

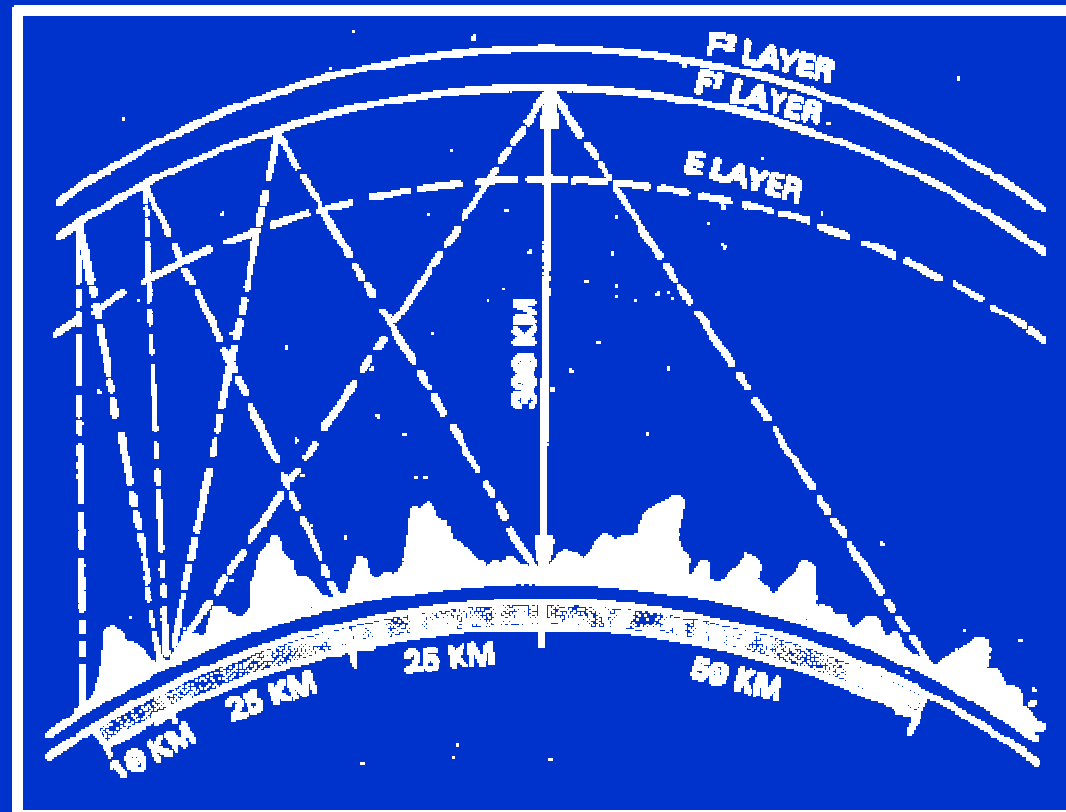


7/25/2007

NVIS

Near Vertical Incident Skywave

Norm Fusaro, W3IZ



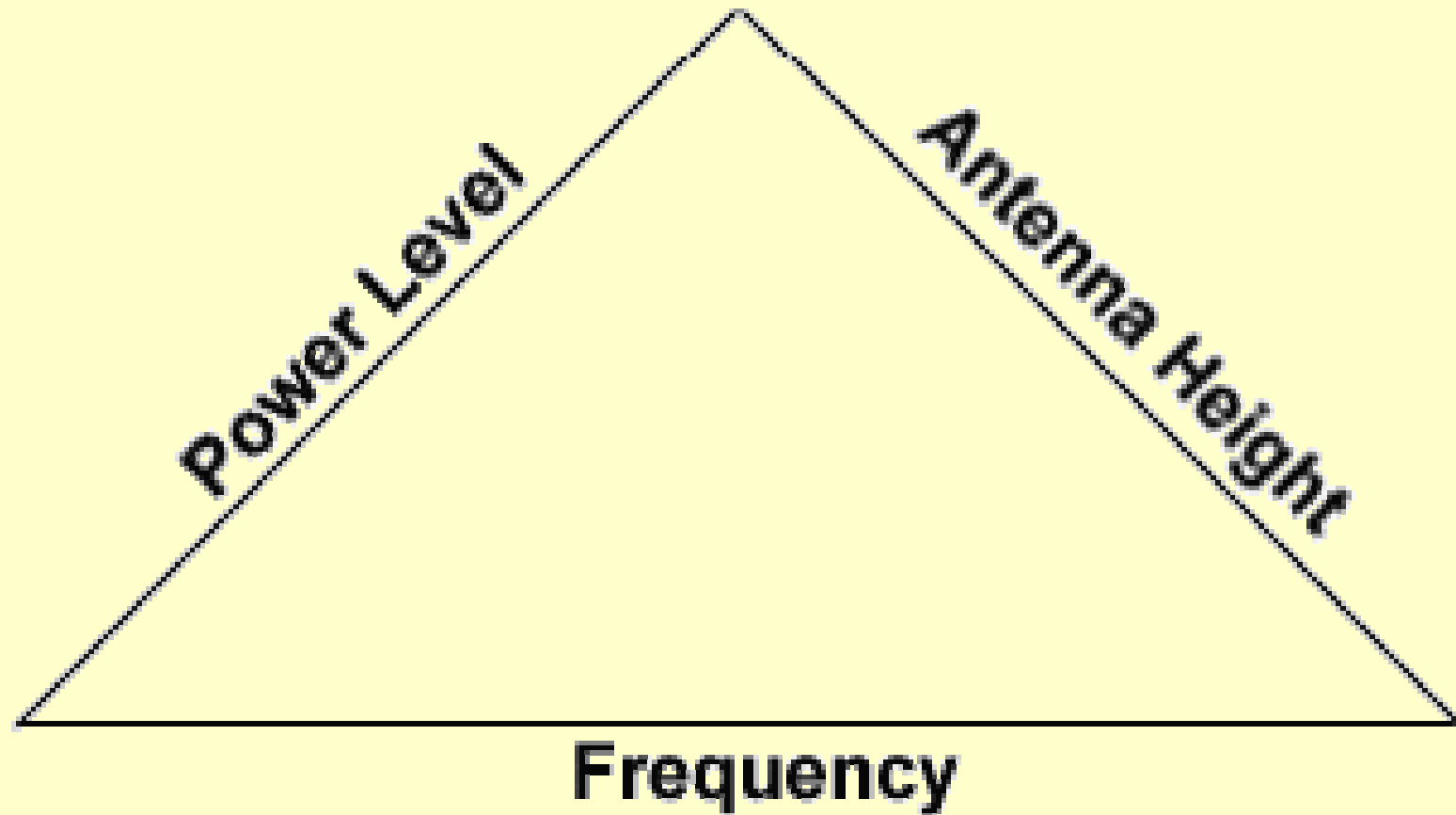
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Introduction

- **What Is NVIS?**
- **Advantages of NVIS?**
- **How to deploy NVIS.**

What Is NVIS?

- **Near Vertical Incidence Skywave:** A radio propagation mode which uses antennas with a very high radiation angle, approaching or reaching 90 degrees (straight up), along with selection of an appropriate frequency below the critical frequency, to establish reliable communications over a radius of 0-200 miles or so, give or take 100 miles.



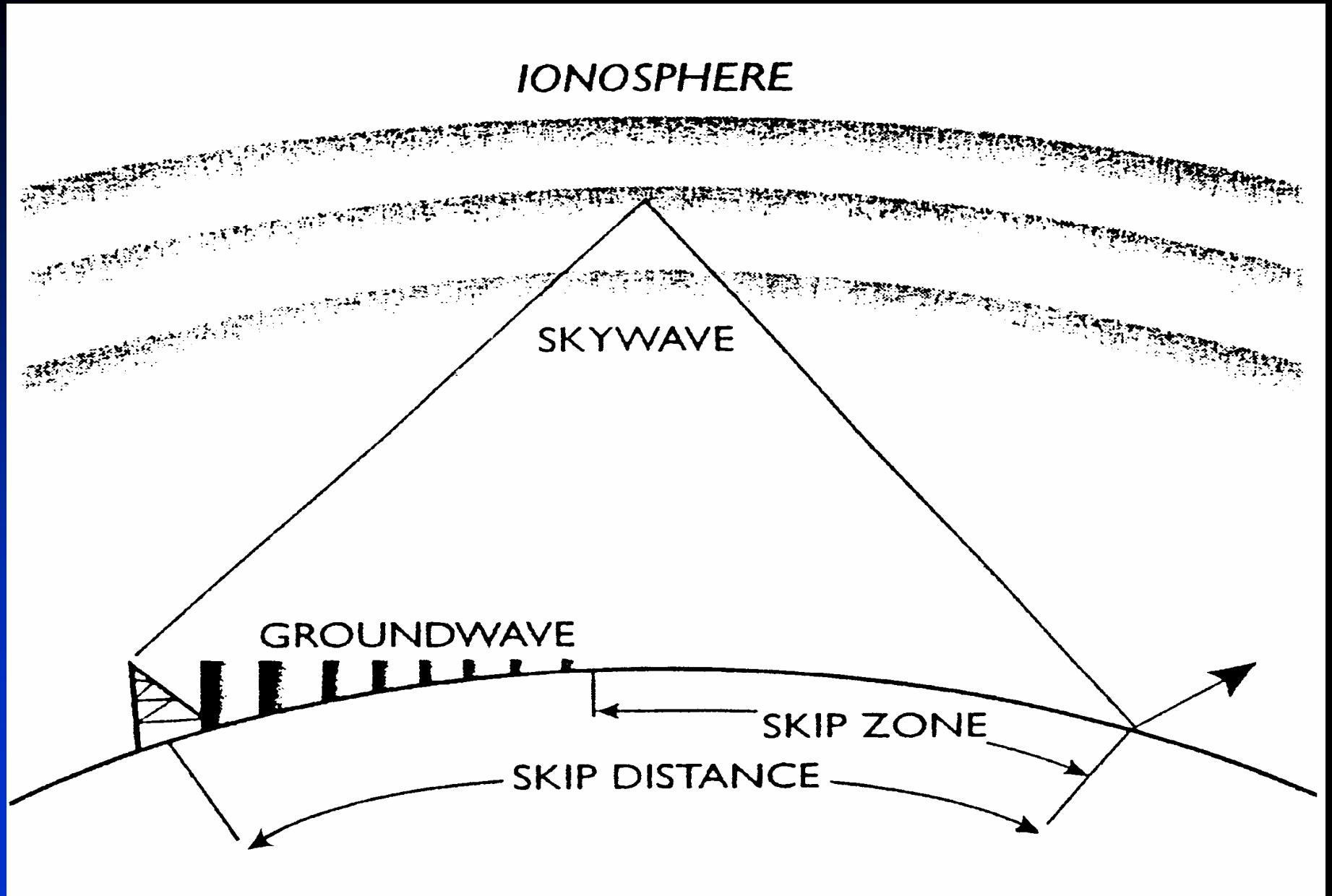
NVIS is a technique, not an antenna.

