M-PA 101

Part #5: *Understanding and Using Firmware*

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OVERVIEW:

Of all the various skills you will master in assembling your M-PA radio, the topic of FIRMWARE might be the most intense for some of you. I feel that that this installment will be the most involved and possibly the longest in this series.

I have attempted to distill this information down from a full-blown classroom based technical discussion into something bite-sized, and comprehendible by the average layperson. To create a simplified recipe to achieve the desired result, without needing to know all the techie stuff in the background. A simple 'need', to 'process', to 'successful outcome' metric.

I did include a detailed Techie section at the end for those who would be interested.

POSSIBLE SCENARIOS:

Each and every radio you encounter will contain firmware of some flavor.

If you are lucky, you will be in the FIRST GROUP, will have the correct logic board and RF Bandsplit hardware, AND the radio will already contain the correct version of firmware to achieve the operational goal you have. Your only efforts will be to program the radio to the desired frequencies and start using.

In the SECOND GROUP, the radio will have the correct logic board and RF Bandsplit hardware, but the firmware may not be the optimal for your intended use. The biggest example of this will be radios which were used for an EDACS Trunked radio system, but you wish to use for only conventional operation.

> **REMEMBER:** Trunked firmware only supports 48 conventional memory channels, versus Conventional Only firmware supports 192 memory channels.
>
> A net gain of: 144 channels!

An alternate variation on this could be changing from Trunked firmware to KEYBOARD PROGRAM firmware (aka: HamFlash).

This reflashing/upgrade process is actually a minor change will require you to upload new firmware into the radio, and reprogram. Total time required to upload new firmware is on average 15 minutes.

The THIRD GROUP of consists of radio which mostly have the correct hardware, but you the builder has decided to add in a Digital Voice daughter board, requiring that hardware addition, plus a firmware upgrade to support the new function.

The FORTH GROUP is where you have acquired a radio with a HARD CODED logic board, which no upgrade or change in firmware is possible. What are your options?

The FIFTH GROUP is where the builder is starting with a pile of components, and wanting to end-up with a functioning radio. The most complex task but quite do able!

ID'ing THE FIRMWARE CONTAINED IN THE RADIO:

As I mentioned earlier, each and every radio you encounter will contain firmware of some flavor. The first task is to identify the firmware presently contained within the radio. This is a two-step process. **You will need a fully charged battery for this procedure.**

With the radio POWERED-OFF, look on the left side of the radio. Located between the UDC (Universal Device Connector) and the Push-To-Talk button is a small BLUE colored oval button. Depress the blue oval button, and while continuing to hold it down power-on the radio. The radio's display will start flashing two alternating screens of data.

The display will flash between "GROUP **xx**" and "**Iyyzz**M**aa**".

Where: **xx** = Flash Group Level

yy = Flash Type (see table below)
zz = Flash Revision Level
aa = Control/Logic Board's Microprocessor Revision Level.

"FLASH TYPE" DESIGNATIONS:

FLASH	TYPE	DIGITAL SUPPORT	SOFTWARE FILE NAME
10	EDACS	No VG or AEGIS	VER_10zz.BPD
20	CONV	No VG or AEGIS	VER_20zz.BPD
30	EDACS	Unencrypted AEGIS	VER_30zz.BPD
40	CONV	Unencrypted AEGIS	VER_40zz.BPD
50	EDACS	VG DES	VER_50zz.BPD
52	EDACS	AEGIS/VG DES	obsolete use file: VER_70zz.BPD
55	EDACS	VG VGE	VER_55zz.BPD
57	EDACS	AEGIS/VG VGE	obsolete use file: VER_75zz.BPD
60	CONV	VG DES	VER_60zz.BPD
62	CONV	AEGIS/VG DES	obsolete use file: VER_80zz.BPD
65	CONV	VG VGE	VER_65zz.BPD
67	CONV	AEGIS/VG VGE	obsolete use file: VER_85zz.BPD
70	EDACS	AEGIS/VG DES	VER_70zz.BPD
75	EDACS	AEGIS/VG VGE	VER_75zz.BPD
80	CONV	AEGIS/VG DES	VER_80zz.BPD
85	CONV	AEGIS/VG VGE	VER_85zz.BPD

