ZETACO EVALUATION

I. What were your objectives in attending the Zetaco/Design Data training class?

Did the class satisfy you objectives?

[ ] YES [ ] NO (Please explain why and how it might be improved)

II. General

Please use the following scale to rate your evaluation of areas listed below:

1	2	3	4	5	6	7	8	9	10
Poor		Fair			Good				Excellent

A. Location and Facilities: _____

B. Educational Services: _____

Instructor: _____

Content: _____

Selection: _____

Comments: _____

_____

C. Hands-On Lab: _____

Comments: _____

_____

D. Overall Training: _____

E. Suggestions for future training course:

NAME: _____

COMPANY: _____ TITLE: _____

Non-Virtual Characteristics

```
Enter Command (? to see choices): L
```

CURRENT CONFIGURATION FACTS

	Port 0	Port 1	Port 2	Port 3
Throttle Burst Rate	32	32	32	32
Break Count	0	0	0	0
Sync Byte	223	223	223	223
ECC Enabled	YES	YES	YES	YES
Media Format Type	ZTA1	ZTA1	ZTA1	ZTA1
Interleave Factor	1	1	1	1
Sector Slip Enabled	NO	NO	NO	NO
Data Transfer Method	BMC			
BMC Priority	2			
Dual Port Enabled	NO			

The disks on this controller are:

	DISK	HDS	HDS-REM SECS	PHY. UNIT#	LG. UNIT#
PRT 0	UD-User Defined	5	32	0	0
PRT 1	UD-User Defined	5	32	0	0
PRT 2	UD-User Defined	5	32	0	0
PRT 3	UD-User Defined	5	32	0	0

```
Enter Command (? to see choices): ?
```

COMMAND MENU

CHANGE CONTROLLER FACTS:

A - Data Transfer Method
B - BMC Priority
D - Disk Drive(s)
P - Dual Porting Flag

CHANGE DISK PER PORT FACTS:

E - ECC Enable or Disable
F - Throttle Burst Rate
G - Throttle Break Count
I - Interleaving & Sector Slip
M - Media Format & Sync Byte

MISCELLANEOUS COMMANDS:

H - HELP (Operations)
W - HELP (What To Do)
J - CHANGE ALL controller facts
K - CHANGE ALL DISK per port facts
L - LIST all configuration facts
N - START logging to printer
O - STOP logging to printer
Q - QUIT the program
U - UPDATE EEPROM
X - SWITCHES (ZETACO Only!)

```
Enter Command (? to see choices): O
```

Virtual Characteristics

Enter Command (? to see choices): L

CURRENT CONFIGURATION FACTS

	Port 0	Port 1	Port 2	Port 3
Throttle Burst Rate	32	32	32	32
Break Count	0	0	0	0
Sync Byte	223	223	223	223
ECC Enabled	YES	YES	YES	YES
Media Format Type	ZTA2	ZTA2	ZTA2	ZTA2
Interleave Factor	1	1	1	1
Sector Slip Enabled	NO	NO	NO	NO
Data Transfer Method	BMC			
BMC Priority	2			
Dual Port Enabled	NO			

DISK NAME	PHYSICAL Unit	Total Secs.	Logical Interlv.	Ports 0 1 2 3	LOGICAL Unit	MB	Emulation
ND-New Disk Type	0	70	NO	X X X X	0	147	6161
					1	147	6161

Enter the number of a port to examine closer or enter a carriage return or newline to return to the main menu: 0

********** PHYSICAL CHARACTERISTICS **********

DISK NAME	Unit	Cyls	Secs	Slipped	Heads	Megs	Split Method
ND-New Disk Type	0	1646	35	0	10	194	Secs/2;Cyls*2

********** LOGICAL CHARACTERISTICS **********

EMULATION NAME	Unit	Cyls	Secs	Heads	Megs
6161	0	822	35	10	147
6161	1	822	35	10	147

Enter Command (? to see choices): O
...Logging to the printer ended.

