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GARDEN STATE SITREP

The Official Newsletter of NJ Army MARS

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 Zone 2 Coordinator: OPEN
 Zone 3 Coordinator: OPEN
 Zone 4 Coordinator: AAR2SQ
 Zone 5 Coordinator: AAR2EY
 Zone 6 Coordinator: OPEN
 Zone 7 Coordinator: AAR2MF

Proud, Professional, Ready



NJ Army MARS

SMD COLUMN BY AAA2NJ

I hope that the 18 members that attended our fall membership meeting enjoyed the camaraderie of the day. Thanks to Mike AAR2HR for making the arrangements for the meeting. As I pointed out at the meeting, the mission of Army MARS has changed from handling morale traffic to one of supporting the Director of Military Support (DOMS) and the Joint Director of Military Support (JDOMS).

Members must be knowledgeable in the preparation of EEI messages. Members should strive to send at least one exercise EEI a month. Preparation of exercise EEI messages will allow members to become familiar with the procedure. There are two parts to effective EEI reporting. The first part is the ability to convert a perceived or actual scenario into a cogent message. The second is the "mechanical"

listing and processing of the message.

This training is leading towards the objective of notifying DOMS/JDOMS of any actual incidents that occur that may be of interest. Members should be aware of these scenarios and promptly send an **Actual Incident EEI** at those times. Some of the incidents that may occur which should be reported are:

BLOCKED LANE = complete closure of an Interstate or strategic highway or other major road, bridge, or tunnel.

FALLEN STAR = crash of any aircraft

HOWLING WIND = hurricane

DARK DAY = major power failure

BROKEN TRACKS = train wreck or derailment

Keep in mind that the objec-

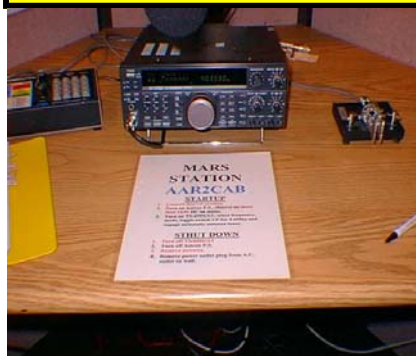
tive of an Actual Incident EEI report is either to provide immediate notification of a reportable incident as well as providing information of a local nature that would not be on the national news of the event. For example, sending a message that Hurricane Charlie has passed through the area would not be appropriate unless the message contained information on the local effects of the hurricane on the area.

Members having questions on the EEI reporting procedures should consult the three page guide that has been prepared on EEI messages or by contacting me.

Thank you for your support of the MARS program.

AAA2NJ, SMD New Jersey

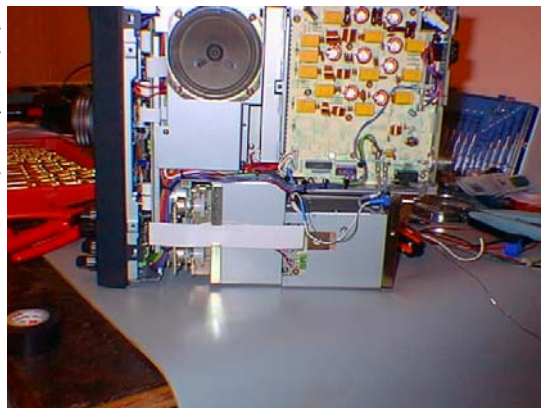
TS-450S/AT auto tuner mod for MARS by AAR2EY continued on page 2



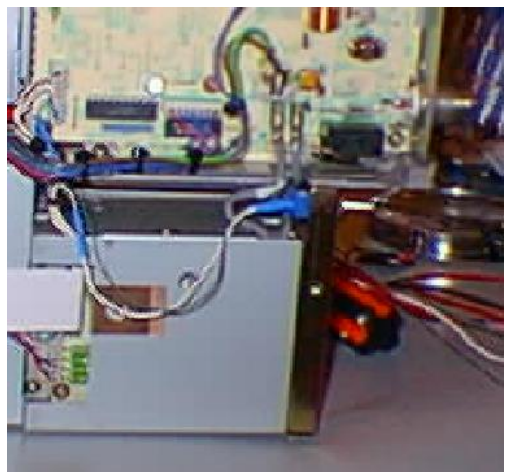
At my QTH and on loan at AAR2CAB, I have MARS stations based on the Kenwood TS-450S/AT transceivers. The TS-450S/AT is a fine radio in many ways, and capable of being modified for operation on MARS frequencies, its internal antenna tuner does not properly function frequencies between 4.0-7.0 MHz when so modified, or below 3.5Mhz for that matter. So, I developed a modification to address the 4-7Mhz problem as Kenwood, to the best of my knowledge has never published a fix for this problem. For the last year now, my TS-450S/AT auto tuner does now work on all fre-

TS-450S/AT AUTO TUNER MOD FOR MARS BY AAR2EY CONTINUED FROM PAGE 1

quencies 3.5-30Mhz. I started to study the schematics to determine what was wrong and how to fix it and I determined that the tuner contains inductance for tuning which consists of 3 coils: an air wound coil with 4 taps, in series with a pair of coils wound on powdered iron toroid cores. For operation on 80/75 meters, the entire inductance is required (more needs to be switched in to operate below 3.5Mhz). As you go up in frequency less inductance is required, thus various tap points along this inductance are shorted to ground to reduce the total inductance. This is done by a set of 6 relays, controlled by signal lines designated as 28A, 25A, 21A, 14A, 10A and 7A. So, if you selected 7 MHz, the 7A line becomes active, energizes relay K106 (through choke L106) and shorts out one of the toroid coils, leaving the other toroid in the circuit, along with the entire air wound coil. As you reach 28 MHz, only a small portion of the air wound coil is used.



The problem with operating on 4-7MHz MARS frequencies is that the control logic of the radio is incorrect, the logic activates the 7A line as soon as the frequency hits 4.000 MHz. This reduces the inductance considerably, and it is not sufficient to allow the tuner to tune until nearing 7Mhz. Thus, we need to keep the 7A signal from reaching the relay when operating between 4-7Mhz. I mapped out a method to use the band data signals to achieve this automatically, however the simplest way to implement a fix is to insert a small toggle switch in series with the 7A line at the rear of the radio. Taking apart the radio and tracing out the lines to do so is a bit of effort, then you need to drill a hole (be careful of metal chips) and mount the switch, break the line (its a ribbon cable) as close to the switch as possible, add two additional lead lengths to the installed switch and insulate with heat shrink tubing (blue tubing in the photos) and bingo your done.



Once modified, to operate normally on the ham bands, the switch must be closed so the relay will operate normally. To operate on MARS frequencies between 4-7MHz, the switch must be open. The radio will activate the 7A line but the signal will not get to the relay, the coil will not be shorted out, and there will be enough inductance to tune your antenna. At AAR2CAB, as it's a multi user station, I have a START UP/SHUT DOWN list so that the operators of the station always remember to set the switch appropriately for MARS vs. Amateur operation.

This mod is not perfect in a number of ways. For one thing you need to remember

to set the switch, for another, depending on whether the radio is on the Amateur 75m band when you change the switch, the radio's auto tuner may still not work properly and you may need to toggle the switch and change below 4.0Mhz and then back, again, this the logic of the radio. As I stated earlier, I have planned out an automated interface that uses the band data to perform this switching automatically, but I have not built and tested it yet. I also need to address the adding of additional inductance and switching it in/out for operation below 3.5Mhz, there is not very much spare room inside that TS-450S/AT. An alternative approach would be to use an external auto tuner (or manual depending on your type of operation), however the basic mod of the toggle switch on a TS-450 that has the internal tuner is an awful lot cheaper. I shall provide a follow up article when I implement the automated design I have worked up and get the antenna tuner to work below 3.5Mhz, if I can find space for a coil !

