



Civil Air Patrol Communications Micom-3T HF Radio Operation

Overview of the Motorola Micom-3 Series High Frequency Radios

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Objectives

- ▶ Intro to CAP Communications
- ▶ HF Theory and Use
- ▶ Micom-3T Configuration
- ▶ Micom-3T Use
 - ▶ Simplex
 - ▶ ALE
- ▶ Antenna Configuration
- ▶ Practical Exercise

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Introduction to CAP Commo

“You can talk about us,
but you can't talk without us!”



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Guidance

Communications Use In Accordance With:

- Department of Defense (DoD),
US Air Force (USAF)
- National Telecommunications and
Information Association (NTIA)
- Civil Air Patrol (CAP)
 - National Headquarters (NHQ)
 - National Technology Center
(NTC)
 - PA Wing Guidance

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Introduction to CAP Commo

- Aircraft
 - VHF-AM
 - VHF-FM
 - Repeaters
- Ground
 - VHF-FM
 - HF



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Aircraft Capabilities

- VHF-AM
- VHF-FM
 - Technosonic TDFM-13
 - Northern Airborne Technology NPX-138
- VHF Repeaters
 - Motorola PDR-3500
 - Customer Furnished



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Ground Capabilities

- VHF-FM Radios
 - Analog
 - Digital APCO-P25
 - DES / AES Capable
- Asset Overview
 - Fixed Stations
 - Vehicles
 - Cache Kits



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Ground Capabilities

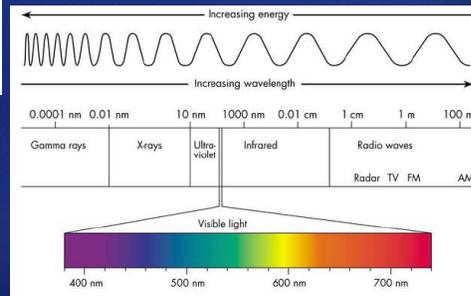
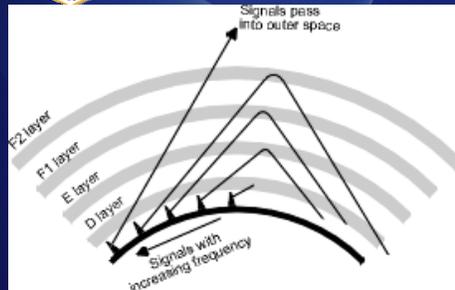
- VHF-FM Repeaters
 - Motorola Quantar Repeaters
 - 21 (2+1) Repeaters Online
 - Portable Repeaters
- Site Selection
- Phone Remote Access



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Introduction to High Frequency Theory



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What Does HF Mean?

HF stands for **HIGH FREQUENCY**

These are the frequencies from 1.8 to 30 MHz. Frequency length will vary from 160 meters to 10 meters long.

HF is also known as **shortwave**.

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How is HF Different from VHF?

HF = 2 MHz to 30 Mhz

(30 Mhz Spread)

VHF = 136 Mhz to 174 Mhz

(40 Mhz Spread)

No infrastructure / repeaters are used.

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How is HF Different from VHF?

Propagation is strongly effected by solar activity.

Several communication modes are available to use in CAP.

HF = SSB, AM, Digital (ALE)

VHF = FM, Digital (P25)

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How is HF Different from VHF?

- Allows communication beyond line of sight.
- Contacts are generally a couple of hundred miles to over several thousand miles.

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Who Uses HF?

Because of the ability to communicate over long distances, HF is used by:

- Government
- Military
- Commercial
- Amateur Radio
- Maritime
- Aircraft

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Basic HF Theory

Radio Waves enter region of charged particles in the Ionosphere

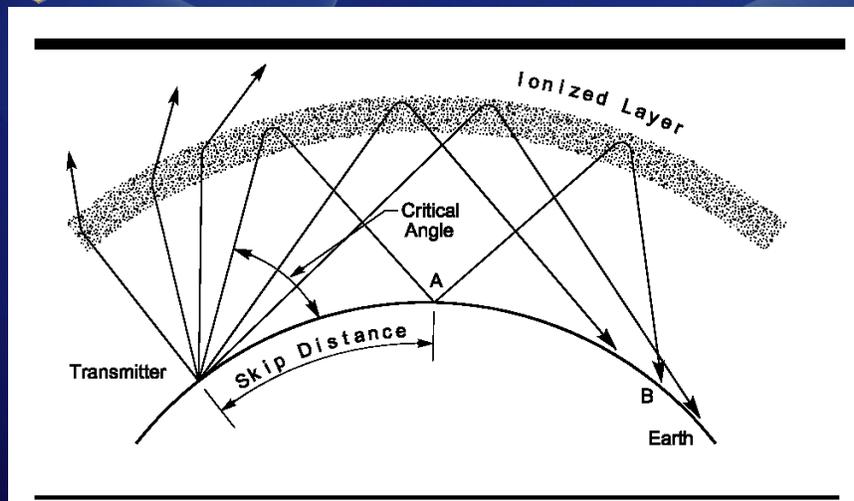
Radio Waves can reflect, path altered.

