Distributed Tactical Communications System (DTCS)

Radio Only Alpha (ROA) Operator Training

Mountain Warfare Training Center
Bridgeport, CA

Version 1.10, August 2008

This version supersedes all previous operator training packages.

Instruction Overview

In this course you will learn:

- DTCS basics
  - Introduction
  - Iridium satellite and GPS/PLI

- ROA basics
  - Equipment
  - Assembly
  - Operations: Hardware
  - Operations: Software
  - Basic maintenance and troubleshooting

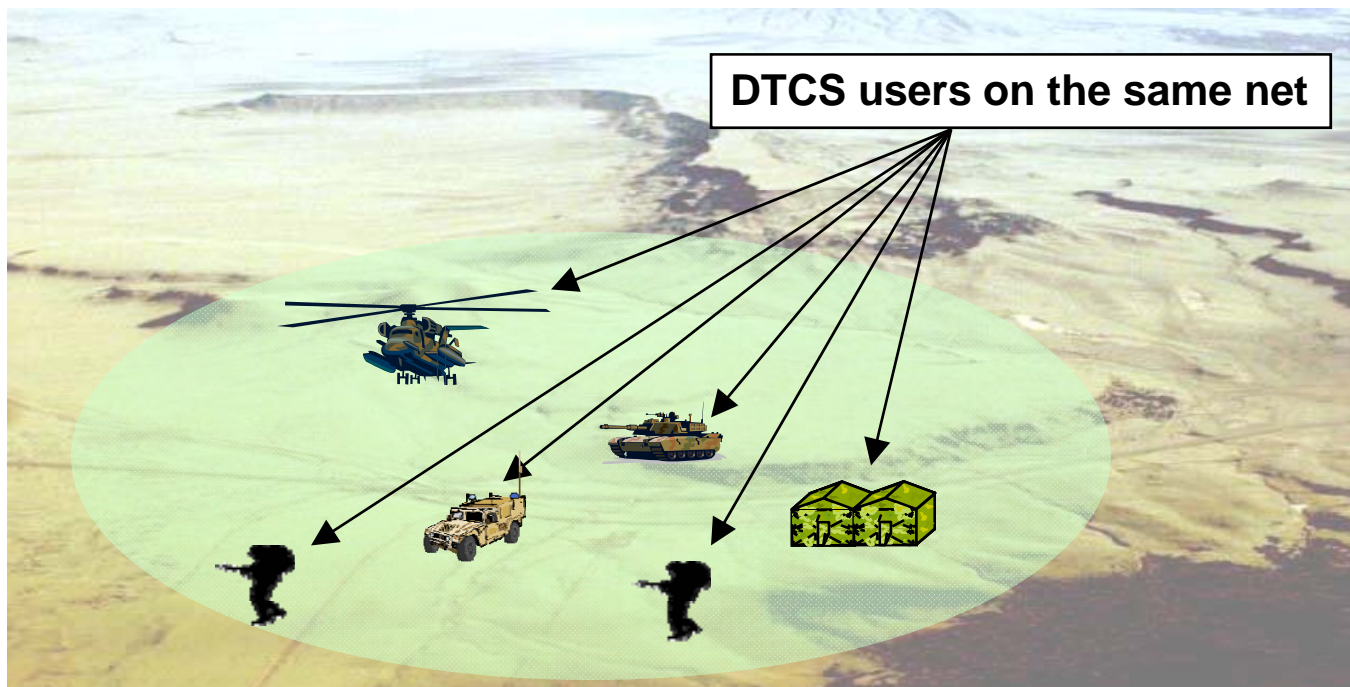**Distributed Tactical Communications System**

DTCS Introduction

What is DTCS?

- DTCS = Distributed Tactical Communications System

- Satellite-based communications system that incorporates Iridium satellite technology, software, and commercial GPS

DTCS users on the same net

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DTCS Provides…

- Push-To-Talk (PTT) voice service

- Over The Horizon (OTH)

- On The Move (OTM)

- Beyond Line of Sight (BLOS)

- Position Location Information (PLI)

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5

DTCS Spiral Improvements

- The Radio Only Alpha (ROA) has been developed based on results from previous prototypes.

Previous Manpack


Current ROA

Future RO:
expected delivery 2009

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Questions?

Iridium Satellite and GPS/PLI Basics

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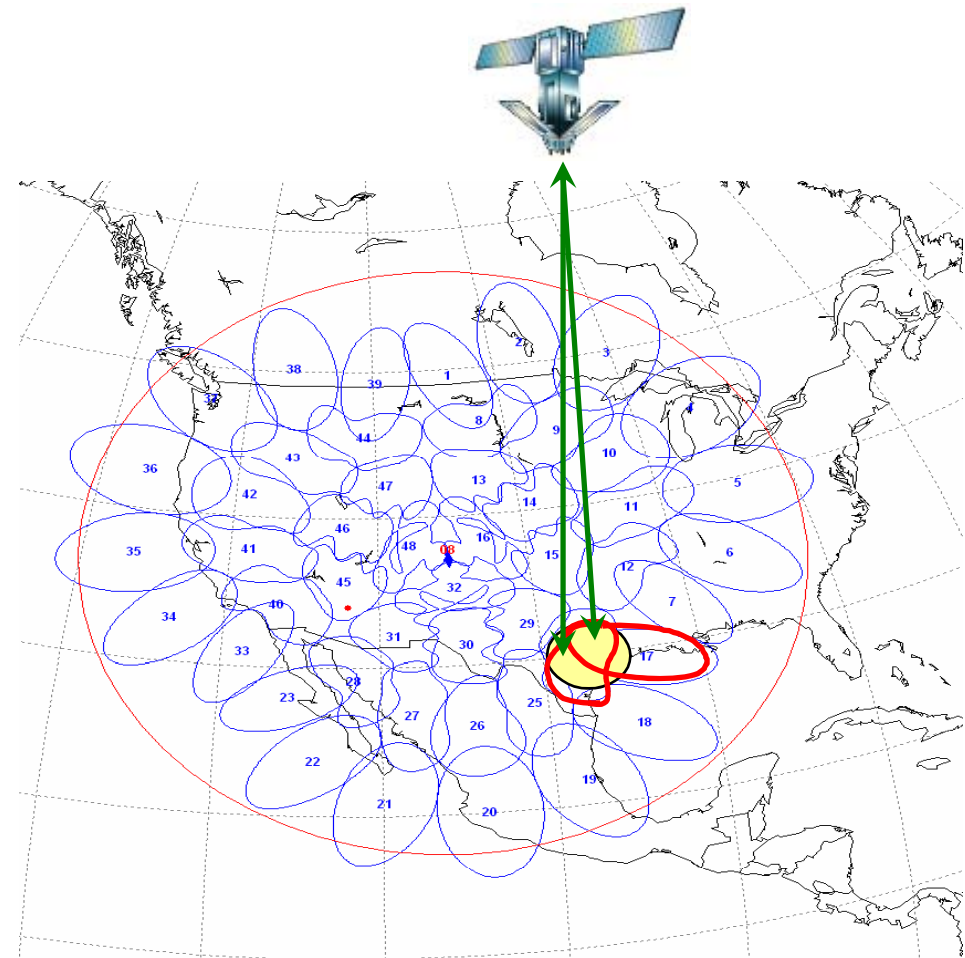
Iridium Constellation

- 66 active Low Earth Orbit (LEO) satellites

- "True global satellite coverage"