MARS STATION AAR2CAB

STARTUP

1. **Connect desired antenna.**
2. **Turn on Astron P.S., observe no more than 14.0v DC on meter.**
3. **Turn on TS-450S/AT, select frequency, mode, toggle switch UP for 4-6Mhz and engage automatic antenna tuner.**

SHUT DOWN

1. **Turn off TS/450S/AT**
2. **Turn off Astron P.S.**
3. **Remove antenna.**
4. **Remove power outlet plug from A.C. outlet on wall.**

ARMY MARS, Proud, Professional, Ready.... The Bottom Line.. The Soldier !

GO Kit for possible US ARMY MARS Deployment by AAT2BD

- Kenwood TS-870S (Has built-in tuner)
- 3 50' lengths of rg8X coax w/ PL-259
- 2 double female PL 258 connectors (to extend coax)
- Basic toolkit (Hammer, Screwdrivers, Butane Soldering Iron, Solder, Pliers, etc...)
- 30 AMP 12 V Power Supply (110 VAC)
- 150 Ft 110V Extension Cord
- Power Strip
- Short (5 Ft or so) extension cord
- Flashlight (A good one like Maglite)
- Spare Flashlight Batteries
- Small desk lamp (110 V)
- 350 Watt 12V to 110 V Inverter
- Desk Mike for TS-870
- Spare Hand Mike for TS-870
- Dell Laptop Computer (for digital operation, also has latest revision of all MARS Documents ie. NETPLAN OPLAN ROSTER etc...)
- MiXW Rig Expert USB Data Interface for TS-870
- 110 V Power Supply for Dell Laptop
- Verizon Wireless Air Card for Dell Laptop (Broadband Wireless Internet Access)
- Combo 802.11 A/B Card for Dell Laptop (in case deployment location has wireless network access)
- B&W Broadband Inverted V (1-54 Mhz)
- 30 Ft Army Surplus collapsible mast kit (includes guy ropes, stakes, antenna mount and hammer) (Available from Fair Radio Sales - Lima, OH)
- Folding table and chair
- 3 days MRE kit (available from www.nitropak.com), 2 Gal Water
- Plastic or Paper Cups, Knife, Fork, Spoon, Plates
- 3 ball point pens
- 2 SHARPIE Markers

- Notebook (Paper)
 - Clipboard (flat writing surface)
- Personal stuff (Bathroom Tissue, Kleenex, Deodorant, Soap, etc...)

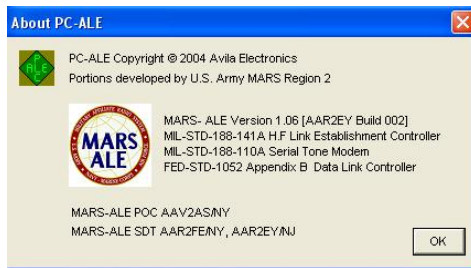


2004 ARRL Frequency Measuring Test (FMT)

The 2004 ARRL Frequency Measuring Test (FMT) will take place November 18 starting at 0245 UTC (the evening of Wednesday, November 17, in US time zones), replacing the W1AW phone bulletin normally transmitted then. However, in a departure from the last two FMT's since its return, rather than measuring the transmission's carrier frequency, participants in this year's FMT will be attempting to accurately determine the frequency of an audio tone. W1AW will make the 2004 FMT transmissions on 80, 40 and 20 meters. The FMT will begin with a general W1AW "QST" starting at 0245 UTC sent simultaneously on the three W1AW transmission frequencies. The test itself will consist of three 60-second tone transmissions on each band, followed by a station identification. The whole test will run for about 15 minutes and will end with a station ID. The tone frequency will be the same on all three bands.

During the 2004 FMT, W1AW will indicate the band on which participants should measure. After the initial call-up, W1AW will begin the test by announcing, "Now 80 meters." Except for the tone transmission, all transmissions will be voice. Frequencies are 3990 kHz (LSB), 7290 kHz (LSB) and 14,290 kHz (USB), and all frequencies will be accurate to at least 0.1 ppm (eg, 3990 \pm 0.4 Hz). For full details see:

<http://www.arrl.org/news/stories/2004/11/02/4/?nc=1>

MARS ALE SOFTWARE DEVELOPMENT BY AAR2EY *CONTINUED ON PAGE 8*

The future of MARS Digital Communications is now in our hands and that future is Automatic Link Establishment (ALE) !

The advent of Automatic Link Establishment has significantly increased the utility and ease of use of high frequency (HF) radio communications. As many of you know, for just under a year now, authorized MARS (Army, Air Force, Navy) stations have been working with Automatic Link Establishment (ALE) and additional protocol layers in an effort to provide a low cost sound card implementation so that the MARS program can support interoperability their customers that use ALE. The goal to provide MARS volunteers a PC sound card software replacement for the high-priced ALE hardware operated by government agencies and the military. This would be a low-cost solution to add ALE capability to existing MARS stations HF radios, utilizing PC hardware, yielding an ALE Standards compliant, robust, reliable ALE Controller, while compensating for the limitations of the non-ALE radios it controls. By providing a low-cost means of bringing the vast number of non-ALE MARS HF radios into the ALE realm, significant benefit will be provided to both the MARS program and customers that we serve.

The effort originally involved just working with the PC-ALE proof of concept application developed by Dr. Charles Brain, G4GUO. Dr. Brain undertook this effort to improve upon the proof of concept work done by the U.S. Institute of Telecommunication Sciences (ITS) ALE Lite effort, which was the first PC MS-Windows based ALE software application. Where ALE Lite provides just the basic ALE FS-1045/MIL-STD-141A mes-

saging capabilities and supports only one make of transceiver, Dr. Brain took PC-ALE into the world of additional protocol layers such as FS-1052 Data Link Protocol which provides compatible MIL-STD-110A serial modem signaling to provide ARQ and Broadcast modes for test messaging and binary file transfers via FTP (FS-1052 ARQ mode is fully adaptive. It starts at 600 bps and will adapt the data rate to the HF channel conditions) and began work on HF e-mail to the NATO STANAG 5066 standard.

During early 2004 the ALE Test Team lead by AAV2AS/NY (seen below) was in constant communication with Dr. Brain exchanging bug reports and comments



for features, testing various aspects and functions of the PC-ALE software that Dr. Brain had not be able to do such as Group Call and others. This started speeding along development of the application to the point that Dr. Brain went from version 1.03 to 1.04 to 1.05 and then 1.06, adding more and more refinements. Then during the summer, Dr. Brain, provided PC-ALE source code for 1.06 to AAV2AS for MARS to form a development team to continue the process. "Don't sell the executables commercially without my permission," he told AAV2AS, who negotiated the cost-free deal, "but you can give them away." AAV2AS a retired telecommunications engineer himself, then began to tap the pool of Army MARS talent on the ALE Test team and formed the MARS-ALE Software Development Team (SDT).

The PC-ALE software as it currently ex-

ists, is a 32 bit MS-Windows multi-threaded C++ application created using the Microsoft Visual Studio v5.0 Standard Edition C++ (we are now using v6.0) compiler and the Microsoft Foundation Class (MFC) libraries. The application provides support for ALE to MIL-STD-188-141A and parts or MIL-STD-141B and beyond, thus is it a hybrid application.

The MARS Software Development Team (SDT) is currently analyzing the code to become familiar with its framework while also investigating and defining the requirements for a development methodology and life cycle plan to bring the application into a production level tool within MARS. To date new builds have been made to correct a number of problems with the 1.06 code as received. The overall PTT function and computer controlled radio PTT functions for Kenwood and numerous Yaesu transceivers have been addressed, scanning has been fixed and an experimental 10 channel per second scan rate to the 141B spec has been added. In addition, a new signal detector algorithm as well as a input drive level meter have been added.. A comprehensive "TO DO" list is being compiled to address other needed bug fixes, such as radio control of currently listed supported radios and the addition of more radio makes/models, and the completion of code for features that have not been fully implemented, as well new desired functions.

