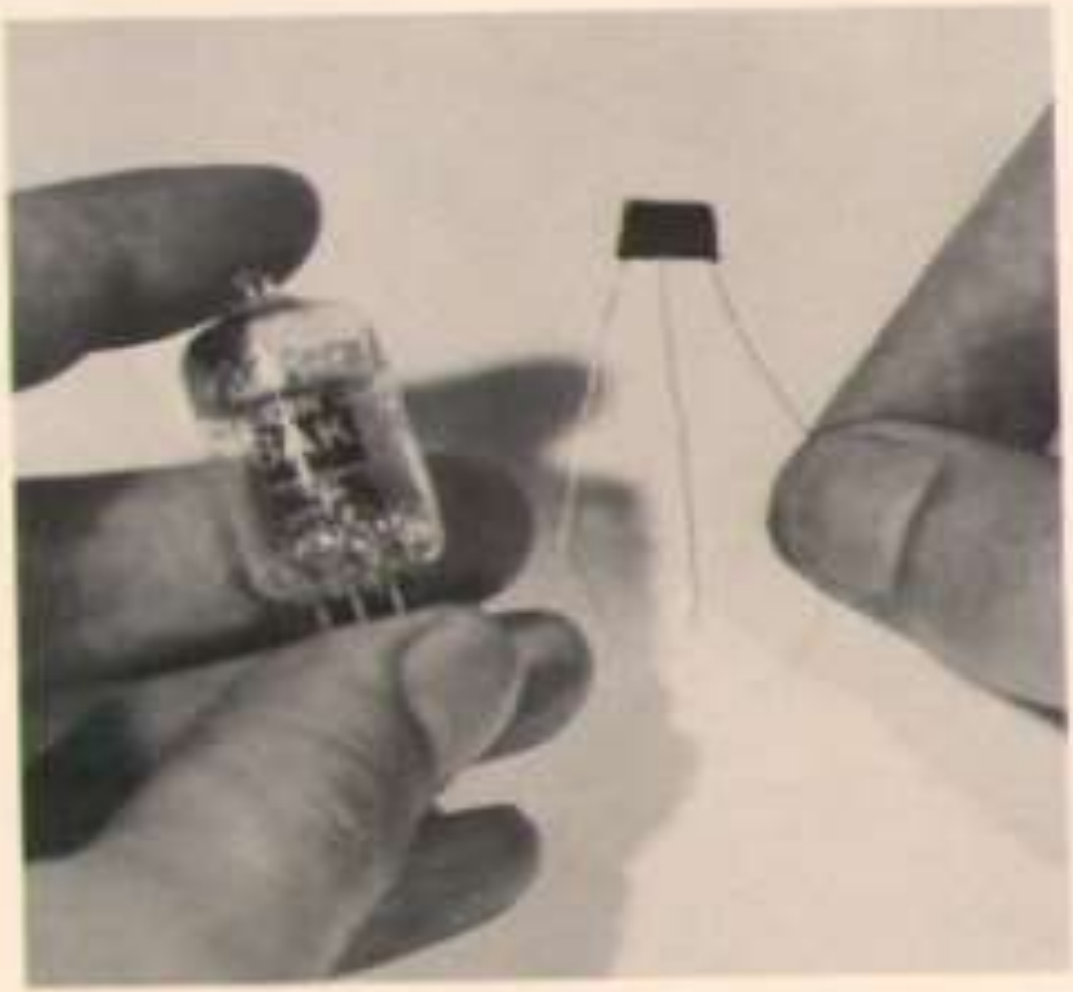


Figure 7 - Inside an audio beam tetrode

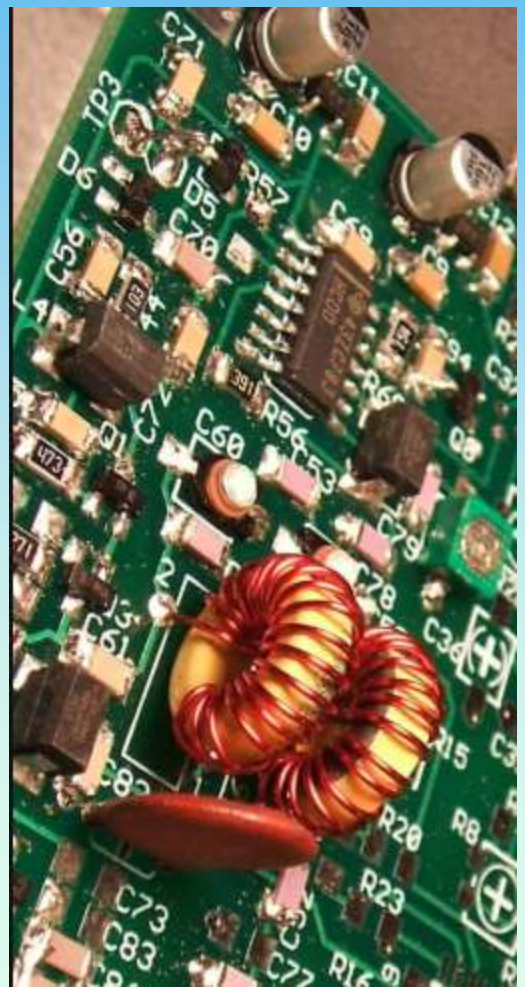
Tube and Transistor



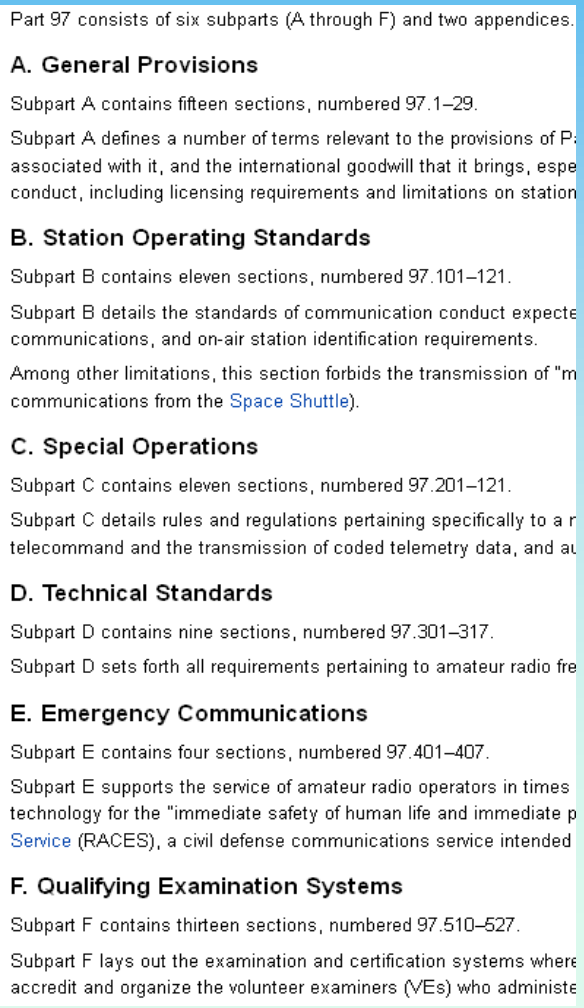
NEW LITTLE WONDER of the electronics world was the transistor, shown here (right) with the conventional vacuum tube it was expected to supersede. Heatless and requiring energy of only one-millionth of a watt, transistors could provide concentrated power for new electronic equipment impractical to build with power-wasting tubes.

Solid State

Solid state revolutionized electronics, making pocket-sized Amateur Radio stations(and cellphones) an everyday reality



What The Heck Is Ham Radio?



Part 97 consists of six subparts (A through F) and two appendices.

A. General Provisions

Subpart A contains fifteen sections, numbered 97.1–29.

Subpart A defines a number of terms relevant to the provisions of P
associated with it, and the international goodwill that it brings, espe
conduct, including licensing requirements and limitations on station

B. Station Operating Standards

Subpart B contains eleven sections, numbered 97.101–121.

Subpart B details the standards of communication conduct expecte
communications, and on-air station identification requirements.

Among other limitations, this section forbids the transmission of "m
communications from the Space Shuttle).

C. Special Operations

Subpart C contains eleven sections, numbered 97.201–121.

Subpart C details rules and regulations pertaining specifically to a r
telecommand and the transmission of coded telemetry data, and au

D. Technical Standards

Subpart D contains nine sections, numbered 97.301–317.

Subpart D sets forth all requirements pertaining to amateur radio fre

E. Emergency Communications

Subpart E contains four sections, numbered 97.401–407.

Subpart E supports the service of amateur radio operators in times
technology for the "immediate safety of human life and immediate p
Service (RACES), a civil defense communications service intended

F. Qualifying Examination Systems

Subpart F contains thirteen sections, numbered 97.510–527.

Subpart F lays out the examination and certification systems where
accredit and organize the volunteer examiners (VEs) who administe

Defined in FCC Rules Part 97:

...the amateur service as a "**voluntary**, **noncommercial** communications service" devoted to **advancement** of the amateur art, the **skills** associated with it, and the **international goodwill** that it brings, especially with regard to the provision of **emergency communications**. It also establishes the basic constraints and rights that pertain to amateur licensing and conduct, including licensing requirements and limitations on station equipment and power output.

What The Heck Is Ham Radio?

A "Hobby" Radio Service that Works When Others Fail, Often Used as B/U When They Do!

What The Heck Is Ham Radio?

Does Not –Rely- on Delicate Infrastructure- AC Power Grid, Cellsites or Internet

What The Heck Is Ham Radio?

Does not –replace- Telephones/Cellphones

Not better/faster than the internet, Just more robust & reliable when things go FUBAR

It is primarily a Technical & Communication "Hobby" with Important Ties to Disaster Preparedness

Examples, Anyone?

What The Heck Is Ham Radio?

Electronic Education thru Experiences

Contesting or Practicing thru Drills, etc.

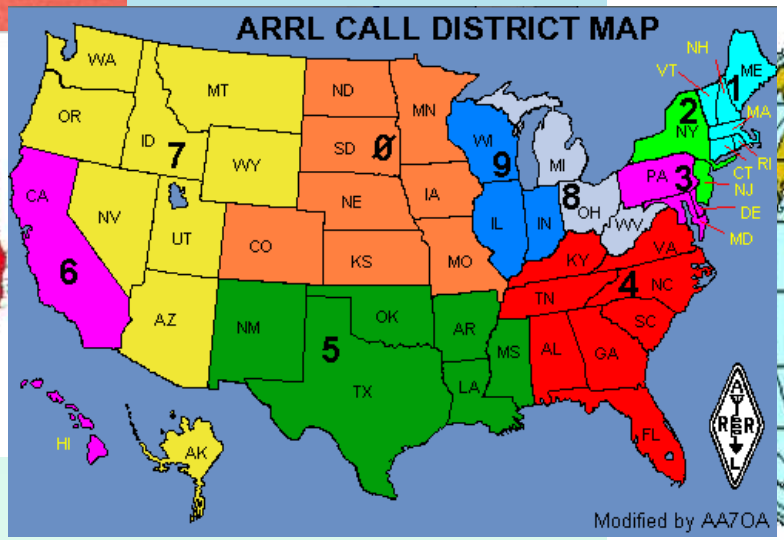
"Play" Radio Enough and You Become a Real-Life Expert on Many Aspects!

