

<b>GENERAL DYNAMICS</b> SATCOM Technologies  Longview, TX Facility	TYPE:  Firmware Upgrade Procedure	NO:  <b>CG-1281</b>	REV:  <b>C</b>
	TITLE:  <b>72XX Antenna Control Units</b> (With VCPU 201358-01 & Version 4 Firmware)	PAGE:  1 OF 18	

<b>WARNING</b>
<p><b>This procedure will erase the ACU NVRAM database. This includes site data, antenna parameters, the target data base, and OPT solutions.</b></p>

## **PURPOSE**

This procedure describes the steps for upgrading the 7200/7205/7210 Antenna Control Unit (ACU) firmware on VCPU boards (201358-01), using the Version 4 FLASH command to copy an image from a PC.

## **SCOPE**

This operational procedure is applicable when upgrading factory installed Version 4 firmware on the 72xx family of Antenna Control Units (ACU) for the following:

- Field upgrades of VCPU (201358-01) ACU firmware.

<b>NOTE</b>
<p><b>This procedure may ONLY be used to upgrade CPU boards running Version 4.XX ACU firmware.</b></p> <p><b>For V3.XX FLASH instructions, see document CG-5546</b></p> <p><b><i>V2.xx does not provide support for the FLASH command</i></b></p>

<b>EXPORT CONTROL WARNING</b>
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## **PERSONNEL RESPONSIBLE FOR IMPLEMENTATION**

Manufacturing, Project Engineering, Field Services, R&D departments as necessary, and site Maintenance Engineers upon General Dynamics recommendation only.

To successfully complete this procedure you must be familiar with the terminal software on your laptop or PC and have a working knowledge of the General Dynamics SATCOM Technologies ACU product you need to program, particularly the type of CPU board used.

## **DESCRIPTION**

This procedure describes the steps required to upgrade a VCPU board, using the Version 4 FLASH command to copy an image from a PC. The VCPU board has 4 Mbytes of FLASH memory for use as System PROM, mapped to the following VME addresses:

```

$FD00 0000 ... FD0F FFFF --- FLASH Bank 0 (bootable)
$FD10 0000 ... FD1F FFFF --- FLASH Bank 1
$FD20 0000 ... FD2F FFFF --- FLASH Bank 2
$FD30 0000 ... FD3F FFFF --- FLASH Bank 3

```

In factory a "bootable" firmware image is programmed on Bank 0 (the first Mbyte of FLASH). The Version 4-firmware images are about 640 Kbytes in size.

The method described in this procedure requires an operational ACU system running Version 4 firmware and with a RS232 serial port available to configure as a Menu Tree Remote M&C shell (MT M&C).

Some preparation and planning must precede the execution of this procedure. As a minimum, you will need to obtain the following:

- a binary image (electronic file) of the firmware you need to duplicate.
- The equipment described below (and this procedure).

<b>WARNING</b>
<b>This procedure will erase the ACU NVRAM database. This includes site data, antenna parameters; the target data base, and OPT solutions.</b>

Record all user parameters BEFORE executing this procedure, and then re-enter them as necessary once the new ACU firmware is operational. For that purpose a

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worksheet is provided in Appendix A to facilitate recording the user parameters or if the ACU is using V4.3 or higher firmware an automatic full parameter download to a PC is available (Reference GDST Document #CG-1295). This is extremely important in the case of upgrades to ACU systems already in service.

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## TECHNICAL SUPPORT

Read over the following procedure before attempting to program your VCPU. If there are any questions concerning this procedure, or technical support is needed, please contact *General Dynamics SATCOM Technologies (903)295-1480* or send a fax to the attention of the *Technical Support department at (903)295-1479* or email at *vertexrsi@gdsatcom.com (Website is www.gdsatcom.com)*.