A key desired feature is support of transmission of E-mail over HF radio channels which is experiencing widespread use in the Government and military communities. This ability is made possible through the convergence of Internet and radio communication protocols, primarily by the implementation of transmission control protocol/internet protocol (TCP/IP) for radio channels. One popular implementation is a software package called JNOS, initially developed by the Amateur Radio community. JNOS has been adapted for use over HF chan-

SHared RESources (SHARES) High Frequency (HF) radio program overview by AAR2EY

The SHared RESources (SHARES) High Frequency (HF) radio program is part of the National Communications System (NCS), in its role of planning and preparing for national security and emergency preparedness (NS/EP). SHARES further implements Executive Order No. 12472, "Assignment of National Security and Emergency Preparedness Telecommunications Functions," dated April 3, 1984. MARS supports the SHARES program, approximately 200 Army MARS stations are chosen to support the National Communications System's SHARES (SHared RESources) project.

The SHARES network consists of stations operated by a number of Federal agencies (Depts of Defense, Energy, Justice, Treasury, FEMA, NDMS), some state emergency management agencies and a number of other telecommunications companies (such as AT&T, MCI, Sprint, the Regional Bell Operating Companies, etc.). The SHARES network operates voice and data networks on a number of HF (2-30 MHz) frequencies using HF Automatic Link Establishment (ALE), Pactor and Amtor technology.

The SHARES program is charged with promoting interoperability between HF radio systems used by the Federal departments and agencies. It is also tasked to foster interoperability through examination of regulatory, procedural, and technical issues. This role has taken on added importance with the widespread purchase and use of Automatic Link Establishment (ALE) technology throughout the HF radio community. In responding to this role, the NCS SHARES HF Interoperability Working Group has established the SHARES Action Item process to identify, record, and track issues affecting HF radio interoperability in the Federal government.

Emphasis has also been placed on expanding awareness of new technologies in HF radio. Technological advancements have made HF radio more

efficient and competitive in day-to-day operations. Multiple microprocessors, Digital-Signal Processing (DSP) and computer control, and Automatic Link Establishment (ALE), combine to simplify and enhance HF radio operation and frequency selection. The US Navy has successfully demonstrated e-mail links within a surface fleet Battle Group via HF radio, with transmission speeds of up to 4.8 kbps.

SHARES is available on a 24-hour basis to provide an emergency communications link to support intra- or interagency mission requirements. No prior coordination is necessary; no SHARES "activation" is required. The flagword "SHARES" is all that is needed to get the message through. Certain conditions must exist, however, to use SHARES. These include: 1 The information must support national security and emergency preparedness requirements. 2 The information must be communicated to a Federal entity and be of critical importance to the Federal government, the entity's mission, and/or involve the preservation of life and property. 3 The primary means of communications must be inoperative or unavailable for use. 4 The processing of SHARES message traffic must not interfere with the primary mission requirements of the SHARES participants.

To access SHARES, a user contacts the nearest SHARES station listed in the SHARES Directory (NCSH 3-3-1), and requests assistance in processing a SHARES message. All SHARES messages are unclassified; however, encrypted messages are authorized to be passed over SHARES. Message precedence is not used in SHARES. The priority for handling SHARES messages, in relation to other mission or emergency message traffic, is established by the participating SHARES station. Use of the flagword "SHARES", however, serves to notify SHARES station personnel that the information supports NS/EP, and that the information is of critical importance.

The National Communications System (NCS), in its role of planning and preparing for national security and emergency

preparedness (NS/EP), has undertaken a number of initiatives to provide communications to support all hazards situations. One of these initiatives, developed through the combined efforts of the 23 NCS member organizations, is the SHared RESources (SHARES) High Frequency (HF) Radio Program. As of July 2004, over 1000 HF radio stations, representing 93 Federal, state, and industry entities are resource contributors to the SHARES HF Radio Program. SHARES stations are located in every state and at 20 overseas locations. One hundred ninety four emergency planning and response personnel also participate in SHARES. Over 150 HF frequencies have been authorized for use in SHARES.

SHARES provides the Federal community a forum for addressing issues affecting HF radio interoperability. The SHARES HF Interoperability Working Group (IWG), established as a permanent standing committee under the NCS Council of Representatives, is responsible for providing guidance and direction for the SHARES radio network, and for fostering interoperability of Federal HF radio systems through examination of regulatory, procedural, and technical issues. The SHARES HF Interoperability Working Group currently consists of 151 members and 105 participating entities vice organizations.

Overall support for the SHARES HF Radio Program is the responsibility of the Manager, National Communications System. The Chief, Operations Division, Office of the Manager, NCS, is responsible for administering the SHARES program. The Manager, National Coordinating Center for Telecommunications, is responsible for day to day operations of SHARES. Further information on SHARES may be obtained from the National Communications System, Critical Infrastructure Protection Division (CIP Division), SHARES HF Radio Program, Arlington, VA, 22204-2198 or shares@dhs.gov. For additional information visit:

<http://www.ncs.gov/n3/shares/shares.htm>

MARS IN CANADA ? BY AAR2EY

Actually it is CFARS, Canadian Forces Affiliate Radio System. CFARS, organized to operate in a somewhat similar fashion to MARS, is a program sponsored by the Canadian National Defence Headquarters in which military installation, military unit/club and volunteer licensed Canadian Amateur Radio stations and operators participate and contribute to the aim of providing auxiliary communications on a local, national and international basis as an adjunct to existing military unit/club amateur radio communications.

The Canadian Forces Affiliate Radio System (CFARS) has been in existence for approximately 30 years. Prior to the establishment of CFARS, amateur ham radio operators provided an essential service to isolated troops. Today military personnel and civilian ham operators volunteer their time and expertise to provide phone patching services to CF personnel.

Generally, CFARS was designed to improve the radio communications service provided over the years on the amateur frequencies by:

a. being an adjunct to existing military radio facilities, thus providing an extra means of communication when neces-

sary;

b. eliminating a recurring problem of interference, mainly caused by increasing congestion of the amateur bands - the main cause of delays in handling of phone patches and message traffic; and

c. ensuring that military amateur stations in isolated or remote locations would not be shut down because licensed radio amateurs were not available to operate such stations.

Today, new technologies are threatening CFARS existence, Ken Halcrow, volunteer CFARS manager, said satellite communication has reduced requests for CFARS services by about 90 percent. But while satellite communication is effective, he said, it's also expensive. "With amateur radio, it's free; with satellites, you have to pay for airtime."

The group is working to attract other government departments to its services. Emergency Preparedness Canada, Transport Canada and the RCMP used the CFARS network as an emergency radio backup during Op ABACUS. CFARS volunteers hope to work with the Red Cross in the near future.

Digital Radio Modiale (DRM) by AAR2EY

Have you hear those new strange sounds on 14.236 ? Well they are from a new Digital Voice mode that is sound card based and Part 97 legal for us by U.S. hams (Army MARS use is pending) that is spreading rapidly worldwide. That expensive AOR G4GUO modem is no longer the only digital voice option for Amateur Radio. Well its Sound Card mode implementation of the Digital Radio Mondiale (DRM) standard, is a relative new (2003) digital radio standard for international broadcast bands.

