Mobile TMC

and

MRM Communications System

User Manual

for

Caltrans D12

Caltrans New Technology

UC Irvine

California Polytechnic State University

San Luis Obispo, California

v1.2, June 2006

THEORY OF OPERATION TABLE OF CONTENTS

OPERATING INSTRUCTIONS TABLE OF CONTENTS

OPERATING INSTRUCTIONS QUICK GUIDE

Mobile TMC System Startup

1. Level vehicle (Section 1.3, page 43).
2. Start generator (Section 1.1.1, page 36), or connect shore power (Section 1.1.2, page 38).
3. Turn on breakers (Section 1.1.3, page 39).
4. Raise pneumatic mast (Section 1.4, page 46).
5. Aim satellite system (Section 2.1.1, page 53).
6. Bring Mobile TMC <-> D12 TMC satellite link online (Section 2.1.3, page 58).
7. Power up computer systems (Section 3.1, page 63).
8. Use systems as desired:
   - Remote ATMS Display (Section 3.2, page 65)
   - Video Surveillance (Section 0, page 67)
   - Video Relay (Section 3.3, page 69)
   - Video Conferencing (Section 3.4, page 70)
   - Data Communications (Section 3.6, page 76)

Mobile TMC System Shutdown

1. Shut down all computer, video, and data systems (Please see appropriate sections).
2. Shut down satellite link (Section 2.1.4, page 59).
3. Lower pneumatic mast (Section 1.4, page 47).
4. Turn off breakers (Section 1.1.3, page 40).
5. Stop generator (Section 1.1.1, page 37), or disconnect shore power (Section 1.1.2, page 40).
6. Retract vehicle jacks (Section 1.3, page 44).

Chapter 1
THEORY OF OPERATION

1. MOBILE TMC WIDE AREA DATA COMMUNICATIONS

1.1. Overview

The wide-area data communications system is the heart of the Mobile TMC in that it allows reliable data communications to the District 12 TMC from anywhere in California. This data communications system is TCP/IP based and allows various applications to seamlessly communicate across the link. Adding applications communicating across the link simply entails setting up proper network addresses at each device and ensuring adequate communications bandwidth is available. Figure 1.1 shows an overview of the system.

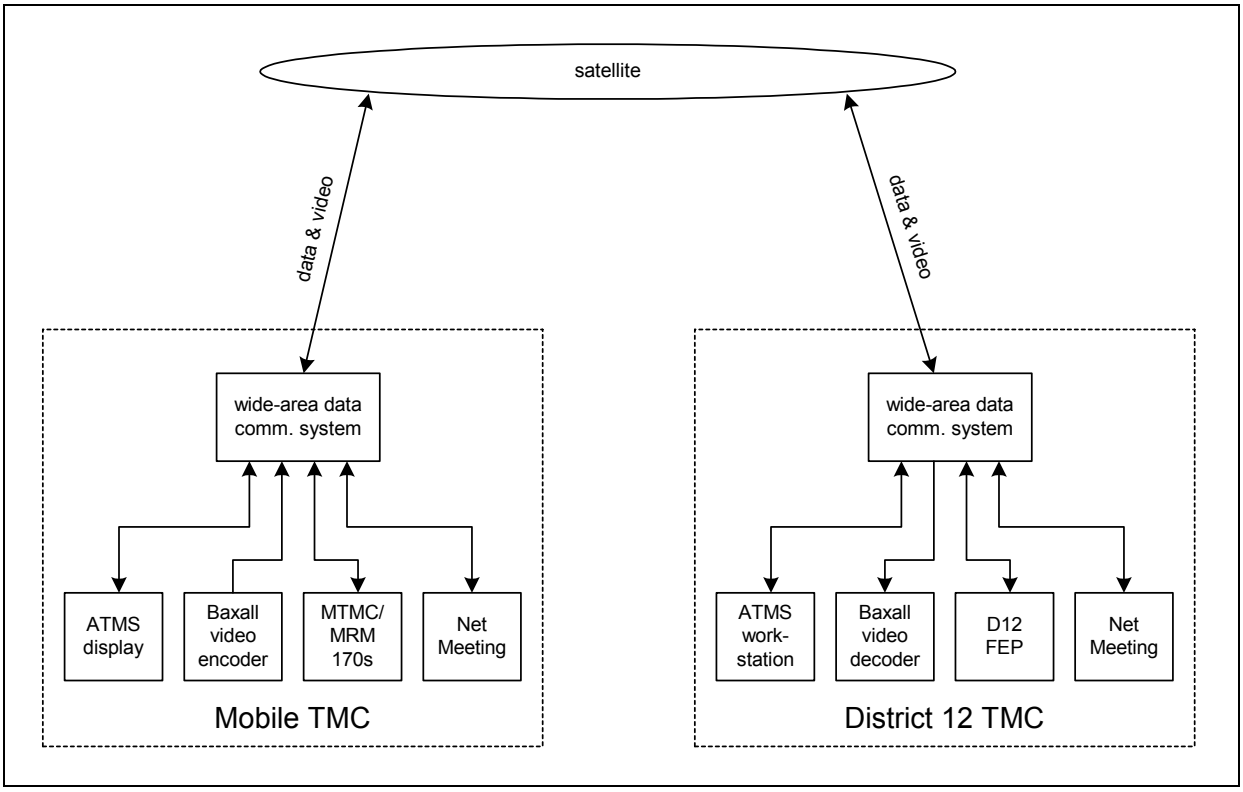


Figure 1.1 Mobile TMC wide-area data communications system.

The wide-area data communications system is satellite based and allows the following TMC application operation:

- ATMS display in the Mobile TMC connected to an ATMS workstation in the District 12 TMC, providing ATMS operation in the Mobile TMC.

- Transmission of compressed video from the Mobile TMC to the District 12 TMC, where it is fed into the District 12 video distribution system.

- District 12 Front End Processor (FEP) polling of 170 controllers in the Mobile TMC and the Mobile Ramp Metering trailer.

- Netmeeting video teleconferencing between the Mobile TMC and the District 12 TMC operations floor.

1.2. Detailed Overview

Figure 1.2 shows the wide-area data communications system and its connections to systems in the Mobile TMC and the District 12 TMC. The Cisco 805 routers monitor the local area network (LAN) they are connected to detect network traffic that is addressed to the network on other side of the satellite. Upon receiving this traffic, the router gives this traffic to the satellite modem via the RS-422 data connection. The satellite modems transport this data across the satellite to the other modem, where it is presented to the far-side Cisco router. The far-side router presents the data to the LAN it is connected to, where it will be picked up by an application.

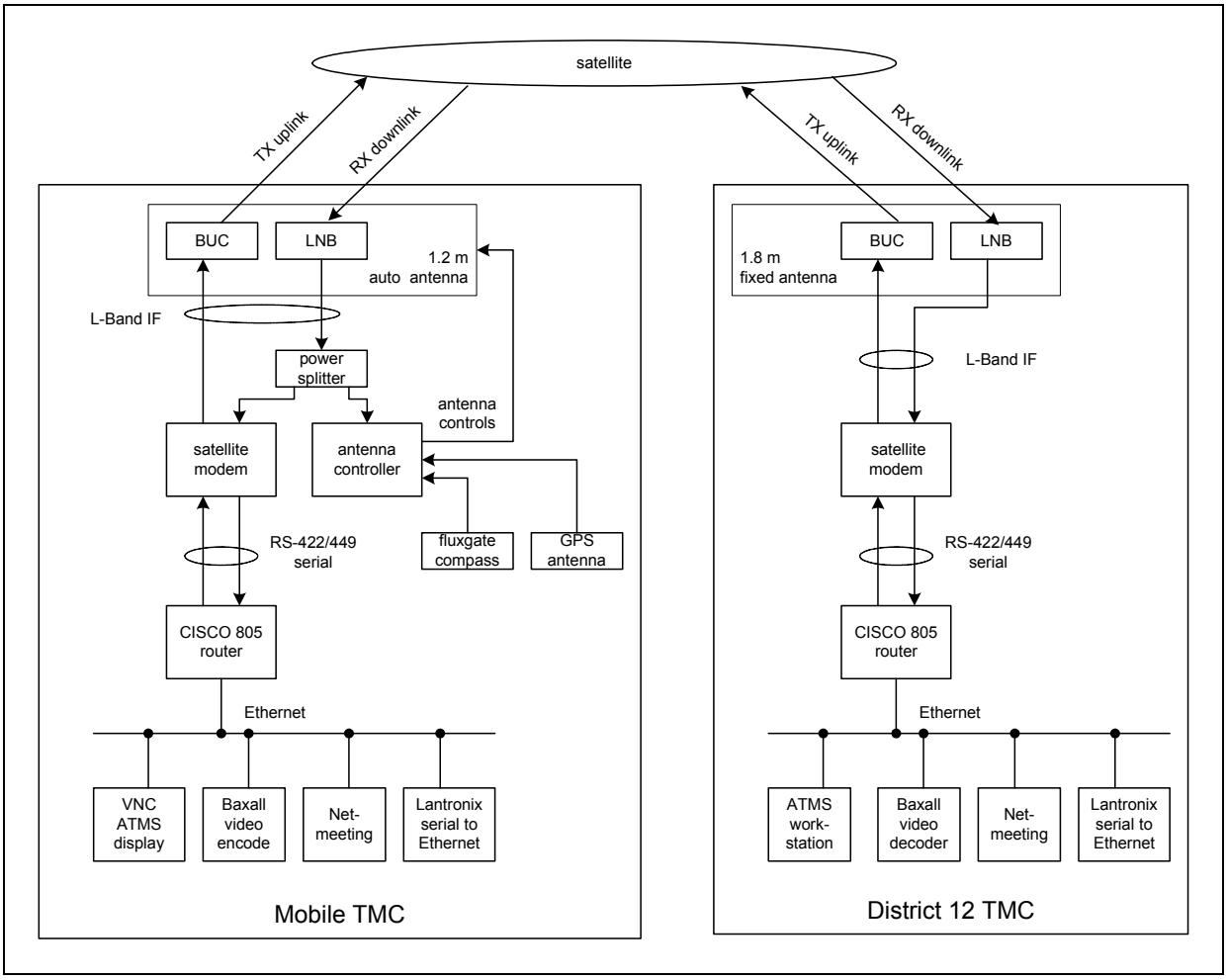


Figure 1.2 Detailed Mobile TMC wide-area data communications system.

1.2.1. Satellite communications modems

The satellite communications link consists of digital satellite earth terminals that operate in the Ku satellite band. The earth terminals provide the interface between the routers and the satellite dishes. During transmit operation, the earth terminal receives high-speed serial data from the wide-area router, performs forward error correction (FEC) and other encoding, and then modulates this signal on the 950 to 1450 MHz L-band IF frequency. The modulated L-band signal is sent to the TX-IF connector on the back of the earth terminal, where the TX cable to the antenna is connected. During receive operation, the earth terminal receives an L-band IF signal from the satellite dish on its input RX-IF connector, performs FEC and other signal decoding, and delivers a high-speed serial stream to the wide-area router.

1.2.2. Forward Error Correction

The earth terminals utilize Forward Error Correction to reduce bit errors and provide a reliable data stream for network communications. Forward Error Correction (FEC) provides improved bit-error performance through the addition of extra data bits, or controlled redundancy, in the transmitted data stream. The FEC decoding process utilizes these extra data bits to determine if a bit error has occurred. The FEC will switch bits to their original value upon detection of a bit error. Forward Error Correction is very effective in making a marginal communications link provide outstanding bit error performance. Observations of the D12 satellite link showed that the uncorrected bit error performance fell within the range of 1 to 10 bits out of 100,000 in error. Corrected bit error performance was typically less than 1 in 1,000,000,000,000.

1.2.3. Satellite antennas with up and down converters

The D12 satellite communications system utilizes 1.2 and 1.8 meter satellite dishes on the Mobile TMC and D12 TMC, respectively. These antennas are 22.5 degree offset dishes, which requires that they be aimed 22.5 degrees lower in the sky than their intended target. Each satellite antenna has an electronics package installed on the feed-horn mounting bracket that provides block up conversion (BUC) for transmit and low-noise amplification and block down conversion (LNB) for receive. The primary purpose of these signal conversions are to translate the signal from the 950 to 1450 MHz L-band IF signal supplied and required by the earth terminal and the satellite frequencies that range from 11,000 to 15,000 MHz.

The 1.8 meter dish on the D12 TMC is installed on the lower section of the Oasis satellite dish mounting pole on the southwest wall of the D12 TMC penthouse. This dish is mounted on an extension bracket that was custom fabricated for this antenna installation. Figure 1.3 shows this antenna installation. The 1.2 meter dish on Mobile TMC has two positions: stowed for travel and set up for operation. The travel position keeps the dish under a maximum vehicle height of 14 feet and minimizes wind load on the dish while driving. Figure 1.4 shows the Mobile TMC satellite dish in its stowed and operating positions respectively.

Figure 1.3 Fixed 1.8 meter dish on the D12 TMC.

Figure 1.4 Mobile TMC 1.2 meter dish in stowed for travel, and in operational position.

1.2.4. Satellite space segment and asymmetrical link

The satellite communications system utilizes 300 KHz of bandwidth of commercial satellite space segment. This space segment is capable of providing 256 Kbps of total data throughput, which may be divided asymmetrically between the TMC to Mobile TMC and Mobile TMC to TMC links.

The wide-area data communications system must be able to support a variety of applications, and hence has a diverse set of data communications requirements. Table 1.1 provides a summary of the bandwidth needed for each application, as required for operation of the Mobile TMC. The TMC to Mobile TMC link utilizes approximately three times the bandwidth of the Mobile TMC to TMC link due to operation of the remote ATMS display. For this reason, the link is not symmetrical. The throughput uses shown below are for demonstration purposes and may be changed as priorities and system needs change.

Mobile TMC APPLICATION	TMC TO Mobile TMC THROUGHPUT (Kbps)	Mobile TMC TO TMC THROUGHPUT (Kbps)
remote ATMS display	144	15
TMC to Mobile TMC video transmission	24	-
Mobile TMC to TMC video transmission	-	24
NetMeeting between Mobile TMC and TMC	24	24
Mobile TMC vehicle detection transmission to TMC	-	1
TOTAL	**192**	**64**

Table 1.1 Summary of wide-area data communications throughputs.

Figure 1.5, satellite spectrum allocation, shows how a channel assigned by the satellite provider would be divided to support the 64 Kbps and 192 Kbps sides of the link. For example, the satellite provider could assign a 300 KHz channel with an uplink center frequency of 12,000.50 MHz. Note that 100 KHz is equal to 0.100 MHz.

center of low band = 12,000.50 MHz – 0.100 MHz = 12,000.40 MHz

center of high band = 12,000.50 MHz + 0.050 MHz = 12,000.55 MHz

These two center frequencies would then be provided to the satellite control center when gaining access to the "bird".

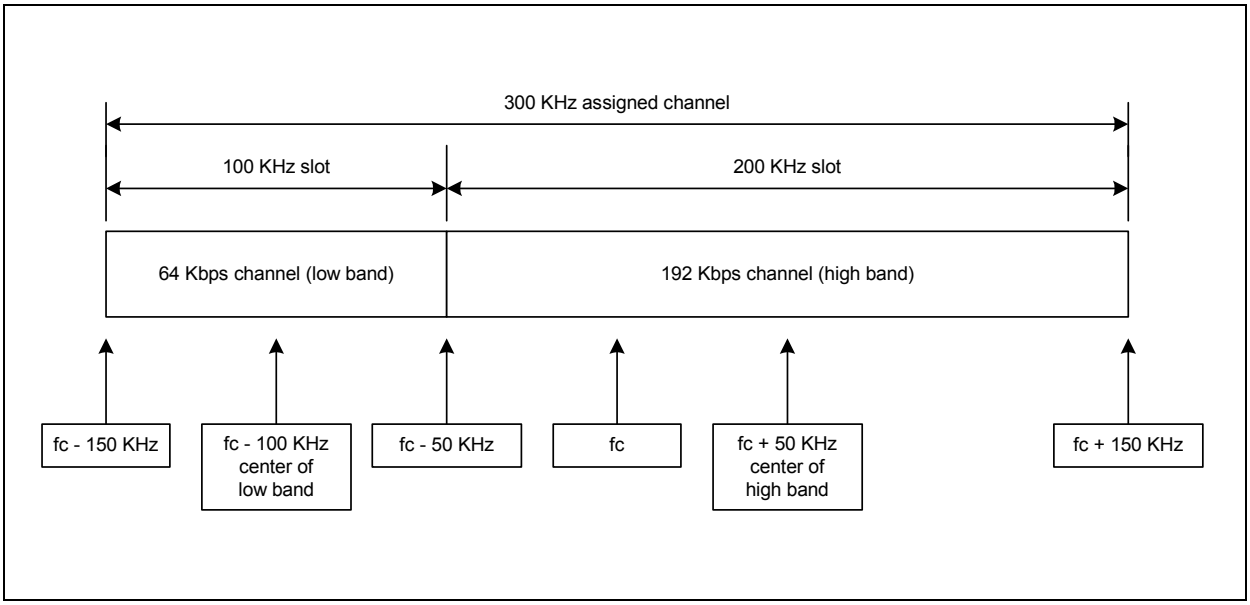


Figure 1.5 Satellite spectrum allocation.

1.3. Cisco 805 Routers

The Cisco 805 routers create a wide area network using the D12 satellite communications link. This network connection is similar to an Internet connection between computers in different locations, except that it is both dedicated and non-public. This wide area network allows virtually any type of computer network connection to be made between the D12 TMC and the Mobile TMC, providing that enough bandwidth in the space segment is available to support the network traffic generated by the Mobil TMC applications.

1.3.1. Advanced router features.

The Cisco 805 routers have the capability to selectively route traffic between the TMC and Mobile TMC based on predetermined parameters, which include priority and minimum service requirements. For example, the routers have a Quality of Service (QOS) feature that will ensure a specific application will receive a minimum amount of satellite throughput. QOS can be configured so that the video transmission channel receives a minimum bit-rate of 30 kilobits per second (Kbps). If the video transmission channel were then configured to produce a video stream that required 28 Kbps, the satellite link would always provide just enough capacity for the video channel, ensuring that other applications such as the ATMS display do not lock out video transmission when they transmit a large quantity of data.

1.3.2. Router interface to the satellite earth terminals.

The serial cable used to connect the router to the satellite terminal is proprietary and manufactured

by Cisco Systems. The cable consist of a smart serial connector, that when connected to the router, will allow the router to detect a clock rate if one is available, or to provide a clock rate if one is needed.

The cable is connected to the satellite terminal via a RS449 connector. The terminal will provide the router with a clock rate; as a result a Cisco Systems EIA/TIA-449 DTE cable is used to connect the router to satellite terminal.

Figure 1.6 Cisco Router.

2. MOBILE TMC OPERATIONS APPLICATIONS

The Mobil TMC supports a variety of TMC applications, giving its operator capabilities similar to those in their fixed center. Systems available to the Mobile TMC operator include the Advanced Transportation Management System (ATMS), video surveillance and display system, video transmission and reception system, video conferencing, and a vehicle detection system.

2.1. Remote ATMS Operation

The Advanced Transportation Management System (ATMS) is remotely displayed in the Mobile TMC using Virtual Network Computing (VNC) remote display application. The software creates a virtual display server, and allows a remote client to connect to it. The server uses a number of compression techniques to make the application suitable for low bandwidth connections.

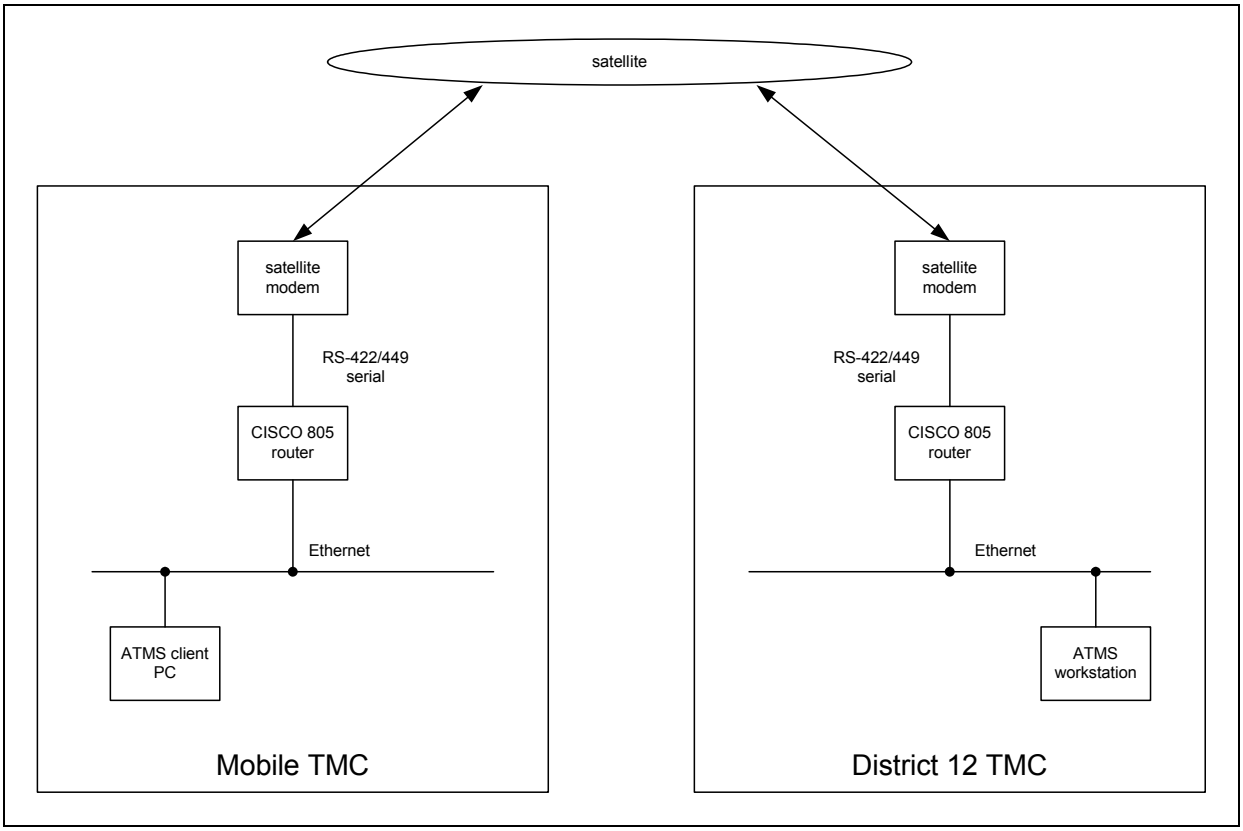


Figure 2.1 ATMS display connection over the wide-area data communications system.

2.2. Video Surveillance and Display

The Mobile TMC is equipped two cameras; one used to sight the RTMS for count data, and the other for general purpose video surveillance. It can receive surveillance video from the Mobile Ramp Meter trailer via a 2.4GHz radio link using Enerdyne video codec systems. The Mobile TMC can also send video back to the District 12 TMC, using a set of Baxall Destiny IP codecs to transport video across the satellite link.

Control of the video, and the Mobile TMC's onboard cameras is handled from the video control panel at the operator console inside the vehicle. From the panel, operators can direct video to either of the two monitors, record video for later viewing, direct a video feed back to the District 12 TMC over the satellite link, or operate the two onboard cameras. Figure 2.2 Video Surveillance Console, shows the video controls, monitors, and VCR at the operator console. Figure 2.3 provides a summary of the Mobile TMC video systems.

Figure 2.2 Video Surveillance Console

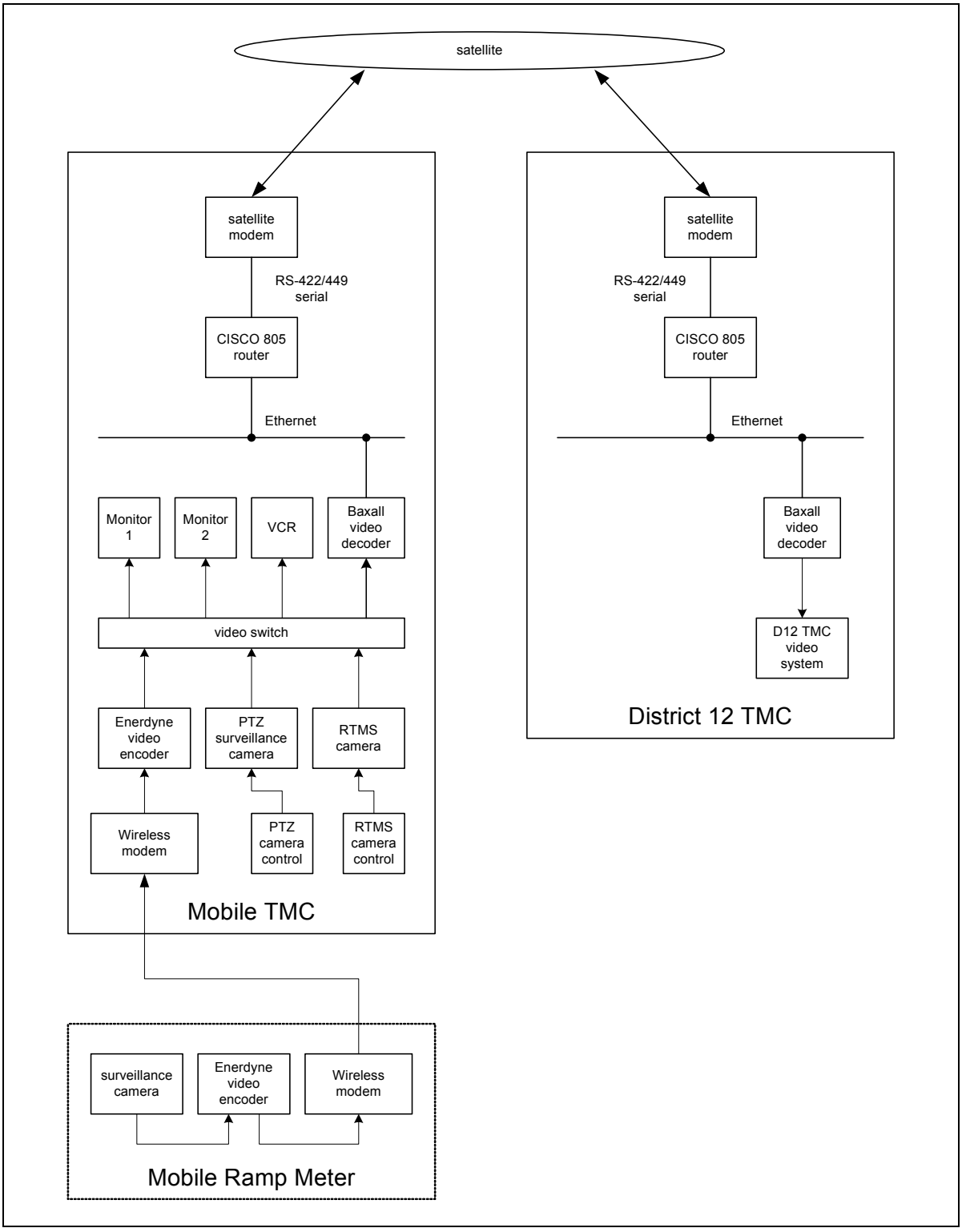


Figure 2.3 Video surveillance overview.

2.3. Vehicle Detection

The Mobile TMC vehicle detection system, as shown in Figure 2.4, provides 30 second vehicle data for use on-board the Mobile TMC or in the District 12 TMC via the satellite link. The RTMS vehicle detection is mounted in tandem with a surveillance camera on a pan-tilt mount on top of the pneumatic mast. The RTMS is controlled by the RTMS/video conference PC in the operator console. The RTMS provides standard contact closure vehicle presence signals to a 170 controller via an input file. The 170 controller operates with District 12 firmware and provides 30-second vehicle data in a form that is compatible with the District 12 Front End Processor (FEP).

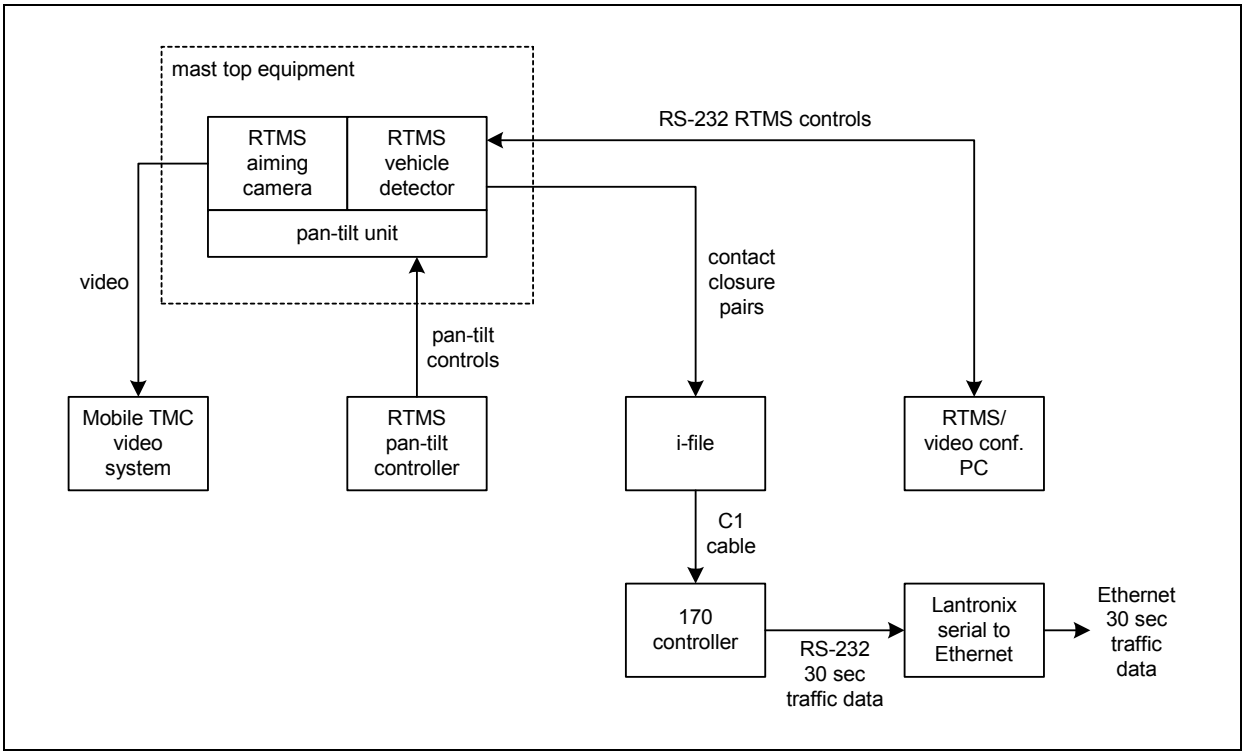


Figure 2.4 Vehicle detection system on the Mobile TMC.