- The satellites orbit north-south

  - Signal strength will change over time

- Satellite overflight: 7-9 minutes

1 Jul 2007 12:00:05.000   Time Step: 5.00 sec

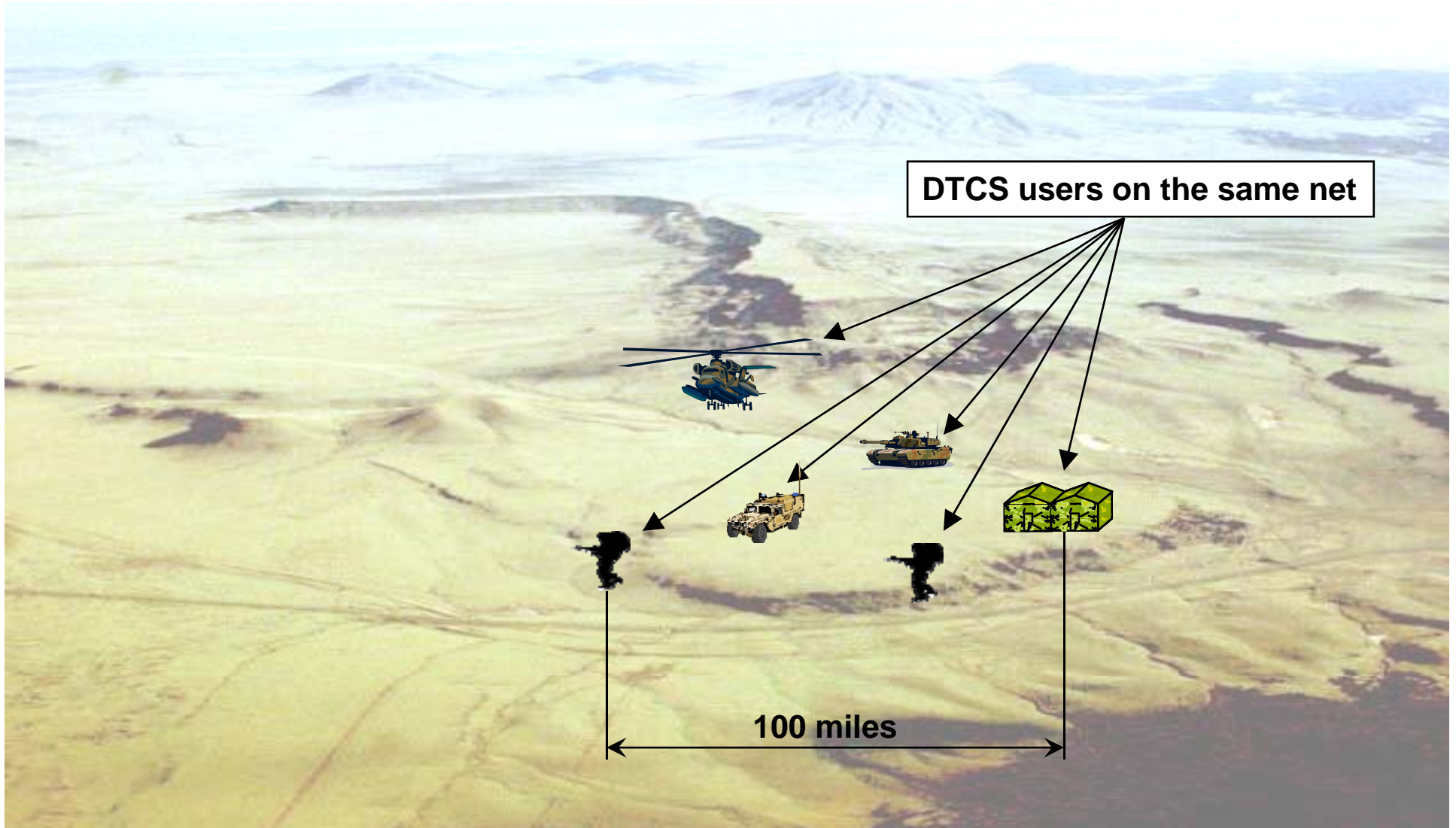*Distributed Tactical Communications System*
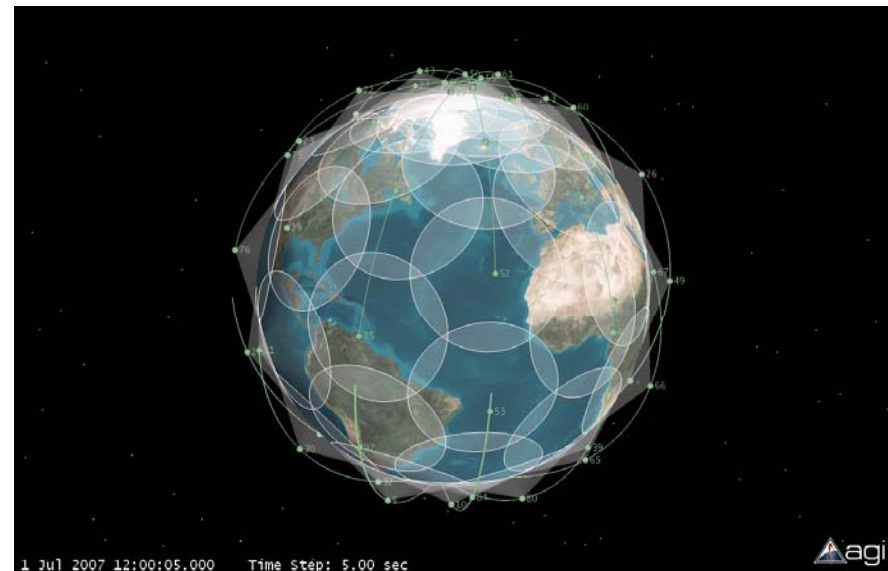
Satellite Coverage

- Each satellite includes 48 spot beams

  - Satellite and spot beam footprints overlap

- DTCS uses one spot beam of one satellite

- Ability to communicate ~100 miles from talker

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DTCS Satellite Communication

DTCS users on the same net

100 miles

DTCS Satellite Communication

1. The talker presses PTT
2. Space Vehicle (SV) grants a group/net and illuminates a spot beam
3. SV activates control net
4. Listeners tune to net
5. Listeners receive traffic
6. Talker releases PTT
7. Architecture torn down

Control Net
Traffic Net (talker)
Traffic Net (listen)