This standard was developed by a non-profit consortium (<http://www.tu-darmstadt.de/fb/et/uet/drm/>) in co-operation with the ITU. Dream is an open source software implementation of DRM that was developed by the University of Darmstadt in Germany allowing free reception of digital voice (and multi-media). This open source DRM project (www.sourceforge.net/projects/drm/) was recently modified by Cesco, HB9TLK so that it will fit into narrower 2.4Khz bandwidth SSB channel without the requirement of modifying receivers IF. In addition, he added a Linear Predictive Coder (LPC-10) audio coder/compressor provide noise-free communications voice quality on our HF bands. Hamdream is capable of SVD, simultaneous voice and data. The software is going through a rapid development cycle with the next version WinDRM already in beta testing which will make use of two sound cards, one for transmit and the other for receive. For more information and to download the software see the following URL's:

<http://www.qslnet.de/member/hb9tlk/>

http://www.qslnet.de/member/hb9tlk/hamdream_setup.htm

<http://planeta.terra.com.br/lazer/py4zbz/hamdream.htm>

<http://groups.yahoo.com/group/hamdream24/>

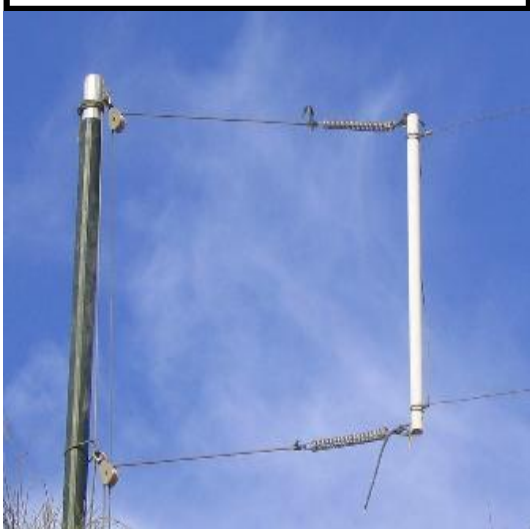
[tp://www.qslnet.de/cgi-bin/onlinefinder.pl?list](http://www.qslnet.de/cgi-bin/onlinefinder.pl?list)

The closest known MARS Station to a worlds most famous Spider hole !

Army MARS station operator AEM3AI (above) used the wooden foot locker based TS-430S/KAM XL station pictured at the right was used from Tikrit, Iraq, near the most famous spider hole in the world.

A Barker & Williamson BWD90 broadband folded dipole was used for the antenna as seen below left with detail of the tensioned pulley system to withstand the desert winds directly below.

AEM3AI had regular successful connections to the digital Pactor port of the MARS Message Center System (MMCS) that is located at the European MARS Gateway station (AEM1USA) on frequency KDG when it was still active.



<http://www.foims.org>

MARS ALE Software Development By AAR2EY *continued on page 9*



nels and has been demonstrated to perform at acceptable levels. It is planned that MARS-ALE shall provide its first HF e-mail capability by an interface with JNOS to our MARS Message Center System (MMCS). Our first objective is to pass messages received by PC-ALE or FS-1052 directly to JNOS over this interface.

Then we shall complete the support for NATO standard "STANAG 5066 HF to IP Gateway" begun by Dr. Brain. Although not totally functional yet, PC-ALE already opens up a couple of UDP sockets, one socket is to support a remote command line over a network. The other pair of sockets will eventually support email from Outlook Express, PC-ALE appears as a POP3/SMTP server on the local loop back address, it is possible to set up say Outlook Express to talk to PC-ALE, add a new mail server using the loop back IP address and it will swallow messages and save them in a directory, but that is the extent of it at present. Then later, support for Winlink 2000 which MARS is currently evaluating.

SOFTWARE DEVELOPMENT TEAM:

Lead programmer on the team is AAR2FE (above left), an MIT graduate Current living in Dobbs Ferry, NY. He explains his interest in the project this way: "Here was something complex that I didn't know anything about. Something obscure and hard to understand; just the kind of project I love!" AAR2FE has 25 years of industry experience in areas including digital voice response systems, X.25 packet switching systems, data acquisition and industrial control, machine vision systems, power electronics and electrohydraulic systems.



He is experienced in software and firmware (assembly, C, Basic, Perl, database etc), hardware (analog including precision instrumentation, digital, power electronics, bus and system design, system architecture and microprocessor interfacing) and user interface design. He has led hardware development projects for such companies as AMNET, Foxboro/Octek, ADAC, American Power Conversion, and Real Technology Corporation. In the software field, he has written custom system BIOSs, device drivers, quantitative analysis bond portfolio optimization software for a Wall Street firm, a secure internet chat system for the finance industry, high volume secure web site systems for the health care industry and numerous embedded microprocessor applications. AAR2FE served as president of a firm which designed and produces assistive devices for handicapped children after winning the \$15,000 first prize in the IEEE Entrepreneur's Society business plan competition. He is currently building custom content-managed database driven web sites for small to medium sized companies.

Also on the team is AAR2EY (above left) of Lakewood NJ who originated direct technical dialog with Dr. Charles Brain regarding PC-ALE early in the PC-ALE test cycle. His background includes 20 years of firmware, software and hardware development and Independent Verification and Validation (IV&V) of Military ATE/ESS, Communications, Test and Weapons systems (while self employed and working for ITT/Avionics, Lavoire Laboratories, PRC Inc., Engineering and Professional Services). He currently works in the commercial field of Electronic Data Automation (EDA) as an Applications Sales Engineer of Mentor Graphics software tools for FPGA and ASIC development. Having been Project Leader and Lead Programmer for the MS-Windows based Advanced Monitor Display System (AMDS) for the Army I-REMBASS system, he conceived and developed features in Ada and then ported it to Microsoft C++ to achieve better performance as the Ada software tools as the time were no as good. AAR2EY is experienced with both team software development, Rapid Application De-

AAA2NJ/O Multimode Net by AAR2EY

On Sunday, Tuesday and Thursday at 1801 local AAA2NJ/O is being run by AAR2EY as an afternoon net opportunity for multimode training. All authorized modes are used to include ALE for stations that are registered with EAMC for ALE operation. The purpose of this net is to provide an additional opportunity for stations to actively work with their digital stations, to get up and running, fine tune their configurations and to familiarize themselves with their protocols and software feature sets so as to become proficient in MARS Digital Communications.

As number of out of state stations from Maine down to Virginia which are actively working with ALE check into this net, which also provides for the opportunity to experience and deal with weak signals and adverse band conditions such as high noise levels, strong static crashes, side channel interference and propagation characteristics to include Seasonal, Absorption, Multipath and others.

MARS ALE Software Development By AAR2EY *continued from page 8*

velopment (RAD) techniques, configuration management, risk mitigation and developing multi-threaded applications under MS-Windows. In addition, AAR2EY has developed various software applications for his own pleasure in such areas as private key data encryption (B_Crypt PC-SIG 1382) and applications for Amateur Radio Logging/Rig Control (CATCC), Terrain Analysis/SAR (Sight It!) and Peet Bros. Weather Station Data Display/Analysis (SkyWarn/2001). As such, one of his key areas of attention regarding MARS-ALE will be the radio control layers of the application.

The SDT members shall focus on specific units of code and at times may be working together on the same unit of code together. Builds will be made by each SDT member to test each incremental change to a unit code and documentation shall be maintained regarding every change/addition made to the code. Each SDT member shall test their builds personally and may also use other ALE authorized MARS members to the specific areas of the applications being worked on in their builds. After testing of each unit of code is completed, AAR2FE shall integrate all units of code into a new build for distribution to the entire ALE TEST TEAM for further testing of all functions. Strict configuration management shall be maintained by the SDT so that there is always a working baseline to return to as needed.

ALE TEST TEAM: The ALE TEST TEAM conducts preliminary tests on software builds and supported equipments before release to the general authorized MARS membership, the team includes, AFA1LZ, AAR1DD, AAR1FP, AAM2TNY, AAR2EY, AAR2FE, AAR2JQ, AAV2AS, AAR3AN, AAR3FI and NNN0STE. Currently in our testing, our MARS HF ALE communication links are established the same as a MARS voice net, using a manual process where nets are predefined using a predetermined frequency plan and during the net the NCS selects alternate frequencies as may be needed. This frequency selection method does not always result in the best communications link since the selected frequency is not optimized for the existing environmental conditions. As a result, operators often encounter unreliable, and in the worst case, complete loss of communications. The next step in testing will be by the use of ALE Sounding techniques where a number of frequencies using a predetermined frequency plan will be programming into a scan group and the ALE software in Sounding mode, where it receives Sounding transmissions from other ALE stations in a predefined Group sounding on the same channels, will by virtue of Link Quality Analysis (LQA) predicated on Bit Error Rate (BER) and SINAD readings shall determine what channel(s) are best to utilized. In order to participate in ALE Sounding, which is the mode used in SHARES operations, all stations will need to utilized transceivers that can be controlled by the MARS-ALE software to change frequency and mode and the use of broadband NVIS antenna with or without automatic antenna tuner will be required. If an automatic antenna is utilized, it will need to rapidly tune on each frequency in the ALE scan group.

