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Compaq Recommended SMART Array Rebuilding/Restoring Techniques

Abstract: The purpose of this document is to provide instructions for replacing hard drives in Compaq systems, particularly during circumstances where multiple drive replacement is desirable.

Factors that can contribute to a situation where multiple drive replacements might be desirable include:

- Mixed Ultra2/Ultra3 environments where there is a desire for a single drive platform.
- Mixed drive speed environments (10K RPM/15K RPM) where there is a desire for a single drive platform.
- Upgrading Array Subsystem to larger capacity drives

Whatever the reason for effecting multiple drive replacements, this document is designed to outline a process for effecting those replacements. Two replacement methods are documented—one for when the drive(s) to be replaced are in a protected set (RAID 1, RAID 5 or ADG) and the other for situations where the drives are unprotected (RAID 0 or JBOD) or when there is a concern that multiple drives in a protected set could fail concurrently.

Note: Throughout this document, the term **TARGET DRIVE** is used to refer to any drive targeted for replacement per these instructions.

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Compaq Recommended SMART Array Rebuilding/Restoring Techniques
White Paper prepared by Industry Standard Storage Group

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Overview

Replacing multiple Compaq hard drives requires specific methods. Factors that can contribute to a situation where multiple drive replacements might be desirable include:

- Mixed Ultra2/Ultra3 environments where there is a desire for a single drive platform.
- Mixed drive speed environments (10K RPM/15K RPM) where there is a desire for a single drive platform.
- Upgrading Array Subsystem to larger capacity drives.

Two replacement methods are documented—one for when the drive(s) to be replaced are in a protected set (RAID 1, RAID 5 or ADG) and the other for situations where the drives are unprotected (RAID 0 or JBOD) or when there is a concern that multiple drives in a protected set could fail concurrently.

The purpose of this document is to provide instructions for replacing hard drives in Compaq systems, particularly when multiple drives in a given system need to be replaced at the same time.

First Method. The first method assumes that any drive needing to be replaced is a member of a RAID 5, RAID 1, or ADG set such that the removal of a single drive from the array should not result in the loss of data or of the array. This method involves removing a **TARGET DRIVE**, replacing it, and allowing the array to rebuild to the replacement drive. The process is repeated until all **TARGET DRIVES** in the array have been replaced. Should a drive fail during the rebuild process, data may be lost requiring that the array be restored from backup media. It is important, therefore, to assess the condition of all the drives in the array prior to beginning this process. An ADU report would be the best tool for this purpose.

Second Method. The second method should be used in any situation where it is known that the removal of a single drive would result in loss of data (RAID 0, JBOD), or if there is a sufficient number of **TARGET DRIVES** in an array that would make the first method described inconvenient or too time consuming. Another factor that should be considered is the statistical fact that as the number of **TARGET DRIVES** in an array increases, the odds of a drive failing during the rebuild process also increase. With this method, all **TARGET DRIVES** would be replaced at the same time and each logical drive would need to be restored from backup media.

IMPORTANT: For either replacement method, insure that you have current, known good, full backups from which you could restore the logical drives where the drives are being replaced. Compaq recommends that at least two (2) such backups are available and that one of them be moved off-site.

Both methods include steps to upgrade array controller firmware and to apply the Monitoring & Performance (M&P) Patch to the hard drives. You should have the appropriate firmware and patch files available before beginning either process.

Helpful Information for Hard Drive Replacement

In an NT or Windows 2000 environment, the array controller firmware can be flashed remotely while the system is online, though the system will require a reboot for the new firmware to take effect. In a NetWare or Linux environment, the array controller must be flashed from a diskette. In either environment, the M&P Patch must be applied from a diskette.

Instructions for remote ROM flash can be found here:

<http://www.compaq.com/support/files/server/us/webdoc/ROM/BestRemoteROMUsers-001.pdf>

Note: The following links and firmware revisions were current at the time this document was written (October 2001). Check Compaq's website (<http://www.compaq.com/support/files/>) for more current firmware before proceeding.

- Remote flash firmware (v 1.72) for the SA5300 controller is here:
<http://www.compaq.com/support/files/server/us/download/8784.html>
- Remote flash firmware (v 1.30) for the SA4200 controller is here:
<http://www.compaq.com/support/files/server/us/download/9893.html>

NOTE – a more recent firmware rev (v 1.44) is available if you can flash from diskette.