## EQUIPMENT REQUIRED

- Phillips screwdriver for #10-32 screws
- A VertexRSI 72XX ACU with V4.XX firmware
- Laptop or PC with available serial port and terminal software (i.e. Tera Term, ProComm, HyperTerminal, etc.) capable of binary data transfers using Xmodem with CRC checksums.
- The laptop or PC must have the binary image (electronic file) of the upgrade on a hard disk (not a floppy drive).
- An RS-232 serial communication cable. The pin out of the interconnecting cable must be set up as follows:

D-sub 9-pin female Connect to PC	D-sub 25-pin male Connect to CPU	Modular wire color
2	2	Black
3	3	Yellow
5	7	Green

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## PROCEDURE

1. Record all user parameters in ACU NVRAM using the worksheets contained in Appendix A OR the parameters can be downloaded using the *DOWNLOAD-PARAMS* command per GDST procedure CG-1295 (the *DOWNLOAD-PARAMS* command is only available in firmware version 4.3 or higher).

<b>WARNING</b>
<p><b>This procedure will erase the ACU NVRAM database. This includes site data, antenna parameters, the target data base, and OPT solutions. Make sure the ACU parameters have been properly recorded in the preceding worksheet.</b></p>

<b>WARNING</b>
<p><b>This procedure must be performed with the system in <b>STANDBY</b>.</b></p> <p><b>All tracking operations must be halted prior to proceeding.</b></p>

2. Place the ACU in **Standby** mode.
3. FLASH memory on the VCPU is protected by DIP switch settings. To enable writing to FLASH memory it is necessary to access the front of the CPU board and change DIP switches.
  - a) Attain access to the top cover of the 7200 ACU.
  - b) Remove the screws in front of the hinge, near the edges of the top cover.
  - c) Open the top cover of the ACU chassis (or the Servo Control Unit on 7210 systems).
  - d) Locate DIP switch number S6 on the front left side of the printed circuit board (PCB). Set DIP switch S6 1,2,3,4 to the **ON** position to enable writing to FLASH memory.

The VCPU board (201358-01) is located in slot 1 of the VME card cage and the front panel looks like this:



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Hex Rotary Switch S2 – This rotary switch is used to determine which firmware to run when the system is powered on. The VCPU contains enough flash memory to hold four unique versions of application code (each of these four allocations in memory is referred to as a boot bank). This is useful when upgrading the 7200 ACU firmware because the new image can be uploaded to another boot bank, the rotary switch can be changed, and the ACU can be booted up with the new application firmware without erasing the original factory supplied application code. The rotary switch positions and their respective functions are defined in the table below:

TABLE 2-2 VCPU S2 HEX ROTARY SWITCH POSITIONS DEFINITION	
S2 SWITCH POSITION	DESCRIPTION
0 (Factory Setting)	On power-up, run the application firmware contained in boot bank 0.
1	On power-up, run the application firmware contained in boot bank 1.
2	On power-up, run the application firmware contained in boot bank 2.
3	On power-up, run the application firmware contained in boot bank 3.
4 - D	Unused (currently these positions are treated like position E).
E	On power-up, run the MONDO Monitor program. MONDO is a low level monitor program used by VertexRSI to power-up, test and program a new 7200 ACU. MONDO uses an ASCII based protocol to interface with a PC via a terminal program via serial port 0 (front panel display or serial port 1 – J14 on the rear of the 7200).
F	On power-up, run the Swift X talker (Used by VertexRSI software developers only)

DIP Switch S6 – This DIP switch directly controls various hardware related board functions as defined in the following table:

TABLE 2-4 VCPU S6 DIP SWITCH POSITIONS DEFINITION		
S6 SWITCH POSITION	OFF POSITION (SWITCH OPEN)	ON POSITION (SWITCH CLOSED)
1 - 4	Flash Write Disabled ♦♥	Flash Write Enabled
5	EEPROM Write Disabled♦	EEPROM Write Enabled
6	Normal Operation♦	Hold the VCPU board in Reset
7	CPU Watchdog Disable♦	CPU Watchdog Enable
8	Board Reset Disabled	Board Reset Enabled♦

♦ Denotes the normal operating position of the switch (factory setting).

♥To program the flash boot banks with new application code, S6 pos 1-4 must be in the ON position; after programming is complete, return these four switches to the OFF position.