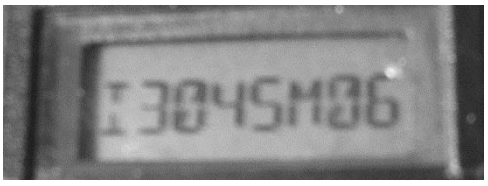
Control/Logic Board's Microprocessor Revision Level vs. Hardware:

Microprocessor Revision	Controller Board Type
03	19D903**081**G1
05	19D903**081**G1
06	19D903**081**G1
10	19D902**628**G3
12	19D902**628**G3

*Remember, the **081 controller board** supports all versions of operation including digital voice. The **628 controller board** requires a 3 volt backup battery and does not support digital voice operation.*

Here are some screen shots of what you might expect to see with a decrypt of what the data means:

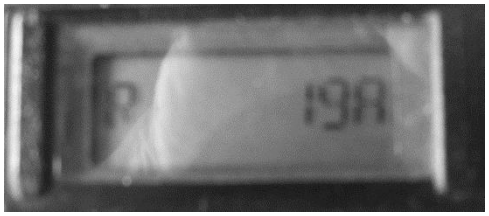
I2050M06
- 20 = CONVENTIONAL Firmware, no digital voice
- 50 = Flash Revision Level #11
- M06 = radio contains a 081 control/logic board



I3045M06
- 30 = TRUNKED Firmware with AEGIS Digital & unencrypted digital operation
- 45 = REVISION GROUP #12
- M06 = radio contains a 081 control/logic board

I65BEM03
- 65 = CONVENTIONAL Firmware with VG Digital & VGE encryption
- BE = REVISION GROUP #19
- M03 = radio contains a 081 control/logic board

Group Levels usually say the word 'GROUP', however, the final release of firmware was Group 19, can display: '**GROUP 19'**, '**R 19A**' or even '**ALPHA 19'** for some unknown reason. All are valid.



Firmware version display for HARDCODED RADIOS will always prefix with the letter "**P**":

While you cannot upgrade the firmware in a HARDCODED radio*, the radio is quite useable for conventional only operation,* and must be programmed using the DOS software application.

Below is the complete table of all known DOS software programed M-PA firmware revisions through **Group 19** which was the final for the product line, and was released in 2000.

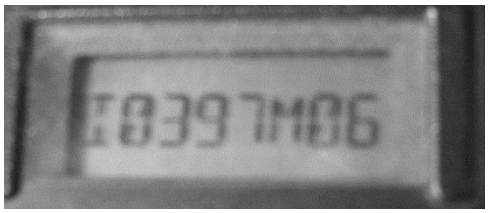
Group Level	FLASH TYPE (Conventional)								FLASH TYPE (EDACS)								
	20	40	60	62	65	67	80	85	10	30	50	52	55	57	70	75	90
1	-	1	44	62	39	62	6	4	-	1	26	62	21	62	6	4	1
2	-	-	53	-	53	-	-	-	-	-	28	-	23	-	-	-	-
3	-	-	56	-	57	-	-	-	-	-	30	-	25	-	-	-	-
4	-	19	71	-	71	-	23	23	-	-	36	-	31	-	-	-	-
5	-	-	-	-	72	72	-	24	-	-	37	-	32	-	-	-	-
6	-	23	-	-	75	75	-	27	-	-	56	-	57	-	-	-	5
7	-	-	-	-	-	-	-	-	-	-	-	-	71	71	-	23	-
8	28	28	78	-	78	-	28	28	22	22	74	74	74	74	26	26	22
9	34	34	84	-	84	-	34	34	-	23	-	-	75	75	-	27	-
10	45	45	95	-	95	-	45	45	28	28	78	-	78	-	28	28	28
11	50	50	9A	-	9A	-	50	50	34	34	84	-	88	-	34	34	34
12	-	-	-	-	-	-	-	-	45	45	95	-	95	-	45	45	45
13	-	-	-	-	-	-	-	-	50	50	9A	-	9A	-	50	50	50
14	-	-	-	-	-	-	-	-	51	51	9B	-	9B	-	51	51	51
15	-	-	-	-	-	-	-	-	53	53	9D	-	9D	-	53	53	53
16	-	-	-	-	-	-	-	-	64	64	9E	-	9E	-	64	64	64
17	68	68	68	-	68	-	68	68	68	68	A8	-	9E	-	68	68	68
18	-	-	AA	-	-	-	-	-	79	-	AA	-	-	-	-	-	-
19 *FINAL*	7e	7e	be	-	be	-	7e	7e	7e	7e	be	-	be	-	7e	7e	7e