- To upgrade the firmware from diskette (v 1.72 for the SA5300 and v 1.44 for the SA4200):
<http://www.compaq.com/support/files/server/us/download/10633.html>
- For other controller firmware:
<http://www.compaq.com/support/files/server/us/download/./winroms.html>
- To download the M&P patch:
<http://www.compaq.com/support/files/server/us/download/10468.html>
- To access a White Paper describing the M&P Patch:
<ftp://ftp.compaq.com/pub/products/storageworks/hdd/152W-0501A-WWEN.pdf>

Method 1 - Drive by Drive Replacement with Rebuild

IMPORTANT: DO NOT USE this method if the drive to be replaced is NOT a part of a RAID 5 (data guarded), RAID 1 (mirrored), or ADG (Advanced Data Guarding) set. Furthermore, insure that there are no degraded or failed drives in the set.

Verify that all logical drives in an array are configured for RAID 5, RAID 1, or ADG. Logical drives that are not redundant and drives that are part of a RAID 0 set will not rebuild after **TARGET DRIVES** are replaced.

This method should only be used if the drives to be replaced are not reporting a significant number of errors, which may indicate a greater likelihood of drive failure (an ADU report can be used to determine current error counts). Since ANY drive could fail at ANY time, Step 1 below CAN NOT be skipped.

It is assumed that you know the physical position of the **TARGET DRIVES** within the arrays. If not, then you should generate an ADU report prior to starting this process (for NT and Windows 2000 environments) or during this process (for NetWare and Linux environments). Instructions for generating the ADU report (which may help you identify **TARGET DRIVES**) are at the end of this document.

Perform the following steps:

1. **Perform backups** - INSURE THAT YOU HAVE CURRENT, KNOWN GOOD, FULL BACKUPS FROM WHICH YOU COULD RESTORE THE ARRAY(S) IN WHICH DRIVES ARE BEING REPLACED. COMPAQ RECOMMENDS THAT AT LEAST TWO (2) SUCH BACKUPS ARE AVAILABLE AND THAT ONE OF THEM BE MOVED OFF-SITE. This is a precautionary measure in the event of a drive failure during the rebuild process.
2. **Set the array controller's Rebuild Priority to High** – Using the Array Configuration Utility, verify that the array controller's Rebuild Priority is set to High (the default is Low). If the Rebuild Priority is not set to High, then change and save the setting.
3. **Document array and partition configuration information** – In the event of a failure that would require you to rebuild the array, redefine logical volumes or partitions and restore from backup media as you may need this information.
4. **Upgrade array controller firmware** - Flash the array controller(s) in the server with the latest firmware available for the controller.
5. **Generate an ADU report for the server (if you don't already have one)** – The ADU report can be generated by booting the server with the SmartStart CD and running the Array Diagnostic Utility or it can be done from within Windows NT or 2000 with ADU 1.50 or greater. Detailed instructions are provided at the end of this document.
6. **Apply the Monitoring & Performance Patch** – Refer to the URLs provided earlier in this document for information about this patch.
7. **Restart the system** – Allow the system to restart.
8. **Remove one of the TARGET DRIVES** – Refer to the ADU report to verify which drives in the array are **TARGET DRIVES**. If your array is configured with a Hot Spare, and the Hot Spare is a **TARGET DRIVE**, then replace the Hot Spare first. Using your ADU report, use the error counts, if any, to prioritize the order of drive replacement, replacing the drive(s) with the highest error counts first. Instructions for reading error counts in the ADU report are at the end of this document.

WHEN REPLACING DRIVES:

- a. Remove the **TARGET DRIVE**.
- b. If your array is configured with a Hot Spare, the array will immediately begin to rebuild to the spare (unless the drive you're replacing is the Hot Spare). The new drive can be inserted at anytime. This will terminate the spare rebuild process and will immediately initiate the rebuild process on the new drive. The controller will flash the online LED at approximately once per second on drives that are in the process of being rebuilt. There are also online utilities that will indicate the status of the logical drives and arrays and will display the completion percentage of the rebuild process. For Netware, this utility is CPQONLIN.NLM and for Windows, it is ACU. For Linux, ACU will need to be run from the SmartStart CD.
- c. Insert the replacement drive. After locking the drive lever, insure that it is fully seated by firmly pressing the drive in. The array will begin to rebuild as soon as the drive is spun-up and tested. (If a spare was allowed to rebuild completely, data will now be copied directly from the spare to the replacement drive).