100 miles
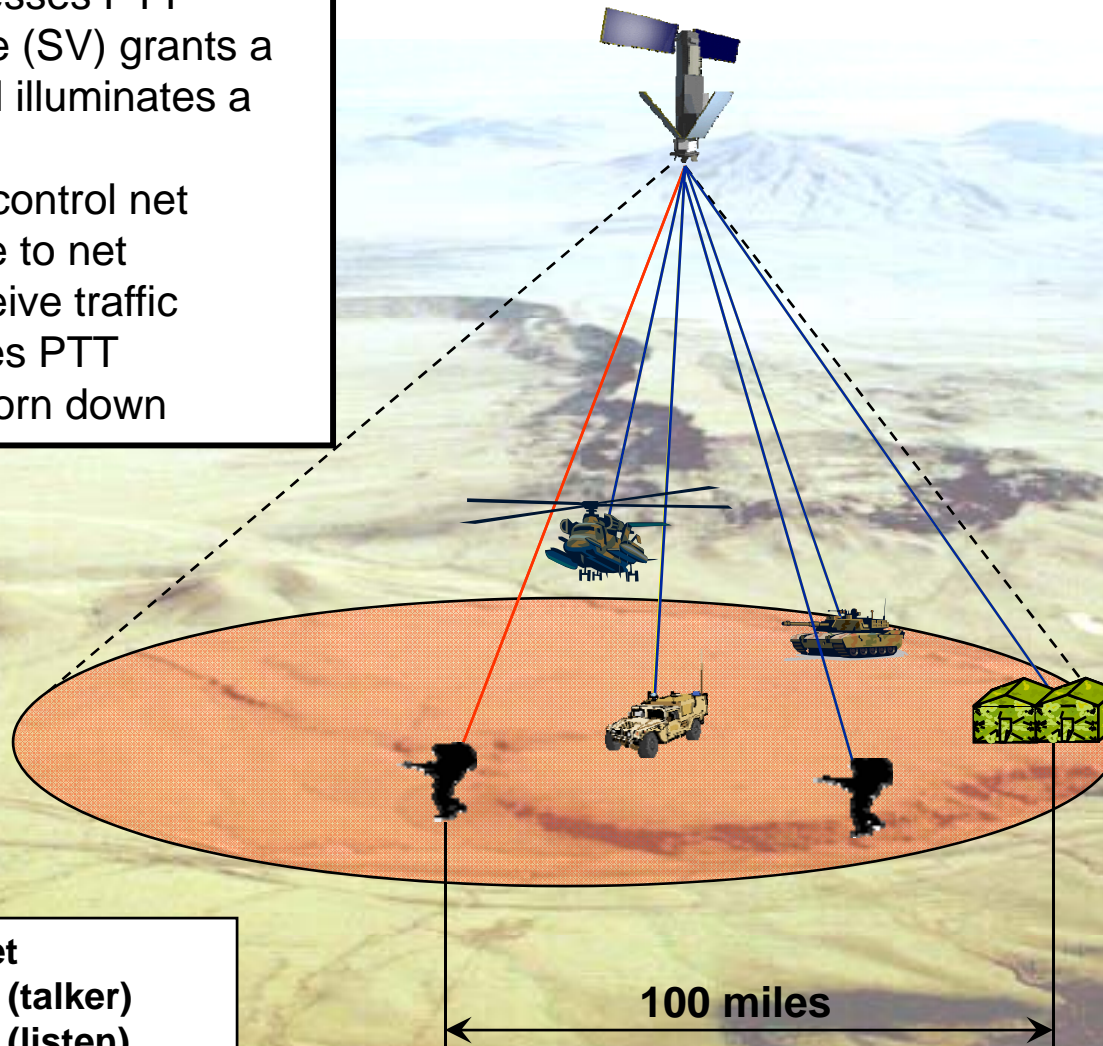
DTCS Satellite Communication

1. *New* talker presses PTT
2. SV grants a net and illuminates a *new* spot beam
3. SV activates control net
4. Listeners tune to net
5. Listeners receive traffic
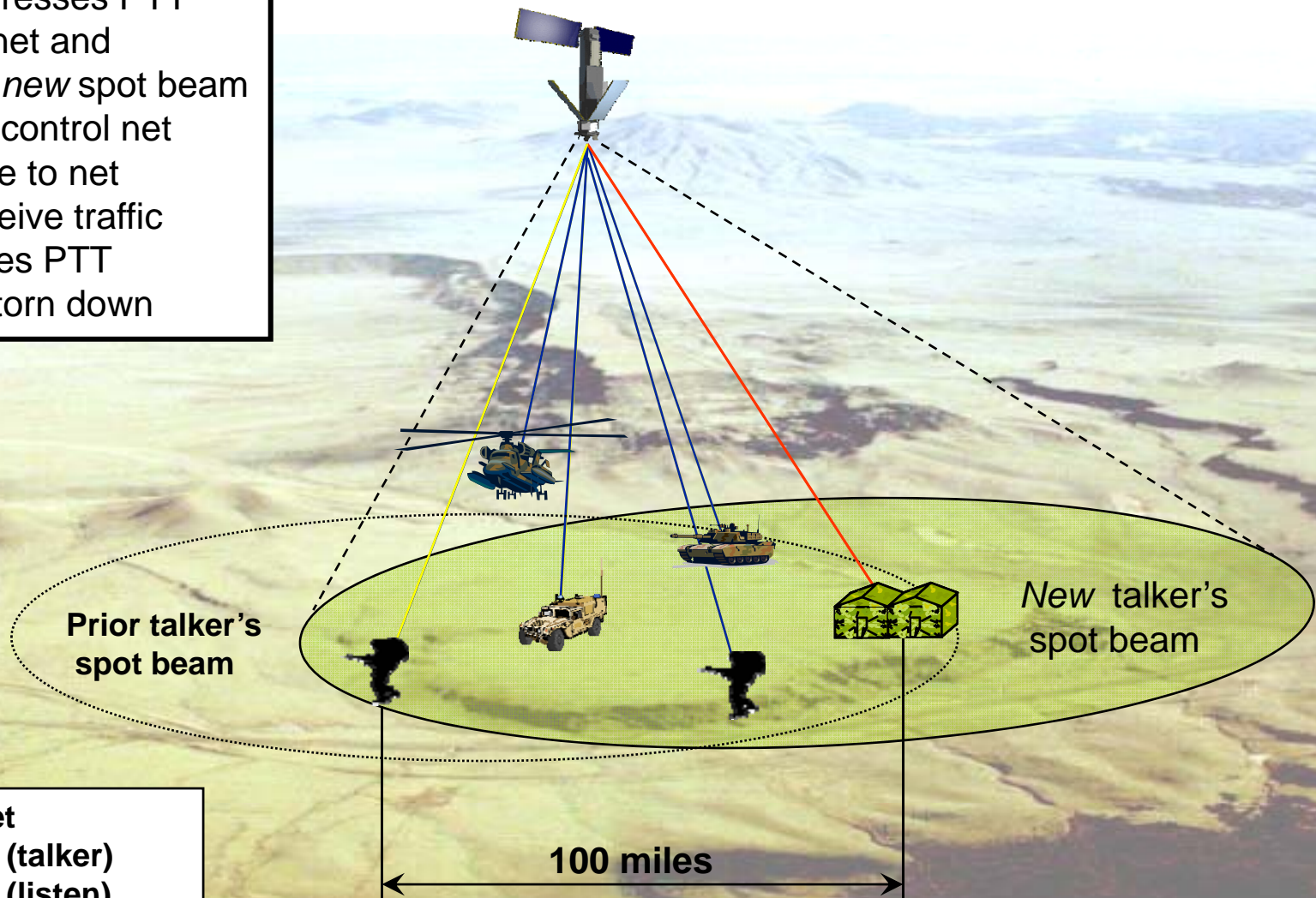6. Talker releases PTT
7. Architecture torn down

Prior talker's spot beam

New talker's spot beam

	Control Net
	Traffic Net (talker)
	Traffic Net (listen)

100 miles

DTCS in Action

- DTCS is <u>not</u> a telephony service.

- DTCS provides netted voice and data capabilities.

- DTCS netted is a "one to many" communications system.

- DTCS is half-duplex – one talker at a time.