MARS ALE STATION APPROVALS: All US Army MARS members desiring to operate on ALE NETS must get authorization per the guidelines in Chapter 8, Section 8-8 of the US Army MARS NET PLAN. MARS members from other services should get authorization from their respective Chief, through their SMD to operate on Army MARS ALE Networks. At present within NJ Army MARS, only AAR2BD, AAR2CAB, AAR2DT, AAR2EY, AAR2JQ and AAT2AW are authorized for ALE operation.

MARS Repeater Station Hardware

In response to the many questions, the coming MARS repeater is **Motorola MSR-2000** based with **Wacom** duplexer. In the past I have retuned used Station Master antennae for Amateur band repeater use, however, the ones that I had laying around just would not go down low enough. So what to do ? We need an antenna that will perform well in repeater station service, which brings to the table a number of characteristics in physical design, an antenna that we will not need servicing for many many years. As begger's can't be to choosy, the answer was a Hustler, commercial **Spirit line model HX6-14448** antenna, which is similar in some respects to the Station Master as noted below: **Gain:** 6 dBd, **Bandwidth:** 4 MHz., **V.S.W.R.:** 1.5:1, **Polarization:** Vertical, **Power Rating:** 600 Watts Maximum, **Termination:** Type N Female, **Vertical Aperture** (3 dB from max.): 16 Degrees (6 dBd), **Weight:** 24 lb., **Wind Load** (Lateral thrust @ 100 mph): 92 lb., **Wind Area** (flat plate equivalent): 1.65 sq. ft., **Maximum Wind Speed:** 140 mph, **Material Feed Lines:** Copper, **Radiators:** Brass, **Color Radome:** White Fiberglass, **Mounting:** Galvanized steel mounting clamps permit mounting the antenna to a support pipe up to 3.25" O.D., **Lightning Protection:** Direct Ground,. The internal and external construction of the Spirit is not the same as the Station Master, the later being much more physically rugged, however, the gain and actual on the air performance is pretty much the same. It is my goal to have a Station Master that will resonate on our transmit frequency ready to replace the Spirit when/if the Spirit fails (and eventually it will physically fail, but hopefully not for a number of years) or when an opportunity presents itself to swap it out before then. The actual unit in my possession had only 1 year of service before it was stored at my residence, it was taken out of service by my Amateur Radio club and replaced due to a broken N connector on the antenna and associated problems, it has been tested at our transmit frequency and provides a 1.1:1 VSWR and should work for use for some time.

MARS Repeater Station Terrain Analysis by AAR2EY *continued on page 11*

We have received our no cost contract for the siting of the AMRS repeater station at a commercial site and are now awaiting the free installation of the antenna some time this fall. So, as we are getting closer to having our NJ Army MARS repeater operational, I decided that I would take the time to share some predicted coverage models for the system based on terrain analysis prediction methods. The data presented herein is for reference only. It has been created using a combination of technical facts regarding the repeater siting for the MARS repeater station and terrain analysis. Should any member want a model of the repeater their location as depicted herein, please provide your coordinates and as I find the needed elevation data for your area and I have the time, I will be glad to create a projection of the coverage area.



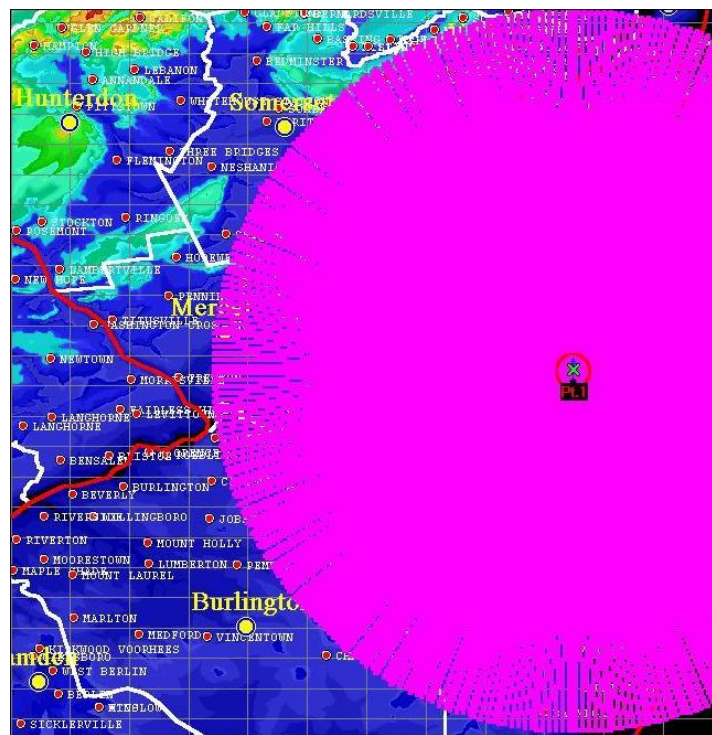
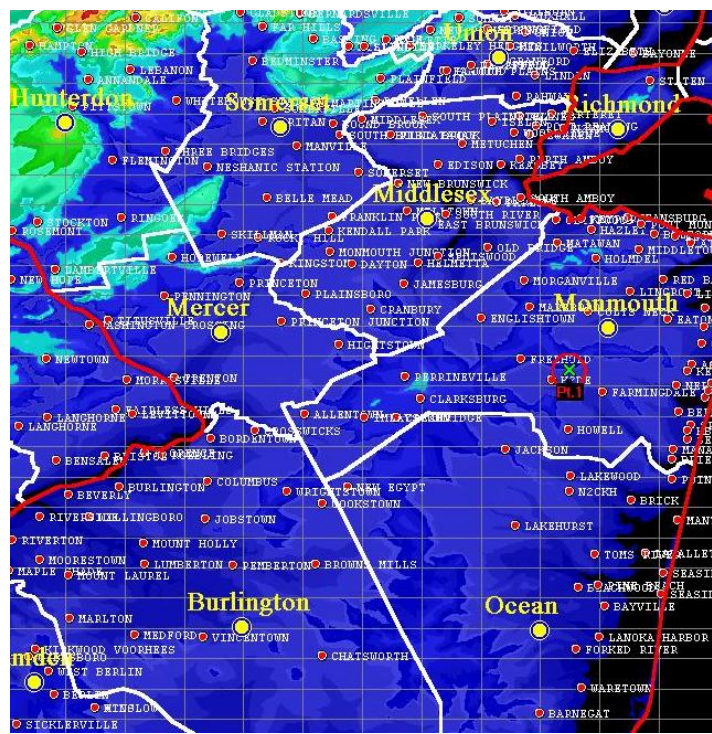
As the repeater tower is over 100 feet Above Mean Sea Level (AMSL) and the tower is 328 feet Above Ground Level (AGL), the coverage area for the repeater station will be very good in the central part of the state as one would expect. The coverage in the Monmouth, Middlesex and Ocean counties will be great, the same goes for parts of neighboring NY in Staten Island, Long Island. Access with 5 watt hand helds in the clear from most areas of those areas will be easy. Mobile coverage will also be very good in those areas, but just how good will the coverage statewide truly be, is the question. The answer has to do with the physical conditions of terrain foliage and man made structures around and between each MARS stations location with respect to the location of the repeater station as well as antenna type, gain and height.

Terrain Analysis does NOT take into account foliage or man made obstructions or antenna characteristics (such as gain, tilt angle, radiation pattern) of the repeater site or your station antenna. What it does however, is provide an idea of the Line of Sight (LOS) and Radio LOS (R.LOS) to the horizon between locations, be it point to point or a 360 degree sweep from a single point based on height above sea level and height above ground level if that later is factored in. Many Amateurs are familiar with 7.5 minute topographical maps for determining their exact coordinates and elevations that have been involved in satellite communications or installation of a repeater system. However, software is the way that most terrain analysis is performed these days, using software costs tens of thousands of dollars.