Advantages of NVIS

- **NVIS covers the area which is normally in the skip zone, that is, which is normally too far away to receive ground wave signals, but not yet far enough away to receive sky waves reflected from the ionosphere.**

**There is no skip zone unless you,
the communicator, create it.**

Ordinary Propagation



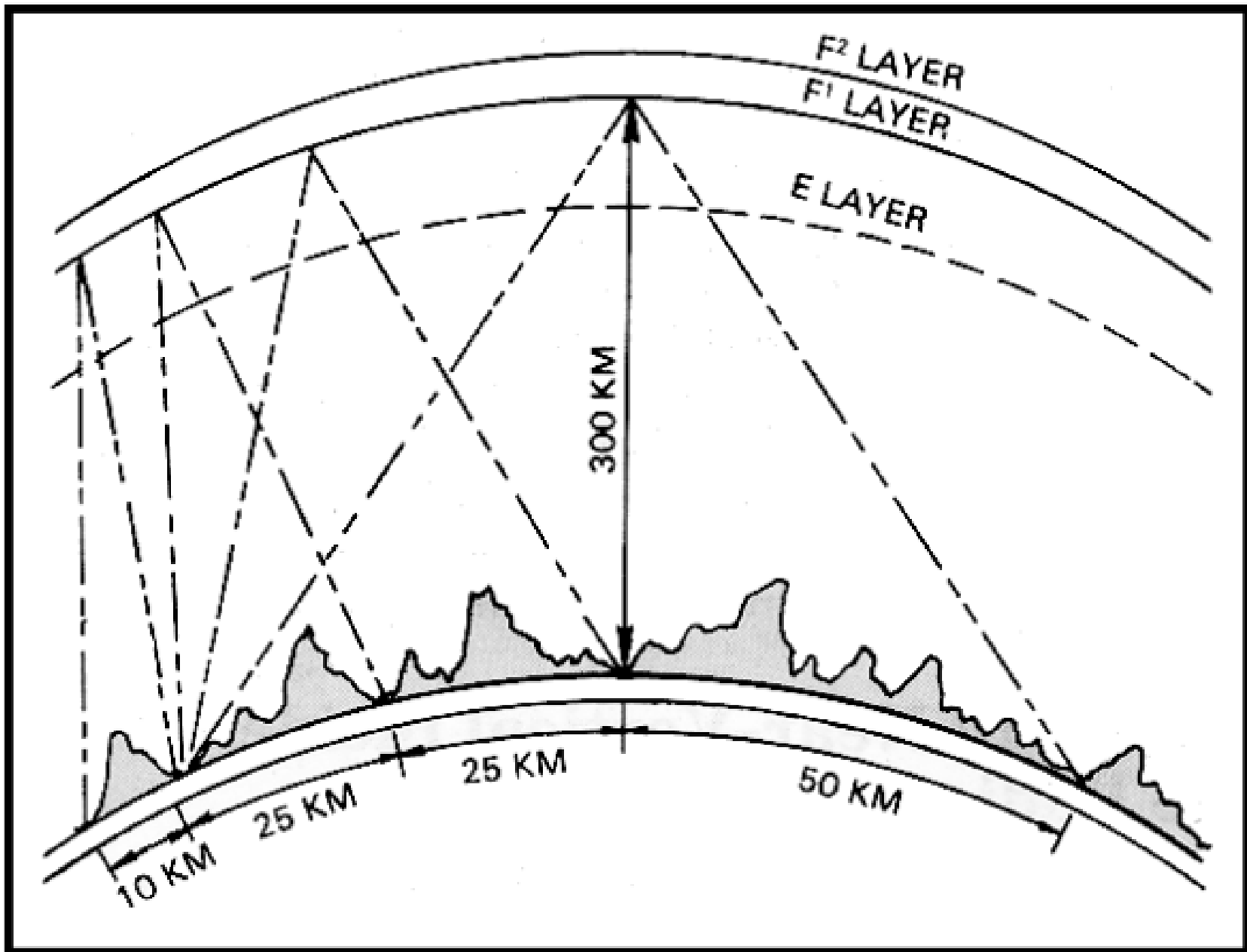
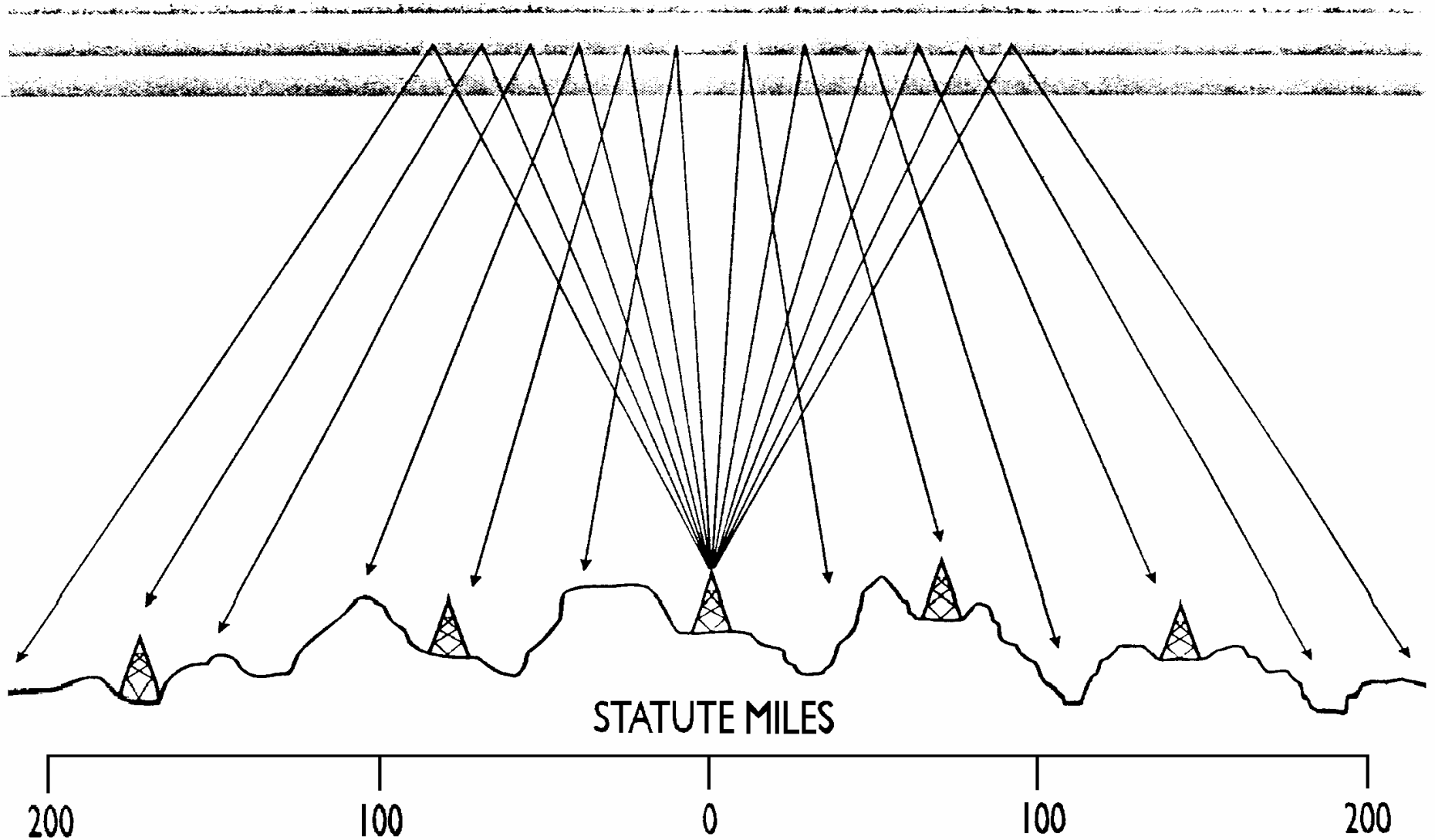


Figure M-1. Near-vertical incidence sky-wave propagation concept.

If you squirt a garden hose at the ceiling you can blanket a large area with water very effectively.