- d. WAIT until the online LED has stopped blinking and is on solid, indicating the rebuild process has completed. The status can also be checked with ACU or CPQONLIN. Note that multiple logical drives may exist on the same array of drives; so wait for all logical drives to finish rebuilding at which point the Online LED on the replacement drive will be on solid.
- e. Repeat steps 8a through 8e until all **TARGET DRIVES** have been replaced.

If, for some reason, you encounter a multiple drive failure or if the array fails to properly rebuild resulting in loss of the array and loss of data, then you will need to follow the instructions for the second method, Multiple, Simultaneous Drive Replacement, which follows.

Method 2 - Multiple, Simultaneous Drive Replacement

This method must be used for any drive that is not a member of a RAID 5 (data guarded), RAID 1 (mirrored), or ADG (Advanced Data Guarding) set. It is optional for drive replacement within a RAID 5, RAID 1, or ADG set and should be considered as an alternative to Method 1, particularly if it is believed that drives to be replaced are at a high risk of failure. This method is also intended as a way to recover in the event that Method 1 fails due to multiple, simultaneous drive failures.

If you are replacing drives that contain the system volume, you will need to re-install your operating system and backup software before restoring your data. Therefore, you might want to consider replacing drives that contain operating systems with Method 1 or obtain a disaster recovery backup utility that will allow you to restore after booting off a floppy, bootable CD, or bootable tape. Be sure that you have any required distribution media, device drivers, license keys, etc. at your disposal before beginning.

It is assumed that you know the physical position of the **TARGET DRIVES** within the arrays. If not, then you should generate an ADU report prior to starting this process for NetWare and Linux environments or during this process for NT and Windows 2000 environments. Instructions for generating the ADU report are at the end of this document.

IMPORTANT: This method requires that you restore your data from backup media. DO NOT replace any drives before verifying the completeness and reliability of your backups.

1. **Perform backups** - INSURE THAT YOU HAVE CURRENT, KNOWN GOOD, FULL BACKUPS FROM WHICH YOU WILL RESTORE THE DRIVES AND/OR ARRAY(S) IN WHICH DRIVES ARE BEING REPLACED. COMPAQ RECOMMENDS THAT AT LEAST TWO (2) SUCH BACKUPS ARE AVAILABLE AND THAT ONE OF THEM BE MOVED OFF-SITE. This is a precautionary measure in the event of a drive failure during the rebuild process.
2. **Document array and partition configuration information** – Document the array configurations(s) and partition/volume information. This information may be needed to redefine the array after replacing drives and will likely be needed to redefine logical partitions and/or volumes.
3. **Upgrade array controller firmware** – Flash the array controller(s) in the server with the latest firmware available for the controller.
4. **Generate an ADU report for the server (if you don't already have one)** – The ADU report can be generated by booting the server with the SmartStart CD and running the Array Diagnostic Utility, or it can be generated from within Windows NT or 2000 with ADU 1.50 or greater. Detailed instructions are provided at the end of this document.
5. **Shut down and power off the server and THEN power off all external storage.**

6. **Replace the TARGET DRIVES** – Using the ADU report, identify and remove the **TARGET DRIVES** and install replacement drives. As you remove the drives, it may be helpful to label each one with its location in case there is some reason you need to reinstall the drives as they were.

NOTE: If you ARE NOT replacing one or more drives in the system volume (OS volume), then skip to Step 10, Configure array(s) (No OS installation performed).

Rebuilding the Operating System (OS) drive – The next few steps should be performed if you are replacing one or more drives on which the OS is installed. As a result, you will need to reinstall the OS after replacing those drives. If you want to perform a SmartStart installation of the OS, then you'll need to run the System Erase Utility as part of the process, otherwise, SmartStart will always boot to the System Utilities window.

If you plan to perform a SmartStart assisted OS installation, continue with Step 7.

If you do not plan to perform a SmartStart installation of the OS and instead plan to perform the OS manufacturer's standard install, then skip to Step 9, "Configure array(s) and install the OS (OS manufacturer's standard installation.)"

7. **Run the System Erase Utility – (SmartStart assisted OS installation only) -**

THE SYSTEM ERASE UTILITY WILL DESTROY ALL DISK PARTITION INFORMATION FOR ANY ATTACHED HARD DRIVE. It will erase internal drives, external drives, drives attached to all Smart Array controllers, drives attached to any dumb SCSI controllers and any Fibre attached drives.