Luckily I have my own software, some years ago as a defense contractor, I was tasked with developing an updated software package for the Army I-REMBAS Ground Mounted Sensor System to run under MS-Windows, called the Advanced Monitor Display System (AMDS) it written in the Ada programming language, to support among other things numerous digital mapping and elevation data file formats and to provide terrain analysis capabilities. As such, I needed to develop a fair amount of expertise in many new areas to add to my resume. My experience at developing AMDS gave me many ideas for a terrain analysis tool to meet Amateur Radio terrain analysis needs. The Terrain Analysis models of our coming MARS repeater herein were created using my "Sight It!™ LOS Calculator™" (a 32 bit MS-Windows program, coded using the latest Visual C/C++ v5.0 tools and techniques) terrain analysis application that I developed, but have never marketed as its still incomplete. However, the software is quite a powerful Terrain Analysis tool, it is geared for use by Radio Amateur's in that it provides numerous capabilities such as APRS support, Maiden Head Grid Square overlays, Entry of Antenna Heights at points 1 and 2, Distance to the Common Radio Horizon between to points, taking into consideration the user entered antenna height at both locations, HAAT calculation, Path Loss and other capabilities that are pretty much radio specific and in some case Amateur Radio specific.

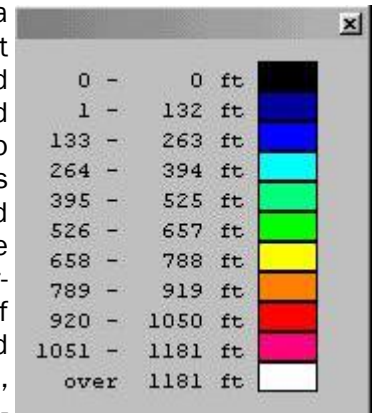
The images in herein contain many pieces of data, the colors for each elevation bin have been set in the software with Black as sea level and various colors for each elevation bin, in some models I have also turned on the Cities, County (white line) and State (Red line) boundry outlines as well as maiden head grid square display overlay lay-

MARS Repeater Station Terrain Analysis by AAR2EY *continued on page 12*



ers for a point of reference. Due to the nature of the 1 degree Digital Elevation Models (DEMs) sourced from the U.S. Geological Survey (USGS) and the coastal proximity of NJ and the siting of the MARS repeater station, the plots created by *Sight It!*TM will not depict the full 360 degree sweep as the physical location of MARS repeater site is in the lower right quadrangle of the DEM, on the coast line thus no DEM data is available for that area as it is the Atlantic Ocean at sea level.

To create these models, I have used 1 degree by 1 degree DEMs (10MB data files) two of which, that *Sight It!* Has combined into one DEM and saved with 70% compression so that they take up less space than one and load faster. These DEMs are available in formats offering greatly in density of elevation data, provided in 1 degree, 30 minute, 15 minute and 7.5 minute coverage for most areas of the U.S., the 7.5 minute provides the greatest accuracy and the smallest coverage area, it would take a dozen or more 7.5 DEMs combined to provide the coverage area being modeled.

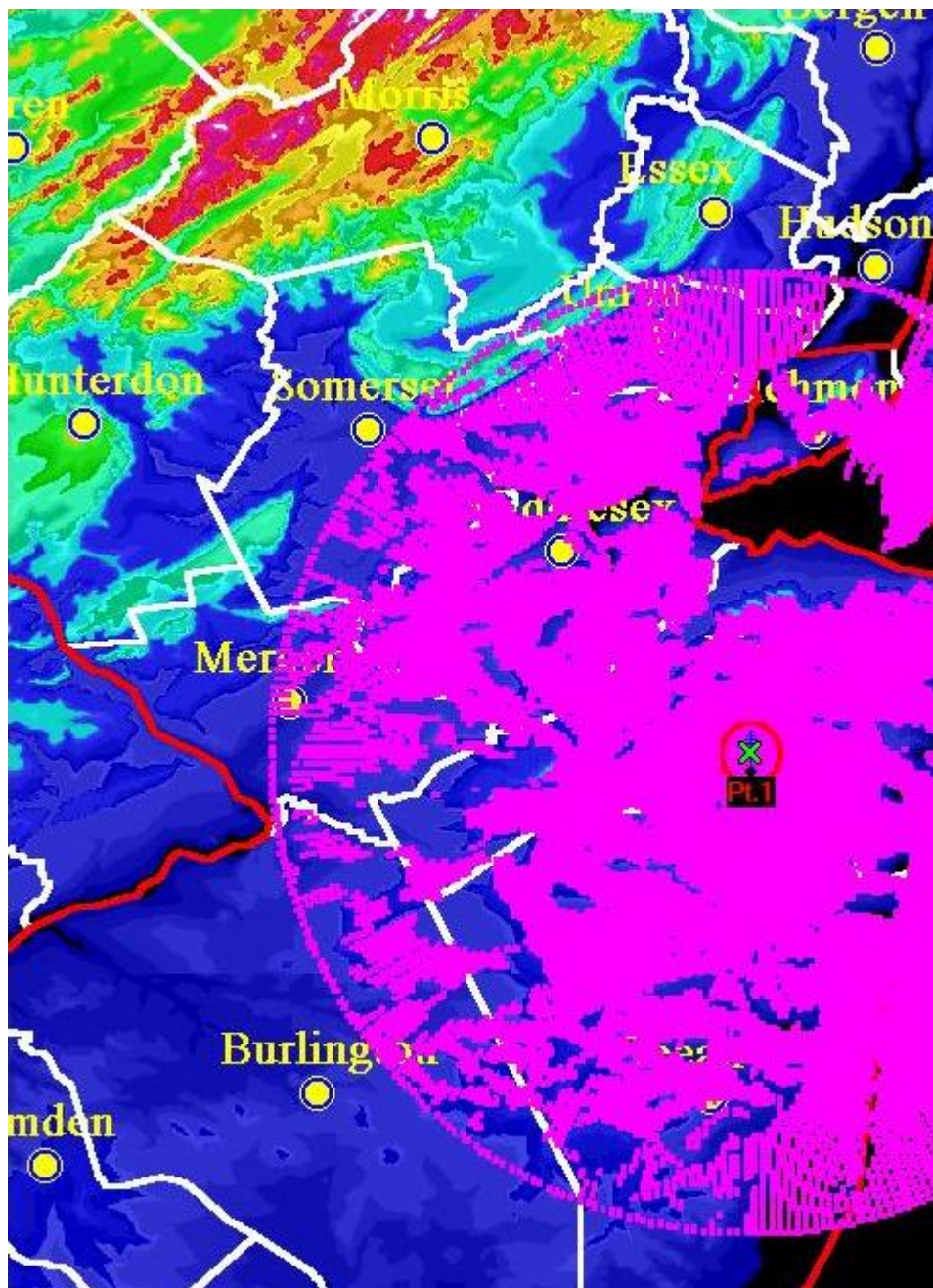


In my software I have the ability to set different colors for each elevation bin that I configure to vividly highlight changes in ground elevation with changes in color. At the right you see that Black is used for sea level, at the left you can see that the ocean is Black. Also notice that 1-132 feet in elevation is in dark Blue, then 133-263 feet is a lighter Blue, look at the image to the left and you will see the correlation, the 264-294 elevation bin is in an even lighter shade of Blue, in the center part of the state there are very few ridges that reach that elevation bin, the Homdel hills do in Monmouth county as does an area South West of Perrineville in the western part of the county. The really high elevations can be seen in the northern part of the state where we are well into the white, the highest elevation in the data used for these models was 1299 feet ABSL.