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4. Connect the PC or laptop RS-232 port to an RS-232 port (typically Port 1 – J14 connector on the rear of the 7200) on the CPU using the RS-232 Serial Communication Cable referenced in the **EQUIPMENT REQUIRED** section in this document. Typically, the 7200 ACU utilizes RS-422 on ports 3-7. 7205 and 7210 systems may have custom port configurations. **Port 0 is always reserved for the front panel console and should not be used.**

<b>NOTE</b>
On most laptops COM1: is the only available serial port (RS-232); if using a PC make sure to connect to the correct COM port.

Make sure the communications parameters in the terminal program match those of the ACU. The ACU communications parameters are found in the **Edit System configuration/Remote Port configuration** Menu. Recommended settings are:

Port = 1 (or 2), Baud = 38400, Parity = None, Data bits = 8, Stop bits = 1, Shell = MT M&C, Echo = Enabled, Newline = CRLF, Handshake = None and Screen lines = 20.

5. Confirm communications are working by pressing the **ENTER** key on the terminal program; the ACU should respond with a prompt '>'.
6. Further confirm that communications are working by entering the **HELP** command and verify that the ACU responds by sending the help screen text.
7. The FLASH memory is partitioned into four banks (0-3). Each FLASH bank is 1 MB in size; therefore each bank may contain a complete ACU firmware image. FLASH bank 0 is programmed in factory by Vertex and cannot be changed with this procedure. FLASH banks 1, 2 and 3 can be used for firmware upgrades.
8. From the 72XX ACU front panel, set the User Level of the ACU to Monitor mode. This is found under **Set User level (and Passwords)...** menu.
9. From the terminal program type (All commands shown are case sensitive):

```
> SU 0 <ENTER>
>
```

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This is a request for the M&C port to enter Supervisor mode. If your system uses a security password the **0** in the **SU** command will need to be replaced by the numeric password. Verify that you are in Supervisor mode by typing:

> **WHO** <ENTER>  
>

10. Look at the VCPU board inside the ACU chassis or inside the Servo Control Unit (SCU) in 7210 systems. Verify the position of rotary Switch 2 (mounted on the front edge of the board). The location of Switch 2 dictates which FLASH bank is used when the ACU boots up. When using the FLASH command in the next step **DO NOT** upload the new firmware into the current bank that is currently in use by the ACU.
11. From the terminal program type:  
> **FLASH 1** <ENTER>  
>  
The number 1 in this command is the FLASH bank you wish to program (i.e. you can use 2 or 3 as well).
12. The ACU will respond with *"Erasing Flash bank #:"*. Then the ACU will erase the FLASH bank specified by the **FLASH** command in the previous step.
13. When the ACU has finished erasing the selected FLASH bank (this takes approximately 10 seconds), the ACU will then respond with *"Start XMODEM send."*
14. Using the terminal program, send the file using a binary transfer using XMODEM protocol, with CRC checksums. For example, using Windows Terminal the XMODEM/CRC should be selected under the **Settings/Binary Transfers...** menus; and the image should be sent using the Transfers/Send Binary file...menu.

#### NOTE

The ACU will be sending a "C" character to the terminal program about every 6 seconds. After sending 11 "C"s in the ACU will timeout on waiting for the upload and abort the process with the following message "Transfer canceled."

Sample sessions follow, including a timeout example followed by a successful transfer:



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```

>
>SU 0
>WHO Port 2 at supervisor
>FLASH 1
Erasing flash bank #:-----:
Start XMODEM send. CCCCCCCCCC
Transfer canceled