The last type of information display you can encounter is radios which have been programmed with HamFlash. HamFlash firmware files are based on a four digit date code.

The display will "**Immyy**M**aa**".

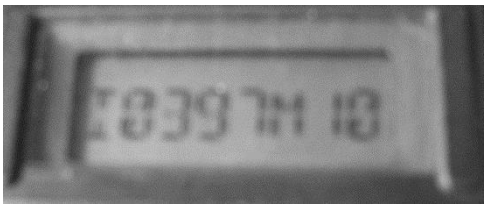
Where: **mm** = Month in two-digit format
yy = Year in two-digit format
aa = Control/Logic Board's Microprocessor Revision Level.

The both of the examples show below are for firmware released in March 1997.



I0397M06

0397 = HamFlash, Revision March 1997
M06 = radio contains a 081 control/logic board



I0397M10

0397 = HamFlash, Revision March 1997
M10 = radio contains a 628 control/logic board

The firmware filenames for these two versions of HamFlash are:

Ham628_9.bpd and **Hamvgb_9.bpd**

In the zip file containing these two firmware files is also the 14-page User Manual for HamFlash:

M-PA_HamFlash_Guide_Revision2.00.pdf

Firmware ID Summary:

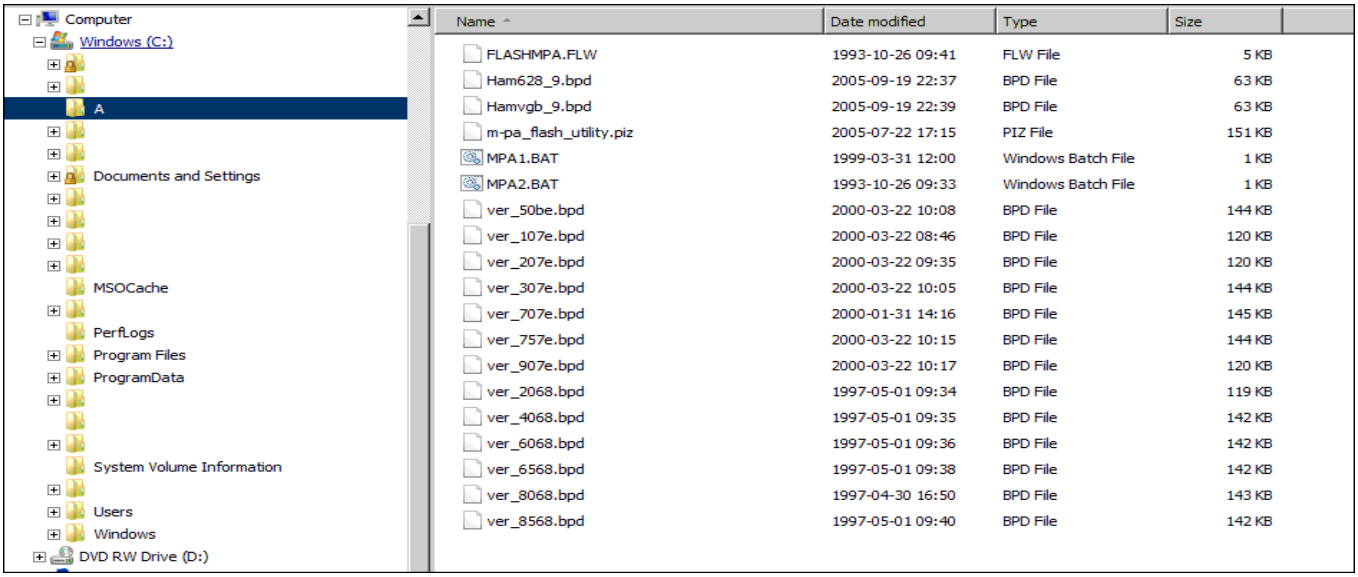
My philosophy on replacing the firmware code file in a radio is simple. ***If it is not broke, DO NOT FIX IT.*** If you do need to update the code for whatever reason, I strongly recommend using Group 19, which will be available for download from the Sparks31 website after this document is published. HamFlash firmware for both the 081 and 628 control/logic board will also be available for download, along with the DOS based installation utility, which is run from a HyperTerminal environment window.