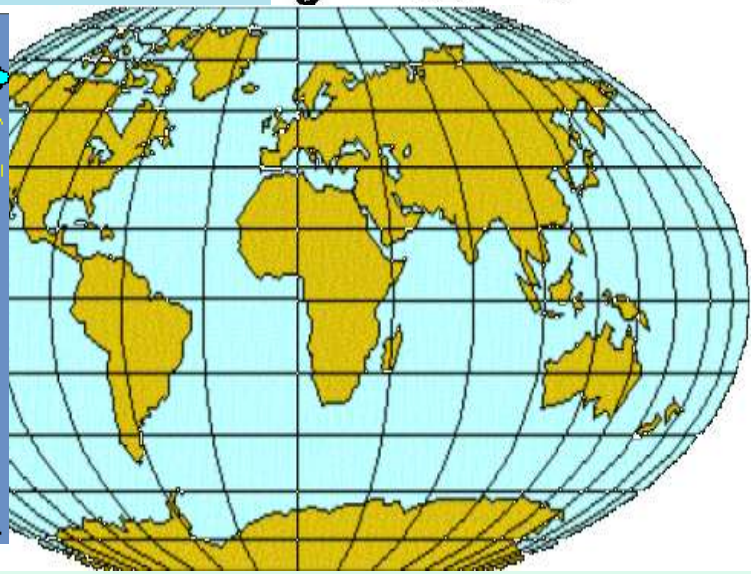
Examples, Anyone?

What The Heck Is Ham Radio?

Local, Regional & Worldwide Peer-Peer Comms

Using Voice, Data & Images





What The Heck Is Ham Radio?

Digital Communications:

PACTOR, WINMOR, RMS Express & Winlink

FreeDV (Open-Source Digital Voice)

Digital SSTV

Soundcard Modes- FT8, PSK31 & derivatives

New Modes Invented almost Daily!

DMR, Yaesu Fusion, D-Star, etc.

Work the world with minimal power/antennas.

Examples, Anyone?

What The Heck Is Ham Radio?

Internet & Ham Radio Your –NEW- Social Media!

VOIP modes like Echolink, IRLP, ICOM's D-Star, Yaesu's WIRESX, DMR, etc. Eases Linking Challenges

Hams Communicate Despite HOA Restrictions

Examples, Anyone?

What The Heck Is Ham Radio?

On The Air Activities!

EAA AIRVENTURE OSHKOSH 2018

61st JAMBOREE ON THE AIR
BOY SCOUTS OF AMERICA
October 19-21, 2018

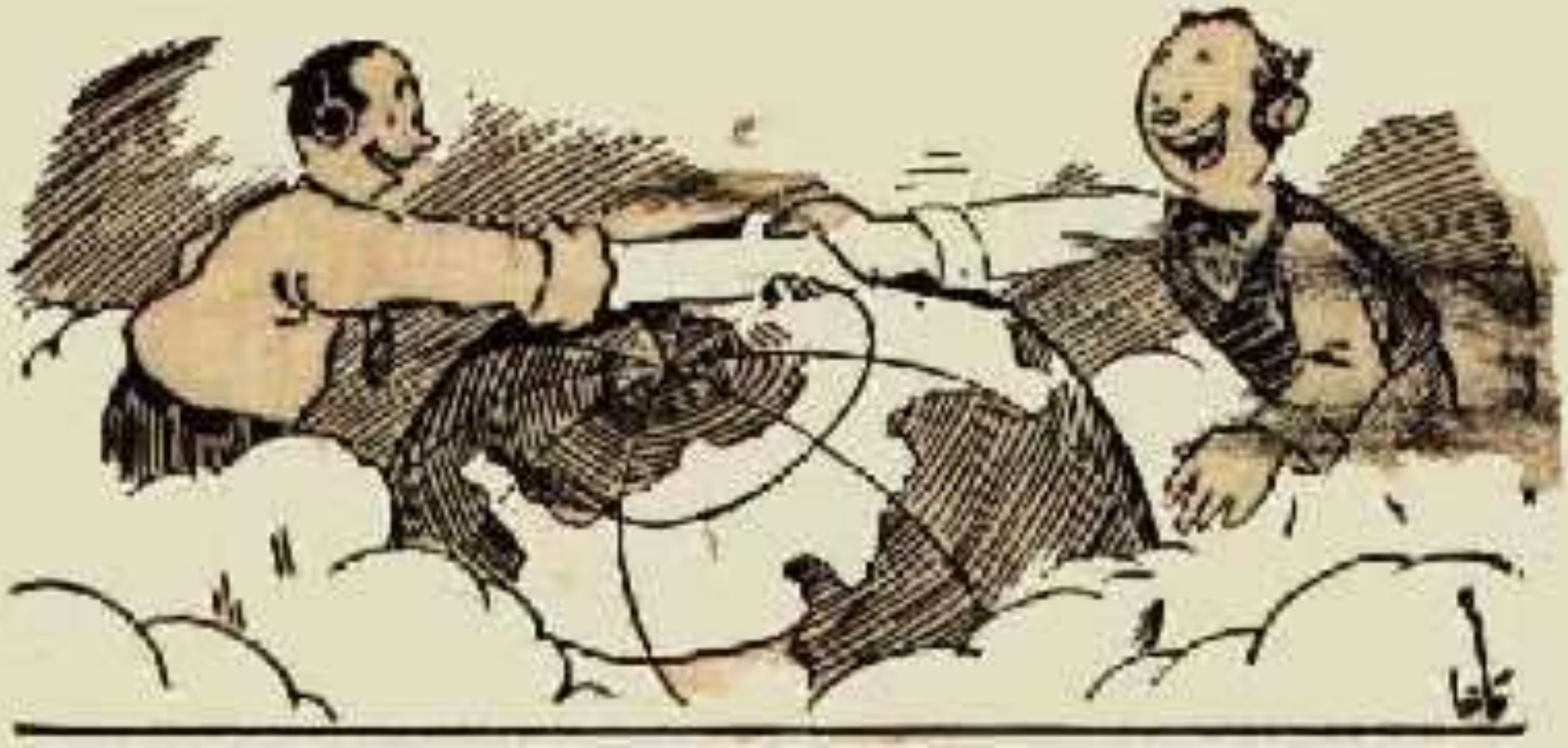
ARRL Field Day

June 23 & 24, 2018

www.arrl.org

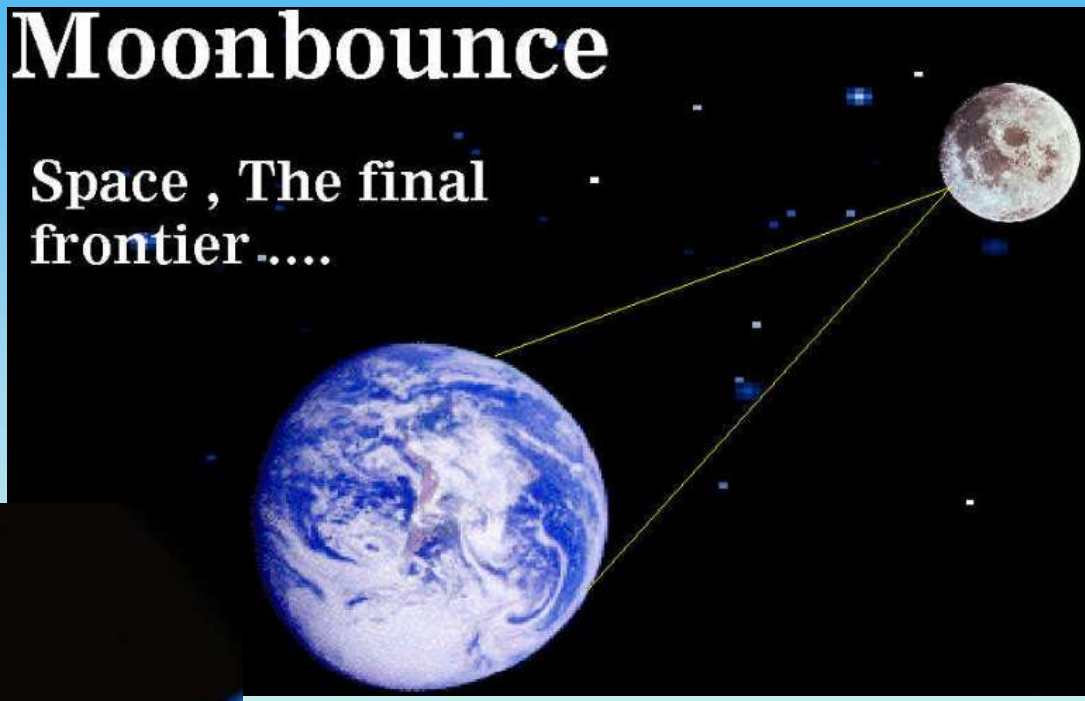
What The Heck Is It Good For?

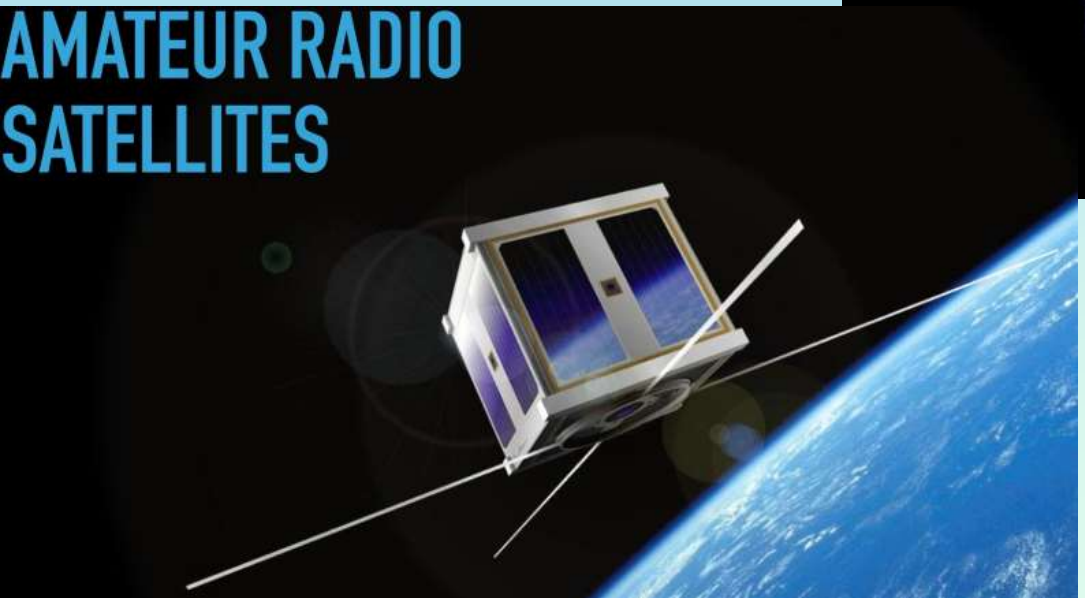
International Goodwill- Radio Knows No Borders



What The Heck Is It Good For?