NVIS Propagation

IONOSPHERE



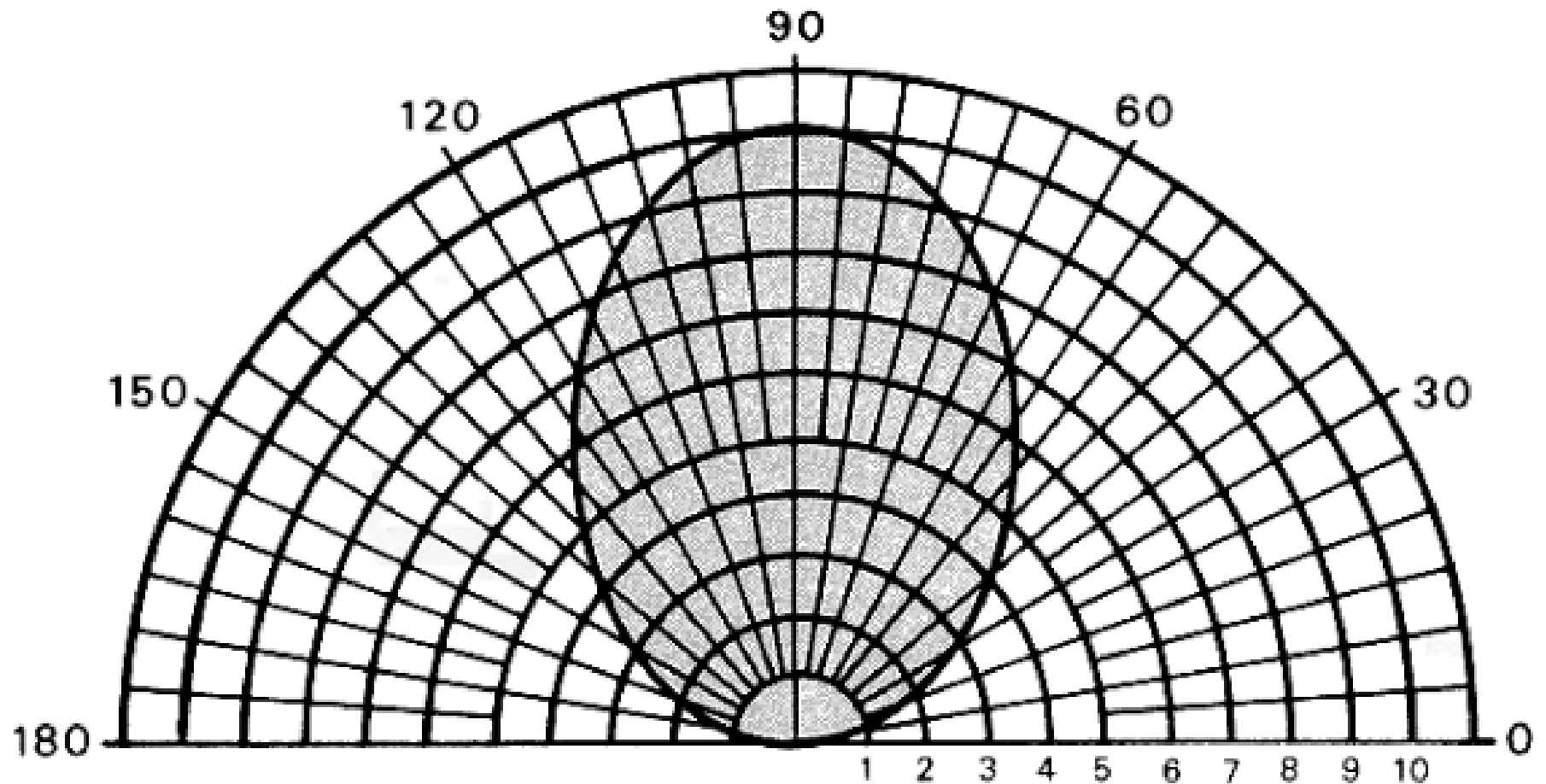
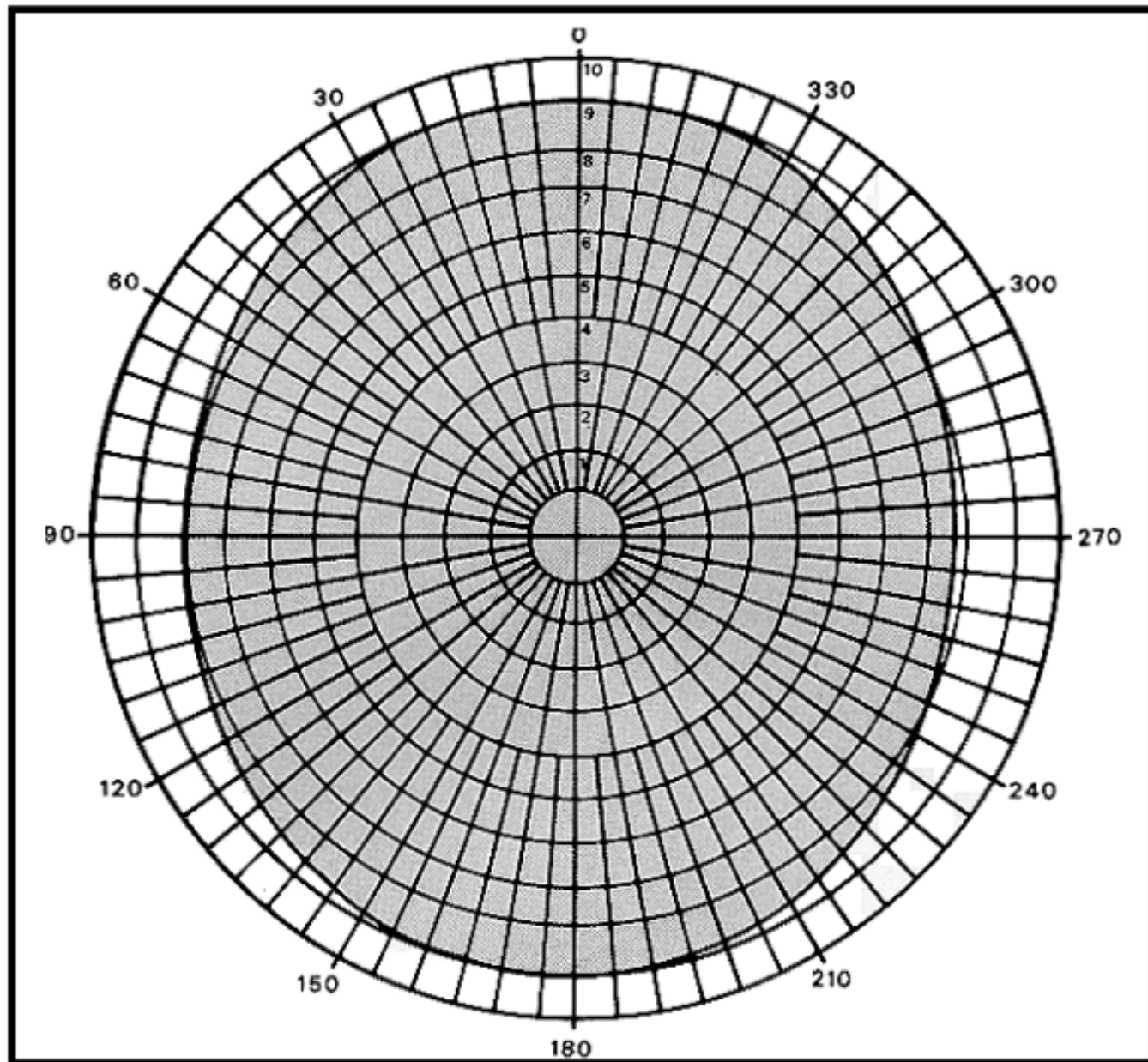


Figure M-6 Typical elevation plane patterns for half-wavelength antennas one-eighth wavelength or less above ground.



*Figure M-2. Near-vertical incidence sky-wave antenna
typical azimuth plane pattern.*

Advantages of NVIS

- **NVIS requires no infrastructure such as repeaters or satellites. Two stations employing NVIS techniques can establish reliable communications without the support of any third party.**
- **NVIS techniques can dramatically reduce noise and interference, resulting in an improved signal/noise ratio.**
- **With its improved signal/noise ratio and low path loss, NVIS works well with low power.**

Advantages of NVIS

- **Pure NVIS propagation is relatively free from fading.**
- **Low areas and valleys are no problem for NVIS propagation.**
- **Antennas optimized for NVIS are usually low. Simple dipoles work very well. A good NVIS antenna can be erected easily, in a short amount of time, by a small team (or just one person).**

NVIS Military Applications



- **The U.S Army uses NVIS and other techniques to provide effective HF signals for short, medium and long haul communications. The next frame is an impressive view of part of their antenna farm at Fort Bragg.**

3rd Special Forces FT. Bragg Phased Logs
Array Solutions



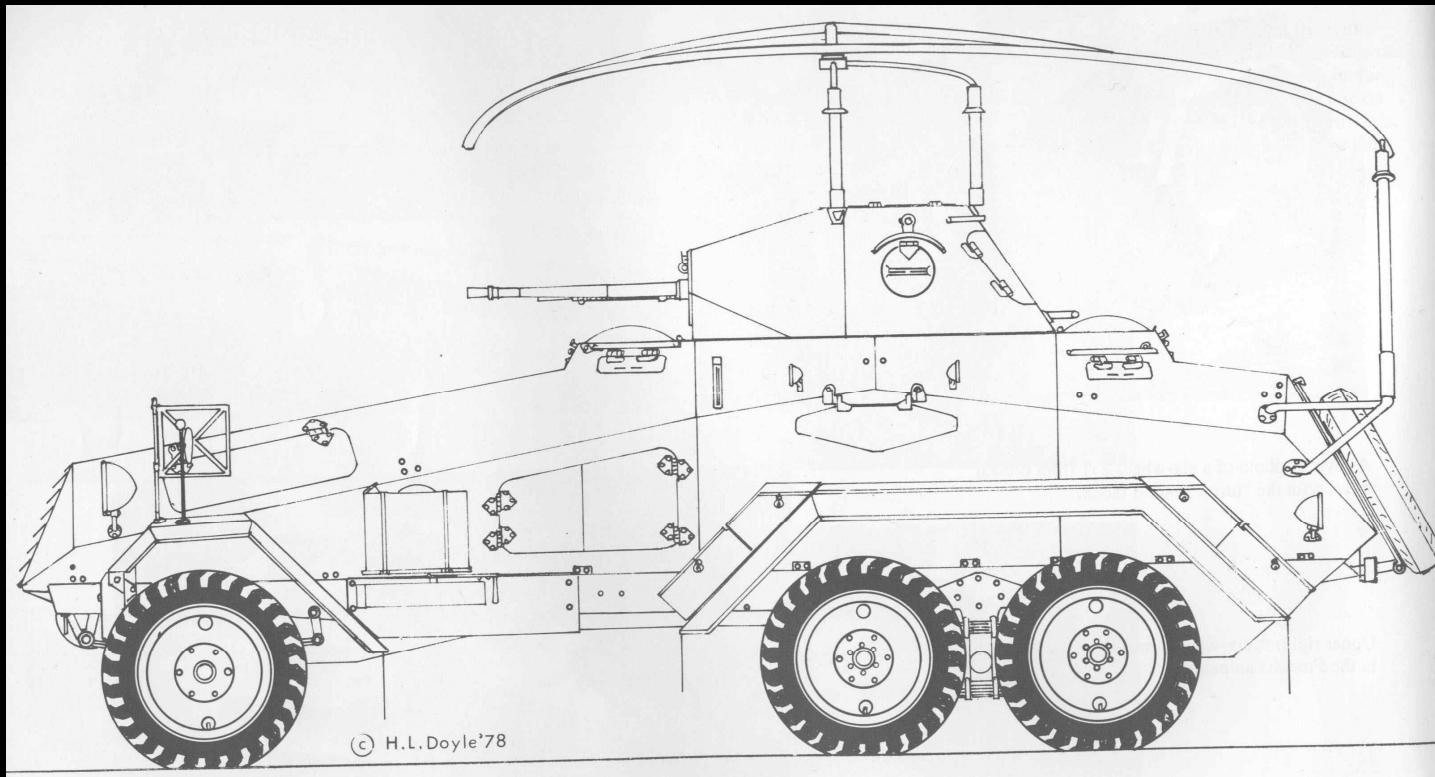
**Russian military communications
vehicle which uses an NVIS antenna system.**

