



# Field Guide

for the

## Tactical 1.0 Meter Very Small Aperture Terminal (VSAT) Communications Handler (VCH) System

Contract No. T0698BN3405  
CDRL Sequence No. TVSAT-83

Prepared for:

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# Raytheon

Note that in this guide “Antenna” is used to refer to the entire antenna assembly (dish, feed arm rods, feed assembly, and cable). “Dish” is used to refer to only the satellite dish.

A “**WARNING**” indicates that injury or death to humans may occur if the instructions are not followed.

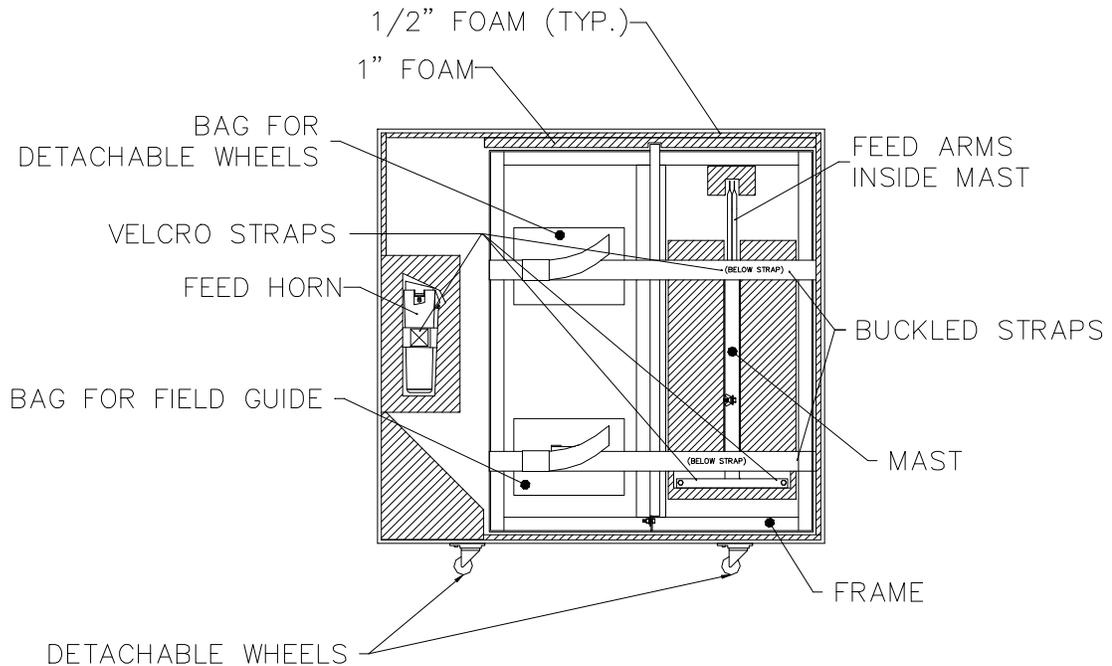
A “**CAUTION**” indicates that damage to equipment may occur if the instructions are not followed.

## Document Revision Record

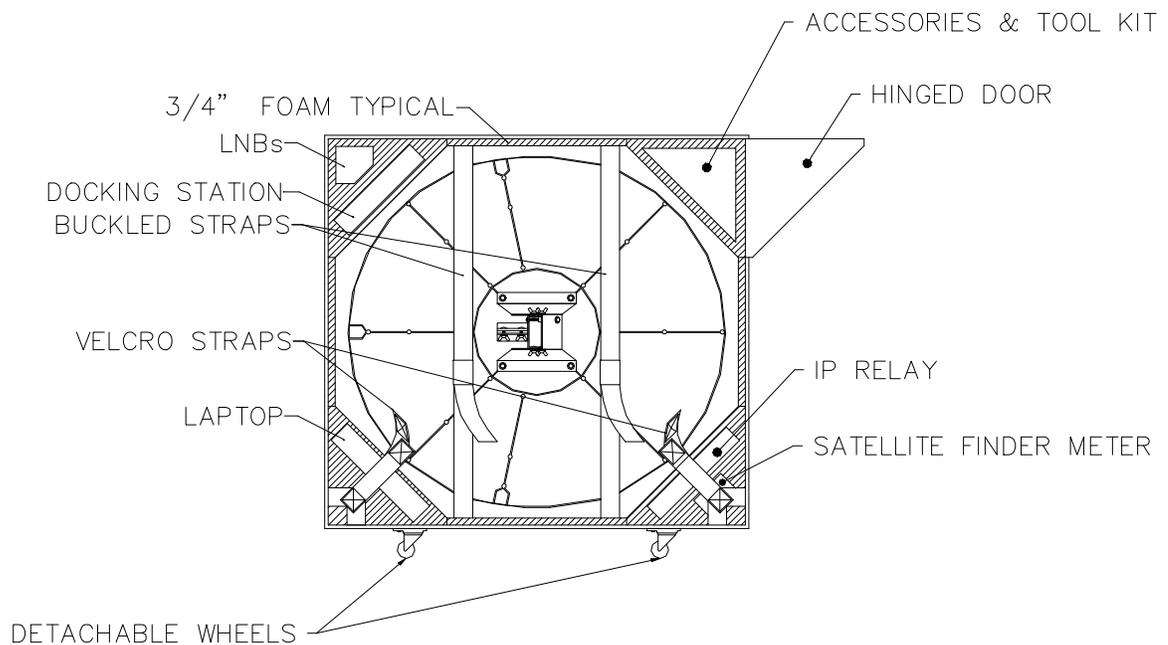
Date	Description	Affected Pages
14 Jun 1999	Initial Release	
20 Jun 2000	Revisions resulting from VCH 2.4 release and hardware changes	All
21 Aug 2000	Combined “Setup” and “Point Antenna” sections; revised terminology	All

# 1) Situate and Open the Antenna Case

Your tactical VCH system will have one of two case styles. Determine which case style you are using and refer to the appropriate diagrams.



