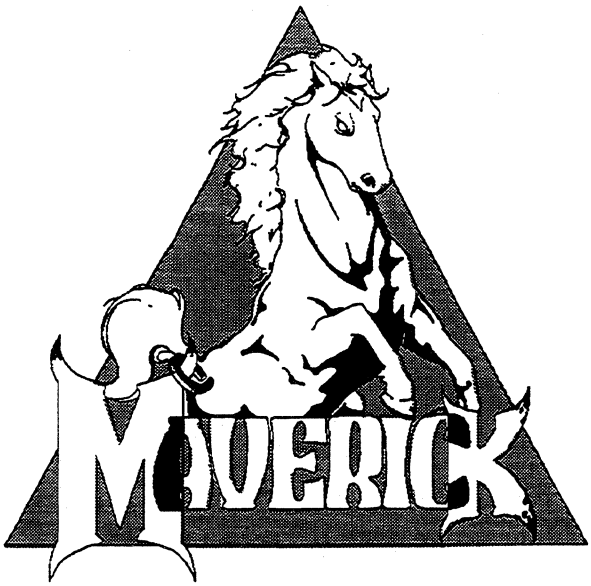
COMPAQ/QUANTUM

MAVERICK DESIGN REVIEW

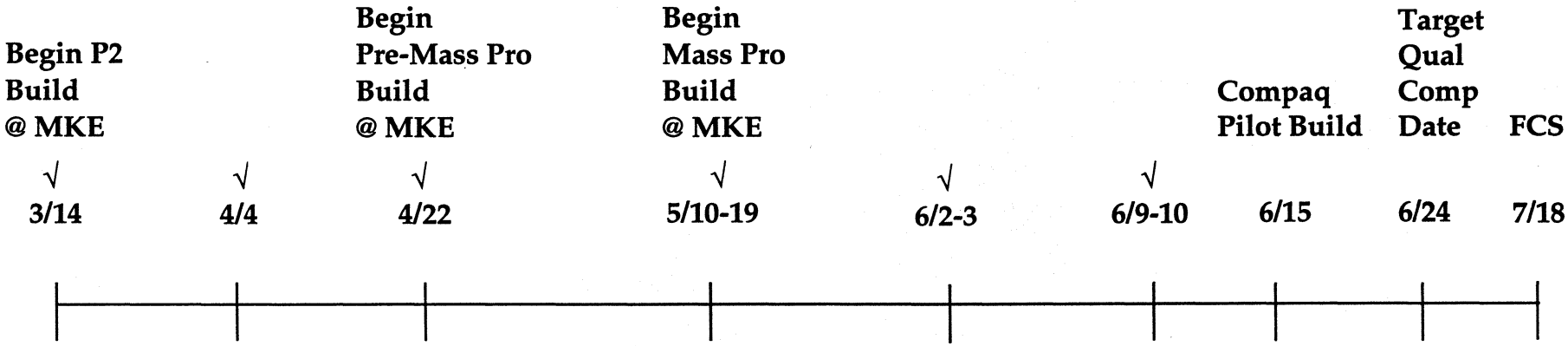


June 2, 1994
Milpitas, California

COMPAQ Quantum

Maverick 270/540AT COMPAQ Qualification Summary

Qualification Schedule



Top Issues	Next Steps	Owner	Target Closure
• Technical Issues - Noise Immunity - Interface Signal	• Collaborate with Compaq on Possible Solutions	Compaq Qual Team	Closed
• 6.05 ROM Transition	• Ship Compaq Samples with 6.05 ROM	M. Evans/D. Fortino	Closed
• Maverick Production Backlog	• Obtain Initial Production Purchase Orders	T. Eiland	Closed

Quantum®

COMPAQ/QUANTUM
MAVERICK DESIGN REVIEW MEETING
Board Room, Building 2C
June 2, 1994

Attendees:

Compaq

Pak Chan, Senior Electrical Engineer
David Shiramizu, Procurement Engineer
Richard Tomaszewski, Electrical R&D Engineer

Quantum

Earl Allen, Quality/Reliability, Maverick
Mike Allen, Field Applications Engineer
Tim Eiland, Senior Account Executive
Mark Evans, New Product Qualification Engineer
Dean Fortino, Manager, Account Management
Jerry Foster, Manager, Compatibility Lab
Jim Godwin, Electrical Manager, Maverick
Stu Lerner, Product Line Manager, Maverick
Ross Pace, Mechnical Manager, Maverick
Kurt Richarz, Central Region Sales Manager
Rick Shimizu, Firmware Engineer, Maverick

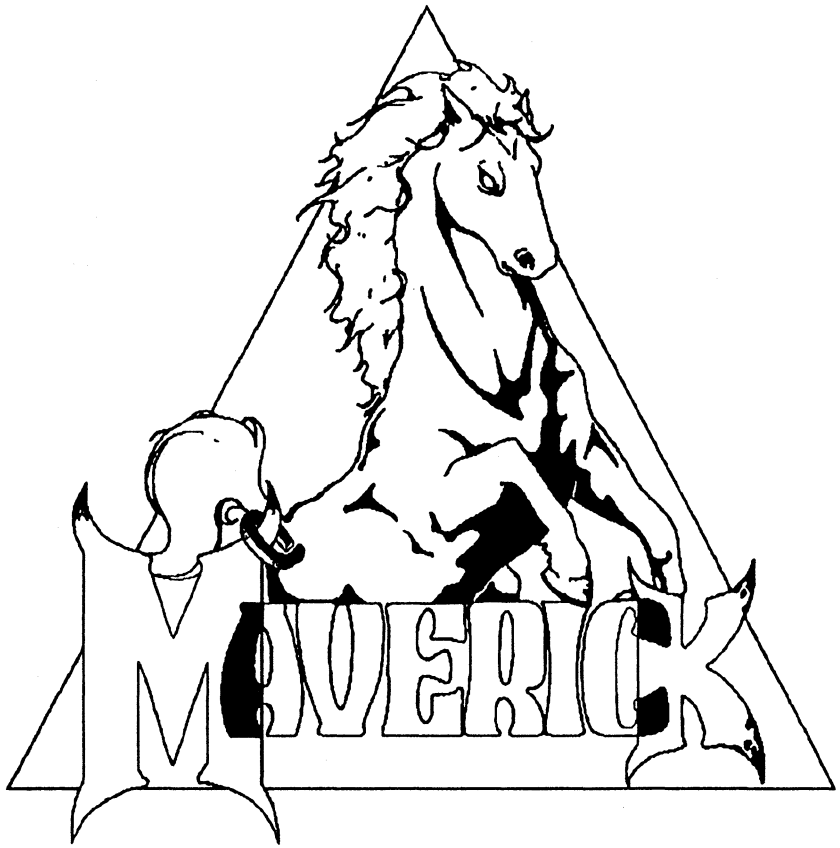
Agenda:

8:30	Introduction/Agenda Review	D. Fortino

	Maverick Program Status
	- Assessment of Program Risks/Outstanding Issues
	- Planned Product Changes
	  - Hardware
	  - Firmware
		J. Godwin

	Maverick Specification Review (Compaq Format)	J. Godwin
	Heads/Media Review	J. Godwin
9:30	Maverick Electrical Review - Block Diagram - ASICs - Read/Write Channel - Window Margin Expectations - Servo	J. Godwin
10:15	Maverick Firmware Review - Caching Algorithms - Error Recovery Algorithms	R. Shimizu
11:00	Maverick Mechanical Review	R. Pace
11:45	Design Reliability Testing - DVT/DMT Status - Acoustics - Shock/Vibration - Thermal Voltage	E. Allen
	Working Lunch	
12:15	Maverick Compatibility Testing	J. Foster
12:45	Action Item Review	
1:00	Wrap-Up	

Maverick 270/540 AT
Program Status
Prepared for Compaq



Program Status

Maverick AT Mass Production Began 5/31

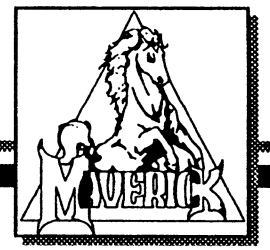
- 2,500 units per day

Maverick SCSI Mass Production to Begin 6/20

- Interface issues found at Quantum CE during PMP

PMP Overall Yields

- Similar to PP2 & PMP -1
- 83% First Pass
- 86% Last Pass



Major Yield Detractors / Correction

Off-track Read

- AMC heads have low resolution due to short throat height.
- AMC has corrective action plan in place.

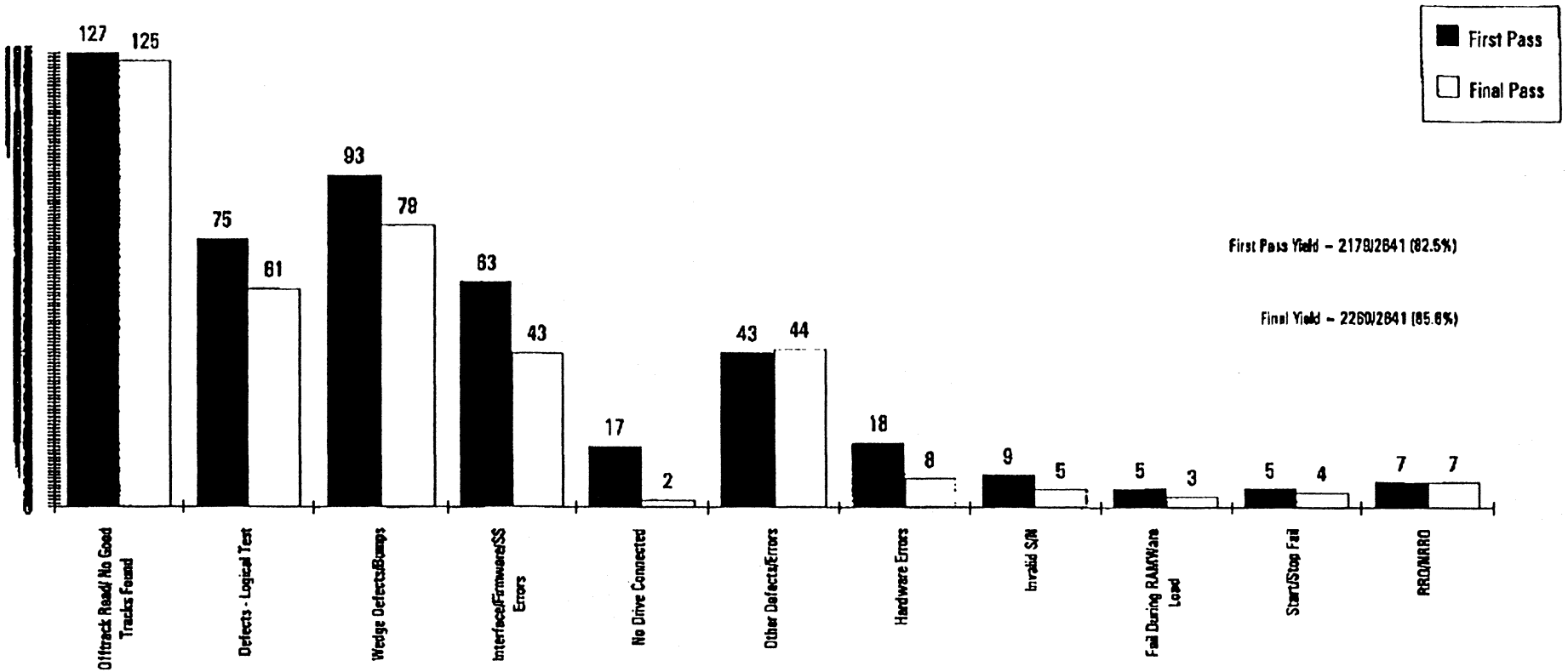
Defects, Logical Test

- Improved yields with optimized data patterns to identify more defects during Selfscan.
- Improvement will be monitored as MP begins.

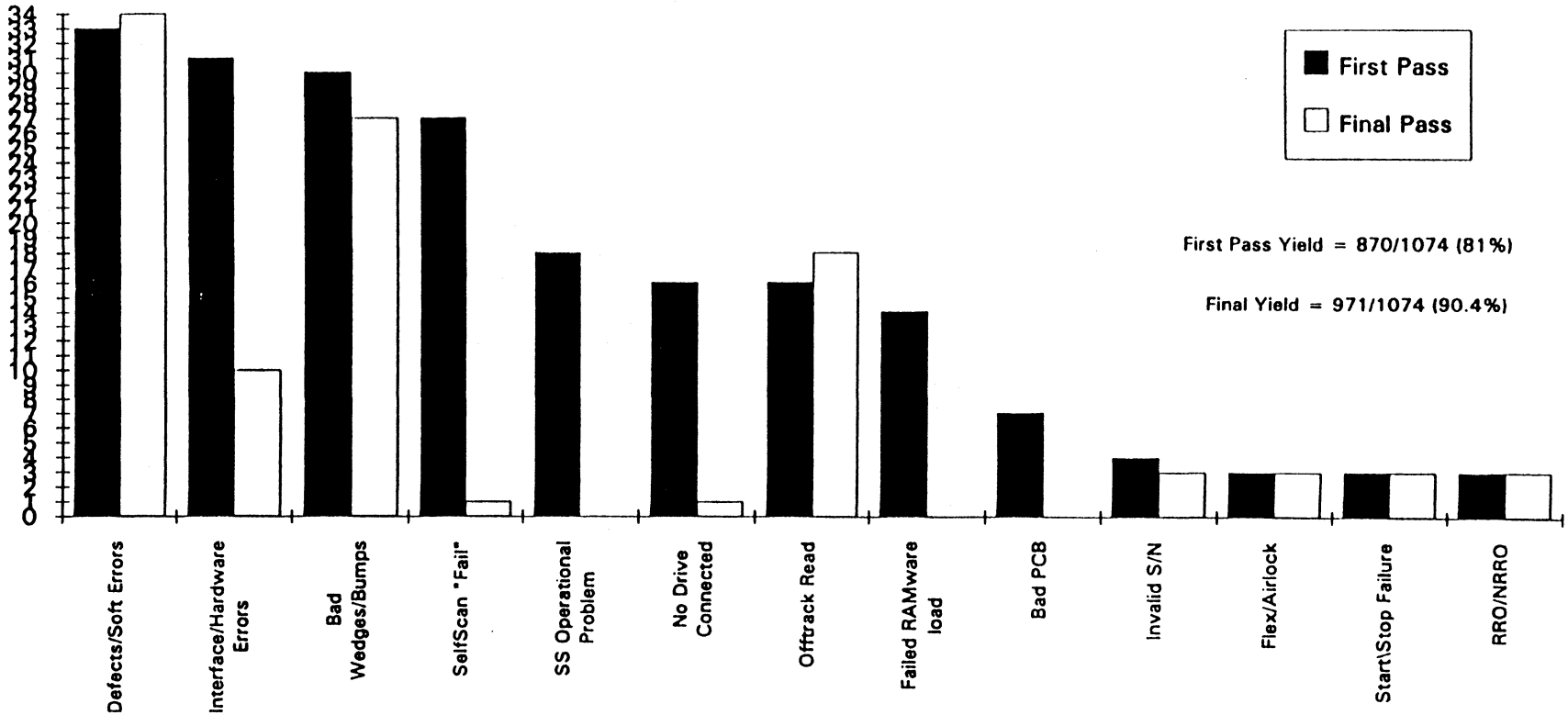
Wedge Defects

- Reduced Servo Verify at Servowrite has pushed this to SS.
- Re-Servowrite generally fixes problem
- MKE line balancing issue.

Maverick P-MP SelfScan Results (No UNKNOWN S/Ns)



Maverick P2 SelfScan Results



Maverick F2 Failure Analysis
Open Issues
3/22/94

Failure Category	Exit Code	# Failed First (Final)	Analysis	Disposition
Defects/Soft Errors	26, 43, 44, 45, 47, 48, 56	33 (34)	Bad hd (5) Bad disk (4) Investigate at Quantum (25)	Replace hd Replace disk J. Min (R/W)
Interface/Hardware Errors	21, 22	31 (10)	S02.2120/A02.1120 fixed many NTF (9) Not initialized (5) Bad preamps (2) Investigate at Quantum (8)	Passed second SS run at MKE Passed second SS run at MKE Passed second SS run at MKE D. Chau (R/W) J. Dickson (Drive Group)
Bad Wedges/Bumps	53, 4E	30 (27)	Bad media surface (9) Defects on unverified head (9) Bad hd (1) Investigate at Quantum (8)	Replace media Re-Servowrite Replace hd E. Wong (Servo)
SS "Fail"	2D	1 (1)	Drive hung during SelfScan. Failure is similar to RoadRunner.	B. Condie (F/W)
Offtrack read	Err A6	16 (18)	NTF (1) Bad hd (3) Investigating at Quantum (15)	Passed second SS at MKE Replace hd R. Zeid (R/W)
Invalid S/N	14	4 (3)	Servowriter Bison problem	S/W Group
Start/Stop Fail	Err 59	3 (3)	Investigate at Quantum	Jeremy C. (Mechanical)
HDA Hardware	-	3 (3)	Torn flex (2) Airlock (1)	Replace flex Investigate Airlock - R. Pace
RRO/NRRO	55	3 (3)	Investigate at Quantum	R. Pace (Mechanical)

Second Release Plan

(Very Preliminary)

Identified Product Changes

- NEC processor - Die shrink
- Hitachi Preamp - Reduced bandwidth
- Ryan II - Spec relief
- Firmware changes as required

Schedule

■ Build	August/September
■ Customer Evaluation	October
■ Mass Production	November

Head / Media Status

MP began with AKCL media / Read Rite Heads

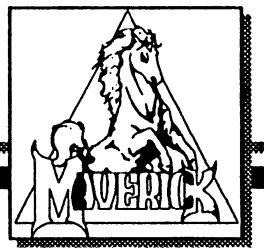
- Pass A/P, W/M, and 50K CSS

TDK to deliver heads in early June

- Had a pole tip mask mix-up in their production
- Pass A/P, W/M, and 50K CSS

Fuji / MKC cut in expected June end

- Pass A/P, W/M, and 50K CSS



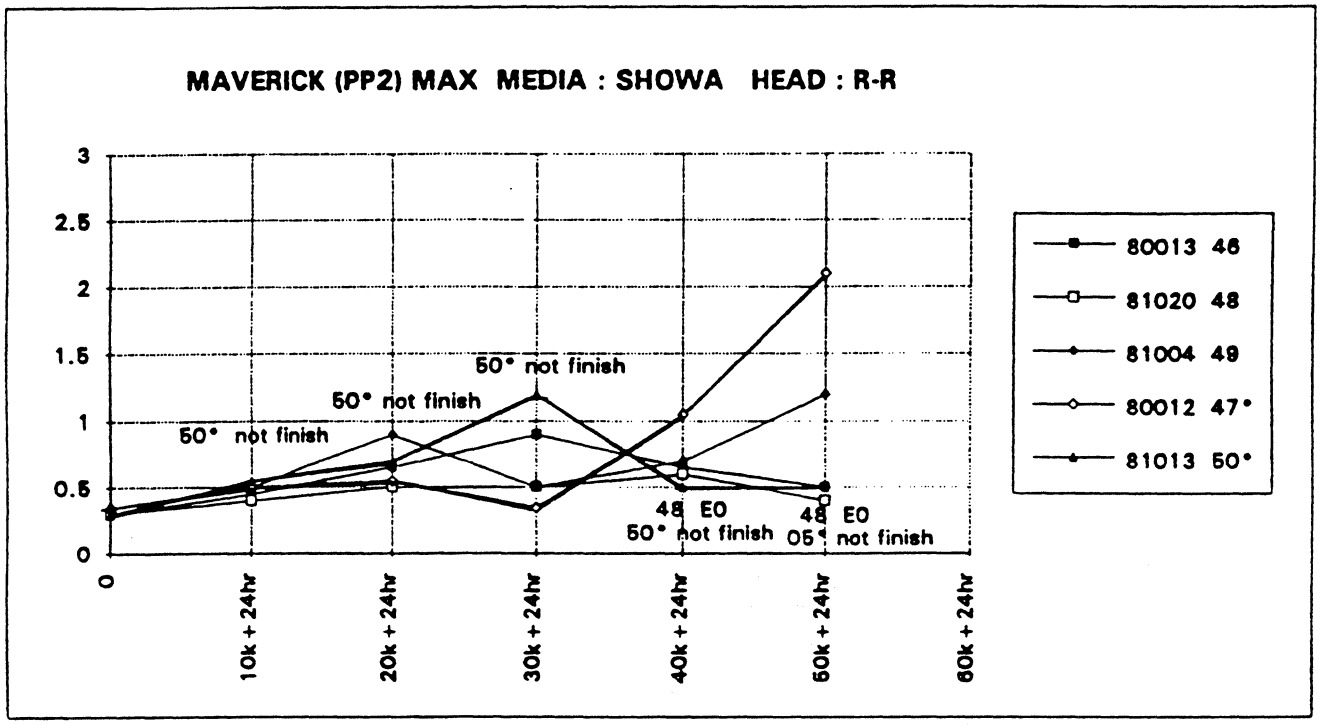
Head / Media Status (continued)

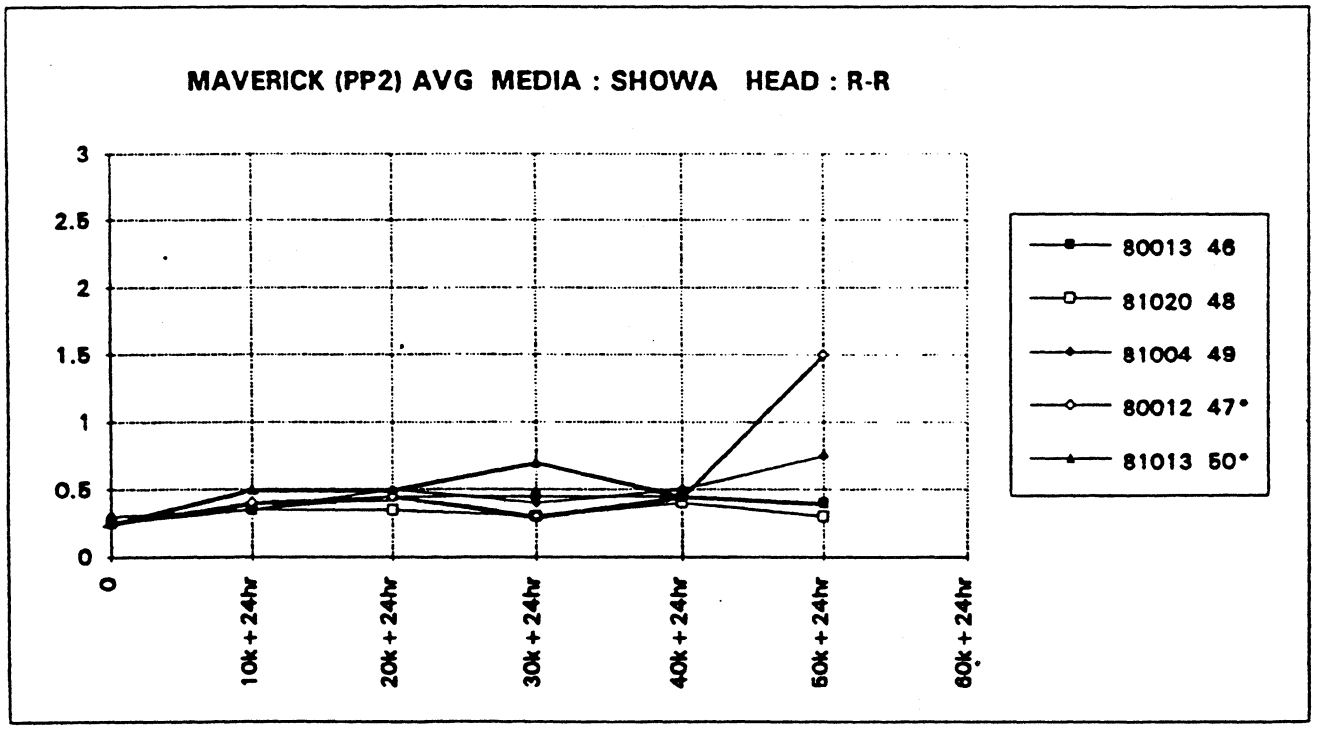
AMC to deliver improved heads for late June build