Update not successful

>FLASH 1
Erasing flash bank #:-----:
Update successful.
>

```

NOTE
<p>The <b>FLASH</b> command takes approximately 4 minutes to complete, at a baud rate of 38400.</p>

15. After the upload is complete, the ACU will return the message " *Update Successful.*" if the command was successful. Change rotary Switch 2 on the VCPU board to the number of the FLASH bank into which you downloaded the image (i.e. if you used a **FLASH 1** command turn the rotary switch S2 to 1).
16. Press the Reset Button S1 on the front of the VCPU board.
17. To confirm this procedure was performed successfully and that the ACU is using the correct firmware, simply view the firmware revision information provided in the **Display System Status... Firmware Version Information** screen.
18. Enable FLASH memory protection by returning DIP switch S6 1,2,3,4 to it's original position (OFF).
19. Navigate the 7200 menu system to Edit System Configuration/Factory Tests/Reset the ACU to ROM defaults. Select YES and press Enter.
20. Enter all the user parameters previously recorded in the worksheet (See Appendix A) or upload the parameters per the instructions contained in CG-1295.
21. The ACU firmware upgrade is complete.

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## Appendix A

Worksheet to manually record the parameters. Firmware version 4.3 or higher enables the user to download the parameters to a PC as an alternative to manually filling out the tables below (Reference GDST Document #CG-1295 72xx Parameter Download/Upload Procedure)

TRACKING RECEIVER SETUP	
PARAMETER	VALUE
Frequency	
RF input	
Attenuation [dB]	
Receiver controller	
0 dB setting	
A/D slope	

STEPTRACK DEFAULTS		
PARAMETER	DEFAULT	VALUE
Cycle time	00:02:00	
Receive -3 dB beamwidth [deg]	0.45	
Step size [deg]	0.040	
Position deadband [deg]	0.040	
Maximum no. of cycles	5	
Cycle to start rate estimates	3	
Peaking correction limit (%BW)	30	
Weight adjustment value	1.00	
Low tracking signal level [dB]	-10.00 dB	
Signal threshold [dB]	15.00 dB	
Axis to peak first	Elevation	
# of samples	10	
Sun outage protection	Enabled	

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POSITION ENCODER CONFIGURATION PARAMETERS			
PARAMETER	AZ	EL	POL
Encoder direction			
Current position [deg]			
Offsets [deg]			
Encoder type			
2-speed internal alignment (Only in systems with Encoder type set to 2-speed resolvers. )			

MOTION LIMITS PARAMETERS		
PARAMETER	DEFAULT	VALUE
Soft limits	Enabled	
Lower/CCW soft limits [deg]	AZ: 100.00 EL: 0.00 POL: -90.00	
Upper/CW soft limits [deg]	AZ: 260.00 EL: 90.00 POL: 90.00	
Motion errors	Disabled	
Immobile/reversed timeout [ms]	AZ: 2000 EL: 2000 POL: 2000	
Immobile/reversed tolerance [deg]	AZ: 0.02 EL: 0.02 POL: 0.20	
Runaway angle [deg]	AZ: 0.1 EL: 0.1 POL: 0.2	
Velocity error timeout [ms] (Used only for dc/ac flux vector motor control.)	AZ: 2000 EL: 2000	
Velocity error tolerance [%]	AZ: 20 EL: 20	

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MOTION LIMITS PARAMETERS		
PARAMETER	DEFAULT	VALUE
(Used only for dc/ac flux vector motor control.)		

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POSITION LOOP PARAMETERS			
PARAMETER	VALUE		
	AZ	EL	POL
Gain crossover [1/sec*1000]			
Integral break [1/sec*1000]			
Filter break [rad/sec*1000]			
Velocity limit [deg/sec]			
Acceleration limit [deg/sec^2]			
Positioning deadband [deg]			
Velocity deadband [deg/sec]			
Jacksaver			
Track -> stop coast time [ms]			
Inching on time [ms]			

ADDITIONAL POSITION LOOP PARAMETERS (AVAILABLE IN SYSTEMS WITH AUXILLARY DRIVES)	
PARAMETER	VALUE
Slew rate	
Slew -> track transition [deg]	