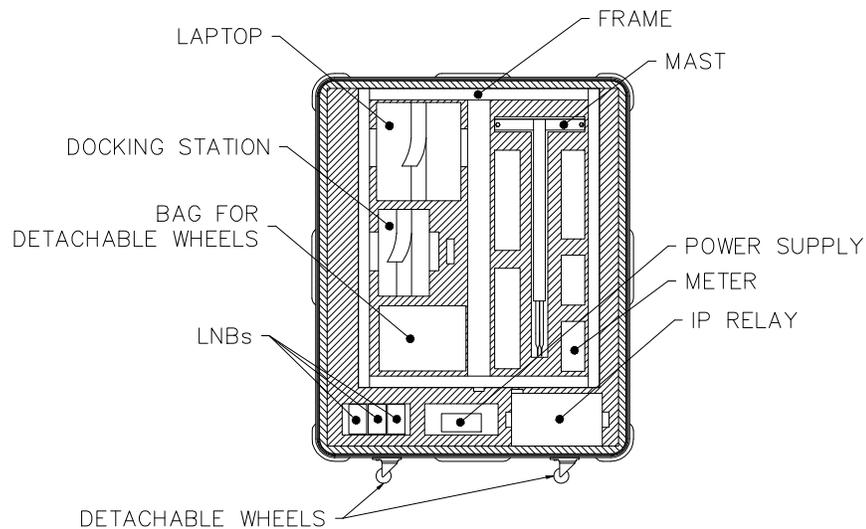
**LID - Case Style 1**



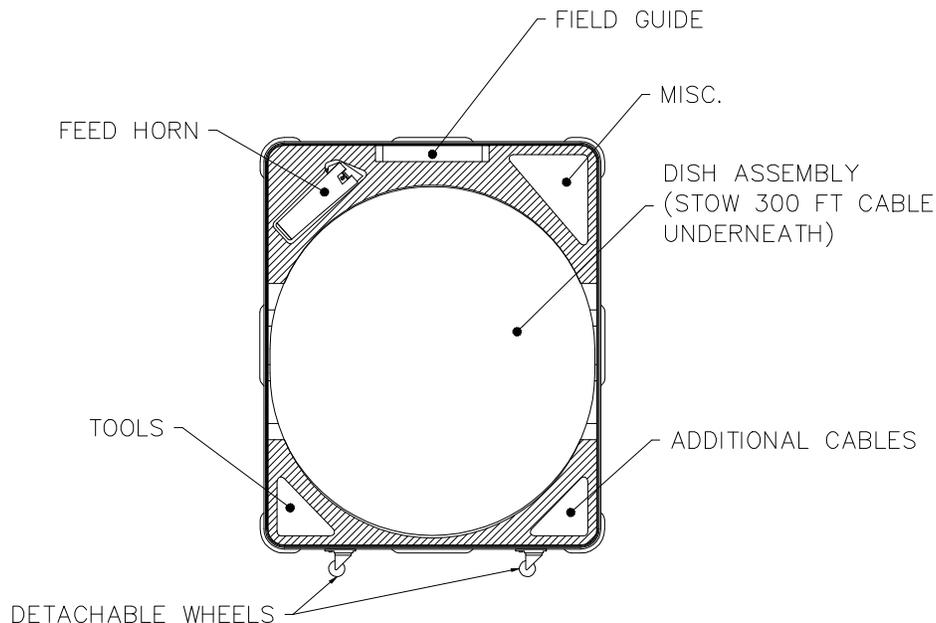
**BASE - Case Style 1**

Procedure continued on next page →

# 1) Situate and Open the Antenna Case (cont'd)



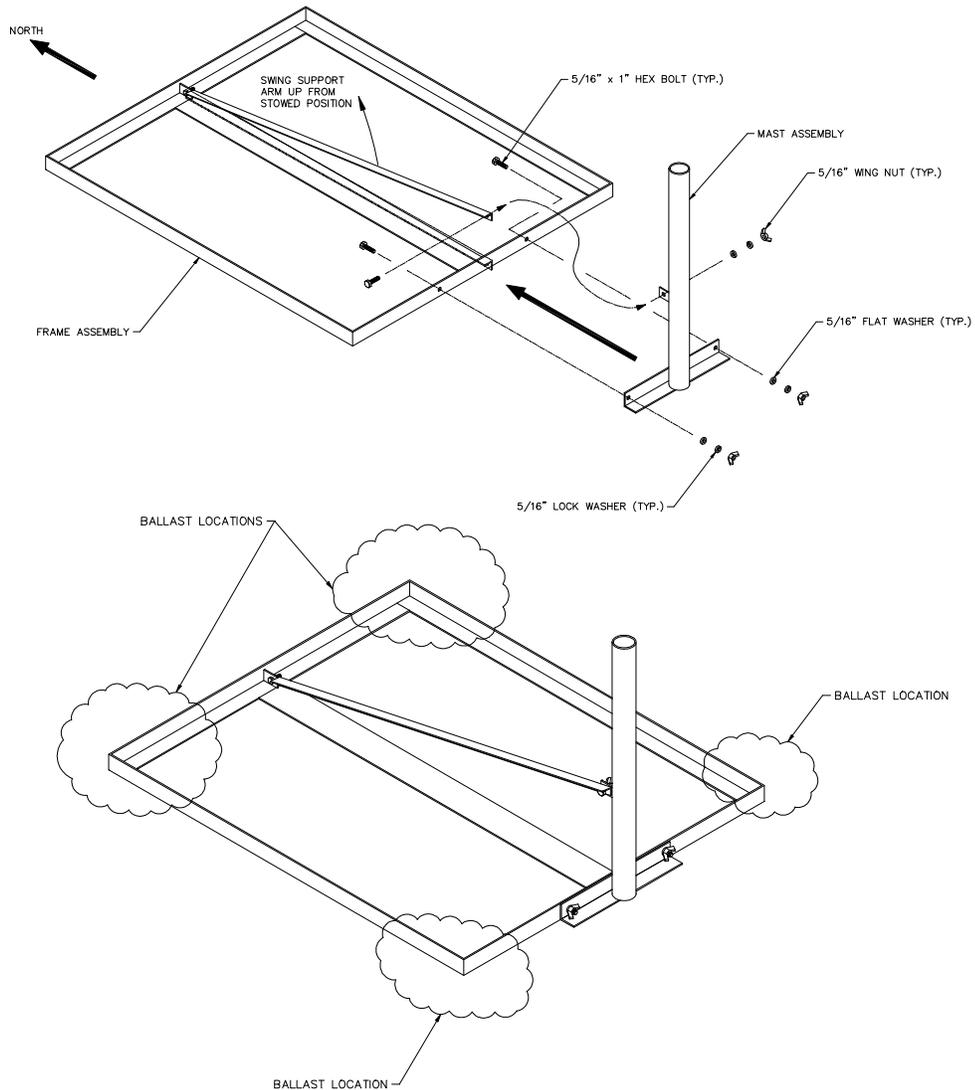
**LID - Case Style 2  
(Panels Removed for Clarity)**



**BASE - Case Style 2**

- A. Place the antenna case near the set-up site. *The set-up site must be (1) roughly horizontal, (2) large enough to open the antenna case and provide working room, and (3) have a clear line-of-sight to the satellite.*
- B. Open the antenna case. The inside of the case is shown above or on the previous page.
- C. Remove the frame (with attached support arm) and the mast from the lid of the case.

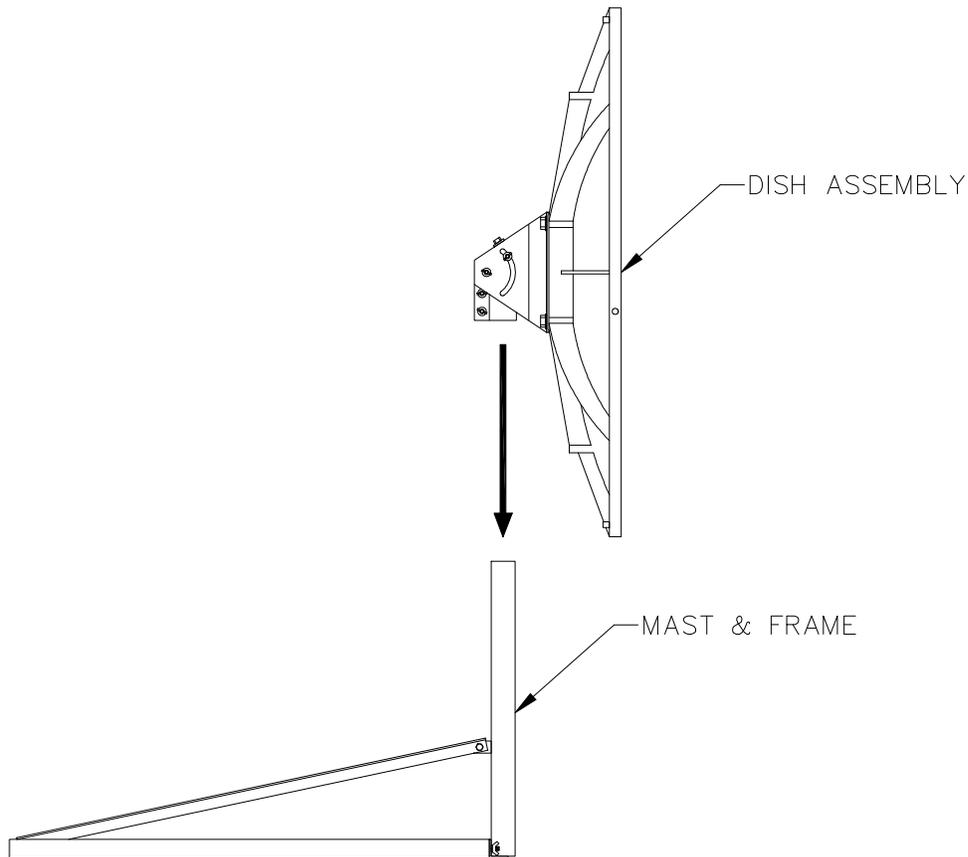
## 2) Assemble the Antenna Frame



- A. Place the frame on the site, *positioned so that the end with the mast is toward the satellite*. If necessary, place padding under the frame so that it is level.
- B. Attach the mast to the base frame.
- C. Attach the support arm to the mast.
- D. Tighten all nuts.
- E. Place ballast on the frame. Use concrete blocks or sandbags for ballast. The recommended amount of ballast is shown below.

Wind Speed (MPH)	70	80	85	90	100	110
No. Blocks @ 25 lbs Each	6	9	10	12	14	18
Actual Weight	204	264	306	346	408	509
Distributed Load (lbs/ft)	23	29	34	38	45	56

### 3) Attach the Dish to the Mast



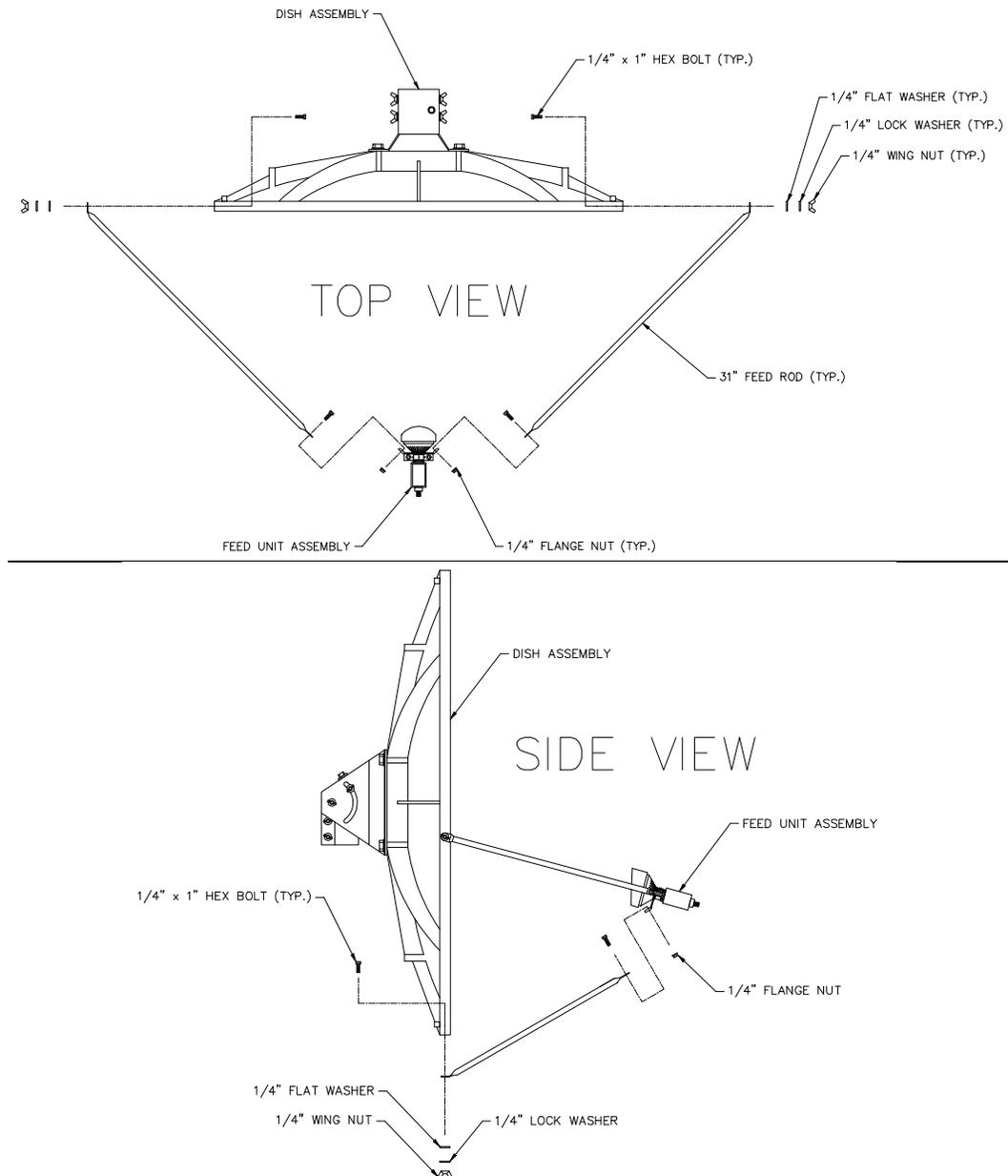
A. Slide the dish mount collar over the mast (as shown above).