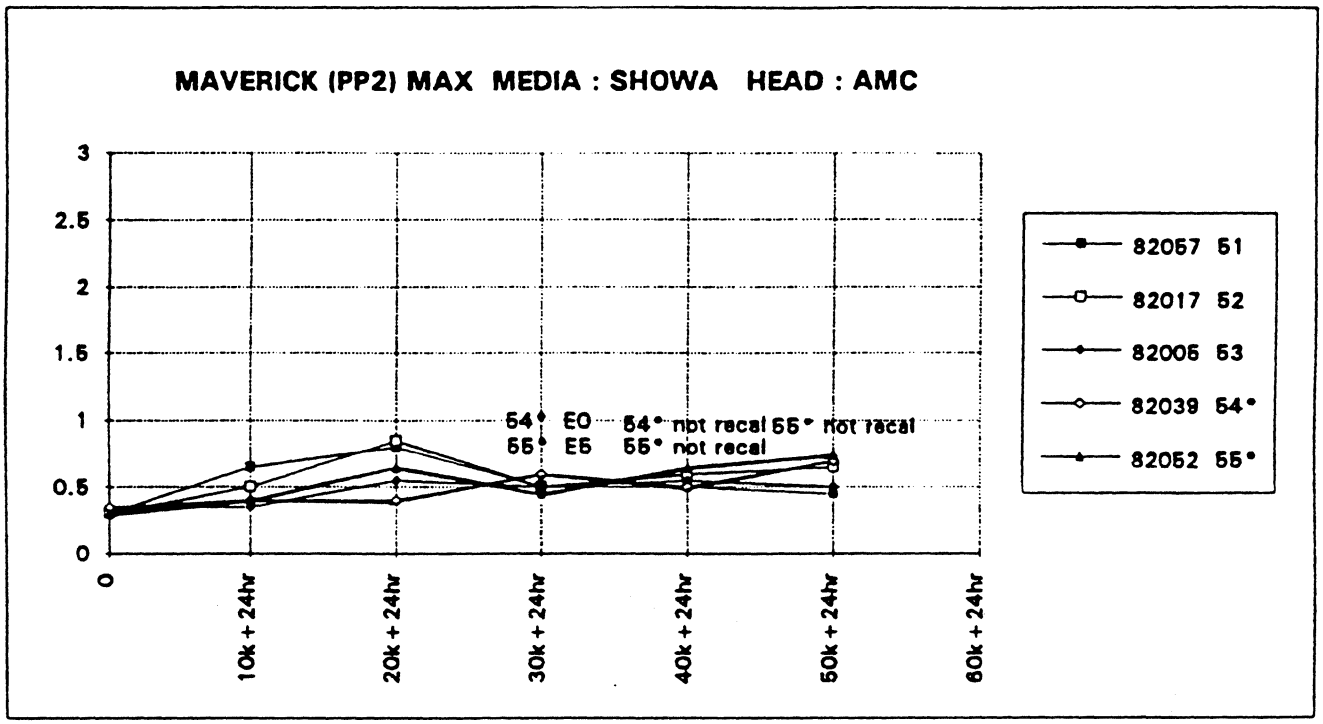
- Improved control of throat height
- Pass 50K CSS

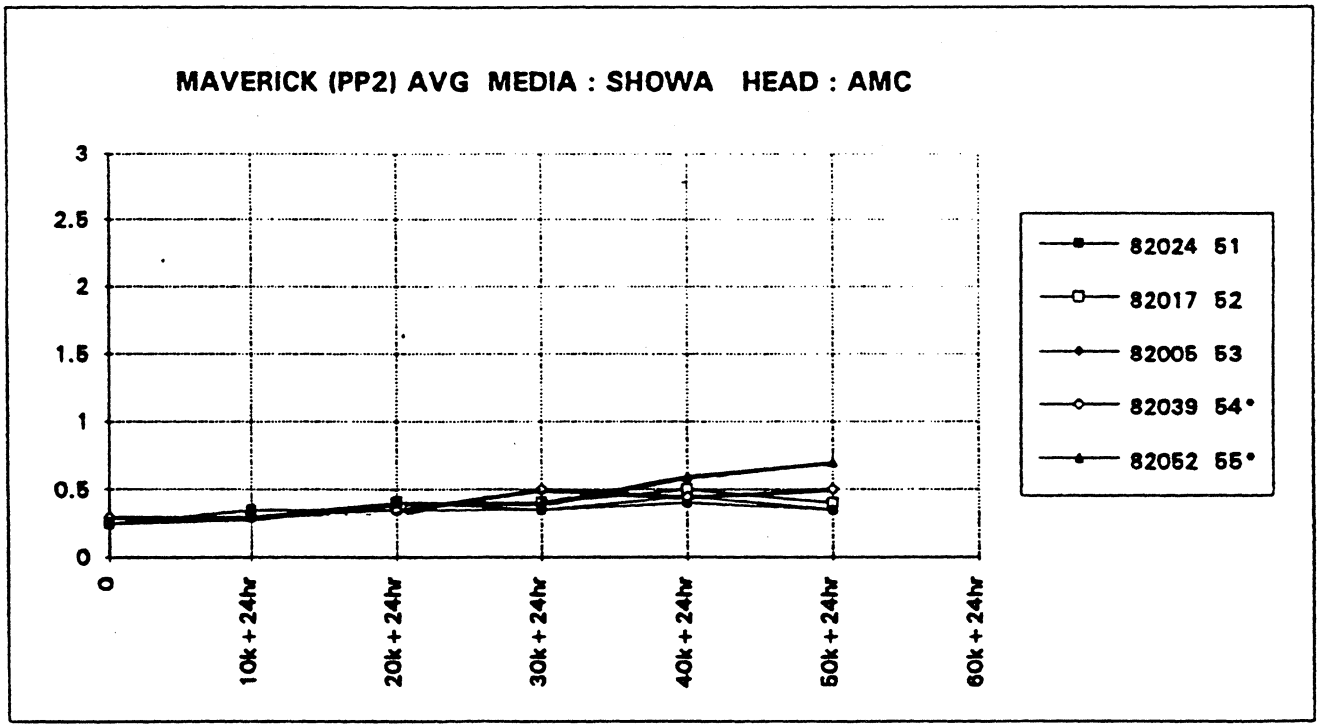
Showa Denko has CSS issues

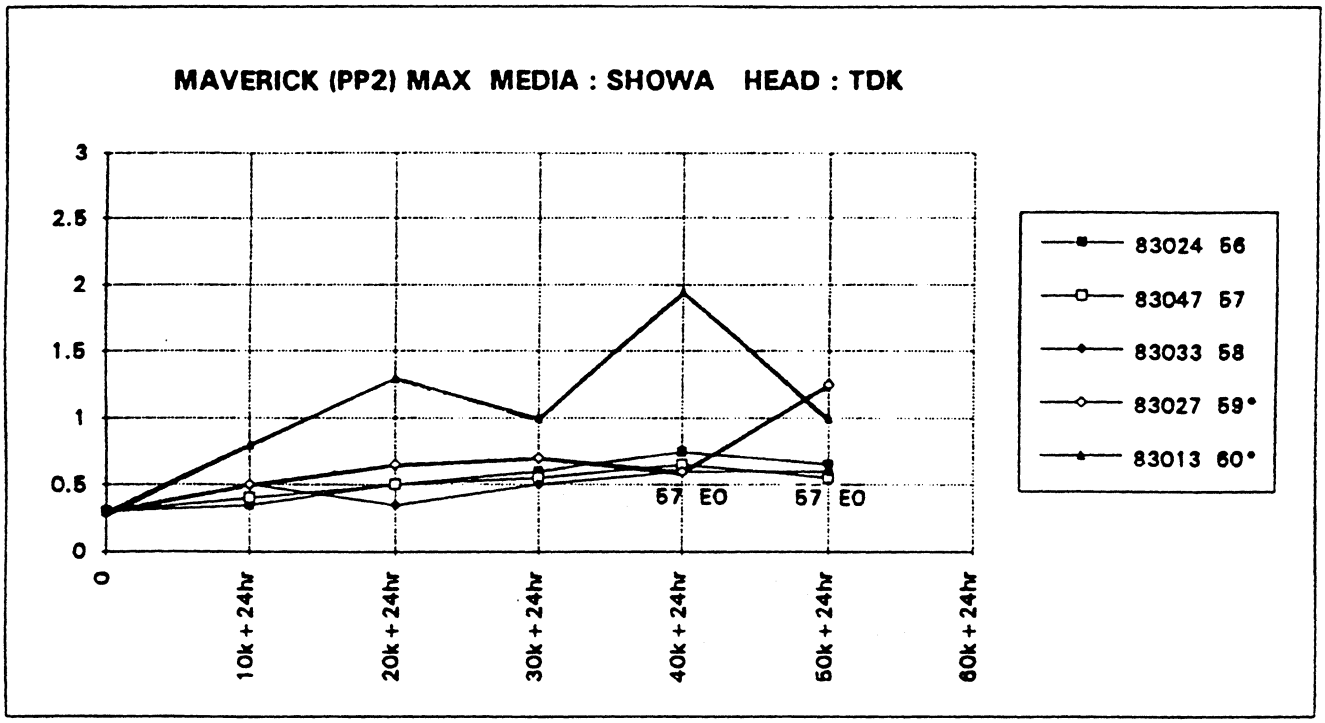
- Higher spin up torque than other media
- Currently examining lube bonding technique
- Pass A/P and W/M

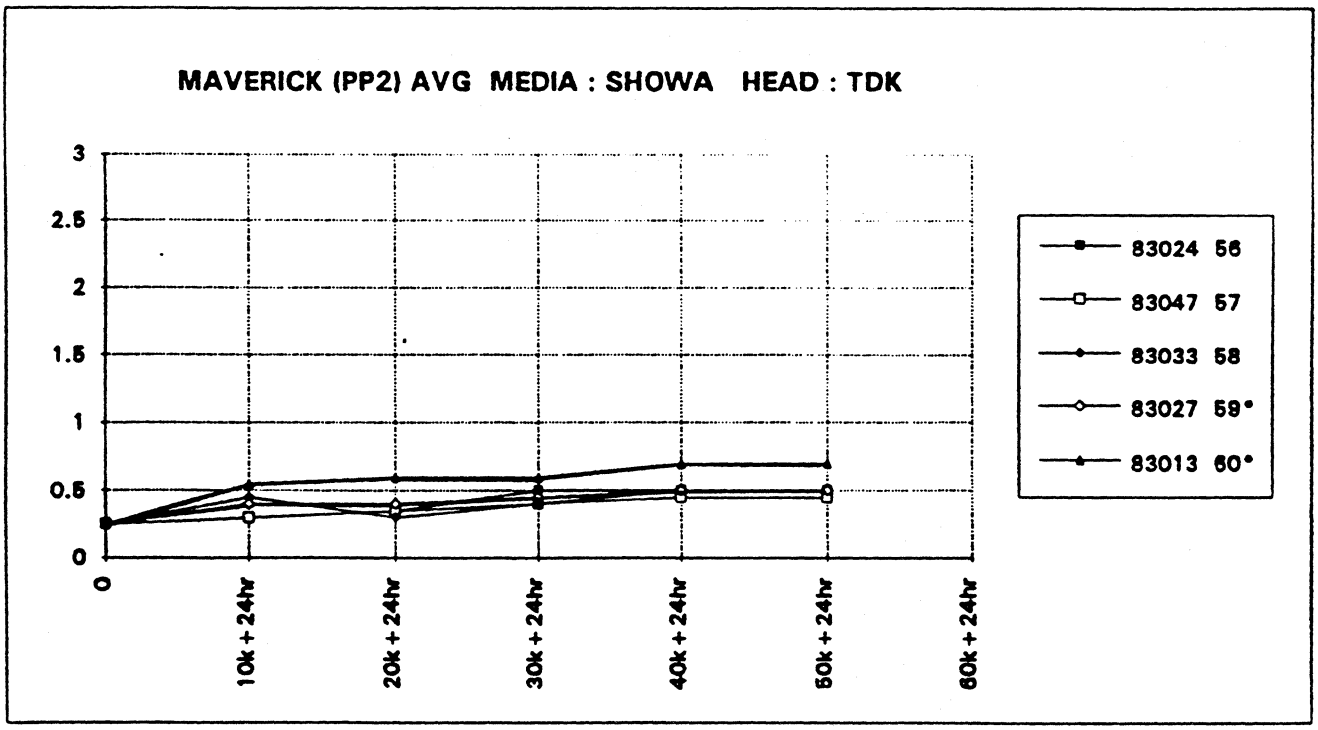

MAVERICK (PP2) MAX MEDIA : SHOWA HEAD : R-R
3
2.5
2
1.5
1
0.5
0
0
10k + 24hr
20k + 24hr
30k + 24hr
40k + 24hr
50k + 24hr
60k + 24hr
50° not finish
50° not finish
50° not finish
48 E0
50° not finish
48 E0
05 not finish
80013 46
81020 48
81004 49
80012 47°
81013 50°

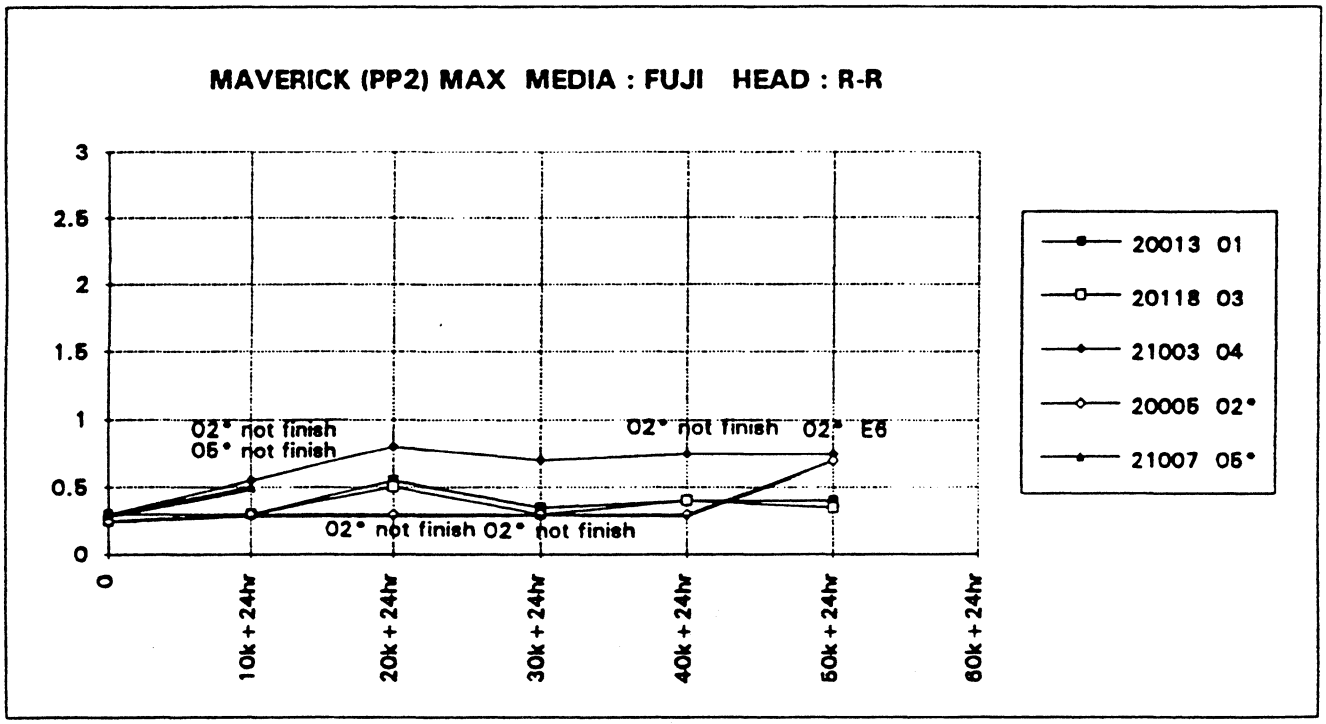

MAVERICK (PP2) AVG MEDIA : SHOWA HEAD : R-R
3
2.5
2
1.5
1
0.5
0
0
10k + 24hr
20k + 24hr
30k + 24hr
40k + 24hr
50k + 24hr
60k + 24hr
80013 46
81020 48
81004 49
80012 47°
81013 50°

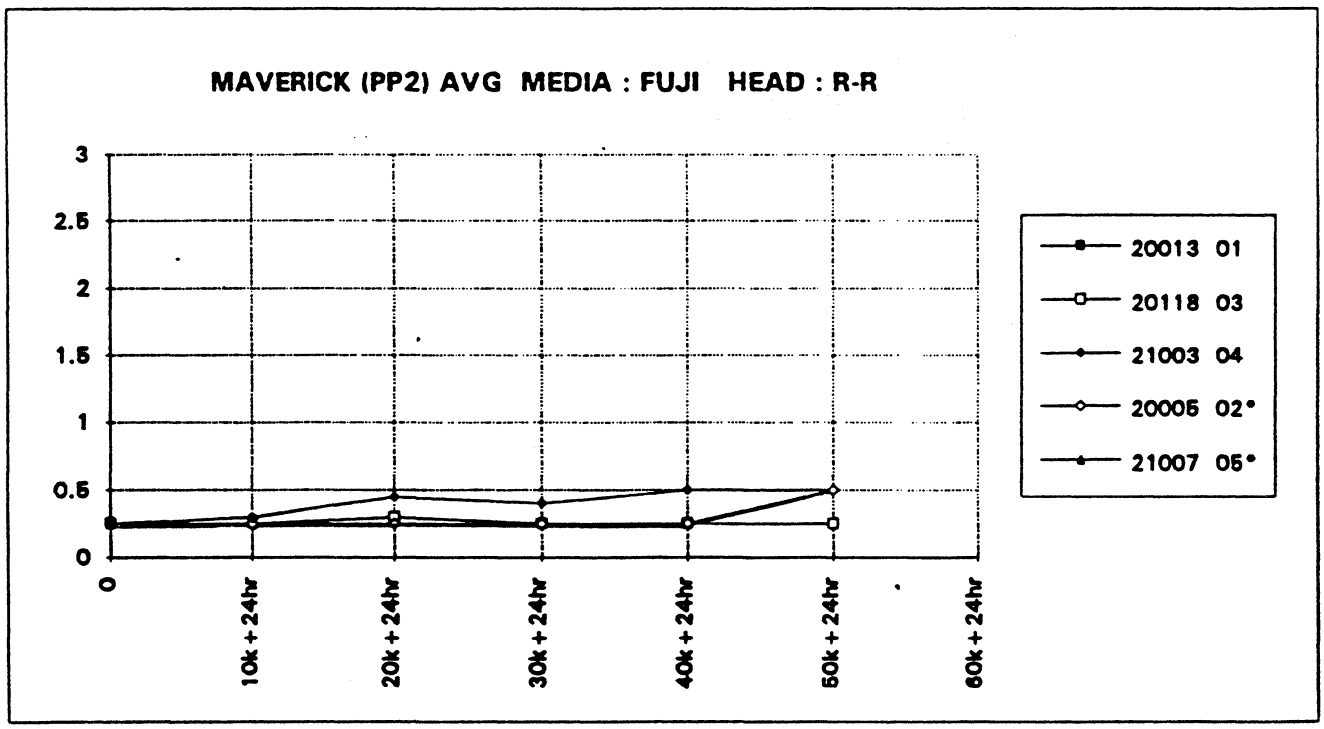

MAVERICK (PP2) MAX MEDIA : SHOWA HEAD : AMC
3
2.5
2
1.5
1
0.5
0
0
10k + 24hr
20k + 24hr
30k + 24hr
40k + 24hr
50k + 24hr
60k + 24hr
54* EO 54* not recal 55* not recal
55* E5 55* not recal
82057 51
82017 52
82005 53
82039 54*
82052 55*

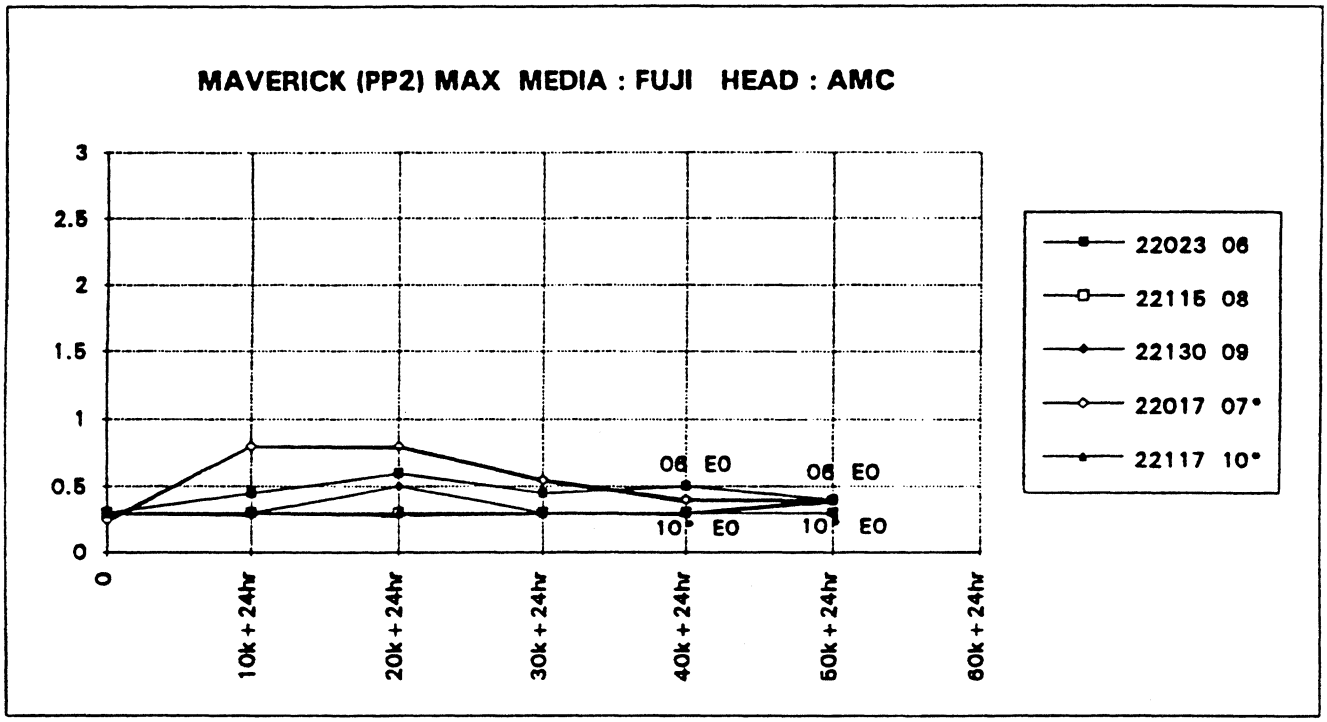

MAVERICK (PP2) AVG MEDIA : SHOWA HEAD : AMC
3
2.5
2
1.5
1
0.5
0
0
10k + 24hr
20k + 24hr
30k + 24hr
40k + 24hr
50k + 24hr
60k + 24hr
82024 51
82017 52
82005 53
82039 54*
82052 55*

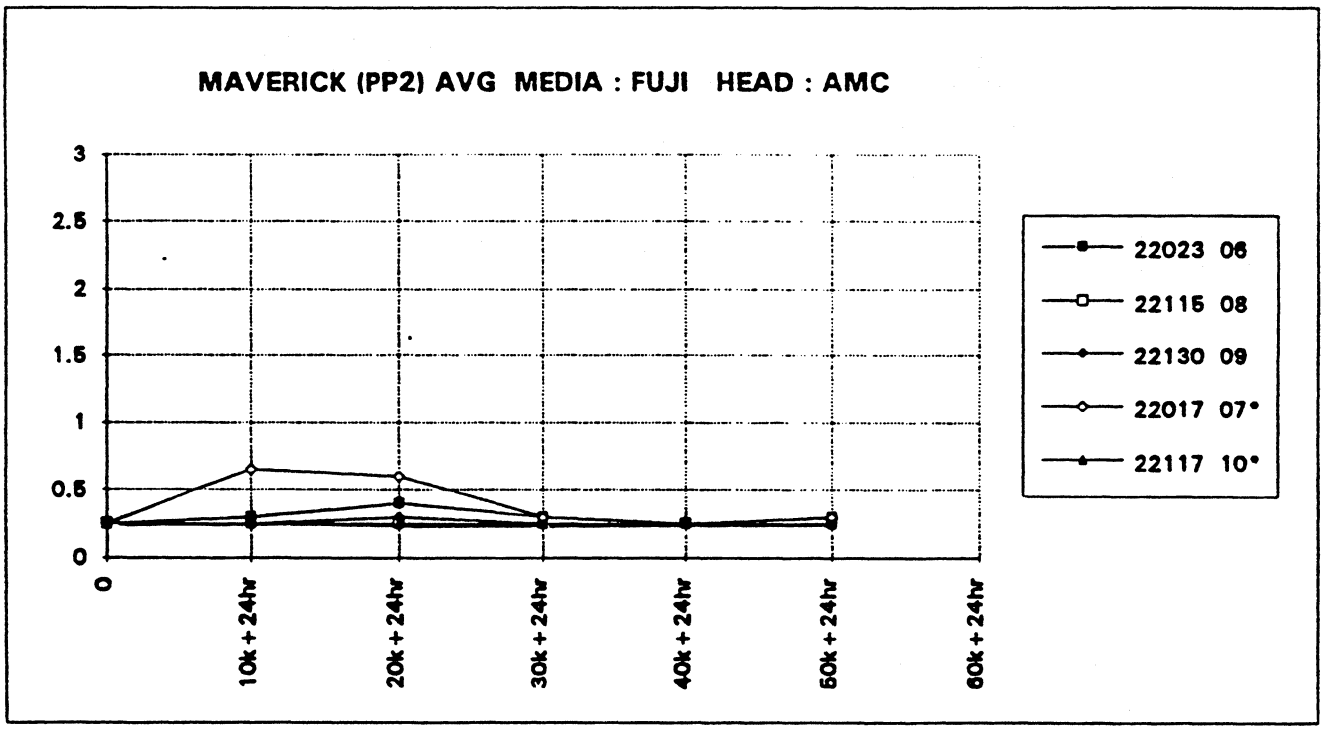

MAVERICK (PP2) MAX MEDIA : SHOWA HEAD : TDK
3
2.5
2
1.5
1
0.5
0
0
10k + 24hr
20k + 24hr
30k + 24hr
40k + 24hr
50k + 24hr
60k + 24hr
57 EO
57 EO
83024 56
83047 57
83033 58
83027 59°
83013 60°