2.4. Remote Traffic Sensing

The Mobile TMC is capable of remote traffic sensing via its own RTMS/170 controller combination as well as with the RTMS/170 combination operating in the Mobile Ramp Metering trailer. The Mobile TMC can operate in either stand-alone or relay mode. In stand-alone mode, the Mobile TMC acts as an independent Mobile Transportation Management System (MTMS), responsible for polling available 170 controllers for data, and displaying that data for its operator. In relay mode, the 170 polls are generated in the District 12 TMC FEP and routed to the Mobile TMC and any associated 170 controllers. Responses to these polls are routed back across the wide-area network to the FEP, where the data is available to the District 12 ATMS network. The following sections outline these modes of operation.

2.4.1. Mobile TMC in Relay Mode

Figure 2.5 shows an overview of relay mode, where all polls originate at the District 12 FEP, and are routed to the Mobile TMC via the wide-area data communications system. Responses to these polls are routed back across the wide-area system to the District 12 FEP.

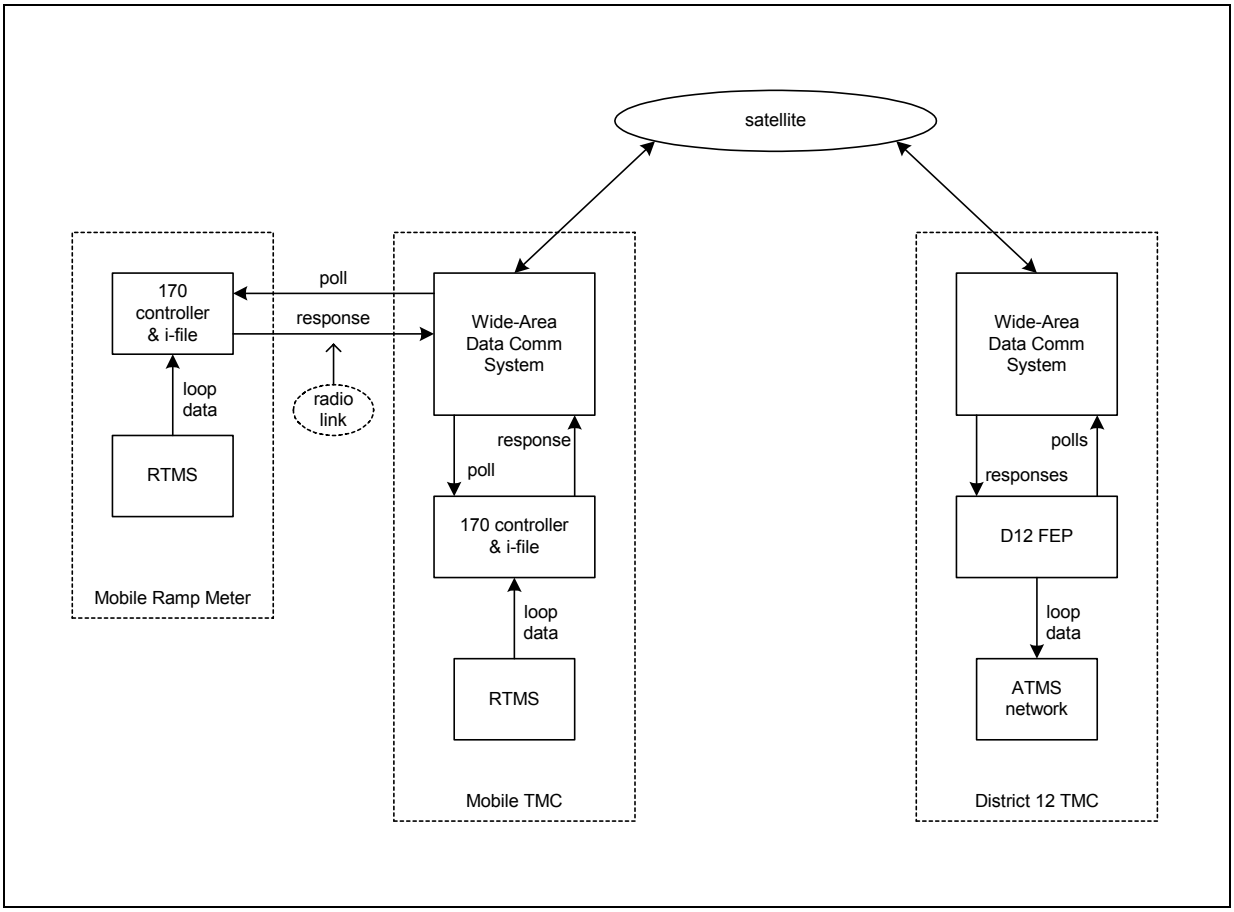


Figure 2.5 Mobile TMC operating in relay mode.

Figure 2.6 provides a more in-depth view of relay, where the Lantronix serial-to-Ethernet converters are utilized to provide multi-drop capability, allowing one FEP port to poll and receive data from several remote 170 controllers.

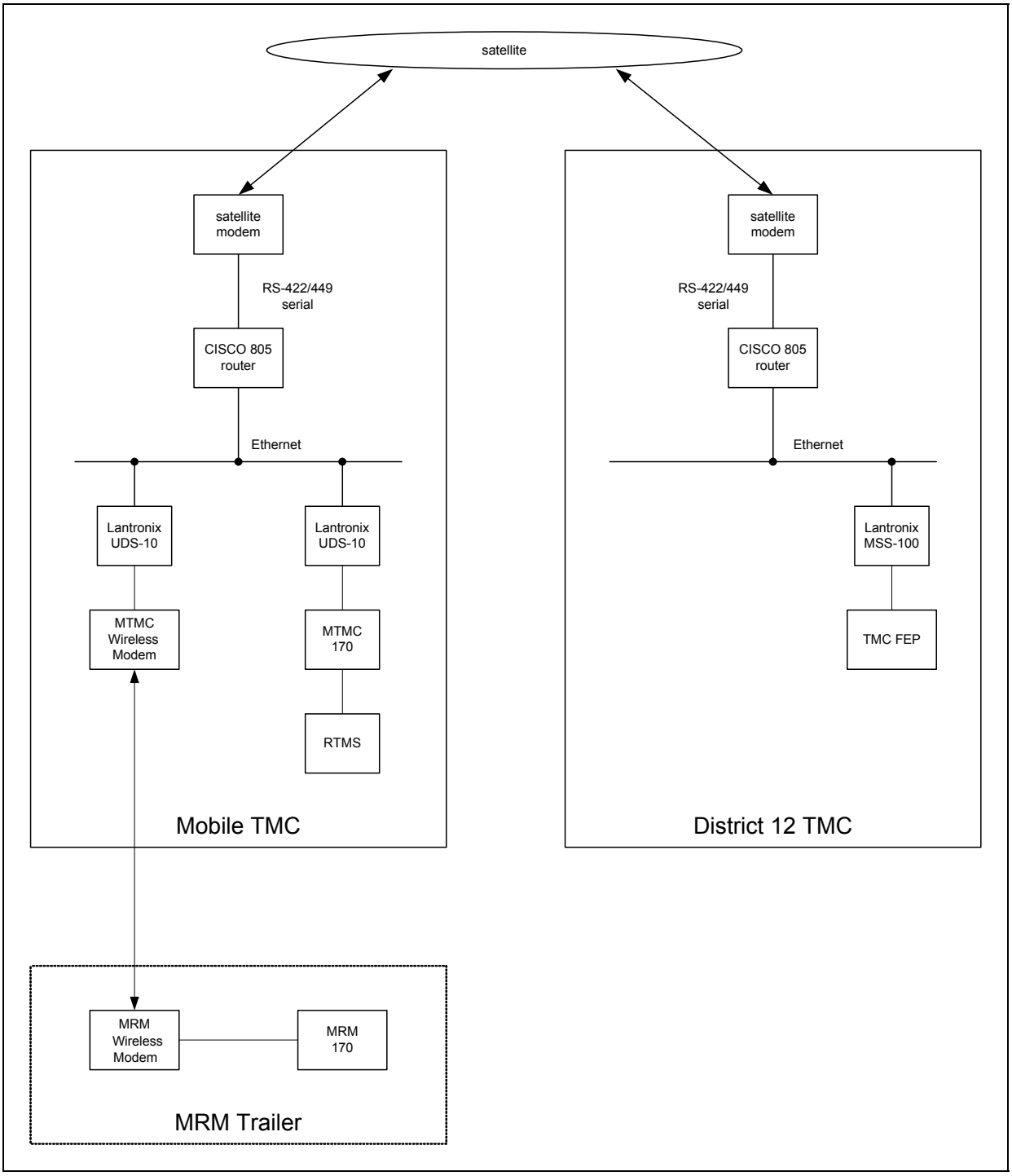


Figure 2.6 Mobile TMC data relay to TMC via satellite link.

In this configuration, the Mobile TMC acts as a relay point for communication between the FEP and remote 170 controllers.

As seen above, upon receipt of a poll request from the FEP, the MRM 170 controller sends data to the Mobile TMC through a wireless data connection. This serial data received on the Mobile TMC radio is sent into the Lantronix UDS-10 serial converter, and converted into Ethernet packets. The RTMS traffic sensor on the Mobile TMC is connected to a local 170 controller, whose serial output is also connected to a Lantronix UDS-10 on the local network. Both of these Lantronix units are configured to relay the data across the satellite link, to the Lantronix MSS-100 Server in the TMC. The MSS-100 Server converts the Ethernet packets back into serial data readable by the FEP.

2.4.2. Mobile TMC in Stand-Alone Mode

Figure 2.7 shows how the Mobile TMC operates in stand-alone mode, where all traffic controller polls originate in the Mobile TMS software residing on the Mobile TMC and responses to those poles are received on the Mobile TMC.

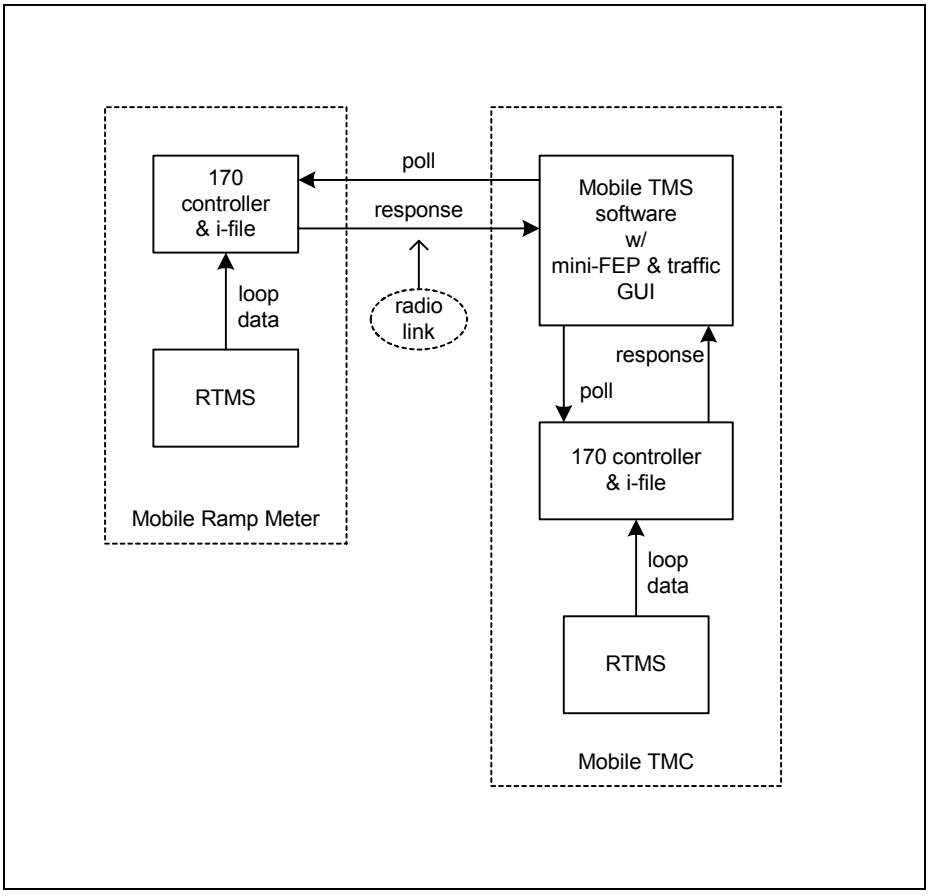


Figure 2.7 Mobile TMC operating in stand-alone mode, providing 170 data to the on-board traffic monitoring software.

Figure 2.8 provides additional detail regarding operation of the Mobile TMC in relay mode. In this configuration, the Mobile TMC uses a custom-designed application, the Mobile Traffic Management System (MTMS), to emulate a Front End Processor and poll the 170 controllers, collecting the data directly. This data can then be displayed to operators onboard the Mobile TMC, and recorded for later review.

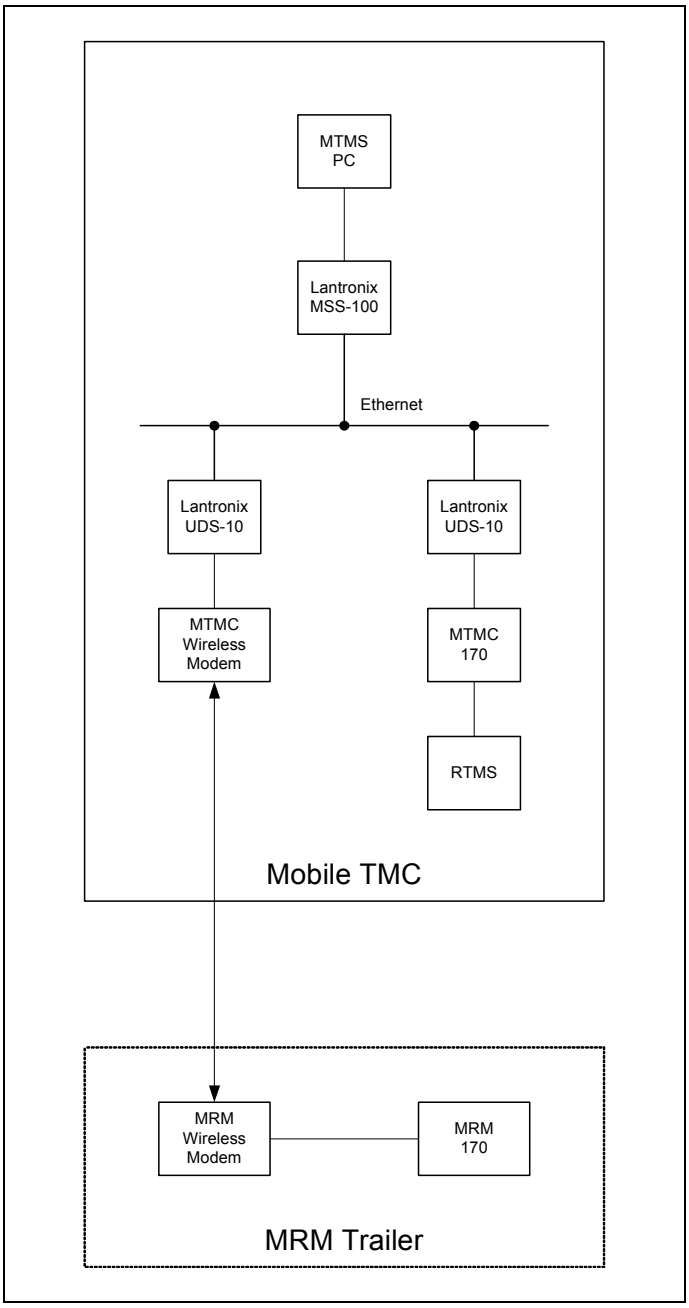


Figure 2.8 Mobile TMC FEP emulator configuration

Data from the MRM 170 controller and Mobile TMC controller are collected in a similar manner to the first configuration. The MRM 170 controller sends data to the Mobile TMC through a wireless data connection, which is received by a Lantronix UDS-10 serial converter, connected to the Mobile TMC's local network. The RTMS traffic sensor on the Mobile TMC is connected to a local 170 controller, whose serial output is connected to a Lantronix UDS-10 on the local network. However, instead of relaying across the satellite link, both Lantronix relay their data to a MSS-100 Server onboard the Mobile TMC, where it is converted back to serial data and read by the FEP emulator (MTMS).

2.5. Video Conferencing

The video conferencing system allows operators in D12 to communicate with operators in the Mobile TMC. Each terminal in the system consists of a PC, camera, microphone, and desktop speakers. Video conferencing is achieved using Microsoft's NetMeeting, and available in most Windows packages. In addition to being an industry standard, NetMeeting also allows for variable bandwidth usage through adjustments in video quality. Other features include file sharing, cooperative whiteboards, and text messaging.

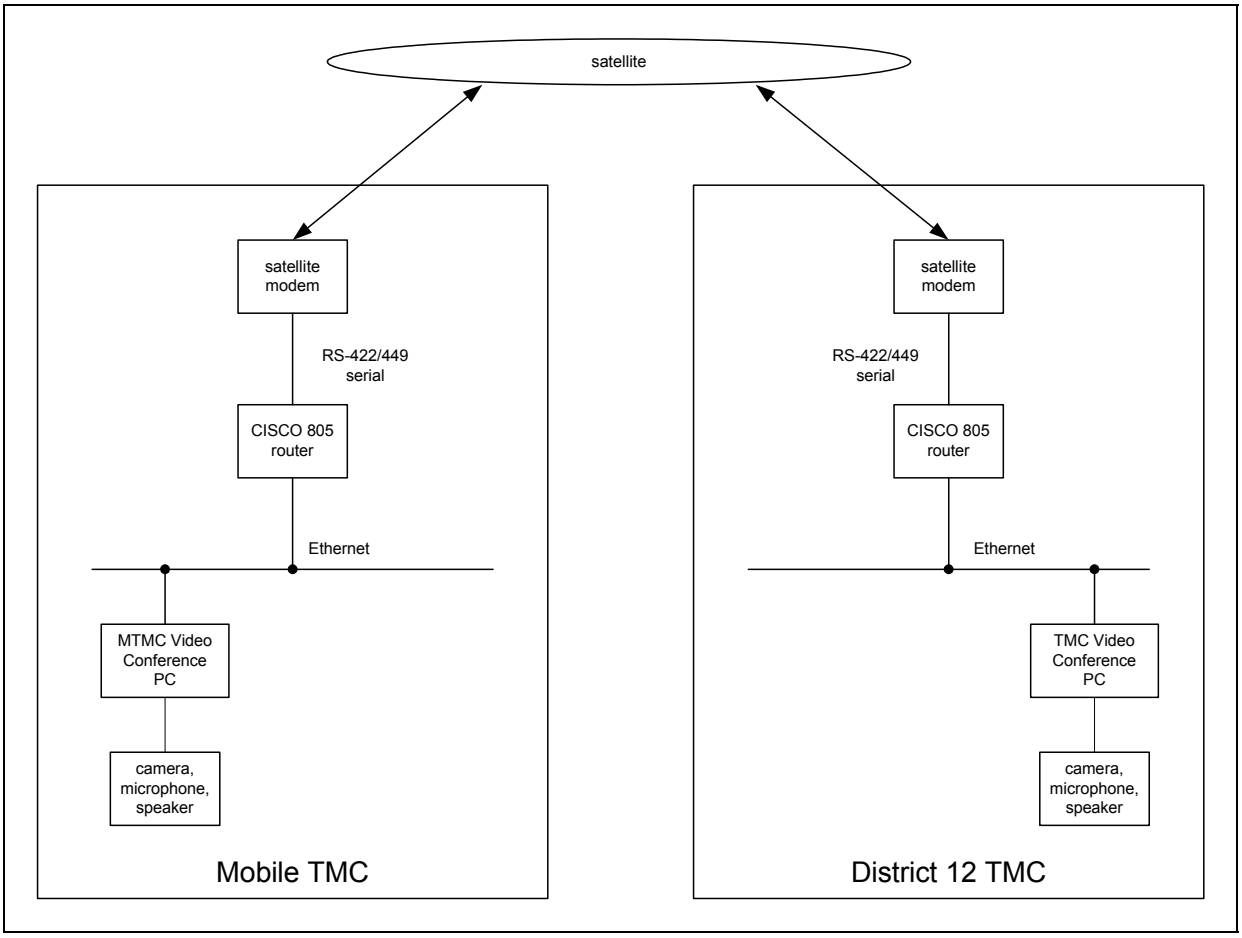


Figure 2.9 Video conferencing overview.

2.6. Voice Radios

Figure 2.10 shows a voice radio installed in the operator console of the Mobile TMC. This radio operates off of one of the auxiliary 12V DC power supplies that operate when the Mobile TMC has 120 VAC power turned on. The voice radios are programmed for District 12 frequencies. An additional radio is installed in the driver's compartment.

Figure 2.10 Voice radio.

3. MOBILE TMC ELECTRICAL SYSTEMS

3.1. AC Electrical System

Figure 3.1 below shows an overview of AC electrical system provides an overview of the Mobile TMC's AC power system.

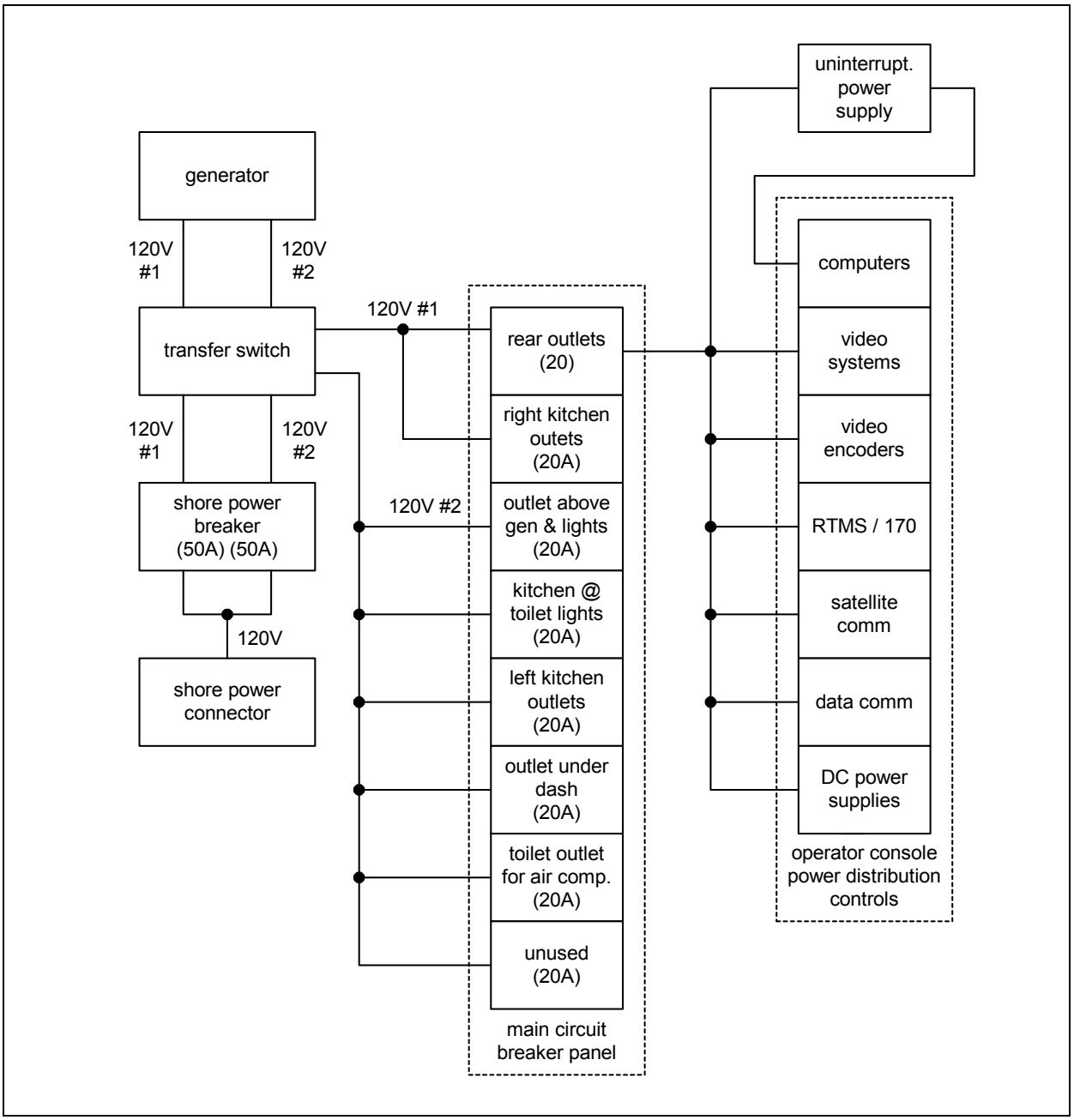


Figure 3.1 Overview of AC electrical system.

This system allows the vehicle to be powered from either the on-board 5.5 KW generator or shore power as needed. A manual transfer switch, located in the front of the vehicle above the driver console, selects between shore and generator power. The output of the transfer switch is applied to the main circuit breaker panel, where it is distributed to outlets throughout the vehicle. All electronic and computer systems are supplied by the receptacle at the rear of the vehicle via the power distribution controls on the operator console.

Please see Appendix O, Wiring Diagrams, for further details.

3.2. DC Electrical Systems

The DC electrical system powers the voice radios, amber safety lights, pneumatic mast controls, pneumatic mast flood lights, and the fresh-water delivery pump. This power system utilizes both the vehicle's 12 volt DC power system as well as four 120 volt AC powered DC power supplies. Figure 3.2 shows an overview of how the DC power supply system operates. The DC system is divided into four DC circuits DC#1 – DC#4, as shown in the figure.

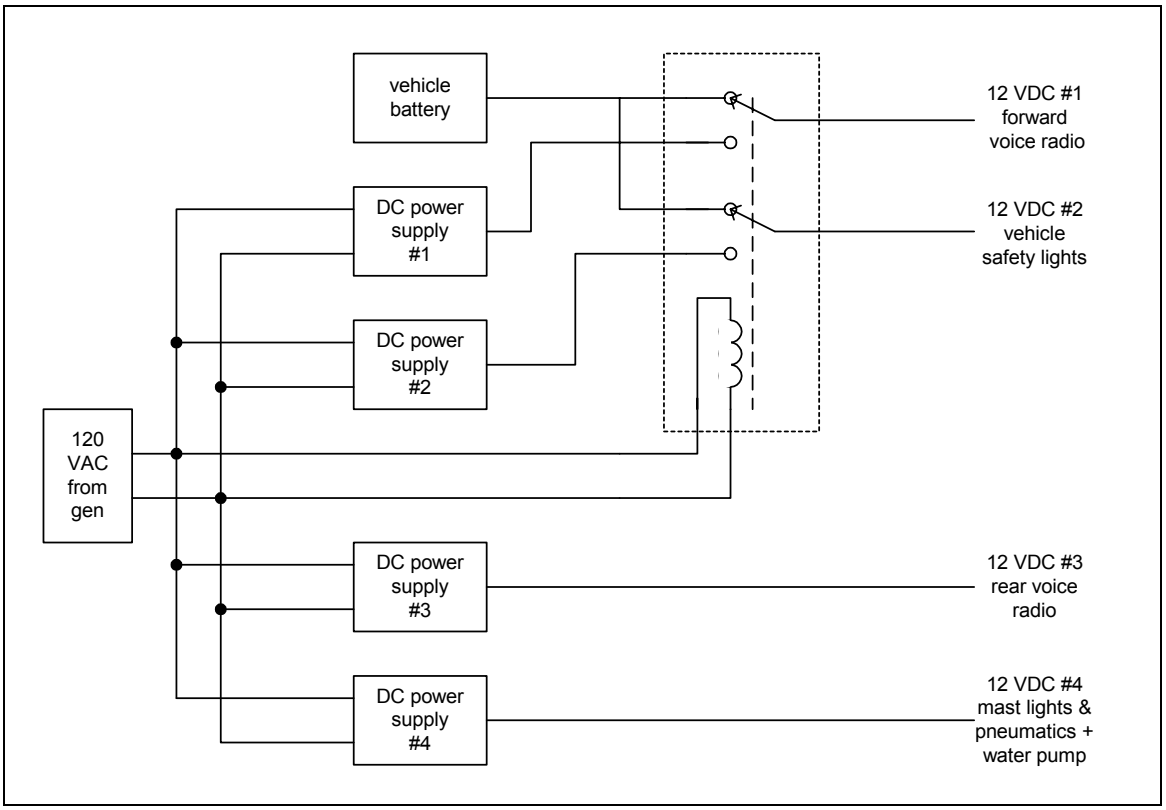


Figure 3.2 Overview of DC electrical system.

Please see Appendix O, Wiring Diagrams for further details.

4. MOBILE TMC MECHANICAL SYSTEMS

4.1. Pneumatic Mast

The pneumatic, or compressed air system, on the Mobil TMC is used to raise the mast. The entire system is located in the lavatory of the Mobile TMC. The system is comprised of a compressor, a regulator/lubricator/dehydrator, a 3-way valve and the mast.

Figure 4.1 Pneumatic system.

The air is compressed by the compressor, and stored in the compressor's tank. The compressor is supplied power by its own 15A breaker at 110VAC. The compressed air then flows through the regulator / oiler. This device maintains an adjustable constant pressure of 15-20 psi. It then adds a small amount of oil, which is vaporized at that pressure. The addition of oil lubricates the mast. The 3-way valve allows for either compressed air to enter the mast and raise it, for air to be locked in the mast to keep it raised, or for the air to be drained from the mast, returning the pressure inside the mast the atmospheric pressure.