Photos by PA3EQB

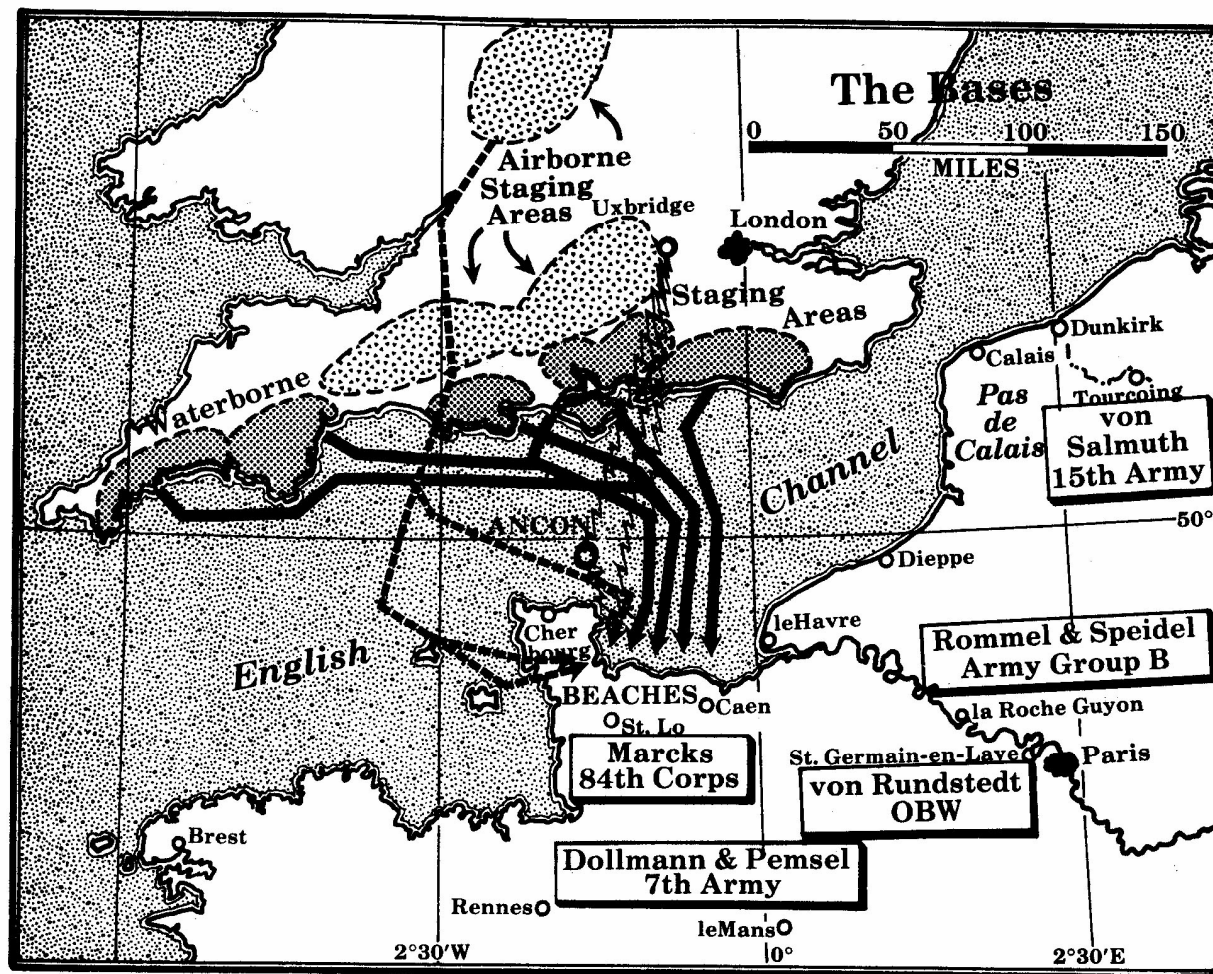




Light-recon vehicle used in forward areas by German forces during WW II.



NVIS played a key role for Allied Forces during D-Day in 1944. These techniques were incorporated by Dr. H. H. Beverage.



**USMC test
proves NVIS
highly reliable.**

**20 watts = 100%
effectiveness in
200 mile radius**

Lt. Col. David M. Fiedler, NJARNG

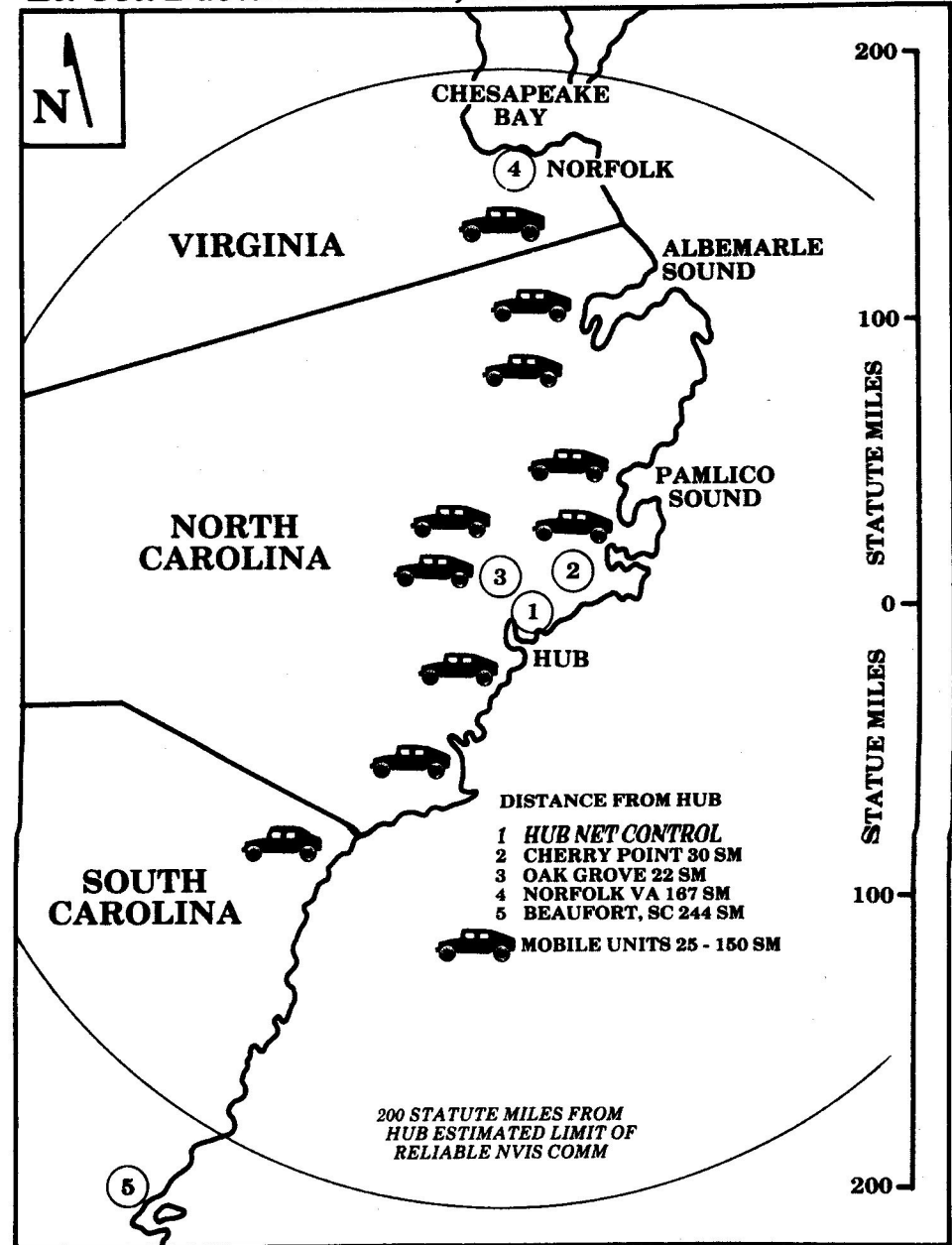
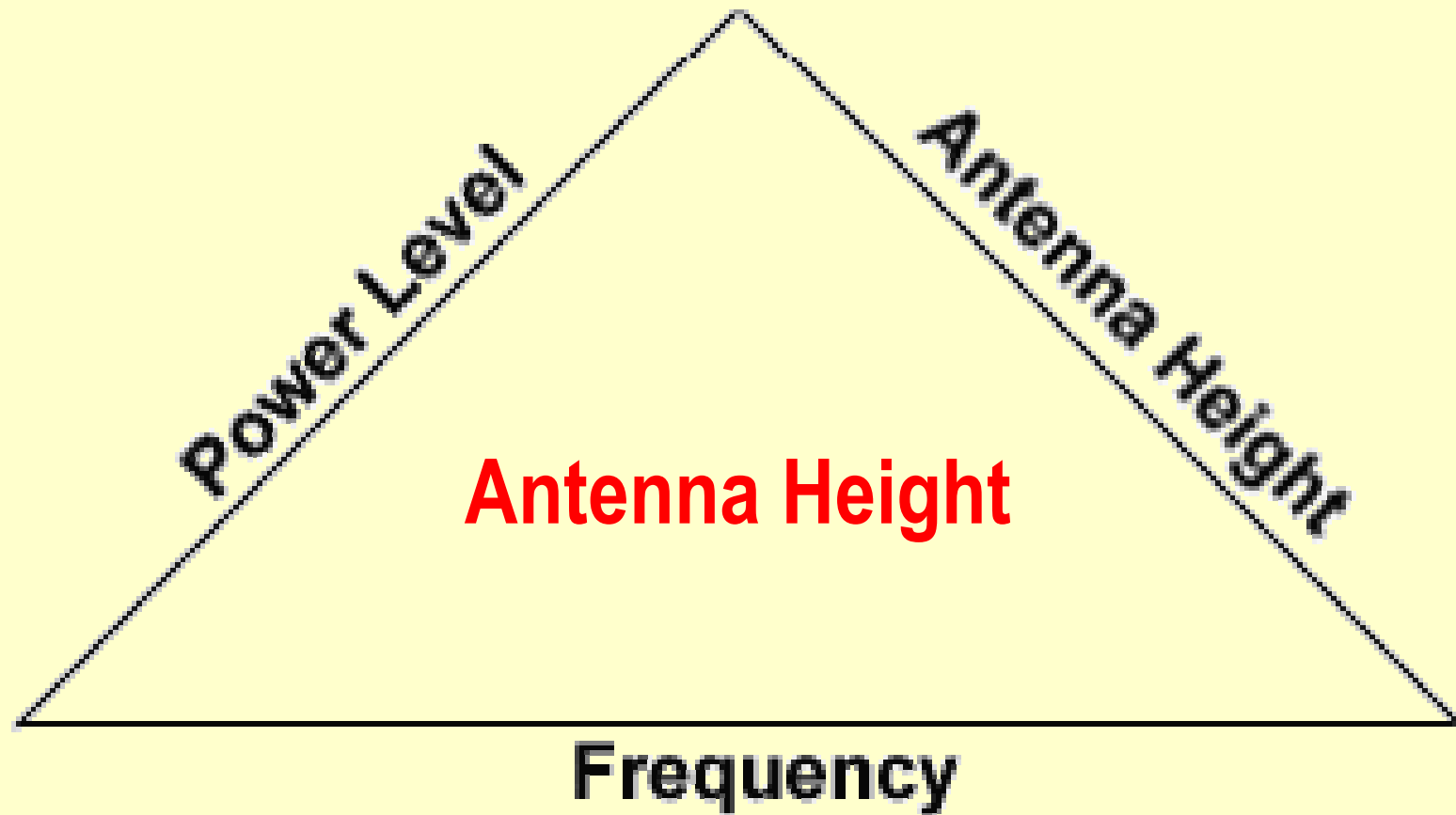