MPA/MTL/P400 FIRMWARE UPDATING:

To flash a **MPA/MTL/P400** radio, copy all of the required files from the zip file downloaded from SPARKS31, into a subdirectory on the hard drive of your computer.

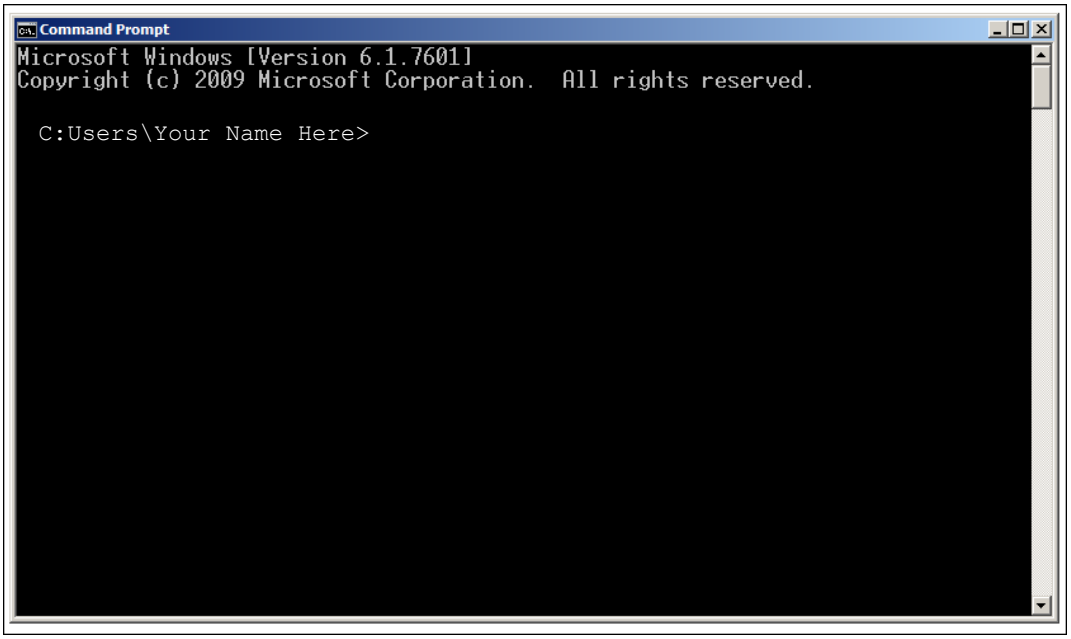
I strongly suggest you put the files an *easy to locate and use* file location directly on the root of the computer's hard drive. The reason for my suggestion is many of you have never used a terminal window before, if ever. So, I try to have your access to this older form of software as painless as possible.

In this instance I chose to use the folder: "A".



Once all the files are stored correctly, you will need to access them.

On most any widows based computer, go to START, then ACCESSORIES, then COMMAND PROMPT.