Figure 4.2 Mast top.

Air pressure raises the mast. It is retracted by its own weight and the weight of the mast top, evacuating the air. Air drained from the mast is routed out of the vehicle so as not to leave oil residue on the valve and the rest of the lavatory.

The mast system of the Mobile TMC includes a warning system to prevent accidental vehicle movement while the mast is still extended. The mast warning lights are located on the center console of the dashboard, and directly above that in the bulkhead at the front of the vehicle. These lights will flash if the mast is not fully retracted.

The trigger for this system is a magnet inside the bottom of the top mast section. This magnet is detected by a sensor on the side of the mast. The mast should still be visually inspected every time before the vehicle is moved.

Figure 4.3 Mast warning light.

4.2. Vehicle Leveling System

The Mobil TMC is outfitted with a hydraulic leveling system that both levels and stabilizes the vehicle. This system uses a 12VDC pump to push oil to the four hydraulic jack cylinders under the Mobile TMC. A joystick mounted between the driver's seat and in front of the bathroom wall controls the system.

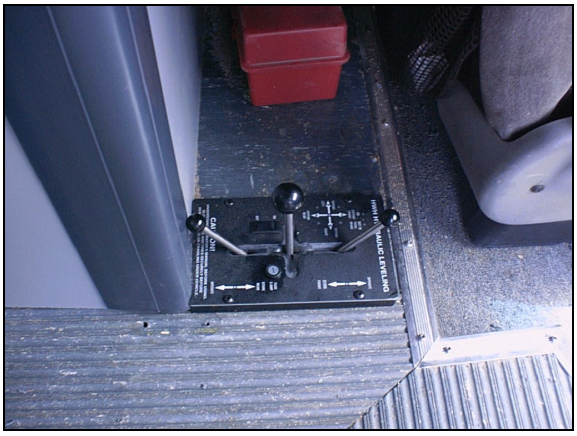


Figure 4.4 Hydraulic leveling system control panel.

The jack cylinders are retractable to allow for better ground clearance when the vehicle is in motion. The system also contains a warning light and buzzer, which are actuated when any of the jacks are not fully retracted and the ignition key is turned to the on position. The leveling system also includes sensors to prevent system operation unless the vehicle is in park, and the parking brake is set.

Figure 4.5 Hydraulic jack.

The leveling system on the Mobile TMC is necessary to keep the vehicle from "swaying". Without stabilizing the vehicle, it would be impossible to precisely aim the mast-mounted equipment and satellite antenna. Stabilizing the vehicle also creates a more pleasant work environment for those utilizing the Mobile TMC. The leveling system will deploy the jacks only when the vehicle is in Park, and the Parking Brake is set.

The Mobile TMC includes a warning system to prevent accidental vehicle movement while the jacks are still extended. The warning light is mounted to the left of the instrument panel. The buzzer is loud enough to be heard over the engine. The warning system will trigger if anyone of the four jacks is not completely retracted. The jacks should still be visually inspected every time before the vehicle is moved.

Figure 4.6 Jacks down warning light.

4.3. Water Systems

4.3.1. Freshwater System.

The Mobile TMC is equipped with both a freshwater system and a wastewater holding system. Freshwater for the system can come from one of two sources: either from a pressurized "city fill" line or from the freshwater tank. Water from the tank is first run through a SHURflo potable water strainer, a pump and then an accumulator to provide smooth water pressure. The "city fill" or pressurized input has a regulator to maintain appropriate pressure.

Figure 4.7 Fresh water fill.

4.3.2. Sink Drain and Grey Water System.

The Mobile TMC includes, for use with the kitchen area, a sink with appropriate plumbing. The sink is fed by the fresh water system and drains into the gray water tank, located in the rear-center of the vehicle. The level of this tank can be monitored with the gauges above the coffee maker. The tank is drained, along with the black water tank, through a standard RV style holding tank drain.

Figure 4.8 Sink.

4.3.3. Toilet and Black Water System.

Located just behind the driver seat in the Mobile TMC is the bathroom. Inside the bathroom is the toilet. The toilet is plumbed into the freshwater system and the black water tank. The black water tank is located directly bellow the toilet. The level of this tank can be monitored with the gauges above the coffee maker. The tank is drained, along with the gray water tank, through a standard RV style holding tank drain.

Figure 4.9 Toilet.

4.4. Kitchen Appliances

For the comfort of the user, included in the Mobile TMC is a kitchenette. This includes a sink; with hot and cold water, a microwave oven, a refrigerator, and a coffee maker. All of these appliances are powered by the AC system and run only when the generator is on, or when the vehicle is connected to shore power.

Figure 4.10 Microwave.

Figure 4.11 Refrigerator.

Figure 4.12 Coffee maker.

4.5. Roof Racks

The Mobile TMC is equipped fore and aft with custom roof equipments racks. These racks provide support for the satellite and various radio antennae, as well safety lighting and cable boxes. The racks are bolted to the vehicle's support ribs. Detailed mechanical drawings of the racks are included in the configuration manual.

Figure 4.13 Mobile TMC equipment racks.

5. MOBILE TMC VEHICLE SYSTEMS

5.1. Exits and Emergency Hatch

The Mobil TMC has two ground level exits, one emergency window exit, and one roof exit. The primary entrance and exit for the vehicle is the electric door located on the front passenger side of the vehicle. This door can be opened or closed from the outside with the key slot located to the right of the door. The door is actuated from the inside with either the switch next to the door, or the switch on the center console. In the event of electrical failure, the door can be released with a lever located above the door on the inside.

The other significant ground level door on the Mobile TMC is in the rear. There is no workspace access through this door. The purpose of this door is for the maintenance of the systems mounted in the operator console.

In case of an overturn emergency, or to use as a vent, there is an emergency exit in the roof located near the coffee maker. The hatch may be pushed straight up as a vent, or the front side released to use as a door.

Figure 5.1 Emergency roof hatch.

5.2. Engine High-Idle System

The Mobil TMC's Ford Power Stroke Diesel engine includes a high-idle management system. The high-idle control enables the operator to either manage the charge control to the vehicles battery, or to set the engine idle to a higher speed. These options will prove helpful if the operator wishes to run many accessories off of the vehicle's 12V system, or, if the operator would like to set the idle higher, while using the vehicle's air conditioning systems to cool the vehicle.

5.3. Safety Lights

The Mobile TMC is equipped with two different sets of safety lights. The vehicle has two sets of yellow warning lights mounted fore and aft, as well a pair of halogen spotlights to assist in raising the vehicle's mast in low light. The warning lights consist of a light bar mounted just above the rear door of the vehicle, and pair of rotary lights mounted on front roof equipment rack. Both sets of lights receive their power from 12VDC power supplies, located on the racks of the operator console.

The yellow warning lights are actuated by a controller mounted on the bulkhead in the front of the vehicle. These controls are mounted such that they are accessible to the driver, so that the vehicle may be safely pulled off and on the road. The halogen mast spotlights are controlled by standard light switch, mounted in the bathroom above the air systems for the mast.

Figure 5.2 Halogen Mast Spotlight

Chapter 2

OPERATING INSTRUCTIONS

1. MOBILE TMC MECHANICAL AND ELECTRICAL SYSTEMS

1.1. Electrical Power System

1.1.1. Generator Operation Instructions

Generator Pre-Start Checks:

1. Check generator coolant level. This is viewed through the generator enclosure view port. With the aid of a flashlight, a greenish liquid will be visible. (See Appendix I in the Mobile TMC Configuration Manual for the Onan Operators Manual)

2. Check generator oil level. Access is available by opening generator enclosure main hatch. Remove the dipstick by pulling on the yellow rubber handle. The oil level should be midway on the white plastic dipstick end. (See Appendix I in the Mobile TMC Configuration Manual for the Onan Operators Manual)

Figure 1.1 Generator access hatch and generator dipstick

Power-Up:

> **Caution: Excessive cranking can damage the starter motor. Do not crank for more than 30 seconds at a time. If generator does not start, wait 2 minutes before attempting to start again.**

1. Perform generator pre-start checks as described above.

2. Confirm that the Power Transfer Switch is set to OFF. Confirm that all circuit breakers in the Main Circuit Breaker Panel are set to OFF. The power transfer switch is located in the

middle of the forward bulkhead, behind the hinged panel above the Flashing Safety Light Controls. The main circuit breaker panel is located to its immediate right.

3. Move to the operator's console at the rear of the Mobile TMC. On the Generator Controls, push the control rocker switch to the **START** position and hold until generator completely starts. Rocker switch status light will blinks rapidly (this blinking indicates preheat and crank) during this time.

Figure 1.2 Generator controls panel

4. Release the switch when the status light becomes continuous. (Depending on outside weather conditions, preheat can take up to 15 seconds).

5. If after several tries, the generator does not start, see Appendix I of the Mobile TMC Configuration Manual for troubleshooting, further instructions, and assessment.

6. Let the generator warm up for 3 minutes. It should then be running smoothly.

7. Check for fuel and exhaust leaks. If a fuel, coolant, or exhaust leak is discovered, **STOP the generator immediately, and notify maintenance**.

Power-Down:

1. Please ensure all operator console systems are off at this point. If not, follow the related power-down sequences for those items that are currently on.

2. Confirm that all switches on the Power Distribution Controls panel are OFF.

3. Confirm that the UPS located under the Operator Console is OFF.

4. Move all circuit breakers in the Main Circuit Breaker Panel at the front of the Mobile TMC to the OFF position.

5. Turn the Power Transfer Switch on the vehicle's front bulkhead to the OFF position.

6. Prior to stopping the generator, allow it to run for at least 5 minutes with no electrical load. This allows the engine to cool.

7. After the cool-down period, push the rocker switch on the Generator Controls panel to the **STOP** position.

1.1.2. Shore-Power Operation Instructions

Power-Up:

1. Confirm that the Power Transfer Switch is set to OFF. Confirm that all circuit breakers in the Main Circuit Breaker Panel are set to OFF. The power transfer switch is located in the middle of the forward bulkhead, behind the hinged panel above the Flashing Safety Light Controls.

Figure 1.3 Power transfer switch.

2. Connect the shore power cable to the connector on the driver's side of the vehicle. Be sure that the connector is secure and the locking ring is turned counter-clockwise until it stops.

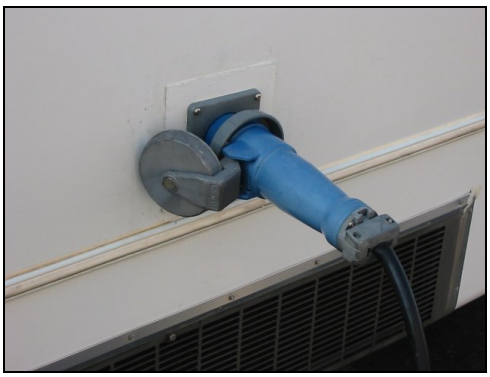


Figure 1.4 Shore power connector and cable.

3. Connect the shore power cable to 115 VAC source.

Power-DOWN:

1. Please ensure all operator console systems are off at this point. If not, follow the related power-down sequences for those items that are currently on.

2. Confirm that all switches on the Power Distribution Controls panel are OFF.

3. Confirm that the UPS located under the Operator Console is OFF.

4. Move all circuit breakers in the Main Circuit Breaker Panel at the front of the Mobile TMC to the OFF position.

5. Turn the Power Transfer Switch on the vehicle's front bulkhead to the OFF position.

6. Disconnect the shore power cable from the AC source and then from the vehicle.

1.1.3. Electrical Systems Instructions

Power-Up:

Figure 1.5 Main circuit breaker panel.

1. With either the generator turned on (Section 1.1.1), or the shore power connected (Section 1.1.2), turn the Power Transfer Switch to GENERATOR or SHORE accordingly. In the Main Circuit Breaker Panel, turn all circuit breakers ON.

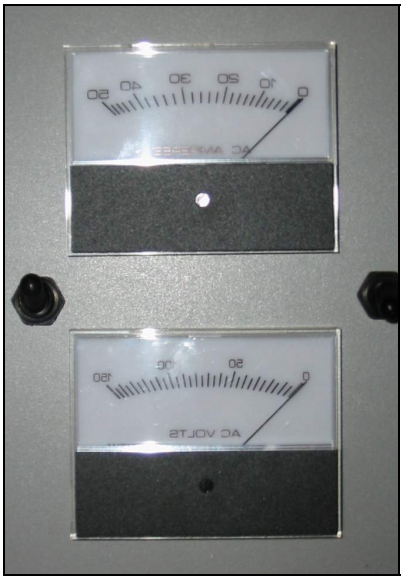


Figure 1.6 Operator console power gauges.

2. At the rear operator's console, check the voltage of both Phase A and Phase B by moving the toggle switch to the desired position (See Figure 1.6). Both should have 115 V AC. Now check the amperage of both phases in the same manner. Both should have less than 30A of current. The current is affected by what is switched on, so the reading given should approximately match the sum of the amperages of the appliances running.

3. Begin turning on individual subsystems at the Power Distribution Controls panel, located on the operator console. Be sure to turn on systems one at a time, starting with the DC Power switch, and allow a few moments to avoid a breaker/GFCI trip (excessive current draw). This is especially important when using shore power.

4. If an overload occurs, all systems will power down, and an audible 'click' will be heard from the Main Circuit Breaker Panel. Turn off all subsystems, reset the tripped breaker, and return to power up sequence.

Power-Down:

1. Refer to Sections 1.1.1 or 1.1.2 for power down sequences of the Generator and Shore Power.

1.2. Climate Control System

1.2.1. Driver Area

Figure 1.7 Driver climate control.

1. Ensure vehicle engine is operating.
2. Turn the rotary switch on the dash to MAX A/C, NORM A/C, VENT, FLOOR, or MIX.
3. Select fan speed.

1.2.2. Rear Main Air Conditioner

Figure 1.8 Rear air conditioner.

The operation of this system is controlled by the two knobs located on the left-most side of the driver's center console. **The vehicle's engine must be running for this system to operate.**

1. Select the degree of cooling with the *TEMP* knob.
2. Adjust the AIR knob to control fan speed.
3. For more effective cooling, use the vehicle's High Idle system (as described in section 1.7) to increase the cooling capacity.

1.3. Vehicle Leveling System Operation

Figure 1.9 Vehicle leveling system control panel.

Pre-Check:

1. Ensure that people and equipment are clear of the vehicle.
2. Ensure the vehicle is parked on solid, level ground. Confirm that the surface under the vehicle is stable enough to take the load of the vehicle.
3. Confirm that the vehicle is in Park (P), and that the parking brake is set.

Vehicle Leveling:

CAUTION: This is a two-person operation, requiring one person to run the controls, and another to watch the jacks as they extend. Do not attempt to do this alone.

1. Turn vehicle ignition switch to ON.
2. Push leveling system control panel power switch to ON.
3. Move the FRONT and REAR STORE levers to the operate position. These are the two smaller levers.
4. Push the center jack control lever to FRONT EXTEND and then REAR EXTEND. Stop the extension of each jack when its red EXTEND LED illuminates, indicating that the jack is down and ready to lift.

5. Look under vehicle and ensure that all jacks are vertical.. If the ground is soft, raise the jacks by pushing the center control lever to the STORE position, place wooden pads under the jacks, and repeat Step 4 above.

Figure 1.10 Correct jack positioning.

The yellow LED indicates which area of the vehicle is low, either front, rear, right, or left.. Move the jack control lever in the direction indicated by the yellow LED to raise that area of the vehicle. Release lever when the LED is no longer illuminated. Continue this process until all yellow LEDs are extinguished.

> **CAUTION: All wheels should remain in contact with the ground at all times to prevent the vehicle from rolling off the jacks.**

6. Once vehicle is level, extend any jacks not touching the ground so that they make contact to stabilize the vehicle.

7. Turn the leveling system control panel power switch to OFF, and the vehicle ignition switch to OFF.

Retract Jacks:

1. Ensure that people and equipment are clear of the vehicle.

2. Turn vehicle ignition to ON.

3. Push leveling system control panel power switch to ON.

4. Move the FRONT and REAR STORE levers to the STORE position. This will allow the jacks to retract.

5. Visually check all four jacks to make sure they have fully retracted. If they have not fully

retracted, extend and re-store the jacks.

6. Turn the leveling system control panel power switch to OFF, and vehicle ignition switch to OFF.

1.4. Pneumatic Mast

CAUTION: Vehicle should be level and stable before raising mast. The vehicle should be parked where the area above is completely clear. It is unlawful to operate this equipment within 10 feet of high-voltage lines of 50,000 volts or less. If there is any question as to whether the mast will clear an overhead object, YOU ARE TOO CLOSE.

Pre-Check:

The system elements shown below, from left to right, are the Dehumidifier, the Primary Air Regulator, the Mast Oiler, and the Electric Air Control Valve.

Figure 1.11 Mobile TMC pneumatic system.

1. Confirm that the pneumatic system's Mast Pressure Gauge is reads no higher than 20 PSI. The mast pressure can be adjusted by rotating the large knob on the bottom of the regulator. Clock-wise rotation, when viewed from the bottom, increases mast air pressure.

2. Confirm that the Mast Oiler is filled by looking through the Mast Oil Viewing Window to see that oil is present within the oiler.. Ensure that the adjustment screw, found at the very top of the clear plastic piece located on the top of the Mast Oiler, is set approximately in the middle of its adjustment range.

Raising the Mast:

1. Connect the Pneumatic System Quick Disconnect coupler set located inline just after the

compressor. This allows the mast pneumatic system to be charged with air. Disconnecting this coupler set acts as a safety to prevent the mast from being raised during vehicle motion.

2. Turn the power switch on the compressor to the ON position. This will pressurize the air compressor's primary tank and the Auxiliary Mast Air Tank, located under the kitchen sink. The compressor will automatically stop when the two tanks are pressurized to the value indicated on the larger of the two air compressor gauges.

3. The air compressor is powered from a GFCI outlet in the bathroom. This breaker may trip and prevent operation of air compressor. Reset breaker if tripped.

4. This gauge should read between 60 and 90 PSI. This pressure is reduced by the Secondary Air Regulator, directly between the Dehumidifier and Mast Oiler.

5. Ensure that DC power on the Power Distribution Controls at the operator console is set to ON.

6. If it is dark, turn the Mast Floodlights switch, located on the forward wall above the air compressor, to ON.

7. Take the yellow mast control pendant, located just inside the main door, outside the Mobile TMC. Proceed to a position where the mast, mast top, and area above vehicle can be clearly seen.

8. Press the UP button. You may hear an audible 'click' to indicate that the mast is pressurized. The button does not need to be continuously depressed during rising.

<u>Lowering the Mast:</u>

1. Take the yellow mast control pendant, located just inside the main door, outside the Mobile TMC. Proceed to a position where the mast, mast top, and area above vehicle can be clearly seen.

2. Press the DOWN button.

3. Disconnect the Pneumatic System Quick Disconnect coupler set located inline just after the compressor.

1.5. Fresh Water System

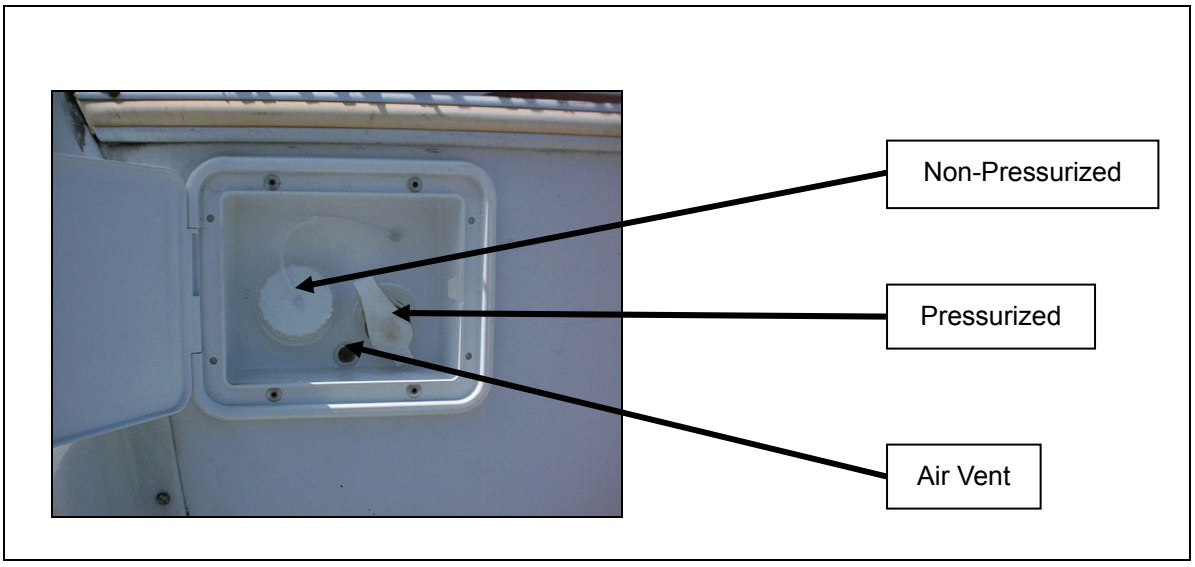


Figure 1.12 Water intake.

Note: If the Mobile TMC water system will be connected directly to an external pressurized connection such as a garden faucet, connect a hose between the pressurized source and the right recipticle, labeled PRESSURIZED. This bypasses the water tank and pump and the water pressure inside the Mobil TMC will be dependent on the pressure from the hose. In this situation, you do not need to fill the freshwater tank.

Filling the Freshwater Tank:

1. Locate and unlock white fresh water access door, located on the driver's side exterior of the vehicle, behind the rear wheels.

2. Connect a drinking water grade hose from a water faucet and place the end of the hose inside the left connection, labeled NON-PRESSURIZED.

3. Turn water faucet on. The tank is full when water overflows either through the air vent or from around the hose.

Chapter 2

OPERATING INSTRUCTIONS

Operation

1. Ensure that either the water tank has been filled, or an external pressurized water source has been connected per instructions above.

2. Ensure that DC power on the P*ower Distribution Controls* at the operator console is set to ON.

3. If the holding tanks are empty, run the sink for approx. 30 seconds, and flush the head five times. Add 'Holding Tank Deodorant' chemical to toilet, enough for 20 gallons, then flush toilet or add water to tank as specified for chemicals.

4. Check under the vehicle to insure there are no leaks.

Draining the Tank:

1. Locate the draining valve at the driver's side rear of the vehicle, beneath the bumper.

2. Turn the release knob counter-clockwise to open the valve. When draining is complete, turn knob clockwise to close valve.

1.6. Grey & Black Water Systems

Emptying the Holding Tanks

Note: The water drained in this procedure will be unsanitary. It is advised that protective rubber gloves be worn.

1. Unlock and open sewer hose access door found on the driver's side of the vehicle, forward of the rear wheels.

2. Remove sewer hose from its enclosure.

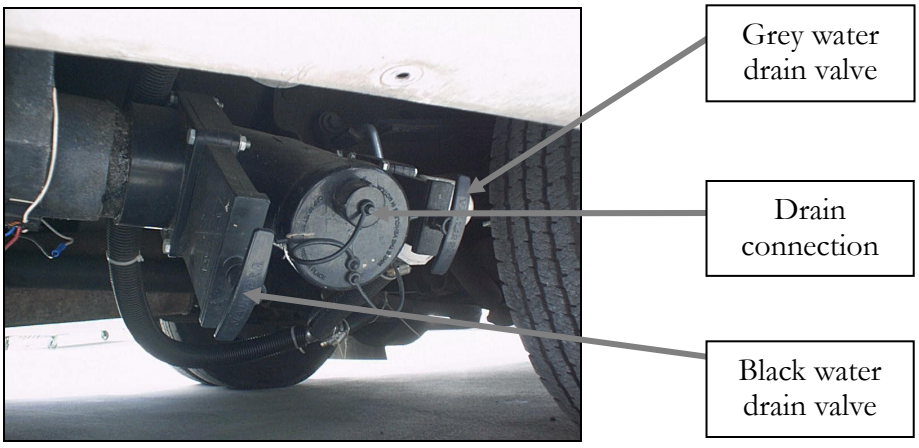


Figure 1.13 Black & Gray Water Drain

3. Connect the sewer hose to the 'drain connection,' as shown above.

4. Place the other end of the sewer hose in a receptacle suited for this type of waste.

Important: Receptacle must be lower than drain connection for tanks to drain.

5. Empty the black water tank first, by pulling the lever on the left. When the tank has finished draining, push the lever to close.

6. Empty the gray water tank by pulling lever on the right. When the tank has finished draining, push the lever to close.

> **Important: Tanks should be drained in this order to prevent odor problems with the drain hose.**

7. Carefully disconnect the drain hose, and replace its cap.. If freshwater is available, rinse the sewer hose for sanitary purposes.

8. Reinsert the sewer hose in its enclosure and lock the access door.

9. WASH HANDS!

Storing Mobile TMC

1. Empty holding tanks as described in the above section, run the sink for 2 minutes, and flush the head 10 times.

2. Drain the holding tanks again.

3. Drain the freshwater tank with the valve located on the back of the tank, as described in Section 1.5.

1.7. Vehicle High-Idle System

Figure 1.14 Mobile TMC high-idle system.

1.7.1. Charge Protection

If there is a significant draw on the vehicles 12VDC system you may wish to increase the charge. To do this, press the CHARGE PROTECT button. If the system needs a charge, the engine's idle speed will increase and the computer will show the charge being put into the system. To stop the charge protection, hit the FORD button.

1.7.2. RPM or High Idle Control

When running the vehicle's air conditioning systems you may wish to increase the engine speed, which will increase the cooling capacity of the system. To do this:

1. Press the RPM CONTROL button.

2. Use the arrow buttons on the right to select a higher idle speed. Each button corresponds to a different speed.

3. Once a value is selected, push the FORD button to execute this value. The engine will rev up and settle approximately on the value you have selected.

To return the engine to a normal idle speed, push the FORD button.

2. WIDE AREA DATA COMMUNICATIONS

2.1. Satellite Equipment

Operation of the wide area data communications system requires careful aiming of both the mobile and fixed satellite dishes. Deployment of the Mobile TMC, with its included dish aiming, is simplified when the fixed dish at the District 12 TMC is aimed and on-line. This is so because the on-line fixed dish transmits a signal to the satellite that the mobile dish can be locked to, providing positive confirmation that the dish is aimed properly.

> **Important: Do not attempt to bring up the satellite system without prior approval from the satellite service provider. Even with prior approval, transmit must not be turned on at either side of the link until directed to do so by a service technician during a "coming online" phone call.**

2.1.1. Automatic Aiming of Mobile TMC Satellite System

Start-Up

> **Note: Aiming of the satellite antenna requires LNB power on the satellite modem to be on, to provide accurate peaking information to the controller. Turn on LNB Power in the Demodulator section of Configuration of the modem before aiming.**

1. Confirm that the Mobile TMC is properly leveled (see Section 1.3), and that the Operator's Console has power (see Section 1.1).

2. Turn on power to the satellite systems with the "Satellite Comm" power switch on the Operator Console.

3. Turn on power to the satellite controller (located directly above the center VGA monitor on the Operator Console.

4. Ensure that the satellite communications modem is on with the following settings:

   configuration -> modulator -> TXIF = OFF
   configuration -> modulator -> ODU power = OFF
   configuration -> demodulator -> LNB power = ON

5. Raise the satellite antenna for aiming by pressing "1" on the satellite controller. The controller will prompt for confirmation to deploy the dish. Press "BKSP" to confirm.

6. Once the antenna is deployed, press "Mode" the return to the main menu. Press "3" on the keypad to begin locating a satellite.

7. Choose the "Preset" option by pressing "2", and use the scroll buttons on the keypad to select the desired satellite. Press "Enter" to select the preset.

8. Wait a few moments while the satellite controller acquires GPS and compass positioning information. Those positioning fields on the controller's display will stop blinking, and the controller will display "Ready to Locate". Press "Enter" to continue aiming.

9. The controller will prompt for polarization orientation of the feed horn. Choose the appropriate polarization as given by the satellite carrier using the "7", "8", and "9" keys on the controller. Press "7" for a horizontal polarization, "9" for a vertical polarization, and "8" for a neutral polarization.

10. The antenna will adjust itself accordingly, locate the satellite, and peak the receive signal.

2.1.2. Aiming of the District 12 Satellite System

Note: Although these antenna aiming instructions do not apply to the Mobile TMC, the satellite location calculations and measurements, as well as the signal analysis instructions, can be helpful to confirm that the Mobile TMC has acquired the correct satellite. This is so because the on-line fixed dish transmits a signal to the satellite that the mobile dish can be locked to, providing positive confirmation that the dish is aimed properly.

Determine Satellite Location

1. Determine the latitude and longitude of the Mobile TMC and the satellite longitude in degrees:

   District 12 @ -117.75 degrees E & 33.67 degrees N
   Satellite @ -100.00 degrees E

2. Log into **www.satsig.net/ssazel.htm** and enter the data. If internet access is not available, skip steps 2 and 3, and calculate satellite azimuth and elevation using the Satellite Calculation Equations and Satellite Magnetic Declination charts in Appendix A1.

   satellite longitude = -100.00
   earth station latitude = 33.67
   earth station longitude = -117.75

3. Click the calculate results button and get the following data:

   E/S azimuth = 150.0 degrees E of true north
   E/S azimuth = 137.5 degrees E of magnetic north
   E/S elevation = 46.45 degrees

4. Record the above data and prepare to aim the dish.

5. Take a compass measurement. This measurement must be taken away from any large metal objects, such as the Mobile TMC, as they will interfere with the compass reading. Rotate the bezel ring on the compass until the above recorded E/S azimuth degrees from magnetic north is at the location on the compass where it says "READ BEARING HERE".

6. Hold the compass in front of you and rotate yourself until the red compass north pointer points to the red N on the compass. The fixed arrow on the back plate of the compass (where it says "READ BEARING HERE" will now be pointing at where the dish should be aimed. Repeat the measurement in a few different locations to ensure that you get the same reading more than once.