DO NOT APPLY POWER TO ANY EXTERNAL STORAGE ENCLOSURES UNTIL INSTRUCTED TO DO SO.

In steps 7a and 7b below, you are asked to unseat certain hard drives. If you choose to physically remove drives from their slots, be sure to mark them so that you can return them to their original positions when asked to reseat them in a later step.

- a. IF THE OS IS INSTALLED TO THE SERVER'S INTERNAL DRIVES:

All external storage enclosures should be powered off. Do not apply power to any external storage enclosures until instructed to do so.

- **Any internal hard drive that is not being used for the operating system should be unseated at this time.**

- b. IF THE OS IS INSTALLED ON DRIVES EXTERNAL TO THE SERVER:

All external storage enclosures should be powered off. Do not apply power to any external storage enclosures until instructed to do so.

- Unseat all of the server's internal hard drives.
- Unseat any external drives not being used for the operating system.
- Apply power ONLY to the external enclosure that contains the OS. All other external enclosures should remain powered off.

- c. Apply power to the server and boot to the SmartStart CD.

- d. You may get an "Array not configured" error message with a prompt to press F10 for system partition utilities or F1 to continue. Press F1 to continue.

**** WARNING – CONTINUING WITH THE NEXT STEP WILL ERASE THE PARTITION INFORMATION ON ALL DRIVES CONNECTED TO THE SYSTEM. PLEASE MAKE SURE YOU HAVE FOLLOWED THE INSTRUCTIONS IN STEPS 7a AND 7b ABOVE BEFORE PROCEEDING. The next step will erase internal drives, external drives, drives attached to all Smart Array controllers, drives attached to any non-intelligent SCSI Host Bus Adapter and any Fibre attached drives.**

- e. From the System Utilities window, select the System Erase Utility and follow the instructions provided by the utility.
- f. Power down the server and appropriate external storage enclosures.
- g. Reseat (or replace) all hard drives that were unseated (or removed) in Steps 7a and 7b.

8. Configure array(s) and install the OS (SmartStart assisted OS installation) – This step assumes that drives in the OS partition have been replaced and that you are reinstalling the OS using a SmartStart assisted installation and that you have just completed Step 7, “Run the System Erase Utility – (SmartStart assisted OS installation only).”

- a. Apply power to all external storage enclosures.
- b. Apply power to the server and boot to the SmartStart CD. You may get an “Array not configured” error message with a prompt to press F10 for system partition utilities or F1 to continue. Press F1 to continue.
- c. Perform a SmartStart installation of your OS. When the Array Configuration Utility is run, use the documentation you created in Step 2 to redefine any arrays as required.
- d. Skip to Step 11, “Apply the Monitoring & Performance (M&P Patch).”

9. Configure array(s) and install the OS (OS manufacturer’s standard installation) – This step assumes that drives in the OS partition have been replaced and that you are reinstalling the OS per the manufacturer’s standard installation process. If you don’t need to reinstall the OS, skip to Step 10 (Configure array(s) (No OS installation performed). If you need to reinstall the OS but plan to use a SmartStart assisted installation, you’ll want to follow the instructions in Steps 7 and 8.

- a. Apply power to all external storage enclosures.
- b. Apply power to the server and boot to the SmartStart CD. You may get an “Array not configured” error message with a prompt to press F10 for system partition utilities or F1 to continue. Press F1 to continue.
- c. From the System Utilities window, run the Array Configuration Utility. Use the documentation you created in Step 2 to define any arrays that were lost as a result of drive replacements. Exit the ACU when finished.
- d. Reinstall the OS using the OS manufacturer’s standard installation process.
- e. Skip to Step 11, “Apply the Monitoring & Performance (M&P Patch).”

10. **Configure array(s) (No OS installation performed)** – You should be performing this step if you’ve just completed Step 6, “Replace the **TARGET DRIVES**” and did not need to reinstall your OS.
 - a. Apply power to all external storage enclosures.
 - b. Apply power to the server and boot to the SmartStart CD. You may get an “Array not configured” error message with a prompt to press F10 for system partition utilities or F1 to continue. Press F1 to continue.
 - c. From the System Utilities window, run the Array Configuration Utility. Use the documentation you created in Step 2 to define any arrays that were lost as a result of drive replacements. Save the configuration and exit the ACU when finished.