How will SKS-HP performance compare to Data General's RAMS?

Theoretically, they're close because the technical strategy of RAMS and SKS-HP are very similar. We'll actually know more when the in-house testing is done, and will pass the results on to you. Meanwhile, our theoretical estimates are included here (and noted as estimates.)

Like SKS-HP, Data General's RAMS also has a high speed bus (5 MB/sec) and the capability to overlap both seeks and latency, resulting in the controller being active about 15% of the time during a transaction. Both SKS-HP and RAMS utilize the low controller involvement in a transaction to allow a multiple-drive strategy that significantly improves performance as drives are added.

RAMS has an slight advantage in most other drive performance parameters (see table), but SKS-HP has a significant advantage in that it is built around drives that can be added to take advantage of parallelism at a much lower cost.

This all nets out to a one-drive RAMS performing 37.3 transactions per second (TA/sec), compared to a one-drive SKS-HP performing 34 TA/sec, or 90% of RAMS. **However, with SKS-HP, we can add one extra drive and outperform RAMS, while remaining at significantly lower cost to provide better performance.**

SKS-HP drives are built on a high production line that has produced literally millions of drives, which therefore allows us to offer lower prices, in turn allowing SKS-HP pricing that makes this multiple drive strategy practical for any performance-oriented MV user.

Two add-on SKS-HP 323-MB drives are priced at $12,595, while one 500-MB RAMS add-on drive is $22,000 -- or **43% more cost for 37% fewer megabytes!** Utilizing the 601-MB drives, SKS-HP provides 20% additional capacity per drive added. As you can see, an SKS-HP configured with one extra drive typically provides improved performance over RAMS, at far less cost, no matter which drives are used!

SKS-HP configurations can be sold against RAMS to provide more capacity and higher performance at a significantly lower cost. Against RAMS configurations of up to 3 drives, just ensure the SKS-HP subsystem has one more drive. When competing against 4-drive RAMS subsystems, an SKS-HP configuration with 2 controllers and at least 4 drives is recommended. Refer to the charts on the next pages for comparisons.

SKS-HP~~323~~ 327 & SKS-HP601: Major Features

* **Higher Subsystem Performance....**	Through drive parallelism in multi-drive configurations, and 2nd generation SCSI hardware technology.
* **Faster Data Transfers.....**	4 MB/sec transfer with bursts up to 4.75, achieved through synchronous SCSI technology on both controller & drive/s.
***Larger Capacities per Drive.....**	Offering the latest & greatest: synchronous SCSI drives, in 5.25" form factor, your choice of 323 or 601 formatted MB per drive.
* **Data General Compatibility.....**	Through true emulation of Argus/DPJ driver. No patching, no modifications, just Plug-and-Play compatibility.
* **Variety.....**	Removable or fixed disk modules, or <u>both</u> on one subsystem!
* **Configuration Flexibility.....**	Choose from 300-MB, ~~323~~ 327-MB, and 601-MB drive modules. Mix 'n match as needed, up to 7 drives on the same controller.
* **Easy to Fit into System.....**	Drives are of the 5.25" form factor, and two of them need only 3.5" of vertical space in a standard rack.
* **Highly Reliable.....**	Although the drive models are new, they are simply the latest generation of a drive technolgoy with a field-proven 30,000-hour MTBF! The new controller, as well, is an evolution of proven technology, with 100,000-hour MTBF!
* **Improved Features.....**	Zetaco has significantly improved the mirroring resynch time on the SCZ-3 over the SCZ-1.