7. Note the location on the horizon where the compass is pointing.

Aiming the Satellite Dish for Receive Operation

Note: Manually aiming a satellite antenna requires two people - one to view signal output on a spectrum analyzer, and one to physically manipulate the antenna to peak the signal.

1. If manually aiming the Mobile TMC satellite antenna, ensure that the vehicle is properly leveled and the Operator Console is powered (see Section 1.1).

2. Ensure that the satellite communications modem is on with the following settings:

   configuration -> modulator -> TXIF = OFF
   configuration -> modulator -> ODU power = OFF
   configuration -> demodulator -> LNB power = ON

Important: RF radiation can be harmful to your health. Although the satellite communications used in the Mobile TMC <-> District 12 link is of relatively low power, care should be taken to avoid direct exposure in front of the feed-horn while the transmitter is on.

DO NOT LOOK INTO THE FEEDHORN EMITTER AREA WHILE THE TRANSMITTER IS ON UNDER ANY CIRCUMSTANCES.

3. Rotate the dish until it points in the approximate direction on the horizon where the satellite is located. Lightly tighten the two bolts that secure the antenna to the mounting post.

4. Hold the orange angle measurement device on the back of the antenna support framework and adjust the large nuts until the angle reads about 6 to 8 degrees. This measurement is

relatively imprecise. The important thing is to get the antenna aimed at roughly the correct azimuth and elevation. Do not tighten the nuts as further fine-tuning will be required.

5. Turn on the spectrum analyzer and adjust settings to the following:

LNA/BDC PWR	**18V ON**
SCALE	**10 dB/DIV**
INTENSITY	**Maximum clockwise, can be reduced later**
VERT	**adjust until you can see the trace**
BAND SELECT	**950-1450 MHz**
SWEEP	**Maximum clockwise**
SPAN	**Set to the square marker located 2/3 the distance clockwise from 1 to 50**
REFERENCE LEVEL	**-20 dBm**
CENTER FREQUENCY	

6. Attach one of the two RG-58 coax patch cables from the RX coax cable coming from the feedhorn to the RF input on the spectrum analyzer. The RX cable originates from the smaller rectangular device on the feedhorn and does not have a yellow marker on it.

Important: Be sure that the TXIF and ODU power are off when aiming the satellite dish to minimize exposure to RF radiation.

7. Move the dish from side-to-size and up and down in a methodical fashion, looking for a signal on the spectrum analyzer. This may take a little work to complete. Optimize the signal for maximum amplitude on the analyzer by adjusting the angle and azimuth of the dish. This may take a few iterations to complete.

2.1.3. Bringing the Transmitter On-Line

Important: Do not attempt to bring up the satellite system without prior approval from the satellite service provider. Even with prior approval, transmit must not be turned on at either side of the link until directed to do so by a service technician during a "coming online" phone call.

Important: RF radiation can be harmful to your health. Although the Mobile TMC's satellite communications system is of relatively low power, care should be taken to avoid direct exposure in front of the feed-horn while the transmitter is on.

DO NOT LOOK INTO THE FEEDHORN EMITTER AREA WHILE THE TRANSMITTER IS ON UNDER ANY CIRCUMSTANCES.

The following steps provide instruction on how to bring up one side of the satellite link, and must be followed on both the District 12 and Mobile TMC sides of the link for the link to be active.

1. Ensure that the modem's transmit function is disabled:

   configuration -> modulator -> TXIF = OFF
   configuration -> modulator -> ODU power = OFF

   - TXIF = OFF turns off the modem's transmitter.
   - ODU power = OFF turns off power to the outdoor power amplifier, ensuring that even if TXIF is on, the signal will not be transmitted to the satellite.

2. Call the satellite service provider network control center to coordinate bringing the transmitter on line. Be prepared to give the following information:

   - Satellite
   - Transponder
   - TX Terminal Frequency
   - RX Terminal Frequency
   - Organization

The network controller will request you to set your power level and bring your transmitter on line:

configuration -> modulator -> TX POWER LEVEL = -21.0 dBm
configuration -> modulator -> TXIF = ON
configuration -> modulator -> ODU power = ON

If the controller requests you increase the transmitter power, use the arrow buttons to adjust the power level accordingly. For example, -11.0 dBm is 10 dB more power than –21 dBm. The network controller will give you instructions and ask you set your modem accordingly. It is our requirement under contract to set system levels and parameters exactly as specified by the service provider.

The satellite service provider may do a cross-polarization check while on the phone. If cross-polarization is too high, they will request that it be adjusted. Cross-polarization is adjusted by loosening the Allen screws and rotating the electronics assembly on the feed horn by a few degrees as instructed by the satellite service provider. **TRANSMIT POWER AND ODU POWER SHOULD BE OFF FOR THIS ADJUSTMENT.**

2.1.4. Shutting down the Satellite Link

Important: The satellite service provider must be informed when you are shutting down the link.

Mobile TMC

1. Set the satellite modem with the following parameters:

   configuration -> demodulator -> LNB power = OFF
   configuration -> modulator -> ODU power = OFF
   configuration -> modulator -> TXIF power = OFF

2. Call the satellite service provider to notify them that the antenna's transmit has been shut off.

3. Press "Mode" on the satellite controller to return to the main menu.

4. Press "2" on the satellite controller to stow the antenna. Press "BKSP" to confirm the action.

District 12 TMC

1. Set the satellite modem with the following parameters:

   configuration -> demodulator -> LNB power = OFF
   configuration -> modulator -> ODU power = OFF
   configuration -> modulator -> TXIF power = OFF

2. Call the satellite service provider to notify them that the antenna's transmit has been shut off.

3. Unplug the satellite modem.

2.2. Routing and Network Equipment

2.2.1. Confirming that the Mobile TMC Router is Online.

Once the satellite communications link is operational, confirm that the router has indeed come online automatically.

1. Confirm that the router is powered on.
2. Open a command prompt at any of the three PCs by doing the following:
    a. Click Start.
    b. Click Run.
    c. Type 'cmd' in the textbox and click OK.
3. In the command prompt ping the ethernet IP of the router, [redacted]. Refer to below for an example of a ping command. Figure 3.3.1 shows the expected results of the ping command. If these results are not received reconfirm that both ends of the satellite link are operational, and that both routers are operational. For further assistance refer to either Appendix A1, Satellite Communication System, or Appendix A2, Cisco Routers.

    Example:

```
C:\> ping [redacted]
```

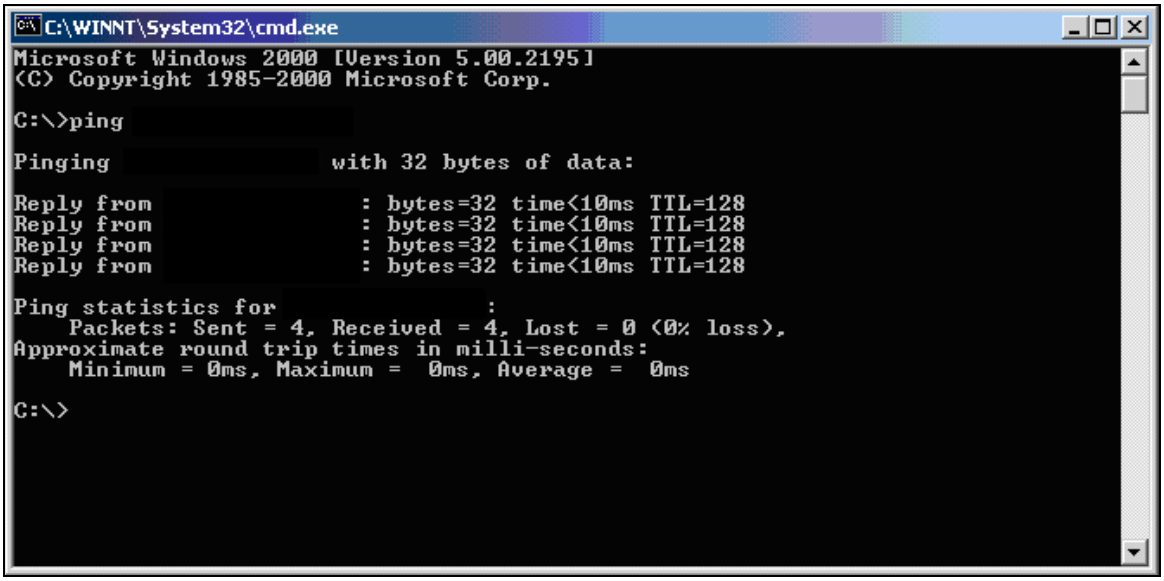


Figure 3.3.1. Expected Results of Ping Command.

4. Ping the serial interface of the router, [redacted].

   Example:

   C:\> ping [redacted]

5. Ping the serial interface of the router on the other side, [redacted].

   Example:

   C:\> ping [redacted]

6. Ping the ethernet interface of the router on the other side, [redacted].

   Example:

   C:\> ping [redacted]

7. Ping the decompression machine on the other side, [redacted].

   Example:

   C:\> ping [redacted]

3. MOBILE TMC OPERATIONS APPLICATIONS

3.1. Computer Systems

The Mobile TMC is equipped with three onboard computers. Their names and functionalities are as follows:

- *MTMS* – Runs the MTMS software for local FEP Emulation.
- ATMS – Runs the VNC ATMS Display.
- RTMS/VID CONF – Handles communication to the RTMS and Video Conferencing software.

3.1.1. Power

Power-Up

1. Endure that the proper power up sequence has been followed, as explained in Section 1.1.
2. Find the APC Uninterrupted Power Supply (UPS) beneath the operator's console desk, on the right side of the vehicle. Press the upper button, which is labeled with a vertical line and "TEST," to turn on the power supply.
3. At the operator's console Power Distribution Controls, turn the Computers switch to ON.
4. Press the power buttons on the Mobile TMC computers to apply power.

Power-Down

1. Log out of each computer and shut down Windows.
2. At the operator's console Power Distribution Controls, turn the Computers switch to OFF.
3. Press the lower button on the UPS, labeled with a circle, to turn off the power supply.

3.1.2. Monitor Switching

At the rear operator's console, a 'Belkin OmniView' monitor switcher is provided to toggle keyboard and mouse control between the three Mobile TMC computers. Positions 1 – 3 on the Monitor Switch are utilized, and correspond to the computers as follows:

a. Position 1 – *MTMS* PC

b. Position 2 – *ATMS PC*

c. Position 3 – *RTMS/VID CONF* PC.

To switch between computers, the following keystrokes are used: SCROLL LOCK – SCROLL LOCK – UP ARROW, or SCROLL LOCK – SCROLL LOCK – DOWN ARROW. Scrolling 'up' will move in decreasing order, position 3 to position2, and scrolling down will move in increasing order, position 2 to position 3.

3.2. Remote ATMS Display

3.2.1. Start the VNC Server

1. Ensure that the ATMS PC is powered up.
2. From the ATMS PC, click the PuTTY icon on the desktop
3. Double-click the ATMS HPUX connection option.
4. Login to the remote ATMS workstation using the login detailed in Appendix N.

```
login: username
Password:
```

5. Determine if the VNC server is already running by doing a process search as shown below. If anything other than the command you enter is echoed back, the VNC server is already running. If so, skip the next step.

```
# ps –ef | grep vnc
```

6. Type "`vncserver`" at the prompt, and press Enter.
7. Type "logout" to exit.

3.2.2. Connecting to the VNC Server

1. Click on the 'Connection to ATMS HPUX' icon on the desktop of the ATMS PC.
2. Enter a password as given in Appendix N in the dialog box that appears.
3. A window will appear displaying a familiar HPUX desktop, with an open terminal. At the prompt, type "atms –single" to start the ATMS.
4. If fullscreen operation is desired, right-click on the VNC task on the Start bar, and choose the Full Screen option.

3.2.3. Shutdown of VNC Connection

1. Close the ATMS application.

2. Close the VNC window. If the VNC client is in fullscreen mode, press Ctrl + Esc to bring up the Start bar, right-click on the VNC task, and choose Close.

3. Shutdown the ATMS PC by clicking the Start button, choosing Shutdown, and clicking OK.

3.2.4. Terminating the VNC Server

1. Ensure that the ATMS PC is powered up.

2. From the ATMS PC, click the PuTTY icon on the desktop

3. Double-click the ATMS HPUX connection option.

4. Login to the ATMS HPUX using the login detailed in Appendix N.

```
login: username
Password:
```

5. Determine if the VNC server is running, and if it is which display number is in use by doing a process search as shown below. If the server is running, "vncserver :1" will be displayed, possibly along with other additional parameters. The number following the colon (1 in this case) is the number that should be entered into Step 6.

```
# ps –ef | grep vnc
```

6. Type "`vncserver –kill :1`" at the prompt, where the number following the colon is the number obtained from Step 5. Then press Enter.

7. Type "logout" to exit.

3.3. Video Surveillance and Display on Operator Console

The video surveillance system consists of two monitors, two cameras, pan-tilt controls, video selection switches, and a VCR.

Figure 3.1 Mobile TMC video surveillance control panel.

3.2.5. Viewing Video on a Monitor (MONITOR 1 or MONITOR 2)

1. On the Video Surveillance Control Panel, press one of the buttons on either the Monitor 1 or the Monitor 2 video switches to see the desired input on either monitor.

2. The selected video source will appear. Use the phase, chroma, bright, and contrast knobs on the monitor to optimize the image.

3.2.6. Controlling the Surveillance Camera (PTZ CAM)

1. Select PTZ CAM on one of the TV monitors.

2. The surveillance camera is labeled PTZ CAM and has pan, tilt, zoom, and focus controls. Use the PTZ CAM joystick, zoom, and focus controls to adjust the camera.

3.2.7. Controlling the RTMS Aiming Camera (RTMS CAM)

1. Select RTMS CAM on one of the TV monitors.

2. The RTMS aiming camera is labeled RTMS CAM and has pan and tilt controls. Use the RTMS CAM joystick to aim the camera. Note that the center of the image represents the center of the RTMS scanning area.

3.2.8. Recording Video With the VCR

1. Select the desired input on the VCR video switch.

2. Use the standard VCR controls to record an video feed. The VCR output during play mode may be viewed on MONITOR 1 by selecting VCR on the MONITOR 1 input switch and watching it on the monitor.

3.4. Mobile TMC to TMC Video Transmission

3.4.1. Starting video relay

1. Confirm that the satellite link is operational, and that the Baxall video encoder located under the Operator Console is powered.

2. Select the appropriate video feed from the Encoder video switcher on the Video Surveillance Control Panel of the Operator Console.

3.5. Mobile TMC to TMC Video Conferencing

3.5.1. Starting Up Video Conferencing Machine.

1. Ensure that the Video Conferencing PC is powered up.
2. The PC is configured to start NetMeeting on startup, and to run it in the background. To access NetMeeting do one of the following:
   - Click Start, then Programs, then Accessories, then Communications, and then NetMeeting.
   - Double Click on the globe icon on the bottom right corner.

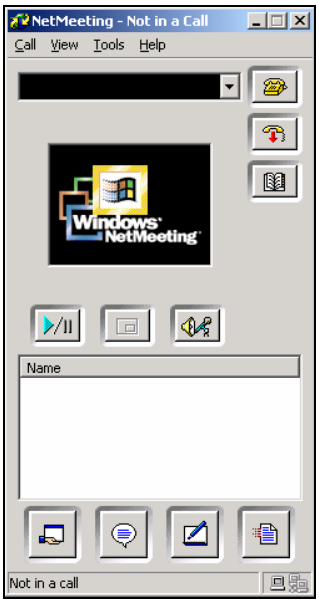


Figure 3.2 Netmeeting.

3.5.2. Netmeeting - Making A Call.

1. Click Call and go to New Call.
2. Type in the IP Address of the video conferencing terminal, as listed in Appendix N.
3. Click Call.
4. When the other terminal has accepted your call the video and sound will start to send and

receive automatically.

5. There is a 2 to 3 second delay in the video images and sound received.

Receiving A Call.

Simply click Accept on the toolbar that appears at the bottom right of your screen.

3.5.3. Netmeeting - Chatting With Other Conference Members.

1. Click Tools and click on Chat.

2. When you type your first message the chat window will pop open on the other individuals' screens with your message.

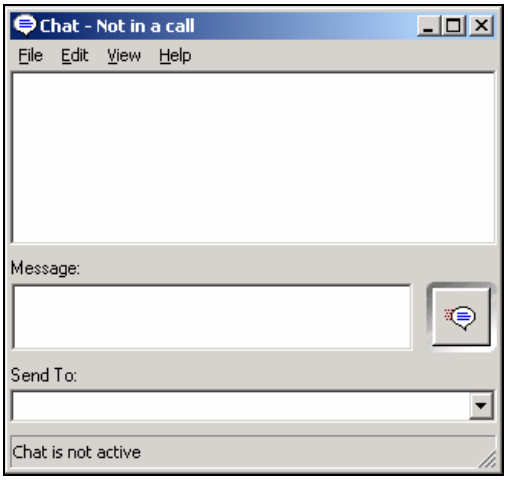


Figure 3.3 Netmeeting Chat window.

3. If you close the window and another conference member sends you a message. NetMeeting will not pop open the chat window again. As a result, the message sent is lost, so it is best to minimize the window when not in use, and then close it after the conference is over.

3.5.4. NetMeeting - Using the Whiteboard.

1. Click Tools and then Whiteboard.

2. When started, the whiteboard will automatically pop open on the other person's screens. NetMeeting will not pop open the whiteboard window again. As a result, any changes sent are lost, so it is best to minimize the window when not in use, and then close it after the conference is over.

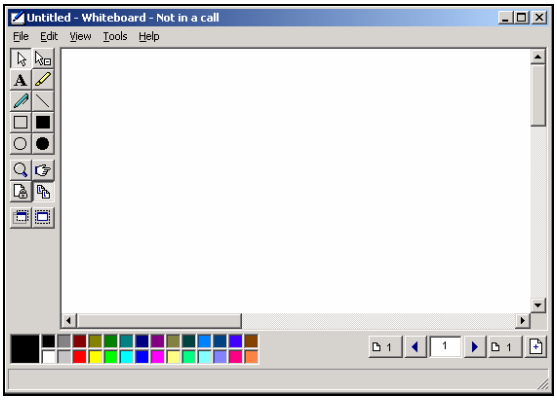


Figure 3.4 Netmeeting Whiteboard.

3.5.5. NetMeeting - Transferring Files.

1. Click Tools and then go to File Transfer.

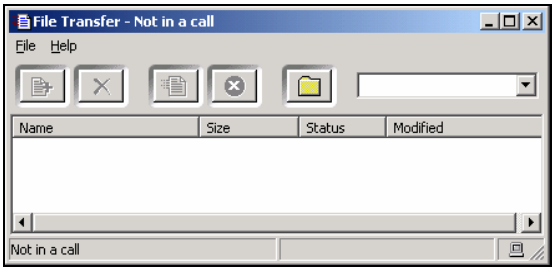


Figure 3.5 Netmeeting "File Transfer" window.

2. It will take a moment for the application to become initialized. When it is ready the taskbar, above the File Menu, will read "File Transfer – In a Call".

3. To add files for transfer click the first icon, which is a paper with a red cross next to it.

4. Once all the files have been added click the third icon to transfer all files.

5. To remove, select the file, click the second icon. This will remove the selected file.

6. When a file is received it is stored at the following path "C:\Program Files\NetMeeting\Received Files".

7. To view these files click the folder icon.

3.5.6. NetMeeting - Sharing Files.

1. Click Tools and go to Sharing.
2. This application will allow you to share types of files located on your desktop.
3. Select one of the files of a certain type and then click Share.
4. Once a file has been shared, a window will pop open showing the shared files on the other person's screen.

3.5.7. NetMeeting - Hosting A Call.

1. Click Call and then Host Meeting.

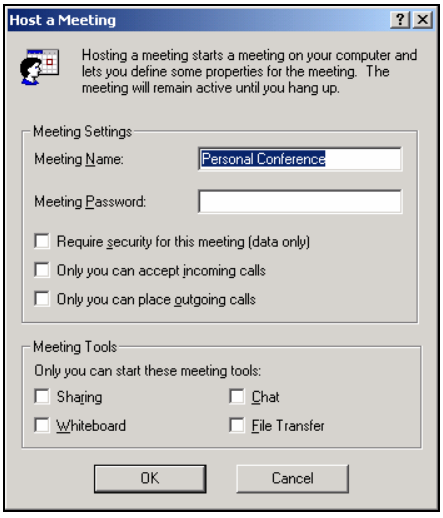


Figure 3.6 Netmeeting "Hosting a Call" window.

2. Type in the Meeting Name and Password.
3. Click all the tools that you will be using during your meeting.
4. Click OK.
5. Make a call to all the people that you would like to participate in the meeting.
6. The advantages of a meeting for a regular call is that more then two individuals can participate in a conference, and other video callers cannot disturb you during the meeting. However the host of the meeting will be the only one who can initiate a tool.

3.5.8. Shutting down the Video Conferencing PC.

1. Click Call, then Exit.
2. Click Start, then Shutdown.
3. In the pull down menu select shutdown, and then click the OK button.

3.6. Mobile TMC Voice Radio

The Mobile TMC is equipped with two Motorola Voice Radios, located by the front passanger entrance, and in the rear at the operator's console. The radios were provided to Cal Poly by Caltrans and were installed and maintained by the California Department of General Services. These radios allow the Mobile TMC operators to communicate with personal in the field via Caltrans voice radio network.

Figure 3.7 Mobile TMC voice radio.

3.7. Mobile TMC Data Communications

The Mobile TMC is designed to act as a remote data collector that may provide data to the Caltrans TMC FEP controller. The Mobile TMC is equipped with a 170 Controller, RTMS traffic sensor, and radio equipment for connecting to nearby data sources (Mobile Ramp Meter, FOT, etc…). Two data collection modes are available:

- Traffic data may be collected and polled by the Caltrans FEP through the wide area network.
- An FEP emulator, the Mobile Traffic Management System (MTMS), can be run on the Mobile TMC to simulate traffic data collection.

The Mobile TMC utilizes Lantronix serial to Ethernet converters to collect data from remote data. Refer to Section 2.4 in Chapter 1 for an overview of the Mobile TMC Data Connection.

3.7.1. Power up needed Systems

1. Ensure that the proper power up sequence has occurred, as described in Section 1.1.
2. Confirm that the MTMS computer has been powered up, as described in Section 3.1.1.
3. At the Operator Console, turn on the RTMS/170 and Data Comm switches on the Power Distribution control panel. These electrical subsystems apply power to the local 170 Controller, RTMS, and radio communications equipment.

3.7.2. Configure RTMS

1. Ensure that the RTMS PC is powered up.
2. At the operator's console, use the Monitor Switch to toggle control to the RTMS/VID CONF computer.
3. Double-click the RTMS shortcut on the Windows desktop.
4. The RTMS software will load, establishing communications to the RTMS.
5. Refer to Appendix F1 for instructions on usage of this software.

3.7.3. Configure Mobile TMC 170 Controller

1. Toggle the power switch on the lower right corner of the 170 Controller to apply power.

2. Refer to Appendix F2 for instructions on usage.

3.7.4. Lantronix Configuration

The Lantronix UDS-10 and MSS-100 Device Servers are located in the rear of the vehicle, rack mounted above the power bays. Additionally, a MSS-100 is located within the CalPoly cabinet in the District-12 TMC. Communication with these units is done through a web browser.

Figure 3.8 Lantronix mounted in Mobile TMC.

UDS-10 Device Servers

A UDS-10 Lantronix Device Server connects to the serial interface on a 170 controller. The following steps describe how to configure the UDS-10 for data communication.

1. At the operator's console, use the Monitor Switch to toggle to the *MTMS* PC.

2. Open Internet Explorer, and enter in the UDS-10 IP Address from the following list. Figure 3.9 shows the resulting screen. You may need to refresh the browser if the gray buttons do not appear on the left portion of the window.

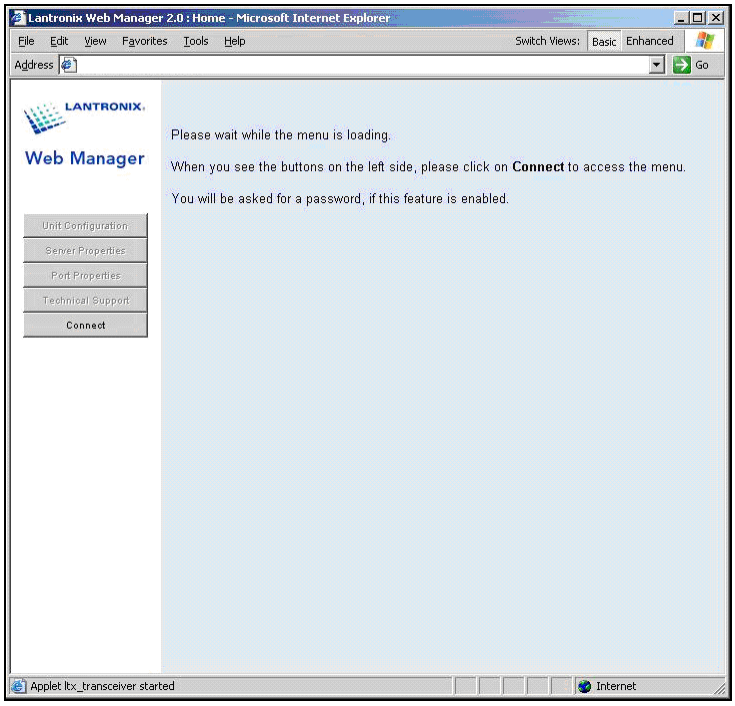


Figure 3.9 Initial UDS-10 connection screen

3. Press the CONNECT button to establish communication with the UDS-10. Connection can be validated by noticing all buttons on the window becoming active, as seen below.

Figure 3.10 Enabled buttons.

4. Press the UNIT CONFIGURATION button to bring up the window seen in Figure 3.11. This shows a general overview of current configuration settings. All fields are read-only and cannot be changed.

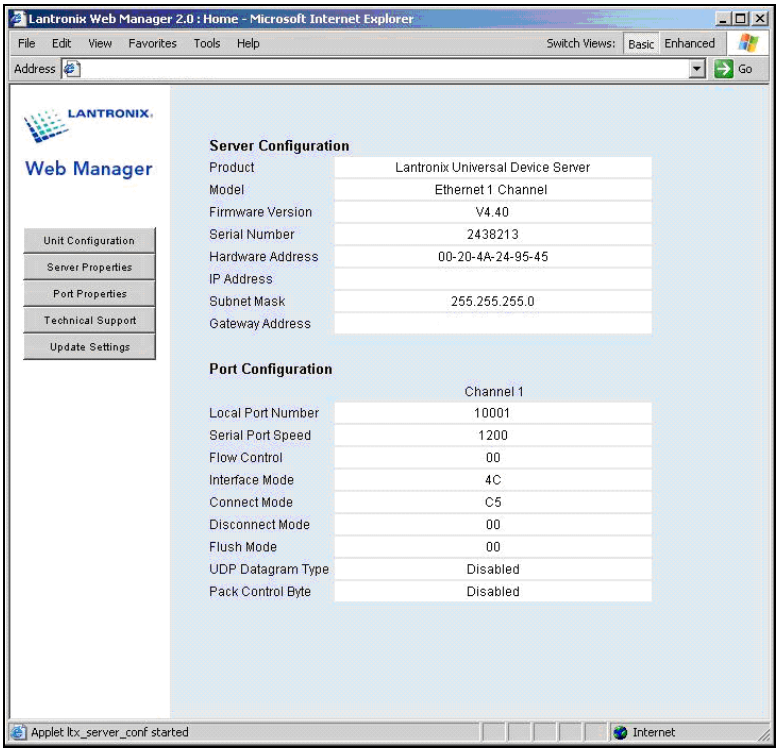


Figure 3.11 Unit configuration screen

5. The SERVER PROPERTIES button brings up the screen seen in Figure 3.12. In this screen, the IP Address and Gateway may be changed for the UDS-10.

Important: Do not change the UDS-10 IP Address or Gateway. Changes may render UDS-10 unreachable without the aid of network administrator.

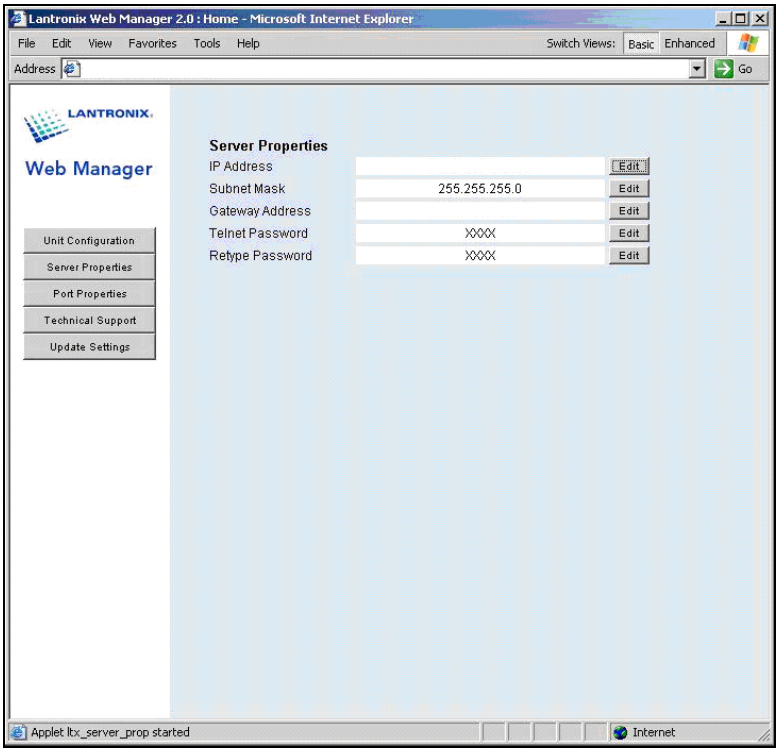


Figure 3.12 Server properties screen.

6. Press the PORT PROPERTIES button to bring up the screen seen in Figure 3.13. The only item that will need to be changed is the 'Remote IP Address.' This address is the location of the MSS-100 Server Lantronix located in the Mobile TMC or District-12 TMC. These addresses are as seen below, and also found in Appendix N. Be sure to press the UPDATE SETTINGS button to apply changes.