IMPORTANT NOTE: At this point the following should be true:

- You have replaced all of your **TARGET DRIVES** (Step 6).
- Your OS is installed (either you didn’t need to reinstall it or it was reinstalled in Steps 7 and 8 or in Step 9).
- All arrays are configured (Steps 7 and 8 or Step 9 in the case of an OS reinstallation, Step 10 otherwise).
- All system components (external storage enclosures and server) are powered up.

If any of these statements is not true, please review the steps taken and return to this point when the statements are true.

11. **Apply the Monitoring & Performance (M&P) Patch** - Insert the M&P Patch diskette and reboot the server. Follow the on-screen instructions for the patch.
12. **Boot to the Operating System** – Restart the server, booting to the Operating System.
13. **Define and format volumes** – If necessary, use the tools provided with your OS to redefine and format any volumes lost as a result of replacing drives.
14. **Install your backup software (if necessary)** – If you replaced drives in your OS volume and had to reinstall the OS, then you will probably need to reinstall your backup software or backup agents at this time.
15. **Restore data** – Restore from backup media those volumes lost as a result of replacing drives.

Generating an ADU Report

Generating the report and identifying TARGET DRIVES

An ADU report provides a wealth of information relative to the configuration and health of the array(s) and drive(s). It can be used to identify array controllers and drives by model number, serial number, firmware, error counts, etc. The ADU allows you to save the report it generates to a text file for analysis and documentation.

For NT and W2K servers, download the latest Array Diagnostics Utility (ADU) from <http://www.compaq.com/support/files/server/us/download/10420.html>. This version of the ADU can be run from each server while the server is online. For NetWare and Linux servers, shut down the server and run the ADU by booting from the SmartStart CD and selecting the ADU icon.

Once the ADU is loaded, select File, Save data, and choose all array controllers. You will be prompted to insert a diskette in drive A:. If running the ADU from the SmartStart CD, you will need a diskette to save the report. For NT and W2K servers you will have an opportunity to change the location of the report file. In either case, click OK at the prompt for a diskette. You will be prompted for the path and filename to which the report will be saved--enter a valid path and filename and click OK. You will then be presented with a dialogue box where you can enter comments that will be saved at the top of the report. You should enter the system name here for later identification.

Samples from various portions of an ADU appear on the following pages.

ADU Sample

The report begins with subsystem (external drive shelf) and controller information:

USER ENTERED INFORMATION:

Customer provided comment

Date/Time: Friday, September 28, 2001 3:37PM
 Computer Model: ProLiant DL380
 System ROM Version: 11/08/2000

SLOT SUMMARY:

Slot Num	Slot Type	Array Controllers and Host Adapters Detected
Slot 2	PCI	Smart Array 5300 Controller

SLOT 2 SMART ARRAY 5300 CONTROLLER ERROR REPORT:

No problems detected

SUBSYSTEM INFORMATION:

Chassis Serial Num:	D112FSB1K522
This Controller	
Array Serial Number:	Not Available
Cache Serial Number:	Not Available
Other Controller	
Array Serial Number:	Not Available
Cache Serial Number:	Not Available

CONTROLLER IDENTIFICATION:

Configured Logical Drives:	1
Configuration Signature:	0xa839be4b
Adapter Firmware Revision:	'1.28'
Adapter ROM Revision:	'1.28'
Adapter Hardware Revision:	0x00
Boot Block Version:	'1.28'
Drive Present Map:	0x00000380
External Drive Map:	0x00000000
Board ID:	0x40700e11
Cable or Config Error:	0x00 (No)
Non-disk map:	0x00000000
Invalid Host RAM Address:	No
CPU Revision:	0x00
CPU to PCI ASIC Rev:	0x02
Cache Controller ASIC Rev:	0x02
PCI to Host ASIC Rev:	0x02
Marketing Revision:	0x41 (Rev A)
Expand Disable Code:	0x01
SCSI Chip Count:	2
Max SCSI ID's per Bus:	16
Big Drive Map:	0x0000 0x0007 0x0000 0x0000 0x0000 0x0000
0x0000 0x0000 (continued)	
Big Ext Drive Map:	0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x0000 0x0000	
Big Non-Disk Drive Map:	0x0000 0x0080 0x0000 0x0000 0x0000 0x0000
0x0000 0x0000	

Logical Drive Information

The next segment of the report has logical drive information:

LOGICAL DRIVE IDENTIFICATION:

```

Logical Drive 1:
  Sector Size:          512
  Sectors Available:   35536800
  Fault Tolerance Mode: Distributed Data Guard (RAID 5)
  Logical Param Table: cyl=4355 heads=255 sec/track=32 xlate
sig=0x0
  BIOS Disabled:      No

```

LOGICAL DRIVE CONFIGURATION:

```

Logical Drive 1:
  Configuration Signature: 0xa839be4b
  Mapping Scheme:         Multiple Block
  Physical Drives:        3 (number not valid after drive
movement)
  This Logical Drive:    3 (excluding spare drives)
  Fault Tolerance Mode:   Distributed Data Guard (RAID 5)
  Logical Param Table:    cyl=4355 heads=255 sec/track=32 xlate
sig=0x0
  Drive Assignment Map:   0x00000380
  Distribution Factor:    32
  Spare Assignment Map:   0x00000000
  Operating System:      64768
  Controller Order:      0
  Additional Information: 0
  Offset to Data:        0
  Backed-out Write drives: 0
  Stripes for Parity:    16
  Distribution Mode:      0x00
  Int 13h Support Enabled: Yes
  Sectors on Volume:     35536800
  Sectors per Drive:     17768416
  Big Drive Assignment Map: 0x0000 0x0007 0x0000 0x0000 0x0000
0x0000 0x0000 0x0000
  Big Spare Assignment Map: 0x0000 0x0000 0x0000 0x0000 0x0000
0x0000 0x0000 0x0000
  Array Accelerator is enabled for this logical drive.

```

LOGICAL DRIVE STATUS:

```

Logical Drive 1:
  Drive Status:          OK
  Drive Failure Map:     0x00000000
  Blocks to Rebuild:    0 (continued)
  Blocks Re-mapped:     0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000
  Replaced Drive Map:   0x00000000
  Active Spare Map:     0x00000000
  Spare Status Flags:   0x00
  Spare to Replaced Map: See Big Spare to Replace Map:
  Replaced Marked OK Map: 0x00000000
  Media Was Exchanged:  No
  Cache Failure:        No
  Expand Failure:       0x00
  Unit Flags:           0x00
  Big Remap Count:     All Counts Zero

```

```

    Big Drive Failure Map:      0x0000 0x0000 0x0000 0x0000 0x0000
0x0000 0x0000 0x0000
    Big Replacement Drive Map: 0x0000 0x0000 0x0000 0x0000 0x0000
0x0000 0x0000 0x0000
    Big Active Spare Map:      0x0000 0x0000 0x0000 0x0000 0x0000
0x0000 0x0000 0x0000
    Big Spare to Replace Map:   No spares have replaced any drives
    Big Spare Marked OK Map:   0x0000 0x0000 0x0000 0x0000 0x0000
0x0000 0x0000 0x0000

```

Note: The ADU report can be used to determine drive error counts. When performing a drive-by-drive replacement in an array, it may be helpful to identify any drives that are reporting errors in an effort to prioritize the replacement sequence.

Monitor and Performance Data

The next section of the report, labeled “MONITOR AND PERFORMANCE DATA,” holds information regarding error drive identification. For each drive installed, there will be a section like the one below. In the report segment below, an asterisk has been placed next to the line items where error counts are displayed. Be aware that the counts are displayed in hexadecimal notation.

```

    SCSI Port 2, Drive ID 0
      Factory:      Serial #, Firmware Rev, and Mfg/Model #:
    20 20 20 20 20 20 20 20 34 45 59 39 54 31 31 38
4EY9T118
    00 00 00 00 42 43 31 50 00 00 00 00 43 4f 4d 50
....BC1P....COMP
    41 51 20 20 42 44 30 31 38 36 33 39 38 43 20 20      AQ
BD0186398C
    20 20 20 20 00 00 00 00 00 00 00 00 00 00 00 00
.....
    00 00 00 00
      Since Power: Serial #, Firmware Rev, and Mfg/Model #:
    20 20 20 20 20 20 20 20 34 45 59 39 54 31 31 38
4EY9T118
    00 00 00 00 42 43 31 50 00 00 00 00 43 4f 4d 50
....BC1P....COMP
    41 51 20 20 42 44 30 31 38 36 33 39 38 43 20 20      AQ
BD0186398C
    20 20 20 20 00 00 00 00 00 00 00 00 00 00 00 00
..... (continued)
    00 00 00 00
      Threshold Flags:      0x0001
      Serial Number Control: 0x8054
      Firmware Revision Control: 0x8248
      Mfg/Model Number Control: 0x8268
      Factory      Since Power      Threshold Control
      Serv. Time 00002fae      00002061      ffffffff      8184
      Read Blks 000000001f5751a7 00000000005fa46f      8108
      *Hrd Read 00000000      00000000      ffffffff      8184
      *Rtry Read 00000000      00000000      ffffffff      8184
      *ECC Read 0000000000000000 0000000000000000 ffffffff
8188
      Write Blks 000000000225718b 0000000000f829ba
8108
      *Hrd Write 00000000      00000000      ffffffff
8184