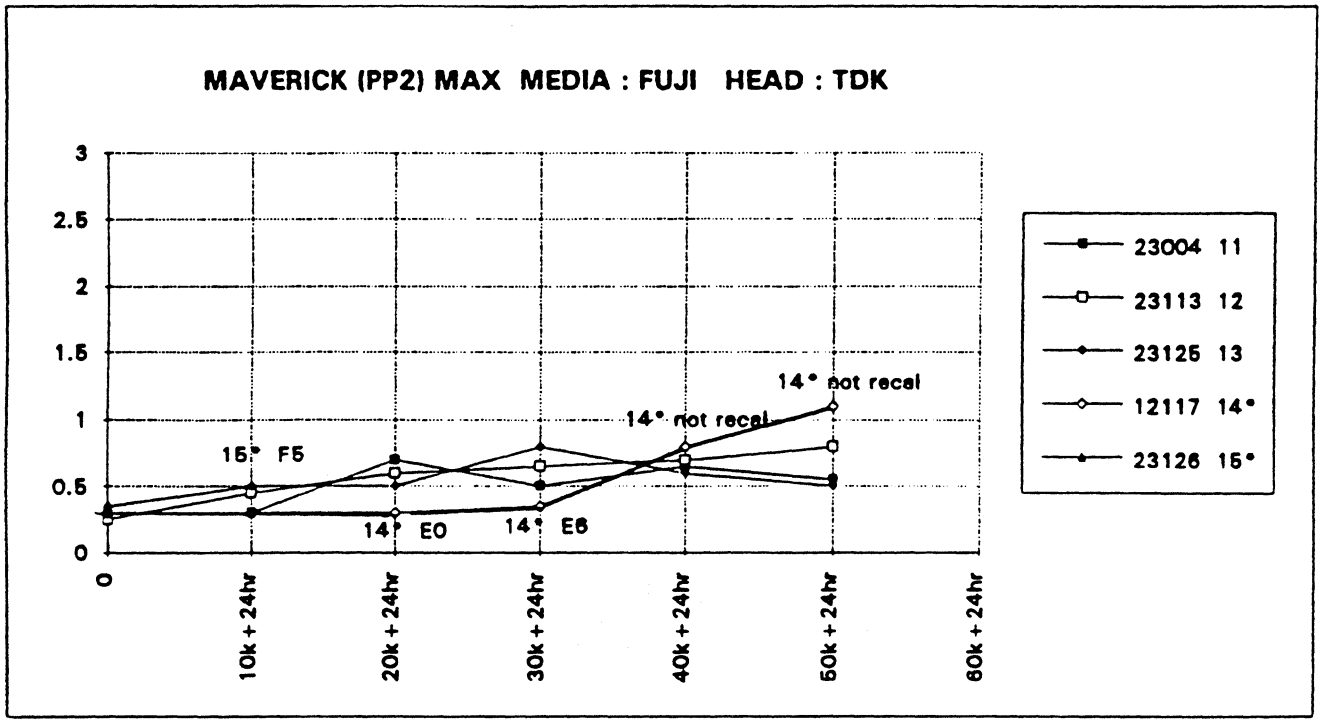

MAVERICK (PP2) AVG MEDIA : SHOWA HEAD : TDK
3
2.5
2
1.5
1
0.5
0
0
10k + 24hr
20k + 24hr
30k + 24hr
40k + 24hr
50k + 24hr
60k + 24hr
83024 56
83047 57
83033 58
83027 59°
83013 60°

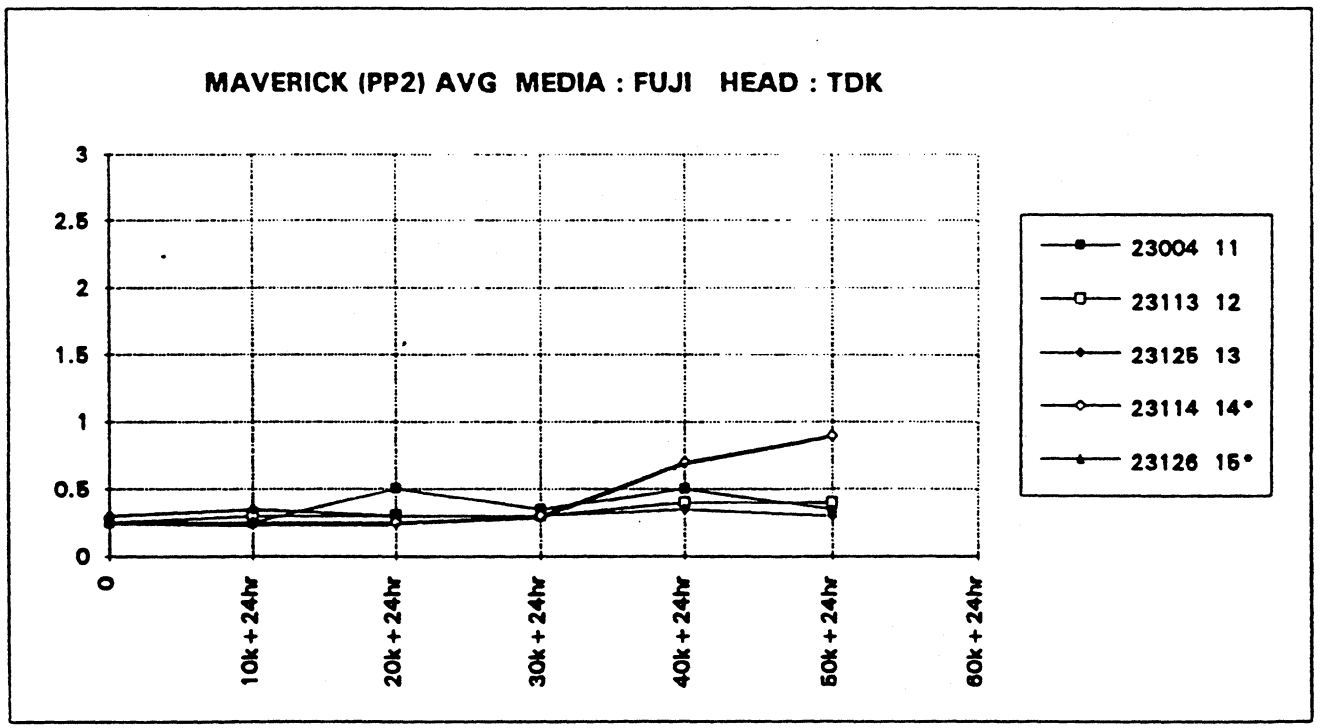

MAVERICK (PP2) MAX MEDIA : FUJI HEAD : R-R
3
2.5
2
1.5
1
0.5
0
02° not finish
05° not finish
02° not finish 02° E6
02° not finish 02° not finish
0
10k + 24hr
20k + 24hr
30k + 24hr
40k + 24hr
50k + 24hr
60k + 24hr
20013 01
20118 03
21003 04
20005 02°
21007 05°

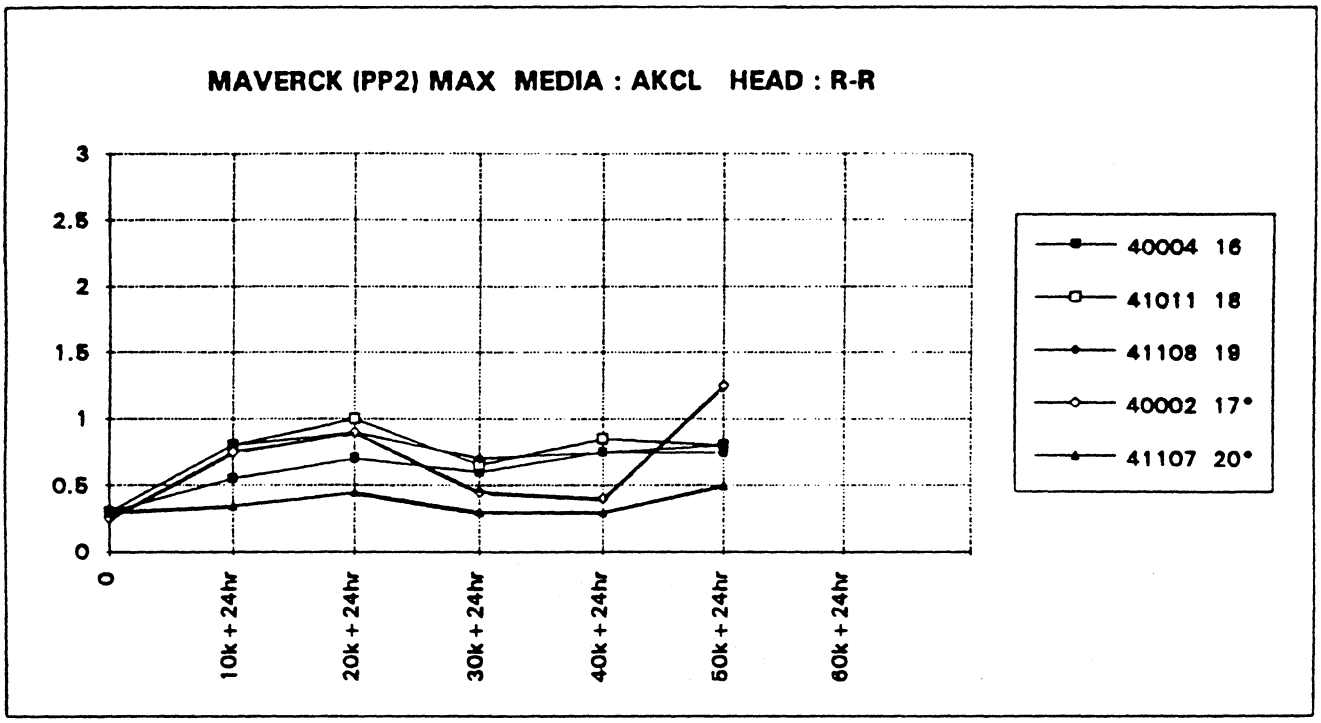

MAVERICK (PP2) AVG MEDIA : FUJI HEAD : R-R
3
2.5
2
1.5
1
0.5
0
0
10k + 24hr
20k + 24hr
30k + 24hr
40k + 24hr
50k + 24hr
60k + 24hr
20013 01
20118 03
21003 04
20005 02°
21007 05°

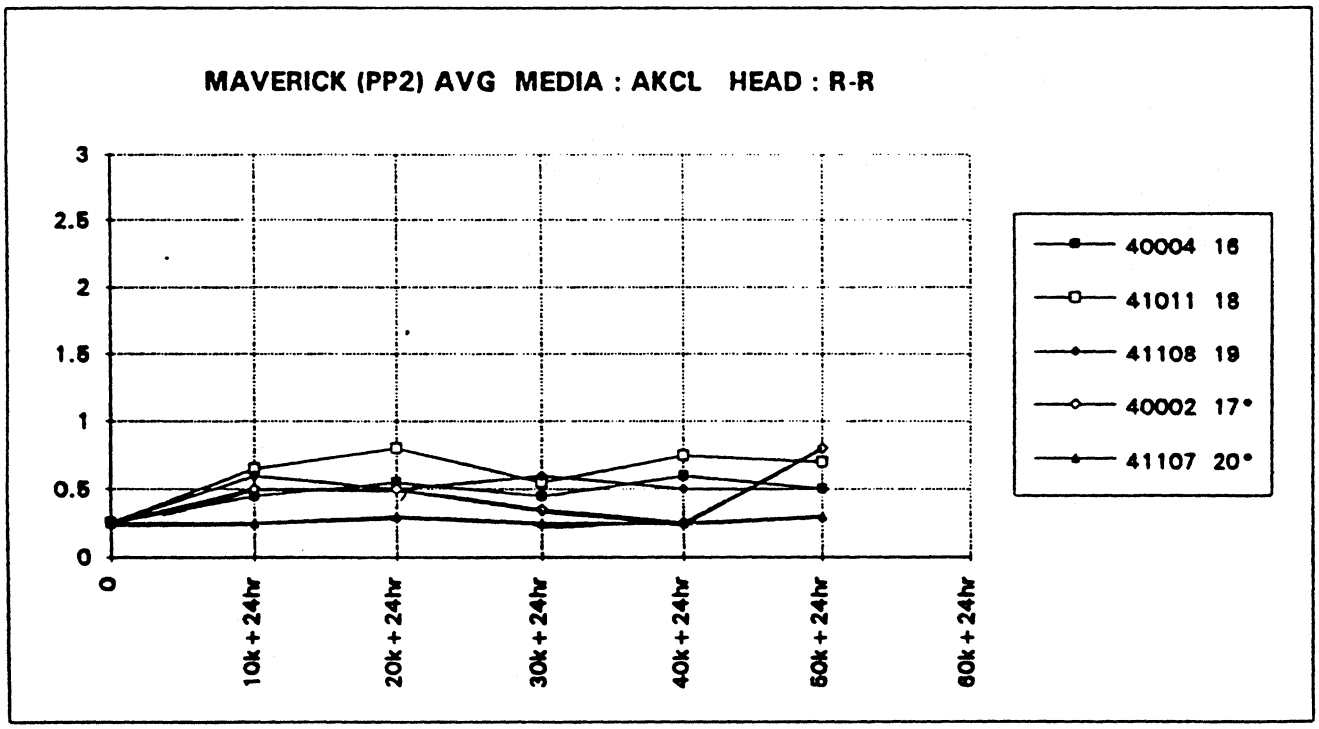

MAVERICK (PP2) MAX MEDIA : FUJI HEAD : AMC
3
2.5
2
1.5
1
0.5
0
0
10k + 24hr
20k + 24hr
30k + 24hr
40k + 24hr
50k + 24hr
60k + 24hr
06 E0
06 E0
10° E0
10° E0
22023 06
22115 08
22130 09
22017 07°
22117 10°

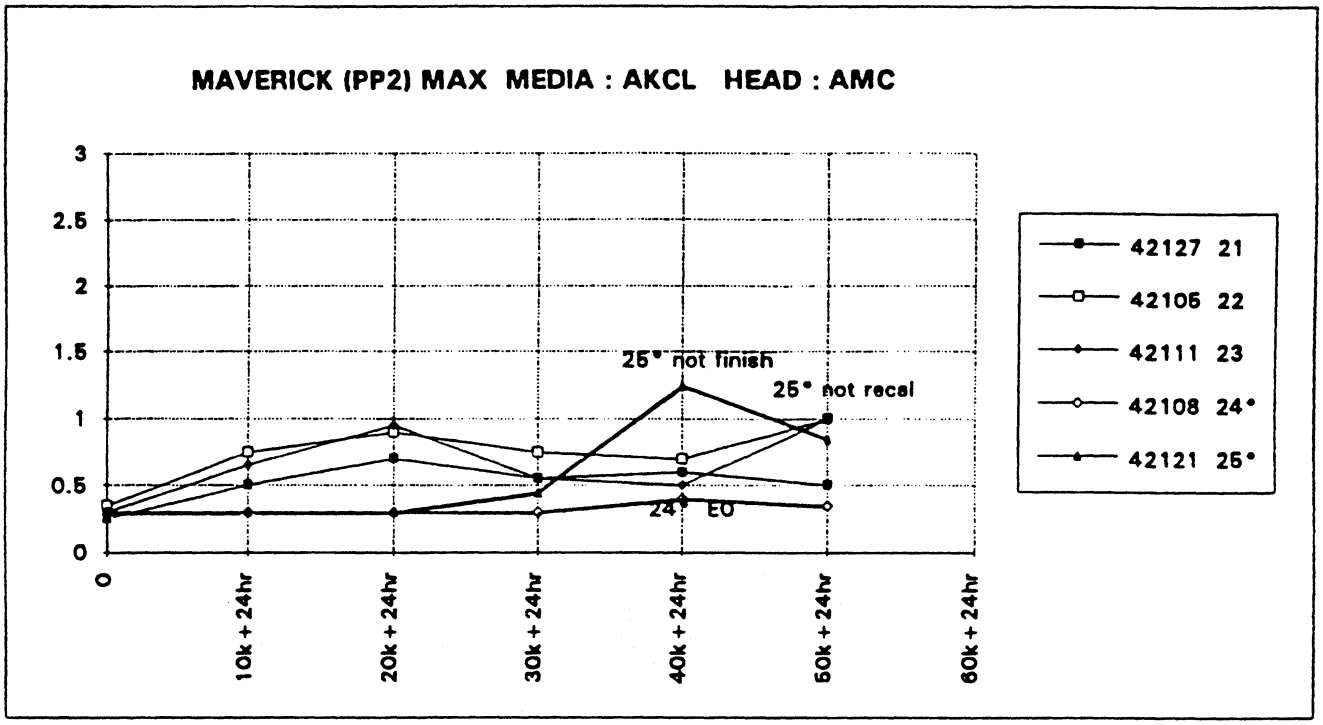

MAVERICK (PP2) AVG MEDIA : FUJI HEAD : AMC
3
2.5
2
1.5
1
0.5
0
0
10k + 24hr
20k + 24hr
30k + 24hr
40k + 24hr
50k + 24hr
60k + 24hr
22023 06
22115 08
22130 09
22017 07°
22117 10°

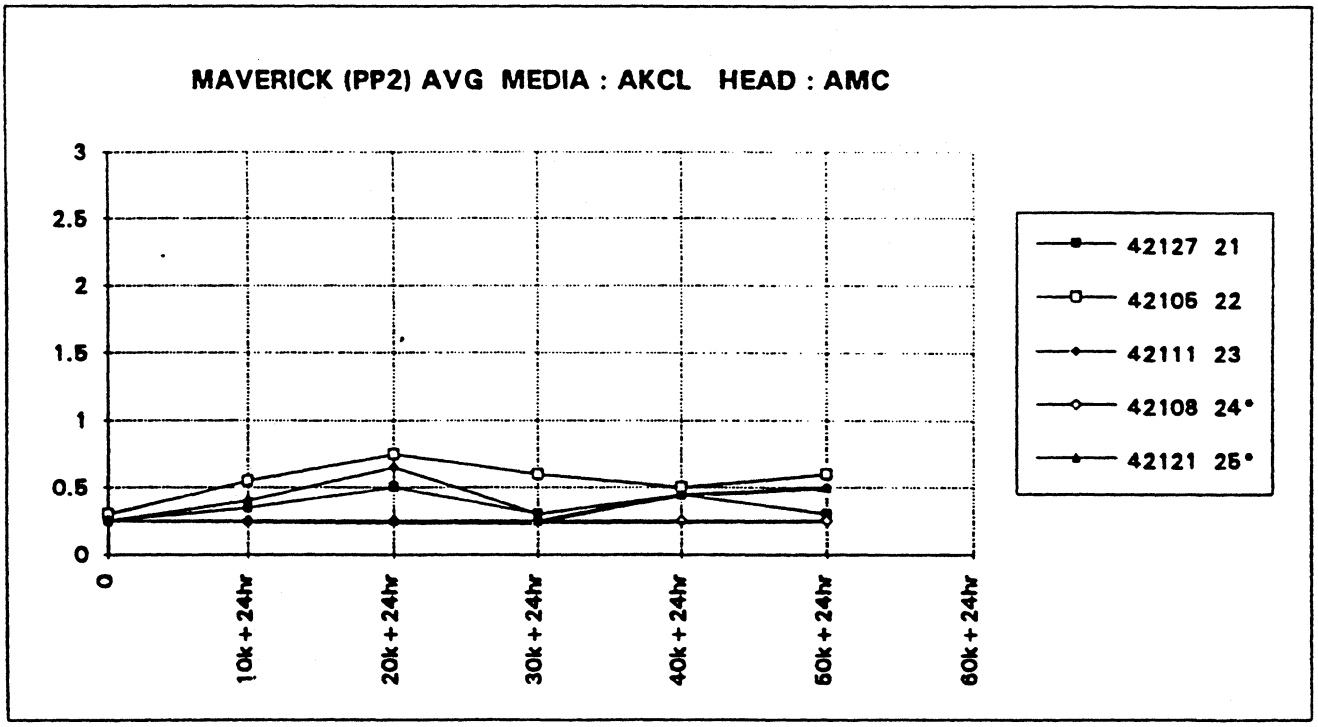

MAVERICK (PP2) MAX MEDIA : FUJI HEAD : TDK
3
2.5
2
1.5
1
0.5
0
0
10k + 24hr
20k + 24hr
30k + 24hr
40k + 24hr
50k + 24hr
60k + 24hr
15° F5
14° E0
14° E8
14° not recal
14° not recal
23004 11
23113 12
23125 13
12117 14°
23126 15°

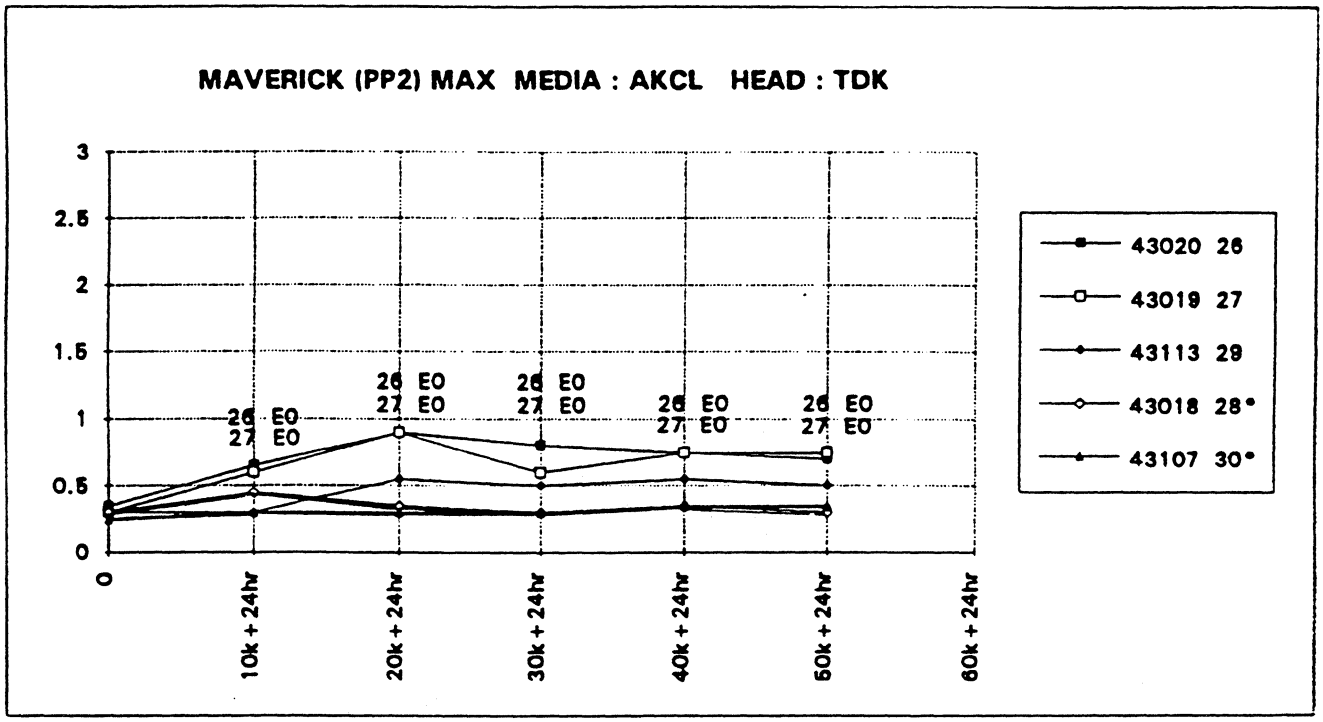

MAVERICK (PP2) AVG MEDIA : FUJI HEAD : TDK
3
2.5
2
1.5
1
0.5
0
0
10k + 24hr
20k + 24hr
30k + 24hr
40k + 24hr
50k + 24hr
60k + 24hr
23004 11
23113 12
23125 13
23114 14°
23126 15°