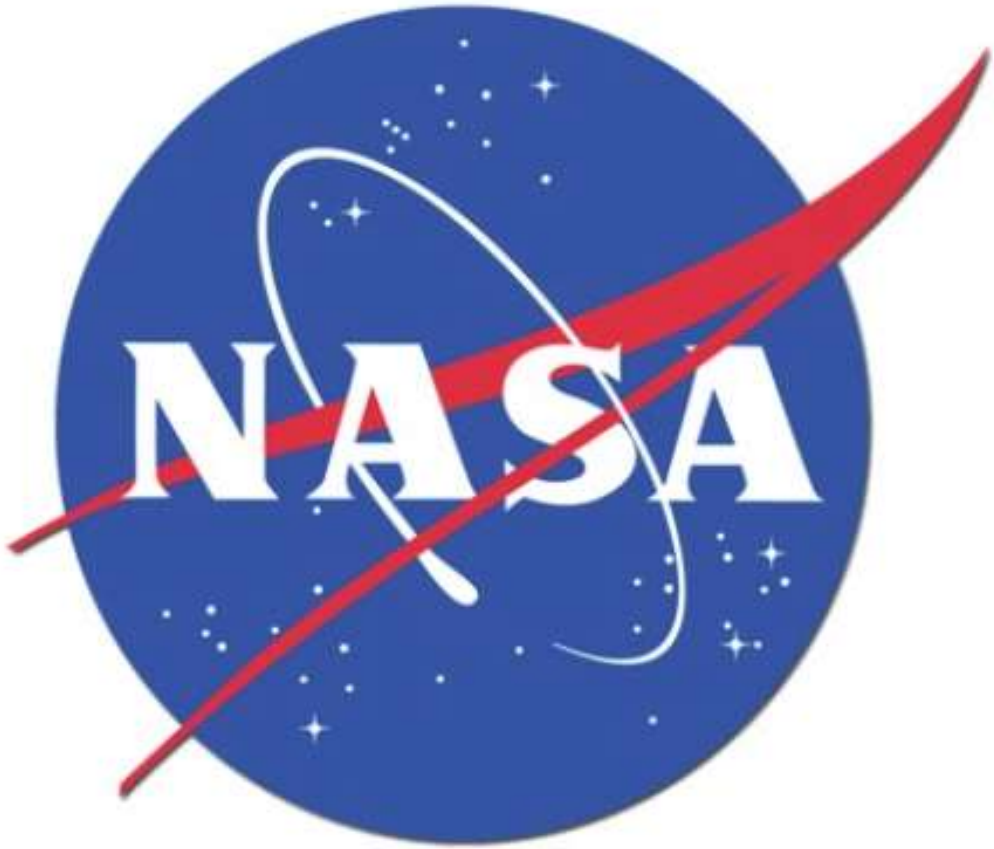
Satellites, EME-Moonbounce!!





What The Heck Is It Good For?

You can talk to Astronauts aboard the ISS!!



What The Heck Is It Good For?

Emergency Preparedness

"Outlet", Hobby, Pastime, & More

Public Service through Volunteerism

Science, Physics, Geography, Social Studies, Public Speaking, etc

International Goodwill- Radio Knows No Borders

Interconnected Resource of Communicators

You can even talk to famous people!!

Examples, Anyone?

Tim Allen as Mike Baxter, KA0XTT
Tim(not his real name) is actually KK6OTD

Bob Heil, K9EID

Joe Walsh, WB6ACU

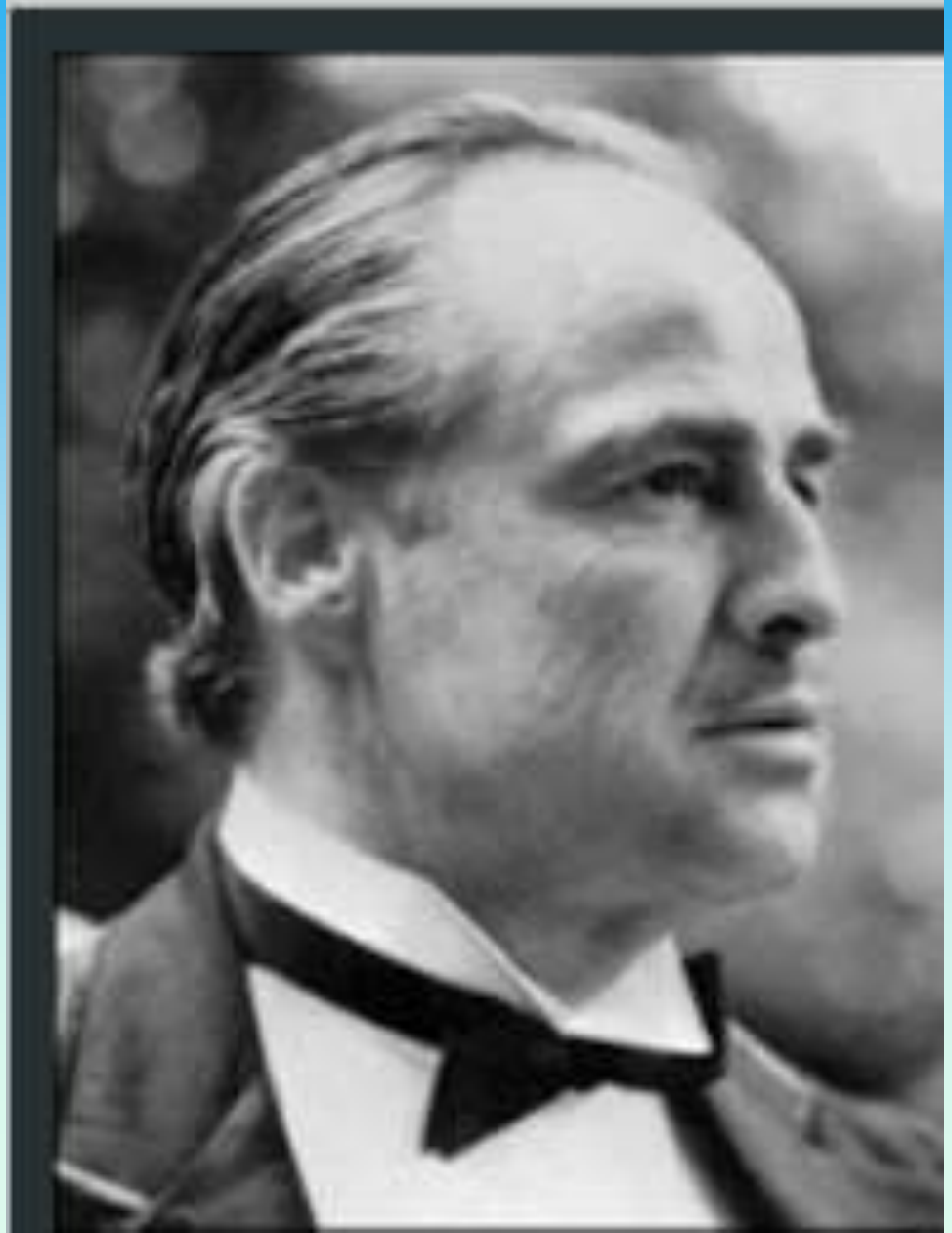
Priscilla Presley, N6YOS

Patty Loveless KD4WUJ


WB4KCG
Ronnie Milsap

Walter Cronkite, KB2GSD

Marlon Brando, KE6PZH



Chet Atkins WB4CGP


K7UGA
Special Event Station


JY1 King of Jordan!!! (SK)


W6XRL4
Herman Munster
1313 Mockingbird Lane
Camelot, New Jersey USA

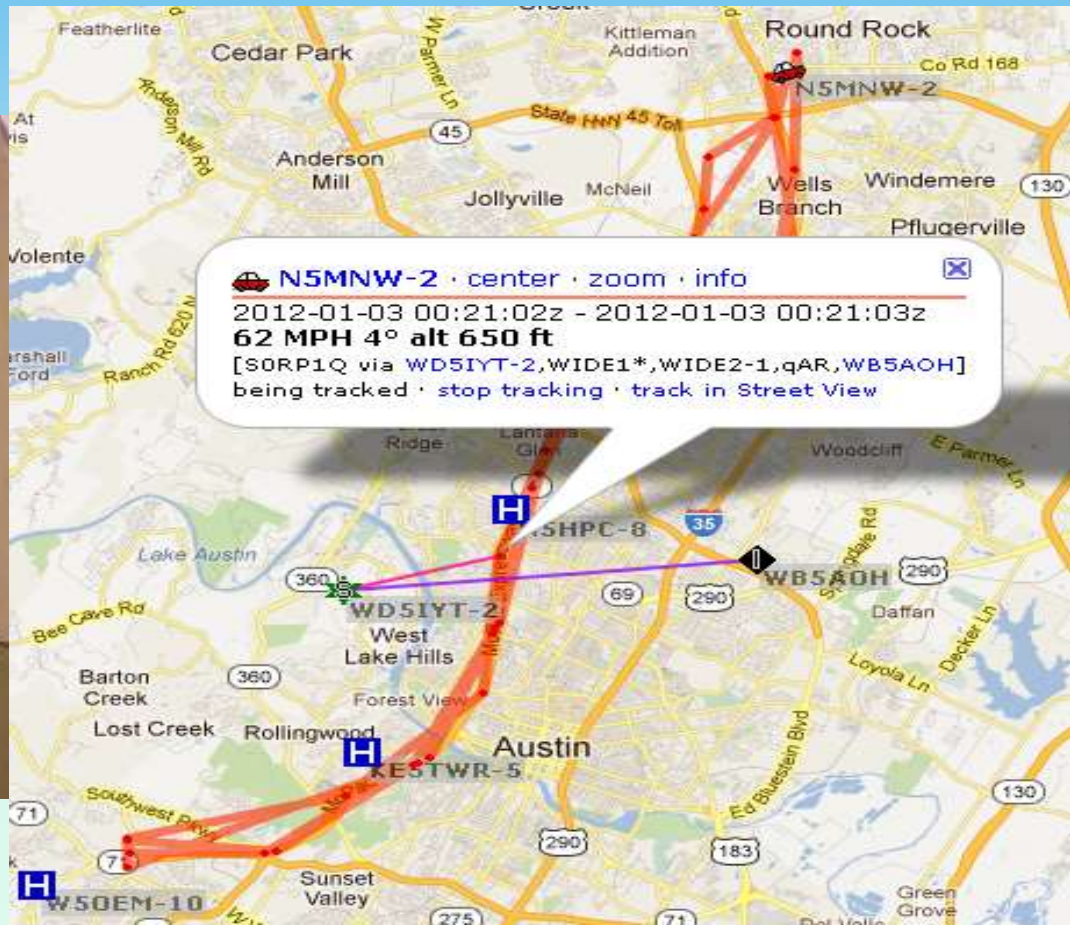
What The Heck Is It Good For?

Emergency Preparedness, Community Service, Weather Watching, and much, much More!

What The Heck Is It Good For?

"Outlet", Hobby, Pastime, & More

(At least Spouse Knows Where You Are...)