Important: Do not change any other values in this screen, as communication with the MSS-100 will be affected.

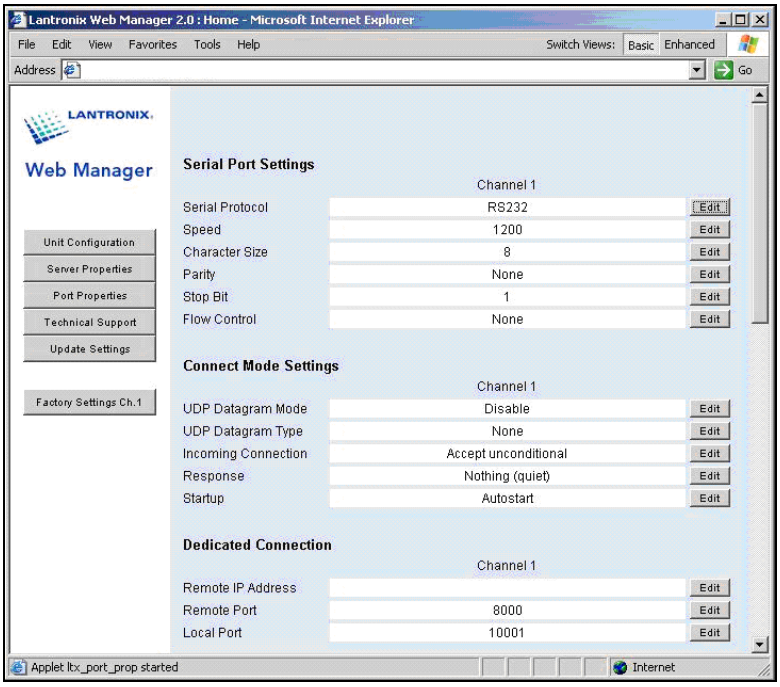


Figure 3.13 Port properties screen.

7. When finished with the connection, simply close the web browser.

MSS-100 Server

A MSS-100 Lantronix Server receives connections from UDS-10 Device Servers and connects to the serial interface on the TMC FEP controller, or the MTMS FEP emulator in the Mobile TMC. The following steps describe how to configure the MSS-100 for data communication. They are for informational purposes only, as the units are configured properly and will not need modification.

1. To connect, open a browser, and enter in the desired address from the following list. Figure 3.14 shows the resulting screen.

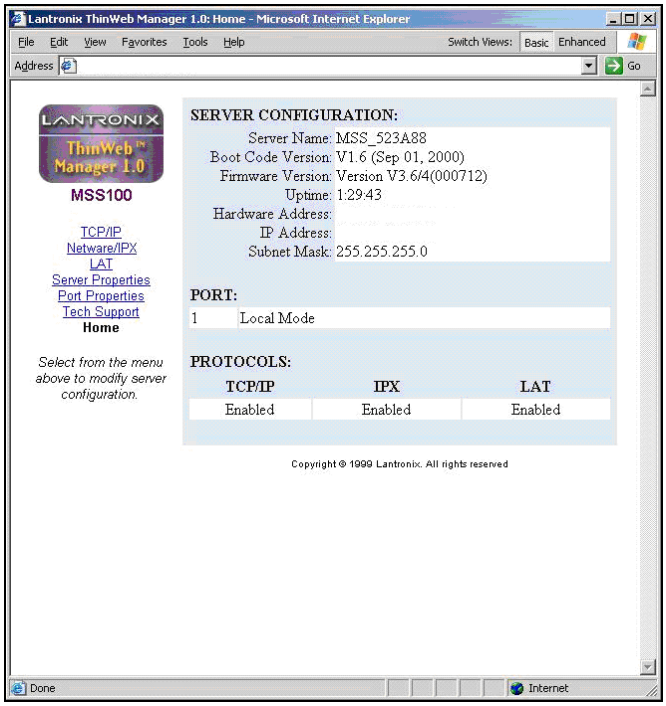


Figure 3.14 Initial MSS-100 connection screen.

2. Click on the TCP/IP link to browse to that section. You will be asked to authenticate yourself, shown in Figure 3.15. The password is **Mobile TMC**. Press LOGIN.

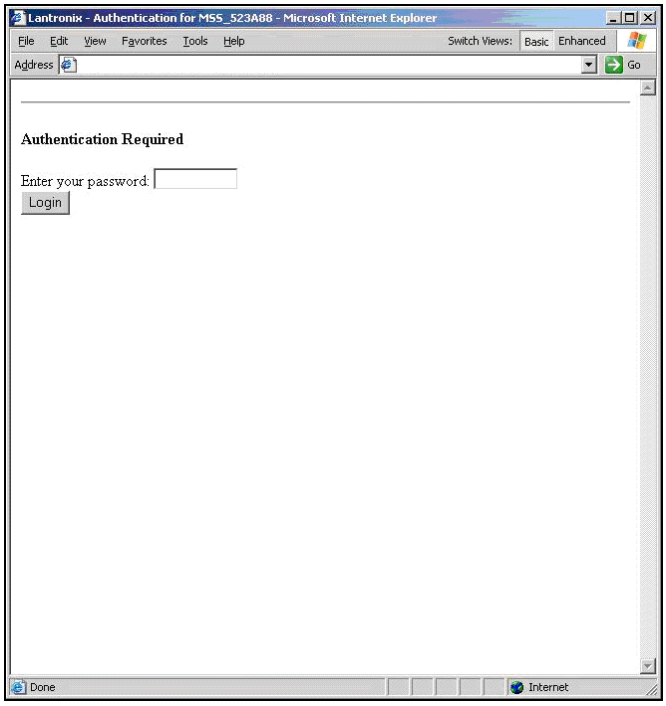


Figure 3.15 MSS-100 authentication.

3. The screen seen in Figure 3.16 will appear. The MSS-100 IP address and gateway may be modified from this screen. The UPDATE SERVER SETTINGS button must be pressed to apply changes.

Important: Do not change the MSS-100 IP Address or Gateway. Changes may render MSS-100 unreachable without the aid of network administrator.

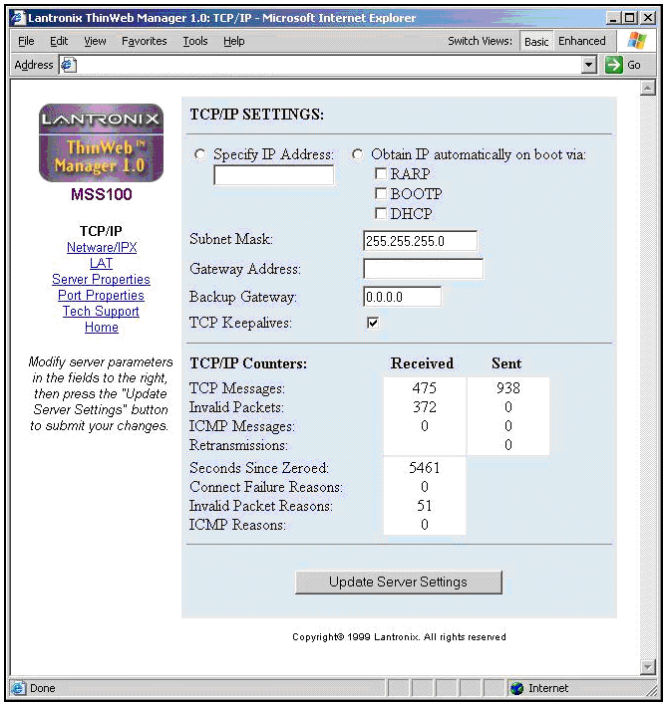


Figure 3.16 TCP/IP screen.

4. When finished with the connection, simply close the web browser.

3.7.5. FEP Data Polling

The MSS-100 will automatically receive connections from the UDS-10 Device Servers when configuration is complete. The MSS-100 software is set to be automatically executed upon boot. If there is a problem, refer to Appendix G2 for information on how to connect to the MSS-100 and start the software to view it's output.

District-12 TMC FEP

For troubleshooting MSS-100 connections to the TMC FEP, locate the MSS-100 within the CalPoly cabinet in the District-12 computer room. Check the following:

1. Ensure that the MSS-100 has power and that it has a connection to the network hub within the cabinet.

2. Ensure that the serial to Ethernet connector is still connected to the *FEP 170* RJ45 cable.

3. Ensure that this cable is connected to the proper RJ45 cable within the FEP modem cabinet.

4. Refer to Appendix G2 for the MSS-100 Technical Manual.

Mobile TMC FEP Emulator

The MTMS FEP emulator software must be started in order to simulate data polling.

1. From the *MTMS* PC, double-click on the *MTMS Server* shortcut to start the local data server.

2. Double-click on the *MTMS Client* shortcut to start the local data client.

3. To add a map to the background, choose "Add Map" from the *MAP* menu item. Browse to the location of your image, select it, and press "Open." The image will appear in the background.

Note: The background image size is 1024x768 pixels. Images can be downloaded online from Yahoo Maps, or Map Quest, and then resized.

4. Click on the "Subunits Configuration" check box in the *View* menu item to open the subunits dialog. Click on an item that you wish to add. The cursor will change to match that item. Click on the main screen in the location that you wish to place the item. Figure 3.17 shows the *Subunit* configuration dialog.

Figure 3.17 MTMS "Subunits" dialog.

5. In the *Setup 170 Controller* dialog that appears after placing an item, seen in Figure 3.18, set the item's hardware address, enter in a description, and press OK.

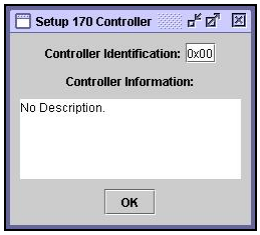


Figure 3.18 MTMS "Setup 170 Controller" dialog.

6. A summary window will appear that displays summary statistics for the 170 unit, shown in Figure 3.19. Pressing the *Detail* button opens the detailed statistics window seen in Figure 3.20. This summary window may be closed and reopened by double clicking on the icon.

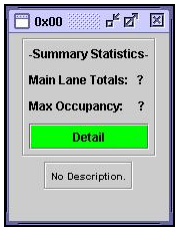


Figure 3.19 MTMS 170 summary statistics.

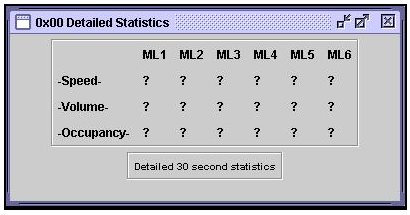


Figure 3.20 MTMS 170 detailed statistics.

To begin polling, check the "Polling ZZZ" check box in the *Mode* menu item. This item changes between "Polling OFF" and "Polling ON" depending on polling status. When checked, the MTMS software is simulating FEP polling to all 170 subunits that have been added.

4. TMC OPERATIONS APPLICATIONS

4.1. Routing and Network Equipment

4.1.1. Confirming That TMC Router is Online

Once the satellite communications link is operational, confirm that the router has indeed come online automatically.

1. Confirm that the router is powered on.
2. Open a command prompt by doing the following:
    a. Click Start.
    b. Click Run.
    c. Type '**cmd**' in the textbox and click OK.
3. In the command prompt ping the ethernet IP of the router, [redacted].

    Example:

    C:\> ping [redacted]

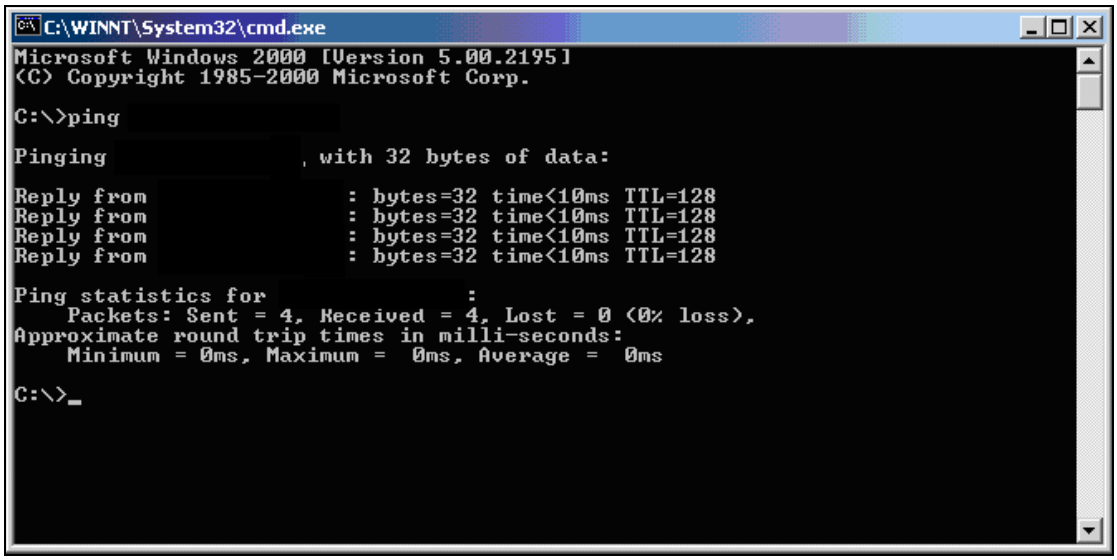


Figure 4.1 Expected results of ping command.

Ping the serial interface of the router, [redacted].

Example:

```
C:\> ping [redacted]
```

4. Ping the serial interface of the router on the other side, [redacted].

   Example:

   ```
   C:\> ping [redacted]
   ```

5. Ping the ethernet interface of the router on the other side, [redacted].

   Example:

   ```
   C:\> ping [redacted]
   ```

6. Ping the decompression machine on the other side, [redacted].

   Example:

   ```
   C:\> ping [redacted]
   ```

4.2. ATMS – HPUX

4.2.1. Start the VNC Server

8. From the ATMS PC, click the PuTTY icon on the desktop
9. Double-click the ATMS HPUX connection option.
10. Login to the ATMS HPUX with the login and password of "atms".

    ```
    login: username
    Password:
    ```

11. Determine if the VNC server is already running by doing a process search as shown below. If anything other than the command you enter is echoed back, the VNC server is already running. If so, skip the next step.

    ```
    # ps –ef | grep vnc
    ```

12. Type "vncserver" at the prompt, and press Enter.

13. Type "logout" to exit.

4.2.2. Connecting to the VNC Server

5. Click on the 'Connection to ATMS HPUX' icon on the desktop of the ATMS PC.

   Enter the password in the dialog box that appears.

6. A window will appear displaying a familiar HPUX desktop, with an open terminal. At the prompt, type "atms –single" to start the ATMS.

4.2.3. Shutdown of VNC Connection

4. Close the ATMS application.

5. Close the VNC window.

4.3. Mobile TMC to TMC Video Transmission

4.3.1. Receiving video from the Mobile TMC

1. Confirm a functioning satellite link with the Mobile TMC (please see Section 4.1.1).

2. Confirm that the Baxall video decoder in the Mobile TMC rack of the D12 computer room is powered, and receiving video.

3. Select video from TMC floor (port 10).

4.4. TMC to Mobile TMC Video Conferencing

4.4.1. Starting Up Video Conferencing Machine.

1. Power on the PC.

2. After the PC has fully booted login as '**`Mobile TMC`**', the password is '**`Mobile TMC`**'.

3. The PC is configured to start NetMeeting on startup, and to run it in the background. To

access NetMeeting do one of the following:

- Click Start, then Programs, then Accessories, then Communications, and then NetMeeting.

- Double Click on the globe icon on the bottom right corner.

Figure 4.2 Netmeeting.

4.4.2. Netmeeting - Making A Call.

1. Click Call and go to New Call.
2. Type in the IP Address of the video conferencing terminal, [redacted].
3. Click Call.

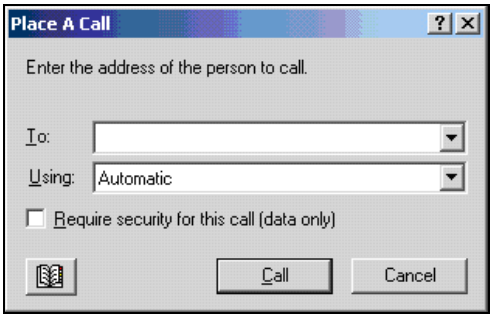


Figure 4.3 "Placing a call" window.

4. When the other terminal has accepted your call the video and sound will start to send and receive automatically.

5. There is a 2 to 3 second delay in the video images and sound received.

Receiving A Call.

Simply click Accept on the toolbar that appears at the bottom right of your screen.

4.4.3. Netmeeting - Chatting With Other Conference Members.

1. Click Tools and click on Chat.

2. When you type your first message the chat window will pop open on the other individuals' screens with your message.

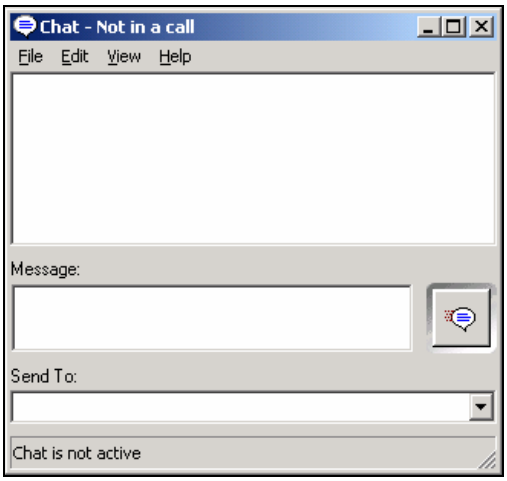


Figure 4.4 Netmeeting chat window.

3. If you close the window and another conference member sends you a message. NetMeeting will not pop open the chat window again. As a result, the message sent is lost, so it is best to minimize the window when not in use, and then close it after the conference is over.

4.4.4. NetMeeting - Using the Whiteboard.

1. Click Tools and then Whiteboard.

2. When started, the whiteboard will automatically pop open on the other person's screens. NetMeeting will not pop open the whiteboard window again. As a result, any changes sent

are lost, so it is best to minimize the window when not in use, and then close it after the conference is over.

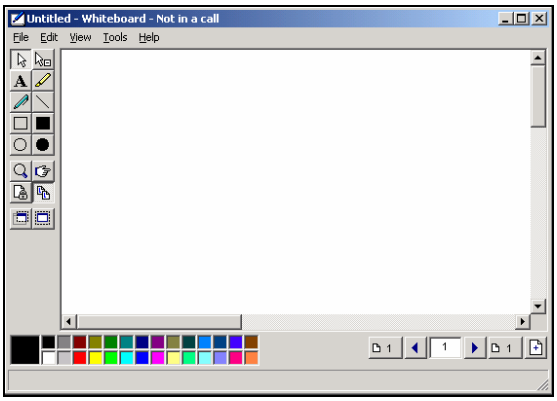


Figure 4.5 Netmeeting Whiteboard.

4.4.5. NetMeeting - Transferring Files.

1. Click Tools and then go to File Transfer.

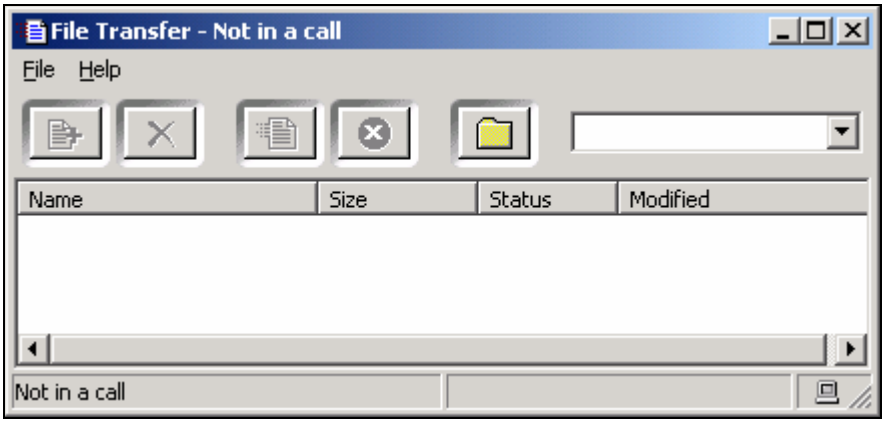


Figure 4.6 Netmeeting File Transfer window.

2. It will take a moment for the application to become initialized. When it is ready the taskbar, above the File Menu, will read "File Transfer – In a Call".

3. To add files for transfer click the first icon, which is a paper with a red cross next to it.

4. Once all the files have been added click the third icon to transfer all files.

5. To remove, select the file, click the second icon. This will remove the selected file.

6. When a file is received it is stored at the following path "C:\Program

Files\NetMeeting\Received Files".

7. To view these files click the folder icon.

4.4.6. NetMeeting - Sharing Files.

1. Click Tools and go to Sharing.
2. This application will allow you to share types of files located on your desktop.
3. Select one of the files of a certain type and then click Share.
4. Once a file has been shared, a window will pop open showing the shared files on the other person's screen.

4.4.7. NetMeeting - Hosting A Call.

1. Click Call and then Host Meeting.

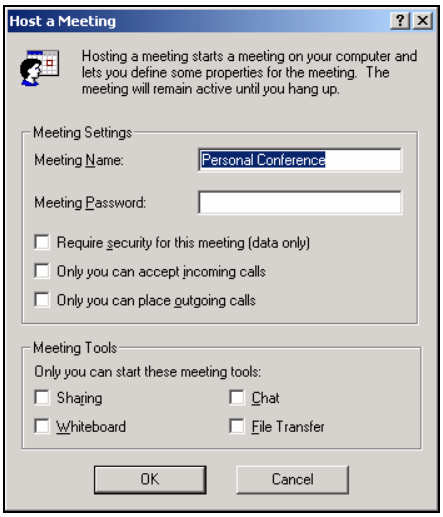


Figure 4.7 Netmeeting "Hosting a Call" window.

2. Type in the Meeting Name and Password.
3. Click all the tools that you will be using during your meeting.
4. Click OK.
5. Make a call to all the people that you would like to participate in the meeting.
6. The advantages of a meeting for a regular call is that more then two individuals can

participate in a conference, and other video callers cannot disturb you during the meeting. However the host of the meeting will be the only one who can initiate a tool.

4.4.8. Shutting down the Video Conferencing PC.

1. Click Call, then Exit.
2. Click Start, then Shutdown.
3. In the pull down menu select Shutdown, and then click the OK button.

APPENDIX A1
Satellite System

Satellite Calculation Equations

$$azimuth = 180 + \arctan\left(\frac{\tan(longitude - satellite\ longitude)}{\sin(latitude)}\right)$$

$$elevation = \arctan\left(\frac{\cos(y) - 0.15116}{\sin(y)}\right)$$

$$y = \arccos(\cos(latitude) \times \cos(longitude - latitude))$$

$$v.polarization = \arctan\left(\frac{\sin(longitude - satellite\ longitude)}{\tan(latitude)}\right)$$

2004 Magnetic Declination

(N / W)	-135	-130	-125	-120	-115	-110	-105	-100	-95	-90	-85	-80	-75	-70	-65	-60
60	24.582	24.937	24.614	23.453	21.257	17.807	12.929	6.621	-0.770	-8.492	-15.617	-21.433	-25.646	-28.308	-29.637	-29.892
59	24.023	24.335	23.989	22.840	20.707	17.394	12.744	6.757	-0.261	-7.638	-14.527	-20.238	-24.449	-27.168	-28.578	-28.918
58	23.485	23.757	23.394	22.259	20.188	17.003	12.563	6.866	0.187	-6.875	-13.539	-19.141	-23.339	-26.102	-27.582	-27.998
57	22.967	23.205	22.827	21.709	19.699	16.633	12.386	6.954	0.582	-6.190	-12.641	-18.134	-22.310	-25.107	-26.646	-27.130
56	22.469	22.675	22.286	21.186	19.235	16.284	12.214	7.024	0.931	-5.574	-11.824	-17.208	-21.356	-24.177	-25.769	-26.313
55	21.990	22.168	21.771	20.691	18.797	15.952	12.048	7.079	1.241	-5.018	-11.080	-16.355	-20.471	-23.310	-24.945	-25.543
54	21.529	21.682	21.279	20.220	18.383	15.638	11.887	7.121	1.517	-4.515	-10.399	-15.570	-19.649	-22.500	-24.174	-24.820
53	21.084	21.216	20.810	19.772	17.989	15.340	11.731	7.152	1.763	-4.059	-9.777	-14.846	-18.886	-21.745	-23.451	-24.140
52	20.655	20.768	20.361	19.346	17.616	15.057	11.580	7.174	1.983	-3.645	-9.206	-14.177	-18.178	-21.039	-22.773	-23.502
51	20.242	20.338	19.931	18.939	17.260	14.787	11.433	7.187	2.180	-3.268	-8.682	-13.558	-17.518	-20.380	-22.139	-22.903
50	19.842	19.923	19.519	18.550	16.921	14.529	11.291	7.194	2.356	-2.924	-8.200	-12.985	-16.904	-19.763	-21.544	-22.341
49	19.455	19.524	19.123	18.178	16.597	14.282	11.153	7.195	2.515	-2.610	-7.755	-12.453	-16.331	-19.187	-20.987	-21.814
48	19.080	19.138	18.742	17.821	16.287	14.045	11.019	7.190	2.656	-2.322	-7.343	-11.958	-15.796	-18.647	-20.465	-21.320
47	18.715	18.765	18.375	17.478	15.989	13.817	10.887	7.180	2.784	-2.057	-6.963	-11.497	-15.296	-18.141	-19.975	-20.857
46	18.361	18.403	18.020	17.147	15.702	13.598	10.759	7.165	2.899	-1.814	-6.609	-11.067	-14.827	-17.666	-19.515	-20.423
45	18.016	18.052	17.677	16.828	15.426	13.385	10.633	7.147	3.002	-1.589	-6.280	-10.665	-14.387	-17.219	-19.083	-20.017
44	17.678	17.710	17.344	16.518	15.158	13.179	10.510	7.125	3.094	-1.382	-5.973	-10.288	-13.974	-16.800	-18.677	-19.637
43	17.348	17.376	17.019	16.218	14.899	12.980	10.389	7.101	3.178	-1.189	-5.686	-9.933	-13.584	-16.404	-18.296	-19.281
42	17.025	17.050	16.704	15.927	14.647	12.785	10.270	7.073	3.253	-1.010	-5.417	-9.599	-13.216	-16.031	-17.937	-18.947
41	16.707	16.731	16.395	15.642	14.402	12.595	10.152	7.044	3.322	-0.843	-5.163	-9.284	-12.868	-15.678	-17.599	-18.636
40	16.395	16.418	16.093	15.365	14.163	12.410	10.037	7.012	3.384	-0.687	-4.924	-8.985	-12.538	-15.343	-17.281	-18.344
39	16.087	16.110	15.797	15.093	13.929	12.229	9.923	6.979	3.441	-0.540	-4.698	-8.701	-12.225	-15.026	-16.980	-18.072
38	15.783	15.808	15.507	14.827	13.701	12.052	9.811	6.945	3.493	-0.401	-4.483	-8.430	-11.926	-14.725	-16.697	-17.817
37	15.483	15.510	15.221	14.566	13.477	11.879	9.701	6.910	3.541	-0.269	-4.277	-8.172	-11.640	-14.438	-16.428	-17.580
36	15.187	15.216	14.940	14.309	13.257	11.709	9.594	6.875	3.586	-0.143	-4.080	-7.923	-11.366	-14.164	-16.174	-17.358
35	14.894	14.926	14.664	14.058	13.042	11.542	9.488	6.841	3.629	-0.022	-3.891	-7.685	-11.103	-13.902	-15.934	-17.151
34	14.604	14.639	14.391	13.810	12.831	11.380	9.384	6.806	3.670	0.094	-3.708	-7.454	-10.850	-13.651	-15.706	-16.959
33	14.317	14.356	14.123	13.567	12.624	11.220	9.284	6.773	3.711	0.207	-3.531	-7.231	-10.605	-13.410	-15.489	-16.780
32	14.034	14.078	13.858	13.327	12.421	11.065	9.186	6.741	3.750	0.318	-3.359	-7.014	-10.368	-13.178	-15.283	-16.613
31	13.754	13.802	13.598	13.092	12.223	10.914	9.091	6.712	3.790	0.426	-3.190	-6.803	-10.138	-12.955	-15.088	-16.458
30	13.478	13.531	13.342	12.862	12.029	10.766	9.000	6.684	3.830	0.534	-3.024	-6.596	-9.914	-12.739	-14.901	-16.315
29	13.206	13.265	13.090	12.636	11.839	10.624	8.913	6.659	3.872	0.640	-2.861	-6.394	-9.696	-12.530	-14.723	-16.182
28	12.938	13.003	12.843	12.415	11.655	10.485	8.830	6.637	3.915	0.747	-2.700	-6.195	-9.483	-12.328	-14.553	-16.059
27	12.676	12.746	12.602	12.199	11.475	10.352	8.751	6.619	3.960	0.853	-2.540	-5.999	-9.274	-12.131	-14.390	-15.946
26	12.419	12.495	12.366	11.989	11.302	10.224	8.677	6.604	4.007	0.961	-2.382	-5.806	-9.068	-11.939	-14.235	-15.841
25	12.169	12.250	12.136	11.785	11.134	10.102	8.608	6.594	4.058	1.070	-2.223	-5.614	-8.867	-11.752	-14.085	-15.744
24	11.925	12.012	11.913	11.587	10.972	9.986	8.544	6.588	4.111	1.180	-2.065	-5.424	-8.668	-11.570	-13.942	-15.656
23	11.689	11.781	11.696	11.395	10.816	9.876	8.486	6.587	4.168	1.292	-1.906	-5.236	-8.472	-11.392	-13.804	-15.574
22	11.461	11.558	11.487	11.211	10.668	9.772	8.434	6.590	4.228	1.406	-1.748	-5.048	-8.278	-11.217	-13.671	-15.499
21	11.242	11.343	11.286	11.035	10.527	9.675	8.388	6.599	4.293	1.523	-1.588	-4.862	-8.087	-11.046	-13.543	-15.430
20	11.033	11.138	11.094	10.867	10.393	9.585	8.348	6.612	4.361	1.642	-1.428	-4.676	-7.897	-10.878	-13.419	-15.366

APPENDIX A2
CISCO Routers

Appendix A2

Cisco 805 Router

1. SYSTEM DESCRIPTION

The Cisco Routers in conjunction with the private satellite link allow two networks to be part of the same virtual network. These networks can literally be separated by miles, and an operator on one side can communicate with the machines on the other side. In addition, the routers also offer Quality of Service commonly referred to as QOS. QOS allows operators to specify a certain amount of bandwidth to individual applications.