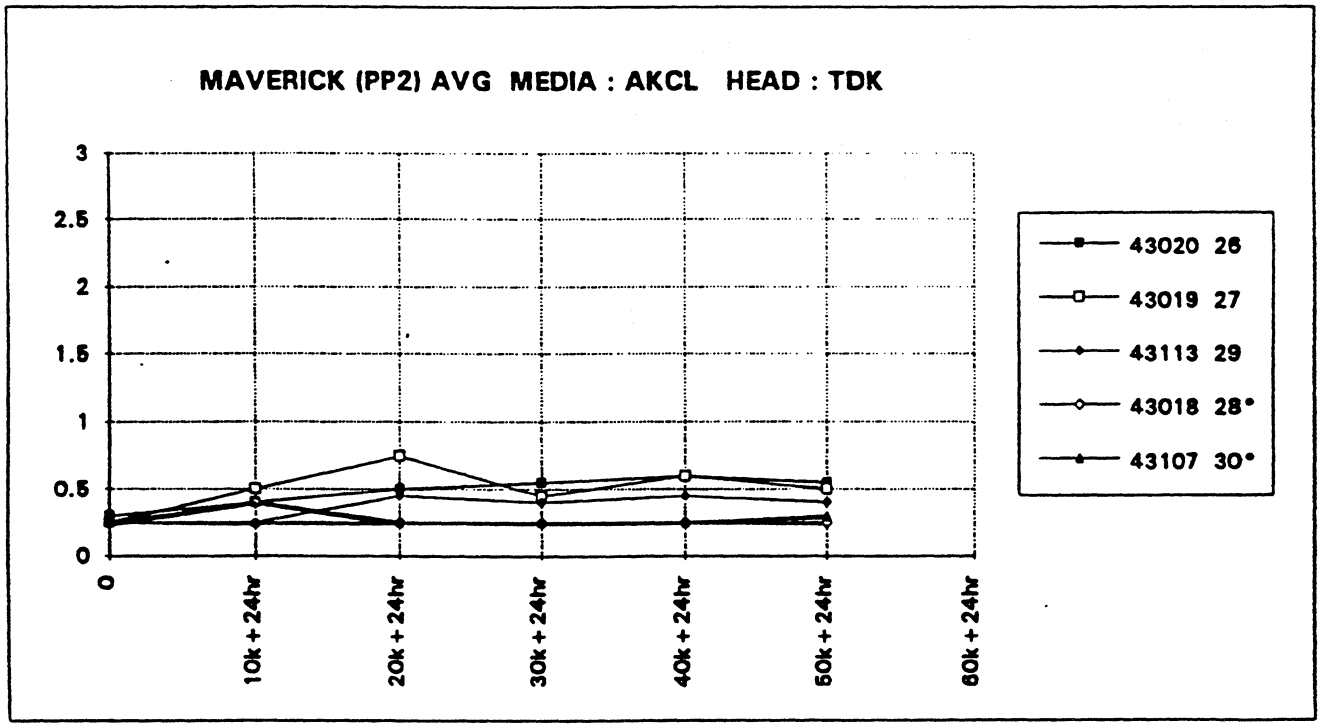

MAVERCK (PP2) MAX MEDIA : AKCL HEAD : R-R
3
2.5
2
1.5
1
0.5
0
0
10k + 24hr
20k + 24hr
30k + 24hr
40k + 24hr
50k + 24hr
60k + 24hr
40004 16
41011 18
41108 19
40002 17°
41107 20°

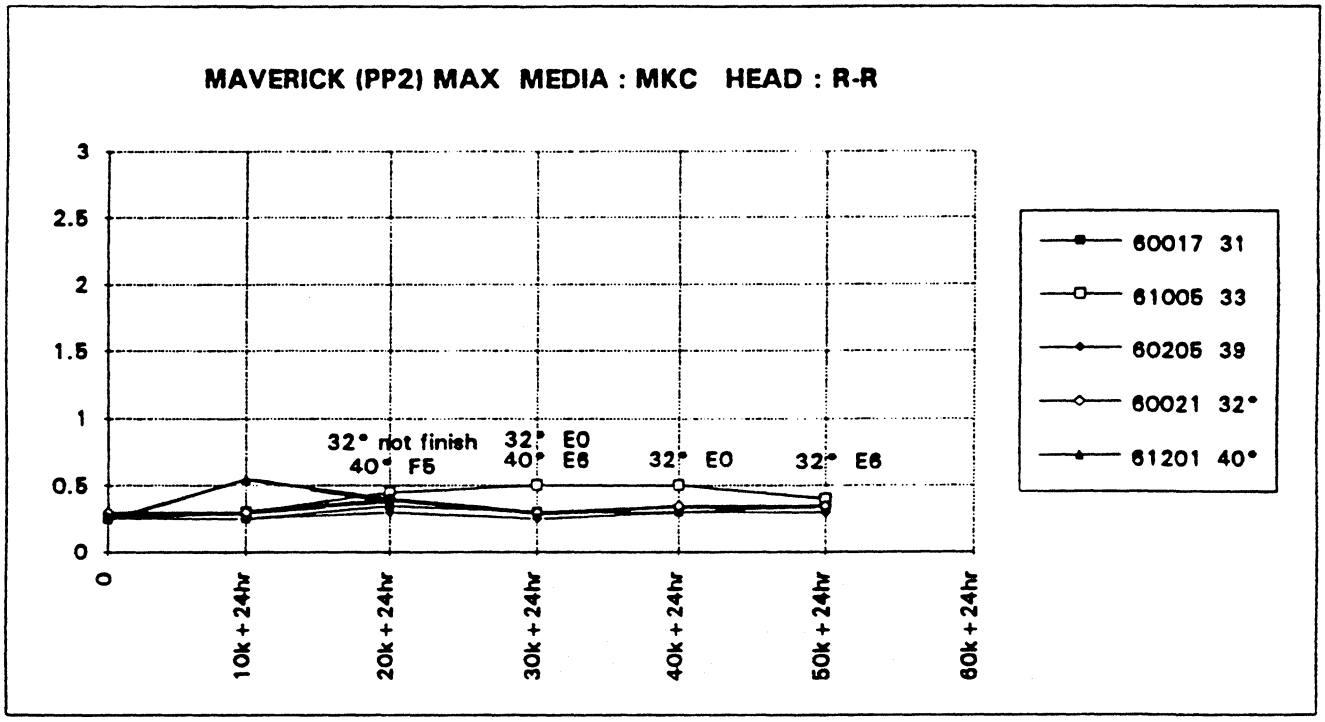

MAVERICK (PP2) AVG MEDIA : AKCL HEAD : R-R
3
2.5
2
1.5
1
0.5
0
0
10k + 24hr
20k + 24hr
30k + 24hr
40k + 24hr
50k + 24hr
60k + 24hr
40004 16
41011 18
41108 19
40002 17°
41107 20°

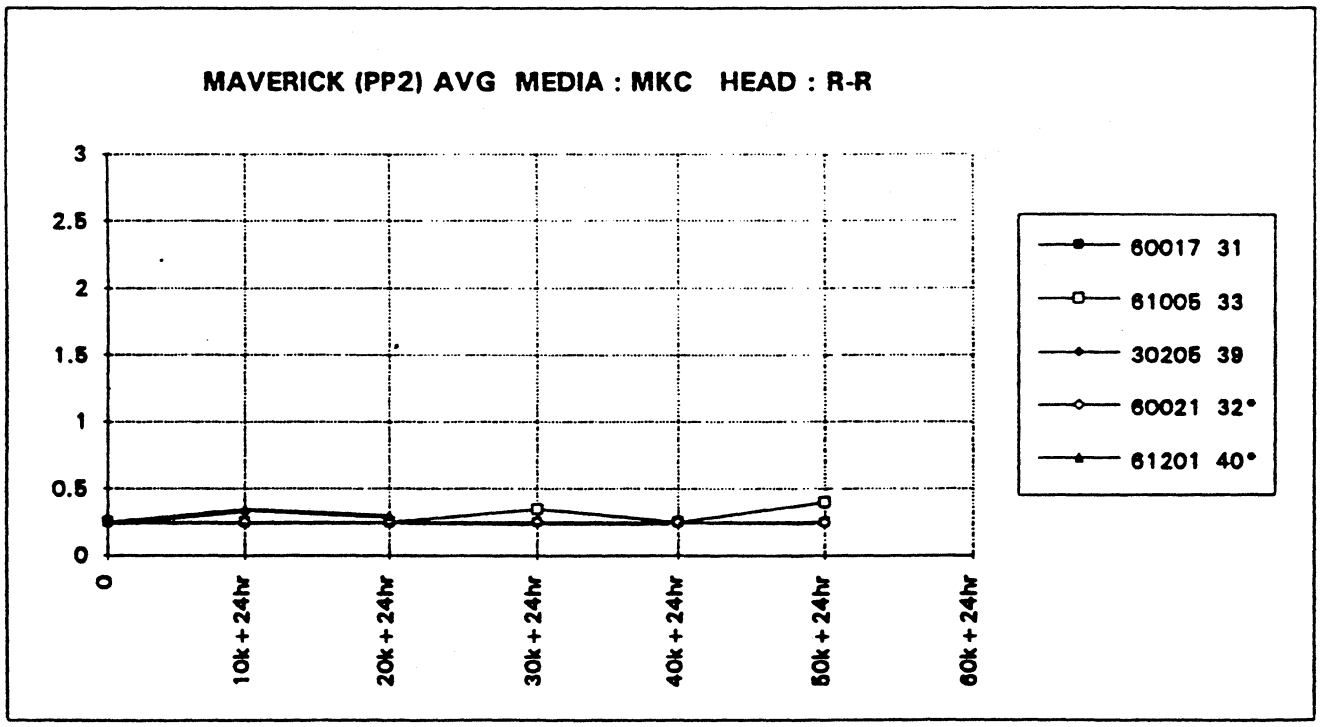

MAVERICK (PP2) MAX MEDIA : AKCL HEAD : AMC
3
2.5
2
1.5
1
0.5
0
0
10k + 24hr
20k + 24hr
30k + 24hr
40k + 24hr
50k + 24hr
60k + 24hr
25° not finish
25° not recal
24° EO
42127 21
42105 22
42111 23
42108 24°
42121 25°

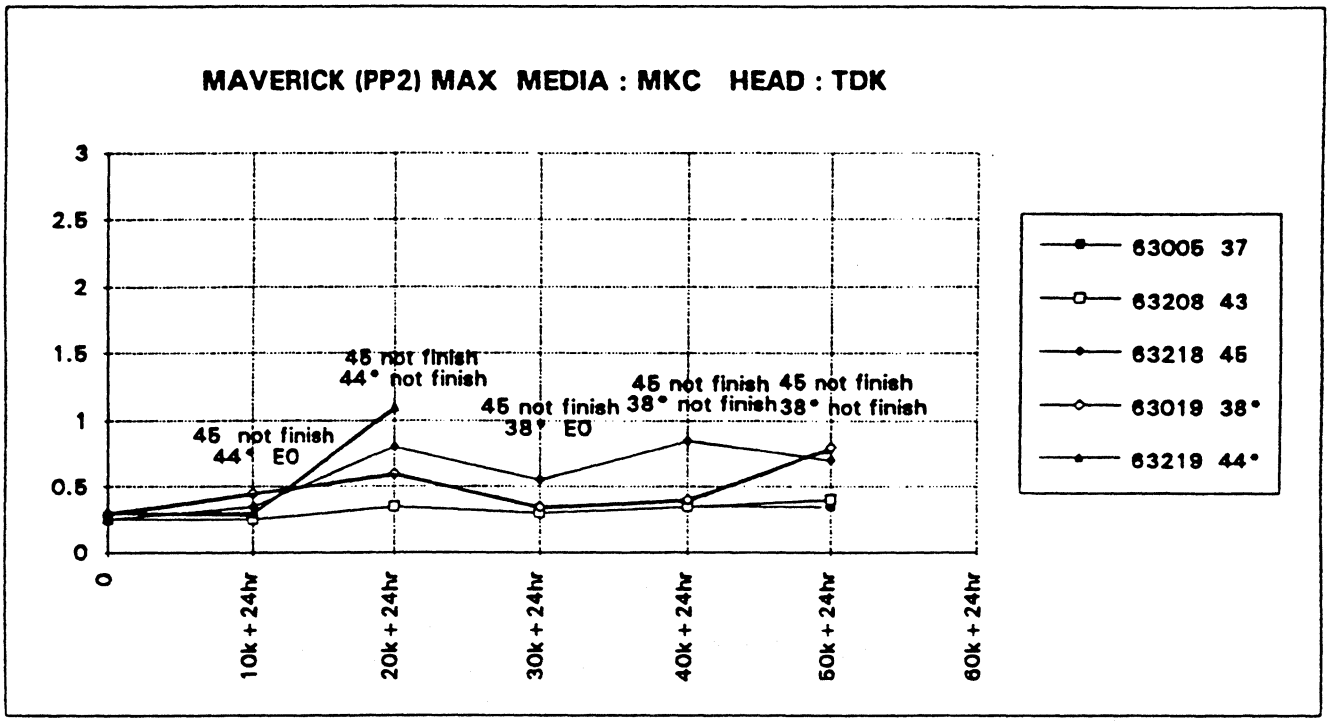

MAVERICK (PP2) AVG MEDIA : AKCL HEAD : AMC
3
2.5
2
1.5
1
0.5
0
0
10k + 24hr
20k + 24hr
30k + 24hr
40k + 24hr
50k + 24hr
60k + 24hr
42127 21
42105 22
42111 23
42108 24°
42121 25°

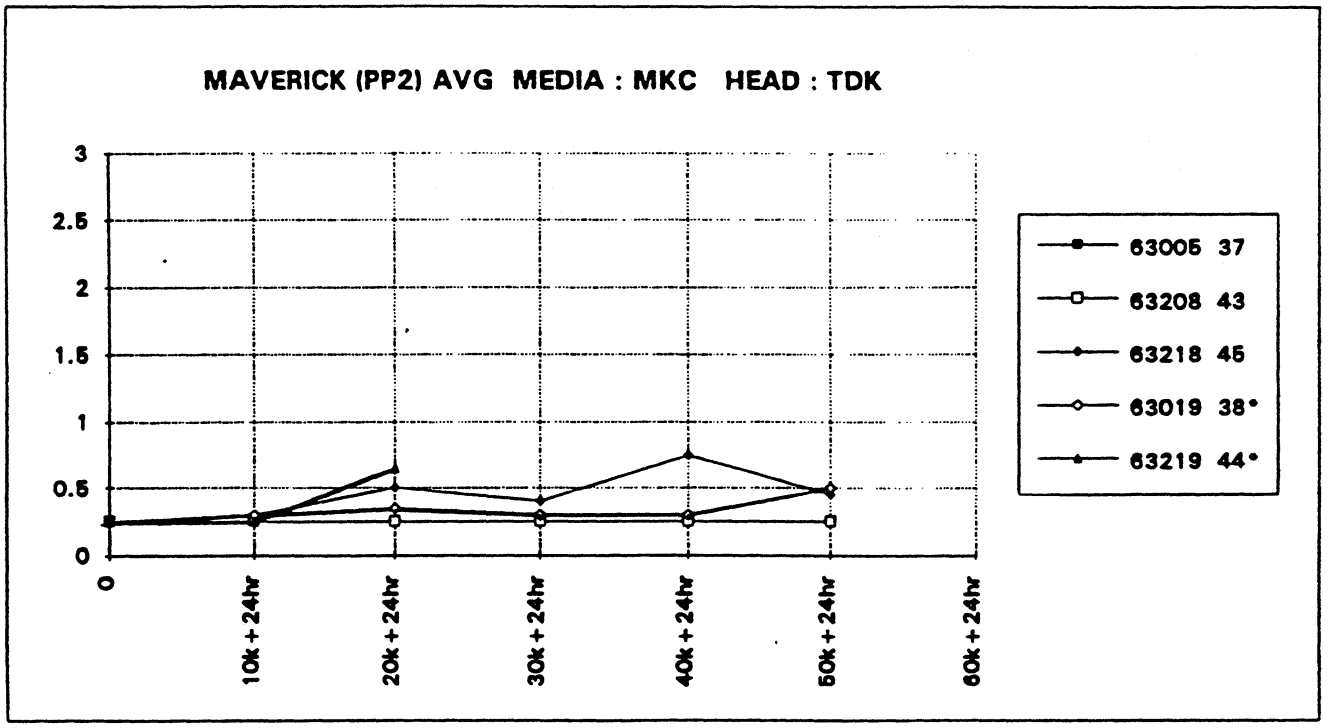

MAVERICK (PP2) MAX MEDIA : AKCL HEAD : TDK
3
2.5
2
1.5
1
0.5
0
26 EO
27 EO
0
10k + 24hr
20k + 24hr
30k + 24hr
40k + 24hr
50k + 24hr
60k + 24hr
43020 26
43019 27
43113 29
43018 28°
43107 30°

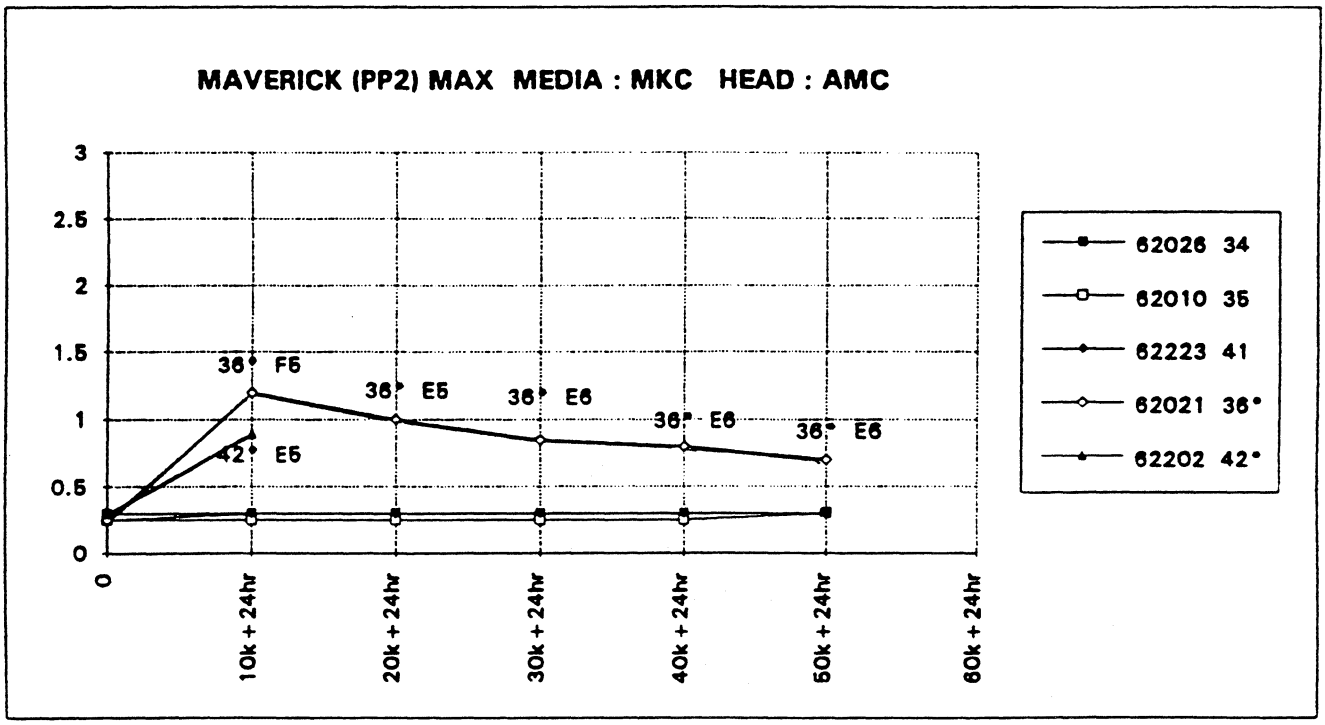

MAVERICK (PP2) AVG MEDIA : AKCL HEAD : TDK
3
2.5
2
1.5
1
0.5
0
0
10k + 24hr
20k + 24hr
30k + 24hr
40k + 24hr
50k + 24hr
60k + 24hr
43020 26
43019 27
43113 29
43018 28°
43107 30°

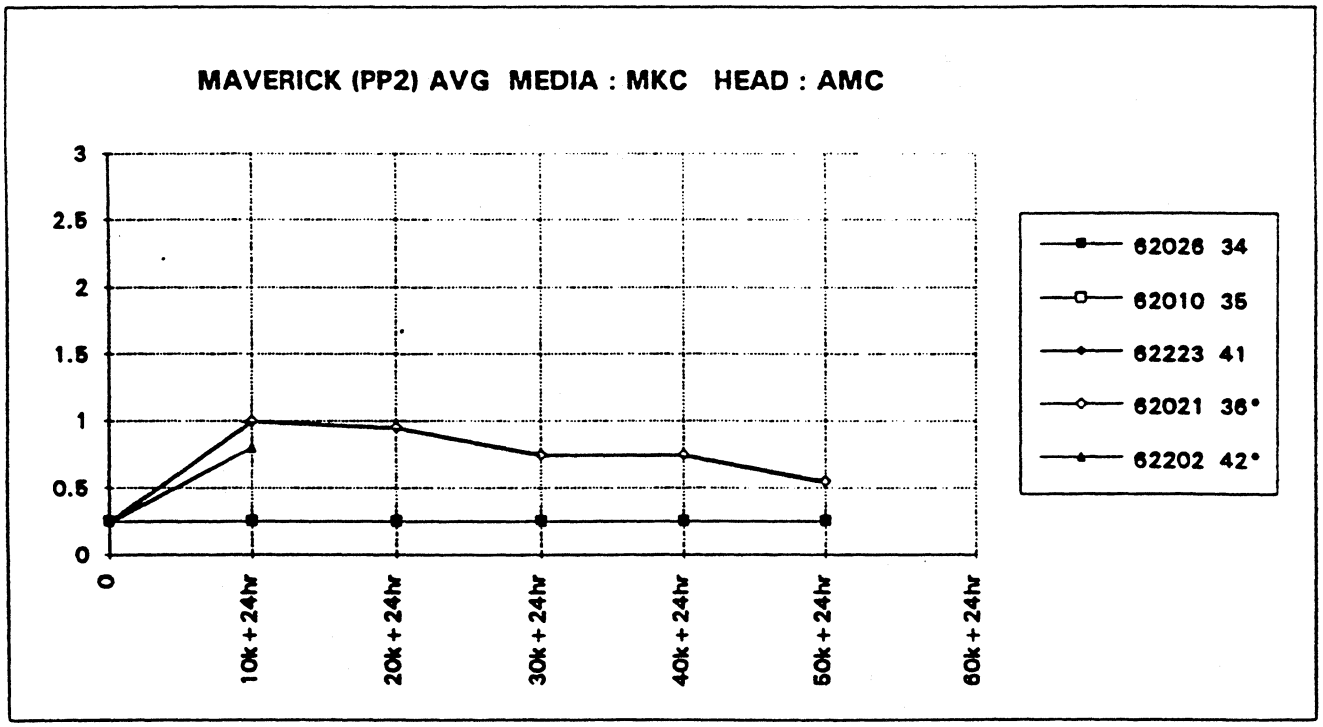

MAVERICK (PP2) MAX MEDIA : MKC HEAD : R-R
3
2.5
2
1.5
1
0.5
0
32° not finish
40° F5
32° E0
40° E8
32° E0
32° E8
0
10k + 24hr
20k + 24hr
30k + 24hr
40k + 24hr
50k + 24hr
60k + 24hr
60017 31
61005 33
60205 39
60021 32°
61201 40°


MAVERICK (PP2) AVG MEDIA : MKC HEAD : R-R
3
2.5
2
1.5
1
0.5
0
0
10k + 24hr
20k + 24hr
30k + 24hr
40k + 24hr
50k + 24hr
60k + 24hr
60017 31
61005 33
30205 39
60021 32°
61201 40°


MAVERICK (PP2) MAX MEDIA : MKC HEAD : TDK
3
2.5
2
1.5
1
0.5
0
45 not finish
44° not finish
45 not finish
44° EO
45 not finish
38° EO
45 not finish
38° not finish
45 not finish
38° not finish
0
10k + 24hr
20k + 24hr
30k + 24hr
40k + 24hr
50k + 24hr
60k + 24hr
63005 37
63208 43
63218 45
63019 38°
63219 44°


MAVERICK (PP2) AVG MEDIA : MKC HEAD : TDK
3
2.5
2
1.5
1
0.5
0
0
10k + 24hr
20k + 24hr
30k + 24hr
40k + 24hr
50k + 24hr
60k + 24hr
63005 37
63208 43
63218 45
63019 38°
63219 44°


MAVERICK (PP2) MAX MEDIA : MKC HEAD : AMC
3
2.5
2
1.5
1
0.5
0
36° F5
36° E5
36° E6
36° E6
36° E6
42° E5
0
10k + 24hr
20k + 24hr
30k + 24hr
40k + 24hr
50k + 24hr
60k + 24hr
62026 34
62010 35
62223 41
62021 36°
62202 42°


MAVERICK (PP2) AVG MEDIA : MKC HEAD : AMC
3
2.5
2
1.5
1
0.5
0
0
10k + 24hr
20k + 24hr
30k + 24hr
40k + 24hr
50k + 24hr
60k + 24hr
62026 34
62010 35
62223 41
62021 36°
62202 42°