DRIVE SPECIFICATION COMPARISON

654 Shadow

MODEL NUMBER -->	SKS-HP~~646~~	SKS-HP1202	RAMS	CSS-234	CSS-322
Capacity Per Drive	323 MB	601 MB	500 MB	234 MB	322 MB
Average Seek Time	17.5 ms	16.5 ms	16 ms	28 ms	18 ms
Average Data Latency	8.3 ms	8.3 ms	6.5 ms	8.3 ms	8.3 ms
User Data Rates					
Average MB/sec	1.46	1.61	2.13	.80	1.11 E*
Maximum	1.65	1.77	2.13	.80	1.11 E*
Data Heads	9	15	12	15	15
Drive Buffer Size	32 KB	32KB	32 KB	8 KB	?

SKS-HP to RAMS SUBSYSTEM COMPARISONS

Configuration with -->	1 drive	2 drives	3 drives	4 drives
Zetaco's SKS-HP646				
Subsystem Capacity	n/a	646 MB	n/a	1292 MB
TA/sec	n/a	60 E*	n/a	105 E*
Subsystem Price	n/a	$18,595	n/a	$31,190
Initial Cost/MB	n/a	$28.78	n/a	$24.60
Zetaco's SKS-HP1202				
Subsystem Capacity	n/a	1202 MB	n/a	2404 MB
TA/sec	n/a	65 E*	n/a	110 E*
Subsystem Price	n/a	$24,995	n/a	$43,990
Initial Price/MB	n/a	$20.79	n/a	$18.30
Data General's RAMS				
Subsystem Capacity	500 MB	1000 MB	1500 MB	2000 MB
TA/sec	37.3	75.1	110.9	?
Subystem Price	$29,300	$51,300	$73,300	$95,300
Initial Price/MB	$58.60	$51.30	$48.86	$47.65

E* = Estimated, based upon current knowledge.
MB = megabytes, ms = milliseconds, TA/sec = transaction per second.

[redacted] With the WREN Runner T/S 42 one drive
81 two drives

Zetaco/DG block conversion

Conversion of logical characteristics ② to physical characteri using a virtual configuration - See example.

To convert bad block or sector which may be given using Reliability with virtual characteristics enabled. :

1.) Convert Logical Cyl., Hd, Sec to Block address.

ex. Cyl. - 41_8 = 33_{10}
HD - 14_8 = 12_{10}
Sec - 26_8 = 22_{10}
UNIT # = Ø

TOT Cyl = 842
TOT HD = 19
TOT SEC = 32

$$\text{BLK ADD.} = \left[\text{Cyl.\#} \times \left(\text{TOT HDS/CYL} \times \text{TOT SEC/TK}\right)\right] + \left[\text{HD\#} \times \text{TOT SEC/TK}\right] + \left[\text{SEC\#}\right]$$

$$= \left[33 \times (19 \times 32)\right] + \left[12 \times 32\right] + \left[22\right]$$

Blk Add = 20470_{10}

2.) Convert BLK. ADD TO Physical Characteristics.

BLK ADD ÷ (TOT SEC/TK × TOT. HEADS) = Cyl + Remainder

REMAINDER ÷ (TOT. SEC/TK) = HD + Remainder

Remainder = SECTOR

ex: $20470 \div (64 \times 20) = 15$ R = 1270
$1270 \div 64 = 19$ R = 54
S = 54

$Cyl = 15_{10}$
$HD = 19_{10}$
$S = 54_{10}$

NOTE: FOR VIRTUAL CHARACTERISTICS That contain more than 1 logical unit, UNIT Ø will be the first N physical blocks ON THE DISK [redacted] AS DETERMINED BY [N = The total Cyl. x tot. heads x tot. Sec.] For that logical unit.

To get the physical parameters from the logical of any successive unit on that drive, figure the Block address for that unit ~~just~~ as was described in the preceding example. STEP 1 Then add the total blk count of any lower numbered logical units on that drive to the Block address figured on the unit in question. This will give the block address of the sector identified. From this, the physical characteristics can be figured as in Step 2.

HARD HEADER NON-COMPARE ON WRITE

-If error logging and relocation is enabled for hard errors thru configurator the ARZ-1 will report a soft error and relocate the block the first time it happens. You will see this block in the soft error log.