- DTCS uses commercial AES 256 encryption.
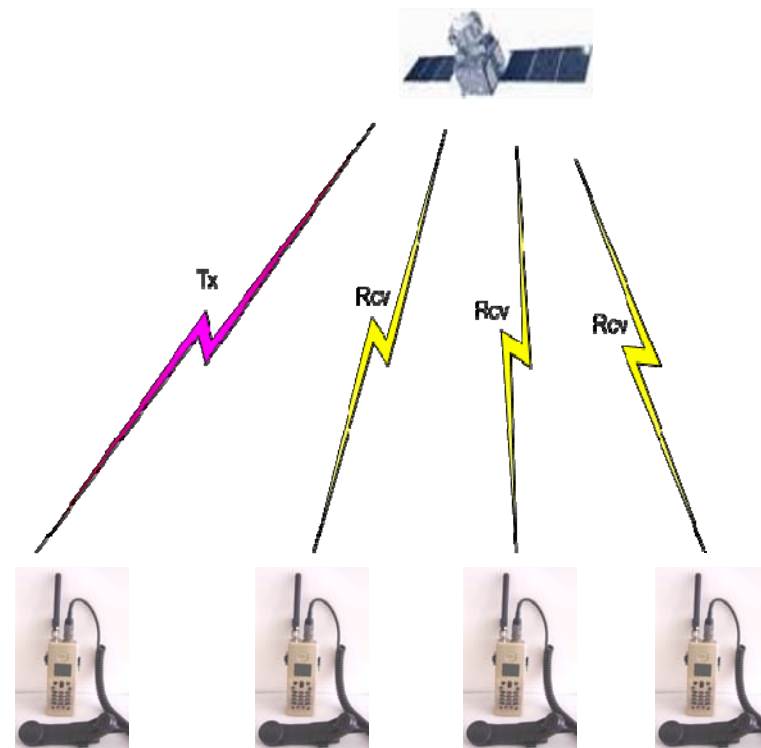
Line of Sight Characteristics

- Satellite communication requires an unobstructed view of the sky.

- Connectivity may be obstructed by:
  - Heavy foliage
  - Entering a building
  - Temporary or permanent structures nearby

- If you do not have a completely obstructed view, you may be able to wait and regain signal without relocating as a new satellite orbits overhead.

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Electromagnetic Interference

- May cause erratic or no signal strength, dropped calls or garbled voice.

- Sources include:
  - INMARSAT terminals
  - Global Star units
  - Radar devices
  - Broadcast stations

- Signal strength indicator may appear high when interference is occurring.

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GPS and PLI

- GPS lock required for Position Location Information (PLI), but not for voice communications.
  - Regularly sends location information
  - Commercial AES 256 encryption
  - Tracks user location in C2PC at the PLI Collector; ability to designate individual units / users
  - Transparent to end user

- DTCS is <u>not</u> a Selective Availability Anti-Spoofing Module (SAASM) GPS. It is a commercial version and is susceptible to jamming.

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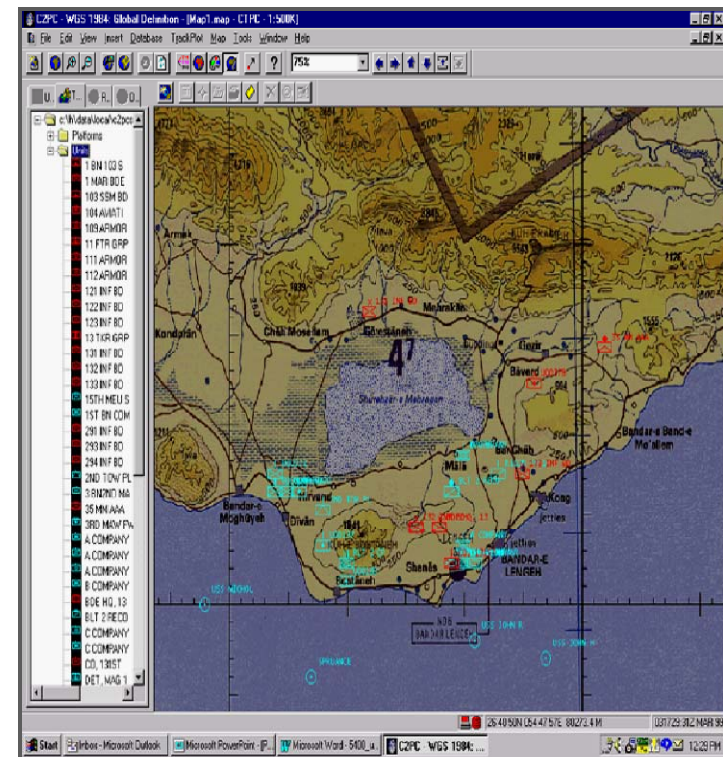
Questions?

ROA Equipment

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DTCS ROA Handheld Radio Components

- ROA unit
- Antennas
  - Iridium and GPS
  - Helmet-mounted option
- Headset
- Handset
- Holster
- Internal battery

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ROA Unit

Iridium connector

6-pin connector

GPS connector

PTT

- Connectors
  - Iridium antenna (TNC connector)
  - GPS antenna (SMA connector)
  - 6-pin connector
    - Headset or handset
    - Compatible with standard 6-pin devices
- Integrated PTT
  - PTT switch also functions as primary power button

Distributed Tactical Communications System
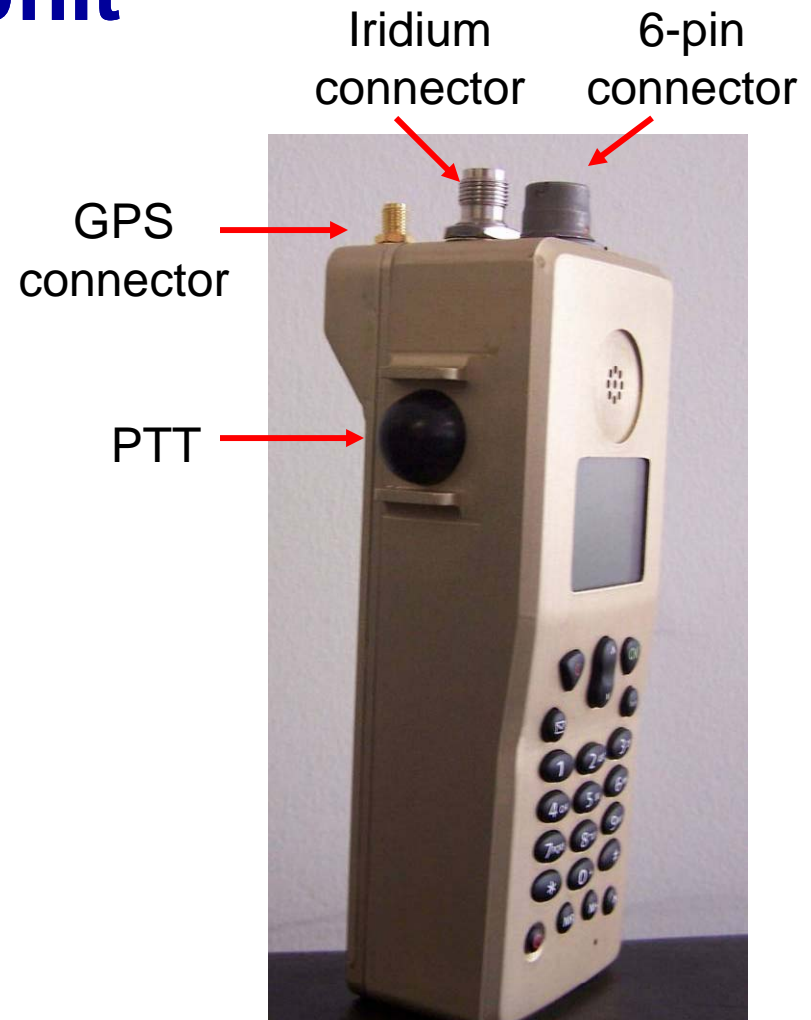
Cont…… ROA Unit

- Can use internal speaker and mic without a headset

- Charging port for recharging internal battery

Internal speaker

Internal mic

Charging port

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For Official Use Only

GPS & Iridium Wand Antennas

- Two antennas provided
  - Iridium wand antenna
  - GPS antenna

- CAUTION – Antennas and connectors are fragile.
  - **Do NOT** grab or pull the unit by the antennas.

- Antenna internal elements are breakable if dropped.