DRIVE SPECIFICATION

		Maverick 270	Maverick 540
1	Model		
2	Capacity Available to User (MB)	270	540
3	Interface (IDE, SCSI2 Fast, etc)	AT/SCSI2 Fast	AT/SCSI2 Fast
	Interface Part (Mfg & Model)	Quantum Neko	Quantum Neko
	Will Hot Plugging cause damage?	No	No
	Will Hot Plugging corrupt bus?	TBD	TBD
4	Sustained I/F Transfer Rate (MB/s)	TBD	TBD
	Transfer Rate @ Head (Mb/s)	36	36
	Spindle RPM	3,600	3,600
	Avg. Seek Time (typ/max ms)	14/28	14/28
	Seek Time for 1 Cyl (typ/max ms)	5	5
	Buffer Size (KB)	96	96
	# Buffer Segments	4	4
	Command Overhead (µs)	<1	<1
	Track Skew (ms)	6	6
	Cylinder Skew (ms)	6.8	6.8
	Spinup Time (max sec)	8	8
5	# Data Cylinders (physical)	2,853	2,853
	# Reserved Cylinders	5	5
	# Data Heads (physical)	2	4
	# Sectors/Track or . . .		
	Table if Zoned Recording	See Product Manual	See Product Manual
	Sector Interleave Factor	1	1
	# Data Bytes/Sector	512	512
	# Defect Mgmt Sectors/Cylinder	2	2
	# Defect Mgmt Cylinders/Drive	0	0
	Format Efficiency (%)	82%	82%
6	Power Supply Regulation Required	12V +10%/-8%	12V +10%/-8%
		5V +/-5%	5V +/-5%
	Power Supply Ripple Limit	100mV @ 12V	100mV @ 12V
		50mV @ 5v	50mV @ 5v
	Peak Amps @ Spinup	12V 1.0	12V 1.0
		5V 0.7	5V 0.7
	Power @ Idle Spin (RMS W)	3.7	3.7
	Power @ Random Rd/Wrt (RMS W)	5	5.2
	Power @ Low Power Mode (RMS W)	<1	<1
7	Operating Temperature Range (°C)	4 to 50	4 to 50
	Air Flow Requirement	TBD	TBD
	Humidity Range (operating)	8 to 85%	8 to 85%
	Incident E-Field Limit	4v/m 20Hz-20MHz	4v/m 20Hz-20MHz
	Incident B-Field Limit	<6 gauss	<6 gauss
	Operating Vibration/Shock Limits	1.0/10.0 G	1.0/10.0 G
	NonOp Vibration/Shock Limits	2.0/70.0 G	2.0/70.0 G
	Power Cycle/Start-Stop Limit	20,000	20,000
	Sound Power @ Idle Spin (mean/max)	4.0/4.5	4.0/4.5
	Sound Power @ Random Read (mean/max)	4.8/5.0	4.8/5.0
	Weight	<1 lb.	<1 lb.
8	Mean Time Between Failure (Hrs)	300,000	300,000

HARDWARE SPECIFICS

1 Model	Maverick 270	Maverick 540
2 Areal Density (Mb/Inch^2)	178.8	178.8
Tracks/Inch	2,950	2,950
Bits/Inch (max)	60,603	60,603
Flux Changes/Inch (max)	45,566	45,566
Servo Type (Dedicated, etc)	Embedded	Embedded
Write Threshold (% of Track)	10	10
Read Detect Threshold (% of Track)	20	20
Read/Write Encoding Method	1,7	1,7
Encode/Decode Table (separate)		
3 Spin Motor Torque Constant	170 g-cm/A	170 g-cm/A
Spin Motor Type/Configuration	8 Pole, 9 Slot, Fixed Shaft	8 Pole, 9 Slot, Fixed Shaft
Starting Torque Available ... from Spin Motor (min)	146.5 g-cm	146.5 g-cm
Starting Torque Required by ... Head/Disk Interface (max)	TBD	112 g-cm
4 Latch Type (Magnetic, Solonoid)	AIRLOCK™	AIRLOCK™
Force Required to ... Pull Out of Latch (max)	3,100 RPM .20 g-cm	3,100 RPM .20 g-cm
Actuator Type	Voice Coil	Voice Coil
Actuator Force Constant	730 g-cm/A	829 g-cm/A
Actuator Coil Amps (max)	5	5
Actuator Moment of Inertia	48.25 g-cm^2	48.25 g-cm^2
Force Available to ... Pull Out of Latch (min)	3,600 RPM	3,600 RPM
5 Head Design Type	Thin Film	Thin Film
Nominal Head Fly Height (µin)	3	3
Min/Max Head Fly Height (µin)	2.25/3.75	2.25/3.75
Head Launch Velocity	3 m/sec	3 m/sec
Head Gap Width	3.5 µm	3.5 µm
Magnetic Track Width	6.5µm	6.5µm
Head Gap Length	11.5 µm	11.5 µm
Head Gram Load	7 gm	7 gm
Head Amplitude (min)	200µV	200µV
Head Resolution (min)	65%	65%
Head Overwrite (max)	26 db	26 db
Head Signal/Noise Ratio (min)	28 db	28 db
6 Media Coercivity	1,550 Oe	1,550 Oe
Media Glide Height	2.0µ"	2.0µ"
Media Roughness	400 nm	400 nm
Media Lube Thickness @ ID	200 Å	200 Å
Media Lube Thickness @ OD	200 Å	200 Å
Media Amplitude (min)	200µV	200µV
Media Resolution (min)	65%	65%
Media Overwrite (max)	26 dB	26 dB

7 Outer Crash Stop Radius	1.8043"	1.8043"
Outer Data Track Radius	1.7975"	1.7975"
Inner Data Track Radius	.8310"	.8310"
Inner Crash Stop Radius	.761"	.761"

8 Agency Certification		
Yes or No (with expected date)		
UL	Yes	Yes
CSA	Yes	Yes
TUV	Yes	Yes
FCC	Yes	Yes

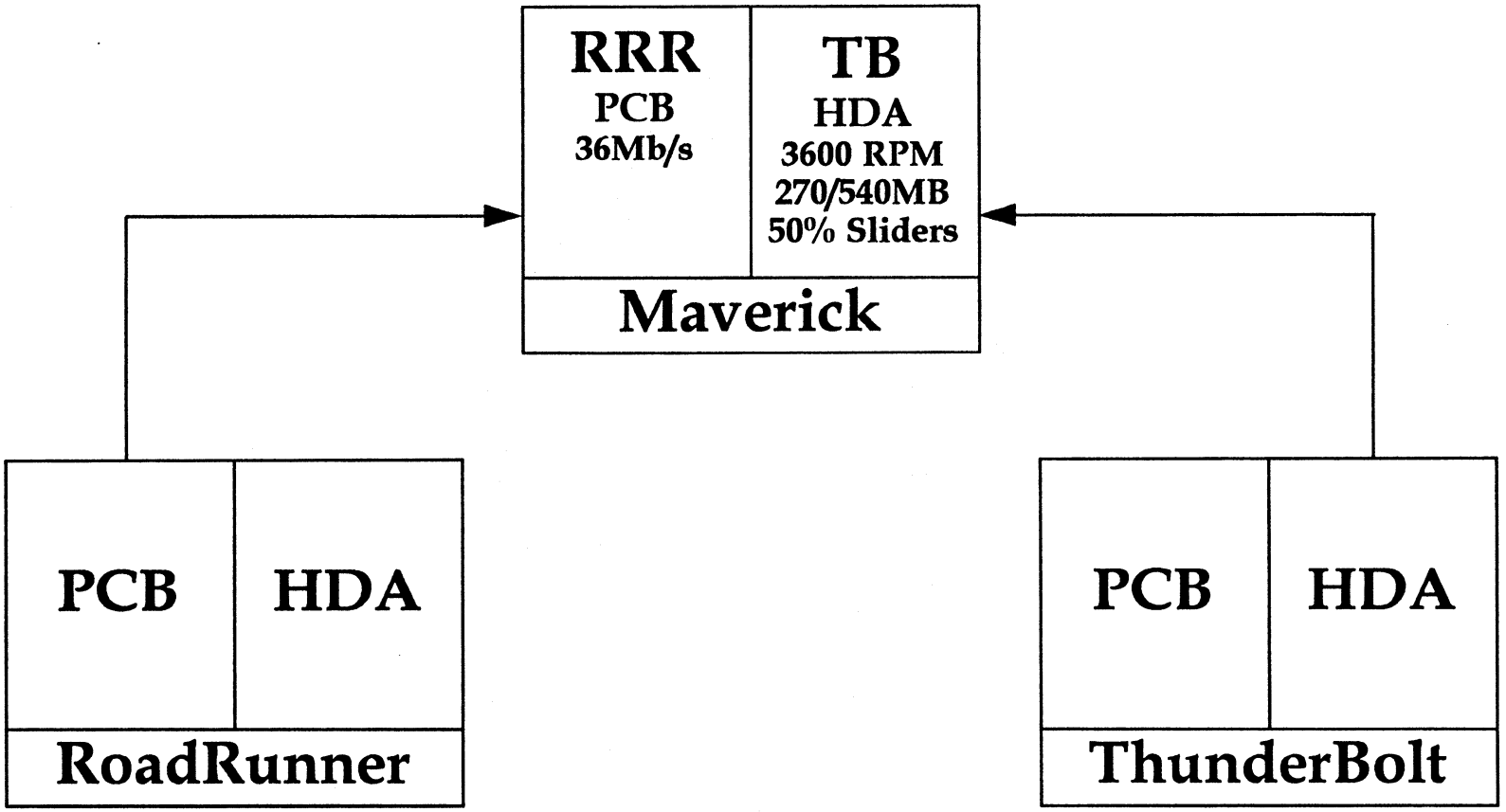
MAVERICK CRITICAL COMPONENTS

PART	SUPPLIER	MANUFACTURING LOCATION	LEAD TIME IN WEEKS	MONTHLY CAPACITY
D-Ram				
64K x 16	Toshiba	Japan	14	150,000
	Oki	Japan	14	70,000
	NEC	Japan	14	250,000
	Sanyo	Japan	14	200,000
Read Channel				
Ryan II	AT&T	USA	14	700,000
Controller/IF				
Neko	TI	Miho, Japan	12	200,000
		KTI, Japan	12	600,000
Synthesizer				
Sakana II	TI	Japan	12	700,000
Filter				
32F8012-CN	SSI	USA/Korea	12	700,000
AD896-JR8012	Analog Devices	USA/Taiwan	12	700,000
Motor Driver				
HA13481AFP	Hitachi	Japan	12	700,000
VCM Driver				
HA13529FP	Hitachi	Japan	12	700,000
CPU				
OTP/ROM 78352	NEC	Japan	16	700,000
Pre-Amp				
VM7164	VTC	USA	12	1,000,000
HA166159RFP4	Hitachi	Japan	12	700,000
Media				
	Showa Denko	Japan	8	750,000
	Fuji	Japan	8	1,200,000
	MKC	Japan	8	1,000,000
	AKCL	Japan	8	600,000
Heads				
	AMC	USA/Malaysia	8	800,000
	Read-Rite	USA/Thailand	8	800,000
	TDK	Japan/PRC	8	800,000
Motor				
	MKE/Ozu	Japan	10	600,000
	NIDEC	Japan	10	250,000

ENR 5/19/94

Maverick 270/540 AT
Electrical Review
Prepared for Compaq

Maverick Product Leverage



Drive Configuration - HDA

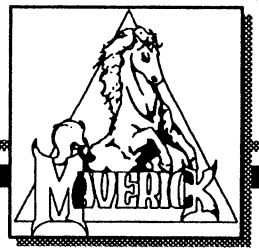
Changes from Thunderbolt HDA

- 3600 RPM Spindle Motor → Lower Data Rate/ Lower Power
- 7 Gram Load w/Modified Rails → Proper Fly Height at New RPM
- 50% Sliders → Increased Data Stroke
- New OD Crash Stop → More Tracks / Lowers FCI

- One Side VCM Magnets → Reduced Seek Spec

- Redesigned Flex Circuit w/New Preamp → Interface RRR PCB to TB HDA

- Add RRR PCB Mounting Holes → Interface RRR PCB to TB HDA
- Slots in Base for Push Pin Servowriter → Servowrite w/Cover On
- Machined Surface on E-Block → Reliable Push Pin Contact

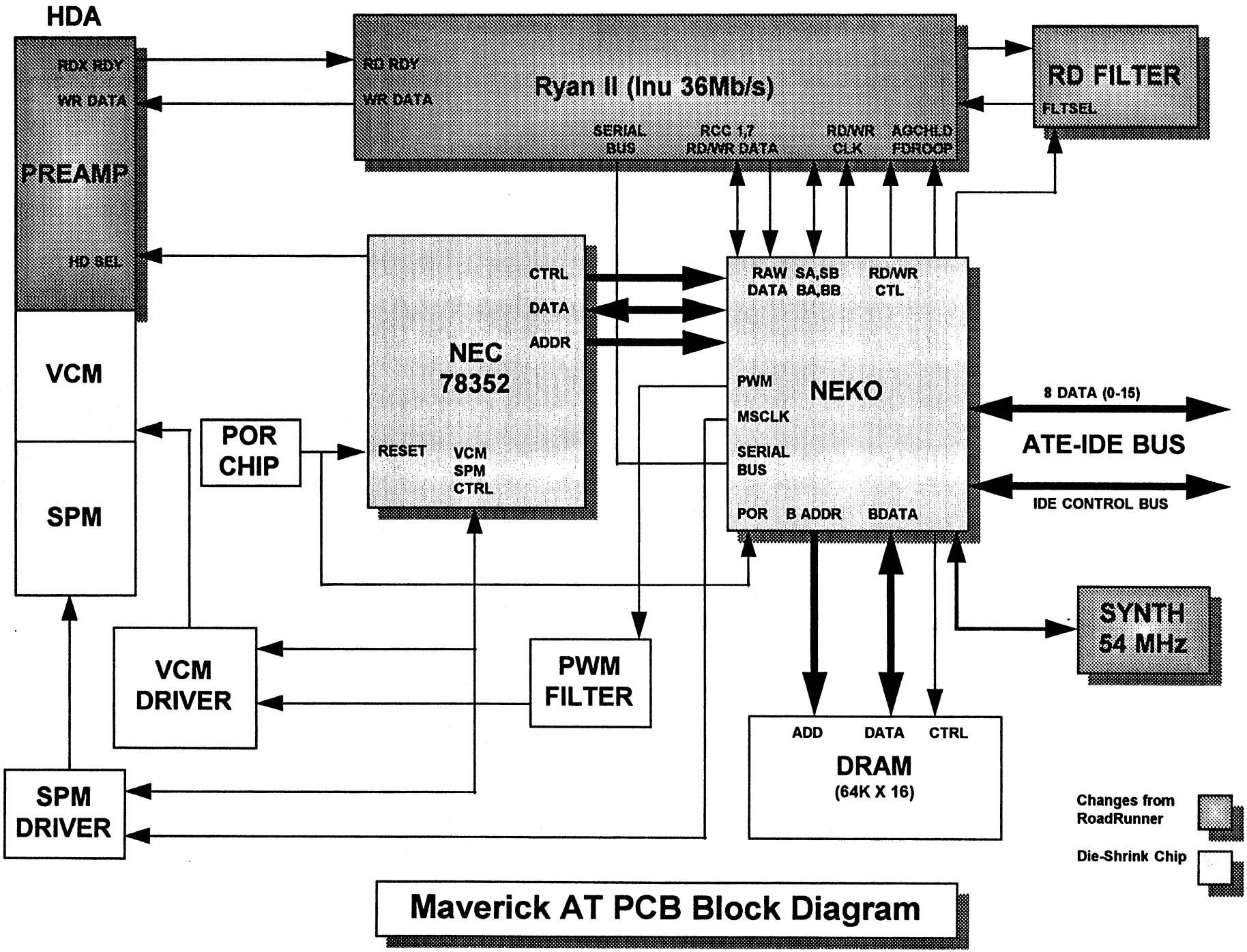


Drive Configuration - Electronic

Changes From RoadRunner PCB

- Read Channel - Ryan II → Inu Tested to 36 Mb/s
- Synthesizer - Sakana II → Sakana Tested to 54 MHz
- 8011 Read Filter → 8012 Read Filter
- ECL Preamp → Hitachi or VTC TTL
- PCB Fab → > 96 % RoadRunner

- Form Factor → Ryan 44 PQFP Package
  → 3.9 mm Jumpers
  → TB I/F Connector



Maverick AT PCB Block Diagram

IC Status

Ryan II - Read Channel

- 100% build from PP2 on
- Specification approved / No known issues

Sakana II - Frequency Synthesizer

- Sakana II (54 MHz) process qualified for MP
- Specification approved / No known issues

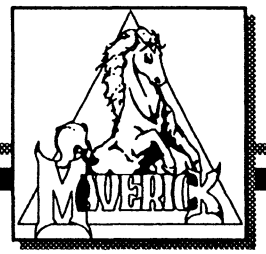
Neko-DS

- Samples will be built and tested at PP2
- Parts approved / No known issues

NEC 78352 -DS

- Redesign from 0.8 to 0.65 μm
- First samples due in late June
- Full FMT and Compatibility testing planned
- Second Release - 4Q94

Maverick 270 / 540
Track Layout



MAVERICK 540 TRACK LAYOUT

16 zones - ID after Wedge

Last Rev:	2/16/94	3:29 PM
Req Cap	541.4994	Million Bytes
Spare	2	per cyl
Surfaces	4	
Rod	1.7992	"
Rid	0.8301	"
Stroke	0.9691	"
RPM	3599.64	rpm
Trot	16668.800	uSec
Frot	59.9923	Hz
TPI	2950.0	
Tot. tracks	2858	
Trks/zone	166	
max. FCI	45594	
% of req.	100.01%	
Total Cap	541.5721	Million bytes
User sectors	1057758	

	Bytes	uSec
ID Sync	9	
ID AM	2	
ID Data	6	
ID CRC	3	
ID Pad	3	
Total	23	
Data bytes	512	
Data Sync	13	
Data AM	2	
Data ECC	14	
Data Pad	3	
Tot. bytes	544	
Split ovhd	18	
AGC/Wiggle Gap	3	1.29
		max.

Srv Fq	26.653869	MHz	
Srv Clk	37.51800536	nSec	
Srv T	1.801	uSec	(Pre & Post gaps)
Srv N	417	Clocks	(Total of fields other than gaps)
Nservos	78	samples	
Tservo	17.44600824	uSec	(Includes pre & post gaps)
Tdata	196.250	uSec	
Servo sample freq =	4679.401093	Hz	Srv OH 8.16%
Wedge-to-Wedge time =	213.7026	µs	Fmt OH 9.70%

	Pre & Post Gaps	AGC Time	Servo Sync	SAM	Index	Gray code (12 bits)	DC Erase	A,B&C Bursts (each)
µs	1.801	3.301584472	1.500720214	1.3881662	0.337662048	4.05194458	0.337662048	1.575756225
Clks	48.00361807	88	40	37	9	108	9	42

Total Servo Burst length = 17.446 µs = 465.0036181 T

Zone	Zone Rod	Zone Rid	Cyls	Max. FC/in.	Data Rate [Mb/s]	Fclk [MHz]	Fmax [MHz]	½Twindow [nS]	ID time [µs]	Sect. time [µs]	Sect/burst w/o split	Time left [µs]	Preamble & AM [µs]	Split Sect	Total Sect (incl. spares)	Zone Cap per surface
OD		1.7992														
System	1.7992	1.7972	5	32127	29.02	43.529	10.882	11.49	6.34	149.97	1	39.115	4.96	16	94	239360
0	1.7972	1.7294	200	41508	36.08	54.118	13.529	9.24	5.10	120.63	1	69.859	3.99	42	118	12032000
1	1.7294	1.6755	159	42843	36.08	54.118	13.529	9.24	5.10	120.63	1	69.859	3.99	42	118	9565440
2	1.6755	1.5948	238	45011	36.08	54.118	13.529	9.24	5.10	120.63	1	69.859	3.99	42	118	14318080
3	1.5948	1.5447	148	45083	35.00	52.500	13.125	9.52	5.26	124.34	1	65.964	4.11	38	114	8600576
4	1.5447	1.5013	128	45217	34.12	51.176	12.794	9.77	5.39	127.56	1	62.595	4.22	34	112	7307264
5	1.5013	1.4477	168	45273	32.94	49.412	12.353	10.12	5.59	132.11	1	57.821	4.37	30	108	8696320
6	1.4477	1.3840	188	45399	31.58	47.368	11.842	10.56	5.83	137.81	1	51.850	4.56	27	104	9962496
7	1.3840	1.3237	178	45095	30.00	45.000	11.250	11.11	6.13	145.07	1	44.250	4.80	20	97	8794624
8	1.3237	1.2599	188	45209	28.63	42.941	10.735	11.64	6.43	152.02	1	36.962	5.03	16	93	8903680
9	1.2599	1.1928	198	45594	27.33	41.000	10.250	12.20	6.73	159.22	1	29.421	5.27	11	88	8870400
10	1.1928	1.1393	168	45203	25.88	38.824	9.706	12.88	7.11	168.15	1	20.068	5.56	5	83	6673920
11	1.1393	1.0586	238	44963	23.92	35.882	8.971	13.93	7.69	181.93	1	5.627	6.02	-1	78	9443840
12	1.0586	1.0186	118	45580	23.33	35.000	8.750	14.29	7.89	186.51	1	0.821	6.17	-1	74	4440576
13	1.0186	0.9718	138	45044	22.00	33.000	8.250	15.15	8.36	197.82	0	186.795	6.55	71	69	4839936
14	0.9718	0.9115	178	45115	20.67	31.000	7.750	16.13	8.90	210.58	0	186.185	6.97	65	65	5878272
15	0.9115	0.8301	240	44743	18.67	28.000	7.000	17.86	9.86	233.14	0	185.107	7.71	59	58	7065600
ID	0.8301		2853													

Total cap =	541.572096
% of goal =	100.01%

Bytes/surface =	135393024
Bytes/disk =	270786048

MAVERICK 270 TRACK LAYOUT

16 zones - ID after Wedge

Last Rev:	2/16/94	3:26 PM	
Req Cap	270.749696	Million Bytes	lc270d.xlw
Spare	1	per cyl	
Surfaces	2		
Rod	1.7992	"	
Rid	0.8301	"	
Stroke	0.9691	"	
RPM	3599.54	rpm	
Trot	16668.7998	uSec	
Frot	59.9923	Hz	
TPI	2950		
Tot. tracks	2858		5711
Trks/zone			
max. FCI	45594		
% of req	100.01%		
Total Cap	270.7860	Million bytes	
User sectors	481879		

	Bytes	uSec
ID Sync	9	
ID AM	2	
ID Data	6	
ID CRC	3	
ID Pad	3	
Total	23	
Data bytes	512	
Data Sync	13	
Data AM	2	
Data ECC	14	
Data Pad	3	
Tot. bytes	544	
Split ovhd	18	
AGC/Wiggle Gap	3	1.29
		max.