As to repeater coverage area, in theory, for our repeater station, with its antenna at 328 feet above ground, the Distance to the Radio Horizon (DTRH) with a receiving antenna at ground level is over 25 miles. That is of course in a perfect world where there are no (or minor) obstructions between your antenna and the direction of the re-

MARS Repeater Station Terrain Analysis by AAR2EY *continued on page 13*

peater station or any electromagnetic interference. However, since radio transmissions involve a transmitting antenna and a receiving antenna, both need to be considered for these calculations. The algorithm in land statute miles is well publicized, let's walk through it: Whereas; H1 = TX antenna and H2 = RX antenna -



Square root of H1 (in feet) x 1.415
= Pt1

Square root of H2 (in feet) x 1.415
= Pt2

Pt1 + Pt2 = Radio Horizon in Statute miles

So, for example, if the transmitting antenna (H1) height = 328 feet and the receiving antenna (H2) height = 50 feet, the math would be:

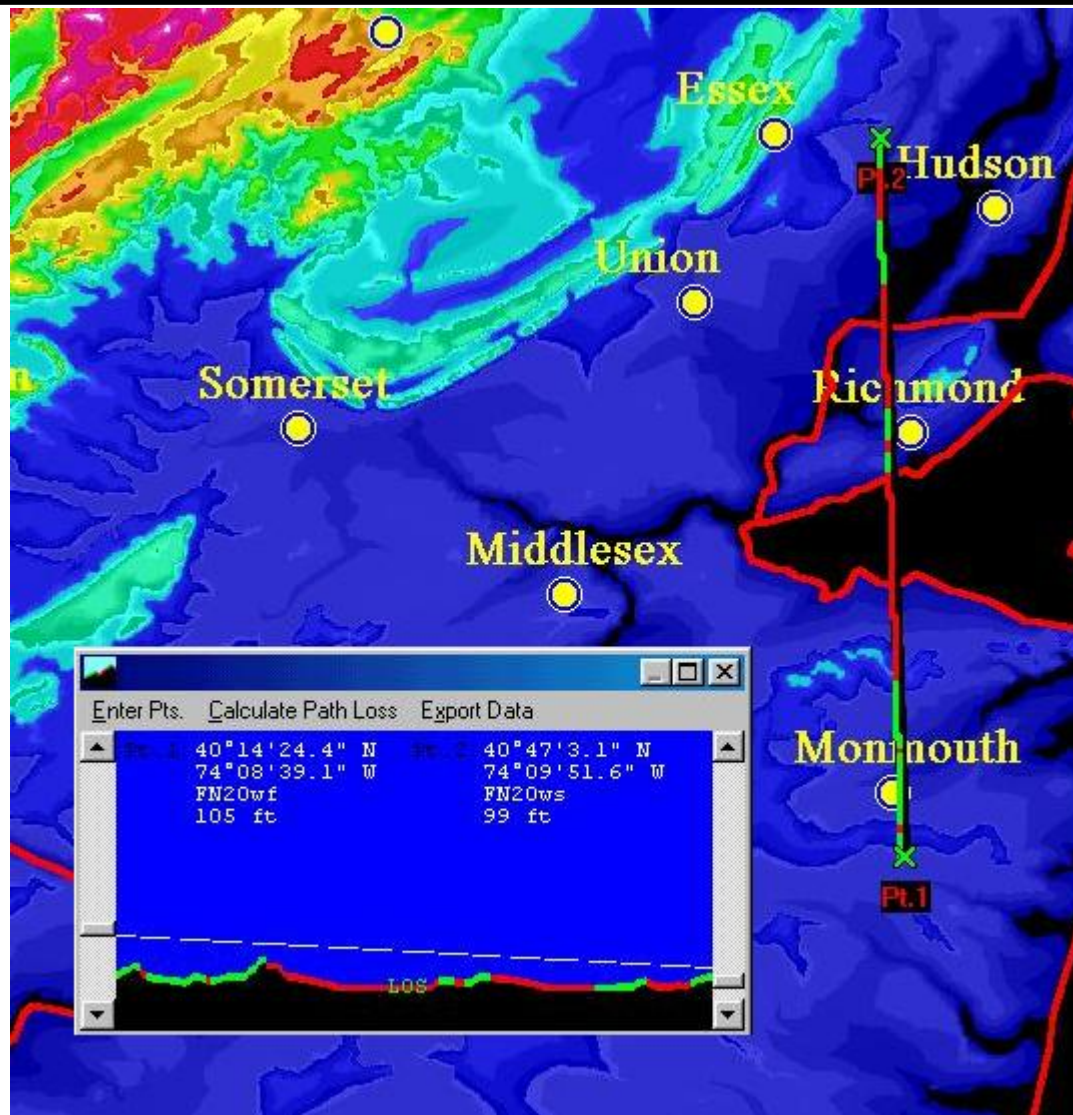
Square root of 328 = 25.6 (Pt1)
Square root of 50 = 10.0 (Pt2)
25.6 (Pt1) + 10.0 (Pt2) = 35.6 statute miles (theoretical maximum distance).

So, in theory, an antenna at 50 feet should be able to receive broadcasts from a 328 foot high antenna located just over 35-miles away, that's assuming both antenna are at the same Height Above Ground Level (ABGL) and there are no obstructions between the two., which the image to the left depicts. However, the fact is, you will rarely find yourself faced with the optimum conditions, especially in mobile communications. In the real world, the gap between theory and reality is cluttered with a plethora of variables, each having an effect of its own. Sometimes the effects will com-

bine to either hamper or improve the expected results and other times one or more will just cancel out the other. Theory versus reality!!!

We often hear "line-of-sight" references made about FM radio frequencies. In reality, the calculated horizon for visual line-of-sight is not the same as the calculated horizon for electromagnetic-wave propagation. The calculated radio wave horizon goes beyond the calculated visual horizon due to a combination of direct radiation and re-

MARS Repeater Station Terrain Analysis by AAR2EY *continued on page 14*

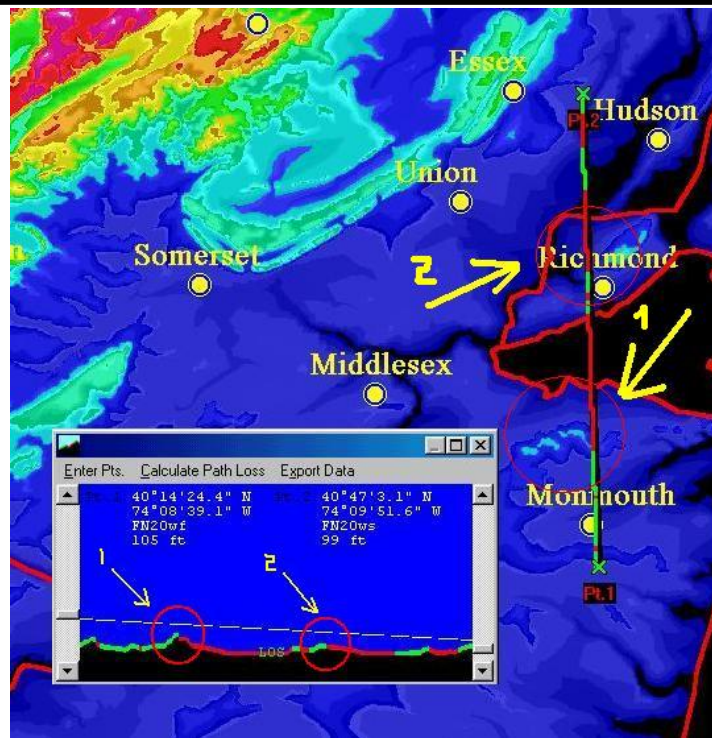


flected ground wave. Even though both horizons can be calculated, the calculations do not take into account the reality of the surround terrain and man made objects or electromagnetic interference, etc. from a radio wave perspective. The image on page 12 is the actual line of sight model (with the cities overlay turned off) from the repeater site which is "Pt. 1" with the Green "X" and encompassed by the Red circle at the center of the horizontal sweep plot.