Note: The dish should not be over the frame (the frame acts as a counterweight).

B. Point the dish in the general direction of the satellite.

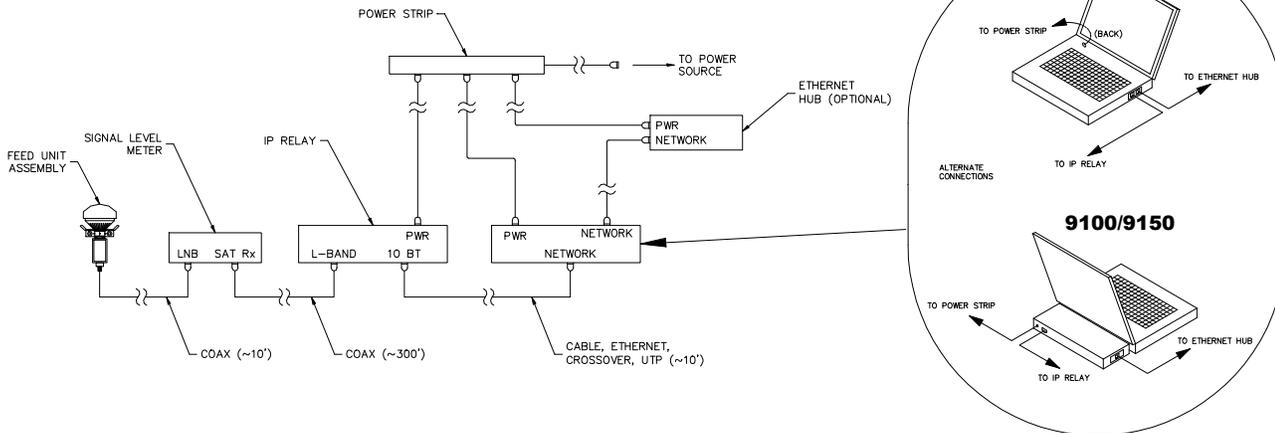
C. Tighten the nuts on the collar until they are snug, but not tight enough to prevent Azimuth rotation.

## 4) Attach the Feed Rods and Feed Unit to the Dish



- A. Attach the feed rods to the dish. The feed rods should angle toward the center of the dish. The bent end of each rod attaches to the dish. Note that the two longer rods attach to the sides of the dish and the shorter rod attaches to the bottom of the dish.
- B. Remove the acorn nuts, gray plastic cover, and flange nuts from the feed unit. Set the acorn nuts and plastic cover aside.
- C. Attach the feed rods to the feed unit using the flange nuts.
- D. Tighten all feed support hardware. To avoid stripping the hardware, do not overtighten.

## 5) Connect the System Components



A. Hook up the satellite signal level meter, IP Relay, laptop PC, and associated cabling as shown above.

- Notes:
- Do **NOT** install a hub or any other hardware between the IP Relay and the laptop. Doing so may cause data loss.
  - If your VCH computer is a Gateway 9100 or 9150, plug the crossover cable into the docking station. If you are using the optional ethernet hub, plug the ethernet cable into the laptop's PCMCIA ("PC Card") network card.
  - If your VCH computer is a Gateway 9300, plug the crossover cable into the network jack on the side of the laptop labeled "SAT". If you are using the optional ethernet hub, plug the ethernet cable into the network jack labeled "LAN".

B. Plug in the IP Relay and laptop PC.

C. Power up the laptop PC. (The IP Relay powers up automatically.)

D. Logon to the PC with the username "rpd" and the assigned password. During login, you will receive one "Service not Started" error message. This is normal. Click the OK button to dismiss this message.

E. Switch the satellite signal level meter to the "Volts" mode and verify that the IP Relay is supplying 15-18 volts. (If it is not, refer to the Troubleshooting section of this guide.)

### *Connecting to a Local Area Network (LAN)*

Connecting the VCH computer to a Local Area Network should only be performed by an experienced Windows NT System Administrator.

There are two network interface cards (NICs) in the laptop PC. Under TCP/IP properties, the NIC that can interface to a LAN is listed as "3Com EtherLink III (3C589D) LAN PC Card" or "Xircom Ethernet Adapter 10/100". You may configure this card as needed for LAN connectivity.

The NIC that interfaces to the IP relay is listed as "3Com Fast EtherLink XL NIC (3C905B-TX)" or "Xircom CardBus Ethernet 10/100 for NT Card Services". **Do not modify any of the settings for this card!**

## 6) Determine Your Location and Magnetic Declination

Determine the following values. These values will be used to rough point your VCH system's antenna towards the satellite.

Determine your location's latitude and longitude with a GPS receiver or a map of your region.

Note that the SATSoft Az/EI program (used in Step 7) uses decimal values. If the source you are using to get your latitude and longitude values is in degrees, minutes, and seconds, you will need to convert your latitude and longitude to decimal values. Use the following procedure to convert the latitude and longitude to decimal form:

- (1) Take the minutes value and divide by 60.
- (2) Add the resulting value to the whole number of degrees.

*Example:*

Starting with 35° 22' 14" North,

- 
- (1)  $22' / 60 = 0.37$
  - (2)  $35 + 0.37 = 35.37$

Determine your location's magnetic declination from navigation charts, the map on page 10, or you can use the Flight Information Publication (FLIP) to look up a nearby radio navigation aid and use its magnetic declination. For example, the FLIP entry for Ramstein, GE reads:

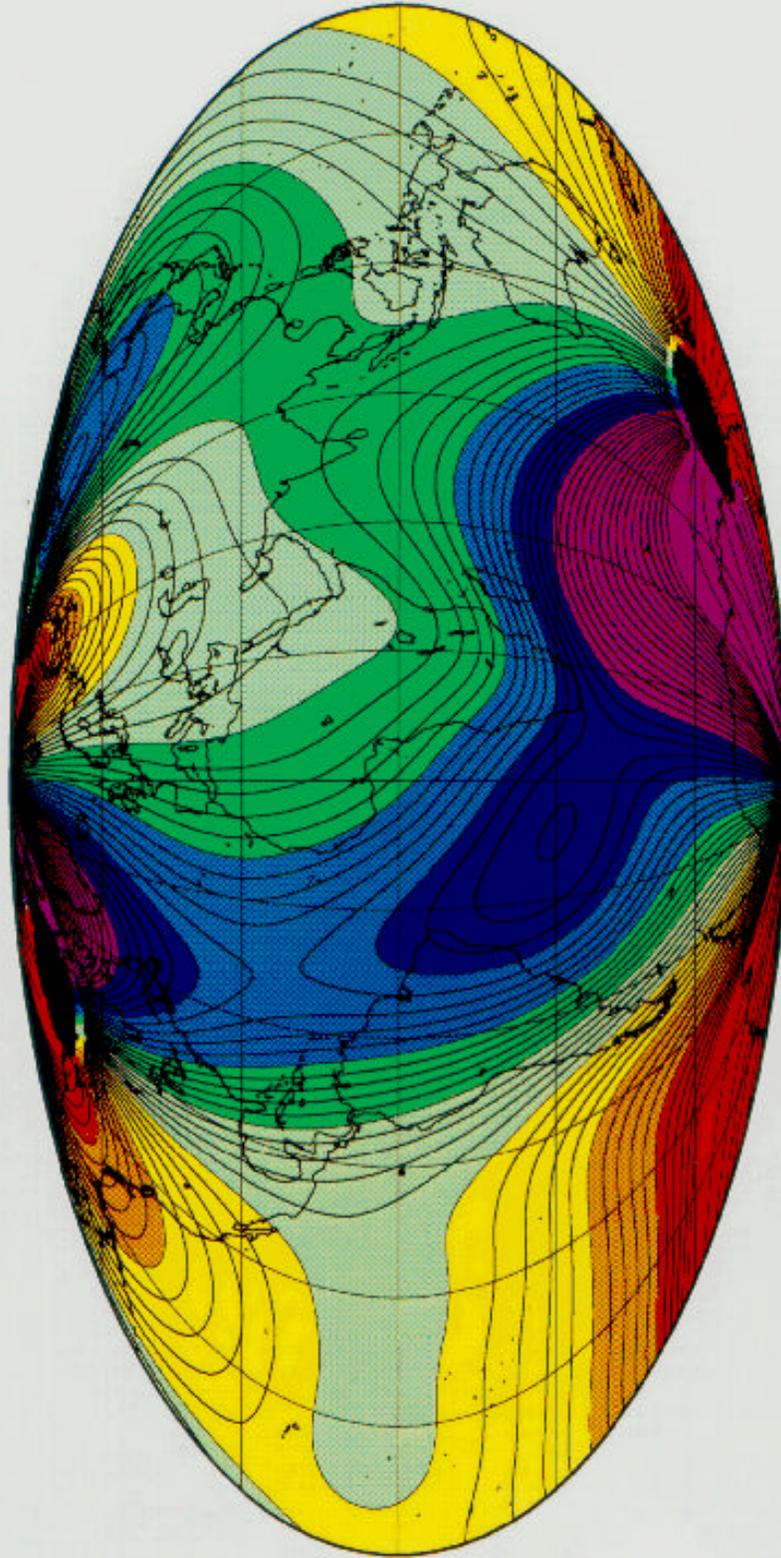
**NAVAIDS - TACAN - RMS CH 81 (80/FL 500) 49°26.1'N  
07°35.5'E At Fld. 071°11.5 NM to Sembach AB.  
7°/2°00'W MP 0300-0500Z+ + Tue, if ASR is opr.**

The key value to look at is the "2°00'W" number. It shows the magnetic variation. Thus, for Ramstein AB, Germany, the magnetic declination is 2° West.