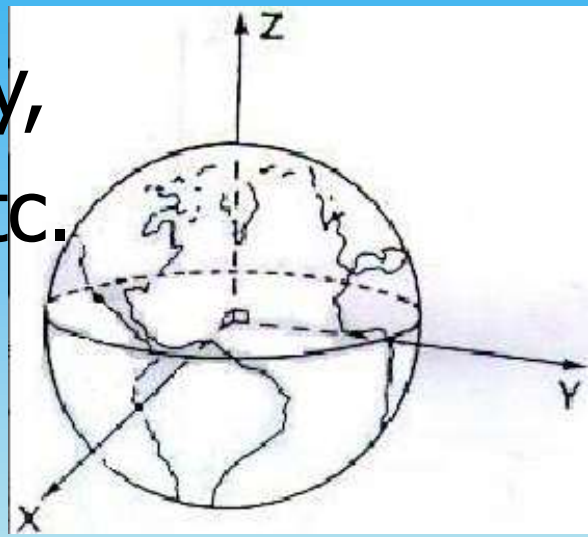


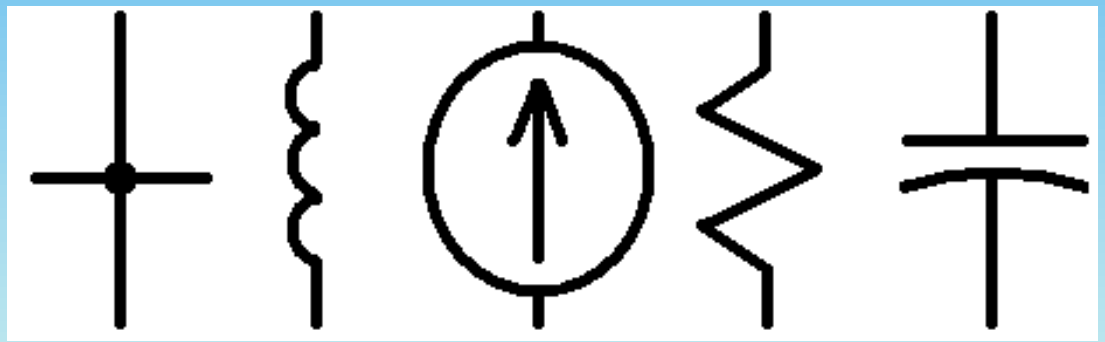
What The Heck Is It Good For?

Public Service through Volunteerism

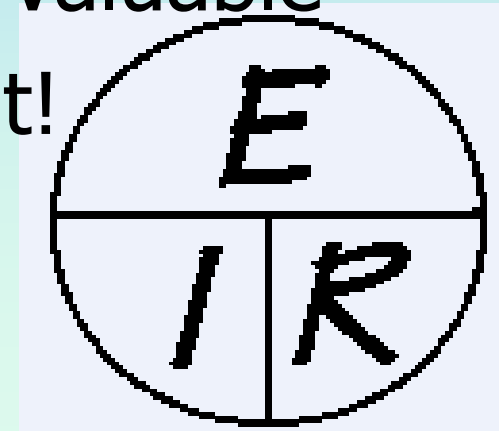
What The Heck Is It Good For?

Science, Physics, Math, Geography,
Social Studies, Public Speaking, etc.





Young Folks Eagerly Learn Cool and Valuable Life Skills, They Don't Even Realize It!



Local & National Organizations

City or County Clubs

Emergency Comms- ARES, RACES

Many CERT & other similar groups

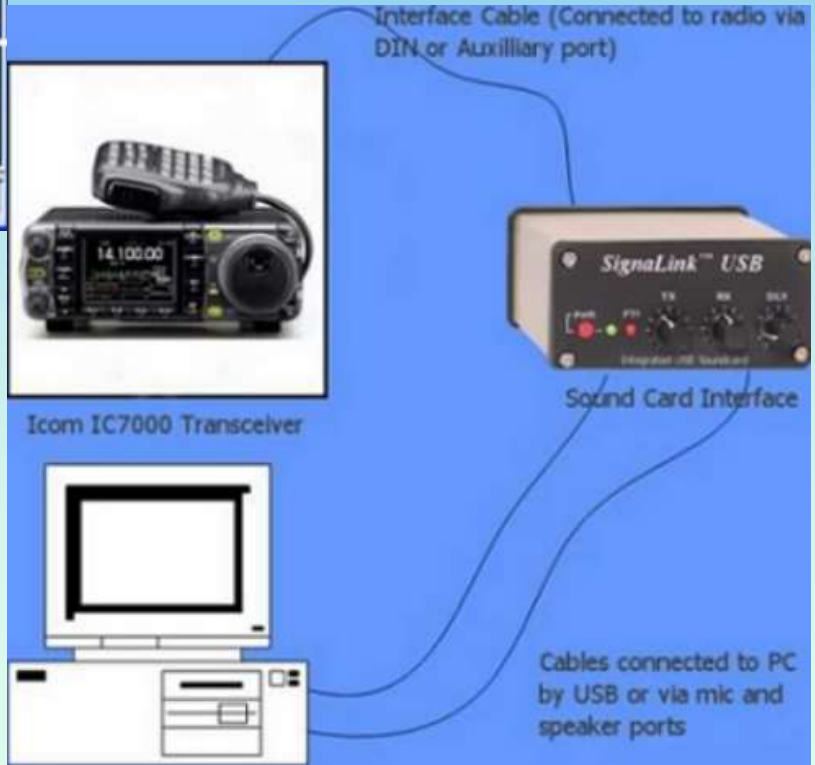
ARRL

Join Up and GET INVOLVED!!! It's FUN!!

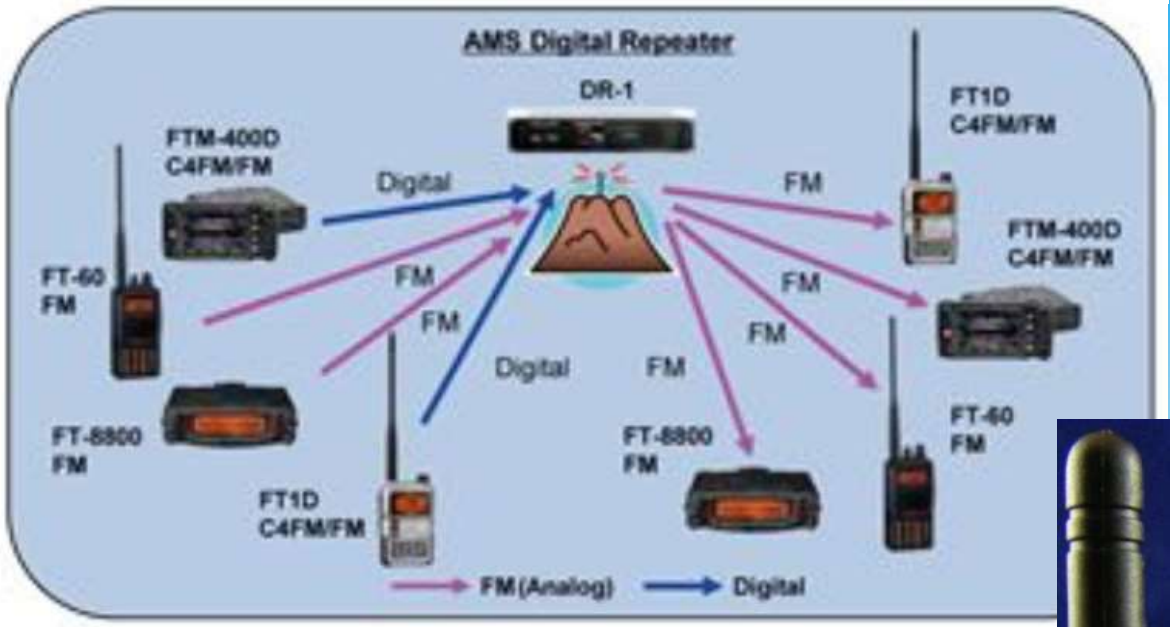
Modes

PSK-XX, FT8, RTTY, CW, MFSK-XX, JTXX, OLIVIA

And –many- more to come!!



System Fusion



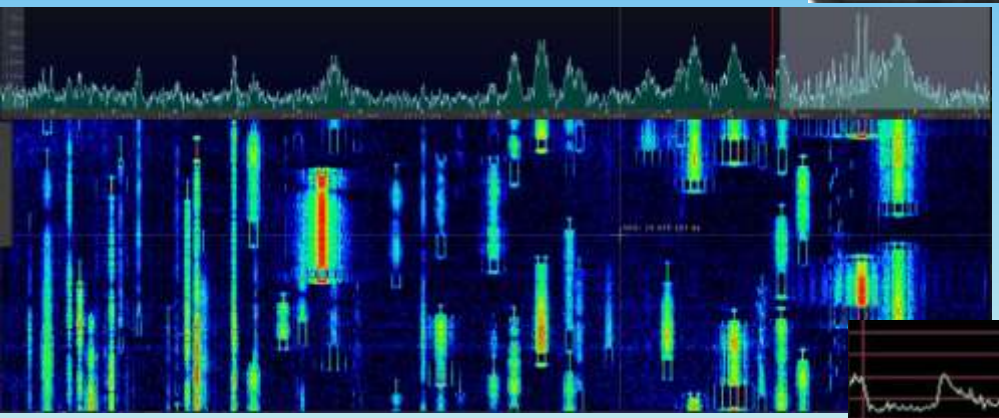
D-STAR DIGITAL

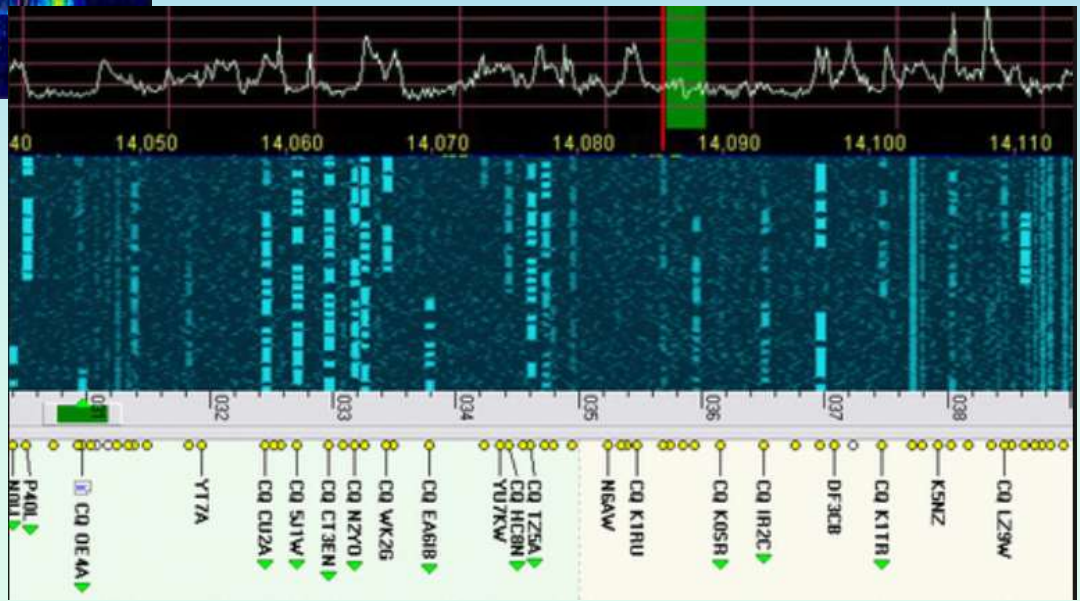
Cool Tech Stuff

Waterfall, Auto decode,

Spectrum Analyzer

And –many- more to come!!