HARD HEADER NON-COMPARE ON READ

-The ARZ-1 will report a hard error. You must re-analyze or add bad block using the Initializer.

HARD ECC ERROR ON WRITE

-Will not happen

HARD ECC ERROR ON READ

-The ARZ-1 will report a hard error. You must re-analyze or add bad block using the Initializer.

SOFT HEADER NON-COMPARE ON WRITE

-Not applicable

SOFT HEADER NON-COMPARE ON READ

-Not applicable

SOFT ECC ERROR ON WRITE

-Will not happen.

SOFT ECC ERROR ON READ

-If error logging and relocation is enabled for soft errors thru configurator, the ARZ-1 will report a soft error, log it and will relocate if count has been reached.

**** If error logging and relocation is disabled all errors are reported as ***
**** soft or hard depending on the severity and type of error encountered ***

2-4 in book

ARZ-1 SELF TEST ERROR CODES

light blinks to indicate # of test failing.

1. RAM TEST
2. BANK 0 BUFFER TEST
3. BANK 1 BUFFER TEST
4. DONE FF TEST
5. BURST COUNTER
6. BREAK COUNTER
7. BMC TRANSFER BANK 0 AND 1 — factory setup problem call zetaco. some tests should be disabled.
8. 512 BYTE BMC TRANSFER
9. EEPROM CHECKSUM
10. DUAL PORT RAM TEST

> 10 blinks dual port ram failures

DISK ERROR CODES

TAKE THE DISK ERROR FROM THE CONTROL BLOCK ERROR PRINTOUT.
THIS ERROR WILL BE IN ~~HEXEDECIMAL~~ AND MUST BE CHANGED TO OCTAL.
THE ERROR WILL BE SHOWN IN AN UPPER AND LOWER BYTE.

UPPER BYTE

2 - NO UNIT RESPONCE
3 - SEEK ERROR
4 - ERROR IN SPECIFIC HEADER
5 - CYLINDER ADDRESS ERROR
6 - NO HEADER FOUND
7 -
8 - ECC DETECTED (NOT CORRECTED)
9 - UNIT FAULTED
A - CLOCK ERROR (SERVO/READ)
B - WRITE PROTECT
C - ECC ERROR/48 BIT
D - ILLEGAL UNIT
E - MARKED BAD SECTOR
F - ECC CORRECTED 32 BIT
10- ECC CORRECTED 35 BIT
11- ECC CORRECTED 56 BIT
12- ECC DETECTED ONLY (NO CORRECTION)
14- ECC DETECTED (NOT CORRECTABLE)

LOWER BYTES

0 - DRIVE ERROR
1 - BMC ERROR DURING SECTOR XFER
3 - ENDING MEMORY ADDRESS ERROR
4 - ILLEGAL CB COMMAND
5 - DRIVE ERROR (CATCH ALL)
6 - BMC ERROR (TIMEOUT)

Table 2-4. Control Block Contents

Word	Bits	Name	Contents or Function
0 and 1	0-15	Link Address	Address of the next CB in the list (see Note 1).
2	0	Interrupt Bit	If set: The controller generates an unconditional interrupt when it completes a CB (see Note 2). Not set: The controller generates an interrupt only if the link address is 0, or if an error occurs.
	1	No Retries Bit	If set: Every error appears hard. No retries occur, regardless of the controller information block values. Not set: Retries occur according to controller information block values.
	2	Atomic Bit	If set: Provided the next CB in the list is for the same unit, the controller executes that CB regardless of options. Not set: CB execution order is affected by the optimization bit in the Unit Information Block.
	3-5	—	Unused.
	6-15	Operation Code	Controller operation to be performed: **Octal Code — Meaning** 000 — No Operation 100 — Write 101 — Write/Verify 104 — Write Single Word 105 — Write/Verify Single Word 142 — Write with Modified Bit Map 200 — Read 201 — Read/Verify 205 — Read/Verify Single Word 210 — Read Raw Data 220 — Read Headers 242 — Read with Modified Bit Map 400 — Recalibrate Disk These operations, called CB commands, are detailed in Chapter 4.
3 and 4	0-15	Page Number List Address	Address of the page number list in host memory (see Note 3).
5	0	Mapping Bit	If set: The transfer address (words 5 and 6) is a logical premapped address. Not set: The transfer address is a physical address.
5 and 6	1-15 and 0-15	Transfer Address	Starting address of the data transfer (see Note 4).
7 and 8	0-15	Device Address	Logical sector address of the device that is to receive the data transfer (see Note 5).