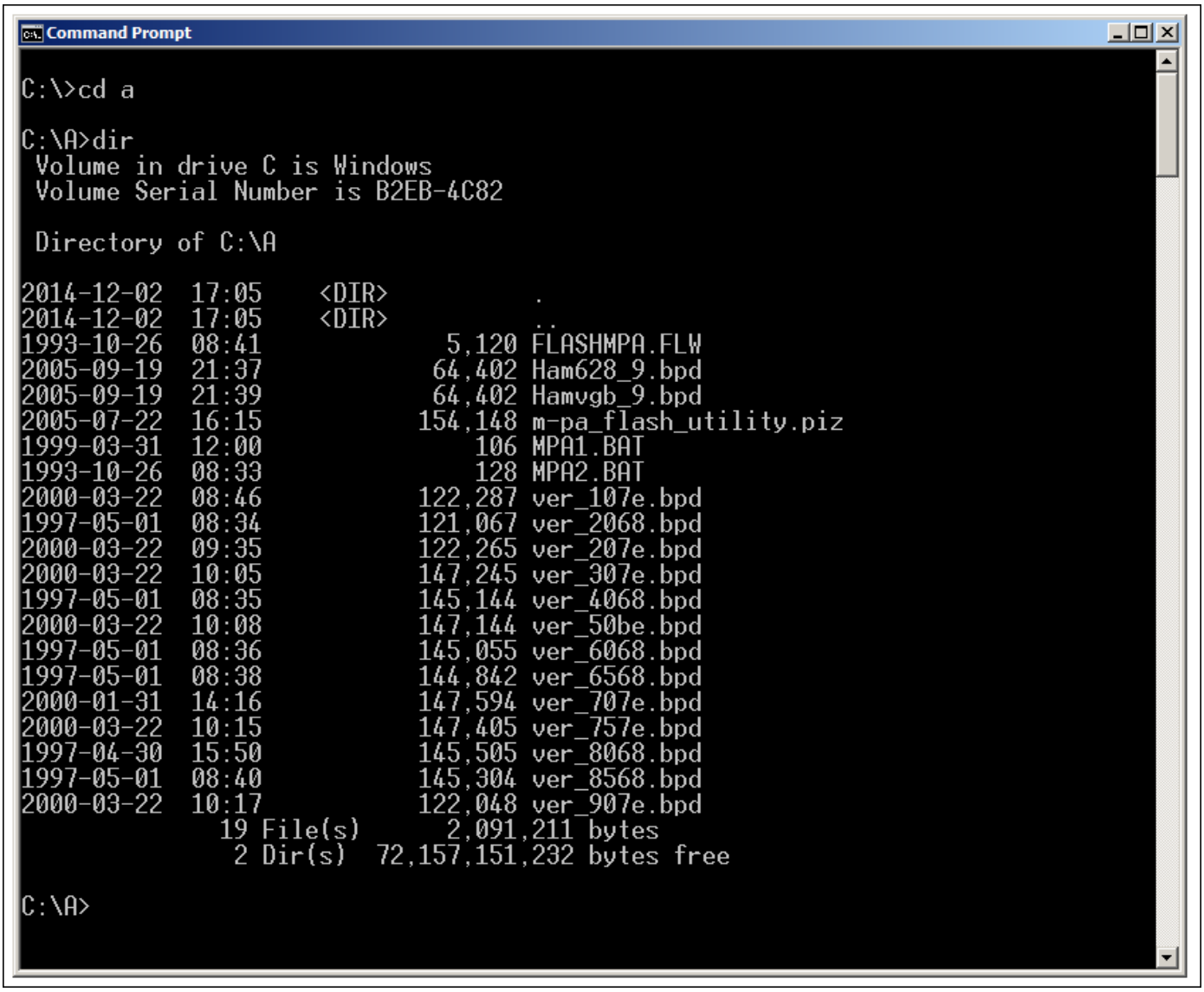
Then type the command **cd** and press the ENTER key. Your result will look like this:

Now type the command **cd a** and press the ENTER key. Your result will look like this:

This has moved you from directly on the C-drive of the computer, into the "A" folder, where the software files are stored. To view the files, simply type in the command

dir

and press the ENTER key. Your result will look like this:



It is a mirror image of the data shown in the WINDOWS EXPLORER screen, just in a raw, more primitive format from the early 1980's.

By The Way…….*Welcome to DOS if you have never visited before*.