- Must use the provided antennas which are tuned to the proper frequencies.

Iridium Wand

GPS

Helmet-Mounted Antenna

- Contains both Iridium and GPS antennas.
  - Includes both TNC and SMA connectors.
  - Can be used in place of the separate Iridium wand and GPS antennas.

- High gain (directional): annotated "This side toward head"
  - CAUTION – Ensure that the antenna is correctly oriented so the radio frequencies are directed away from your head.

- Antenna is placed on top of Kevlar under cover.

- CAUTION – **Do NOT** touch this antenna to the ground or metal when the unit is powered on - it will destroy the GPS antenna.

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Tactical Headset

Headset 1

- Can be worn under a cover/ Kevlar

- Includes external speaker/earpiece, boom mic, and PTT

- Attaches via 6-pin connector

- May get one of two different headsets
  - Headset 1 has a cupped ear
    - Left ear compatible
  - Headset 2 does not have an ear cup
    - Left or right ear compatible
    - Headband or helmet clip options

Headset 2:
shown with headband

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Tactical Handset

- H-250 with 6-pin connector
- Can use any 6-pin accessory with standard pin-out

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ROA Holster

- Holster attaches ROA to any ILBE/PALS system
- Multiple versions
  - Standard Blackhawk MBITR holster
  - Modified Blackhawk holster
- Multiple attachment configurations
  - Natick snap
  - Blackhawk speed clips

Internal Battery

- Battery life
  - Up to 8 hours battery depending on the frequency of use.

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Questions?

ROA Assembly

Step 1

If using a 6-pin accessory, such as headset or handset, attach it first.

• If switching out a 6-pin accessory, be careful around antennas.

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Step 2

Attach Iridium and GPS antennas.

• For the Iridium wand antenna, rotate from the collar [not the top] of the antenna.

• Be careful not to cross the threads, particularly with the GPS antenna. If it hangs, back it out and reseat.

• CAUTION – **Do NOT** operate or leave the radio on without the Iridium antenna attached. Doing so will damage the internal circuits.

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Step 3

Slide into holster.

Step 4

Secure retaining straps.

- Front to back strap
- Shock cord or parachute cord
- Can attach holster to body armor first and then secure radio.

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Holster Options

- There are multiple holster options and multiple ways to secure a given holster.
- We need your feedback based on your experiences as you experiment with the options.
  - What holster works best for you?
  - What method do you prefer for securing the unit in the holster?
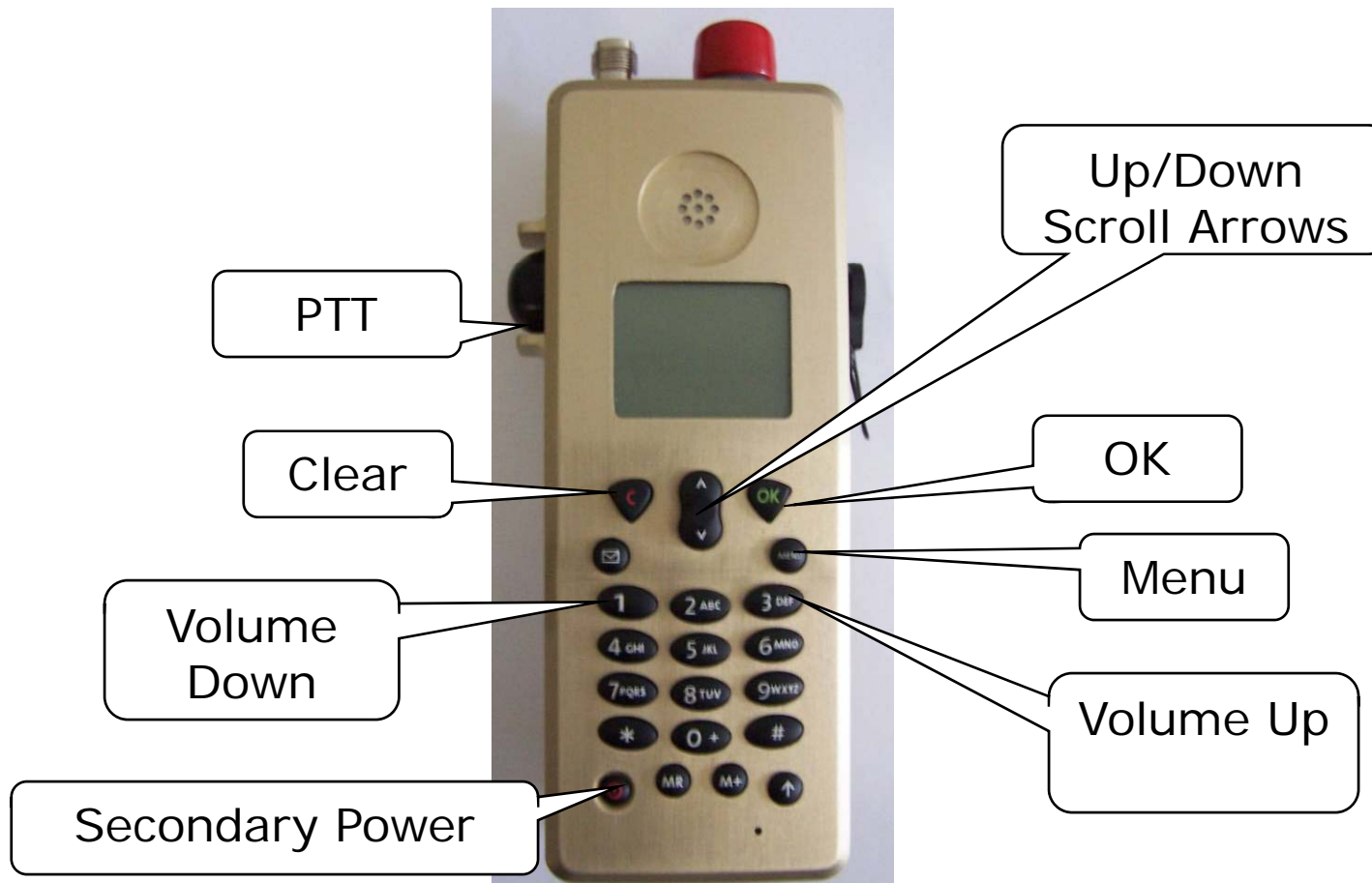 - Where do you attach the holster when in the field?

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Completed Assembly

Questions?

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ROA Operations: Hardware

ROA Buttons

Up/Down
Scroll Arrows

PTT

Clear

OK

Menu

Volume
Down

Volume Up

Secondary Power

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PTTs, Speakers, and Mics

- The ROA has an internal PTT, speaker, and microphone along with a 6-pin connector on which to attach an external headset/handset with PTT, speaker, and microphone.

- The systems are <u>not</u> cross compatible.
  - Keying the internal PTT switches to the internal speaker and mic.
  - Keying the external PTT (on the headset, handset, or cable) switches to the external speaker and mic.
  - Voice communications are received over the speaker associated with last PTT activated.
  - To ensure the desired speaker/mic is active, press the corresponding PTT.

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Radio Frequency Safety

- This device is a low power radio transmitter and receiver.

- As with any radio frequency emitting device, avoid direct contact with the antenna while transmitting.

- Fuel hazard

  - The radio must be turned off <u>within 10 feet</u> of refueling operations or fuel stations.

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Cont…… Radio Frequency Safety

- ## Ordnance hazard

  - The radio with the Iridium antenna attached must maintain a <u>safe separation distance of 10 feet</u> from either Hazards of Electromagnetic Radiation to Ordnance (HERO) susceptible ordnance or HERO unsafe ordnance.