Table 2-4. Control Block Contents (continued)

Word	Bits	Name	Contents or Function
9	0-7	—	Unused.
	8-15	Unit Number	The number of the unit you want to perform the operation on.
10	0-15	Specify/ Return Transfer Count	The transfer count before and after the CB is executed: Specify Transfer Count: The number of data sectors you want to transfer. Return Transfer Count: The number of data sectors transferred (see Note 6).
11	0-15	CB Status	Specifies the CB status before and after the operation. This word must be 0 before the CB is executed. After execution, this word contains the following status information: **Bit — Meaning If Set:** 0 Any CB hard execution error 1 Interpretation error 2 Soft errors in execution occurred; controller recovered 3 CB termination by Cancel List command 4 ECC correction needed 5 ECC correction failed 6-14 Unused 15 CB Done bit
12 and 13	0-15	—	Reserved.
14	0-15	Error Status	**Bit — Meaning If Set:** 0 Interrupt Timeout 1 Drive Interface Fault 2 2901 Timeout 3 Buffer Overflow (Data Late) 4 Controller Detected Checksum Error 5 Drive Error 6 BMC Timeout 7 Ending Memory Address Error 8 Data Checksum Error 9-10 Reserved 11 Verify Error 12 BMC Error 13 Data Parity Error 14 ECC Detected Error 15 Header Noncompare These bits indicate the last error encountered for any CB and are valid whenever bit 0 or 2 of the CB status word is set (see Note 7).
15	0-15	Unit Status	**Bit — Meaning If Set:** 0 Command Failed 1 Power Failed 2 Ready

Table 2-4. Control Block Contents (continued)

Word	Bits	Name	Contents or Function
			3 Busy 4-5 Port Reserve Bits 6-7 Unit Number 8 Logic Fault 9 Power Fault 10 Servo Data Fault 11 Positioner Fault 12 Read/Write Fault 13 Bus Fault 14-15 Reserved These bits apply to the unit specified in word 14; its number is echoed in bits 6-7.
16	0-15	Retries Performed	Total number of retries the controller performed (see Note 8).
17	0-15	Soft Return Transfer Count	The number of data sectors transferred before the final CB error (see Note 9).
18	0-15	Physical Cylinder	Physical cylinder address where the error occurred.
19	0-7	Physical Head	Physical head address where the error occurred.
	8-15	Physical Sector	Physical sector address where the error occurred.
20	0-7	Disk Error Code	Represents one of these drive errors (see Note 10): Bus Fault Logic Power Checkpoint Positioner Read/Write
	8-15	—	Unused

NOTES:

1. *The high-order bit (word 0; bit 0) of the link address indicates whether this address is logical or physical:*

   If set: Logical address premapped by the host.

   Not set: Physical address.

2. *Set the interrupt bit if you want to know when each CB in a list completes. When the controller finishes executing a CB, it generates an asynchronous interrupt and then continues executing the list.*

   The controller will not generate the interrupt in two situations:

   - *When the last CB in a list is completed.*
   - When an error occurs that requires the controller to generate an interrupt.