```

```

      *Rtry Write 00000000          00000000          ffffffff
8184
      Seeks      0000000000010ac0 000000000000a450          8108
      Seek Errs  0000000000000000 0000000000000000  ffffffff 8188
      Spin Cyls  00000000          00000000          ffffffff 8184
      Spin Time  006a             0000             01c2     a282
      Test 1     ffff             ffff             ffff     0a82
      Test 2     0006             0007             0028     a282
      Test 3     0034             0034             0096     a282
      Test 4     005e             005f             012c     a282
      Spare Blks ffffffff         ffffffff         0a04
      Re-mapped  00001808         00000000         00004130 a584
      DRQ Tmots  ffff             ffff             ffff     0982
      Timeouts   0000             0000             ffff     0182
      Rebuilds   0000             0000             ffff     0182
      Spn Retrs  ffff             ffff             ffff     0982
      Fl Rd Recv 0000             0000             ffff     8182
      Fl Wt Recv 0000             0000             ffff     0182
      Format Err  0000             0000             ffff     0182
      (continued)
      POST Err   ffff             ffff             ffff     0982
      Drv Nt Ry  00000000         00000000         ffffffff 0184
      Reallc Abt ffffffff         ffffffff         ffffffff 0984
      IRQ Gltchs ffffffff         ffffffff         ffffffff 0984
      Bus Flts   00000000         00000000         ffffffff 8184
      Hot Plgs   00000000         00000000         ffffffff 0184
      Tk Rwt Err ffff             ffff             ffff     0982
      Rmp Wt Err ffff             ffff             ffff     0982
      Bg Fw Rev  0000000000000000 0000000000000000 0a48
      Med Flrs   0000             0000             ffff     0182
      Hrdw Errs  0000             0000             ffff     0182
      Abt Cmd Fl 0000             0000             ffff     0182
      Spn Up Fl  0000             0000             ffff     0182
      Bd Tgt Cnt 0000             0000             ffff     0182
      Pred Fails 00000000         00000000         00000000 2184

```

DRIVE ERROR LOG:

No errors logged

This ADU report should look as follows:

Drive specific information can be found in the section labeled "PHYSICAL DRIVE IDENTIFICATION." From that point you can scan or search the drive information for that information that helps you identify **TARGET DRIVES**.

Physical Drive Identification

A sample report segment from the “PHYSICAL DRIVE IDENTIFICATION” section appears on the following page. This is where you can get the Product ID, Serial number, Product Rev (firmware version), as well as other information about the drive.

```
SCSI Port 2, Drive ID 1
  Vendor Id:          COMPAQ
  Product Id:         BD0096398B
  Product Rev:        BC1P
  Vendor Specific:    4DY9V379
  Serial Number:      4DY9V379
  SCSI Inquiry Header: 00 00 02 02 9f 00 01 3a
  Device Supports:    Tagged Command Queuing
                     Linked Commands
                     Synchronous Data Transfer
                     16-bit Wide Data Transfer
  Block Size:         512 bytes/sector
  Total Blocks:       17773524 sectors/disk
  Reserved Blocks:    1088 reserved sectors/disk
  SCSI Inquiry Bits:  0x3A
  Stamped for M&P:    yes
  Last Failure Reason: 0x00 (Drive has not failed)
  Phys Drive Flags:   0xcd 0x25 0x85
                     Drive present and operational
                     Wide SCSI transfers Enabled
                     Ultra2 SCSI Enabled
                     S.M.A.R.T. Supported
                     S.M.A.R.T. Enabled
                     Configured as part of Logical Drive
                     Drive write cache setting is changeable and
safe
  SCSI LUN:           0
  Spi Speed Rules:    0x00000000
  Physical Connector: J3 (controller connector attached to drive)
  Physical Bay in Box: 1 (number of the physical drive bay in the
enclosure)
```