Radio Types- RIGS!!!

What's The Best Rig For Me?

…It Depends…

Starting with an HT may be OK BUT…

Where/Who Do Wish To Talk Most Reliably?

What Restrictions Exist? HOA/Antenna/Budget/?

Contests/Public Service/Disaster In Your Future?

Start Cheap(Scanner, 2m or dual band FM)

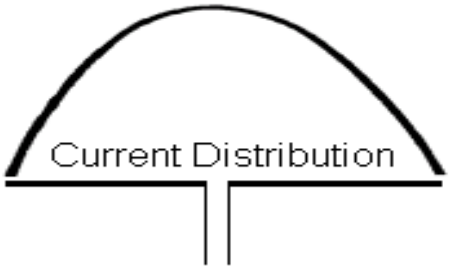
Techs Have 10m(28MHz) CW & SSB Privs

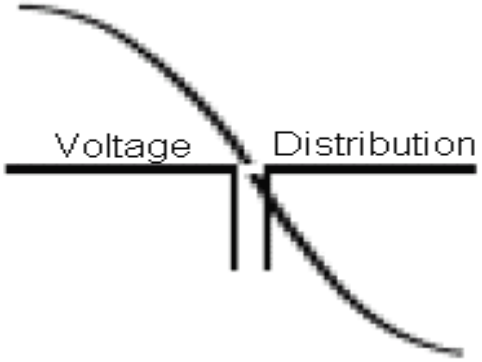
Many SSB CB radios can be converted to 10m

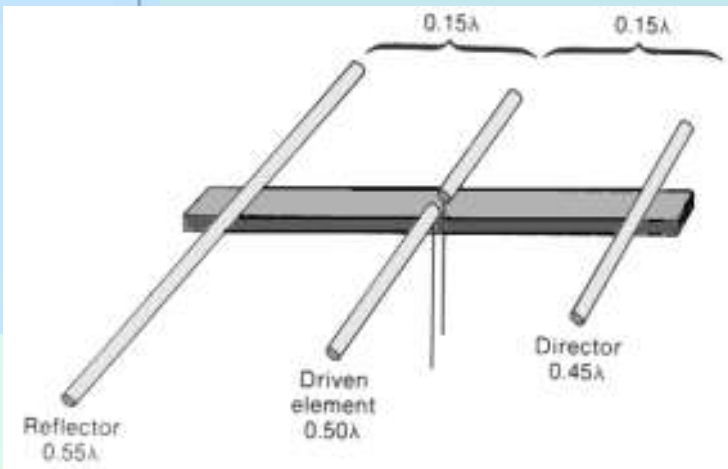
If budget allows HF-6m-2m-70m $1k allmode:

FT857,FT897,IC706,IC7000,etc.

Antennas!


Current Distribution


Voltage
Distribution


0.15λ
0.15λ
Director
0.45λ
Driven
element
0.50λ
Reflector
0.55λ

Why So Many Antenna Choices??

No "Perfect Antenna"(well, maybe a dummy load…)

Ham Radio covers many different RF Bands:

"Longwaves" below the AM Broadcast Band,

Interweaved in "Shortwave",

Near FM/TV Broadcast, and well into

Microwaves above 1GHz & mmeter wavelengths

All Have Different Propagation Characteristics

Most Effective Mode of Comms vary widely

Modulation, Wavelength, Power Level, etc all Play A Role In Antenna Choice(s)

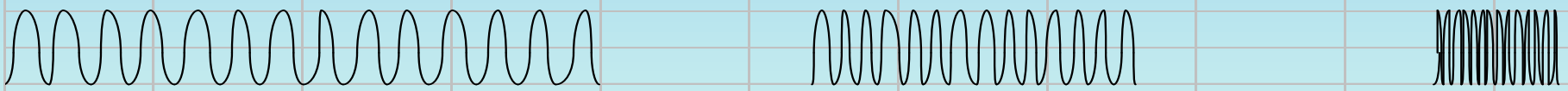
EM Spectrum

Ionospheric effects dominate				Meters			Tropospheric effects dominate			
"D" layer absorption limits daytime range		Worldwide "F" layer skip possible				Occasional "E" layer openings			most range line-of-sight	
600	300	100	60	30	10	6	3	1.0	0.6	0.1
AM Broadcast		"International Shortwave"				FM stereo radio, TV Broadcast, Aviation, Two-way radio			Cellphones	
← MF →		← HF →				← VHF →		← UHF →		
"Medium Frequency" 0.3-3MHz		"High Frequency" 3-30MHz				"Very High Frequency" 30-300MHz		"Ultra High Frequency" 300-3000MHz		
0.5	1.0	3	5	10	30	50	100	300	500	3000
Frequency (Mhz)										

Radio waves all travel at same speed (light-speed!)

Wavelength describes the distance between each wave crest

Lower freqs have more space or "length" **Higher freqs have less space:**



Imagine a piano or harp stringboard- Longer strings make lower notes.

$$\text{Wavelength (Meters)} = \frac{300 \text{ (Million meters)}}{\text{Freq. (Million hertz or cycles per sec.)}}$$

Propagation!

Ionosphere:

Solar Cycles

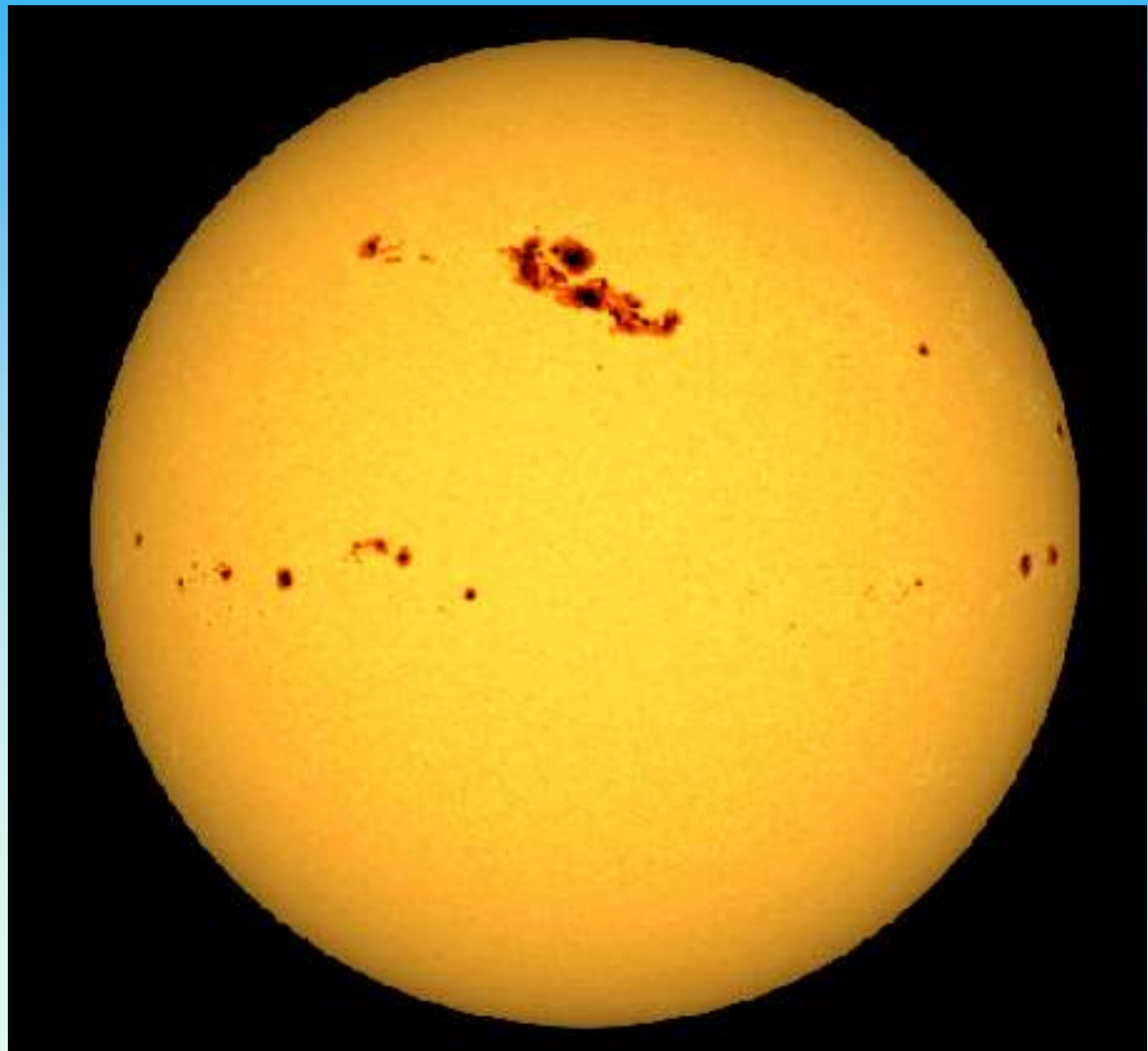
NVIS

E & F-layers

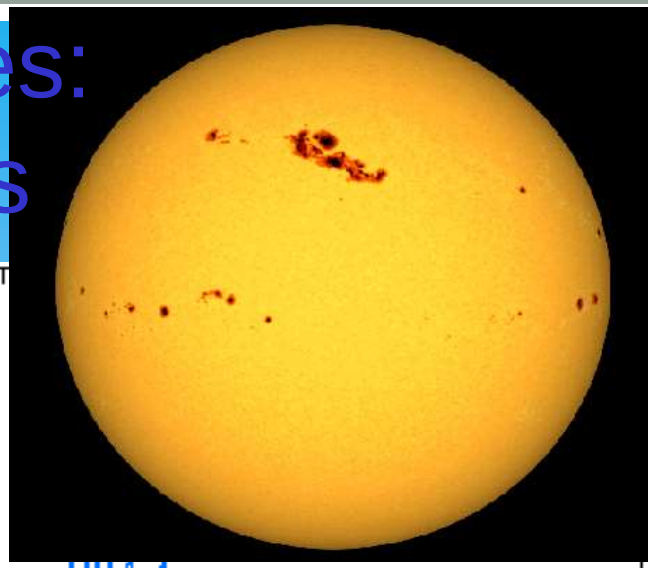
D-Layer(baD)