  - The ROA is <u>safe</u> with small arms and machine gun ammunition, and 40 mm/hand grenades.

  - If you have any questions, please contact your ordnance specialist.
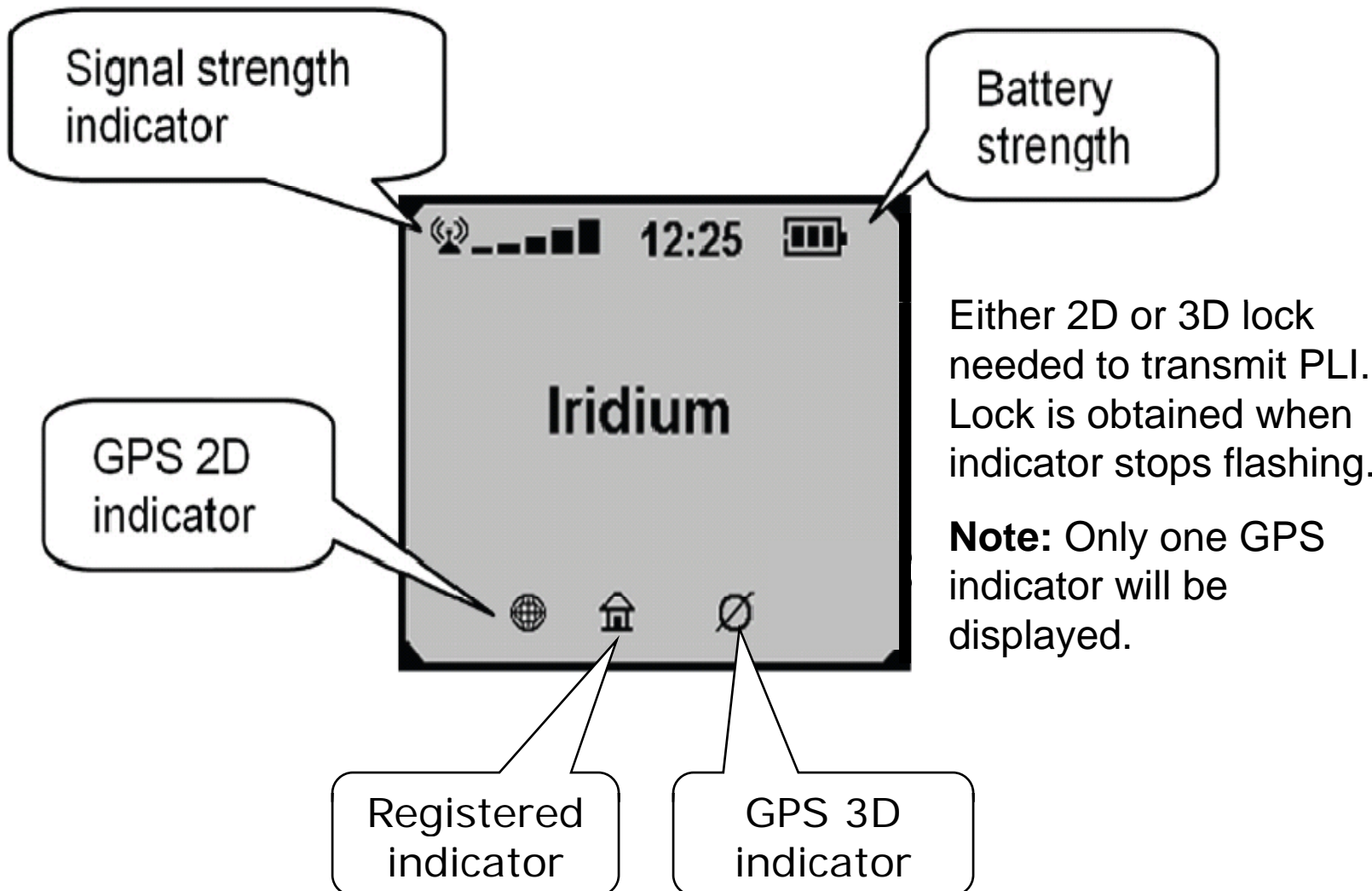
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Questions?

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ROA Operations: Software

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Screen Icons

Signal strength indicator

Battery strength

GPS 2D indicator

Iridium

12:25

Registered indicator

GPS 3D indicator

Either 2D or 3D lock needed to transmit PLI. Lock is obtained when indicator stops flashing.

Note: Only one GPS indicator will be displayed.

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Turning on the ROA

1. Press PTT to power up.

2. Upon power, unit displays **IRIDIUM** (and other graphics) and then **Welcome** momentarily.

3. Unit will attempt to acquire a signal and display **Searching…**.
   - Note: If failed, display will read **Searching…Check** Signal.
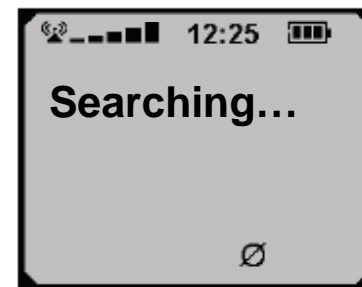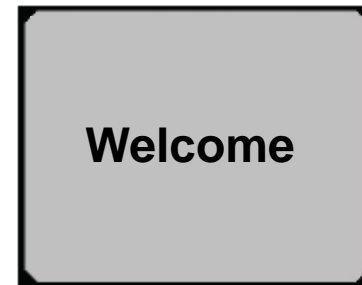
Cont…… Turning on the ROA

4.   Once signal is acquired, unit displays **Registered** momentarily.
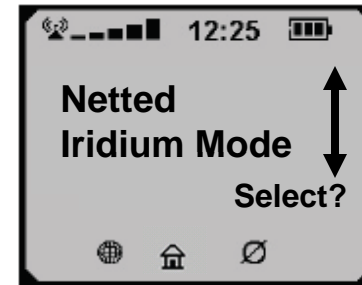
5.   When complete, it displays **Iridium**.

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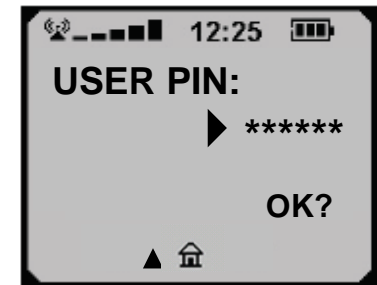
Entering Netted Mode

1. Press (MENU) ; Select **Mode Selection**; press (OK) to view options.
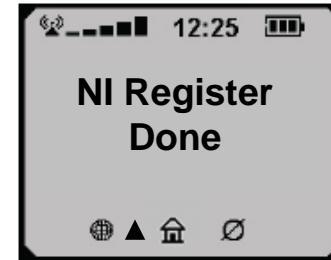
2. Scroll to **Netted Iridium Mode**; press (OK) to select.

3. At **USER PIN** prompt enter 6-digit password (111111); press (OK)

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Cont…… Entering Netted Mode

4. Unit displays **Iridium** momentarily; then **NI Register in Progress** and then **NI Register Done**.

    NI Register Done

5. Select **NI Group Selection**; press **OK** to view options.

    NI Group Selection
    View Options?

6. Scroll to choose the desired group; press **OK** to select a group. This is your primary group/net.

    ✓ Group1: 151
    Select?

    Group2: 152
    Select?

    Check mark indicates presently selected group

    This example depicts selecting 152 as the NI Group.