Srv Fq	26.654	MHz	
Srv Clk	37.518	nSec	
Srv T	1.801	uSec	(Pre & Post gaps)
Srv N	417	Clocks	(Total of fields other than gaps)
Nservos	78	samples	
Tservo	17.446	uSec	(Includes pre & post gaps)
Tdata	196.250	uSec	
Servo sample freq =	4679.401093	Hz	Srv OH 8.16%
Wedge-to-Wedge time =	213.7026	µs	Fmt OH 9.70%

	Pre & Post Gaps	AGC Time	Servo Sync	SAM	Index	Gray code (12 bits)	DC Erase	A,B&C Bursts (each)
µs	1.801	3.302	1.501	1.388	0.338	4.052	0.338	1.576
Clks	48	88	40	37	9	108	9	42

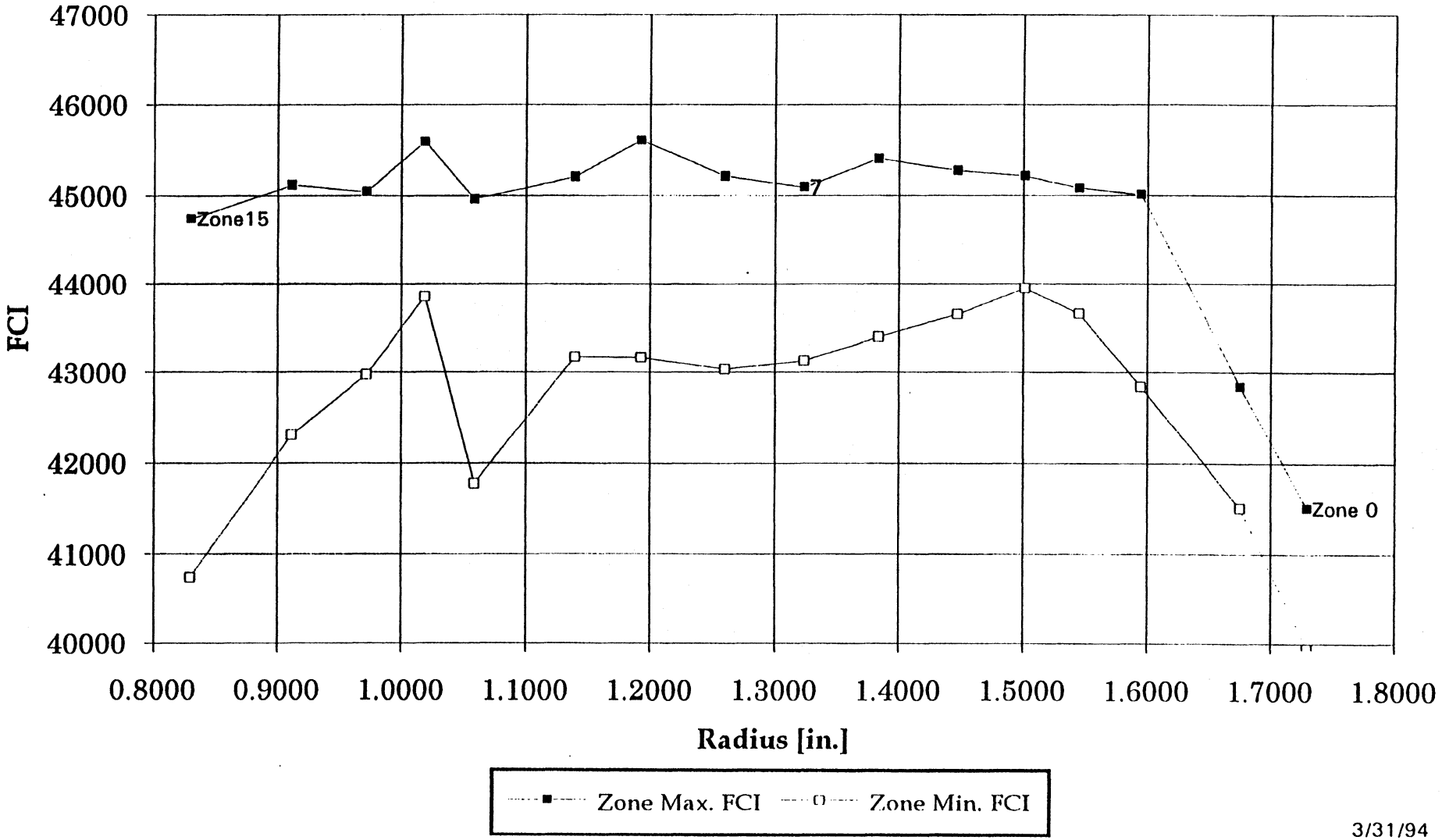
Total Servo Burst length = 17.446 µs = 465 T

Zone	Zone Rod	Zone Rid	START CYLINDER	Cyls	Max. FC/in.	Data Rate [Mb/s]	Fclk [MHz]	Fmax [MHz]	½Twindow [nS]	ID time [µs]	Sect. time [µs]	Sect/burst w/o split	Time left [µs]	Preamble & AM [µs]	Split Sect	Total Sect (incl. spares)	Zone Cap per surface
OD		1.7992															
System	1.7992	1.7972	-5	5	32127	29.02	43.529	10.882	11.49	6.34	149.97	1	39.115	4.96	16	93	236800
0	1.7972	1.7294	0	200	41508	36.08	54.118	13.529	9.24	5.10	120.63	1	69.859	3.99	42	118	12032000
1	1.7294	1.6755	200	159	42843	36.08	54.118	13.529	9.24	5.10	120.63	1	69.859	3.99	42	118	9565440
2	1.6755	1.6948	359	238	46011	36.08	54.118	13.529	9.24	5.10	120.63	1	69.859	3.99	42	118	14318080
3	1.5948	1.5447	597	148	45083	35.00	52.500	13.125	9.52	5.26	124.34	1	65.964	4.11	38	114	8600576
4	1.6447	1.6013	745	128	45217	34.12	51.176	12.794	9.77	5.39	127.56	1	62.595	4.22	34	112	7307264
5	1.5013	1.4477	873	158	45273	32.94	49.412	12.353	10.12	5.59	132.11	1	57.821	4.37	30	108	8696320
6	1.4477	1.3840	1,031	188	45399	31.58	47.368	11.842	10.56	5.83	137.81	1	51.850	4.56	27	104	9962496
7	1.3840	1.3237	1,219	178	45095	30.00	45.000	11.250	11.11	6.13	145.07	1	44.250	4.80	20	97	8794624
8	1.3237	1.2599	1,397	188	45209	28.63	42.941	10.735	11.64	6.43	152.02	1	36.962	5.03	16	93	8903680
9	1.2599	1.1928	1,585	198	45594	27.33	41.000	10.250	12.20	6.73	159.22	1	29.421	5.27	11	88	8870400
10	1.1928	1.1393	1,783	158	45203	25.88	38.824	9.706	12.88	7.11	168.15	1	20.068	5.56	5	83	6673920
11	1.1393	1.0586	1,941	238	44963	23.92	35.882	8.971	13.93	7.69	181.93	1	5.627	6.02	-1	78	9443840
12	1.0586	1.0186	2,179	118	45580	23.33	35.000	8.750	14.29	7.89	186.51	1	0.821	6.17	-1	74	4440576
13	1.0186	0.9718	2,297	138	45044	22.00	33.000	8.250	15.15	8.36	197.82	0	186.795	6.55	71	69	4839936
14	0.9718	0.9115	2,435	178	45115	20.67	31.000	7.750	16.13	8.90	210.58	0	186.185	6.97	65	65	5878272
15	0.9115	0.8301	2,613	240	44743	18.67	28.000	7.000	17.86	9.86	233.14	0	185.107	7.71	59	58	7065600
ID	0.8301		TOTAL	2853													

Total cap =	270.786048
% of goal =	100.01%

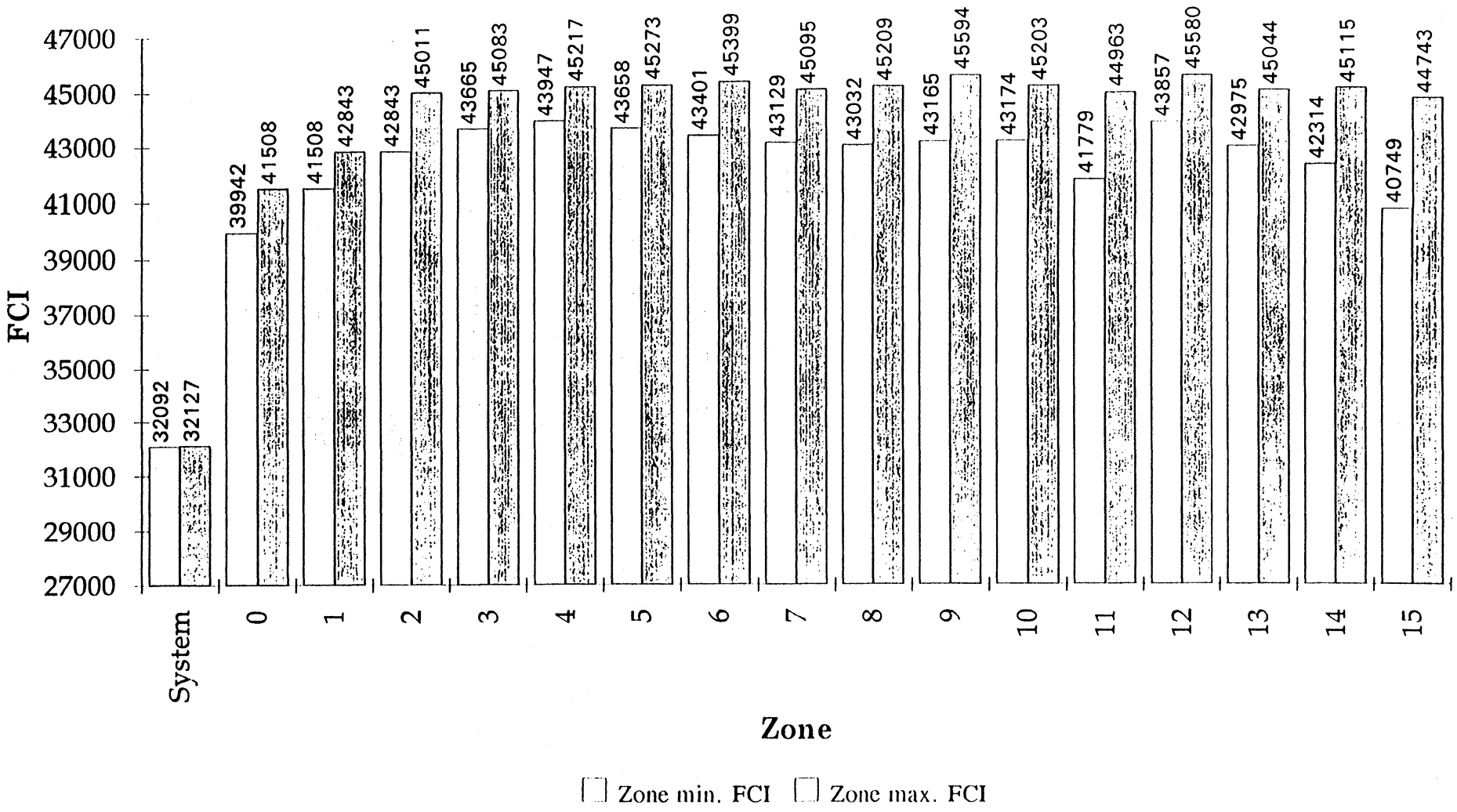
Bytes/surface =	135393024
Bytes/disk =	270786048

Maverick 270/540
FCI vs. Radius



3/31/94

Maverick 270/540
FCI vs. Zone



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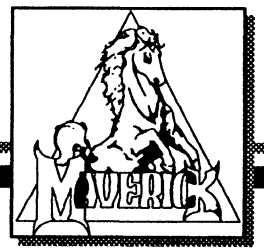
Maverick 270/540 Frequency Table

Zone	DataRate	VCO	OD Cyl	ID Cyl	# of cyl	Max. FCI	HF	LF	½ Twin	Synthesizer	
	Mb/s	MHz					MHz	MHz	nS	Feedback	Prescaler
System	29.0196	43.5294	-5	-1	5	32127	10.8824	2.7206	11.4865	74	17
0	36.0784	54.1176	0	199	200	41508	13.5294	3.3824	9.2391	92	17
1	36.0784	54.1176	200	358	159	42843	13.5294	3.3824	9.2391	92	17
2	36.0784	54.1176	359	596	238	45011	13.5294	3.3824	9.2391	92	17
3	35.0000	52.5000	597	744	148	45083	13.1250	3.2813	9.5238	84	16
4	34.1176	51.1765	745	872	128	45217	12.7941	3.1985	9.7701	87	17
5	32.9412	49.4118	873	1030	158	45273	12.3529	3.0882	10.1190	84	17
6	31.5789	47.3684	1031	1218	188	45399	11.8421	2.9605	10.5556	90	19
7	30.0000	45.0000	1219	1396	178	45095	11.2500	2.8125	11.1111	81	18
8	28.6275	42.9412	1397	1584	188	45209	10.7353	2.6838	11.6438	73	17
9	27.3333	41.0000	1585	1782	198	45594	10.2500	2.5625	12.1951	82	20
10	25.8824	38.8235	1783	1940	158	45203	9.7059	2.4265	12.8788	66	17
11	23.9216	35.8824	1941	2178	238	44963	8.9706	2.2426	13.9344	61	17
12	23.3333	35.0000	2179	2296	118	45580	8.7500	2.1875	14.2857	63	18
13	22.0000	33.0000	2297	2434	138	45044	8.2500	2.0625	15.1515	66	20
14	20.6667	31.0000	2435	2612	178	45115	7.7500	1.9375	16.1290	62	20
15	18.6667	28.0000	2613	2852	240	44743	7.0000	1.7500	17.8571	56	20

	Interval lengths													
Zone	2T		3T		4T		5T		6T		7T		8T	
	MHz	nS	MHz	nS	MHz	nS	MHz	nS	MHz	nS	MHz	nS	MHz	nS
System	10.882	45.946	7.255	68.919	5.441	91.892	4.353	114.865	3.627	137.838	3.109	160.811	2.721	183.784
0	13.529	36.957	9.020	55.435	6.765	73.913	5.412	92.391	4.510	110.870	3.866	129.348	3.382	147.826
1	13.529	36.957	9.020	55.435	6.765	73.913	5.412	92.391	4.510	110.870	3.866	129.348	3.382	147.826
2	13.529	36.957	9.020	55.435	6.765	73.913	5.412	92.391	4.510	110.870	3.866	129.348	3.382	147.826
3	13.125	38.095	8.750	57.143	6.563	76.190	5.250	95.238	4.375	114.286	3.750	133.333	3.281	152.381
4	12.794	39.080	8.529	58.621	6.397	78.161	5.118	97.701	4.265	117.241	3.655	136.782	3.199	156.322
5	12.353	40.476	8.235	60.714	6.176	80.952	4.941	101.190	4.118	121.429	3.529	141.667	3.088	161.905
6	11.842	42.222	7.895	63.333	5.921	84.444	4.737	105.556	3.947	126.667	3.383	147.778	2.961	168.889
7	11.250	44.444	7.500	66.667	5.625	88.889	4.500	111.111	3.750	133.333	3.214	155.556	2.813	177.778
8	10.735	46.575	7.157	69.863	5.368	93.151	4.294	116.438	3.578	139.726	3.067	163.014	2.684	186.301
9	10.250	48.780	6.833	73.171	5.125	97.561	4.100	121.951	3.417	146.341	2.929	170.732	2.563	195.122
10	9.706	51.515	6.471	77.273	4.853	103.030	3.882	128.788	3.235	154.545	2.773	180.303	2.426	206.061
11	8.971	55.738	5.980	83.607	4.485	111.475	3.588	139.344	2.990	167.213	2.563	195.082	2.243	222.951
12	8.750	57.143	5.833	85.714	4.375	114.286	3.500	142.857	2.917	171.429	2.500	200.000	2.188	228.571
13	8.250	60.606	5.500	90.909	4.125	121.212	3.300	151.515	2.750	181.818	2.357	212.121	2.063	242.424
14	7.750	64.516	5.167	96.774	3.875	129.032	3.100	161.290	2.583	193.548	2.214	225.806	1.938	258.065
15	7.000	71.429	4.667	107.143	3.500	142.857	2.800	178.571	2.333	214.286	2.000	250.000	1.750	285.714

Maverick 270 / 540
Read/Write Channel



16.4 Maverick Read/Write channel block diagram

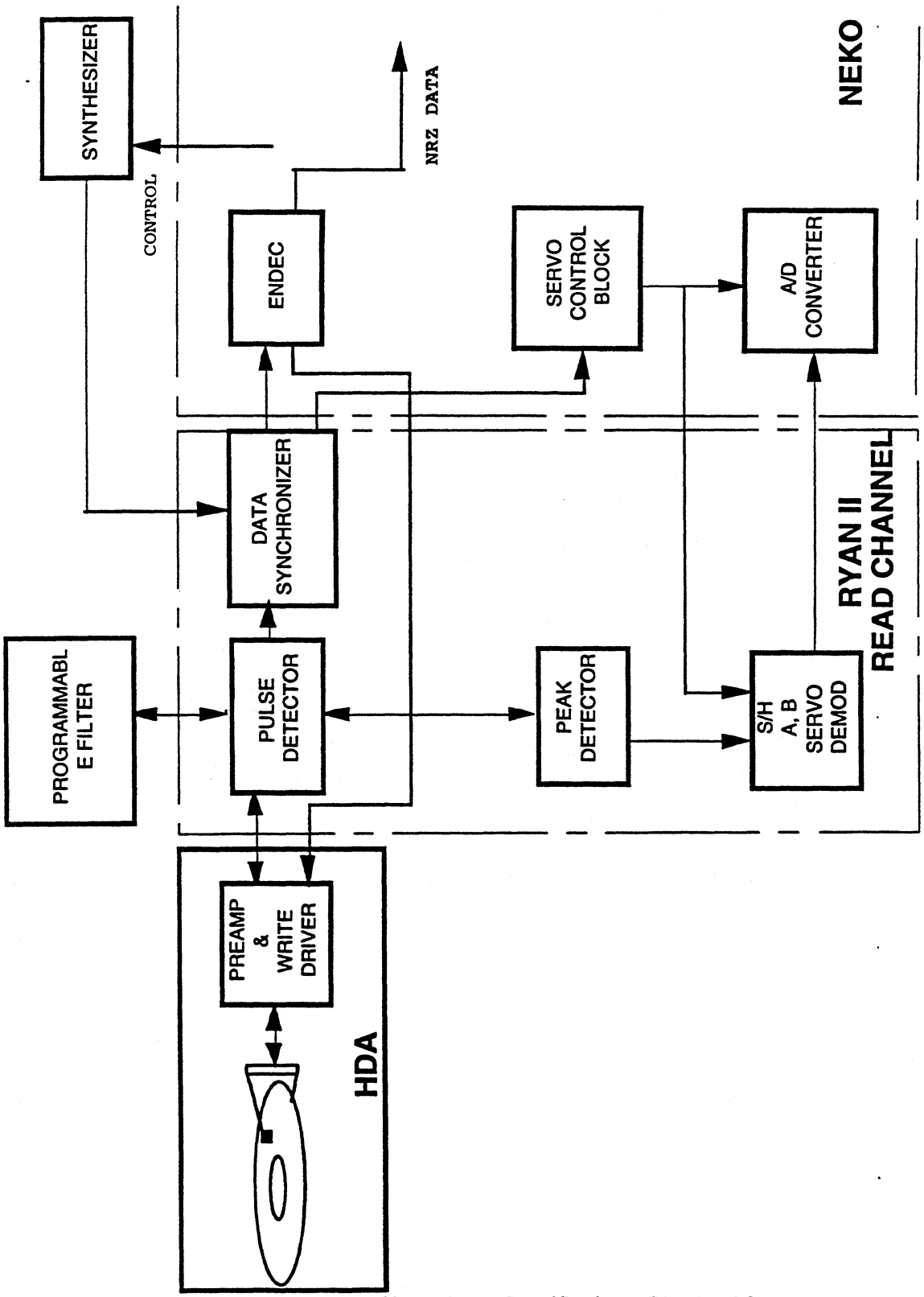
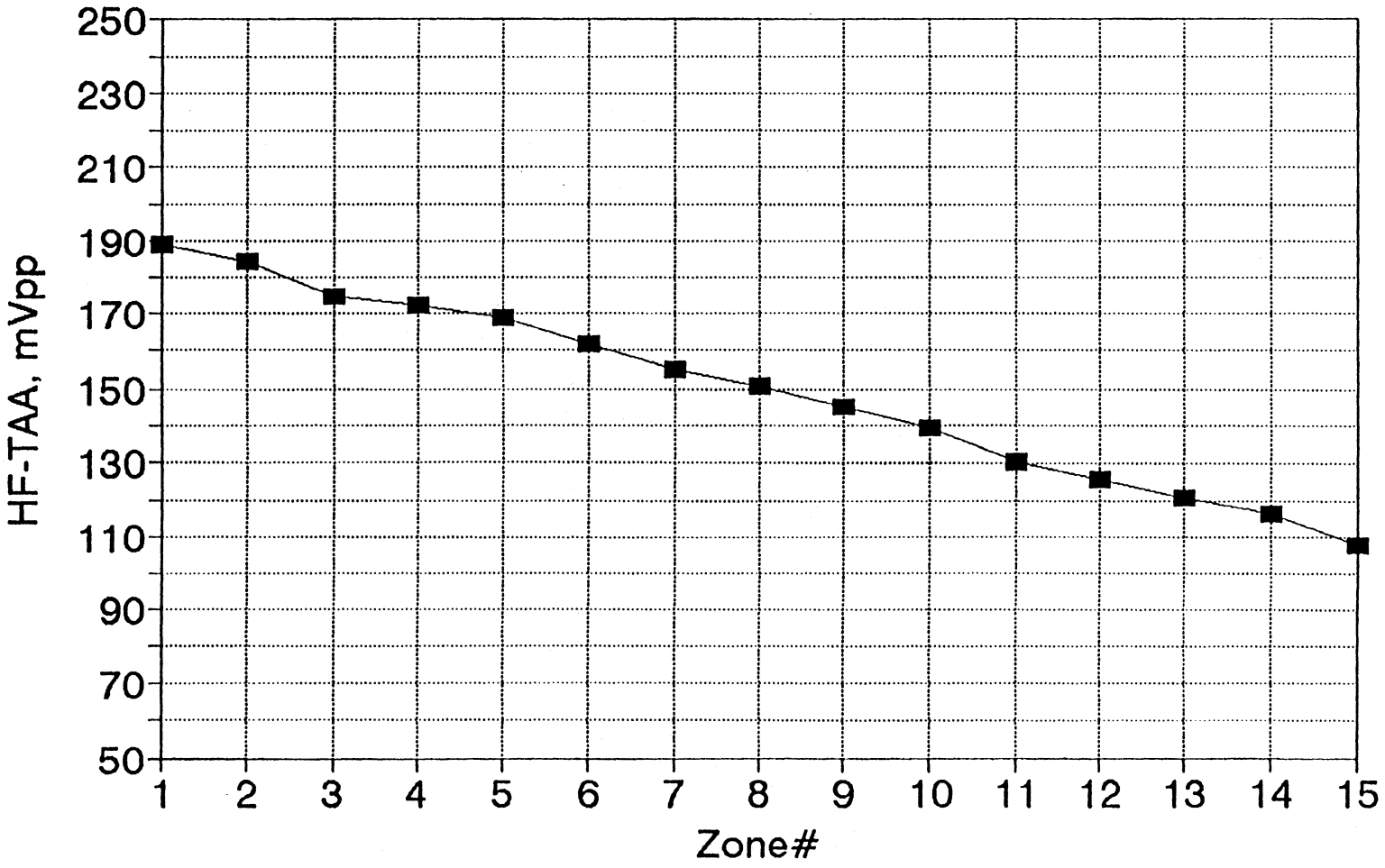


Figure 16-1 Maverick Read/Write Block Diagram

Maverick: P2-build HF-TAA AVGs

Includes all HD/Media combinations

4/12/94



R16 5.1

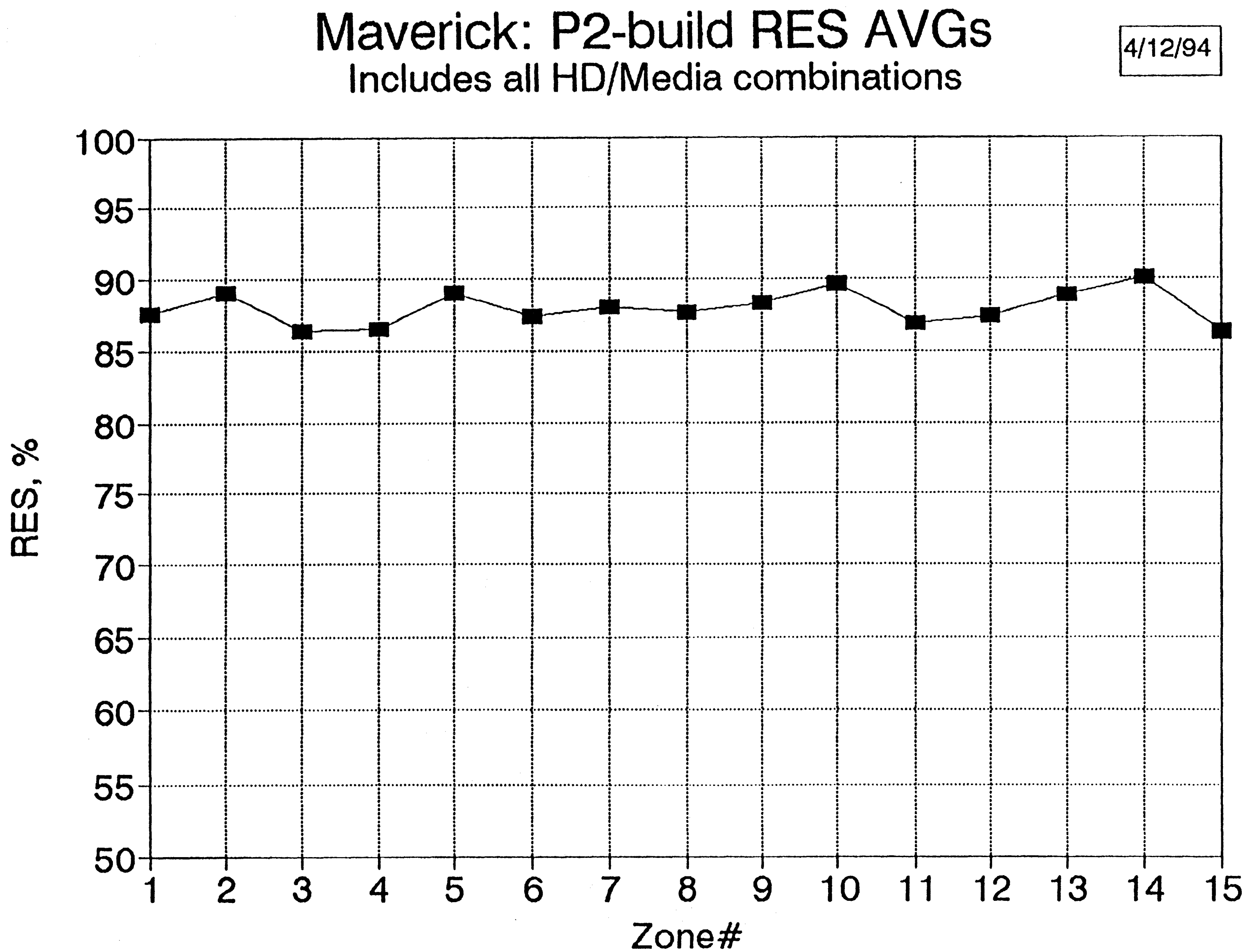
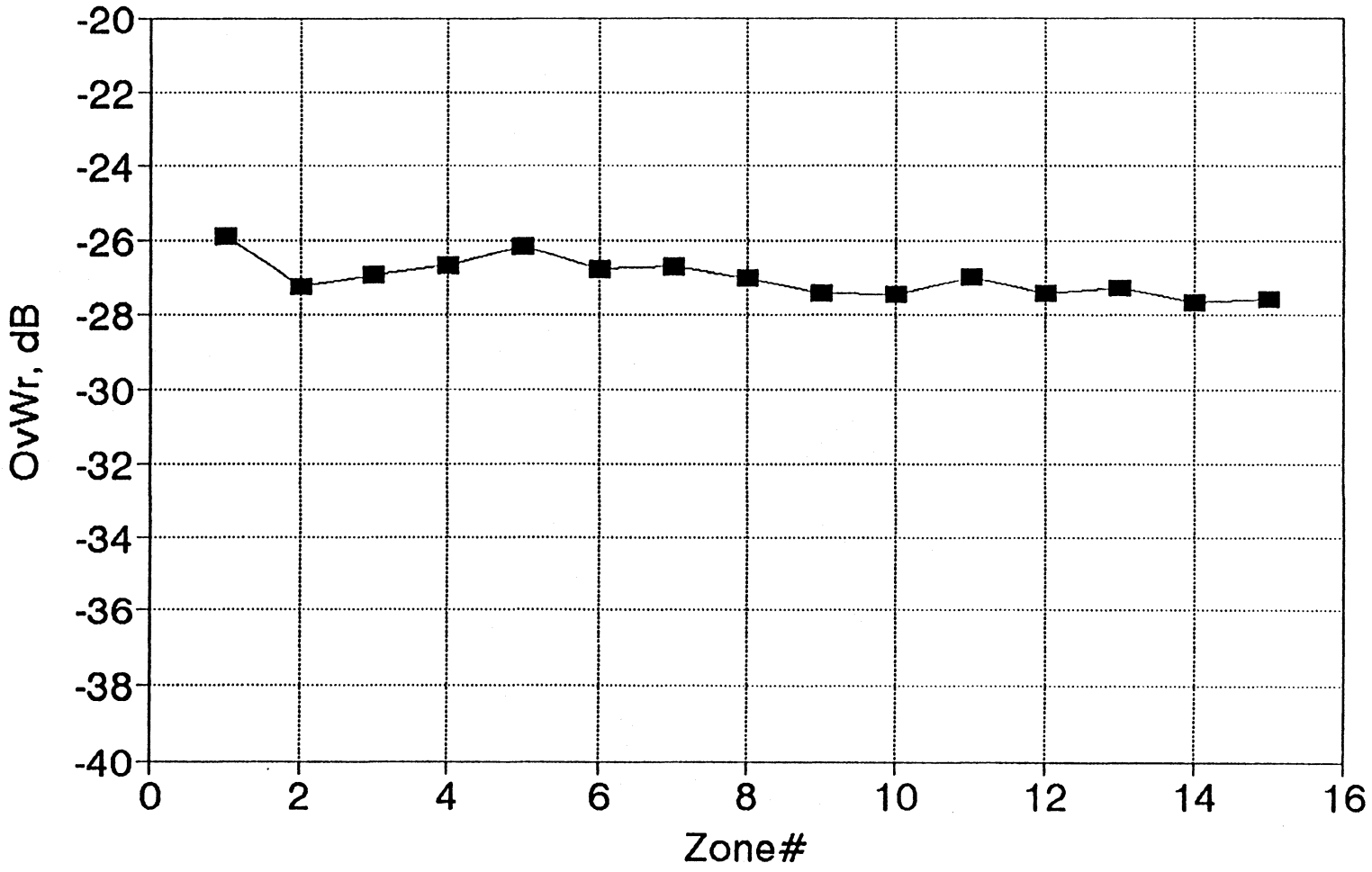