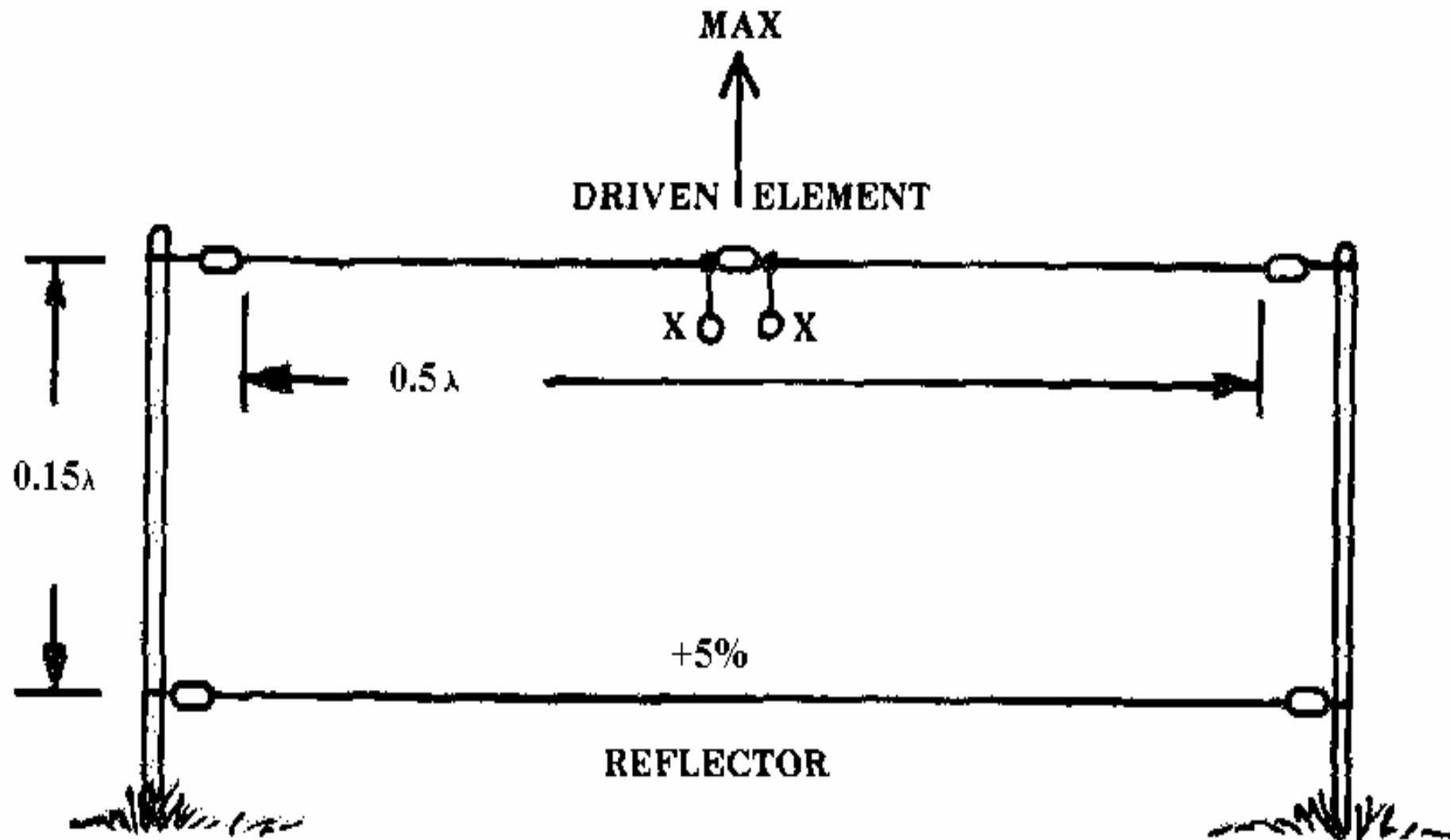
Figure 1. Area of test operations



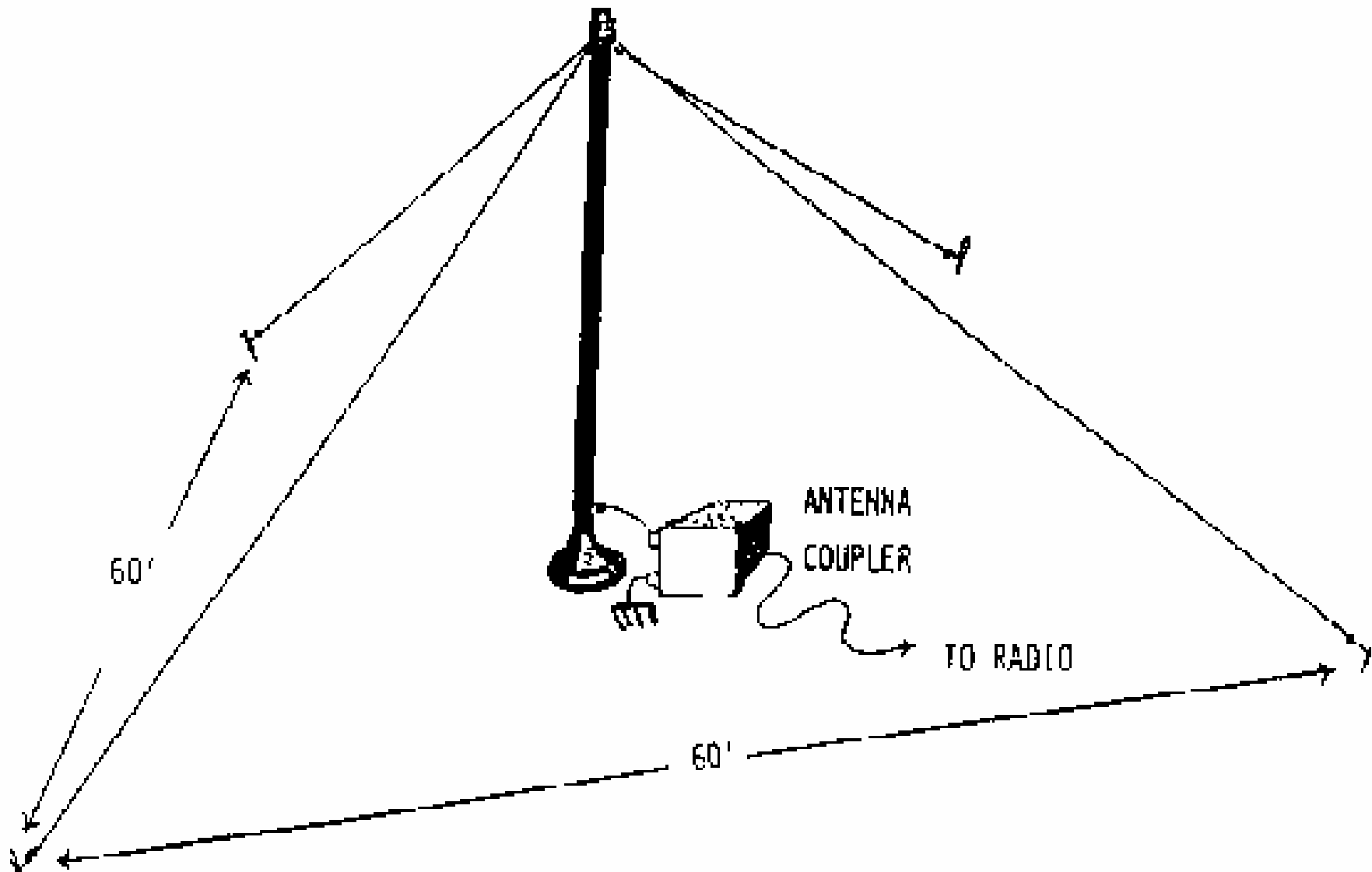
NVIS Deployment

- One of the most effective antennas for NVIS is a dipole positioned from .1 to .25 wavelengths (or lower) above ground.
- Heights of 5 to 10 feet above ground are not unusual for NVIS setups.
- The inverted vee is another good NVIS antenna so long as the apex angle is kept gentle--about 120 degrees or greater.