Depends on Frequency, Time of Day, Solar Effects, Antenna Configuration...

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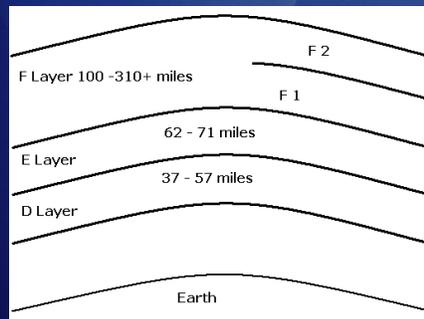
Basic HF Theory



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Layers of the Ionosphere



- F Layer, Longest Range, Skip, Long λ
- E Layer, Long Range, Daytime Effects, Shorter λ
- D Layer, Closer to Earth, Daytime Effects, Shorter λ

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General Skip

In general, for simplex HF operations, primary day and night frequencies may be used.

Automatic Link Establishment (ALE) helps pick the best frequency for conditions.

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Propagation

There are three basic types of propagation of HF radio signals:

- **Sky-wave**
- **Ground wave**
- **High Angle Radiation (NVIS)**

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Sky-Wave

The **Sky-wave** is the wave that travels to the upper regions of the atmosphere and gets reflected back to Earth.

Responsible for very long distance communications.

Engineered Antennas

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Ground Wave

Ground wave is the signal that radiates close to the ground from the Earth's surface up to the lower atmosphere or *troposphere* and is reflected or diffracted by the terrain.

Ground waves are generally good for about 100 - 200 miles on HF during the day.

Tactical HF Antennas, Close to Ground Antennas

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High Angle Radiation

Near Vertical Incidence Sky-Wave (NVIS)
“Straight Up” Communication

Radio Waves that take off at very high angles are reflected straight back to Earth allowing a blanket over a significant area close to the transmit location.

Folded Mobile Whip Antenna Configuration

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High Angle Radiation

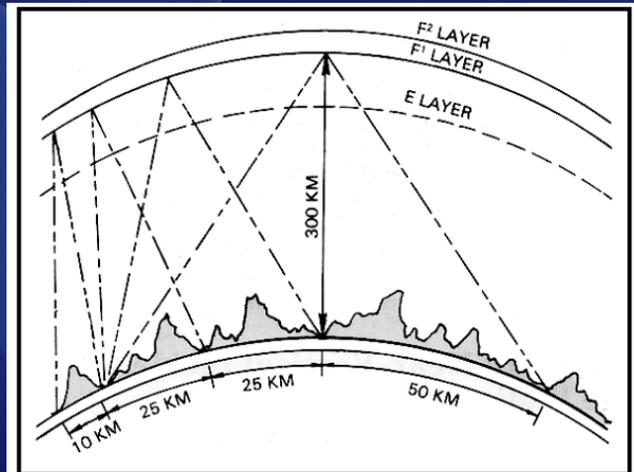


Figure M-1. Near-vertical incidence sky-wave propagation concept.

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HF Theory and Use

Questions?

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Micom-3 Radio Series



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Micom-3 Specs

Manufactured by Elbit / Mobat for Motorola

1.6-30 MHz TX, 100 KHz-30 MHz RX

200 Channels

125 Watt PEP Average

13.8 V \pm 20% (25 Amp Tx, 5 Amp Rx)

ALE MIL-STD-1045 / MIL-STD-188-141B

Digital Signal Processing (DSP)

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General Display

Indication	
	Strong received signal
	Weak received signal
	Full transmit power (125W)
	Actual transmit power
	Low transmit power
	Reflected Power

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Micom-3 Menu

CHAN - Channel mode: the radio uses a set of preset parameters. A standard set of HF frequencies are preloaded and standardized nationally.

FREQ - Frequency mode: you can select manually the frequency and the other parameters to be used. Should not be used on CAP equipment without authorization from the Wing Director of Communications (DC).

ALE - ALE mode: when you want to call other radio, the radio automatically sets up a link on the best free frequency that can be found. A standard set of ALE Nets are preloaded and standardized nationally.

SCAN - SCAN mode: when ALE is not used, a set of channels to be scanned before starting a call.

BIT - BIT mode: lets you check that the MICOM-3 is OK. Should not be used without authorization and equipment from the Wing DC.