Maverick: P2-build RES AVGs
Includes all HD/Media combinations
4/12/94
100
95
90
85
80
75
70
65
60
55
50
RES, %
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Zone#

FIG 5.2

Maverick: P2-build OverWrite AVGs

Includes all HD/Media combinations

4/12/94



Pg 5.3

Maverick: P2-build Window Margin AVGs
Includes all HD/Media combinations

4/11/94

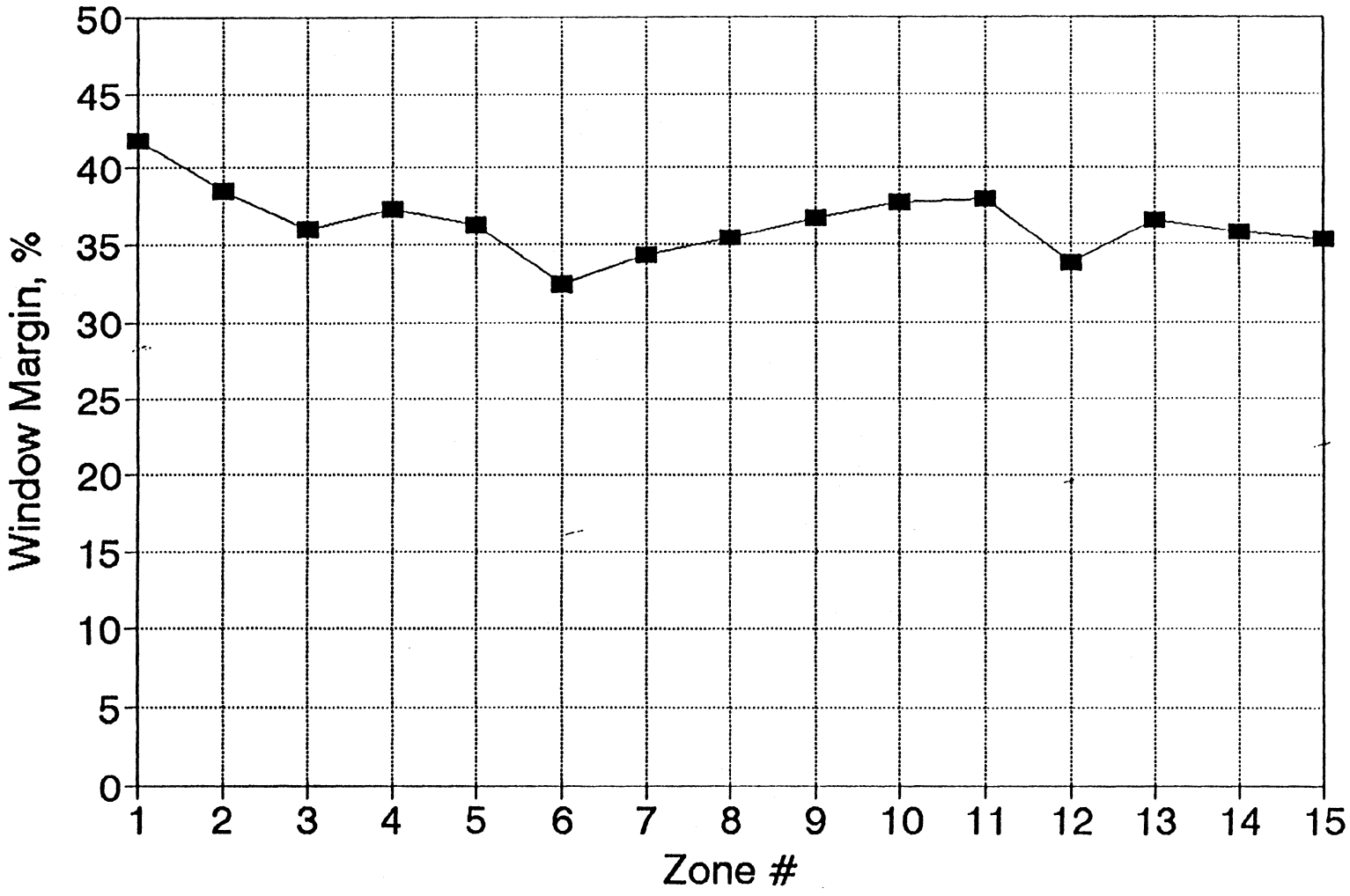
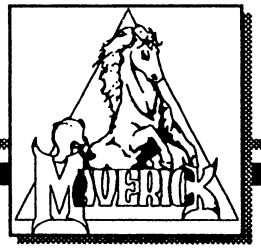


FIG 5.4

Maverick 270 / 540
Preamplifier



Date: 4/11/94.

Differences on Preamplifer and Flex circuit between Maverick drive and ThunderBolt and RoadRunner drive.

1)_ Preamplifier:

The Preamplifiers used in the Maverick drive are the VTC VM716430SPOK preamp and the Hitachi HA166159ARFP4 preamp. These preamplifiers basicly are the same as the preamplifers that are used in the ThunderBolt drive in term of designing with few differences:

- The WDI (write data input) for the Maverick drive is the single end TTL line and the WDI for the ThunderBolt drive are the differential ECL lines.
  The changes from a differential ECL lines of WDI to a single TTL line itoaccommodate the TTL WDI line comes from the controller chip through the interface connector from the RoadRunner PCB.

- The VTC VM716430SPOK originally has WSER line on pin #10 which is different from the ThunderBolt VTC preamp which had WSER line on pin #11. I kept VTC preamp as the original pinout and used it for Maverick drive.

- For the Hitachi HA 166159ARFP4 preamplifer, the WSER (All head write) pin is changed from pin #11 to pin #10 to be pin compatible with the VTC VM716430SPOK. ThunderBolt Hitachi preamp pin #11 is used for WSER line.

Also, the 4 channels preamplifier in Maverick drive is used for both 1 disk and 2 disks drive, while ThunderBolt drive used 4 channels preamp for 2 disk and 2 channels preamp for 1 disk.

2)_ Flex circuit:

The Flex circuit used in the Maverick drive is the same as the RoadRunner flex circuit with few differences:

- In Maverick drive the actuator ground and the Preamp ground are tied together to save one line which is used for the WSER (All head write) line. The RoadRunner flex circuit does not have the WSER line since its preamps do not have the all head write capability.

- Modify the ground line to be thicker and larger in area to improve ground noise in flex circuit.

PREAMPLIFIER SPECIFICATION.

ELECTRICAL:

CHARACTERISTIC	VALUE	UNITS	NOTES
Supply voltage	+5	V	+/- 10%
Max. input noise voltage	0.55	nV/rt-hz	BW=20MHz
Max. differential input cap.	14	pF	
Min. differential input resistance (Reading)	800	ohms	
Single Ended Output resistance (Max)	50	ohms	
-3dB Bandwidth (Min)	75	MHz	
-3dB Bandwidth (Max)	120	MHz	
Differential Voltage gain (typ.)	300	V/V	
Channel Separation (Min)	45	dB	10 MHz
Common Mode Rejection Ratio (Min)	50	dB	100mV @ 10MHz
Power Supply Rejection Ratio (Min)	45	dB	100mV @ 10MHz
Maximum output offset Voltage (0-peak)	150	mV	
Differential Head Voltage Swing(Min)	5	V	
Max. Write current Rise/Fall time	12	ns	1.8uH @ 15 mA
Min. Data frequency Capability	50	MHz	
Write Assymmetry (Max.)	0.5	ns	
Write Current Gain	20	mA/mA	
Write Current Range (0-peak)	13	mA	
Switched Rdamp during write	380	ohms	

4/11/94

David Chau.

ERROR BUDGET TABLE

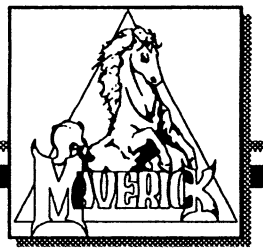
D. Chau

Note : Unles otherwise noted, all times are in ps

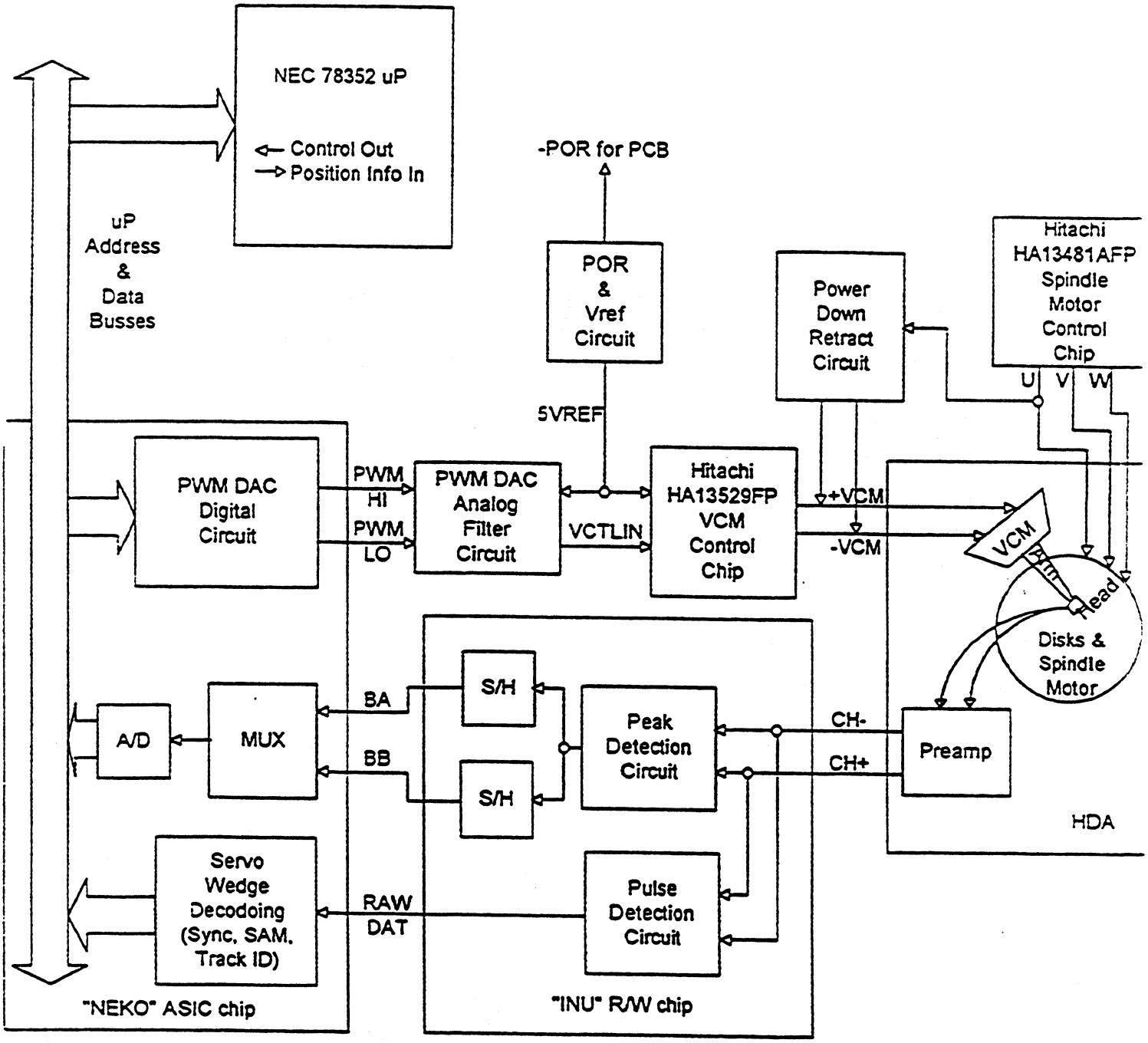
4/12/94

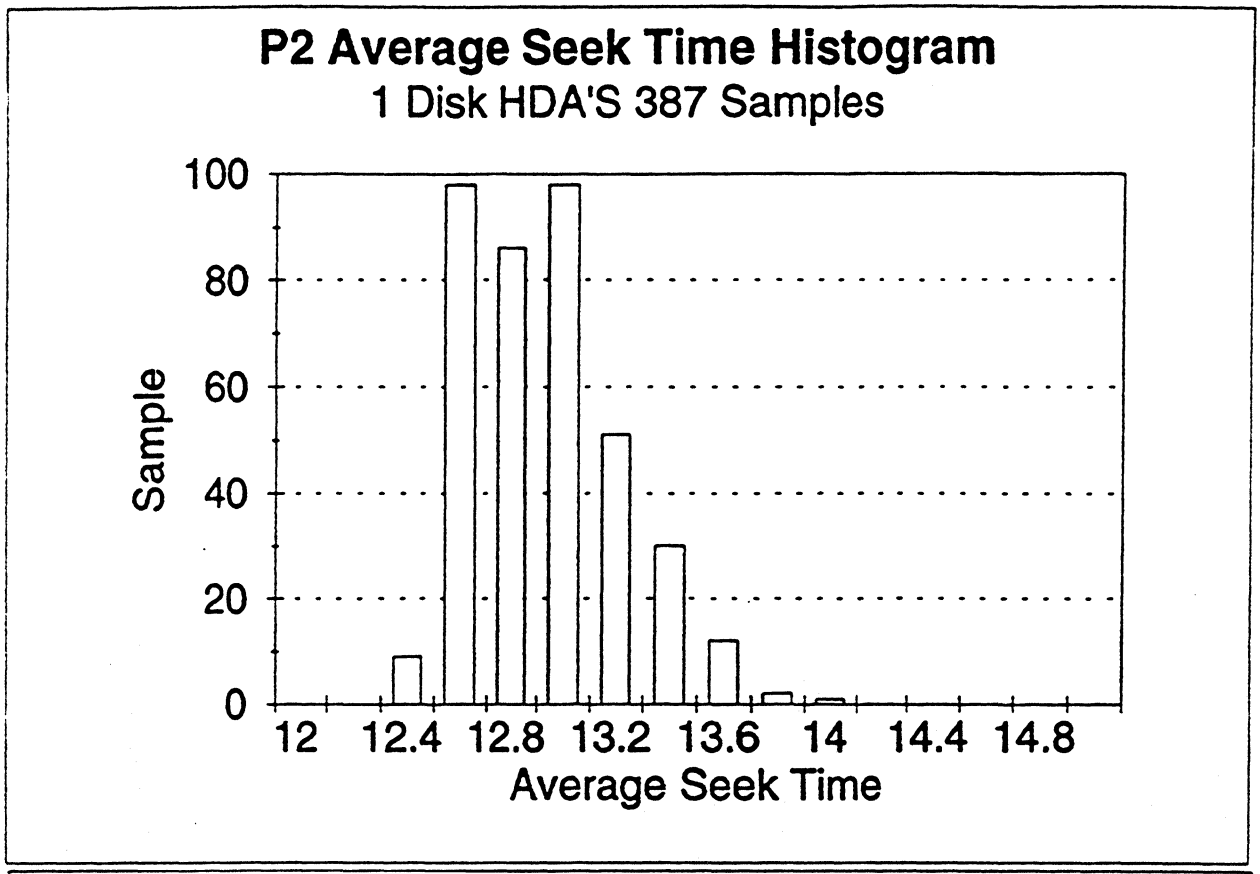
		ZONE 0-9	ZONE 10-15
WRITE PROCESS			
	JITTER (1sigma)		
	Inu plus Neko	100	200
	Synthesizer	200	400
	ASSYMETRY		
	PreAmp	2000	2000
READ PROCESS			
	JITTER (1sigma)		
	PLL	255	510
	Pulse Detector	170	340
	ASSYMETRY		
	Window Closure	918	1275
	Pulse Pairing	870	870
	Window Centering	857	857
HEAD/MEDIA			
	Parameters		
	Preamp noise [nv/rtHz]	0.61	0.61
	Bandwidth [MHz]	40.0	21.0
	PW50 [ns]	39.0	72.0
	Media Noise [nv/rtHz]	2.0	2.0
	2F Amplitude [uv]	597	275
	Overwrite [db]	26	26
	JITTER (* 1 sigma)		
	PreAmp noise *	89	262
	Media noise *	296	1013
	ASSYMETRY		
	Pattern Induced Bit Shift	2220	7140
	Overwrite	691	1276
TOTAL JITTER			
	1 sigma	490	1292
	at 1E-7 BER	2595	6850
	per 1/2 window	1835	4843
TOTAL ASSYMETRY			
	per 1/2 window	3778	6709
WINDOW MARGIN			
	Time	3637	6298
	Percent	39.3	35.3
	Window (ns)	18.50	35.70
	Zone	2	15

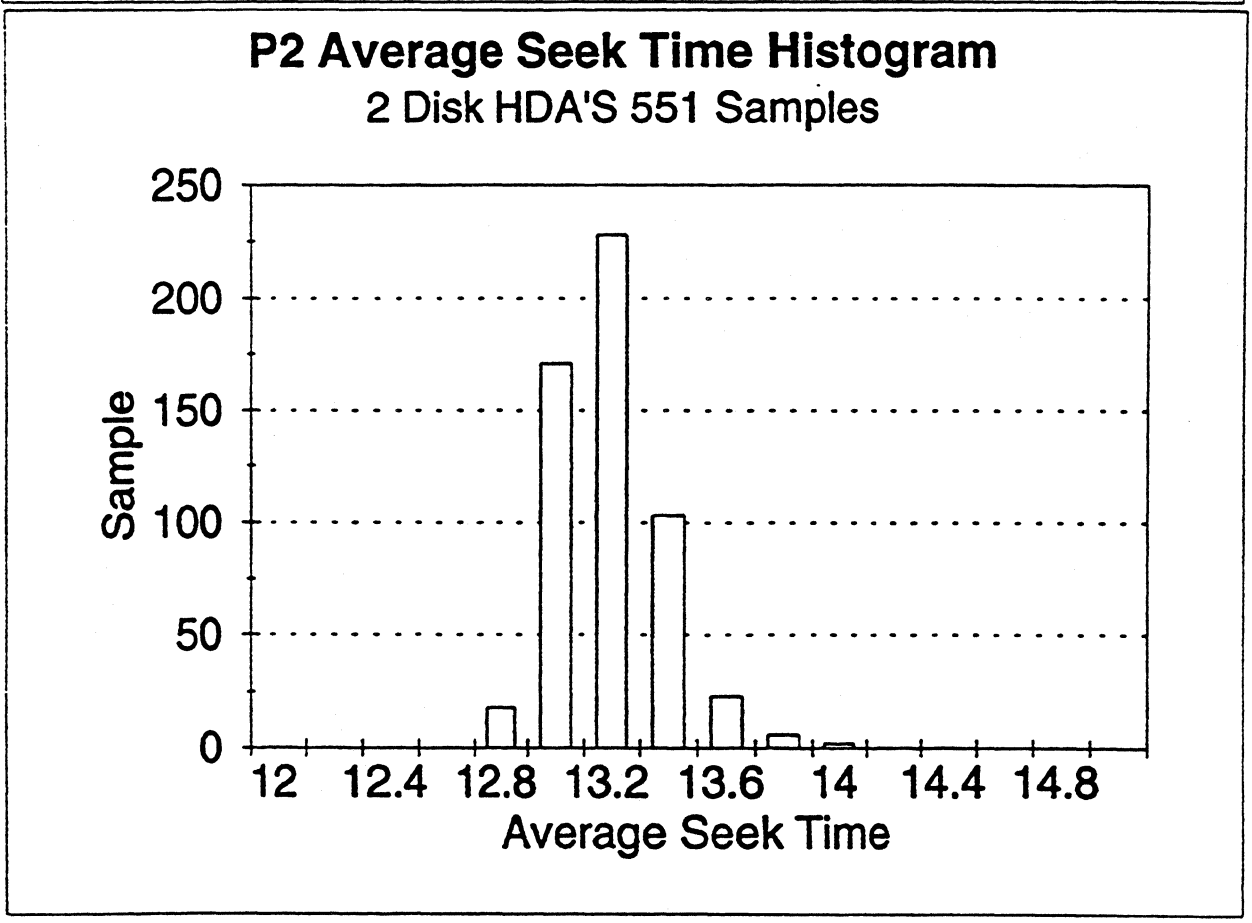
Maverick 270 / 540
Servo Section



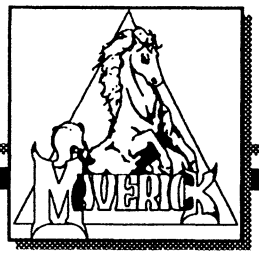
Servo-Mechanical System: Hardware Block Diagram




P2 Average Seek Time Histogram
1 Disk HDA'S 387 Samples
Sample
100
80
60
40
20
0
12
12.4
12.8
13.2
13.6
14
14.4
14.8
Average Seek Time


P2 Average Seek Time Histogram
2 Disk HDA'S 551 Samples
Sample
250
200
150
100
50
0
12
12.4
12.8
13.2
13.6
14
14.4
14.8
Average Seek Time

Maverick 270 / 540
PCB Changes From RoadRunner



Quantum

apple1.doc

PCB CHANGES FROM ROADRUNNER TO MAVERICK

1. Changed the INU Read/Write chip to the RYAN-II lower profile package to avoid going over form factor, which is 4.6mm. AT&T built the RYAN-II low profile 44 pin QFP that is 2.35 mm high max. The pin-outs for the RYAN-II low profile chip are functionally the same as the current R/W chip, but due to its smaller package size and pin pitch, the PCB layout was modified in this area of the P.C. Board.

2. Changed the 4.9 mm high SCSI Address jumpers (J13 and JP11) to a lower profile package to avoid going over form factor. We will use the 3.9 mm AUGAT Jumpers because they are a standard size and are the same cost as the old 4.9 mm Jumpers.

3. Changed from RoadRunneR (AT and SCSI) Interface connectors to ThunderBolt (AT and SCSI) Interface connectors to help alignment/height issues. We decided to use the ThunderBolt Interface connectors because of better FoxConn alignment and form factor height issues.

4. Added a fourth mounting hole on the PCB to aid grounding and help eliminate noise. Mechanical Engineering added a mounting hole boss to the casting to accommodate an existing grounded mounting hole on the PCB. We have also grounded the elastomeric connector mounting hole. This gives MAVERICK four grounded mounting holes, which facilitates grounding and helps minimize PCB noise levels.

5. Used **low profile** electrolytic Caps. to avoid going out of form factor height. Some electrolytics fit the same PCB footprint but are slightly taller and are over the maximum allowable height for the Maverick PCB.

6. NEKO Controller die-shrink is set for Feb. 1994 delivery. Continuation Engineering group will begin testing and qualification of the NEKO Die Shrink when it arrives.