In the Firmware Loading Application, you have your choice of two Serial COMM PORT selections:

- COMM 1 Or
- COMM 2

This dates from the time before the advent of USB ports on personal computers. If using an older computer with an actual DB-9 based Serial Port, I suggest using COMM 1. It keeps things simple. If using a modern computer without a Serial Port, but using instead a USB to Serial Adapter, map the USB port over to COMM 1 after configuring the USB device.

Connect the TQ-3370 Programming/Flash Box to the desired COMM Port. The AC power supply for the interface box can be used but it usually isn't necessary. The radio should be able to power the interface box through the UDC connector on the radio.

Connect a MPA to the radio cable and turn on its power switch, located on the battery.

Something interesting to note at this time is what is displayed on the radio after powering it on with the programming cable attached.

If the radio displays: "**PGM MODE**" …Then the radio contains CONVENTIONAL firmware.

If the radio displays: "**URP9600**" …Then the radio contains TRUNKED firmware.

This is a handy thing to keep track of when programing radios with DOS software. Conventional radios (PGM MODE) will always program with the MPA software application, whereas Trunked radios (URP9600) will always program with the EDACS1 software application. The weird exception to this constant is radios for the 896-941 MHz band. These radios will be loaded with Trunked firmware, programmed with modified EDACS1 software application, but be used in Conventional Mode due to the original factory control/logic boards in these radios being replaced with 081 control/logic boards to facilitate our purposes.

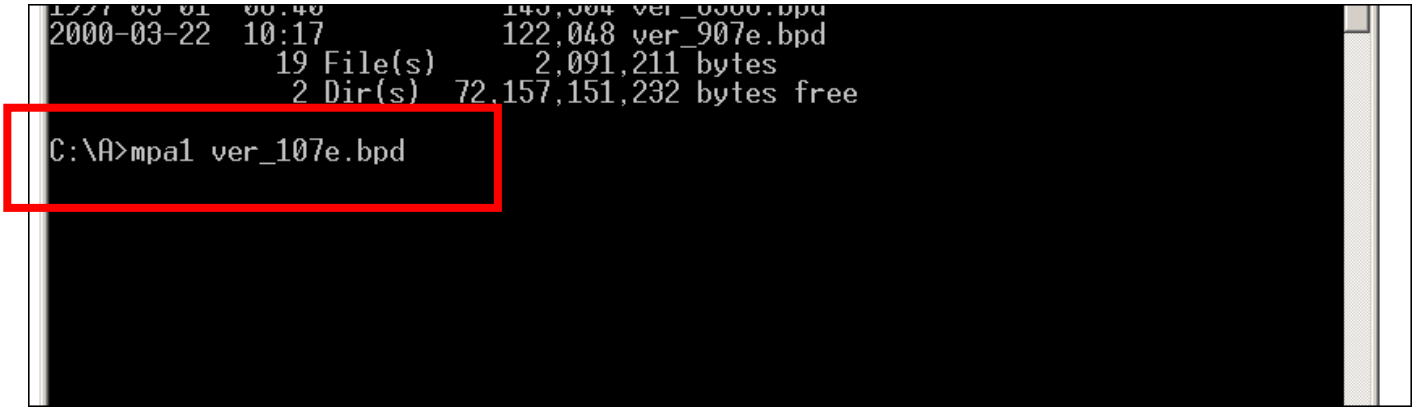
The firmware loading utility contains two .BAT files to activate the utility: **MPA1.BAT** and **MPA2.BAT**. MPA1 is used when using Serial COMM Port 1, and MPA2 is used when using Serial COMM Port 2.

With everything connected properly, to start the loading process, on the DOS Command Prompt screen type the following command for COMM Port 1 and firmware files ver_107e.bpd

mpa1 ver_107e.bpd

…and press the ENTER key. NOTE: There IS a space between the "mpa1" and "ver_".

Your result will look like this:



Thus starts the 5 to 10 minute process. You will see a heck of a lot of data scrolling across the screen, including mention of baud rate changes, and the name of the chap who wrote the application. If the process does not start after a few brief seconds after a hitting the ENTER key, power cycle the radio off and back on, and it should start.