2. INSTALLATION

2.1 Physical Installation

Items Included with Cisco Router

- Yellow Ethernet Cable
- Desktop Power Supply
- Black Power Cord
- Fast Step
- Blue Console Cable
- DB-9 to RJ-45 Adapter
- Documentation

Items Not Included with Cisco Router

- Cisco Serial Cable (Part #: CAB-SS-449MT)

Appendix A2

Cisco 805 Router

Connecting the Cisco 805 Router to a Network

1. Confirm that the HUB/NO HUB button is set to HUB.
2. Connect the yellow cable to the Ethernet port.
3. Connect the other end to the hub.

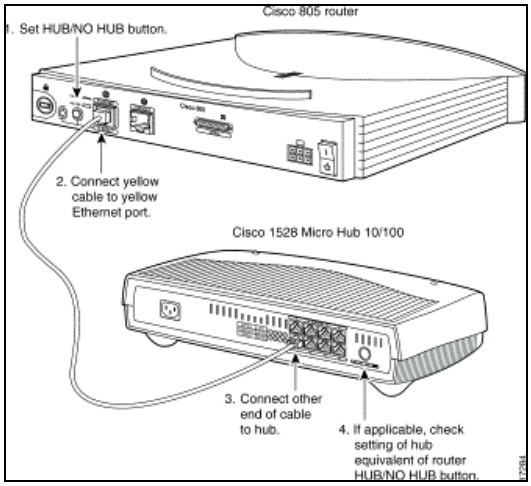


Figure 2.1.1: Connecting the Router to the Network

Connecting the Router to a PC for Console Operation

1. Connect the light blue cable to the blue Console port
2. Connect the other end to the enclosed DB-9 to RJ-45 Adapter.
3. Connect the DB-9 Connector to a PC

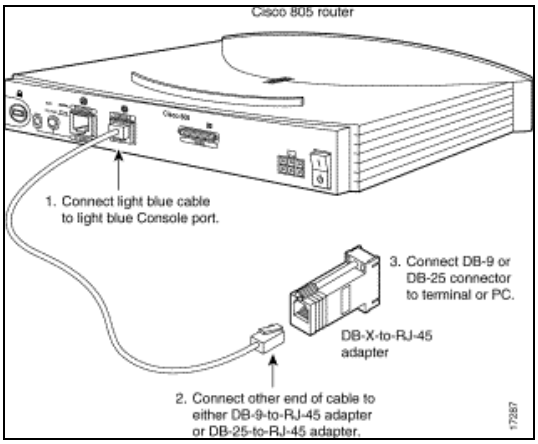


Figure 2.1.2: Connecting the Router to a PC

Connecting the Router to the Satellite Modem

1. Procure the correct serial cable and connect the appropriate end to the router serial port.
2. Connect the other end to the satellite modem.

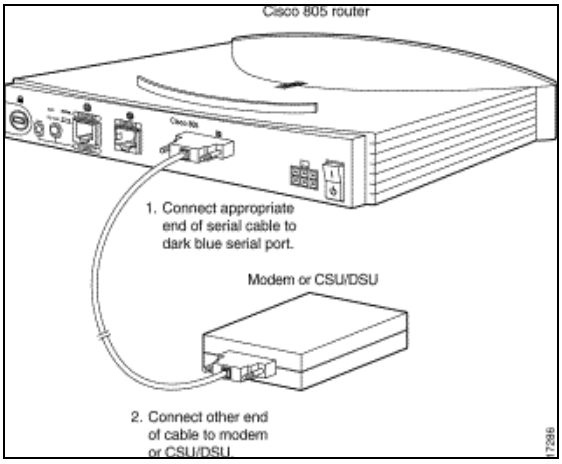


Figure 2.1.3: Connecting the Router to the Satellite Modem

Connecting the Power Supply

1. Turn the Router Off
2. Connect the power supply cable.
3. Connect the black cord to the desktop power supply.
4. Connect the other end to the black cord
5. Turn the Router On.

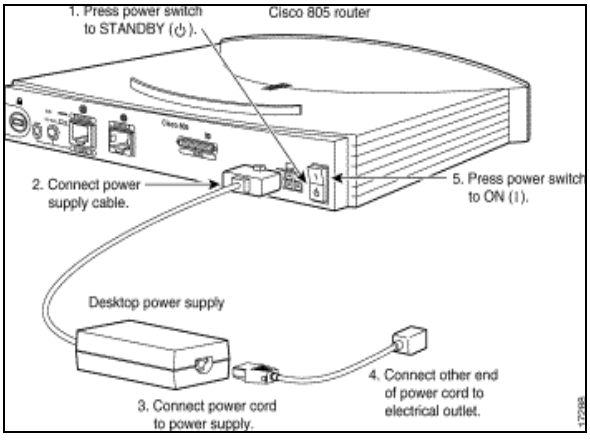


Figure 2.1.4: Connecting the Power Supply

3. CONFIGURATION

3.1 Configuration of HyperTerminal

HyperTerminal is used to communicate with the router for initial configuration, management, and diagnostics.

1. Check if the HyperTerminal Program is installed.
    a. Click Start, then Programs, then Accessories, and finally Communications. Check to see whether the HyperTerminal icon exists.
    b. If it does skip to step 2.
    c. To install, launch Windows Control Panel by clicking Start, Settings, and then Windows Control Panel. Now double click on Add/Remove Programs icon, select the Window's Setup, and then Communication group.
    d. Check the HyperTerminal Box, and click *OK*.
    e. You may be prompted for a Windows Installation CD.
2. Start HyperTerminal
    a. Click Start, then Programs, then Accessories, and finally Communications. Double click on the HyperTerminal icon.
    b. If needed provide the location information. This will only need to be done if this is the first time HyperTerminal has been run.
    c. When prompted for a connection description type Router, select any icon and click *OK*.
    d. In the following window either select COM1 or COM2. If the light blue cable is connected via COM1 choose COM1.

Figure 3.1.1: Selecting COM port for communication

e. Set the properties to the following values and click OK.

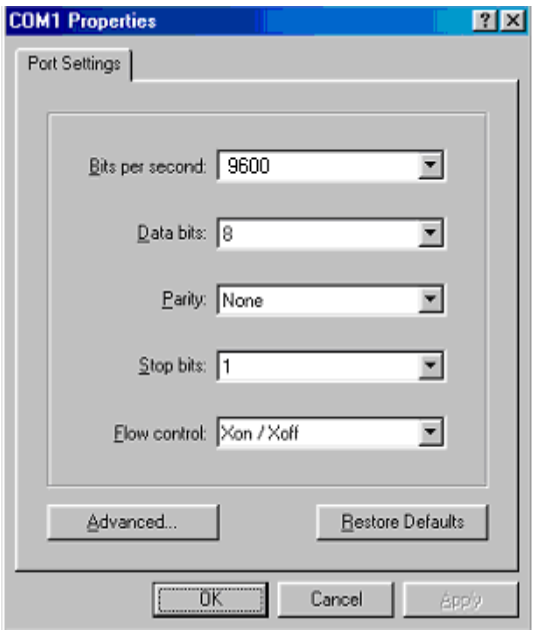


Figure 3.1.2: COM1 Properties dialog

f. Power cycle the router before continuing with configuration.

g. After the router has booted, the following prompt is displayed, answer **no.**

Would you like to enter the initial configuration dialog [yes]: no

3.2 Command Modes And Basic Commands

Command Modes. To better help you understand basic commands of the Cisco Router; we must first explain the different command modes. By examining the prompt you will be able to tell which command mode you are in.

User EXEC: When you begin a router session in HyperTerminal, you are in user EXEC mode. This mode allows you to change terminal settings, perform basic tests, and display system information.

Example:

```
Router>
```

Privileged EXEC: By typing the 'enable' command at the prompt in user EXEC mode you can enter privileged EXEC mode. To exit this mode type the 'disable' command. This mode allows you to configure the routers operating parameters, prevent unauthorized changes to your router configuration.

Example:

```
Router> enable

Router#
```

Global Configuration Mode: By typing 'configure terminal' you will be able to enter global configuration mode. To exit this mode type 'end'. This mode will allow you to configure commands that apply to the whole router.

Example:

```
Router> configure terminal

Router(config)#
```

Interface Configuration Mode: Enter this mode with the 'interface' command followed by the interface, which you would like to configure. To exit this mode type 'exit'. This mode will allow you to configure the ethernet or serial interfaces or subinterfaces.

Example:

```
Router(config)# interface ethernet 0
Router(config-if)#
```

Router Configuration Mode: Enter this mode by typing 'router rip'. To exit this mode type 'exit'. This mode will allow you to configure an IP routing protocol.

Example:

```
Router(config)# router rip
Router(config-router)#
```

Help (?) Command. The question mark is used for obtaining help.

For a list of commands available in any mode, enter a question mark.

Example:

```
Router(config)# ?
access-enable   Create a temporary access-list entry
access-profile  Apply user-profile to interface
...
```

To complete a command, enter the first few letters followed by a question mark, do not include a space.

Example:

```
Router(config)# s?
s=show set show slip systat
```

For a list of command variables, enter the command followed by a space and a question mark.

Example:

```
Router(config)# show ?
```

```
clock   Display the system clock

dialer  Dialer parameters and statistics

...
```

3.3 Network Configuration

Enabling the terminal. The router must enable the terminal, so that changes may be made. To enable the terminal type: enable. This must be done each time HyperTerminal is started.

Example:

```
Router> enable
```

When the terminal is enabled, the prompt will look like the following:

Example:

```
Router#
```

Global Parameters. You will need to use HyperTerminal to do the initial configuration of the router. Please follow the above directions on how to configure the HyperTerminal client properly.

1. Enter configuration mode by typing the following command: configure terminal.

   Example:

   ```
   Router# configure terminal
   ```

2. Specify a hostname for the router. Use MTMC prefix if the router will be installed in the Mobile TMC, and use TMC prefix if the router will be installed in the TMC.

   Example for the Mobile TMC:

   ```
   Router(config)# hostname MTMC_01
   ```

   Example for the TMC:

   ```
   Router(config)# hostname TMC_01
   ```

3. Configure the router to recognize the zero subnet range as a valid subnet range by using the following command: ip subnet zero.

   Example:

```
Router(config)# ip subnet zero
```

4. Use the 'no ip domain-lookup' command to disable router from translating unfamiliar words or typos into IP addresses.

   Example:

```
Router(config)# no ip domain-lookup
```

Ethernet Interface. You will need to use HyperTerminal to complete the ethernet interface configuration. Confirm that you are in configuration mode.

1. Enter the ethernet interface configuration mode by typing the following command: interface ethernet 0.

   Example:

```
Router(config)# interface ethernet 0
```

2. Specify an IP address and subnet mask for ethernet 0.

   Example for the Mobile TMC:

```
Router(config-if)# ip address xxx.xxx.xxx.xxx 255.255.255.0
```

   Example for the TMC:

```
Router(config-if)# ip address xxx.xxx.xxx.xxx 255.255.255.0
```

3. Enable the ethernet interface and configuration changes just made by using the 'no shutdown' command.

   Example:

```
Router(config-if)# no shutdown
```

4. Exit configuration mode for the ethernet interface by using the following command: exit.

   Example:

```
Router(config-if)# exit
```

Serial Interface. You will need to use HyperTerminal to complete the serial interface configuration. Confirm that you are in configuration mode.

1. Enter the serial interface configuration mode by typing the following command: interface serial 0.

   Example:

   ```
   Router(config)# interface serial 0
   ```

2. Specify an IP address and subnet mask for serial 0. The serial interfaces of all the routers have to be the same class A Ips.0

   Example for the Mobile TMC:

   ```
   Router(config-if)# ip address xxx.xxx.xxx.xxx 255.255.255.0
   ```

   Example for the TMC:

   ```
   Router(config-if)# ip address xxx.xxx.xxx.xxx 255.255.255.0
   ```

3. Set the encapsulation type to PPP with the 'encapsulation ppp' command.

   Example:

   ```
   Router(config-if)# encapsulation ppp
   ```

5. Enable the serial interface and configuration changes just made by using the 'no shutdown' command.

   Example:

   ```
   Router(config-if)# no shutdown
   ```

4. Exit configuration mode for the serial interface by using the following command: exit.

   Example:

   ```
   Router(config-if)# exit
   ```

Dynamic Routing. You will need to use HyperTerminal to complete the routing protocol configuration. Confirm that you are in configuration mode.

1. Enable RIP by using the following command: router rip.

Example:

```
Router(config)# router rip
```

2. Specify the version of RIP that should be used. Version 2 is used in both the Mobile TMC and TMC routers.

   Example:

   ```
   Router(config-router)# version 2
   ```

3. Specify each directly connected network. These are the networks used in the ethernet and serial interfaces.

   Example for MTMC:

   ```
   Router(config-router)# network XXX.0.0.0

   Router(config-router)# network XXX.0.0.0
   ```

   Example for TMC:

   ```
   Router(config-router)# network XXX.0.0.0

   Router(config-router)# network XXX.0.0.0
   ```

4. Disable automatic summarization of subnet routes into network-level routes.

   Example:

   ```
   Router(config-router)# no auto-summary
   ```

5. Exit configuration mode for routing by using the following command: exit.

   Example:

   ```
   Router(config-router)# exit
   ```

6. Specify the IP route for each router. This command will tell router where to send all the packets received from the ethernet interface. The following is command for ip routing: **ip route <***Class A of Ethernet network***> <***mask***> < *serial-on-other end*>**

   Example for MTMC:

   ```
   Router(config)# ip route XXX.0.0.0 255.255.255.0 XXX.XXX.XXX.XXX
   ```

   Example for TMC:

   ```
   Router(config)# ip route XXX.0.0.0 255.255.255.0 XXX.XXX.XXX.XXX
   ```

7. To exit configuration mode and return to privileged EXEC mode the command is end.

   Example:

```
Router(config-router)# exit
```

3.4 Saving Changes

Saving changes is very crucial and somewhat difficult the first time. Below are the steps needed to save configuration changes for the first time. Before beginning confirm that the HyperTerminal window is enabled, and in privileged EXEC mode.

1. Locate the boot system file name. To do this type 'show running' at the prompt.

   Example:

```
Router# show running
Building configuration...
Current configuration:
!
version 12.1
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname mtmc_805
!
boot system flash:c805-y6-mw.121-3.XG4
...
```

The image name is located on the after the colon on the above line

2. Type the following at the prompt: boot system flash:c805-y6-mw.121-3.XG4

   Example:

   ```
   Router# boot system flash:c805-y6-mw.121-3.XG4
   ```

3. Now type the command for saving the file.

   Example:

   ```
   Router# copy running-config startup-config
   ```

   The router will now ask for the image file name.

   ```
   Destination filename [startup-config]?
   ```

4. The router will now ask for the image file name. Type in the image file name.

   Example:

   ```
   Destination filename [startup-config]?
   ```

   Type in the image file name and press enter.

   ```
   Destination filename [startup-config]? c805-y6-mw.121-3.XG4
   Building configuration...
   [OK]
   ```

5. Changes have now been saved. To save changes in the future type the following and press enter.

   Example:

   ```
   Router# copy running-config startup-config

   Destination filename [startup-config]?
   ```

   There is no need to type the image name, just press enter.

   ```
   Building configuration...

   [OK]
   ```

3.5 Quality of Service

MTMC.

Creating Access Lists:

Below are the four access lists that must be created for the four devices attached to the router in the Mobile TMC. Enter global configuration mode, before continuing on. On the left is the prompt and then following the '**#**' sign is the command that must be entered to create the access list. Each command is followed by a carriage return.

```
Router(config)# access-list 101 permit udp host XXX.XXX.XXX.XXX any

Router(config-if)# access-list 102 permit udp host XXX.XXX.XXX.XXX any

Router(config-if)# access-list 103 permit udp host XXX.XXX.XXX.XXX any

Router(config)# access-list 104 permit udp host XXX.XXX.XXX.XXX any
```

Class Map Creation:

A class map must be created for each device attached to the router in the Mobile TMC. This class map then must be matched to the correct access list. Enter global configuration mode, before continuing on. On the left is the prompt and then following the '**#**' sign is the command that must be entered to create the access list. Each command is followed by a carriage return.

```
Router(config)# class-map netgator
Router(config-cmap)# match access-group 101
Router(config-cmap)# exit


Router(config-cmap)# class-map lantronix
Router(config-cmap)# match access-group 102
Router(config-cmap)# exit


Router(config)# class-map conference
Router(config-cmap)# match access-group 103
Router(config-cmap)# exit


Router(config)# class-map atms
Router(config-cmap)# match access-group 104
Router(config-cmap)# exit
```

Policy Map Creation:

A policy map is the QOS policy implemented by the router. It is possible to create multiple policies and then to just attach the appropriate policy. Note that each policy must have a different name, if this is not done then result will be an edit of policy1 and not a new policy. Here we will be creating the standard policy used when all devices are active and transmitting. Enter global configuration mode, before continuing on. On the left is the prompt and then following the '**#**' sign is the command that must be entered to create the access list. Each command is followed by a carriage return.

```
Router(config)# policy-map policy1


Router(config-pmap)# class netgator
Router(config-pmap-c)# bandwidth 22
Router(config-pmap-c)# queue-limit 30
Router(config-pmap-c)# exit


Router(config-pmap)# class lantronix
Router(config-pmap-c)# bandwidth 2
Router(config-pmap-c)# queue-limit 10
Router(config-pmap-c)# exit


Router(config-pmap)# class conference
Router(config-pmap-c)# bandwidth 22
Router(config-pmap-c)# queue-limit 30
Router(config-pmap-c)# exit


Router(config-pmap)# class atms
```

```
Router(config-pmap-c)# bandwidth 16

Router(config-pmap-c)# queue-limit 20

Router(config-pmap-c)# exit
```

Attaching A Policy Map:

This is how each policy map should be attached to the serial interface. This example shows how to attach the standard policy map once it has been created. Enter global configuration mode, before continuing on. On the left is the prompt and then following the '**#**' sign is the command that must be entered to create the access list. Each command is followed by a carriage return.

```
Router(config)# interface s0

Router(config-if)# service output policy1

Router(config-if)# exit
```

Unattaching A Policy Map:

This is how to unattach a policy1. Simply replace 'policy1' with the name of the policy map to be unattached. This command should only be used if you are replacing one policy map for another policy map. Without a policy map applications will not be limited to bandwidth, and could cause congestion on the satellite link. Enter global configuration mode, before continuing on. On the left is the prompt and then following the '**#**' sign is the command that must be entered to create the access list. Each command is followed by a carriage return.

```
Router(config)# interface s0

Router(config-if)# no service output policy1

Router(config-if)# exit
```

TMC.

Creating Access Lists:

Below are the three access lists that must be created for the three devices attached to the router in the D12 TMC. Enter global configuration mode, before continuing on. On the left is the prompt and then following the '**#**' sign is the command that must be entered to create the access list. Each command is followed by a carriage return.

```
Router(config)# access-list 101 permit udp host XXX.XXX.XXX.XXX any

Router(config-if)# access-list 102 permit udp host XXX.XXX.XXX.XXX any

Router(config)# access-list 103 permit udp host XXX.XXX.XXX.XXX any
```

Class Map Creation:

A class map must be created for each device attached to the router in the D12 TMC. This class map then must be matched to the correct access list. Enter global configuration mode, before continuing on. On the left is the prompt and then following the '**#**' sign is the command that must be entered to create the access list. Each command is followed by a carriage return.

```
Router(config)# class-map netgator

Router(config-cmap)# match access-group 101

Router(config-cmap)# exit


Router(config)# class-map conference

Router(config-cmap)# match access-group 102

Router(config-cmap)# exit


Router(config)# class-map hpux

Router(config-cmap)# match access-group 103

Router(config-cmap)# exit
```

Policy Map Creation:

A policy map is the QOS policy implemented by the router. It is possible to create multiple policies and then to just attach the appropriate policy. Note that each policy must have a different name, if this is not done then result will be an edit of policy1 and not a new policy. Here we will be creating the standard policy used when all devices are active and transmitting. Enter global configuration mode, before continuing on. On the left is the prompt and then following the '**#**' sign is the command that must be entered to create the access list. Each command is followed by a carriage return.

```
Router(config)# policy-map policy1


Router(config-pmap)# class netgator
Router(config-pmap-c)# bandwidth 28
Router(config-pmap-c)# queue-limit 30
Router(config-pmap-c)# exit


Router(config-pmap)# class conference
Router(config-pmap-c)# bandwidth 28
Router(config-pmap-c)# queue-limit 30
Router(config-pmap-c)# exit


Router(config-pmap)# class hpux
Router(config-pmap-c)# bandwidth 96
Router(config-pmap-c)# queue-limit 20
Router(config-pmap-c)# exit
```

Attaching A Policy Map:

This is how each policy map should be attached to the serial interface. This example shows how to attach the standard policy map once it has been created. Enter global configuration mode, before continuing on. On the left is the prompt and then following the '**#**' sign is the command that must be entered to create the access list. Each command is followed by a carriage return.

```
Router(config)# interface s0

Router(config-if)# service output policy1

Router(config-if)# exit
```

Unattaching a Policy Map:

This is how to unattach a policy1. Simply replace 'policy1' with the name of the policy map to be unattached. This command should only be used if you are replacing one policy map for another policy map. Without a policy map applications will not be limited to bandwidth, and could cause congestion on the satellite link. Enter global configuration mode, before continuing on. On the left is the prompt and then following the '**#**' sign is the command that must be entered to create the access list. Each command is followed by a carriage return.

```
Router(config)# interface s0

Router(config-if)# no service output policy1

Router(config-if)# exit
```

4. TROUBLESHOOTING

4.1 Serial Interface is Changing State From Up to Down Continuously.

Confirm that the serial cables securely tightened on each side. If the interface is still changing state confirm that the satellite link is operational, refer to Appendix A1, Satellite System, for further assistance.

4.2 Received Video Transmission is a Black Screen.

This is the result of bandwidth congestion. A new policy map could be created or the one in use could be edited, on the router on the compression side, to allow for more bandwidth for compressed video, or the stream parameters could be reset within the NetGator to be within QOS

bandwidth limits. Refer to Appendix B1, NetGator, for assistance on resetting the NetGator. Refer to section 3.5 of this document on configuring QOS and creating policy maps.

5. SUPPLEMENTARY INFORMATION

5.1 Contact Information

Cisco Systems

Technical Support Representative
Phone: 800.553.24447
Email: tac@cisco.com

5.2 Product Information

Cisco Systems 805 Router

Manufacturer Part #:
Vendor Part #: 209473

APPENDIX B
Baxall Codecs

APPENDIX C
Video Surveillance System

APPENDIX D
Video Conferencing System

Appendix D

NetMeeting PC

1. SYSTEM DESCRIPTION

The video conferencing equipment will allow individuals from the MTMC and the TMC to conference via a video and audio connection. The software used to achieve this goal will also allow users to share files, chat, and share diagrams during the video conferencing.

2. INSTALLATION

2.1 Physical Installation

Creative Labs 512 PCI Sound Card

1. Turn off your computer; touch a part of the metal chassis to discharge static electricity. Disconnect the power cord from the computer.
2. Disconnect the peripheral devices that are connected to the computer.
3. Remove the computer cover.
4. Locate a free expansion slot for the audio card. If the mounting bracket is covered with a metal plate, remove it and save the mounting screw. If your computer has an old audio card then remove it and save the screw, this will be the expansion slot where you will install the new card.
5. Align the audio card with the PCI slot and press it into the slot.
6. Secure the audio card to the chassis of the computer with the screw removed from the metal plate.
7. Replace the cover, and reconnect the power cord.

Speakers and Microphone

1. Remove the speakers and the microphone from all packaging.
2. Connect both jacks from the Speakers to the sound card. Connect the green jack to the line out jack/ spk out jack. Connect the pink jack to the mic. jack.
3. Connect the jack from the microphone to the pink jack on the front of the right speaker.
4. Plug the speakers into an electrical outlet.

2.2 Setup and Configuration

Creative Labs 512 PCI Sound Card Drivers

1. Turn on your computer. Windows will automatically detect the new hardware.
2. You will be prompted for drivers. Click the cancel button.
3. Insert the Sound Blaster Installation CD into your CD-ROM drive. The installation CD will start running automatically. If the it doesn't then double-click the My Computer icon on your desktop, right-click your CD-ROM drive icon, and click on AutoPlay to start the installation.
4. Follow the instructions on the screen to complete installation.

3Com HomeConnect PC Digital WebCam

1. Insert the Video Connections CD into the CD-ROM drive to run the 3Com Install Assistant.
2. The program should start automatically. If the it doesn't then double-click the My Computer icon on your desktop, right-click your CD-ROM drive icon, and click on AutoPlay to start the installation.
3. Click OK to start installation. If the program shuts down then one of the following criteria have not been met:
    a. Your display must be set to 16 bit color.
    b. You must be running Win 95, Win 98, or Win 2000.
4. Once the installation has finished you will be prompted to click OK to shutdown the computer. Click OK, but leave the CD in the CD-ROM drive.
5. Plug the USB cable into the camera and into the computer's USB port.
6. Turn on the computer.
7. On startup a program will launch to verify that the drivers and the hardware are installed correctly.
8. Next follow the directions to install 3Com's Home Connect software.

3. TROUBLESHOOTING

3.1 Can't Connect To Other Person.

Be sure that other person is ready to receive your call. If they do not accept your call in time it will not start the call. If the problem still persists confirm that the satellite link is operational, refer to Appendix A1, Satellite System, for further details.

3.2 Can't Hear Other Person.

Confirm that computer speakers are operational and connect correctly. Have the other person confirm that there microphone is operational and correctly installed.

3.3 See Other Person.

Confirm that NetMeeting is set to receive video. Click on **`Tools`** and then **`Options`**. If problem still persists have the other person confirm that their webcam is installed correctly, by clicking **`View`**, and then **`My Video`**.

4. SUPPLEMENTARY INFORMATION

4.1 Contact Information

3Com

Technical Support Representative
Phone: 800.638.3266

CDW Government.com

Palmer Pierson
Sales Representative
Phone: 800.808.4239 ext.53383
Fax: 312.705.8683

Labtec

Technical Support Representative
Phone: 702.269.3612

Sales Representative
Phone: 800.732.3053

4.2 Product Information

3Com HomeConnect WebCam

Manufacturer Part #: 003718-00

Labtec Spin 70 Speakers

Manufacturer Part #: LCS-1070
CDWG Part #: 209473

APPENDIX E
Remote ATMS Display using VNC

APPENDIX F1
RTMS Vehicle Detection System

Appendix F

RTMS Notes

1. RTMS Notes (Remote Traffic Microwave System)

The input file is currently wired for up to three two-channel loop emulation cards. The loop emulation cards are currently unnecessary except that they provide surge protection and isolation equivalent to a type 222 Isolator card. RTMS setup software is currently installed on the Video Conferencing PC and a serial cable is connected from that PC to the RTMS. To configure the RTMS, execute the RTMS program from the desktop. From this application, the user may configure all parameters of the RTMS pursuant to the RTMS user manual.