NVIS Dipole with Reflector



AS-2259/GR or Collins Antenna



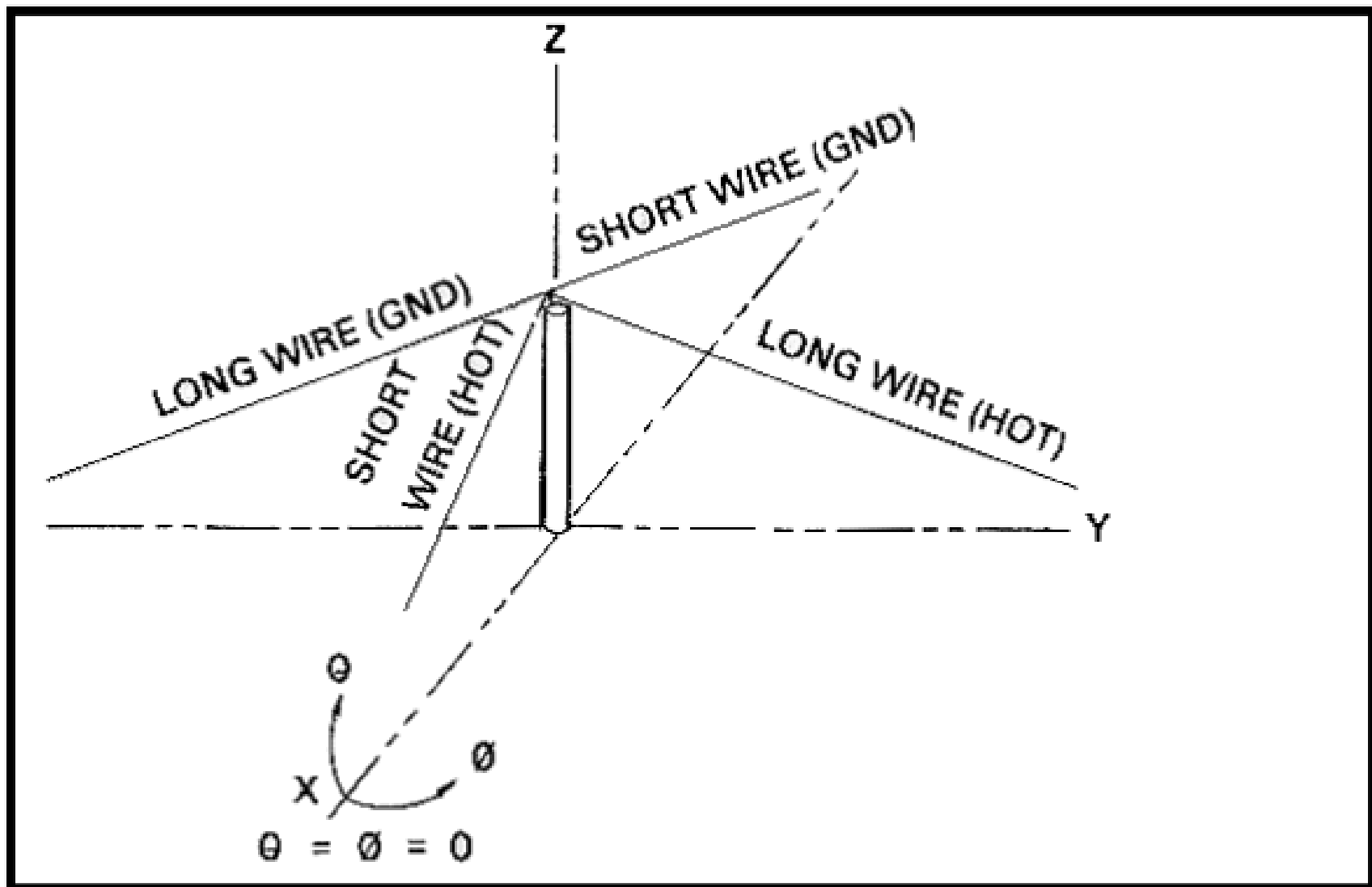
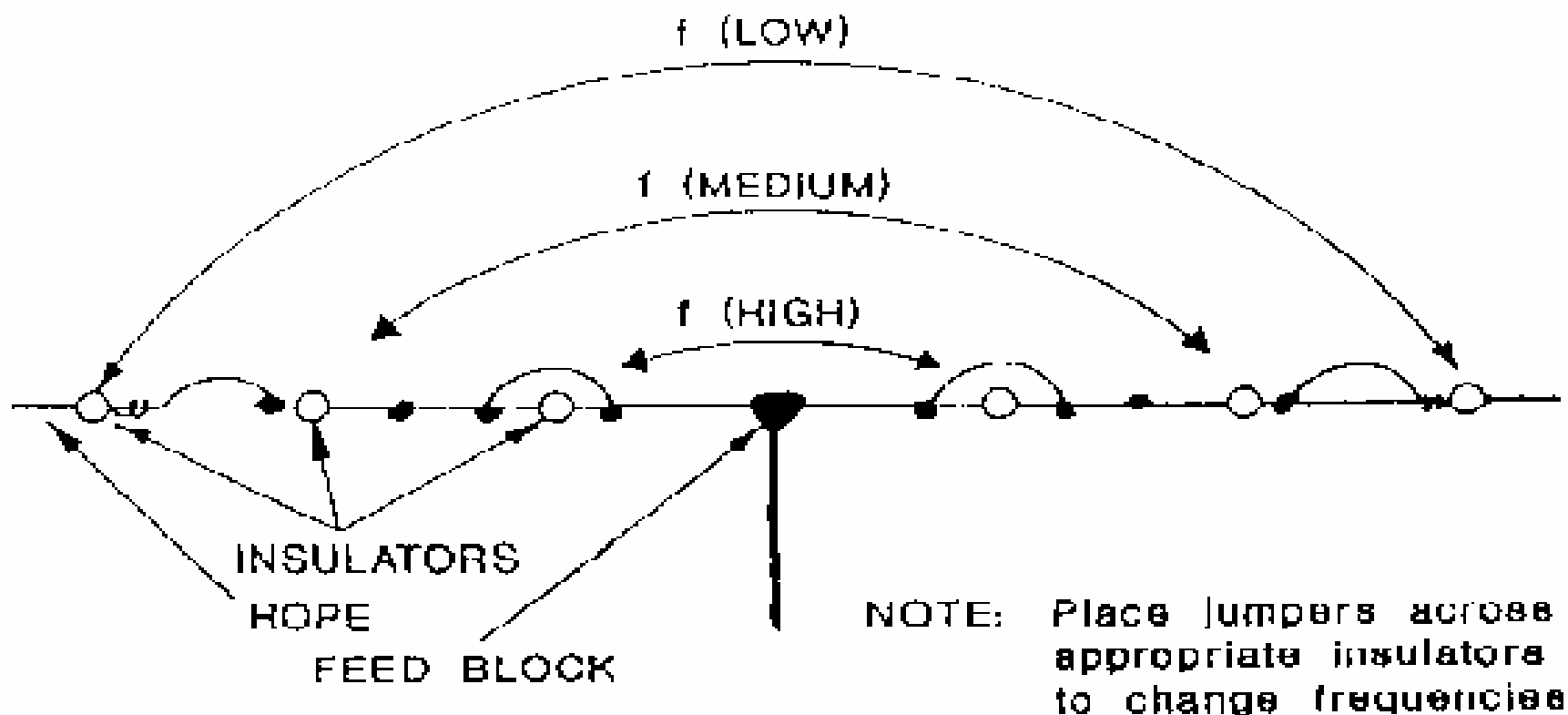
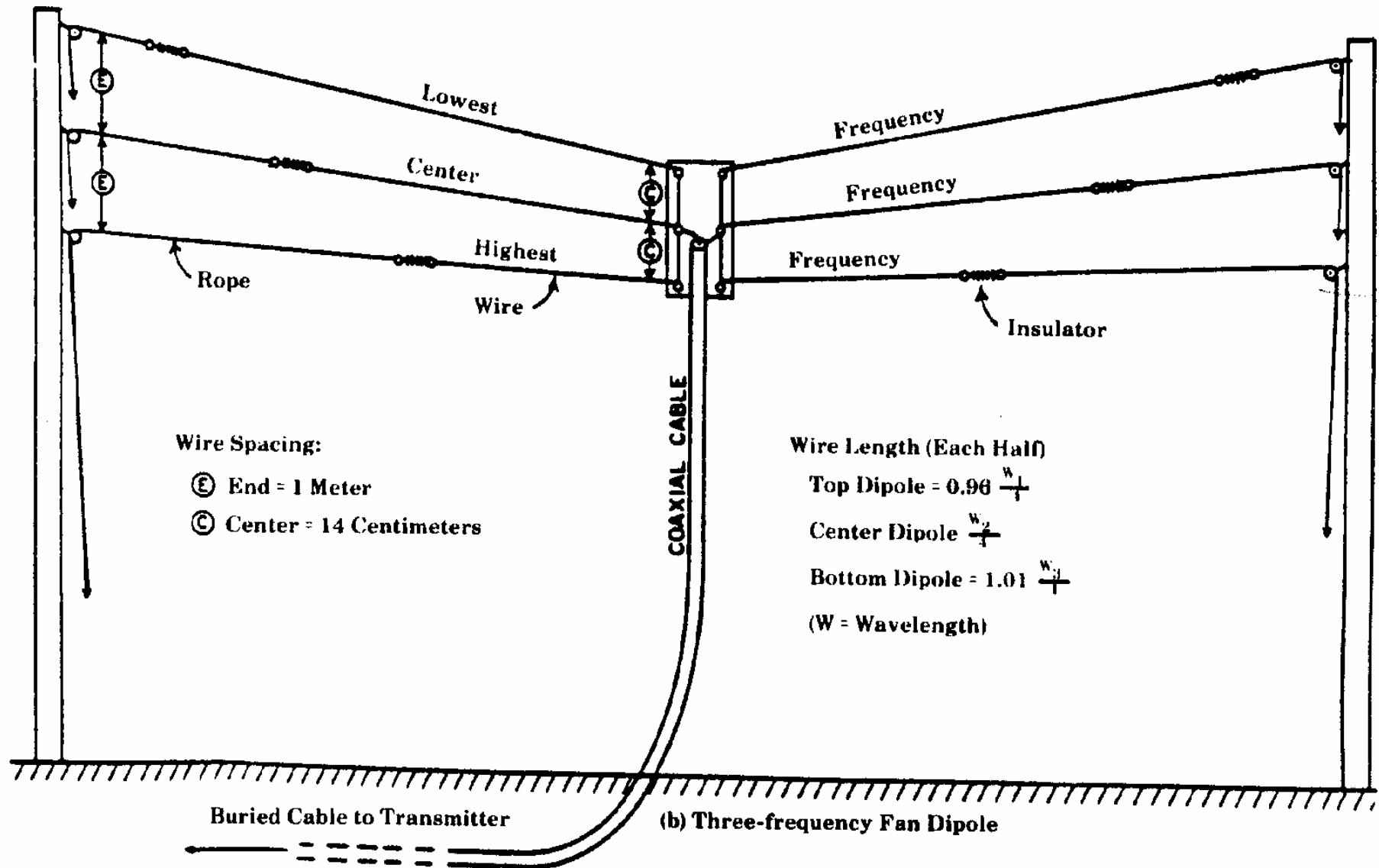


Figure 3-24. Physical configuration and coordinate location of elements of AS-2259/GR antenna.