The computer should then respond with a message saying it has started the flash program. If it can not find the .bpd file listed in the command line, the program will print an error message and exit.

The program's next step is to try and save the radio's personality. It will start looking for file contained with the radio. If it does not think one is out there, it will give a prompt to cycle the radio's power. If it still doesn't think a radio is out there, hitting any key will cause the program to skip the personality step and proceed with the flash sequence. The computer saves personality by using the radio's personality programming commands. This means that the radio must be already running a valid version of software if it is to save personality.

If changing from one flavor of firmware to another (trunked to conventional, conventional to trunked, either to HamFlash) the computer will NOT be able to save the current personality file contained in the radio. ***Nothing to worry about.***

If the radio's software is corrupted, then the program will be unable to enter the radio's personality programming commands. In this case, the computer will hang with the message that it can't find the radio. If this occurs, press any key to proceed with the flash operation. Note that the personality will not be restored even if the radio flashes ok. Personality will then have to be restored with the personality programmer program after the radio have been successfully flashed. ***Nothing to worry about.***

Once a radio has been found, the computer will get the personality information from the radio and save it in memory. This is so it will be able to restore the personality should it be corrupted by flashing. It should be noted that this is not a fail-safe method. Being able to restore personality requires a radio be properly flashed. If the radio flash is trashed, the personality may also be trashed. In this case, the personality would have to be restored with the personality programmer once the radio is properly flashed. ***Nothing to worry about.***

Once personality information is saved, the computer will turn on the programming voltage and wait a few watchdog periods for the radio to reset. After waiting, the computer will try to establish communications with the radio. If it can not find the radio, it will prompt for cycling the power. Recycle the power off and back on.

At this point, pressing any key will cause the program to terminate. If successful, the computer will tell the radio to zero out the flash part and print a message saying it is zeroing the flash part. This will take about ten seconds. After zeroing the flash part, the computer will tell the radio to erase the flash part. It will also print a message on the screen. This operation also takes about ten seconds.

Once past the erase step, the computer sends the new software to the radio. A four hex digit address will be printed on the screen as the computer updates the radio. These addresses should roll by reasonably rapidly. Flashing ends when the computer runs out of software to send to the radio. **So far, so good.**

After the radio has been flashed, the computer will once again try to establish communications with the radio. When it does, it will compare the personality information to that read (or attempted to read) into the computer before flashing on a byte by byte basis. If the personality has been corrupted, the computer will attempt to restore the personality to its pre-flashed state.

Once the personality compare is finished, the computer exits to DOS. The radio is now updated.

You have successfully updated the firmware in the radio, and the radio can now be returned to service.

I wish I could have captured screen shots of this process, but it occurs so fast that was not possible with the image capture software I had. I apologize for this. It would have been handy for the readers of this document.

Additional Information For the Die-Hard Techies In This Group:

DTR CAUTION

The TQ3370 box uses the serial port's DTR line to turn the 12V Vpp voltage on or off. Different vendor computers may power up with DTR set in different ways. Many programs also make use of DTR. Some put if back the way it found it. Others leave it in a particular state. That state may very well be the Vpp on state.

This creates a possible MPA personality programming issue. The EDACS1 programmer does not force DTR until it actually tries to access a radio. If a previous program (or start-up default condition) left DTR in the Vpp on state, there will be 12v on the radio when the programming cable is connected to the radio and the radio is turned on. This enables the flash code inside the radio and will probably crash the radio software.

This opens a possible situation where the radio software may stumble into the erase the flash prom routines before it is brought back to its senses by its watchdog timer. When this occurs, the radio would have to be reflashed.

This condition exists only on the first radio. Subsequent programming operations will be done with the DTR line in the proper Vpp off state.

The main safety mechanism is to have the computer specifically set DTR to the Vpp off state before starting the EDACS1 programmer and before connecting a radio. It is a good practice to do this in the computer's 'autoexec.bat file. The program DTR supplied with the flash programming kit can be used to do this. It would also be a good idea to put the DTR program in the '.bat file that starts up the EDACS1 programmer. The command form would be

DTR x 1 <ENTER>

Where x is the com port number that the 3370 box is attached to.