2. RTMS-IFILE Conections

Contact Pair #	RTMS MS	Wire Number	I-File Connection	Mainline Loop#
1	A	1 Red	I8-4	1
	B	1 Black	I8-5	
2	C	2 Red	I8-6	2
	D	2 Black	I8-7	
3	E	3 Red	I7-4	3
	F	3 Black	I7-5	
4	G	4 Red	I7-6	4
	H	4 Black	I7-7	
5	J	5 Red	I6-4	5
	K	5 Black	I6-5	
6	L	6 Red	I6-6	6
	M	6 Black	I6-7	
7	N	7 Red		
	P	7 Black		
8	R	8 Red		
	S	8 Black		

Appendix F

RTMS Notes

Descr	RTMS MS	Cable No.	I-File loc.	DB-9 Conn.
+12 VDC	F	12 (both)	T15-1	
Ground	G	13 (both)	T15-2	
Serial TX	V	10 Red		2
TX Gnd.	U	10 Black		5
Serial RX	T	11 Red		3
RX Gnd.	W	11 Black		5

APPENDIX F2
DTS 170 Controller

APPENDIX G1
Lantronix UDS-10

APPENDIX G2
Lantronix MSS-100

CAL POLY

MSS Source Code

```
// FEP Communications interface
// to Wireless 170-E Controllers
//
// Platform:  Lantronix MSS-100
//
// Author:  Ben Hawkinson
//          Advanced Technology Labs
//          California Polytechnic State University
//          San Luis Obispo, California
//
// Date:  January 2002
//
// MSS_fepV5a.c
//

// The Port number that will accept UDS TCP/IP connections from
// 170 Controllers
#define      SOCK_IK 8000

// The maximum number of clients that can connect to the system.
#define CLIENTS_MAX 10

// Default buffer size
#define BUFSIZE 200


#include “unp.h”

// automatically include needed c files in PUC
#ifndef NO_PUC
#include “wrapper.c”
#endif

// A ControllerIF object contains all the information neede for managing a
// single field controller connection.  The components of the object are as
// follows:
//
// int id:       The file descriptor associated with the active so ocket that
//               active controller is connected to.  If there is currently no
//               connected controller, the fd variable is set to -1.
// int id:       The id that is hardwired into the C1 connector on the
//               controller this struct manages.  This ID will be extracted
//               from a response from the controller.
// char buffer: The buffer for storing responses from a field controller.
// int size:     The count of the total number of bytes currently stored in
//               the buffer array.
// int msgSize: The size of the first complete message (poll response)
//               contained in the buffer.  If no complete mesages exist,
//               this will be set to 0.
```

```
typedef struct ctrlrBuffer {
   int  fd;
   int  id;
   char buffer[BUFSIZE];
   int  size;
   int  msgSize;
} ControllerIF;

// The FepIF object contains all the information needed for management of the
// FEP connection via the serial port.  The components of the object are as
// follows:
//
// int fd:       The file descriptor associated with reading and writing to the
//               serial port.
// char buffer: The buffer for storing incoming polls to be parsed and
//               delivered to controllers.
// int size:     The count of the total number of bytes currently stored in the
//               buffer array.
// int msgSize: The size of the first complete message (poll) contained in the
//               serial input buffer.  If no complete message exists, this will
//               be set to zero.
typedef struct serialBuffer {
   int fd;
   char buffer[BUFSIZE];
   int size;
   int msgSize;
} FepIF;

// The ctrlrs array contains one ControllerIF object for each field
controller,
// whether connected or not.  As remote controllers initiate connections to
the
// MSS-100, the structs in ctrlrs will be assigned to connections.
ControllerIF ctrlrs[CLIENTS_MAX];
FepIF fep;

int main()
{
   int  listenfd, conntmpfd, serialoutfd;
   socklen_t  clilen;
   SA_in      cliaddr, servaddr;
   char       recvBuf[BUFSIZE];
   int        sendLen, recLen, ndx, msgSize, pollID, totWrote;
   uint       curCtrlr=0;

   // Create a socket that will listen for incoming connections from field
   // controllers.  The file descriptor associated with the listening socket
   // will be assigned to listenfd.  This socket is bound to port SOCK_IK.
   listenfd = Socket(AF_INET, SOCK_STREAM, 0);
   bzero(&servaddr, sizeof(servaddr));
   servaddr.sin_family      = AF_INET;
   servaddr.sin_addr.s_addr = htonl(INADDR_ANY);
   servaddr.sin_port        = htons(SOCK_IK);
   Bind(listenfd, (SA *) &servaddr, sizeof(servaddr));
   Listen(listenfd, LISTENQ);
   clilen = sizeof(cliaddr);
```

```
// This command causes calls to accept() to be nonblocking
fcntl(listenfd, F_SETFL, O_NONBLOCK);
printf("listening on port %d\n\r", SOCK_IK);

// Set up the serial port, and making int nonblocking.
fep.fd = Open("tt0:", O_RDWR, 0);
fcntl(fep.fd, F_SETFL, O_NONBLOCK);

// Initialize all elements.  (unallocated fd's are -1)
fep.size = 0;
for (ndx=0; ndx<CLIENTS_MAX; ndx++) {
   ctrlrs[ndx].fd = -1;
   ctrlrs[ndx].size = 0;
   ctrlrs[ndx].msgSize = 0;
}

//  This is the main polling loop.  Each iteration of this loop services
//  one object in the ctrlrs array (one controller connection) and the
//  serial port
while (1) {
   // First, look for new controllers using the nonblocking accept.
   // If the accept returns a nonnegative value, a connection has been
   // established and we will assign that file descriptor to the first
   // availiable Controller in the ctrlrs array.
   if ((conntmpfd = accept(listenfd, &cliaddr, &clilen)) >= 0) {
      for (ndx = 0; ndx < CLIENTS_MAX; ++ndx) {
         if (ctrlrs[ndx].fd == -1) {
            ctrlrs[ndx].fd = conntmpfd;
            ctrlrs[ndx].size = 0;
            ctrlrs[ndx].msgSize = 0;
            // ensure that the newly connected socket is nonblocking.
            fcntl(conntmpfd, F_SETFL, O_NONBLOCK);
           break;
         }
      }
      // In the event that no clients were free in the ctrlrs array,
      // the connection must be closed.
      if (ndx >= CLIENTS_MAX) {
          printf("\nWarning: maximum client limit reached.\n\r");
         close(conntmpfd);
      }
   }
   // If there are no pending connections, but all else is still ok,
   // an EWOULDBLOCK error is produced.  If this error is not produced,
   // a more serious error has occured.
   else if (errno != EWOULDBLOCK)
      printf("\nWarning: accept error (%d)\n\r", errno);

   // Now we will service a controller.  If the fd field contains a
   // nonnegative integer, we will see if any new data has been rec'd
   // from that controller.  If so we will place it at the end of the
   // buffer and increment its size.
   if (ctrlrs[curCtrlr].fd > -1) {
      if ((recLen = recv(ctrlrs[curCtrlr].fd, recvBuf,
       BUFSIZE - ctrlrs[curCtrlr].size, 0)) > 0) {
          memcpy(ctrlrs[curCtrlr].buffer+ctrlrs[curCtrlr].size,
          recvBuf, recLen);
         ctrlrs[curCtrlr].size += recLen;
```

```
            // Here we look for the start of a message from a controller.
            // Responses from 170-E controllers are prefixed with hex 0D:0A
            // If we find a 0D:0A, we can assume that we are at the start
            // of a message.  If the initial characters are not 0D:0A, we
            // will repeatedly remove the initial character until those
           // are found.
            while (ctrlrs[curCtrlr].size > 2) {
               if (ctrlrs[curCtrlr].buffer[0] == 0x0D &&
                ctrlrs[curCtrlr].buffer[1] == 0x0A)
                  break;
               ctrlrs[curCtrlr].size—;
                memcpy(ctrlrs[curCtrlr].buffer, ctrlrs[curCtrlr].buffer+1,
                ctrlrs[curCtrlr].size);
            }
            msgSize = 0;
            // The fourth byte in a response contains the number of bytes
            // from that point to the checksum.  There are an additional
            // three bytes before tha tnumber and three after the checksum
            // that must be accounted for.  In this step, we check to see
            // if we have receieved a complete response.
            if (ctrlrs[curCtrlr].size > 3)
               if ((msgSize = ctrlrs[curCtrlr].buffer[3]+6) <=
                ctrlrs[curCtrlr].size) {
                  ctrlrs[curCtrlr].msgSize = msgSize;
                  ctrlrs[curCtrlr].id = ctrlrs[curCtrlr].buffer[2];
               }

            // If our input buffer is getting too large, purge the data here
            if ((msgSize == 0) && (ctrlrs[curCtrlr].size >= BUFSIZE-10)) {
               ctrlrs[curCtrlr].size;
               ctrlrs[curCtrlr].msgSize = 0;
               ctrlrs[curCtrlr].id = 0;
            }
         }
         // If the receive returns a negative number, that indicates a
         // possible bad connection, so we will go ahead and close the
         // socket and free up the Controller in the ctrlrs array.
         else if (recLen < 0) {
            close(ctrlrs[curCtrlr].fd);
            ctrlrs[curCtrlr].fd = -1;
            ctrlrs[curCtrlr].size=0;
            ctrlrs[curCtrlr].id = 0;
            ctrlrs[curCtrlr].msgSize = 0;
         }
      }
      // This increments the curCtrlr, so that next time through we
      // check the next controller.
      curCtrlr = ((++curCtrlr) % CLIENTS_MAX);

      // Now we check the serial line for input.  Any data is added to
      // the end of the FEP buffer.
      if ((recLen = read(fep.fd, recvBuf, BUFSIZE - fep.size)) > 0) {
         memcpy(fep.buffer+fep.size, recvBuf, recLen);
         fep.size += recLen;
```

```
      // Now we will do a check for the beginning of a FEP message.
      // These messages always start with 20:20:0D:0A, so we will
      // repeatedly discard the first character in the buffer until
      // the array starts with those characters.
      while (fep.size > 4) {
         if (fep.buffer[0] == 0x20 && fep.buffer[1] == 0x20 &&
          fep.buffer[2] == 0x0D && fep.buffer[3] == 0x0A)
            break;
         fep.size—;
         memcpy(fep.buffer, fep.buffer+1, fep.size);
      }
   }
   // A serial receive resulting in a negative value indicates an error.
   else if (recLen < 0)
      printf(“\nError: serial read error\n\r”);

   // Here we will check to see if any complete polls are ready.  The
   // sixth byte contains the number of bytes to the checksum, and an
   // additional 6 bytes must be added.  If the message in the buffer
   // (which always starts a message) exceeds this length, then a full
   // poll (or timestamp) is ready.
   if ((msgSize = fep.buffer[5]+6) <= fep.size) {
      // Extract the id of the controller from the poll.
      pollID = fep.buffer[4];

      // Here we will examine our list of clients.  If one can be found
      // that has a complete message and whose ID matches the currently
      // polled ID, we will write that response backto the FEP via the
      // serial.
      for (ndx = 0; ndx < CLIENTS_MAX; ndx++) {
         if (ctrlrs[ndx].msgSize && ctrlrs[ndx].id == pollID) {
            totWrote = 0;
            // This loop ensures that all data has been successfully
            // sent to the FEP, before continuing.  (Since writes are
            // also non-bloking)
            while (totWrote < ctrlrs[ndx].msgSize) {
               if ((sendLen = write(fep.fd, ctrlrs[ndx].buffer+totWrote,
                ctrlrs[ndx].msgSize-totWrote)) <= 0) {
                  printf(“\nWarning: send error (%d)\n\r”, errno);
                  break;
               }
               if(sendLen > 0) {
                  totWrote += sendLen;
               }
            }

            // Remove the just sent message from the ctrlrs array.
            memcpy(ctrlrs[ndx].buffer, ctrlrs[ndx].buffer+sendLen,
             ctrlrs[ndx].size-sendLen);
            ctrlrs[ndx].size -= sendLen;
            ctrlrs[ndx].msgSize = 0;
            break;
         }
      }
```

```
            // Now we send the poll from the fep to all controllers
            // with active connections.
            for (ndx = 0; ndx < CLIENTS_MAX; ndx++) {
               if (ctrlrs[ndx].fd > -1) {
                   sendLen = send(ctrlrs[ndx].fd, fep.buffer, msgSize, 0);
                  if (sendLen < 0)
                      printf("\nWarning: send error (%d)\n\r", errno);
               }
            }
            // Here remove the message from the serial input buffer.
             memcpy(fep.buffer, fep.buffer+msgSize, fep.size-msgSize);
            fep.size -= msgSize;
            fep.msgSize=0;
            }
      }  // End of main loop

      // Clean up. Shouldn't get here.
      printf("\nWarning: shutdown\n\r");
      for(ndx=0; ndx < CLIENTS_MAX; ndx++)
         if(ctrlrs[ndx].fd > -1) {
             sprintf(recvBuf, "MSS: server closed down\n\r");
             send(ctrlrs[ndx].fd, recvBuf, strlen(recvBuf), 0);
            close(ctrlrs[ndx].fd);
         }
      close(listenfd);
      close(fep.fd);
      return 0;
   }
```

APPENDIX H
FOT Solar System

APPENDIX I
Onan 5.5kW Diesel Generator

Appendix I

AC Electrical System

1. ONAN GENERATOR TROUBLESHOOTING

The generator is expected to work efficiently without any problems under normal operating conditions. However in case of any faults in the system, the genset controller will provide a diagnostic status by blinking the light in the Controller Switch in a coded fashion. If a 3 blink default code shows momentarily press STOP to bring up a second level fault code. This code consists of double-digit code with the first blink ranging from 1 to 4 and after a brief pause the second blink will range from 1 to 9. For example if it blinks [blink-blink –pause- blink-blink-blink] means an oil pressure fault. Malfunctioning can be due to improper maintenance and use. The following table outlines the common malfunctioning problems and corrective solutions to be taken; it also includes the blinking codes that will be indicated by the controller:

MAINTANCE OPERATION	***Maintenance Frequency***						
	EVERY DAY	AFTER FIRST 50 HRS	EVERY MONTH	EVERY 150 HRS	EVERY 250 HRS	EVERY 500 HRS	EVERY 1000 HRS
General Inspection	✓						
Check Engine Oil	✓						
Check Engine Coolant level	✓						
Clean and check battery			✓[2]				
Check spark arrestor				✓[3]			
Change engine oil and oil filter		✓			✓[1,2,3]		
Replace engine air filter						✓[1,3]	
Check coolant anti-freeze protection						✓[3]	

Flush coolant system						✓[3]	
Replace coolant system							✓[4]
Replace coolant Pressure Cap							✓[4]
Replace Engine V-belt							✓[5,6]
Clean Crankcase Breather							✓[5,6]
Replace coolant hoses and thermostat							✓[5,6]
Adjust Engine Valve lash							✓[5,6]
Service fuel injectors							✓[5,6]

1. Perform more often when operating in dusty conditions
2. Perform more often when operating in hot weather
3. Perform at least once a year
4. Perform at least once every two years
5. Perform at least once every five years
6. Must be performed by a qualified mechanic.

Table 1.1: Maintenance Schedule

Code #	Fault indicated / Description	Corrective Action To Follow
1	High Temperature Engine coolant exceeded 230°F	Check the engine coolant and add coolant as necessary.
		Check for and remove any objects blocking the air inlet and outlet openings in the bottom of the genset.
		Watch the temperature gauge (optional) and run fewer appliances at the same time to keep down the engine temperature)
2	Low Oil Pressure (The low oil pressure cutoff switch closed for more than 10 seconds)	Check the engine oil level and add oil as necessary.
		Drain the excess oil if the oil level is above the Full mark on the dipstick (The oil will foam if the level is too high and result in loss of oil pressure).
3	Service Check (A second level fault occurred)	Check the second level fault code by momentarily pressing STOP. The following faults in this table pertain to second level faults.
12	Overvolatege (Controller not able to regulate the rated voltage)	See authorized Onan dealer
13	Undervolatege (Controller not able to regulate the rated voltage)	Turn off the line circuit breaker on the operator's console
14	Overfrequency (Controller not able to regulate the rated frequency)	Prime the engine fuel system by holding the control switch at STOP for I minute.
		Check for a tripped genset circuit breaker, reset if necessary, and run with fewer connected loads.
15	Undefrequency (Controller not able to regulate the rated frequency)	Turn off the line circuit breaker on the operator's console. If the genset now runs, run it with fewer loads.

		Prime the engine fuel system by holding the control switch at STOP for I minute (There might be air in the fuel system).
21	Starter Solenoid Circuit Protection (The controller sensed a starter control circuit short)	See an authorized Onan dealer.
22	Governor Actuator Overload (The duration of operation at or near full-duty cycle was beyond the design limit)	Reduce the number of appliances running at the same time.
		Replace the engine air filter and clean the spark arrest muffler.
23	Low Oil Pressure Cutoff Switch (The controller sensed a defective switch)	See authorized Onan dealer
24	Coolant temperature Sender (The controller sensed a defective sender)	See authorized Onan dealer
27	Quadrature Sense (The controller was unable to sense the required parameter)	See authorized Onan dealer
28	AC Output Sense (The controller was unable to sense the required parameter)	See authorized Onan dealer
29	High Battery Voltage (The controller sensed battery system voltage greater than 19 volts)	Check the battery bank connections and reconnect if necessary so that the 12-volt batteries serving the genset are connected in parallel (12 volt) rather than in series (24 volt).
35	Control Card (There was a memory error in the microprocessor during self-test)	See authorized Onan dealer

36	Engine Stopped (the genset stopped without a command from the controller)	Check the fuel level and refill as necessary.
		Prime the engine fuel system by holding the control switch at STOP for I minute
		Check the engine air filter and remove any blockage.
		Check for mechanical damage.
		Check for fuel (air) leaks at all fuel fittings and tighten as necessary
		Replace the fuel filter.
37	Invalid Genset Configuration (There was a memory error in the microprocessor during self-test)	See authorized Onan dealer
38	Field Overcurrent (Too many low-power-factor-causing loads were connected).	Reduce the number of air conditioners running at the same time and other appliances that cause low power factor).
		Have the air conditioners and other appliances checked for proper operation (A locked compressor rotor can cause a very low power factor).
45	Speed Sense (The controller failed to sense quadrature frequency and voltage during cranking).	See authorized Onan dealer

Table 1.2: Troubleshooting and Corrective Action To Follow

Appendix I

AC Electrical System

The next table indicates possible problems in operation that are not outlined in the previous table and do not have a code for the controller to display:

Fault Experienced / Description	**Corrective Action To Follow**
The Status Indicator Light Is Dead (There is no response in the control switch.)	Try starting the genset at the operator's console if it does not start at the remote panel.
	Check whether FUSE F1 is blown. If it is, first check the battery connections for proper polarity: battery positive (+) to genset positive (+) and battery negative (-) to genset negative (-). If necessary, reconnect the battery cables properly and replace the fuse. (The control circuit is designed so that the fuse will blow if battery polarity is wrong.)
	Clean and tighten the positive (+) and negative (-) battery cable connections at the battery and at the genset.
	Recharge or replace the battery. Refer to the battery manufacture's recommendations.
The Starting Batteries Do Not maintain A Charge (The battery, battery connectors or charging system are in marginal condition.)	Clean and tighten the positive (+) and negative (-) battery cable connections at the battery and at the genset.
	Recharge or replace the battery. Refer to the battery manufacture's recommendations.
The Engine Cranks But It Does Not Start (Fuel delivery is marginal)	Check the fuel level and refill as necessary.
	Prime the engine fuel system by holding the control switch at STOP for one minute.
	Check the engine air filter and remove any blockage.
	Check for fuel (air) leaks at all fuel fittings and tighten as necessary.
	Replace the fuel filter.
The Starter Engages And Disengages (Cranking voltage dips	Have the vehicle propulsion engine running while trying to start the genset. The battery-charging alternator may be able to maintain starting voltage high enough to get the genset started.

below 6 volts because of low battery charge or poor connections.)	Clean and tighten the positive (+) and negative (-) battery cable connections at the battery and at the genset.
	Recharge or replace the battery. Refer to the battery manufacture's recommendations.
There Is No Power When The Genset Is Running (Aline circuit breaker is OFF, tripped or malfunctioning.)	Reset or turn ON the line circuit breaker on the genset. Refer to Manual in Appendix.
	Reset or turn ON any other circuit breaker in the power supply system.
The Genset Will Not Stop Running (The Run Light Is OFF) (The governor mechanism is stuck or binding.)	See an authorized Onan dealer.

Table 1.3: Troubleshooting and Corrective Action to Follow (uncoded problems)

APPENDIX J
Pneumatic Mast System

Appendix J

Pneumatic System

1. SYSTEM DESCRIPTION

The MTMC is equipped with a Will-Burt 6-27 pneumatic mast. The mast is used to elevate the surveillance camera and the RTMS traffic counter. The system consists of a DeVilbis FA23 air compressor. This device regulates the pressure applied to the mast, and adds a small amount of vaporized oil, which eliminates the need for regular mast lubrication. The air then flows into a three way valve, the system control, which allows the mast to be raised, set in position or lowered.

2. INSTALLATION

2.1 Physical Installation

The mast was installed in the bathroom of the MTMC as per manufacturer's instructions. See appendix N1. The rest of the system components were bolted either to the floor or to the wall of the bathroom in the vicinity of the mast. The air compressor is supplied power by a 15amp breaker that it shares with the water heater.

2.2 Setup and Configuration

Before attempting to raise the mast two things need to be done. The regulator on the compressor should be set no higher than 30 psi, and the other regulator should be set to 20 psi. The oilier should be filled and the adjustment screw for oil disbursement set approximately in the middle of its adjustment.

3. TROUBLESHOOTING

SYMPTOM	*Problem*	SOLUTION
Excess tank pressure-safety valve pops off	Pressure switch does not shut off when compressor reaches cut out pressure	Move the pressure switch to the "Off" position. If this does not work immediately unplug and have switch replaced
	Pressure "cut off " too high	Contact authorized dealer.
Air Leaks at fittings	Tube fittings are not tight enough	Tighten fittings where air can be heard escaping Check with soapy water.
Air leaks at or inside check valve	Defective or dirty check valve	Remove and clean or replace check valve.
Air leaks in air or at air tank welds.	Defective air tank	Air tank must be replaced. Contact authorized dealer

Pressure reading on gauge drops when the mast is used	This behavior is normal	If the drop is too sharp, refer to the previous section to adjust pressure
Air leak from safety valve	Possible defective safety valve	Operate valve manually by pulling on ring. If it still leaks it must be replaced
Knocking noise	Defective check valve	Remove & clean or replace
Compressor does not supply enough air to operate mast	Hole in hose	Check and/or replace
	Check valve restricted	Remove & clean or replace
	Air leaks	Tighten fittings
	Tank pressure exceeds pressure switch cut-in pressure	Motor will start automatically when pressure drops below cut-in pressure
	Check valve stuck open	Remove & clean or replace
Motor will not run	Loose electrical connections	Check wiring connection inside pressure switch and terminal box area
	Possible defective motor	See warranty and contact authorized dealer
	Tripped circuit breaker	❑ Check for low voltage conditions ❑ Check circuit breaker

Table 3.1.1 Trouble Shooting Compressor

SYMPTON	PROBLEM	SOLUTION
Hissing of Air	Air Leak before 3-way valve	Continue to use mast, have pneumatic system serviced soon
	Air leak after 3-way valve	Discontinue use of mast until it has been serviced
Mast won't extend	No air pressure	Check compressor
	Regulator not adjusted	Set regulator to 20 psi max
	Mast seized	See mast documentation for repair instructions or a list of service centers
Mast raising is "jerky" (Mast movement is never "smooth", this means really "jerky")	Mast is not properly lubed	Add oil to regulator, see pneumatic system maintenance
	Mast is faulty or worn	Mast needs to be rebuilt, see mast documentation for instructions or a list of service centers
Mast won't retract	Drain on 3-way valve clogged	Open drain valve at base of mast
	Sticky seal	1. Carefully, from the roof of the vehicle, smack mast with the palm of your hand. 2. If this doesn't work, carefully and with limited vigor, shake mast. (be aware if mast begins to retract)

Table 5.2: Troubleshooting Pneumatic System

APPENDIX K
Vehicle Leveling System

Appendix K

Vehicle Leveling System

1. SYSTEM DESCRIPTION

The MTMC is equipped with an HWH 210 series leveling system. The system consists of 4 hydraulic jacks under the vehicle. Each jack has a rated capacity of 8000 lbs. The jacks are supplied compressed hydraulic fluid by a 12vdc compressor located under the vehicle just behind the main front entry door. A joystick style control unit mounted between the driver's seat and the front wall of the bathroom controls the leveling system.

2. INSTALLATION

2.1 Physical Installation

Villa Automotive of San Luis Obispo, a reputable RV repair facility, performed the physical installation of this system.

3. TROUBLESHOOTING

SYMPTON	PROBLEM	SOLUTION
Jack retracts after coach is level	Hose or jack has external leak.	Have leveling system professionally serviced.
	Fluid is leaking back through control valve	
Leveling Jacks will not retract completely	Jack clogged with mud or ice	1. Clean jacks 2. Attempt to straighten line 3. Have leveling system professionally serviced
	Hydraulic line pinched	
	Actuator rod bent or scored	
	Main rod bent or scored	
	Valve plunger not completely Depressed by valve handle	
	Springs weak or broken	
Unit is extended but not vertical	System error	1. Move the store lever to the "Store" position and wait two minutes. Be sure jack is fully retracted, then try again. 2. Have leveling system
	Roller assembly missing or frozen	
	Actuator rod bent	

	Actuator not functioning properly	professionally serviced
Ignition switch is on, but no power to pump and/or control board	Parking brake not set	1. Set parking brake 2. Have leveling system professionally serviced
	12vDC from engine 12v system not present	
	Faulty PC board	
	Faulty wire or electrical connection	
Pump will not activate	Ground switch on valve not working	Have leveling system professionally serviced
	Pump relay not functioning	
	Pump not grounded	
Hydraulic Pump activates without use of control valve handles	Ground switch at valve shorted	Have leveling system professionally serviced
	Pump relay stuck	
	Relay control wire shorted to ground	
Hydraulic pump activates, but jacks will not extend	Store levers not in the operate position	Move levers to operate position
	Oil supply low in reservoir	Fill oil reservoir, see appendix for specification on oil
	Pump is not developing pressure	Have leveling system professionally serviced
	Broken Hydraulic line	Have leveling system professionally serviced
Leveling lights(yellow) not functioning properly	Yellow lights will not go out when vehicle is level	Adjust sensing unit. See appendix for instructions
	Two or more lights remain on	Have leveling system professionally serviced

Warning lights (red) not functioning properly	Lights will not come on	Check for broken wire at warning switch on jack
	Lights will not go out	Bad warning switch or wires shorted to ground
	PC board faulty	Have leveling system professionally serviced

Table 3.1.1: Troubleshooting Hydraulic Leveling system

APPENDIX L
Vehicle Factory HVAC System

APPENDIX M
Vehicle Water System

Appendix M1

Water System

1. SYSTEM DESCRIPTION

The MTMC is equipped with a water system including a fresh water tank, grey water tank, and a black water tank. The fresh water tank is used to supply hot and cold water to the sink. The grey water tank is filled with the drain water from the sink. The black water tank is filled with the waste water from the toilet. The system can be run with water stored in the onboard storage tank (located on the driver side rear of the vehicle) or with a pressurized connection. Both connections are located on the driver side of the vehicle. Water from the pressurized connection is delivered straight into the system. Pressure for the water from the tank is delivered and maintained by a SHURflo filter, pump and accumulator.

2. INSTALLATION

2.1 Physical Installation

The freshwater tank is held to the vehicle with metal straps. All of the plumbing is done with potable rated PVC pipe and cement. The pump, filter and accumulator are located under the rear countertop, on the wall on the right. Power for the pump comes from one of the 12vdc power supplies.

3. TROUBLESHOOTING

SYMPTON	**PROBLEM**	**SOLUTION**
No Water Flows	No Water in Tank	Fill Tank
	Water Pump not operating	Fill Tank
	No power to pump	Check power to pump, switch, DC converter
	Pump non-operational	Have pump replaced
	System clogged	Have clog removed by professional
	Valves not open	Open valves, see water system diagram
	Broken connection	Drain tank, kill power to pump, have system serviced
Bad/Fluctuating Water	Low Tank Level	Fill Tank

Water System

Pressure	Bad "City connection"	Use city connection to fill tank, run system with pump
	System clogged	Have clog removed by professional
	filter/pump/accumulator problem	Perform filter/pump/accumulator maintenance
	No/fluctuating power to pump	If AC power is ok in the rest of the van, have the DC converter serviced
No Hot Water	Broken water heater	Have hot water heater replaced
	Valve not open	Open valve, see water system diagram
	No power to water heater	Check breaker panel, and outlet
Poor Water Color	Dirty water in hot water heater	Purge water heater, see water system operating instructions
	Dirty filter	Clean filter, see water system maintenance instructions
	Dirty water in tank	Drain tank through valve in back, refill, repeat if necessary
Pools of water in vehicle	Water heater failure	Remove power to pump, drain tank, prepare to mop up a lot of water
	Broken pipe/connection *Remove power to pump, drain tank, have system serviced	

Sink Drains Poorly	Clogged drain	Check trap under sink, if trap is clogged have system professionally serviced
	Gray water tank is full	Empty tank, see water system operating instructions
Toilet won't flush	Poor water pressure	See above
	Full black water tank	Empty tank
	Toilet needs maintenance	Have toilet serviced
Unpleasant Smell	Full tanks	Empty tanks, see water system operating instructions
	Chemicals	Add chemicals, see water system operating instructions
	Vent disconnected	Check vent in bathroom, if disconnected, open vent windows in bathroom, close bathroom door, empty black water tank ASAP, have serviced
	Remnants in tank	Add tank chemicals and water, empty tank
	Clog	Have professionally serviced
Tanks won't drain	Broken valves	Have professionally serviced
	Clog	Have professionally serviced
	Insufficient water in Black water tank	Add water by flushing toilet 4-6 times
Excessive water use without cause	Exterior leak	You may continue to use water, but your supply is limited

	Interior leak	Turn off pump, drain fresh water tank

Table 3.1.1: Troubleshooting Water System

APPENDIX N
Passwords and IP Addresses

Appendix N

IP ADDRESSES AND PASSWORDS

1. SYSTEM DESCRIPTION

In this document is all the supplemental information related to devices in the Mobile TMC to TMC Wide Area Data Communications Link.