NVIS Jumppered Doublet



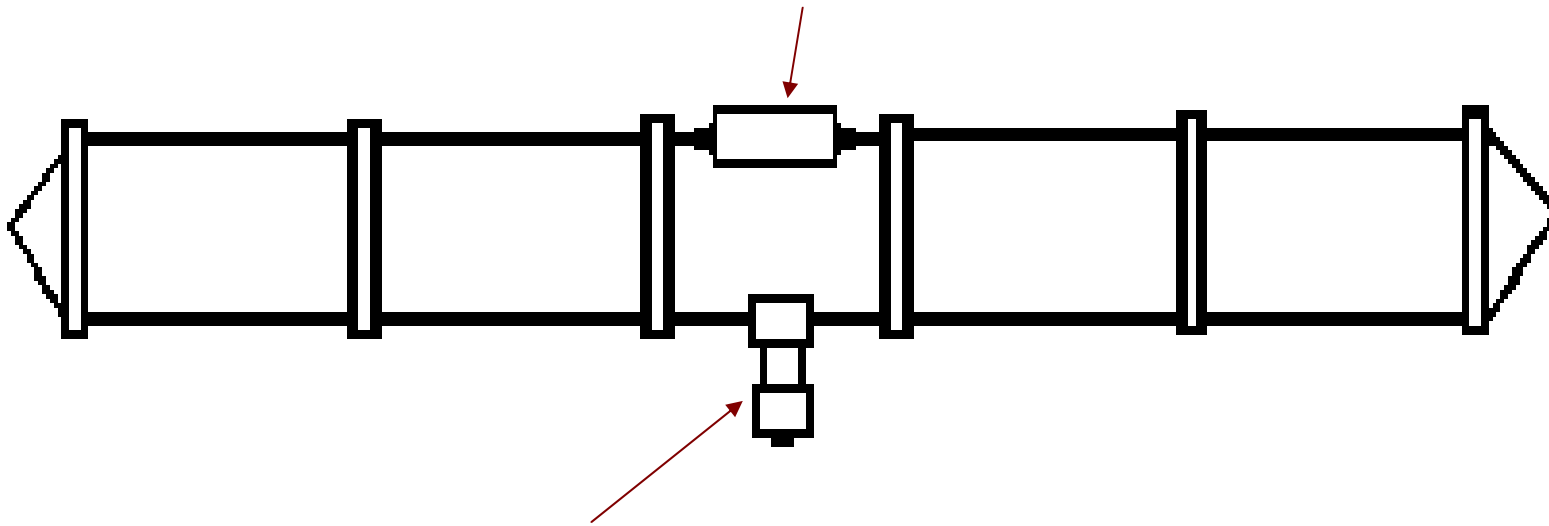
NVIS Fan Dipole



Folded Dipole

Antenna total length approx 90ft

600 Ω Terminating Resistance/Balancing Network



12 : 1 Stepdown Balun to 50 Ω

Example – Barker & Williamson BWD 1.8 – 30 MHz Wideband Folded Dipole

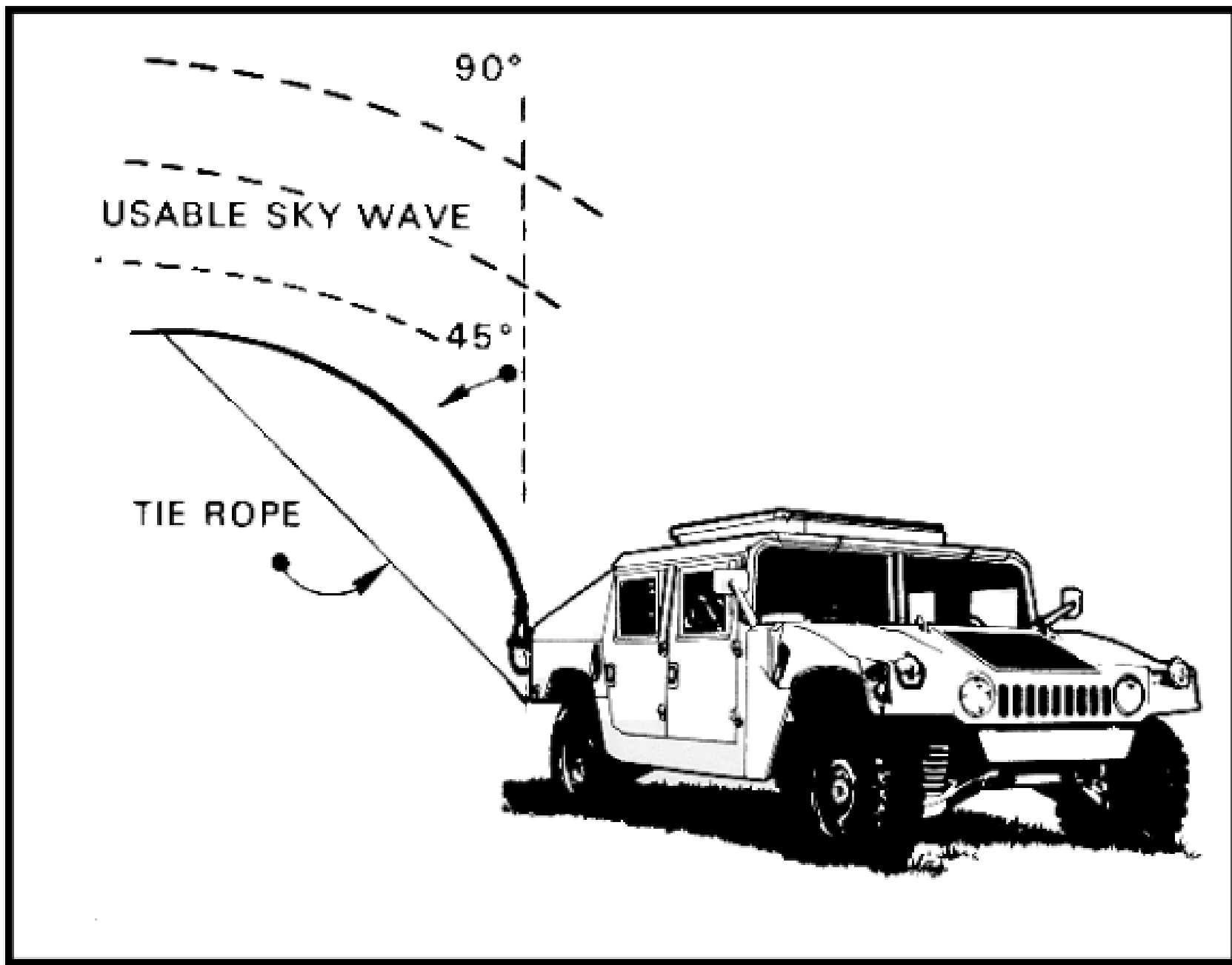


Figure M-9. Tying the whip antenna down.

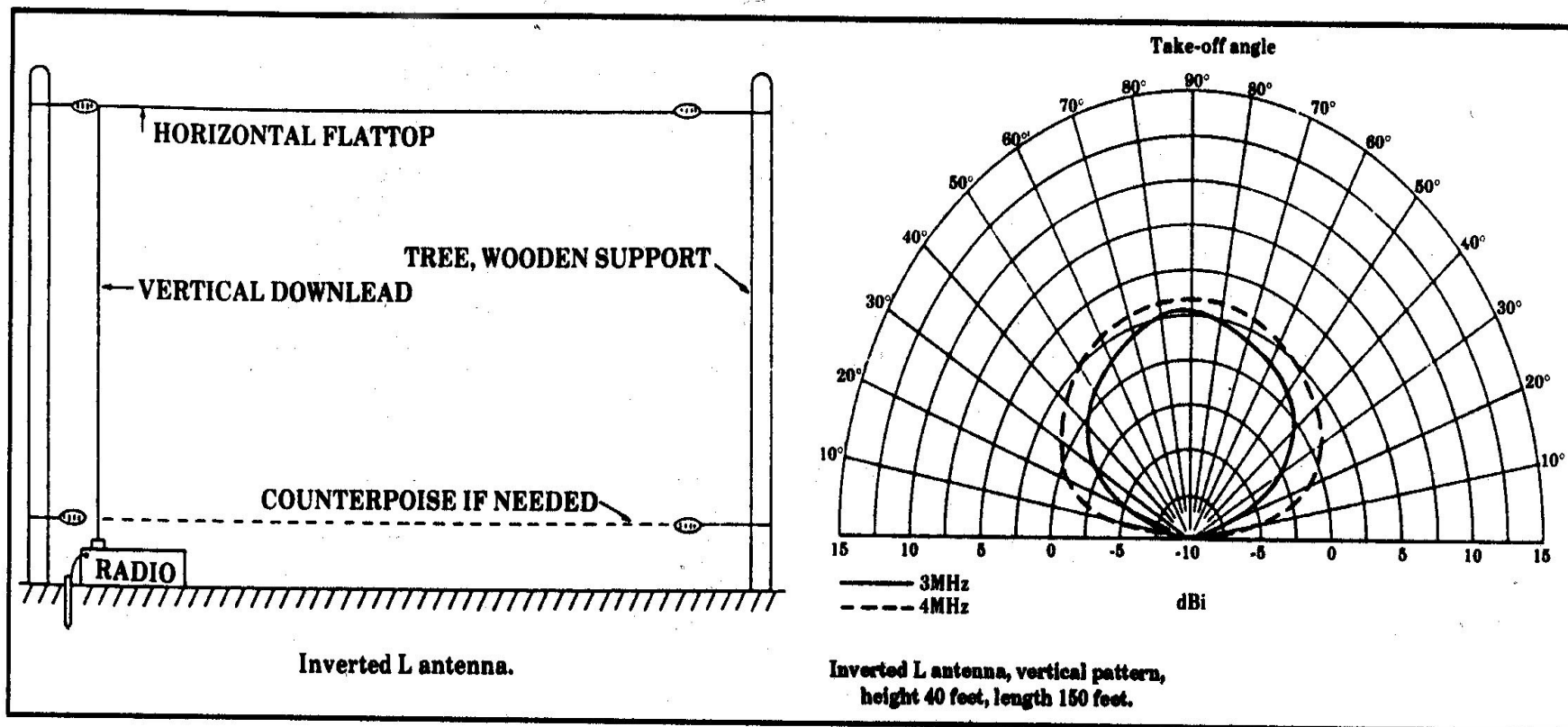
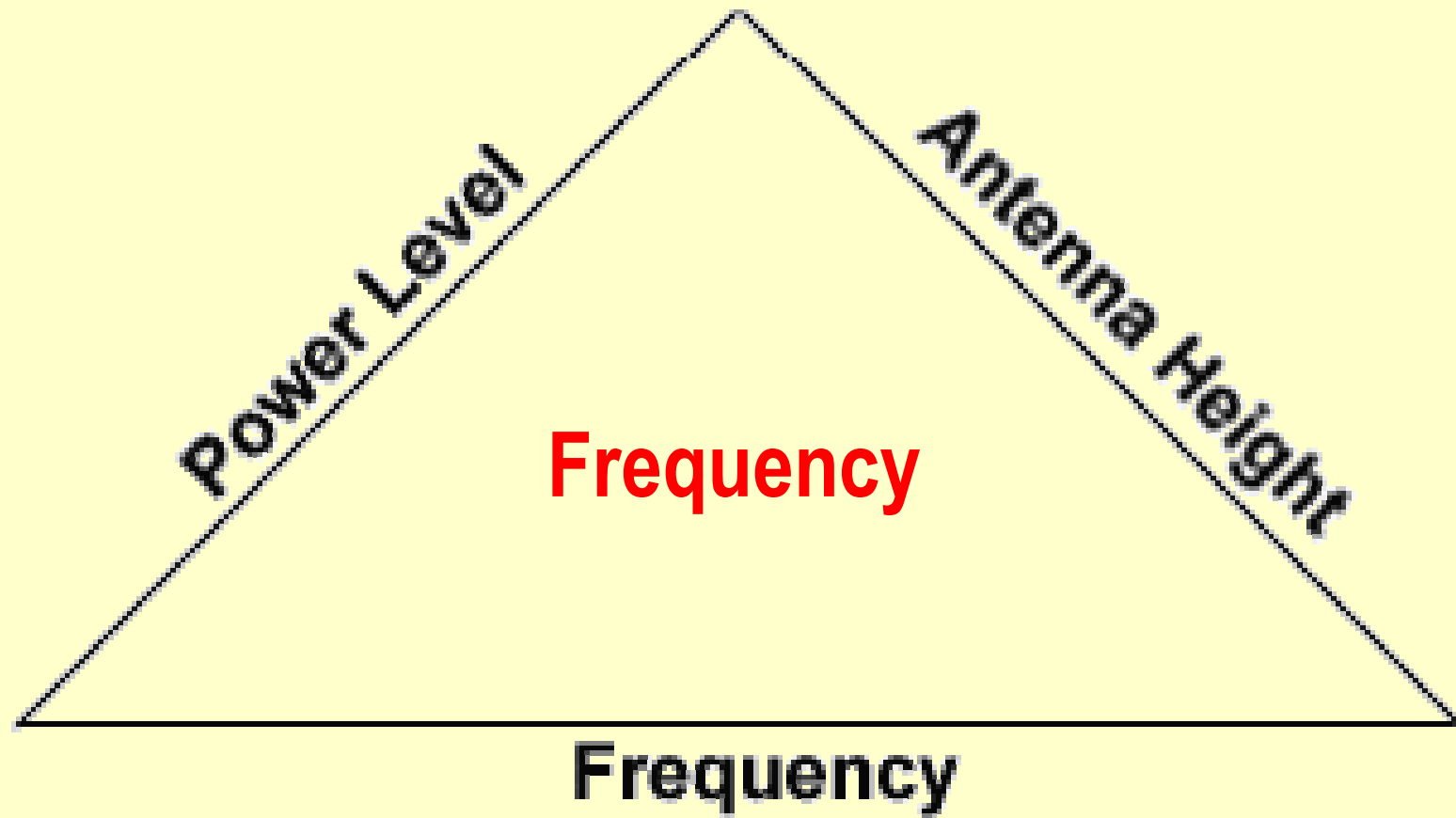