- Your current latitude (to the nearest 1/10<sup>th</sup> of a degree): \_\_\_\_\_
- Your current longitude (to the nearest 1/10<sup>th</sup> of a degree): \_\_\_\_\_
- Your current magnetic declination: \_\_\_\_\_

# Main Field Geomagnetism

Magnetic Declination Model for 1995.0



Degrees of declination (east declination is positive):



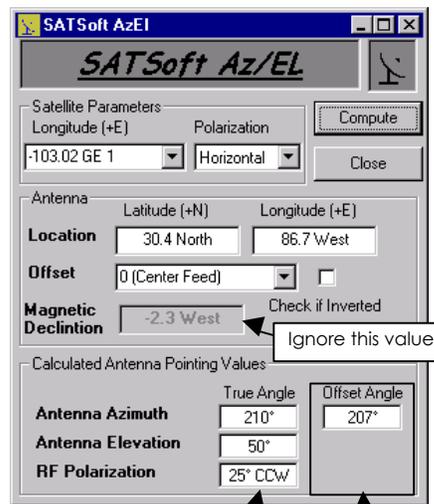
# 7) Calculate the Approximate Azimuth and Elevation

- A. Start the SATSoft Az/El program on the PC by double-clicking on the Az/El icon.
- B. The screen shown at right will display.
- C. In the Satellite Parameters section, use the pull-down menus to choose the appropriate satellite and polarization for your VSAT network:

Network	Satellite	Beam Tilt	Polarization
European	6.97 EUTELSAT	0°	Horizontal
U. S.	-103.02 GE-1	-26°	Horizontal
Pacific	174.01 INTELSAT 802	0°	Horizontal

- D. In the Antenna section, enter the antenna location you wrote down on page 10. Since the offset is already taken into account on the scale printed on the dish mount use the Offset field's pull-down menu to choose "0 (Center Feed)".
- E. Click the "Compute" button.

- F. Subtract the magnetic declination you calculated on page 10 from the value displayed in the Antenna Azimuth True Angle field of the SATSoft Az/El program. Treat WEST magnetic declinations as negative.



One or more Offset Angles may be shown. Ignore them.

"CW" stands for "Clockwise"; treated as negative.  
 "CCW" stands for "Counterclockwise"; treated as positive.

Formula	Example
$\frac{\text{Azimuth True Angle from SATSoft Az/El program} - \text{magnetic declination}}{\text{= Angle at which to point antenna}}$	Using the coordinates for Hurlburt Field, FL: 210 (Antenna Azimuth True Angle) -(-2) (magnetic declination; east values are positive, west values are negative) $\frac{212}{\text{(Angle at which to point antenna)}}$

- G. Compute the polarity value to which you will set the LNB on the antenna. Use the following formula:

Formula	Example
$\frac{\text{RF Polarization value from SATSoft Az/El program} + \text{Beam Tilt of the Satellite (from table in step C)}}{\text{= Interim value}}$ <p>If the interim value is between -90° and +90°, use that value. If the interim value is outside the range of -90° to +90°, add or subtract 180° to bring the value back into the -90° to +90° range. (A change of 180° is the same polarity.)</p>	If you are in the US and using Hurlburt Field's RF polarization of 25° CCW: +25 (CCW is a positive number) -26 (GE-1 has a beam tilt of -26°) $\frac{-1}{\text{(Interim value between -90° and +90°, so adding or subtracting 180° not needed to bring back within range)}}$ -1 Polarity value you set on the LNB's scale

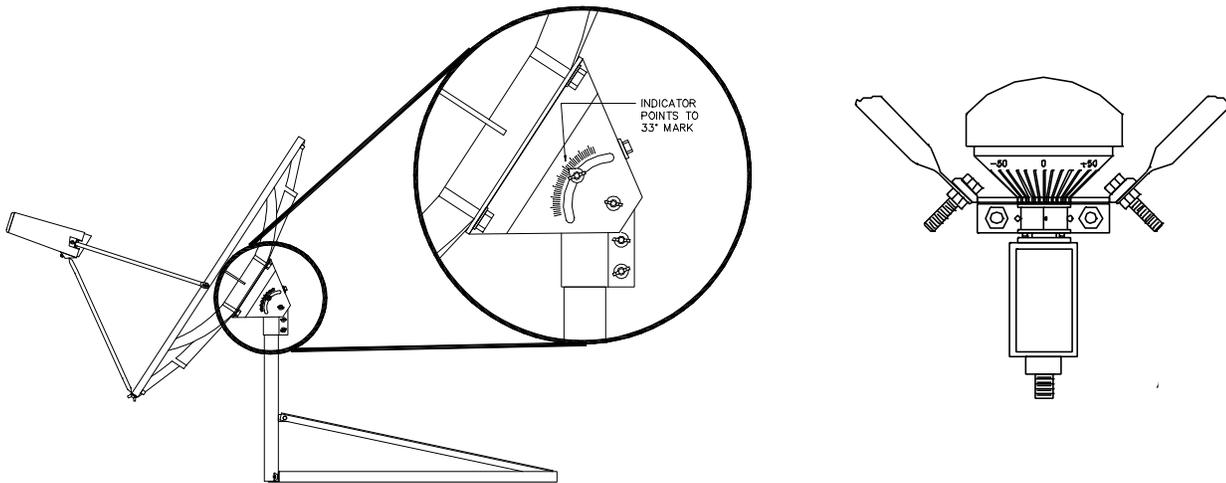
- H. Write down the Calculated Antenna Pointing Values:

Antenna Azimuth: \_\_\_\_\_

Antenna Elevation: \_\_\_\_\_

Polarity Value (from step G): \_\_\_\_\_

## 8) Aim the Dish



- A. Set the LNB's scale to the polarity value from Step 7.
- B. Set the satellite signal level meter to "Signal" mode.
- C. Loosen all wing nuts on the dish mount.
- D. Rotate the dish to the azimuth (left/right position) calculated by the SATSoft Az/EI program. You can determine the dish's current azimuth with the compass.
- E. Using the elevation adjustment bolt on top of the dish mount, tilt the dish to the elevation (up/down position) calculated by the SATSoft Az/EI program. You can determine the dish's current elevation from the elevation guide on the side of the dish mount.

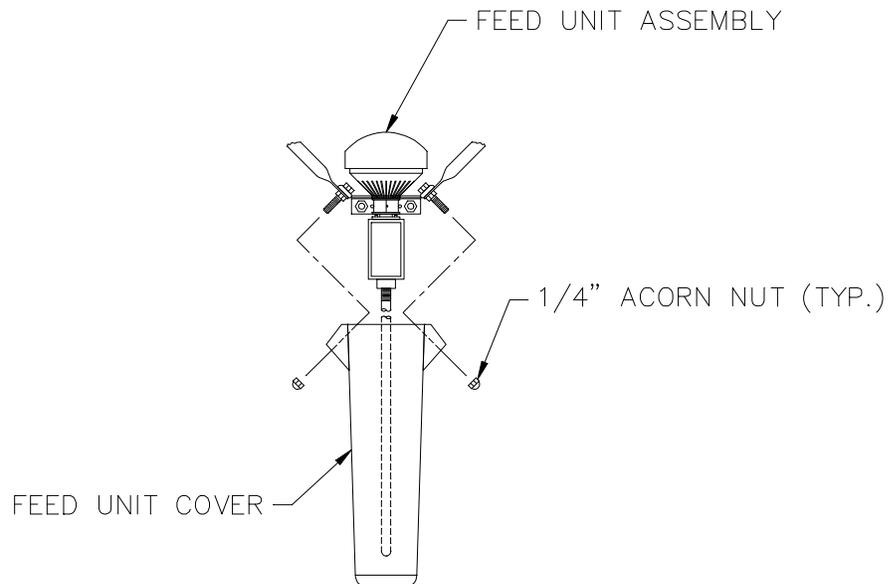
*Caution:* Be careful when adjusting the elevation adjustment bolt. If the nut on the inner side of the dish mount screws away from the dish mount, the barrel attaching the elevation adjustment bolt to the elevation guide can become stripped.

- F. Slowly maneuver the dish left and right, up and down until the satellite signal level meter shows that you have achieved the greatest signal level.

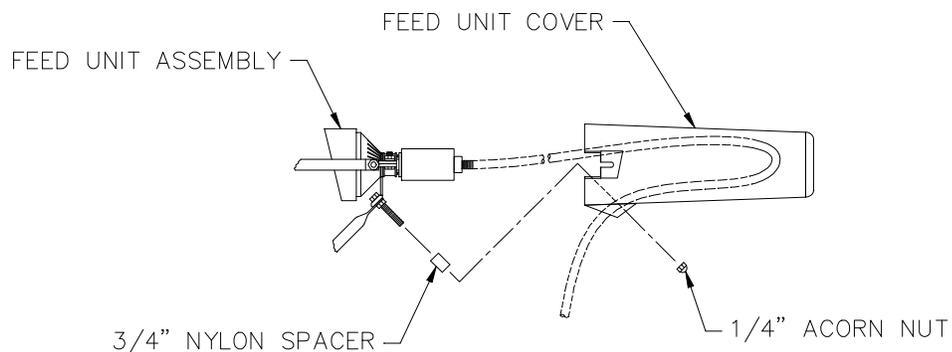
Note: If the satellite signal level meter's needle reaches maximum deflection or will not move from "0", adjust the Gain knob.

- G. Tighten all wing nuts on the dish mount.
- H. If the "Lock" light on the IP Relay does not illuminate within 30 seconds and the "Txd" light on the IP Relay does not blink occasionally, refer to the Troubleshooting section of this guide.
- I. Disconnect the satellite signal level meter and 10 foot coaxial cable. Then connect the 300 foot coaxial cable to the LNB.

## 9) Attach the Feed Unit Cover and Cable



TOP VIEW



SIDE VIEW

- A. Slide the gray plastic cover over the feed unit and bolt it to the feed rods with three 1/4" acorn nuts. The cable should run out past the white nylon spacer.
- B. Secure the cable to the bottom feed rod (twist ties work nice for this task). The intent of securing the cable is to protect the feed unit from damage if the cable is pulled.