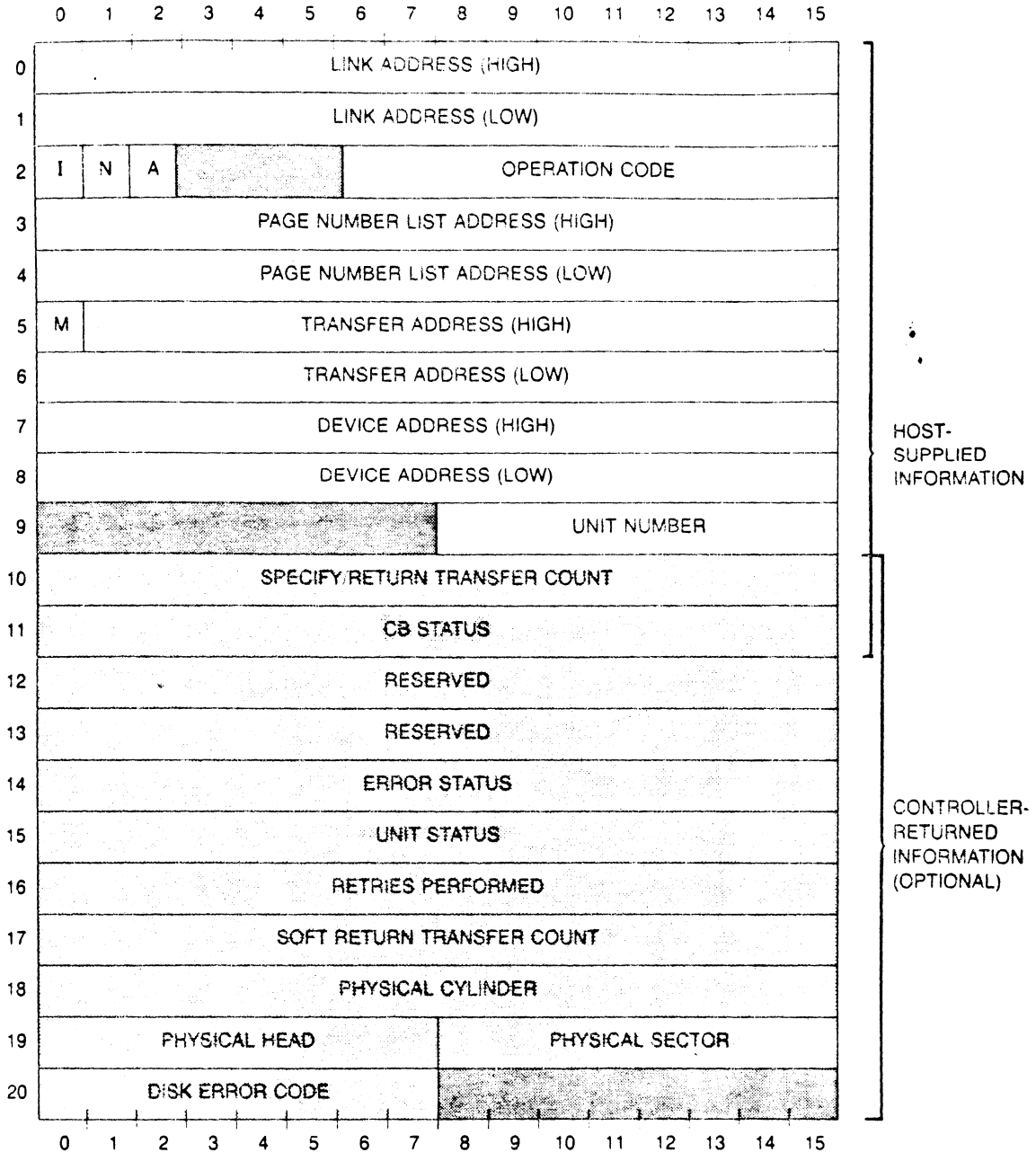

Figure 2-3. Control Block