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Transmitting

1. Must start from **NI Ready**.

2. Press PTT.

   - One LONG beep – net establishing
   - Three quick beeps – **TALK** mode <u>denial</u>

3. The screen will momentarily display **Init TALK**.

Unit is in <u>standby</u> mode

Transmitting

4. After the single audible beep, the screen will display **TALK**.

GROUP 152
TALK

5. Wait 1-2 seconds for all listeners to transition to **LISTEN** mode and begin speaking.

Note: Displayed for listeners only

GROUP 152
LISTEN

6. When transmission is completed, release PTT. The screen will return to group's **NI Ready** standby mode.

GROUP 152
NI Ready

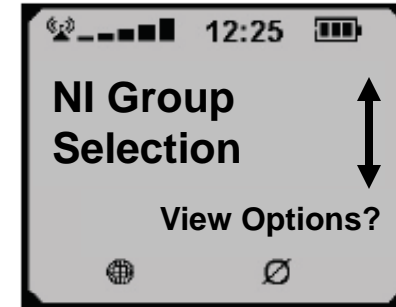**Distributed Tactical Communications System**

Changing Group Selection

1. Press ● MENU ; scroll ● to **NI Group Selection**; press ● OK to view options.

2. Scroll ● to select desired group; press ● OK to select.

This example depicts selecting 153 as the NI Group.

3. Unit displays new group's **NI Ready** standby screen.

NI Group and NI 2nd Group Relationship

- If desired, a **NI 2nd Group** can be selected. This provides the capability to monitor voice comms on two nets. You cannot transmit on the 2nd Group; it is receive-only.

- If the primary **NI Group** selection is not transmitting, you can hear the transmissions on the **NI 2nd Group** selection.

- Note: **NI Group** selection is the _primary_ net for listening and is **ALWAYS** the net for talking.

  - Any time you press the PTT, you are transmitting on the **NI Group** net (not 2nd Group), regardless of what net you were listening to.

> Once a transmission starts, you will **_only_** hear that specific transmission until it ends. _There is no interrupt or override ability._

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NI 2nd Group Selection

1. Press **MENU** ; scroll to **NI 2nd Group Selection**; press **OK** to view options.

   ```
   ⚟ ▃▃▅▆ 12:25  ▥
   NI 2nd Group
   Selection        ↕
                View Options?
   🌐              Ø
   ```

2. Scroll to select desired group; press **OK** to select.

   Note: Group selected as primary under **NI Group Selection** is not available.

   ```
   ⚟ ▃▃▅▆ 12:25  ▥
   Group1: 151       ↕
                Select?
   🌐              Ø
   ```

   This example depicts selecting 151 as the NI 2nd Group.

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Exiting Netted Mode and Powering Down

1. Press **MENU** ; scroll to **Mode Selection**; press **OK** to view options.

2. Scroll to **Satellite Mode**; press **OK** to select.

3. Returns to the **Iridium** home screen.

4. To turn off, push PTT twice and hold.

* Note: The phone must be set in **Satellite Mode** to be turned off.

Questions?

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Basic Maintenance and Troubleshooting

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Recharging the Battery

- The battery should be fully depleted before recharging.

  – If not, the battery life will decrease over time.

- The battery will be recharged by connecting the power cable to the charging port on the right side of the unit and plugging into the wall.

  – The port on the unit is keyed and the power cable can only be inserted one way.

Cont…… Recharging the Battery

- When charging, displays "Charging Battery."

- When done, displays "Fast Charge Complete."
  - Charging takes approximately 2-3 hours.
  - If talking on the radio while charging, the battery can deplete faster than it will recharge.

- Replace the dust cover when charging is complete.
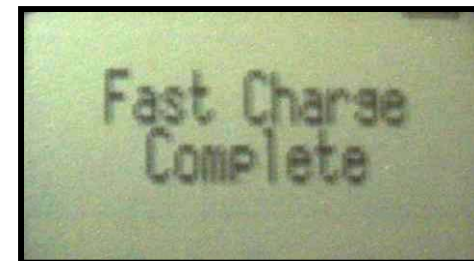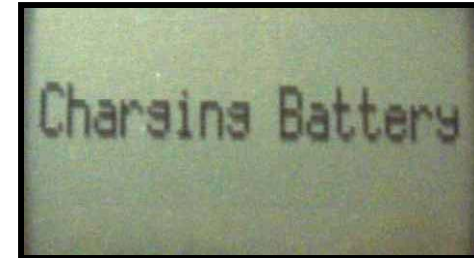
Any spare batteries must charge in the unit.

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Signal Troubleshooting

- If you have no/low signal, are experiencing disconnects, or are receiving a **Searching…Check Signal** display:
  - Ensure you are in Netted Iridium mode (if not, reconnect).
  - Check Iridium antenna connection.
  - Ensure you have an unobstructed view of the sky.
  - Wait and try again. Satellite overflight is 7-9 minutes; signal may improve as another satellite orbits overhead.
  - If still not working, the Iridium antenna should be replaced with a known working antenna to eliminate the antenna as the source of the problem.

- If signal strength is displayed as high (i.e. 4-5 bars) but you are not able to send or receive:
  - Check for sources of electromagnetic interference nearby, including INMARSAT terminals, Global Star units, radar devices and broadcast stations.

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PLI Troubleshooting

- If PLI is not received at the collector:
  - Check GPS antenna connection.
  - Ensure you have an unobstructed view of the sky.
  - The GPS information is transmitted at regular intervals. You may need to wait up to 15 minutes to give the GPS multiple opportunities to transmit.
  - If the DTCS has been moved a large distance, or is used for the first time, the GPS module must "reset" itself (no user action required). This "reset" may take up to 15 minutes.
  - If after 15 minutes there is still no PLI information received at the collector, the GPS antenna should be replaced with a known working antenna to eliminate the antenna as the source of the problem.

  Note: PLI information is <u>not</u> visible on the ROA radio, only at the collector.

Cont…… PLI Troubleshooting

GPS Contacts

- If PLI is not received at the collector (continued):
  - Remove rear plate of unit and ensure GPS contacts in the unit housing are clean, free of debris, and not bent.
    - Note: Avoid removing the rear plate in the field. Opening in an uncontrolled environment risks damaging internal components.
  - If the collector is still not receiving your PLI, it may be due to GCM provisioning issues.
- Note: Removing the GPS antenna does <u>not</u> prevent PLI messages from being sent.
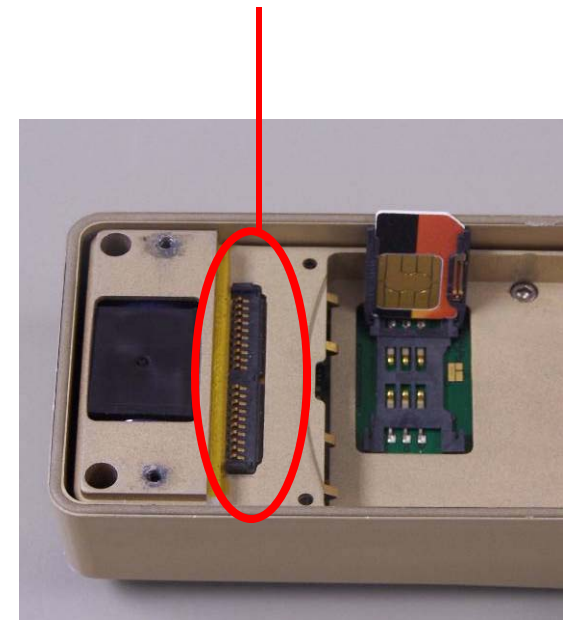
# Handset/Headset Troubleshooting

- If external headset/handset or PTT is not working properly:
  - Verify you are not trying to use a mix of internal and external PTTs, speakers, and mics. They are not cross-compatible.
    - External PTT switches comms to external speaker and mic.
    - Internal PTT switches comms to internal speaker and mic.
    - If unsure which speaker is active, briefly press the corresponding PTT to switch to the desired speaker.
  - Take off headset/handset and test with internal speaker, mic, and PTT.
  - If internal system works fine, try another headset/headset.
  - If replacement headset does not work, it may be the 6-pin connector.
    - Clean the 6-pin connector contacts with a pencil eraser and retry.
    - If cleaning fails to correct the problem, the 6-pin connector may be faulty.