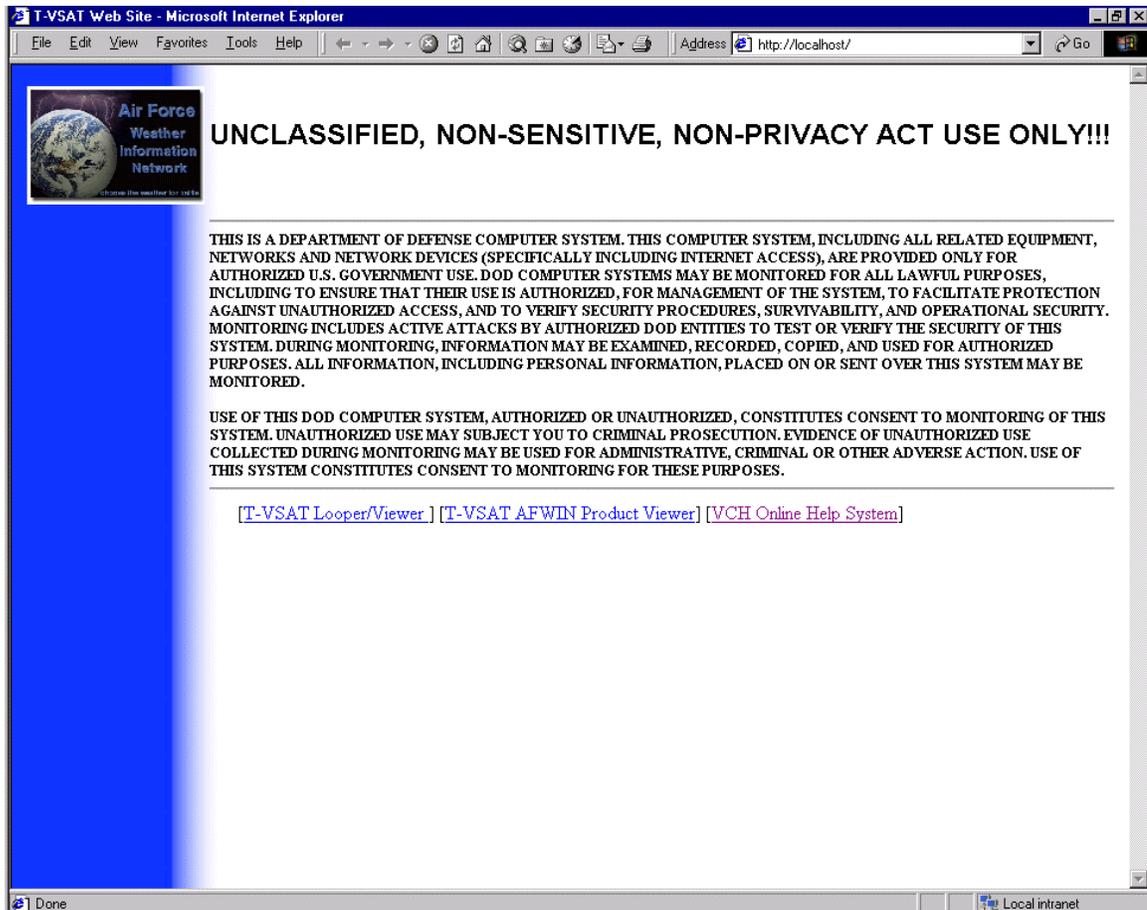
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# 1) Starting the Product Viewer



A. Double click the Internet Explorer icon.

B. After Internet Explorer starts, the screen shown below should display. Note that the Special Notice section may vary.



C. Click the "T-VSAT Looper/Viewer" link to work with image loops.

OR

Click the "T-VSAT AFWIN Product Viewer" link to work with AFWIN weather products. (Clicking this link performs the same action as clicking on the "VCH AFWIN Products" link shown on page 18.)

*Please note that the discussion of the Product Viewer in this section is intended only to provide a basic overview of the Product Viewer system and loop manipulation. You are encouraged to explore the Product Viewer system on your own, especially the functions accessed through the Available Links. For more information, click the link to the VCH Help System and browse through the help files.*

## 2) The Product Viewer Display

The main screen of the Product Viewer is shown below. All viewing options are initially accessed from this screen.

**Active Loops Control**  
This control allows you to select a loop to view. It also allows you to cancel data collection for a loop.

**Current Time Display**  
The current time is displayed here.

**Loop Creation Control**  
This control allows you to select geographical regions and image types for loop image collection. Selecting a loop here adds it to the loop list in the Active Loops control. It also starts collection of images for the loop. The time required for image collection prior to loop viewing depends on the frequency of image delivery for that region and image type.

**T-VSAT Product Viewer System.**

**Use Active Loops to select a loop to view**

- Select loop from the pop-up menu
- Click [Run] to view the loop, or
- Click [Delete] to delete the loop

**Use Loop Creation to start building a new loop**

- Select the region from the Loop Region pop-up menu
- Select the image type from the Data Type pop-up menu
- Click [Start Build] to submit the loop request
- (Some image types are not available on some regions)

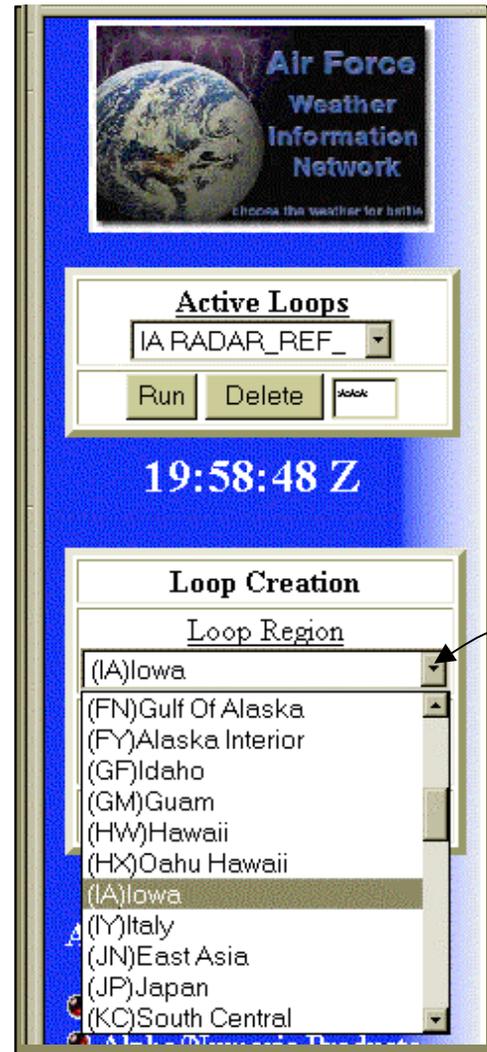
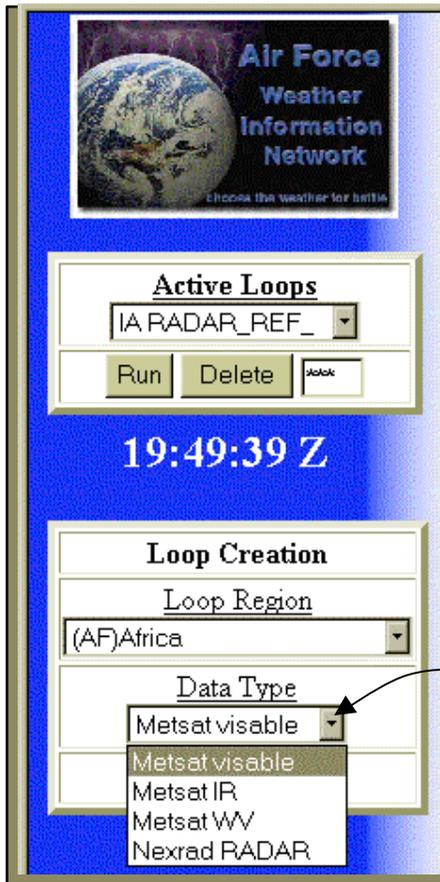
**Select from links (lower left) to see**

- Map Images: Archive of available map regions
- Alpha/Numeric Products: Archive of Alpha/Numeric weather products
- VCH AFWIN Products: Access the T-VSAT AFWIN Product Archive
- Loop Image Archive: Access the T-VSAT Loop Image Archive
- VCH Help System: Access the on-line VCH Help System

**Available Links Control**  
This control allows you to access other (non-loop) products. These products include selected maps, AFWIN and OWS generated web products, previously captured loop images, and user guides.

**Main Viewing Area**  
This is the area where the MPDS Product Looper is displayed. It also displays some of the product indexes and individual product files. Status messages for loop operations are displayed here as well.

### 3) Building a Loop

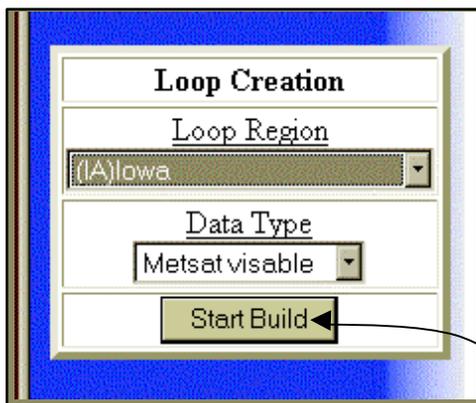


**STEP 1:**

- a) Click here to display the available MPDS image types.
- b) Click on the image type you wish to use.

**STEP 2:**

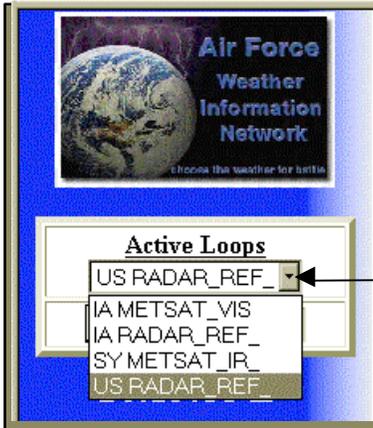
- a) Click here to display the available MPDS image regions.
  - Regions listed with "(special)" represent "non-standard" regions.
  - All other regions are standard AWDS regions.
- b) Click on the image region you wish to use.



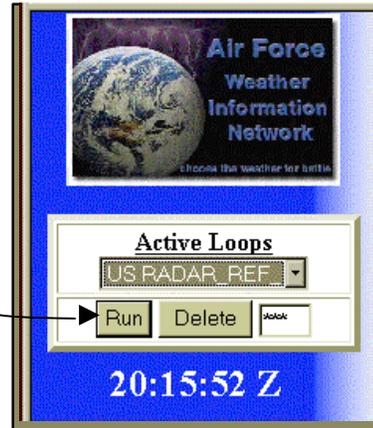
**STEP 3:**

- a) Click the "Start Build" button to start collecting images for this region and image type.
  - Note that the loop will not be viewable until at least two images of this type have been received. The amount of time before two images have been received will vary depending upon the production schedule of MPDS images.
  - For best results, start a few key loops as soon as you start the Product Viewer.