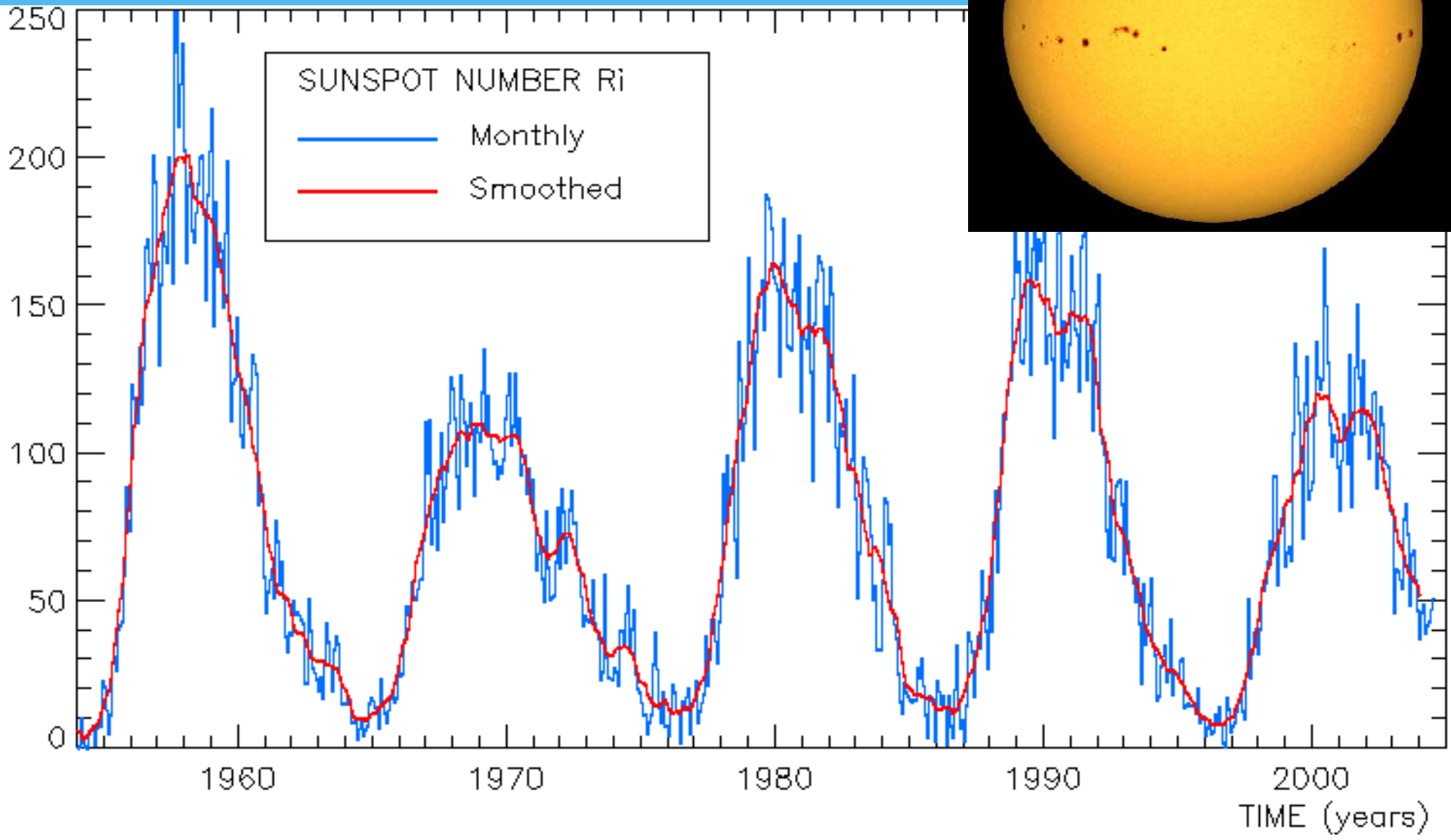
Troposphere:

Ducting

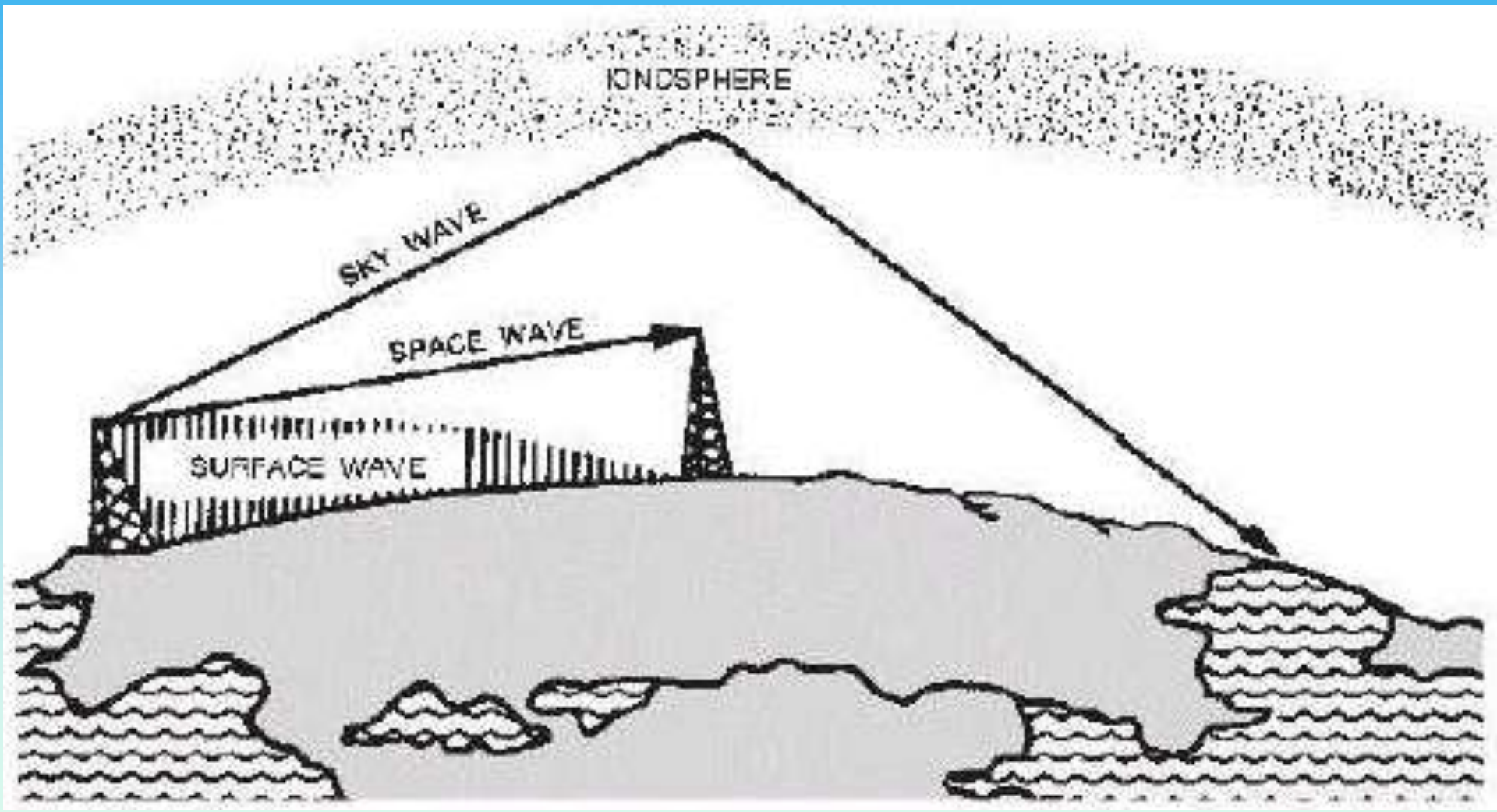


11-Year Solar Sunspots Cycles: X-Rays & UV Affect HF Bands

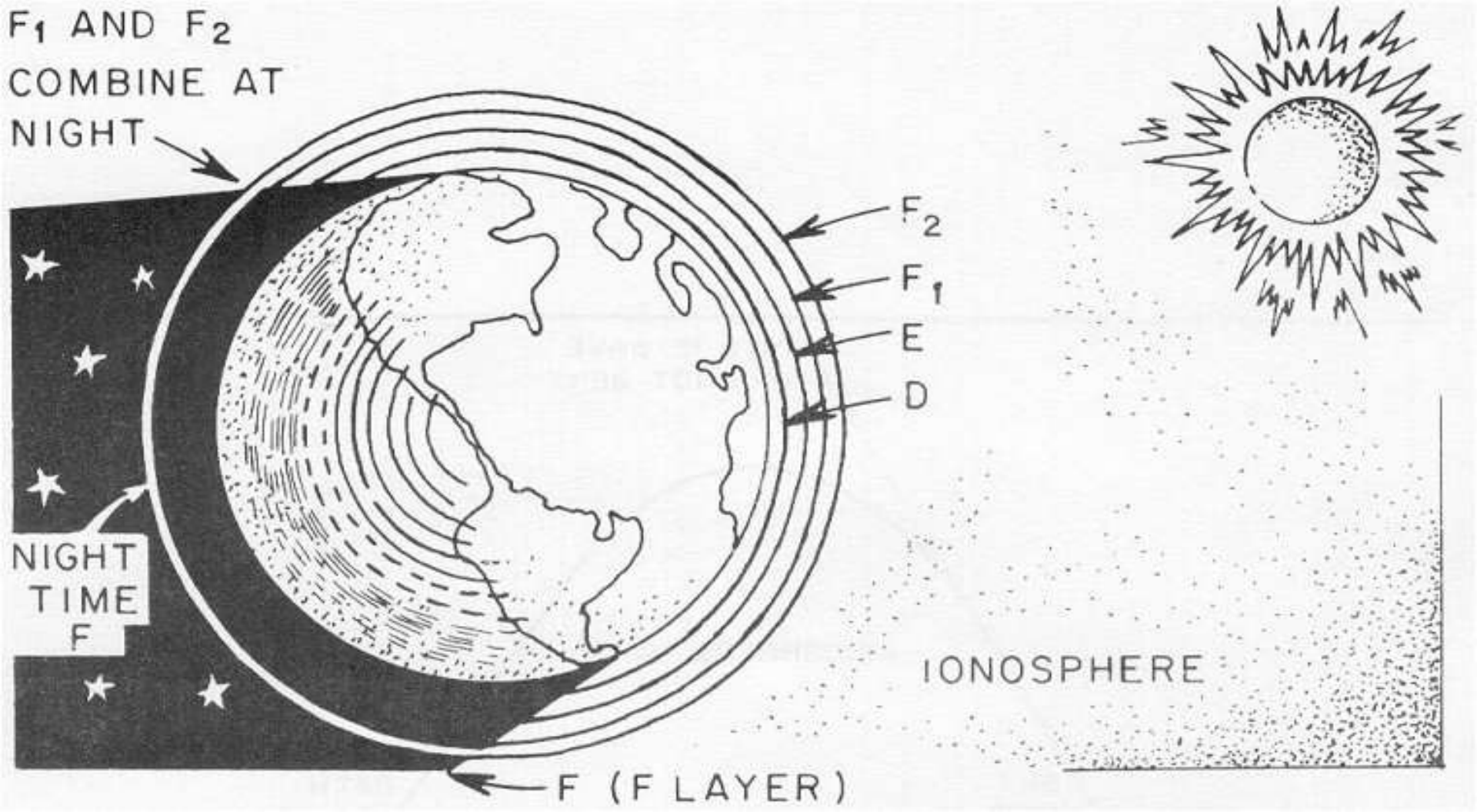




Signals Take Different Courses

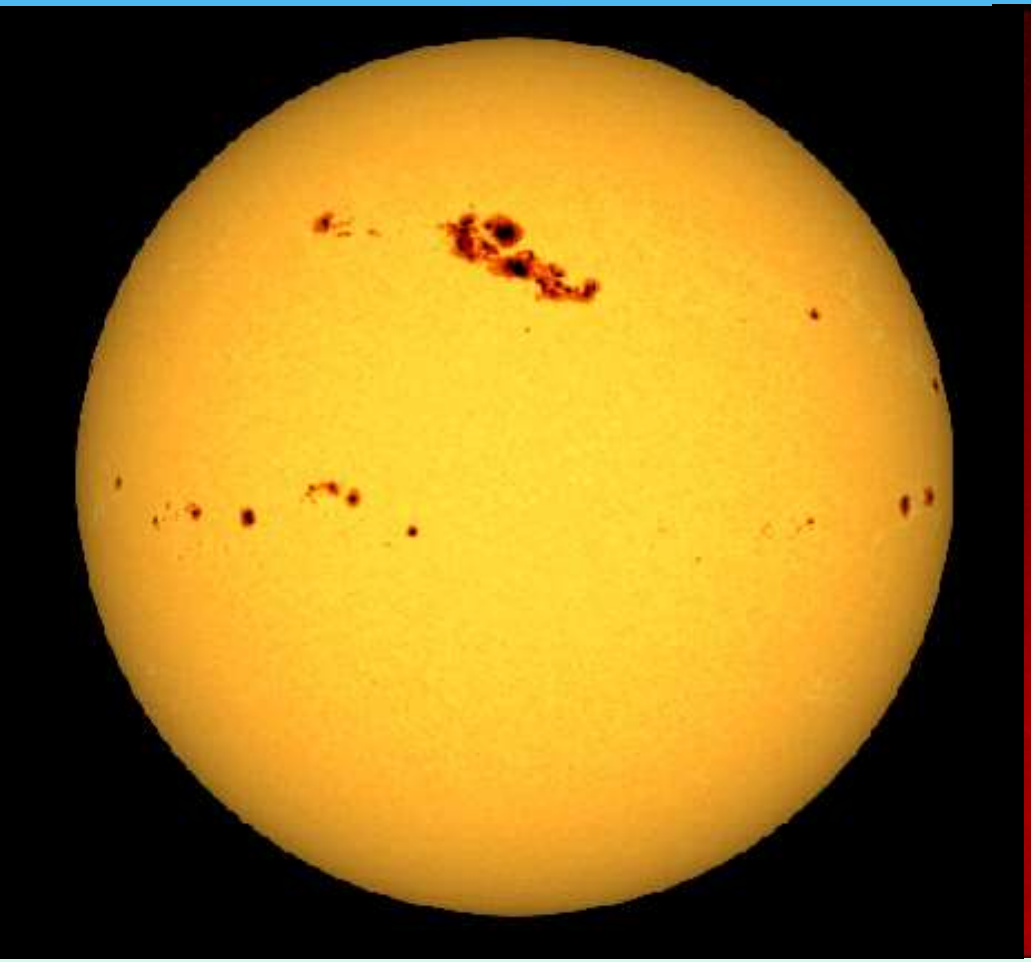


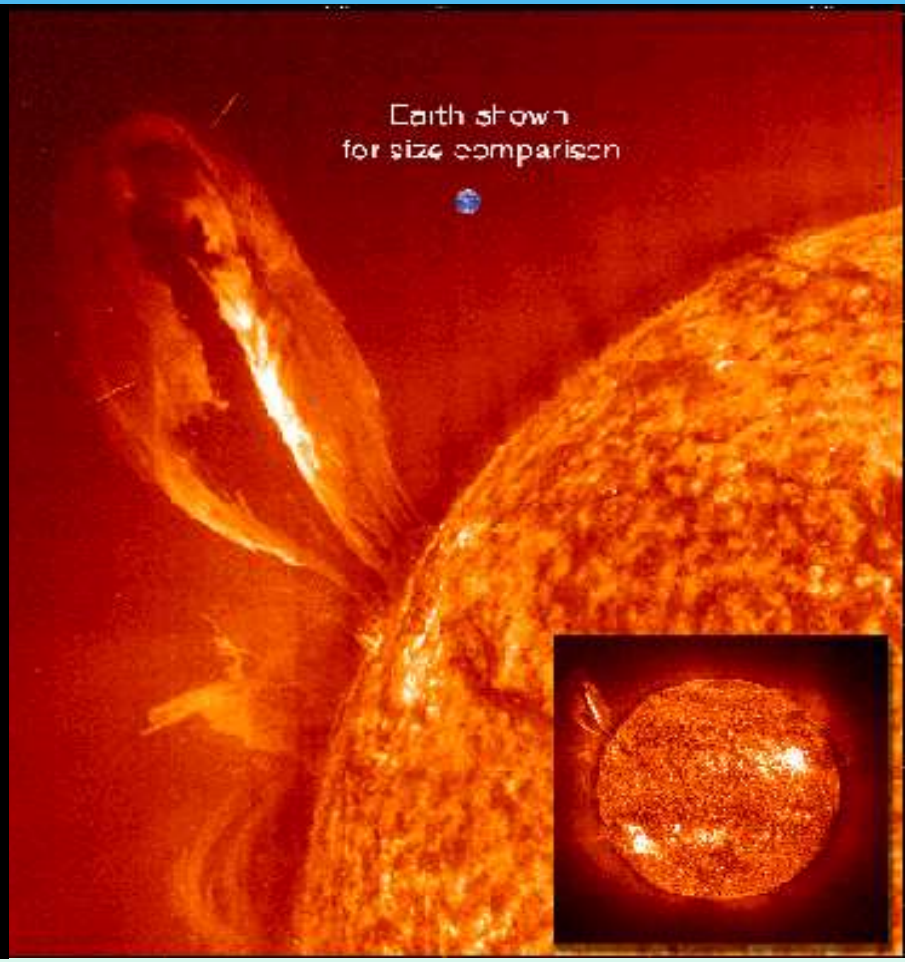
Solar Exposure of Ionosphere Enables Worldwide HF Comms