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Power Troubleshooting

Battery Contacts

- If unit is not getting battery power:
  - Open rear plate of unit and remove battery. Ensure battery contacts are not bent.
    - Note: Avoid removing the rear plate in the field. Opening in an uncontrolled environment risks damaging internal components.
  - If unit is not powering up after recharging, the battery may need to be replaced.

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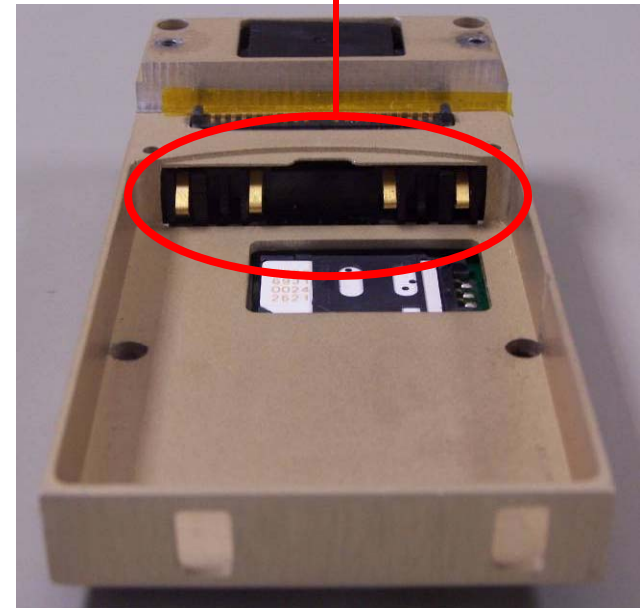
Internal Battery Replacement

Note: Avoid removing the rear plate in the field. Opening in an uncontrolled environment risks damaging internal components.

1. Unscrew rear plate and remove.

    CAUTION - Do **NOT** touch the GPS board. Static discharge could damage the components.

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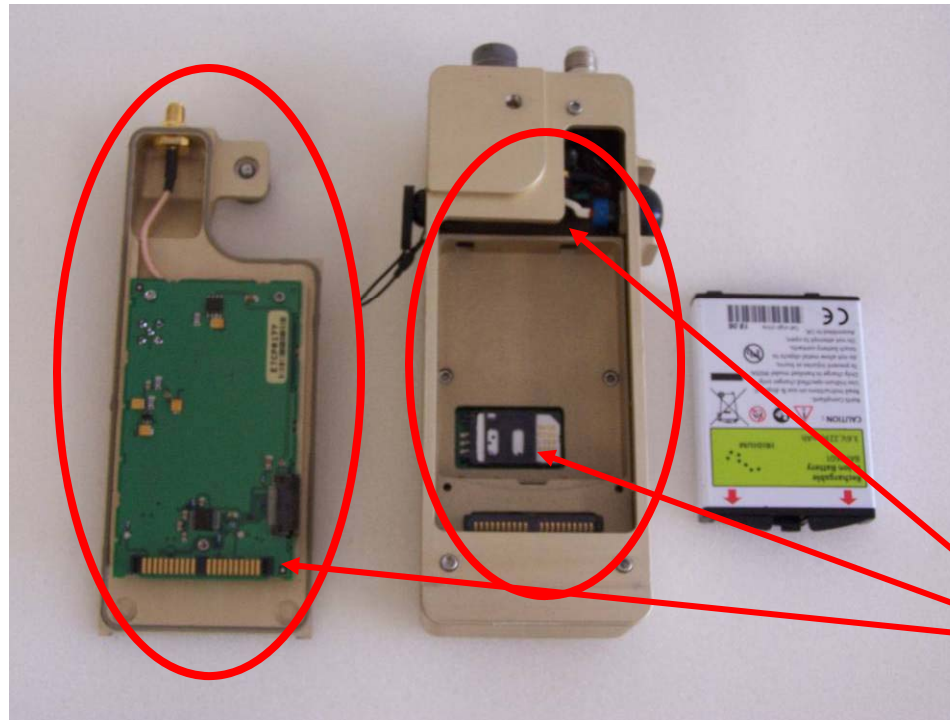
Cont…… Internal Battery Replacement

2. Release clip at bottom and tilt battery up.

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Cont….. Internal Battery Replacement

3. Remove the old battery.

Note: Exposed circuits. Handle with care.

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Cont….. Internal Battery Replacement

4. Put tabs on bottom of new battery towards top of radio.

Cont….. Internal Battery Replacement

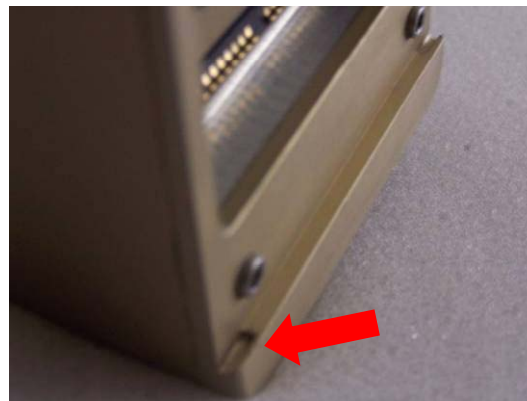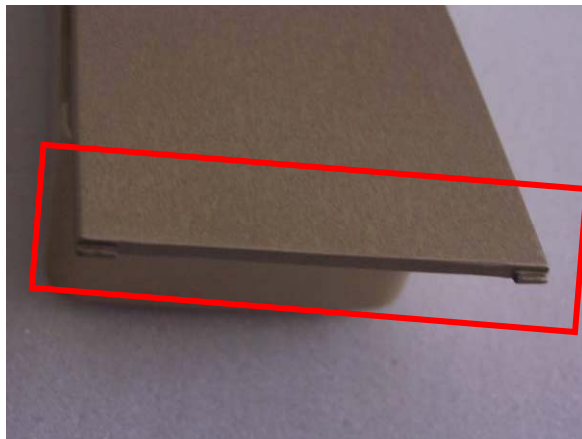5. Tip down and snap to secure clip on the bottom of the radio.

Note: Battery will be upside-down. ⟶

Cont….. Internal Battery Replacement

6. Put tabs on bottom of rear plate into grooves and tilt up.

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Cont…… Internal Battery Replacement

7. Hold top of rear plate in place.

8. Push down on screw (spring loaded) and turn clockwise until secure.

Questions?

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Do's and Don'ts

- **Do** obtain a clear line of sight before transmitting or receiving.

- **Do** wait for the single audible beep before transmitting.

- **Do** keep all gear dry, clean and properly stored.

- **Do** check your connections.

- **Do** use care when the rear plate is opened.

- **Do** maintain safe separation distances from fuel and ordnance.

- **Do NOT** place helmet mounted antennas on the ground or on a metal object when the unit is powered on - it will cause damage to the GPS antenna.

- **Do NOT** use antennas as a handle.

- **Do NOT** operate or leave the radio on without the Iridium antenna attached. Doing so will damage the internal circuits.

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Feedback

- ## We need your input
  - ROA radio and components
  - User interface
  - Holsters
  - Battery life
  - Day/night operation

  - Wearability
  - Durability
  - Maintainability
  - Operational effectiveness

- ## Your instructor will provide further information on the planned method for gathering your comments and suggestions.

Questions?