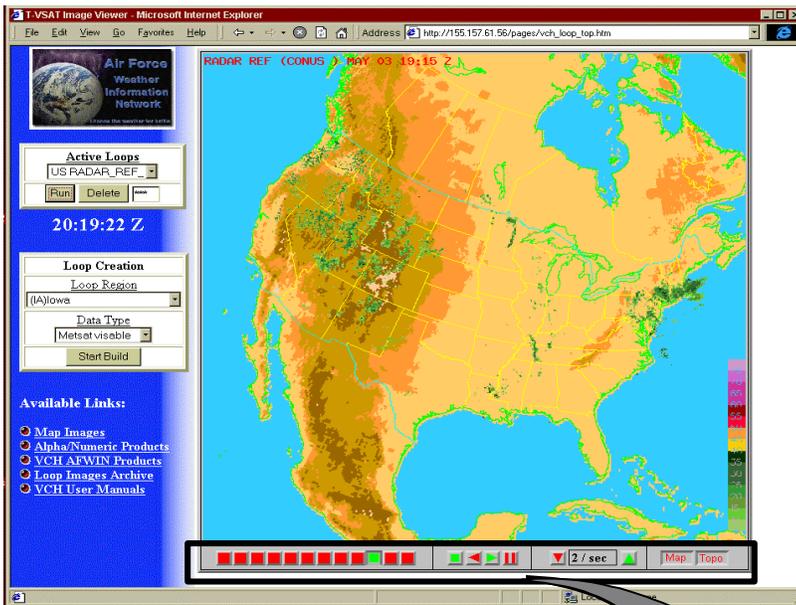
# 4) Viewing a Loop



**STEP 1:**  
 a) Click here to display the active loops.  
 b) Click on the loop you wish to view.



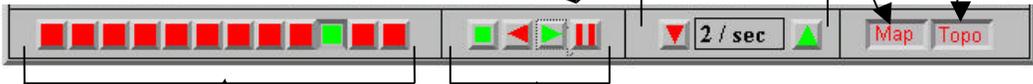
**STEP 2:**  
 a) Click the "Run" button to view the loop.  
 • If there are not enough images to display a loop, an error message will display



**Loop Speed Regulator**  
 The Loop Speed Regulator allows you to adjust the speed at which the images are looped.  
 • Click to loop at a slower rate  
 • Click to loop at a faster rate  
 • The display between the buttons shows the rate at which images are currently being displayed

**Map Button**  
 Click the Map button to toggle the map background on and off. (Map backgrounds are available only for MPDS products using north polar stereographic projection.)

**Topo Button**  
 Click the Topo button to toggle the topographic background on and off. (Topo backgrounds are available only for CONUS-based NexRad imagery.)



**Loop Sequence Indicator**  
 The Loop Sequence Indicator shows which images within the loop are available.  
 • Red buttons indicate available images  
 • The green button indicates the currently displayed image  
 • Buttons containing an "X" (not shown in above example) indicate that less than 12 images are available for the loop  
 • To display a specific image within the loop, click to stop "playing" the loop and then position the mouse pointer over the sequence button of the image you wish to display

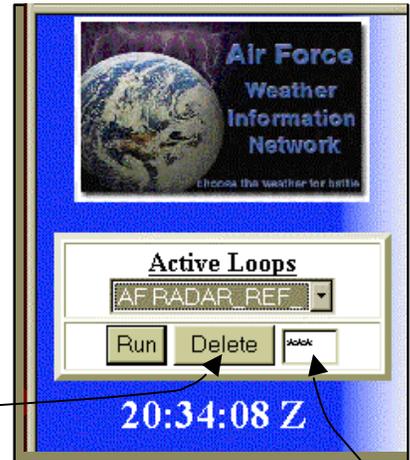
**Loop Control Buttons**  
 The Loop Control buttons allow you to start, stop, and choose direction of the loop.  
 • Click to start "playing" the loop  
 • Click to "play" the loop in newest-to-oldest order  
 • Click to "play" the loop in oldest-to-newest order  
 • Click to stop "playing" the loop

## 5) Deleting a Loop



### STEP 1:

- Click here to display the active loops.
- Click on the loop you wish to delete.



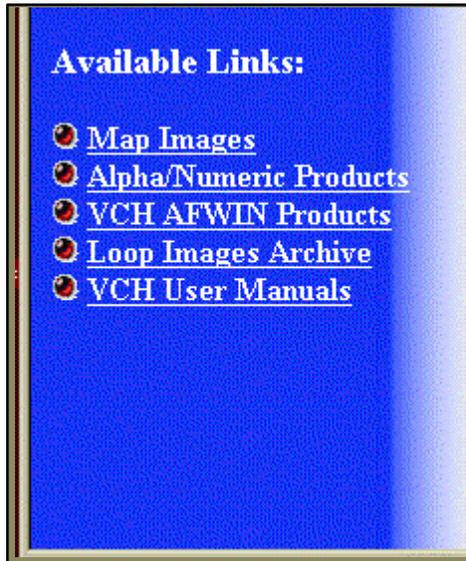
### STEP 2:

- Click the "Delete" button.

### STEP 3:

- In the field to the right of the "Delete" button, delete the "\*\*\*\*", then enter "Hi" (case-sensitive, no quotes) as a password.
  - Deleting a loop deletes only the loop name from the Active Loops frame. It does not delete the images comprising the loop from the laptop PC's hard drive. Thus, if you delete a loop and then recreate that same loop at a later time, images from the original loop may initially display as part of the new loop.

## 6) Viewing Other Products

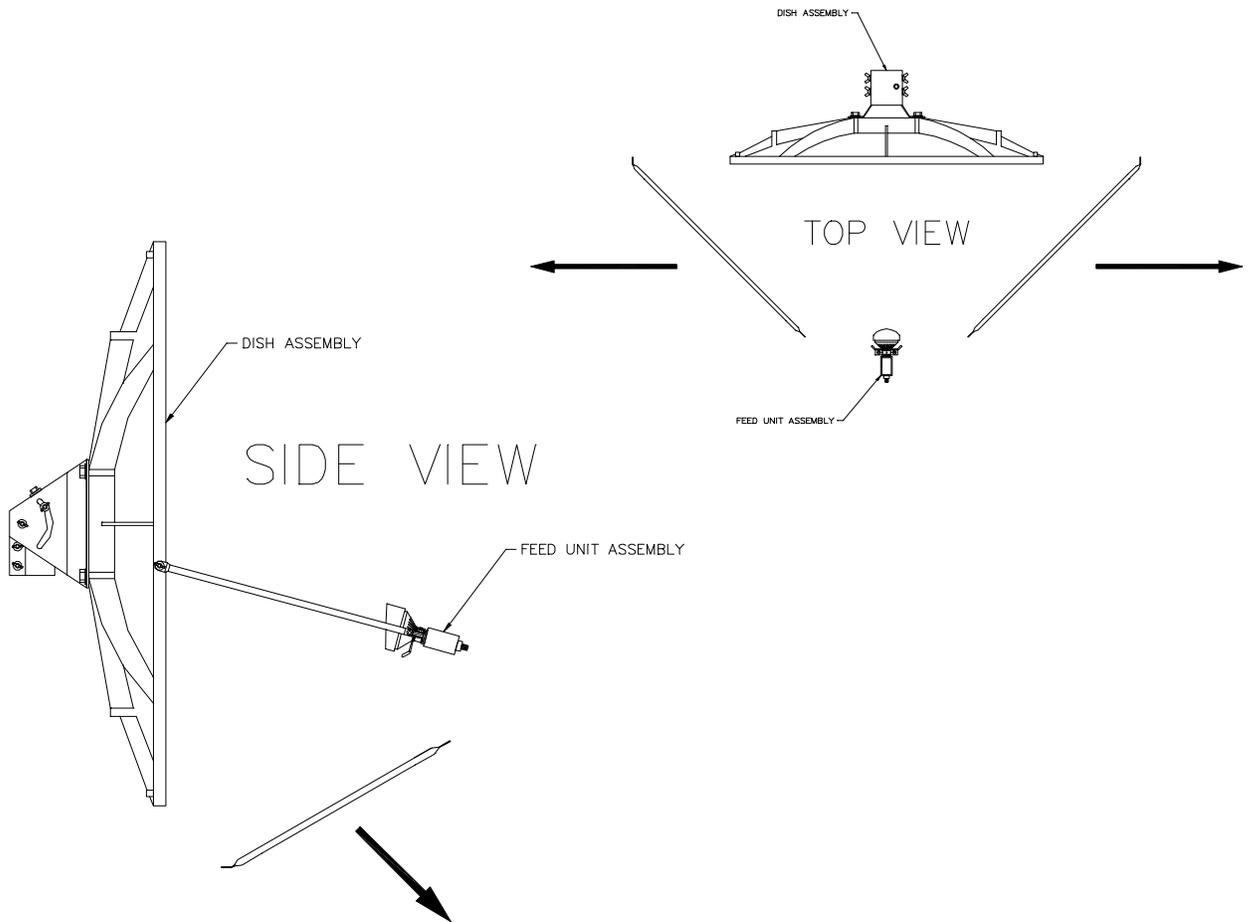


The "Available Links" frame allows you to access non-loop products. These products include maps, AFWIN and OWS generated web products, previously captured loop images, and the on-line versions of the VCH user guides.

Clicking on one of the links displays the directory of items available from that category. From the directory, browse the items by clicking on their filenames.

For example, clicking the "VCH AFWIN Products" link takes you to the VCH AFWIN Product Viewer page, which allows you to view the AFWIN web products that have been delivered via the VSAT network.