Slew -> stop coast time [ms]	

SITE DATA PARAMETERS	
PARAMETER	VALUE
Antenna Name	
E. Longitude of site [deg]	
N. Latitude of site [deg]	
Site altitude [meters]	
Timezone offset	
Timezone abbreviation	

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RF/Geometry PARAMETERS	
PARAMETER	VALUE
Polarization axis	
Antenna droop correction	
Amplitude droop corr. [deg]	
Elevation alignment [deg]	

REMOTE PORT CONFIGURATION				
PARAMETER	Port 1	Port 2	Port 3	Port 4
Port				
bps (baud)				
Parity				
Data bits				
Stop bits				
Shell				
Echo				
Newline				
Checksums				
Screen lines				

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INTERFACE OPTIONS SETTINGS		
OPTION	DEFAULT	VALUE
UTC display	On	
Local time display	On	
UTC date format	dd Mmm	
Local date format	dd Mmm	
Tracking signal display	On	
Signal units	dB	
User level display	On	
Confirm tracking	On	
Confirm edits	On	
Warning bell	On	
Audible alarm	On	
Monitor can [STOP]/[RESUME]	YES	
Monitor can clear defaults	YES	
YES/NO default answer	YES	
Always show target position	NO	
Command angle display	Position	

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The following parameters are only available on 7210 systems configured for Monopulse tracking (not applicable to 7200 and 7205 ACUs).

MONOPULSE GLOBAL PARAMETERS		
PARAMETER	DEFAULT	VALUE
Nominal gain value	200000	
Maximum rotation value	45.0	
Maximum gain ratio	1.000	
Negate RF Input 1 error(s)	e1: Disabled e2: Disabled	
Negate RF Input 2 error(s)	e1: Disabled e2: Disabled	
Error coupler rotation correction	Disabled	
Rotation direction	Forward	
Direct position control	Disabled	
Gain multiplier	0.60	

TARGET PARAMETERS			
PARAMETER	TARGET 1	TARGET 2	TARGET 3
Target name			
Tracking Mode			
Box Center Longitude [deg E]			
Longitude range [deg]			
Estimated inclination [deg]			
Box limit			
Orbit scan			
Frequency [MHz]			
RF input			
Attenuation [dB]			



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TARGET STEPTRACK PARAMETERS				
PARAMETER	DEFAULT	TARGET 1	TARGET 2	TARGET 3
Cycle time	00:02:00			
Receive -3 dB beamwidth [deg]	0.45			
Step size [deg]	0.040			
Position deadband [deg]	0.040			
Maximum no. of cycles	5			
Cycle to start rate estimates	3			
Peaking correction limit (%BW)	30			
Weight adjustment value	1.00			
Low tracking signal level [dB]	-10.00 dB			
Signal threshold [dB]	15.00 dB			
Axis to peak first	Elevation			
# of samples	10			
Sun outage protection	Enabled			

OPT PARAMETERS				
PARAMETER	DEFAULT	TARGET 1	TARGET 2	TARGET 3
Cycle time with ST solution	00:10:00			
Cycle time with LT solution	00:20:00			
Signal fluctuation limit [dB]	0.20			
Min. ST solution time span [hrs]	1.25			
Min. LT solution time span [hrs]	18			

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ADVANCED OPT PARAMETERS				
PARAMETER	DEFAULT	TARGET 1	TARGET 2	TARGET 3
ST discard point	0.10			
LT discard point	0.09			
dB collect cycle time [ms]	500 ms (0.5 sec)			
Propagator cycle time [ms]	1000 ms (1 sec)			
Max solution RMS	0.10 (10% beamwidth)			
Max steptrack fit [db]	0.50			
Max steptrack std [db]	0.20			
Use solutions	Enabled			

NON-GEOSYNCHRONOUS SUPPORT PARAMETERS				
PARAMETER	DEFAULT	TARGET 1	TARGET 2	TARGET 3
Non-geosynchronous tracking	Disabled			
Orbital period [seconds]	86164.09 seconds			
Orbital eccentricity	0.00000			
Orbit argument of perigee [deg]	0.000			

Rev C – Updated ECW STMT	B. Tanner	9/1/10	D. Fredrickson	9/1/10	9722
Rev B – updates to params	M. Neely	1-16-06	D. Harrison	1-16-06	6311
Rev A	D. Harding	9-23-03	B. Harris	9-23-03	4812
- Original Release	M. Neely	9-17-02	D. Harding	9-17-02	4254
Rev. No/change	Revised By	Date	Approved By	Date	ECO#