LOCK - Lock the radio to prevent unauthorized use. To lock and unlock, you enter a password. Should not be used without authorization from the Wing DC.

PROG - Programming mode: lets you program the required parameters. Should not be used without authorization from the Wing DC.

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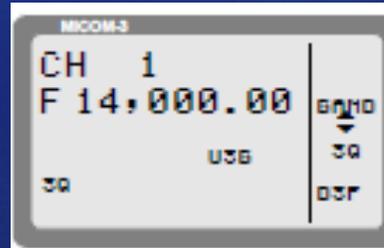


Channel Mode

MENU > CHAN > Enter Channel Number from Keypad > ENTER. Confirm CHAN XX.

PAWG Primary
CH 12

National HF Simplex
CH 1 - CH 4



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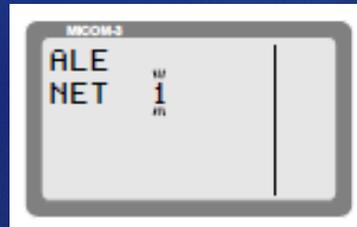


ALE Mode

MENU > ALE > Enter NET Number from Keypad > ENTER. Confirm NET X.

NER Net = NET 1

NHQ Net = NET 9



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Call ALE Station

When calling another ALE station, the radio will automatically find the best mode to communicate with the destination station.

Confirm NET X.

CALL > Use Up / Down Arrow to Selection Station Name OR Use Keypad to TXT > ENTER > SEND. Radio will now call out.

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Call ALE Example

Call PAWG Wing Headquarters Station (0010PACAP).

MENU > ALE > Press "1" > ENTER.
Display should be ALE NET 1.



CALL > Press "0" "0" "1" "0" "7 7" "2 2" "2 2 2" "2 2" "7 7" (This spells 0010PACAP) > ENTER > SEND.

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Call MLE Station

Micom 2 Radios follow MIL-STD-188 and can be called individually using Manual Link Establishment (MLE).

Use similar procedure for ALE, but pick channel. (IE: PAWG Primary CH 12)

Works with addressed Micom-2 Radios

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Call MLE Example

Call PennCAP 99's Micom-2 (0099PACAP).

MENU > ALE > Press "1" > ENTER.
should be ALE NET 1.



CALL > Press "0" "0" "9" "9" "7 7" "2 2" "2 2 2" "2 2" "7 7" (This spells 0099PACAP) > ENTER > CHAN > Press "1" "2" (This selects CH 12 to transmit on) > ENTER > SEND.

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Call MLE Considerations

The station you are calling must:

- Be a Micom-2 Radio
- Be monitoring a channel in the ALE Net Suite of Channels
- Be able to hear MIL-STD tones (Could be impacted by interference, high noise floor, poor propagation)

Bottom Line: MLE establishes and alerts!

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Check ALE Self Address

Default self address is last four SN, Wing Name, CAP (nnnnPACAP).

If the station name is unknown, or the station needs an updated name, it can be changed.

Self-Address is the only authorized field-edited function in the PROG menu.

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ALE Self Address Note

Note: Failure to program Self-Address properly will cause the radio to no longer function in ALE mode!

All Self Address Formats are the same as per CAPR 100-1: nnnnAACAP

nnnn = Wing Call Sign (ie: Penncap 10)

AA = Wing State Abbreviation (ie: PA)

CAP = Standard for Civil Air Patrol

(0010PACAP)

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ALE Self Address Display

MENU > PROG > ALE > NET > NAME >
SELF

This will display the Self Address for the Net selected.

To Edit: MENU > PROG > ALE > NET >
Enter Net Number > ENTER > SELF >
EDIT > Edit Self Address with Keypad >
ENTER

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Micom-3 Modes

Questions?

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Mobile Micom-3T Use



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Mobile Micom-3T Use



Antenna
In
NVIS
Config

WIMA
Antenna
Tuner

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Antenna Tuner

The Micom-3T will automatically tune the antenna whip using the large white tuner assembly at the antenna base.

The WIMA Tuner better matches transmit frequency and reflected power. It does not improve antenna performance.

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Safety Considerations

Radio Frequency Hazards

- Radiation (Non-Ionizing)
- Burns
- Keep Clear of Antenna

- Electrical Hazards
- High Current
- Proper Grounding



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Safety Considerations

DANGER - Never attempt to erect antennas near powerlines.

Always be aware of physical height of mobile HF antennas.

Physical impact to antennas can cause serious injury or death.



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Practical Exercise

Walk Around of CAP Vehicles with Mobile HF equipment.

Familiarization of Micom-3T Operation

Micom-3T Simplex Operation

Micom-3T ALE Operation

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