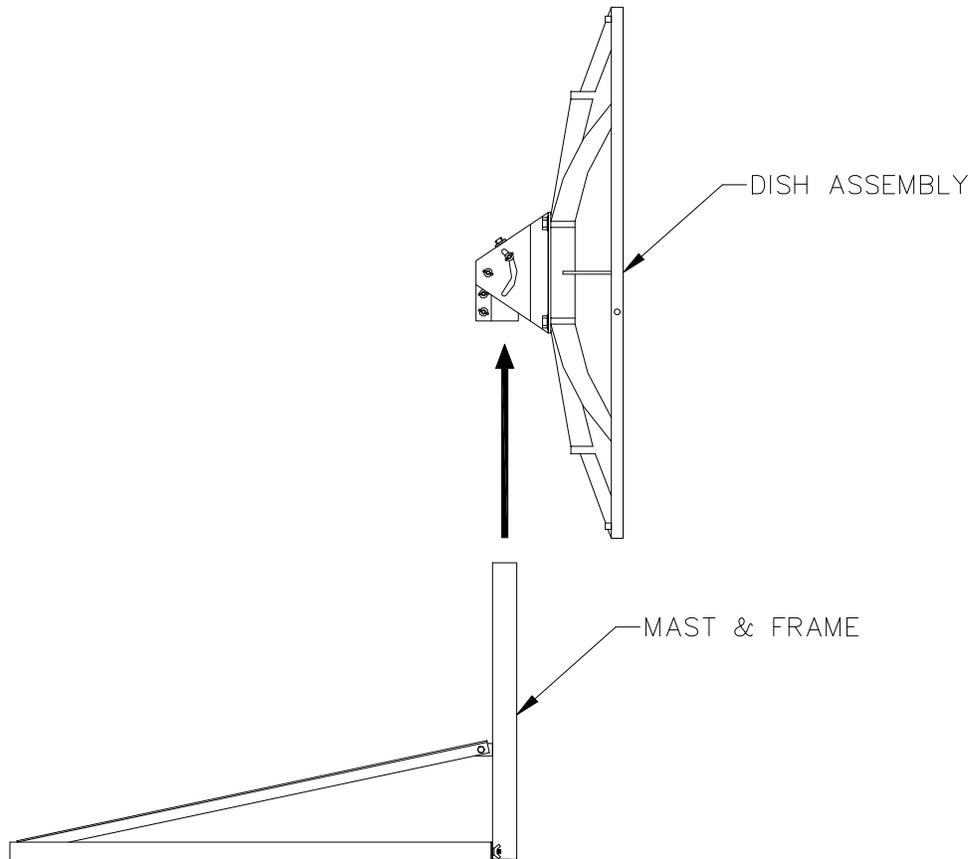
# 1) Remove the Feed Unit and Feed Rods



**Caution:** Before disassembling and packing the 1.0-Meter Antenna, power down the VCH system.

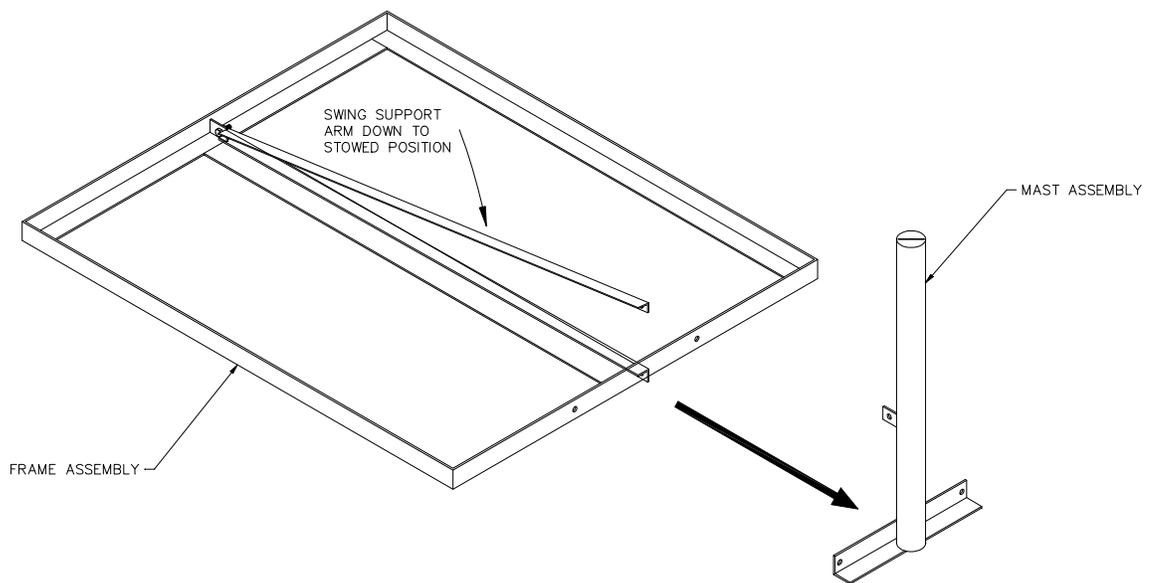
- A. Unbolt the gray plastic cover from the feed unit and slide off the cover.
- B. Unscrew the coaxial cable from the feed unit.
- C. Unsecure the cable from the bottom feed rod and set the cable aside.
- D. Unbolt the feed unit from the feed rods and place the bolts back on the feed unit.
- E. Stow the feed unit inside the gray plastic cover and reattach the acorn nuts.
- F. Pack the gray plastic cover (with the feed unit inside) in the case lid.
- G. Unbolt the feed rods from the dish. Then place the mounting hardware (nuts, washers, and bolts) back on the feed rods.
- H. Set the feed rods (with mounting hardware attached) aside.

## 2) Unmount and Pack the Satellite Dish



- A. Loosen the two collar bolts holding the dish to the mast.
- B. Lift the dish off of the mast.
- C. Place the dish in the case, with the mount facing up.
- D. Coil and place the 300' coaxial cable on top of the dish.

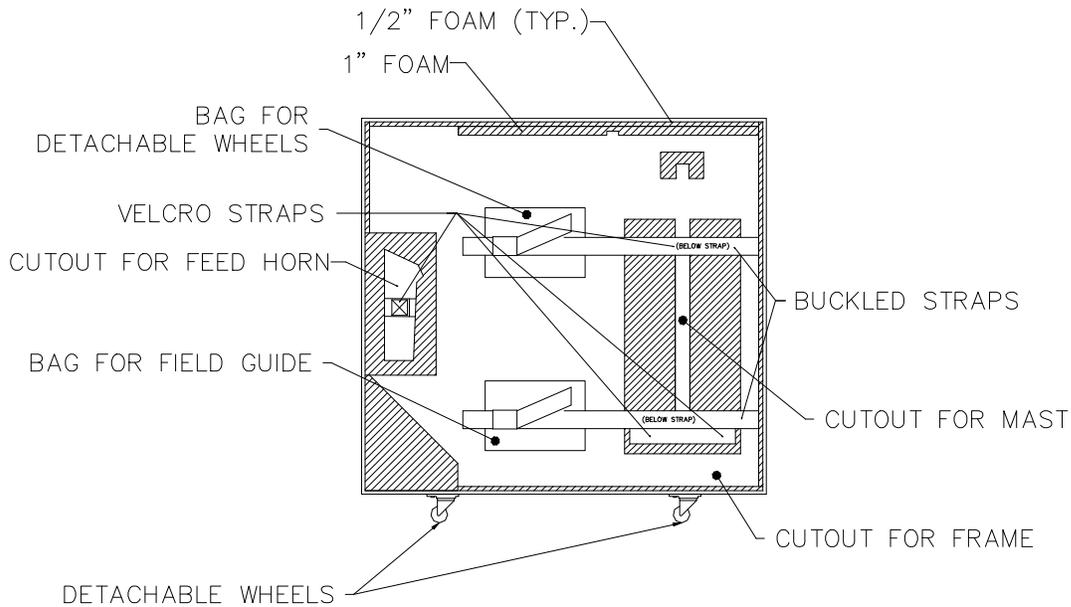
### 3) Disassemble and Pack the Support Arm, Mast, and Frame



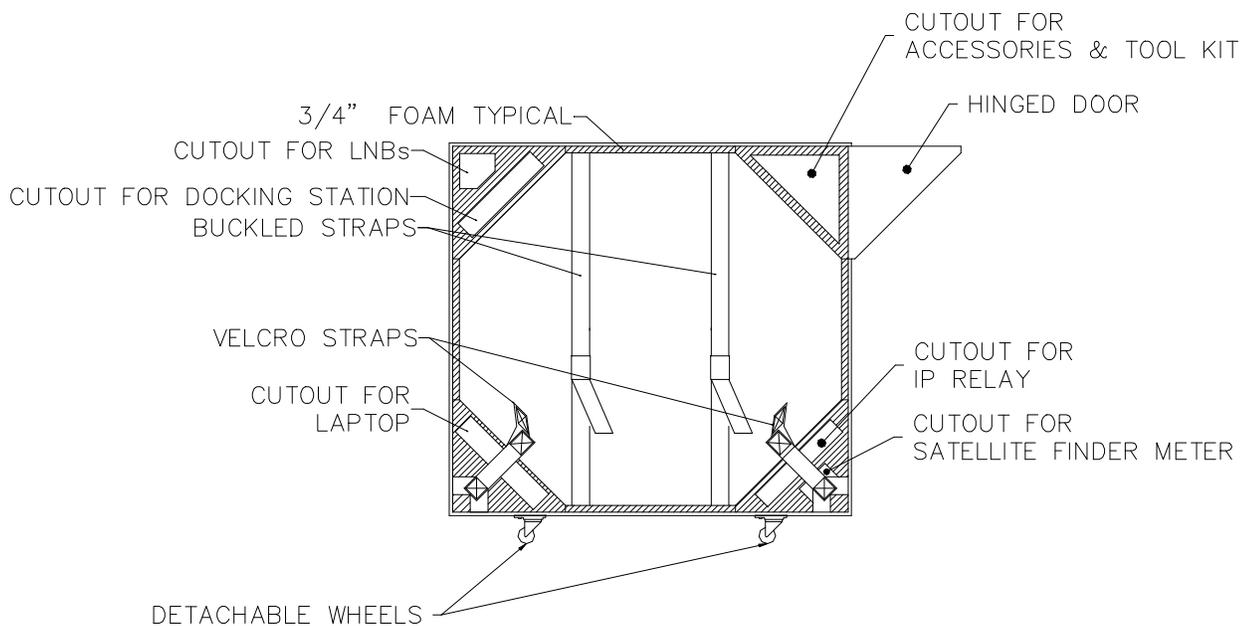
- A. Unbolt the support arm from the mast, then put the nut, washers, and bolt back in the mast connector.
- B. Loosen, but do not remove, the bolt attaching the support arm to the frame. Then lower the support arm.
- C. Remove the bolts holding the mast to the frame. Then reattach the nuts, washers, and bolts to the mast.
- D. Stow the frame (with support arm attached) in the case lid.
- E. Place the feed rods (from step 1H on Page 21) inside the mast, then stow the mast in the case lid.