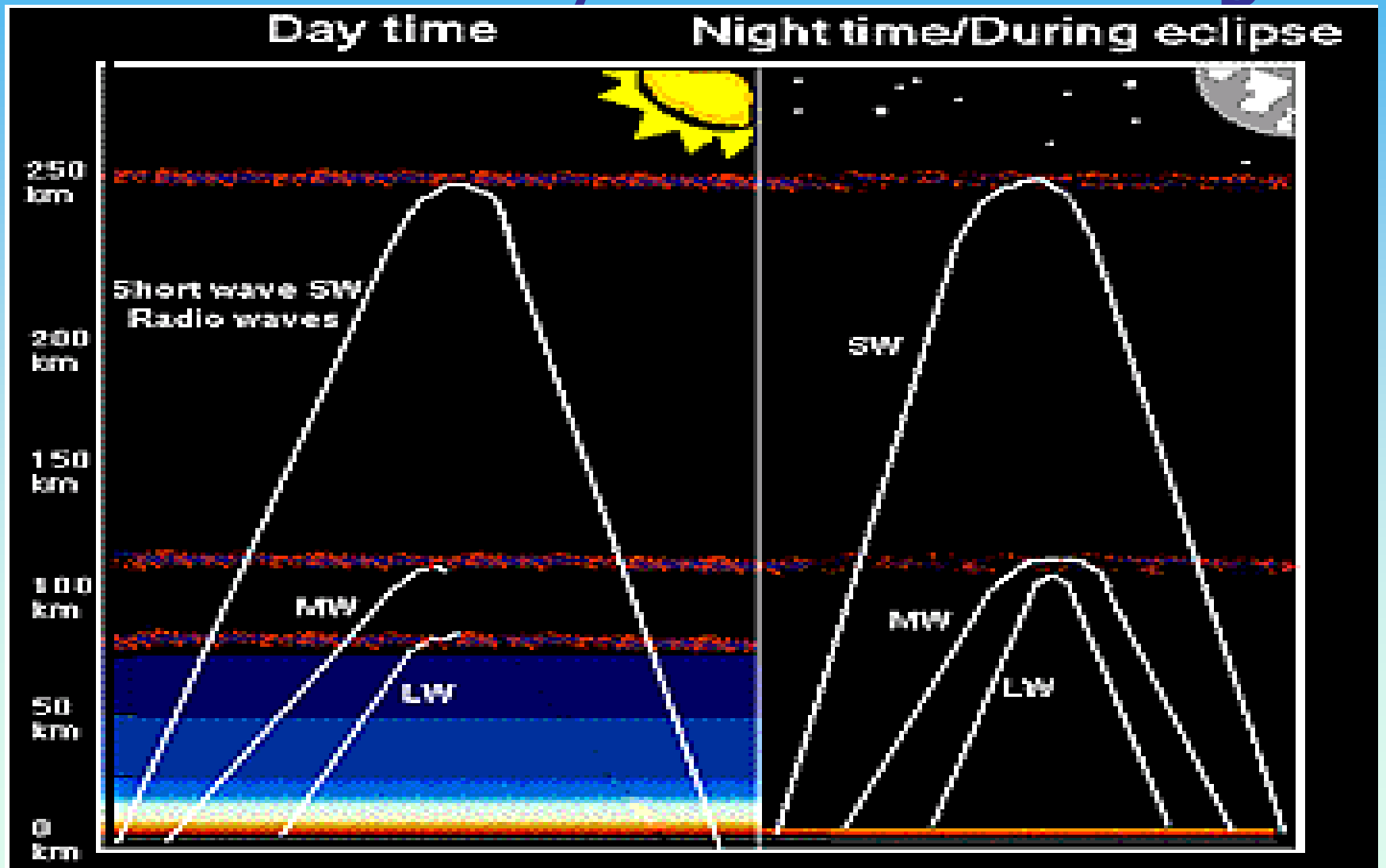
Tropo- VHF & UHF Ionosphere- HF

Our Sun's Aberrations- Spots Storms and Flares

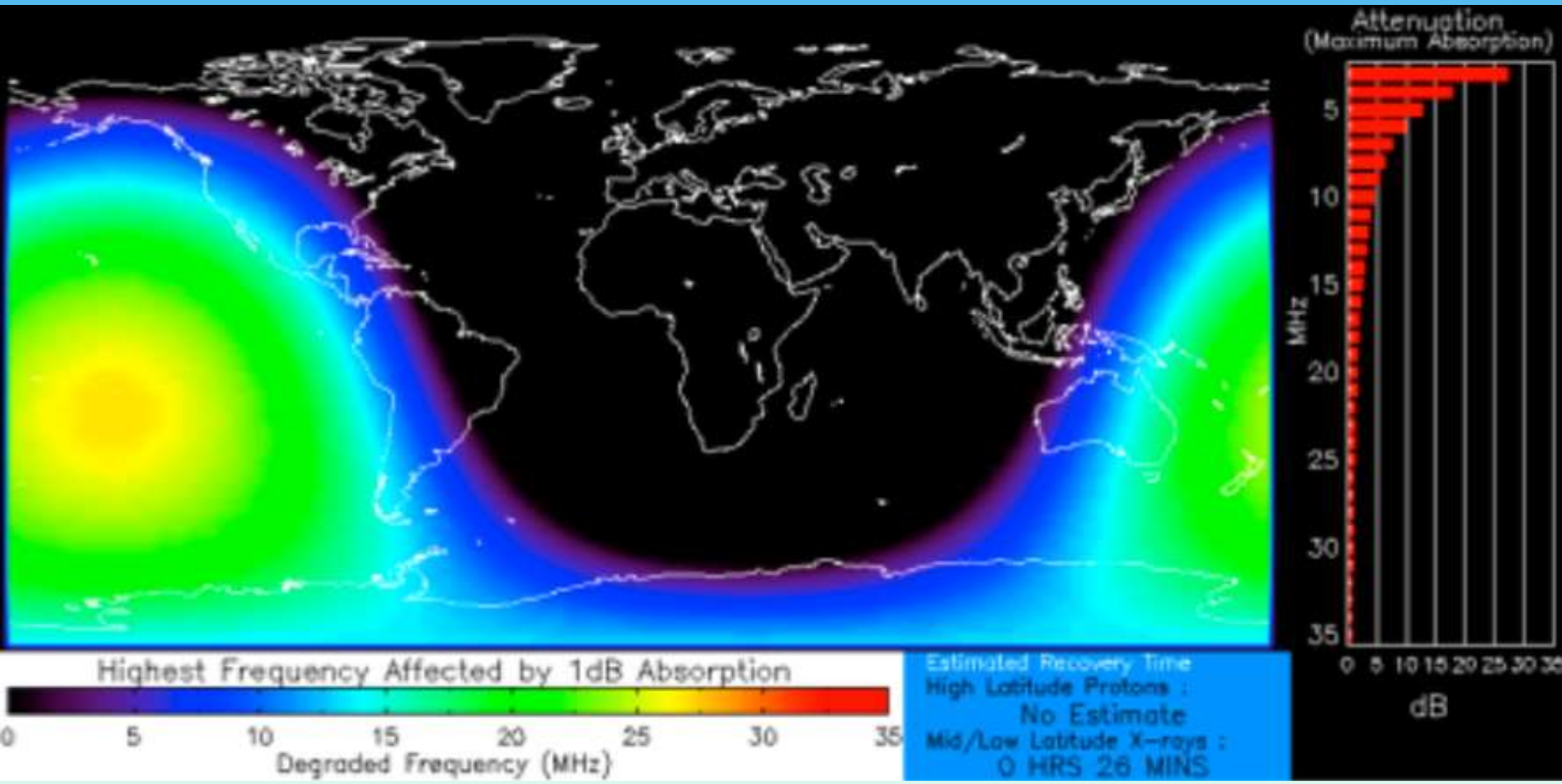




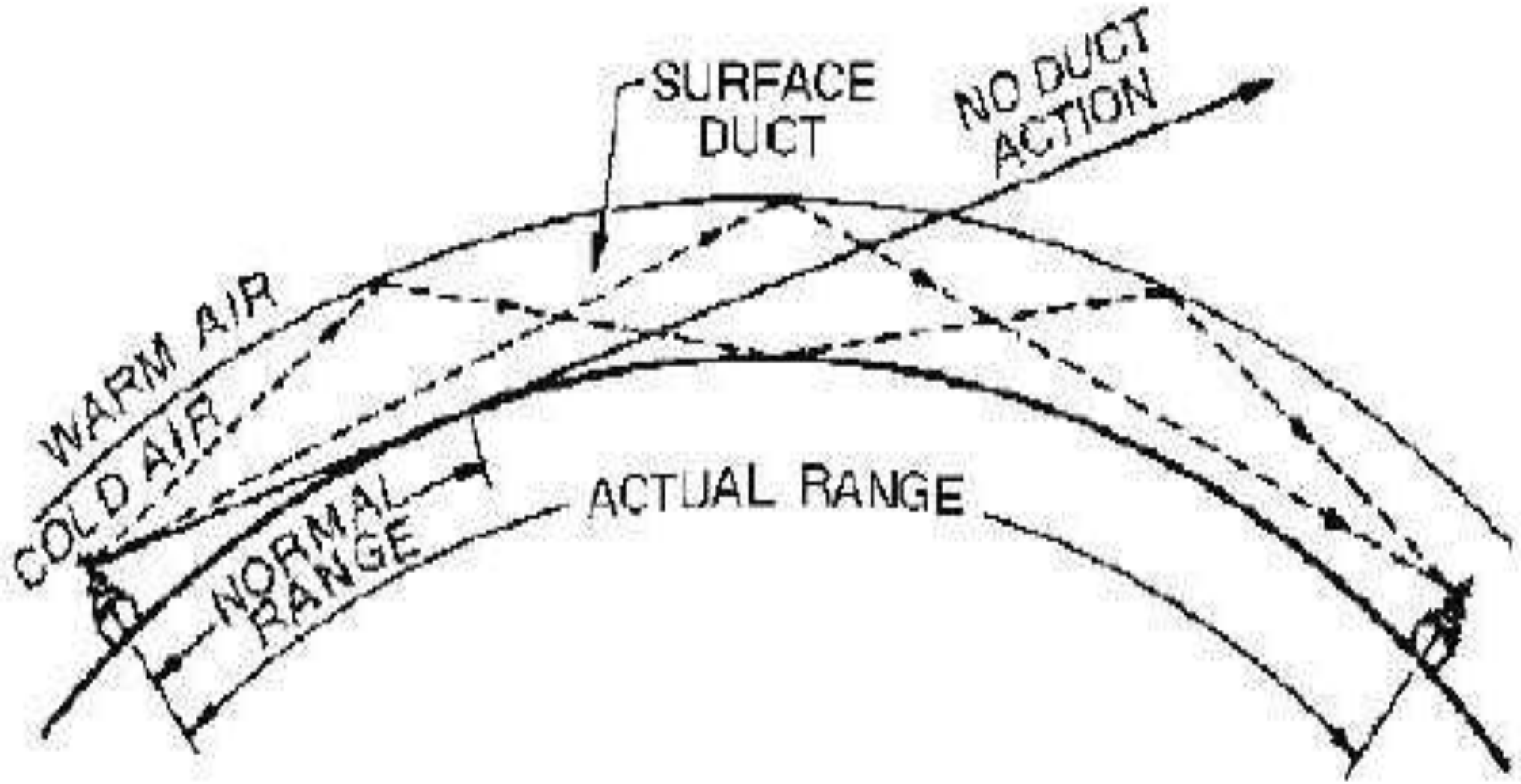
D Layer Absorption-
The baD Layer Gone at Night



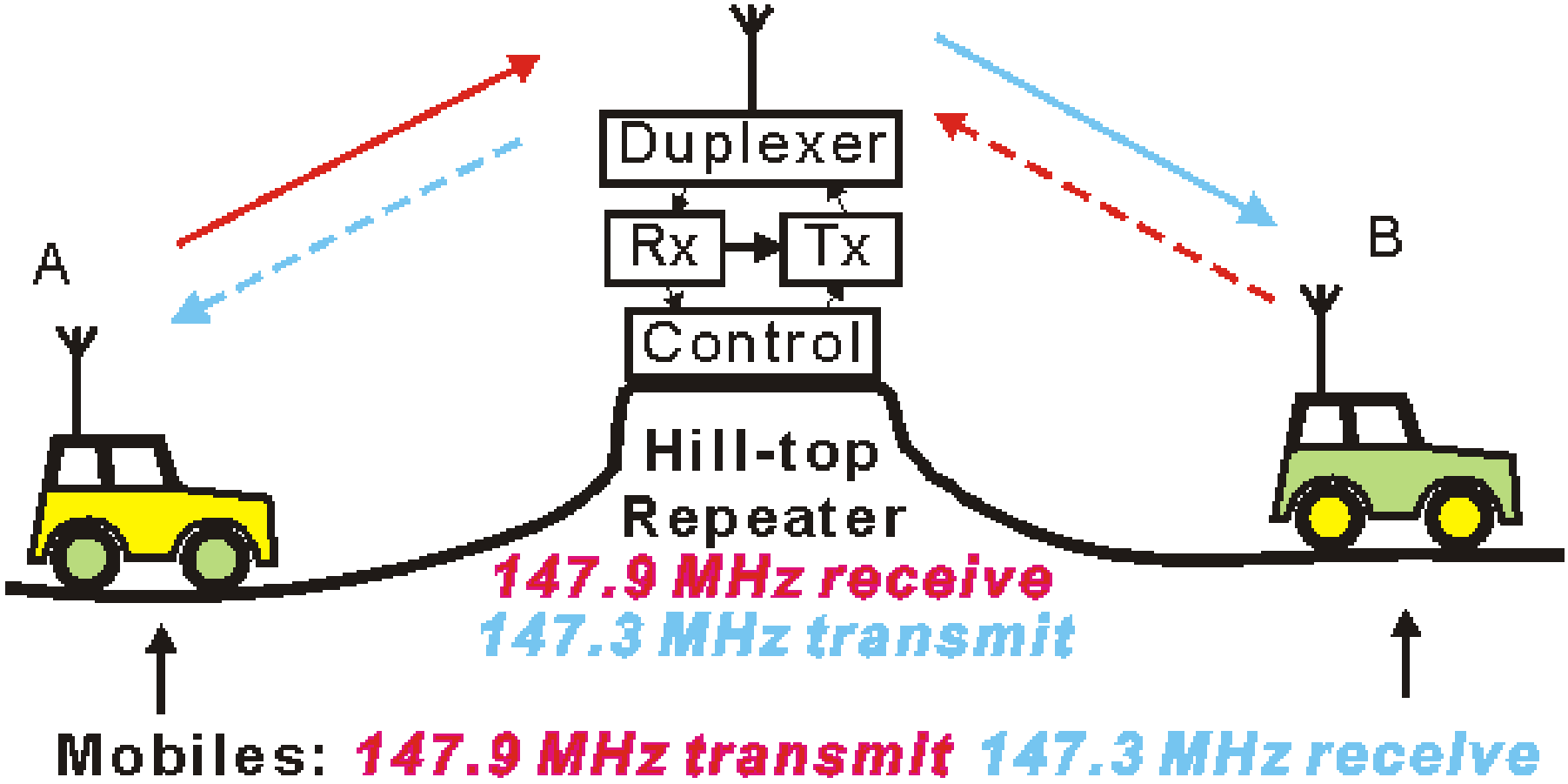
HF D-layer Daytime Absorption Affected by Solar Flares



Tropospheric Ducting at VHF & UHF Mostly Affected By Weather (Not Drawn to Scale)



Repeaters Extend VHF-UHF Range



Repeaters


Goddard, KS 145.47
repeater
Goddard, KS 145.47
repeater. Motorola
MSR 2000


www.hamradio-online.com

Repeater Technical Details

- Standard Input Frequency and Offset
- RX's on One Freq/TX's on Another
- 2m- 600kHz (<147 minus, >147, plus)
- 70cm- 5MHz
- ID-ers Often Use CW, some have Voice ID's
- Time-Out Timer- Limits TX Time
- Autopatch- Telephone Interconnect-
- Not Private, All Tuned in Hear PhoneCall

Repeater Technical Details

- PL/CTCSS/DCS- Sub-Audible Tone or Digital Character Added to
- Enables Selective Reception
- Some Repeaters Need Tone to Access- You Must Select Proper Signalling
- Crossband Repeater Takes Signals From One Band and Retransmits on Another
- D-Star/Fusion/DMR- Digital Voice & Data

Heavy Mystery Time!!!

There are no Dumb Questions

But a Valid MNW Answer may be:

"I Don't Know"…

THANK YOU!!!