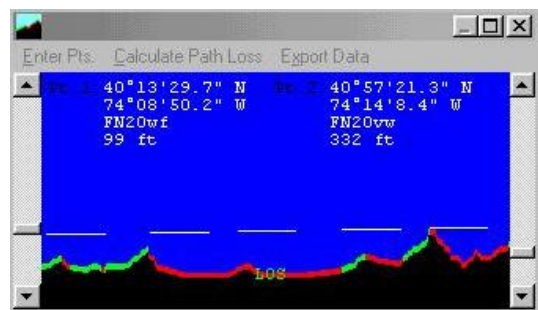
In that image you can see how just the average terrain all by itself, without foliage and man made structures inhibits LOS to many areas within the 360 degree sweep from the repeater site. Look at the area due north of the repeater, see where the purple is on the south side or a brighter blue area, those are the Homdel Hills, the site of the famous "Telegraph Hill",

its at a much higher ground elevation than other surrounding formations and it blocks the areas immediately to the north of the hills from areas to the south, thus if you were portable, mobile or even in a fixed location just on the other side of that area, you would be in a shadow area with respect to our repeater site and your signals into the repeater would be very much affected.

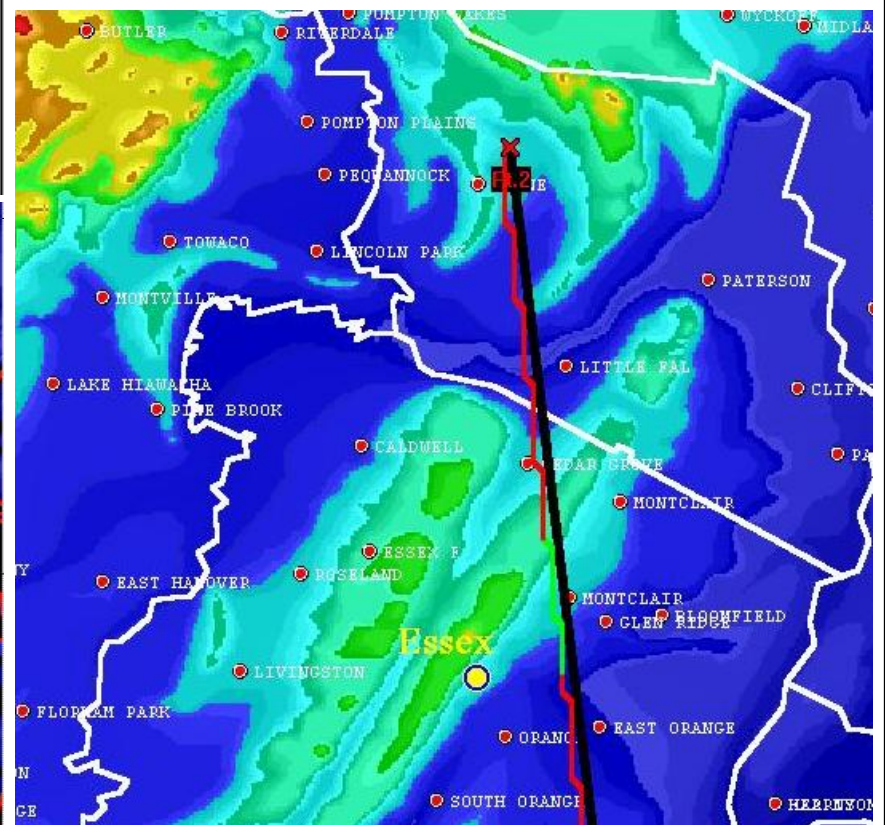
I created a model based on the MARS repeater site and that of AAR2CB seen above. I made use of coordinates that I looked up referenced by his Amateur callsign from the Buckmaster Callbook server, which may or may not be the exact coordinates for his QTH. Using an antenna height for his location of 50 feet (this does not take into account how good of an antenna is being used at either end) Above Ground Level (AGL), the software provided visual LOS between the two sites, with a distance of 37.6 miles between the two locations, the ground elevation above sea level (ASL) at AAR2CB was found to be 99 feet and the repeater site is at 105 ASL. So the ground elevations between the two sites are basically the same, however there are some ridges that come into play, that prevent use of an antenna below 50 feet at AAR2CB, a lower antenna would not exhibit LOS characteristics, which would not necessarily rule out access to the repeater. Take a look at the lime green line going due North of the repeater site, the most northern LOS to the south side of the hills in the Holmdel, Matawan area, that one is the famous Telegraph Hill just off of Route 34. As one can see by the Green changing to Red, the other side of these

MARS Repeater Station Terrain Analysis by AAR2EY *continued on page 15*

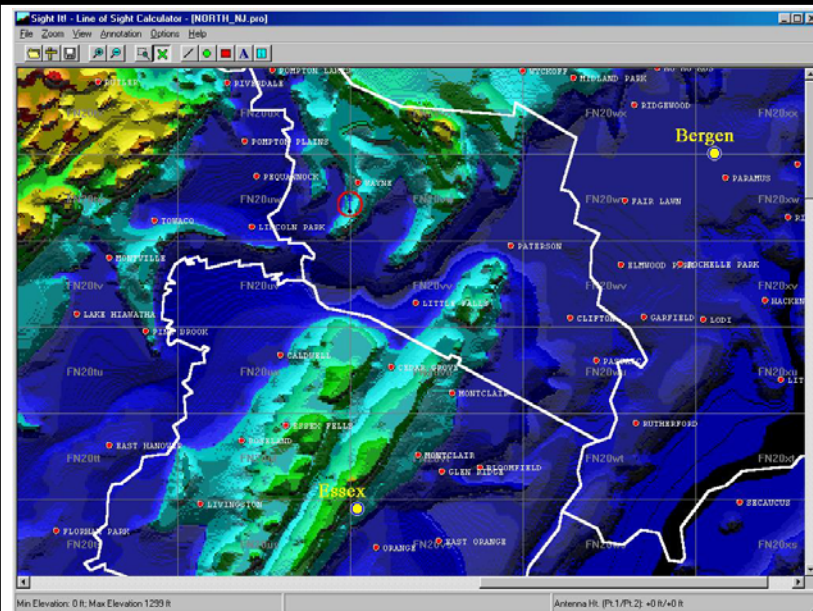
hills block the signal significantly up close to the hills (see the area labeled 1 in the image and cross section box) and in many cases for some distance beyond. If you look North toward Staten Island New York, you will see that rise in elevation causes the south side (labels 2 in the image) of a large area to be LOS from the perspective of our repeater station but the same area completely obstructs it beyond that point for many miles as the elevation drops off considerably. However, the ground elevation again rises in the area of NJ where AAR2CB is located and with an antenna height of 50 feet as depicted, he has LOS to the repeater, which means that he should have no problem accessing it from his QTH with a omni-directional antenna at that height ABGL if the coordinates that I used for the model are fairly accurate for his location.



I also modeled between the repeater site and that of AAR2JQ location as seen below. The problem for AAR2JQ is that he is 51 miles away from the repeater, located on the other side of a very high ridge in Northern NJ (see the zoomed area below) that will be hard to overcome due to his proximity. For LOS he would need to have his antenna at 165 feet ABGL. On the next page I turned on the sun shading feature so that one can appreciate the contours of the aver-



MARS Repeater Station Terrain Analysis by AAR2EY *continued from page 14*



age terrain about AAR2JQ's location (center of the red circle), this guy rides touring bike in those hills ! If AAR2JQ is going to be able to access the repeater station from that location, it will require a high gain directional antenna as high as he can get it, his chances are not very good.

Those members that live in the southern part of the state will be less challenged by the effects of terrain than those in the northern part of the state. A quick look at the images below reveal that the average terrain in most places continues to fall off as one heads further south. There is a ridge that runs NW-SE located in the western part of Monmouth county down through western Ocean county that is some 50-100

feet higher than the average terrain to the east of it that will be a problem for some as seen in these images, but antenna heights of 50 feet should allow for good access to the repeater station for omni-directional antenna use out to about 50 miles for most stations, otherwise a directional antenna will be required.