Figure 3. Inverted "L" antenna

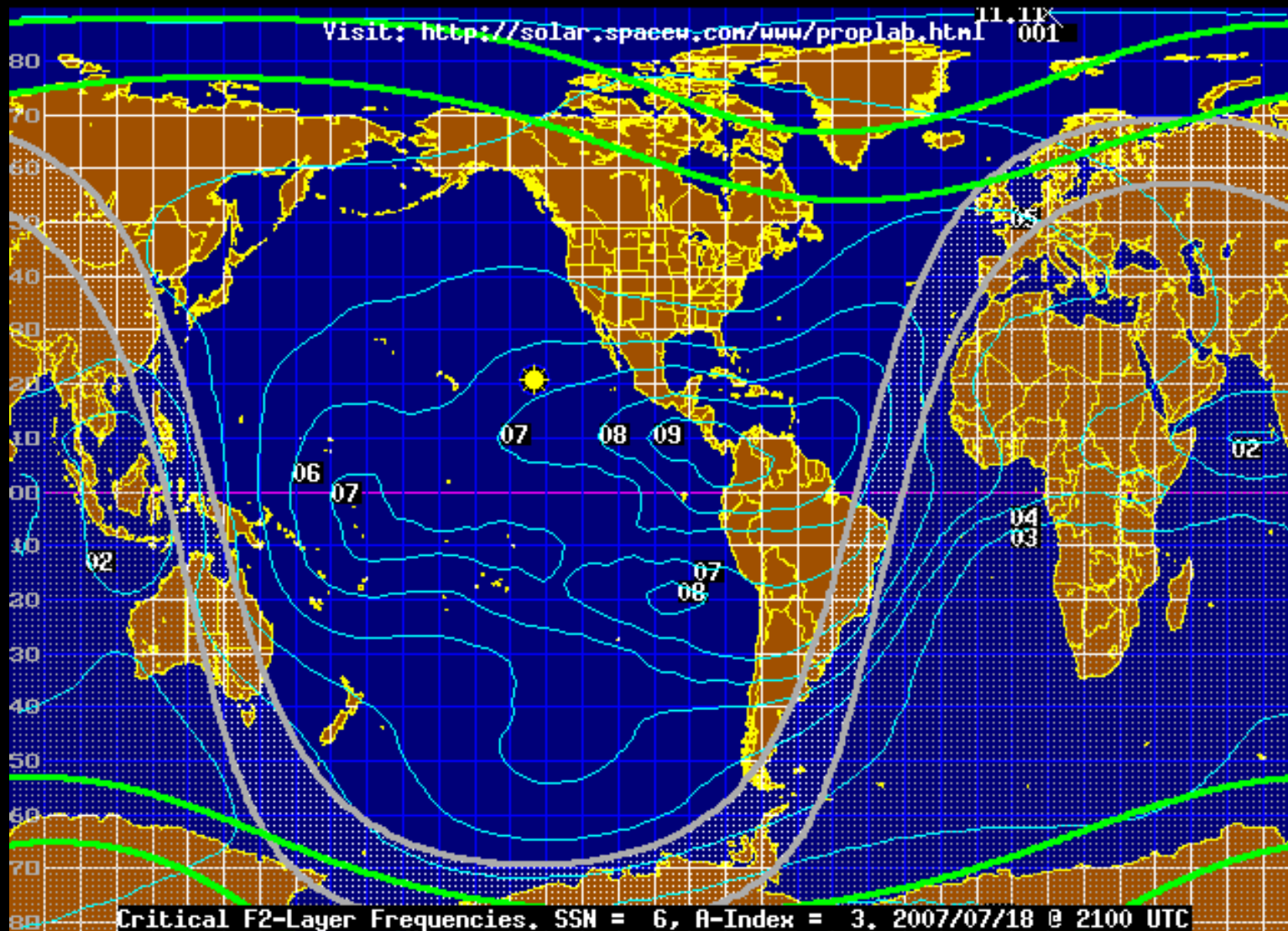
Fixed stations tests				
"Inverted L"				
Camp Lejeune	Cherry Point	Seymore Johnson	Ft. Bragg	Myrtle Beach
	100%	100%	100%	100%

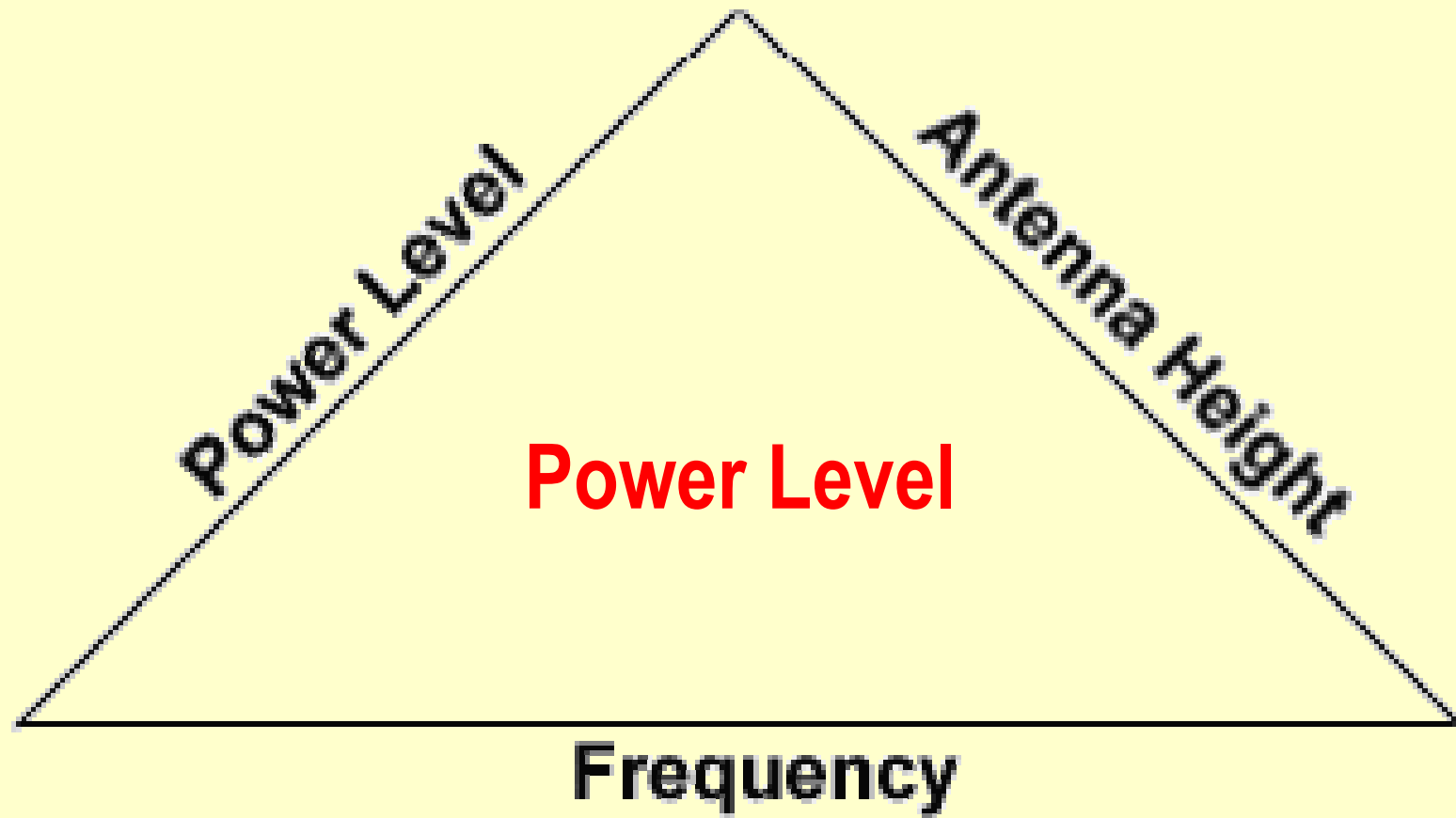


NVIS Deployment

- **Typical frequency ranges used for NVIS are usually between 2.0 and 10 MHz.**
- **40m amateur band for daytime and 75/80m for nighttime communications.**
- **The new 60m band with it's power & antenna limitations can be very effective using NVIS techniques.**
- **Desired modes are SSB, RTTY and PACTOR.**

NVIS F2 Critical Frequency





NVIS Deployment

- **With its improved signal/noise ratio and low path loss, NVIS works well with low power.**
- **20 – 30 watts portable stations have a very high reliability factor making them very favorable for emergency or clandestine operation.**
- **Low power stations can run RTTY at 100% duty cycle.**
- **NVIS stations can generally be of the 100 watt variety.**

W3IZ Deploying NVIS in Nockamixon Park.



NVIS Conclusions

- **By steering the take off angle of your signal, HF communications can be extremely reliable for the long haul, medium haul and short haul.**
- **NVIS and high angle waves are very effective for ranges of 200 to 300 miles and out to 800 miles.**
- **No need for third party support such as repeaters or satellites.**

NVIS Conclusions

- **NVIS is effective in any terrain.**
- **Because of low S/N ratio NVIS is good for RTTY, PACTOR and SSB.**
- **NVIS is easy to deploy and very portable.**

Stuff To Checkout

- **“Near Vertical Incidence Skywave Communication”**, by David Fiedler and Edward Farmer, Oct 1996, \$14.00, from WORLD RADIO Books, PO Box 189490, Sacramento, CA 95818.
<http://www.wr6wr.com/Products/Books/NVIS/nvis.html>
- **Websites of interest**
 - http://www.tactical-link.com/field_deployed_nvis.htm
 - <http://www.qsl.net/wb5ude/nvis/>
- **SGC makes rugged and portable gear**
<http://www.sgcworld.com/2020/2020adsp.htm>
- **NVIS reflector**
<http://groups.yahoo.com/group/nvis/>