## 4) Pack the Remaining Antenna Supplies

Your tactical VCH system will have one of two case styles. Determine which case style you are using and refer to the appropriate diagrams.



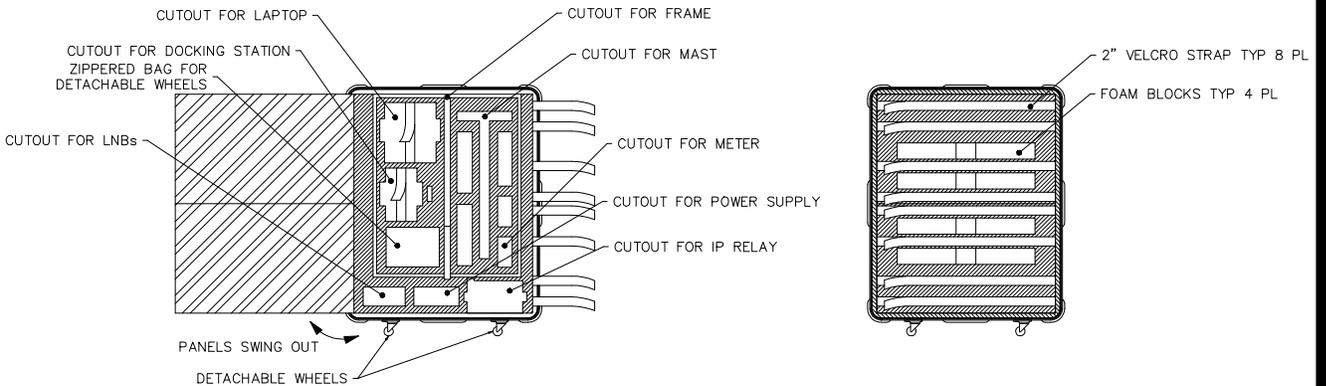
**LID - Case Style 1**



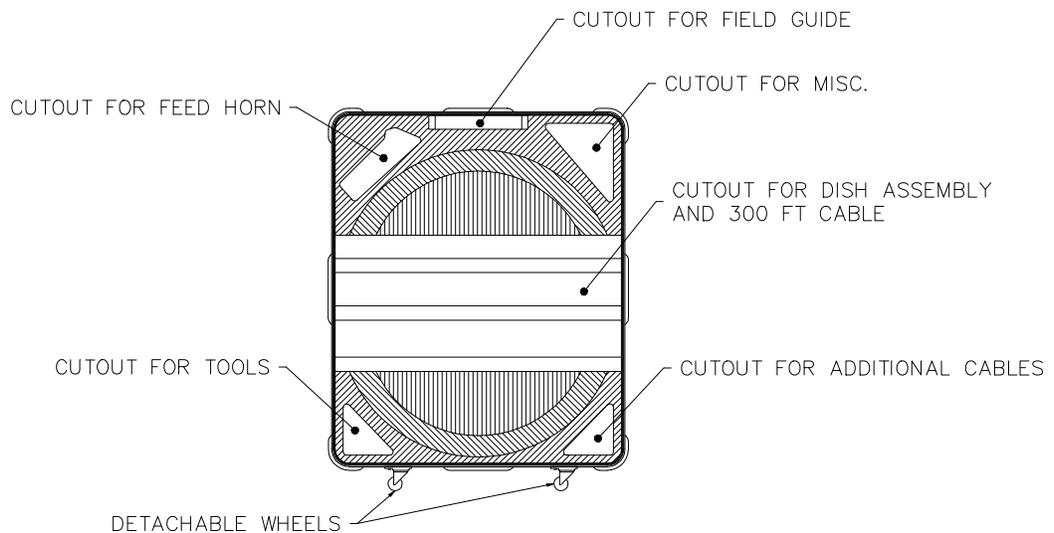
**BASE - Case Style 1**

Procedure continued on next page →

## 4) Pack the Remaining Antenna Supplies (cont'd)



**LID - Case Style 2**



**BASE - Case Style 2**

- A. Put the tools in their pouch, and then stow the tool pouch in its cutout. (For case style 1, the storage area with the hinged door.)
- B. If you used pads to level the case lid, roll up the pads and place them on top of or underneath the dish.
- C. Stow the satellite signal level meter, IP Relay, laptop PC, associated cabling, and this *Field Guide*.
- D. Strap all objects into place and tighten the straps.
- E. Close and latch the case.

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# Troubleshooting

Problem/Symptom	Correction
No Power to IP Relay or computer.	<ul style="list-style-type: none"> <li>- Check the power cable is connected to the IP Relay 18 Volt DC power supply and to an appropriate power source.</li> <li>- Check the IP Relay power supply DIN connector is connected securely to the back of the IP Relay.</li> <li>- Check power connection to computer through the power supply.</li> <li>- If attempting to run on battery pack power, check to be sure battery is not depleted by connecting the computer to a power source.</li> </ul>
IP Relay will not display a LOCK light.	<ul style="list-style-type: none"> <li>- Check all connections from the LNB to the computer to ensure correct and tight connections. Tighten and correct connections.</li> <li>- Inspect the antenna assembly and be sure the LNB support rods are not bent or the mount bracket is not damaged and misaligned. Ensure all hardware is tight holding the LNB in its proper position. Tighten any loose hardware and replace, if possible any bent or broken support equipment.</li> <li>- If the ChannelMaster satellite finder meter is being used, ensure the RG-6 coaxial cables are connected to the proper connectors (SAT Rx connector to the IP Relay and LNB connector to the LNB).</li> <li>- Check the RG-6 coaxial cable(s) being used for damage, crimping, loose connectors on each end. Replace unserviceable cables or repair if capability exists.</li> <li>- Check RG-6 coaxial cable length does not exceed 300 feet without amplification. Reduce distance from LNB to IP Relay and computer to 300 feet or less.</li> <li>- Double check hardware tightness, especially in winds that may have moved the antenna. Add ballast to the antenna base if needed.</li> <li>- Check the antenna dish for ice or snow accumulation.</li> <li>- If heavy precipitation is occurring it can attenuate the signal coming from the satellite. Wait until precipitation intensity diminishes and check again.</li> <li>- Check the LNB and feed horn for obstructions, including ice, frost, and moisture on the plastic covers.</li> <li>- Check the alignment of the rectangular opening on the LNB face and the feed horn to be sure of proper alignment.</li> <li>- Check antenna is pointed at the correct satellite. Reconfirm azimuth, elevation, and polarization calculations and repoint the antenna.</li> <li>- Possible incorrect LNB polarity. Rotate the LNB 90 degrees and wait to see if the lock light illuminates. If no lock light, rotate back to original orientation.</li> <li>- Check LNB is the correct one for the VSAT network (A = CONUS, B = Europe, C = Pacific)</li> <li>- Ensure the IP Relay is programmed correctly for the VSAT network. Use the IP Relay Programmer to verify correct programming.</li> </ul>

# Troubleshooting (cont'd)

Problem/Symptom	Correction
<p>No 18 Volt DC power to the LNB indicated on the ChannelMaster satellite finder meter or multimeter.</p>	<ul style="list-style-type: none"> <li>- Check the IP Relay power supply to be sure at least one output is 18 Volts DC (transmit/receive VSATs with a PES and IP Relay use a 12 Volt DC power supply). Replace the power supply with correct model if this is the problem.</li> <li>- Open the IP Relay and be sure a jumper is installed on LNB POWER JP1. This allows 18 Volts DC to be supplied to the LNB from the IP Relay through the R6-6 coaxial cable for LNB operation. If a jumper is not installed across the two pins at JP1, install a jumper or contact the AFWA Help Desk.</li> </ul>
<p>LOCK light is lit on the IP Relay but no data receipt at the computer.</p>	<ul style="list-style-type: none"> <li>- Check the ethernet crossover cable connecting the IP Relay to the computer. Be sure it is a crossover cable and not a standard ethernet cable. Replace standard ethernet cables with crossover cable.</li> <li>- Check the crossover cable for physical damage, e.g., crimping, pinching, splitting, etc.</li> <li>- Check the connectors on each end for damage and be sure they are securely connected. Inspect as good as possible, the condition of the wires in the connector, particularly wire numbers 1,2,3, and 6 (viewing left to right with the lock tab on the bottom of the connector).</li> <li>- Check the IP address being used by Fazzt is the correct one for the network interface card (NIC) connected to the IP Relay.</li> <li>- Attempt to "ping" the IP Relay from the computer to verify communications. Open a MS-DOS window and type "ping idi" &lt;Enter&gt; or "ping {IP address of the IP Relay}" &lt;Enter&gt;. The IP Relay will respond if good communications exist. If a timeout message is received (no reply from the IP Relay), replace the ethernet crossover cable with another one, verify correct and secure connections in the correct NIC, and/or reprogram the IP Relay.</li> </ul>
<p>IP Relay LOCK light is lit and the computer is receiving partial or incomplete files.</p>	<ul style="list-style-type: none"> <li>- Double check all connections for tightness. Secure all connections and hardware.</li> <li>- Inspect all cables for physical damage and replace or repair as necessary.</li> <li>- Verify signal strength. Ensure you have the strongest possible signal.</li> <li>- Confirm the antenna base is on level, flat ground and not wobbling. Add or readjust ballast and apply padding to firm up the surface under the antenna base.</li> </ul>
<p>Cannot view products on the computer using the looper.</p>	<ul style="list-style-type: none"> <li>- Verify that loops have been identified and created and that sufficient time has elapsed for data receipt to build the loops.</li> <li>- Ensure a Web Client has been created on the computer with the Data Flow Manager.</li> </ul>