1. MOBILE TMC

1.1 Cisco Router

Ethernet IP Address: [redacted]
Serial Interface IP Address: [redacted]

1.2 ATMS Client

Ethernet IP Address: [redacted]
Administrator Password: [redacted]
VNC Client Password: [redacted]

1.3 MTMC 170 Lantronix

Ethernet IP Address: [redacted]
Password: [redacted]

1.4 MRM 170 Lantronix

Ethernet IP Address: [redacted]
Password: [redacted]

1.5 MSS Master Lantronix

Ethernet IP Address: [redacted]
Password: [redacted]

1.6 MPEG Decompression PC

Ethernet IP Address: [redacted]
Administrator Password: [redacted]

1.7 Baxall Video Encoder

Ethernet IP Address: [redacted]

1.6 Video Conferencing PC

Ethernet IP Address: [redacted]
Administrator Password: [redacted]

2. TMC

2.1 Cisco Router

Ethernet IP Address: [redacted]
Serial Interface IP Address: [redacted]

2.2 DSL Router

Ethernet IP Address: [redacted]
Login: [redacted]
Password: [redacted]

2.3 HPUX

Ethernet IP Address: [redacted]
Administrator Login: [redacted]
Administrator Password: [redacted]

2.4 MSS Master Lantronix

Ethernet IP Address: [redacted]
Password: [redacted]

2.5 PC

Ethernet IP Address: [redacted]
Administrator Login: [redacted]
Administrator Password: [redacted]
Client Login: [redacted]
Client Password: [redacted]

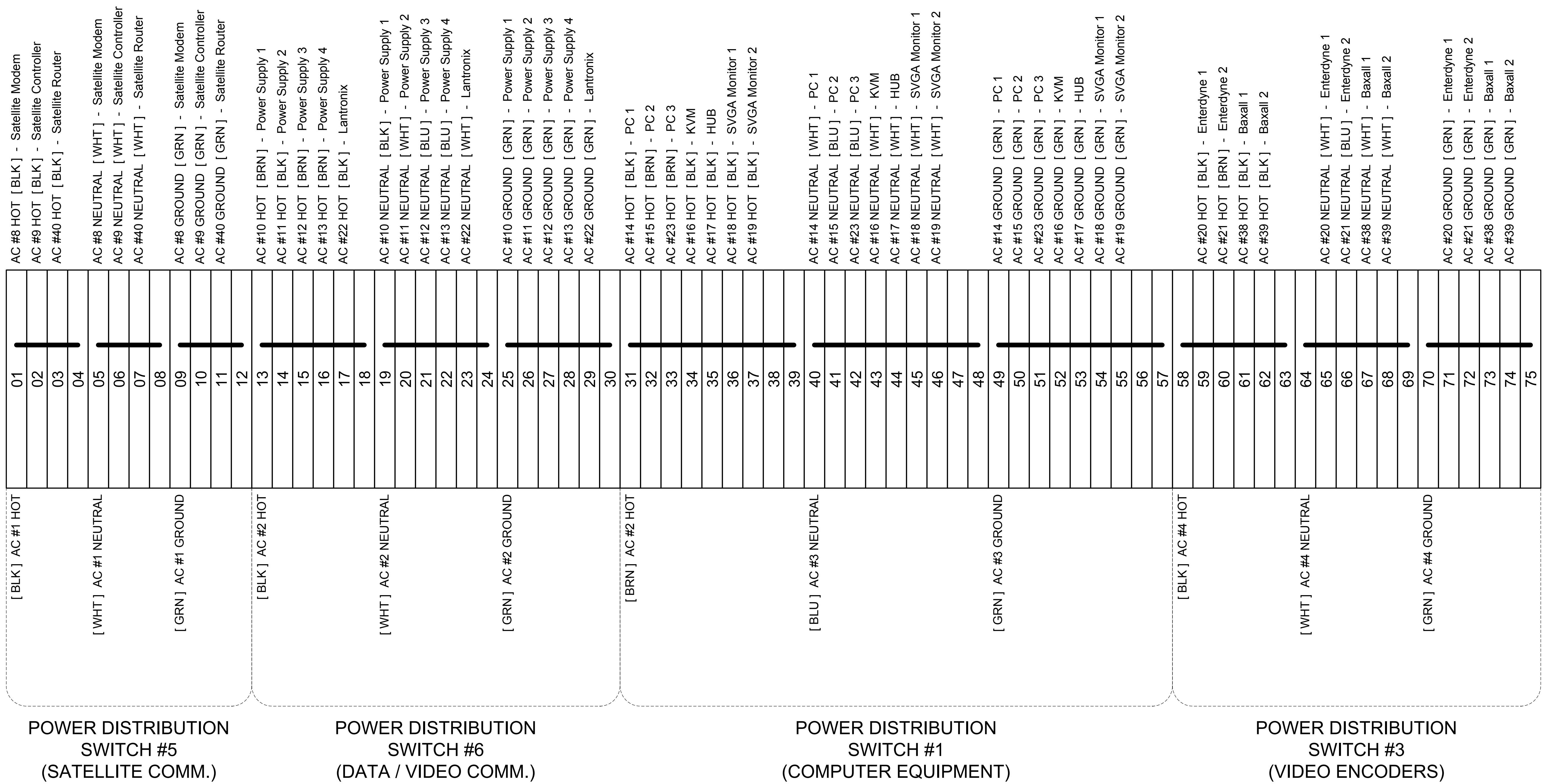
2.6 Baxall Video Decoder

Ethernet IP Address: [redacted]

2.7 Video Conferencing PC

Ethernet IP Address: [redacted]
Administrator Password: [redacted]
Client Login: [redacted]
Client Password: [redacted]

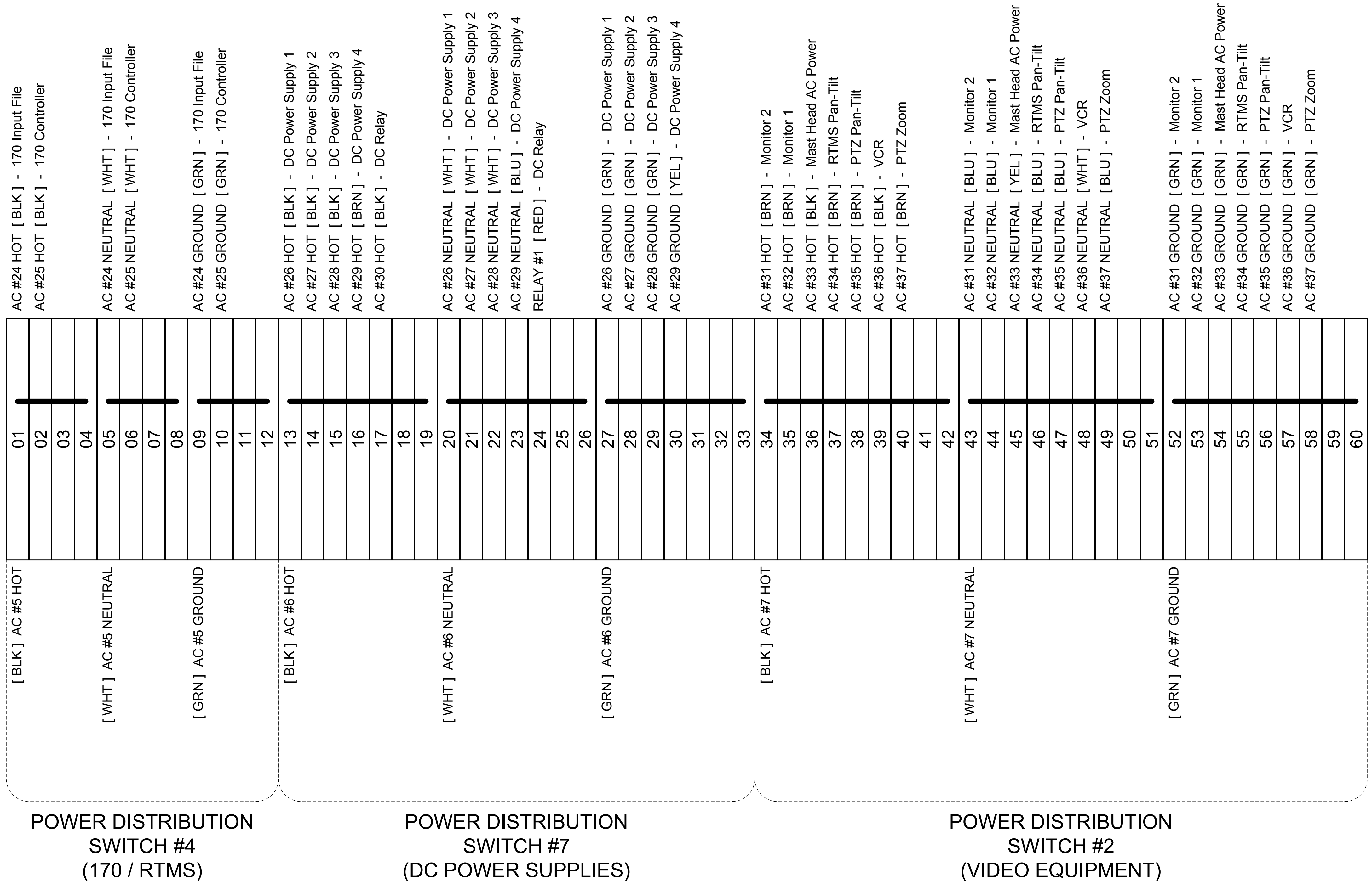
APPENDIX O
Wiring Diagrams


AC #8 HOT [BLK] - Satellite Modem
AC #9 HOT [BLK] - Satellite Controller
AC #40 HOT [BLK] - Satellite Router
AC #8 NEUTRAL [WHT] - Satellite Modem
AC #9 NEUTRAL [WHT] - Satellite Controller
AC #40 NEUTRAL [WHT] - Satellite Router
AC #8 GROUND [GRN] - Satellite Modem
AC #9 GROUND [GRN] - Satellite Controller
AC #40 GROUND [GRN] - Satellite Router
AC #10 HOT [BRN] - Power Supply 1
AC #11 HOT [BLK] - Power Supply 2
AC #12 HOT [BRN] - Power Supply 3
AC #13 HOT [BRN] - Power Supply 4
AC #22 HOT [BLK] - Lantronix
AC #10 NEUTRAL [BLK] - Power Supply 1
AC #11 NEUTRAL [WHT] - Power Supply 2
AC #12 NEUTRAL [BLU] - Power Supply 3
AC #13 NEUTRAL [BLU] - Power Supply 4
AC #22 NEUTRAL [WHT] - Lantronix
AC #10 GROUND [GRN] - Power Supply 1
AC #11 GROUND [GRN] - Power Supply 2
AC #12 GROUND [GRN] - Power Supply 3
AC #13 GROUND [GRN] - Power Supply 4
AC #22 GROUND [GRN] - Lantronix
AC #14 HOT [BLK] - PC 1
AC #15 HOT [BRN] - PC 2
AC #23 HOT [BRN] - PC 3
AC #16 HOT [BLK] - KVM
AC #17 HOT [BLK] - HUB
AC #18 HOT [BLK] - SVGA Monitor 1
AC #19 HOT [BLK] - SVGA Monitor 2
AC #14 NEUTRAL [WHT] - PC 1
AC #15 NEUTRAL [BLU] - PC 2
AC #23 NEUTRAL [BLU] - PC 3
AC #16 NEUTRAL [WHT] - KVM
AC #17 NEUTRAL [WHT] - HUB
AC #18 NEUTRAL [WHT] - SVGA Monitor 1
AC #19 NEUTRAL [WHT] - SVGA Monitor 2
AC #14 GROUND [GRN] - PC 1
AC #15 GROUND [GRN] - PC 2
AC #23 GROUND [GRN] - PC 3
AC #16 GROUND [GRN] - KVM
AC #17 GROUND [GRN] - HUB
AC #18 GROUND [GRN] - SVGA Monitor 1
AC #19 GROUND [GRN] - SVGA Monitor 2
AC #20 HOT [BLK] - Enterdyne 1
AC #21 HOT [BRN] - Enterdyne 2
AC #38 HOT [BLK] - Baxall 1
AC #39 HOT [BLK] - Baxall 2
AC #20 NEUTRAL [WHT] - Enterdyne 1
AC #21 NEUTRAL [BLU] - Enterdyne 2
AC #38 NEUTRAL [WHT] - Baxall 1
AC #39 NEUTRAL [WHT] - Baxall 2
AC #20 GROUND [GRN] - Enterdyne 1
AC #21 GROUND [GRN] - Enterdyne 2
AC #38 GROUND [GRN] - Baxall 1
AC #39 GROUND [GRN] - Baxall 2
01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75
[BLK] AC #1 HOT
[WHT] AC #1 NEUTRAL
[GRN] AC #1 GROUND
[BLK] AC #2 HOT
[WHT] AC #2 NEUTRAL
[GRN] AC #2 GROUND
[BRN] AC #2 HOT
[BLU] AC #3 NEUTRAL
[GRN] AC #3 GROUND
[BLK] AC #4 HOT
[WHT] AC #4 NEUTRAL
[GRN] AC #4 GROUND
POWER DISTRIBUTION SWITCH #5 (SATELLITE COMM.)
POWER DISTRIBUTION SWITCH #6 (DATA / VIDEO COMM.)
POWER DISTRIBUTION SWITCH #1 (COMPUTER EQUIPMENT)
POWER DISTRIBUTION SWITCH #3 (VIDEO ENCODERS)

ATL - CAL POLY

MOBILE TMC AC POWER DIN RAIL 1

ENGINEER	SIZE C	JOB NO.	DWG NO.	REV –
MANAGER	SCALE		SHEET 1 OF 1	


AC #24 HOT [BLK] - 170 Input File
AC #25 HOT [BLK] - 170 Controller
AC #24 NEUTRAL [WHT] - 170 Input File
AC #25 NEUTRAL [WHT] - 170 Controller
AC #24 GROUND [GRN] - 170 Input File
AC #25 GROUND [GRN] - 170 Controller
AC #26 HOT [BLK] - DC Power Supply 1
AC #27 HOT [BLK] - DC Power Supply 2
AC #28 HOT [BLK] - DC Power Supply 3
AC #29 HOT [BRN] - DC Power Supply 4
AC #30 HOT [BLK] - DC Relay
AC #26 NEUTRAL [WHT] - DC Power Supply 1
AC #27 NEUTRAL [WHT] - DC Power Supply 2
AC #28 NEUTRAL [WHT] - DC Power Supply 3
AC #29 NEUTRAL [BLU] - DC Power Supply 4
RELAY #1 [RED] - DC Relay
AC #26 GROUND [GRN] - DC Power Supply 1
AC #27 GROUND [GRN] - DC Power Supply 2
AC #28 GROUND [GRN] - DC Power Supply 3
AC #29 GROUND [YEL] - DC Power Supply 4
AC #31 HOT [BRN] - Monitor 2
AC #32 HOT [BRN] - Monitor 1
AC #33 HOT [BLK] - Mast Head AC Power
AC #34 HOT [BRN] - RTMS Pan-Tilt
AC #35 HOT [BRN] - PTZ Pan-Tilt
AC #36 HOT [BLK] - VCR
AC #37 HOT [BRN] - PTZ Zoom
AC #31 NEUTRAL [BLU] - Monitor 2
AC #32 NEUTRAL [BLU] - Monitor 1
AC #33 NEUTRAL [YEL] - Mast Head AC Power
AC #34 NEUTRAL [BLU] - RTMS Pan-Tilt
AC #35 NEUTRAL [BLU] - PTZ Pan-Tilt
AC #36 NEUTRAL [WHT] - VCR
AC #37 NEUTRAL [BLU] - PTZ Zoom
AC #31 GROUND [GRN] - Monitor 2
AC #32 GROUND [GRN] - Monitor 1
AC #33 GROUND [GRN] - Mast Head AC Power
AC #34 GROUND [GRN] - RTMS Pan-Tilt
AC #35 GROUND [GRN] - PTZ Pan-Tilt
AC #36 GROUND [GRN] - VCR
AC #37 GROUND [GRN] - PTZ Zoom
01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60
[BLK] AC #5 HOT
[WHT] AC #5 NEUTRAL
[GRN] AC #5 GROUND
[BLK] AC #6 HOT
[WHT] AC #6 NEUTRAL
[GRN] AC #6 GROUND
[BLK] AC #7 HOT
[WHT] AC #7 NEUTRAL
[GRN] AC #7 GROUND
POWER DISTRIBUTION SWITCH #4 (170 / RTMS)
POWER DISTRIBUTION SWITCH #7 (DC POWER SUPPLIES)
POWER DISTRIBUTION SWITCH #2 (VIDEO EQUIPMENT)

THE CONTENTS OF THIS DOCUMENT ARE PROPERTY OF ARDFA, CAL POLY AND CAL TRANS. ANY UNAPPROVED REPRODUCTIONS ARE STRICTLY PROHIBITED

ATL - CAL POLY

MOBILE TMC AC POWER
DIN RAIL 2

ENGINEER	SIZE C	JOB NO.	DWG NO.	REV –
MANAGER	SCALE		SHEET 1 OF	

Vehicle Battery #2 (rear)

12 VDC Vehicle Battery (Spare)

12 VDC Power Supply #1

12 VDC Power Supply #2

12 VDC Power Supply #3

12 VDC Power Supply #4

01
02
03
04
05
06
07
08
09
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27

2A
8A
5A
2B
8B
5B

AC DIN 2-24 (AC NEUTRAL)
AC DIN 2-17 (AC #30)
[RED] - VOICE #1 TX/RX (+12 VDC)
[RED] - VOICE #1 CONTROL (+12 VDC)
[PNK & WHT] - SAFETY LIGHTS (+12 VDC)
[RED] - SAFETY LIGHTS (+12 VDC)
[RED] - ROTATING LIGHT RELAY (+12 VDC)
[RED] - VOICE #2 TX/RX (+12 VDC)
[RED] - VOICE #2 CONTROL (+12 VDC)
[GRN] - WATER PUMP (+12 VDC)
[BLK] - VOICE #1 TX/RX (GROUND)
[BLK] - WATER PUMP (GROUND)
[BLK] - SAFETY LIGHTS (GROUND)
[BLK] - SAFETY LIGHTS (CASE GND)
[BLK] - VOICE #2 TX/RX (GROUND)
AUX OUT ON FRONT LIGHT CONTROL

AUX OUT (APPLIED GROUND)

Forward Safety Light
+
-

87
30
85
86

[YEL]

ATL - CAL POLY

MOBILE TMC
DC POWER SYSTEM

ENGINEER
MANAGER

SIZE C | JOB NO. | DWG NO. | REV —

SCALE | SHEET 1 OF 1

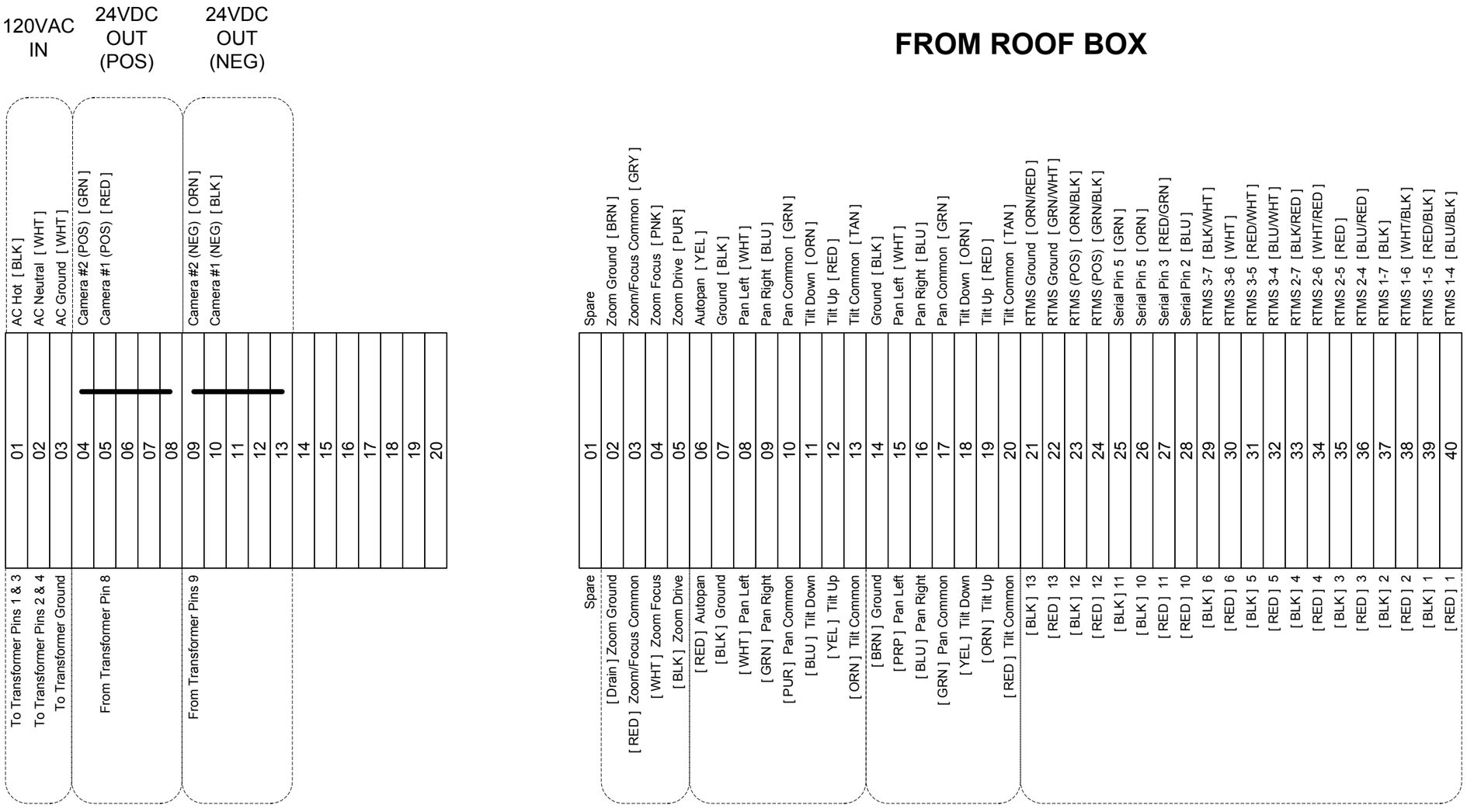
SATELLITE ROUTER
SATELLITE MODEM
SATELLITE CONTROLLER
SPLITTER
SAT RX #1
SAT TX
SYNCHRONOUS SERIAL #1
SAT RX #2
SAT RX #3
J7 (DRIVE)
J3 (LIMITS)
J1 (SENSORS)
NETWORK #4
CPU #1 (ATMS)
CPU #2 (MTMS)
CPU #3 (RTMS / VIDEO CONF.)
MICROPHONE
SPEAKER
CONF. CAMERA
HUB
NETWORK #1
NETWORK #2
NETWORK #3
KVM #3
KVM #2
KVM #1
MRM DATA MODEM
FOT DATA MODEM
SERIAL #2
MRM 170 LANTRONIX
SERIAL #3
FOT 170 LANTRONIX
NETWORK #6
NETWORK #7
MTMC 170 LANTRONIX
SERIAL #1
NETWORK #5
BAXALL VIDEO ENCODER
NETWORK #8
VGA #2
MONITOR 2
MONITOR 1
KVM
VGA #1
KEYBOARD
MOUSE
SERIAL #5
RTMS
170 CONTROLLER
SERIAL #4

ATL - CAL POLY

MOBILE TMC
DATA WIRING

ENGINEER
MANAGER
SIZE C
JOB NO.
DWG NO.
REV —
SCALE
SHEET OF

FROM ROOF BOX



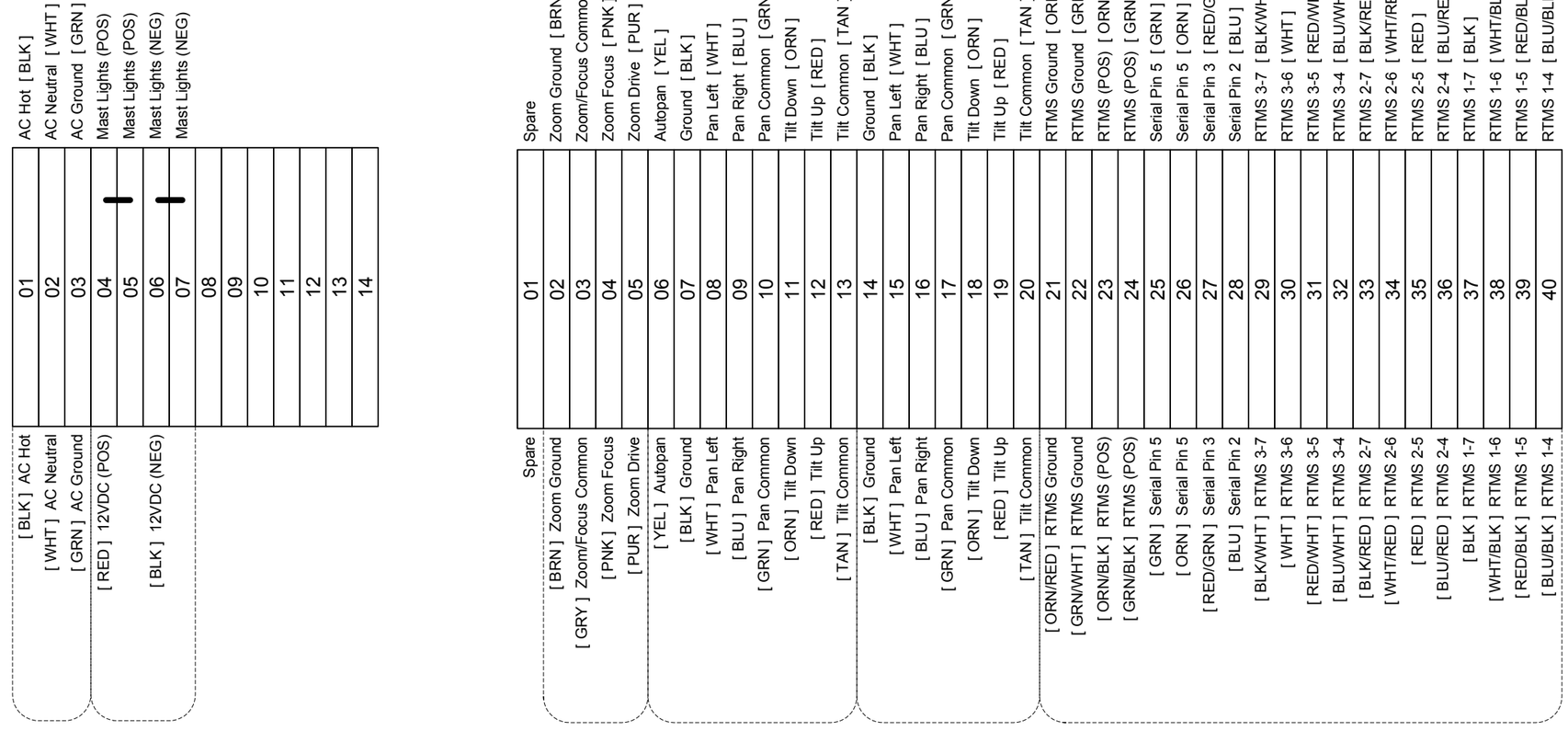
TO MAST COMPONENTS

ATL - CAL POLY

MOBILE TMC
MAST BOX WIRING

ENGINEER	SIZE	JOB NO.	DWG NO.	REV
MANAGER	C			–
	SCALE		SHEET 1 OF 1	

TO MAST BOX



FROM TRUCK

ATL - CAL POLY

MOBILE TMC
ROOF BOX WIRING

ENGINEER	SIZE	JOB NO.	DWG NO.	REV
MANAGER	C			–
	SCALE		SHEET 1 OF 1	

TO ROOF BOX

01	AC Hot [BLK]	[BLK] AC Hot
02	AC Neutral [WHT]	[WHT] AC Neutral
03	AC Ground [GRN]	[GRN] AC Ground
04	Tilt Common [TAN]	[TAN] Tilt Common
05	Tilt Up [RED]	[RED] Tilt Up
06	Tilt Down [ORN]	[ORN] Tilt Down
07	Pan Common [GRN]	[GRN] Pan Common
08	Pan Right [BLU]	[BLU] Pan Right
09	Pan Left [WHT]	[WHT] Pan Left
10	Ground [BLK]	[BLK] Ground
11	Tilt Common [TAN]	[TAN] Tilt Common
12	Tilt Up [RED]	[RED] Tilt Up
13	Tilt Down [ORN]	[ORA] Tilt Down
14	Pan Common [GRN]	[GRN] Pan Common
15	Pan Right [BLU]	[BLU] Pan Right
16	Pan Left [WHT]	[WHT] Pan Left
17	Ground [BLK]	[BLK] Ground
18	Autopan [RED/BLK]	[YEL] Autopan
19	Zoom Drive [ORN/BLK]	[PUR] Zoom Drive
20	Zoom Focus [GRN/BLK]	[PNK] Zoom Focus
21	Zoom/Focus Common [BLU/BLK]	[GRY] Zoom/Focus Common
22	Zoom Ground [WHT/BLK]	[BRN] Zoom Ground

MAST AC | PAN TILT #2 | PAN TILT #1 | PAN TILT #1 ZOOM/FOCUS

FROM COMPONENTS

ATL - CAL POLY

MOBILE TMC
TRUCK REAR P/T WIRING

ENGINEER

MANAGER

SIZE C | JOB NO. | DWG NO. | REV –

SCALE

SHEET 1 OF 1

MTMC PTZ CAMERA

MTMC RTMS CAMERA

MRM VIDEO MODEM

SERIAL #5

MRM VIDEO DECODER

FOT VIDEO MODEM

SERIAL #6

FOT VIDEO DECODER

D12 VIDEO DECODER
(NOT INSTALLED)

PTZ VIDEO

RTMS VIDEO

MRM VIDEO

FOT VIDEO

D12 VIDEO

VIDEO ENCODER VIDEO SWITCH

Outputs: 1, 2, 3, 4

Inputs: PTZ CAM 1, RTMS VIDEO 2, MRM VIDEO 3, FOT VIDEO 4

MONITOR OUT

VCR VIDEO SWITCH

Outputs: 1, 2, 3, 4

Inputs: PTZ CAM 1, RTMS VIDEO 2, MRM VIDEO 3, FOT VIDEO 4

MONITOR OUT

MONITOR 2 VIDEO SWITCH

Outputs: 1, 2, T, T

Inputs: PTZ CAM 1, MRM VIDEO 2, FOT VIDEO 3, D12 VIDEO 4

MONITOR OUT

MONITOR 1 VIDEO SWITCH

Outputs: T, T, T, T

Inputs: PTZ CAM 1, MRM VIDEO 2, RTMS VIDEO 3, VCR 4

MONITOR OUT

VIDEO 01

VIDEO 02

VIDEO 03

VIDEO 04

OUT #4

OUT #3

OUT #2

OUT #1

VIDEO 08

VIDEO 07

VIDEO 06

VIDEO 05

VIDEO 10

VIDEO 09

VIDEO ENCODER

VCR

MONITOR 2

MONITOR 1

VCR VIDEO

T = Terminated Output

ATL - CAL POLY

MOBILE TMC VIDEO

ENGINEER

MANAGER

SIZE C | JOB NO. | DWG NO. | REV —

SCALE | SHEET 1 OF 1

ATMS PRIVATE NETWORK

VIDEO CONFERENCING PC

ROUTER NETWORK

SATELLITE ROUTER

SYNCHRONOUS SAT SERIAL

SATELLITE MODEM

SAT TX

SAT RX

MTMC ATMS (TO ATMS NETWORK)

HUB

D12 MOTHER LANTRONIX

DISTRICT 12 FEP

MOTHER LANTRONIX NETWORK

KVM

PC-1

KVM BUNDLE 1

PC-1 NETWORK

BAXALL NETWORK

BAXALL VIDEO DECODER

DISTRICT 12 VIDEO SYSTEM

MONITOR 1

HPUX WORKSTATION

KVM BUNDLE 2

HPUX NETWORK

ATL - CAL POLY

DISTRICT 12 TMC
DATA WIRING

ENGINEER

MANAGER

SIZE C | JOB NO. | DWG NO. | REV —

SCALE | SHEET 1 OF 1