RADIO BAUD RATES

Most MPA radios must be flashed with a baud rate of 9600. This is the default baud rate of the 'Flashmpa program. However, some 900 MHz radios CONTAINING THEIR ORIGINAL 900 MHz control/logic boards require a baud rate of 4800. These are radios that have a single 5.5296 MHz crystal instead of a 5.5296 and an 11.0592 MHz. crystal. For these radios, the baud rate must be changed with a "/4800" parameter in the 'Flashmpa program's command line.

CONVENTIONAL RADIO FLASHING LOCKUP

Conventional radios using the 081 board can have their software updated by flashing. However, the 'Flashmpa program below Version 1.3 will lock up the computer while trying to save or compare the personality. Typically, the blinking "*" will stop. All further progress will come to a halt.

To get around this, press a key on the keyboard. The program will abort the operation and continue with the program. This does not seem to affect the flash prom update part of the software. But it will result in the 'Flashmpa program being unable to restore a busted personality. In other words, backing up the radio personality is especially critical when flashing a conventional radio.

The reason for the failure was that the conventional personality is larger than the EDACS personality. However, it is smaller than what the 'Flashmpa program expects. As a result, the 'Flashmpa program is waiting for data that never comes.

This problem was fixed with 'Flashmpa version 1.3. This should properly save, compare, and restore a conventional as well as EDACS personality.

IN CASE OF DIFFICULTY

There are three situations where a radio may not want to flash.

1. One case involves the computer not recognizing that a radio is out there. The computer will display a message that it can not find the radio. This can usually be solved by cycling power on the radio. One may have to cycle power several times.
2. The second case involves the computer interpreting noise when powering up as a return parameter to a programming operation. In this case, the computer may wait a long time for a step that never started to complete. The recovery in this situation is to press a computer key to terminate the program, cycle power on the radio, and run the flash program again. In general, pressing any key on the computer will terminate the program.
3. The third radio failure can involve the programming voltage. The input voltage to the programmer's flash voltage regulator always comes from the radio. If the radio has a blown UDC PWR (power) transistor, then the radio can not be flashed. It may not be obvious that a given radio does not have a working UDC power transistor. One way to check is to see if the radio will or will not accept its personality data without an ac adapter on the interface box. If it does not, it is quite likely that the power transistor is cooked. A radio with a bad power transistor should also be unable to handle a speaker mic.

If no radios flash, one should get concerned about the interface hardware. Cables are always a problem area. Flash programming requires the DTR line from the serial port to the interface box. A simple 4 wire RS232 cable (1, 2, 3, 7) will not work, even though one can usually do radio personality as well as talk to many serial devices with such a cable.

Another common situation where no radios flash is that of an earlier radio programming cable has found its way onto the TQ3370 box. Usually, the radio's display will blank when Vpp is applied. When the display remains steady, there is a very good chance that Vpp is not getting to the radio. The usual cause is that the wire that should be on pin 5 of the DB25 is instead on pin 10. The radio should flash when this wire is moved from pin 10 to pin 5. This situation is explained in further detail later in this document. This is the 19A705477P1 (program only) vs. 19A705477P2 (program and flash) cable change I mentioned in an earlier installment of this discussion.

The difference between the P1 and the P2 cable is that the P1 cable had a wire going to pin 10 of the DB25 connector to pick up the control signal RTS. On the P2 cable, this wire goes to pin 5 to pick up the 12v flashing supply. One can usually tell by ohming out the cable. The UDC connector pin in question is on the set of six pins across from the plastic keying pin. If one calls the end with the RF cable the top of the connector, then the contact in question will be the lower of the two contacts that are closest to the keying pin. One can also open up the DB25 connector and make sure. The wire in question is usually a dark green wire.

If the green wire goes to pin 10, it must be moved to pin 5. This is also the only difference between a P1 and a P2 cable.

At this point, the computer can talk to the radio. The 12v flashing voltage is getting to the radio.

If the radio still does not flash, the problem is probably internal to the radio.