7. Changed gold plating thickness on the Interface Connectors from 0.2 uM to 0.05 uM for cost savings.

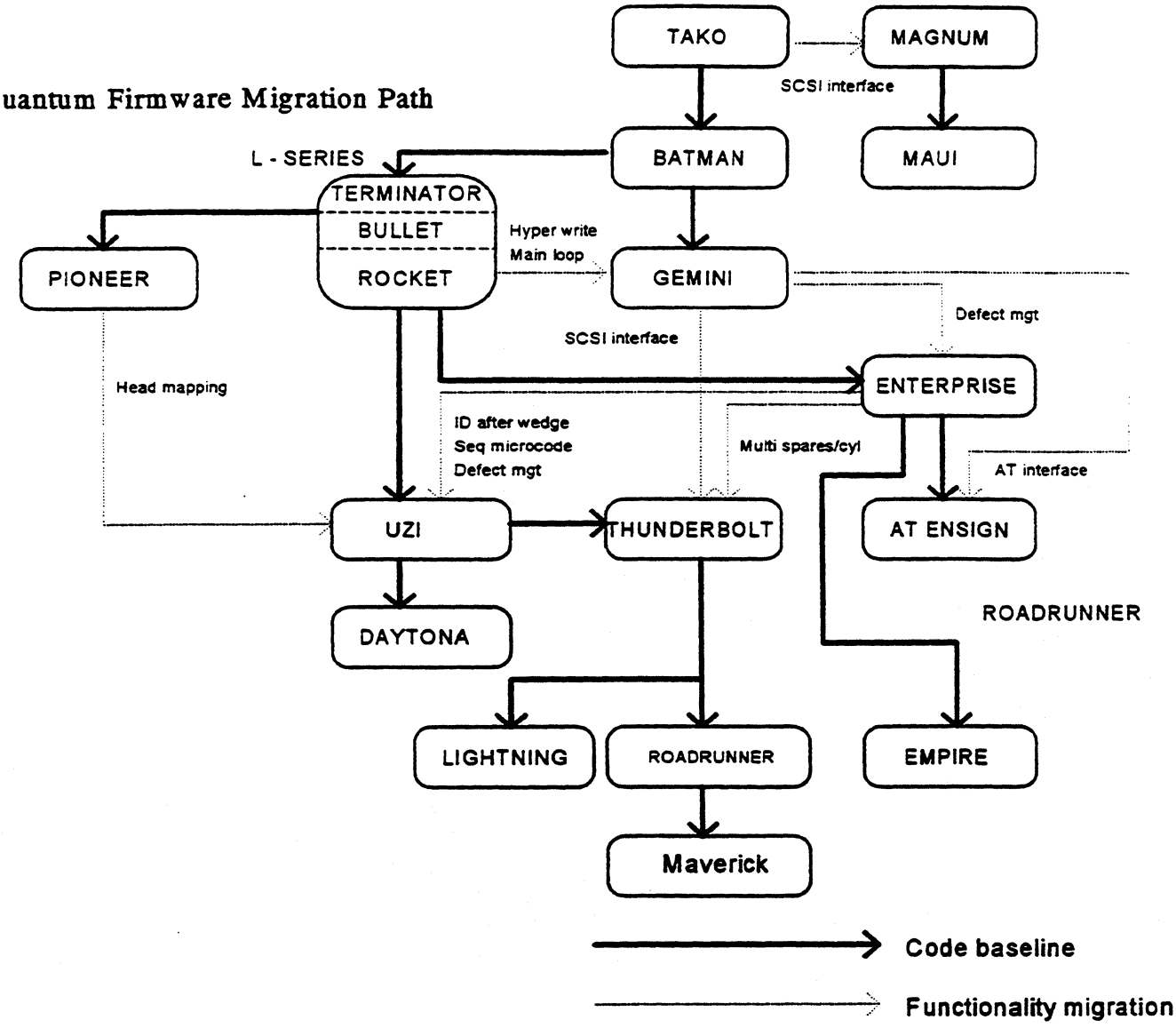
8. Read Channel Improvements for all PCB's are:
   1.) Added R223, Resistor, 22 ohm, 5%, 1/10W, 0805
   2.) Added R224, Resistor, 2.2 ohm, 5%, 1/10W, 0805
   3.) Changed C216 FROM: Capacitor, 0.1 uF, +80-20%, 25v, Y5V, 0805
   TO: Capacitor, .47 uF, +80-20%, 50v, Y5V, 1206
   4.) Changed C235 FROM: Capacitor, 0.1 uF, +80-20%, 25v, Y5V, 0805
   TO: Capacitor, .47 uF, +80-20%, 50v, Y5V, 1206

9. Incorporated MKE's PCB Design requests into our PMP PCB to aid MKE's manufacturability and increase our Fabrication and Assembly yields.

END OF FILE

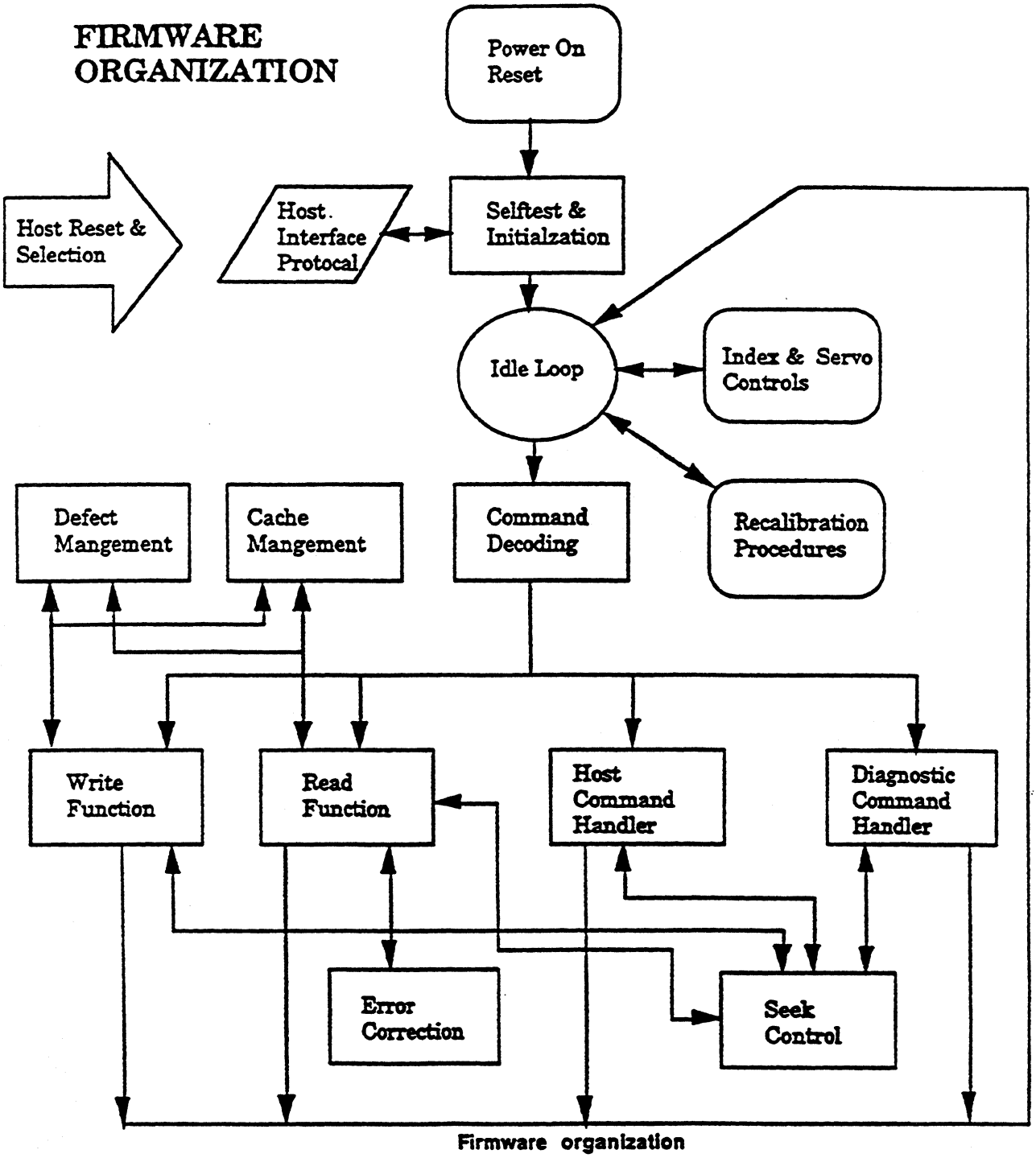
Firmware Migration Flow Diagram

Quantum Firmware Migration Path



Firmware Organizational Block Diagram

FIRMWARE ORGANIZATION



Firmware organization

Cache Algorithm

MAVERICK
Cache Change

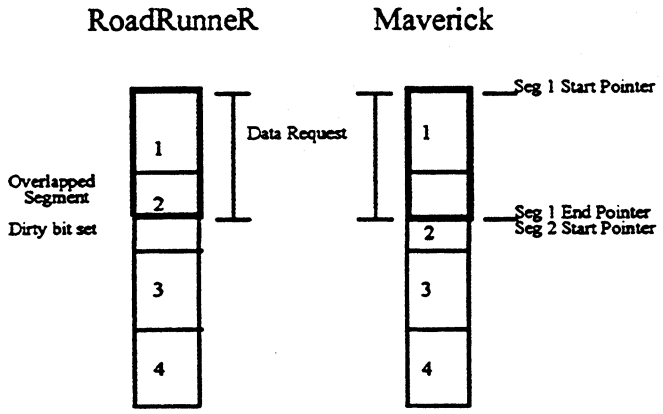
Read Cache Optimization
(Algorithm same as RRR)

RoadRunneR
During Cache/Prefetch if the block of data requested is larger than the cache segment, the algorithm would extend the ending pointer into the next segment overlapping existing data thus setting the "Dirty" bit in segment being "overlapped". If the next request for data was in the "dirtied" segment then data would be retrieved from disk.

Maverick
The handling of data in Cache was changed in that when a block of data requested is larger than the cache segment, the algorithm allows the segment to "overlap" the next, but without setting the "Dirty" bit of the segment being overlapped. What happens is the starting pointer for the segment being "overlapped" is moved and the data is left intact in the buffer for future retrieval from a cache hit.

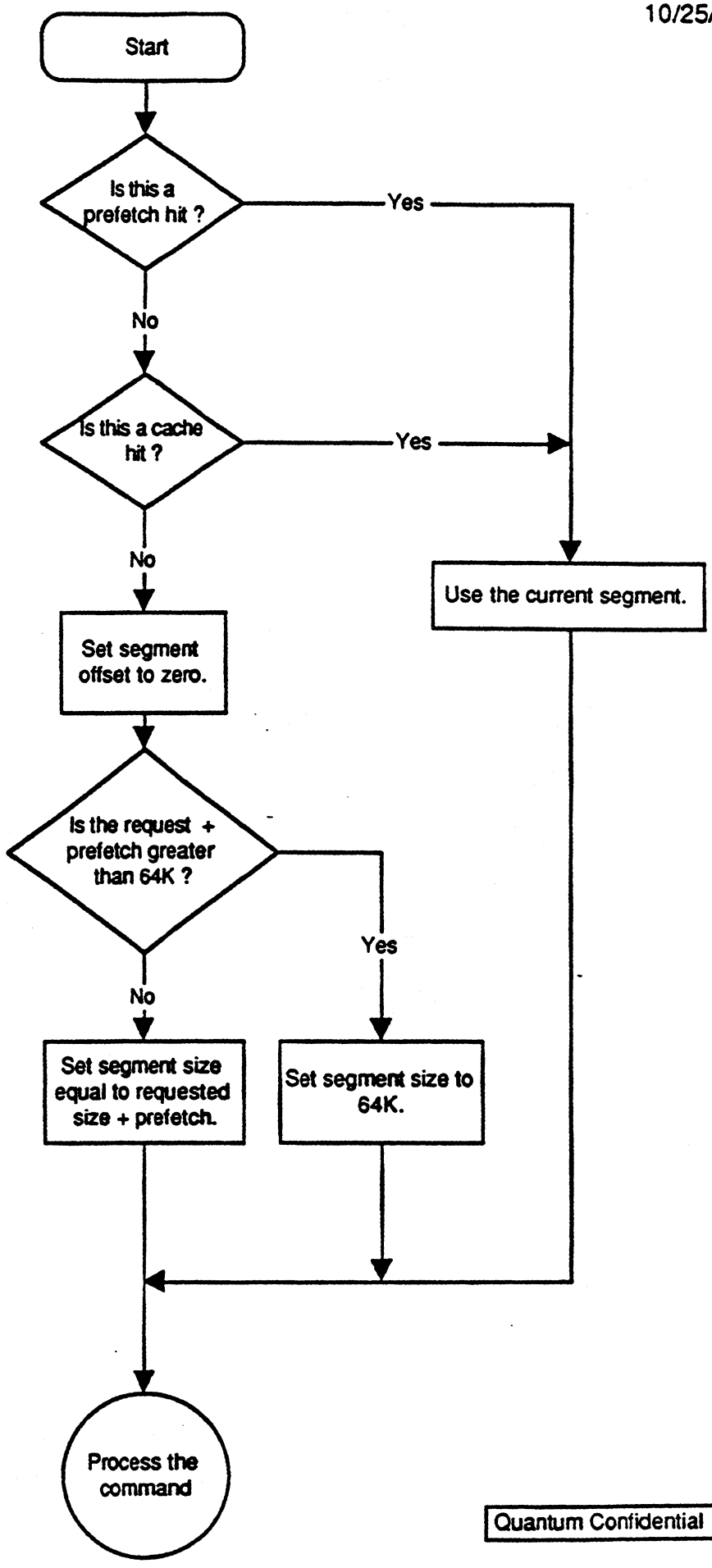
This allows higher throughput performance on random cache hits as the data is stored longer in cache.

EXAMPLE:

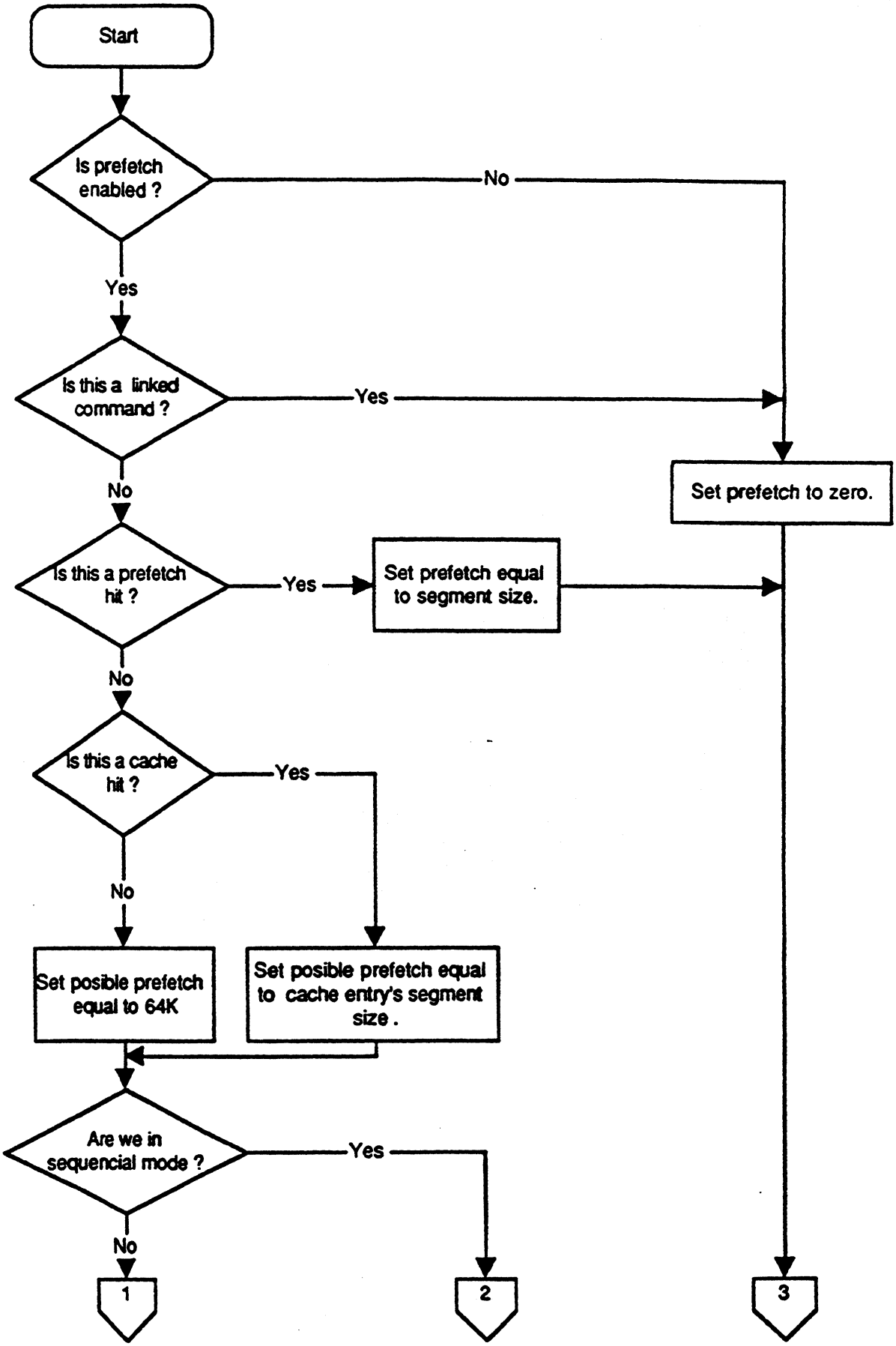


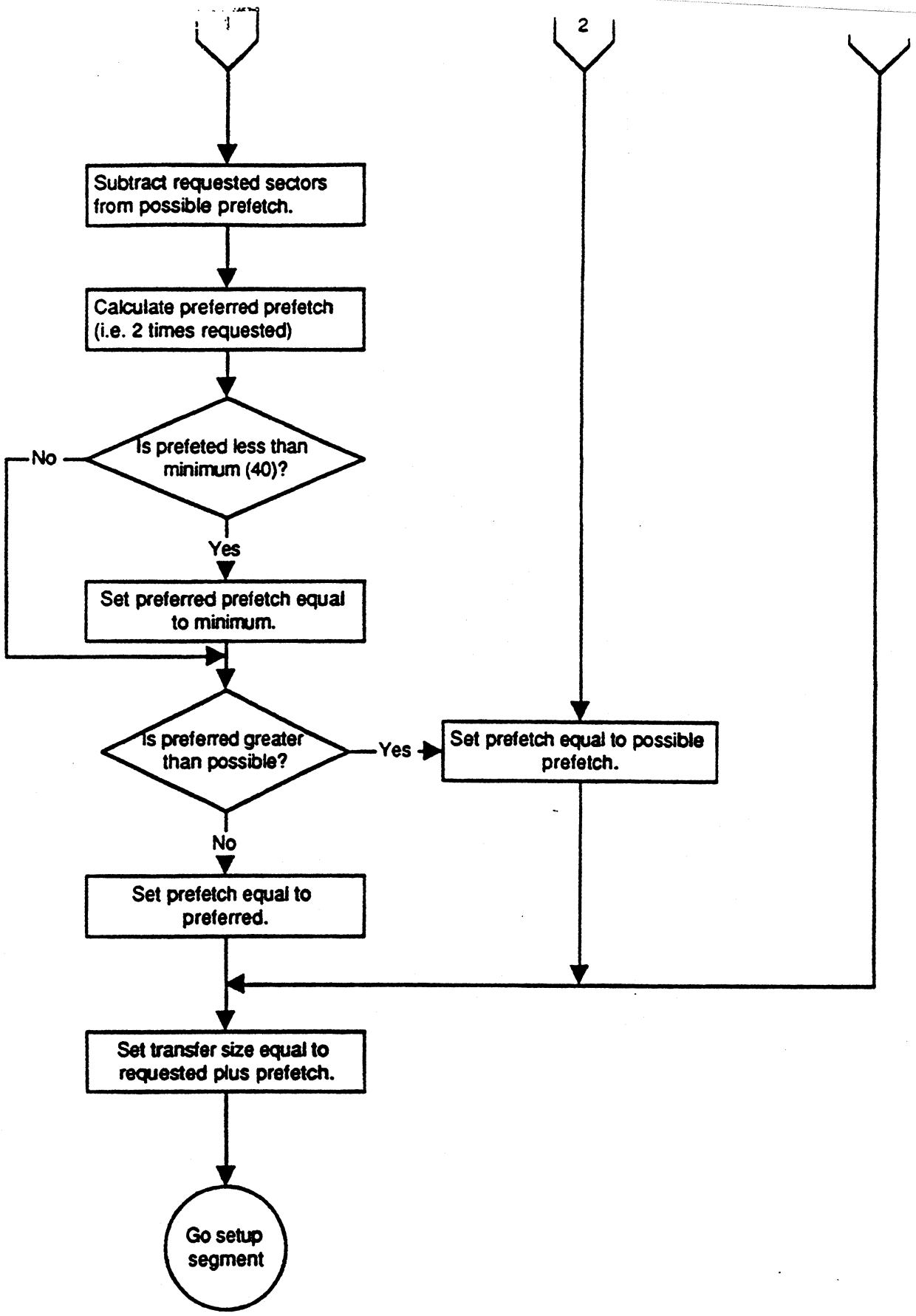
Cache Setup

10/25/93



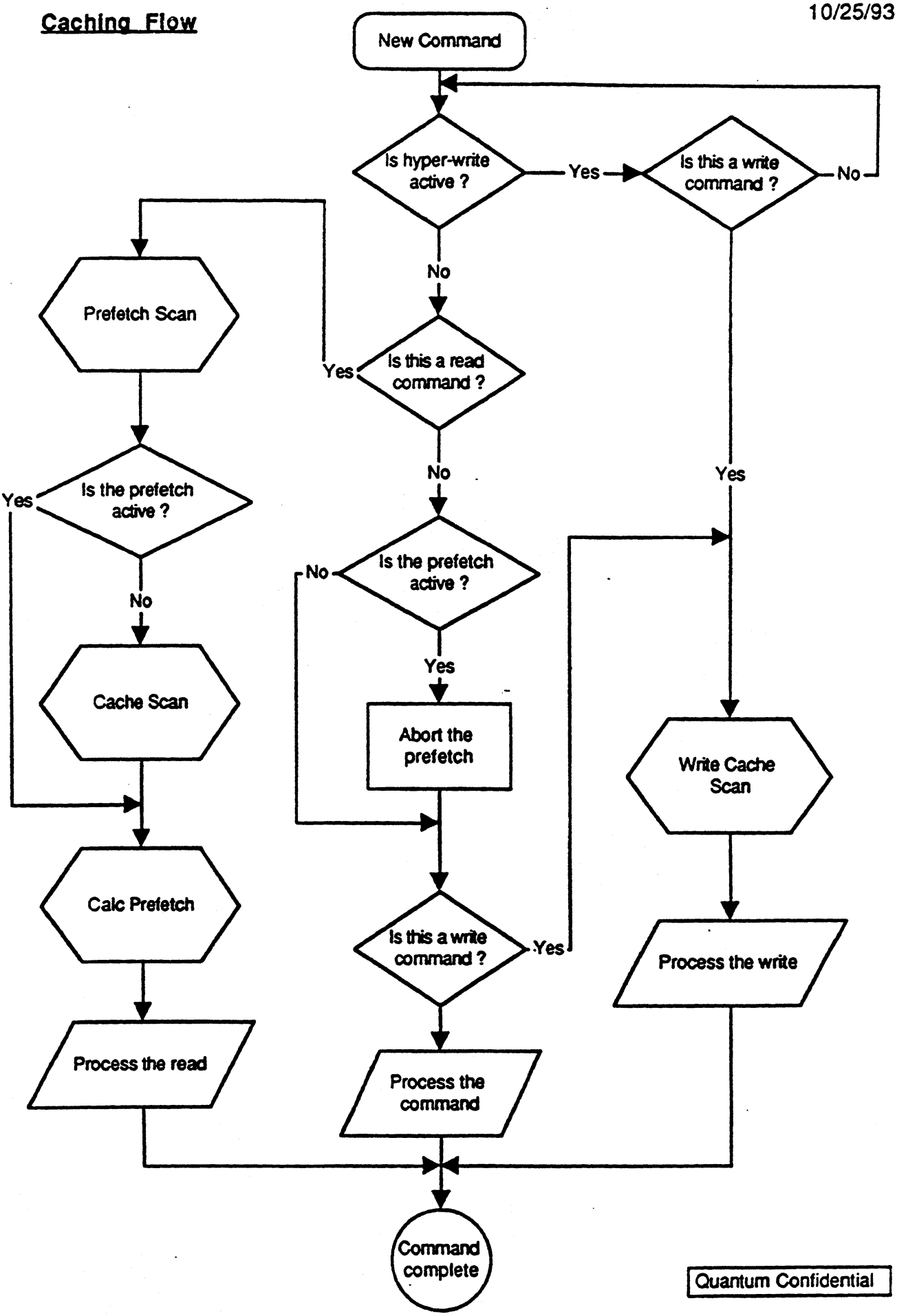
Calculate Prefetch





Caching Flow

10/25/93



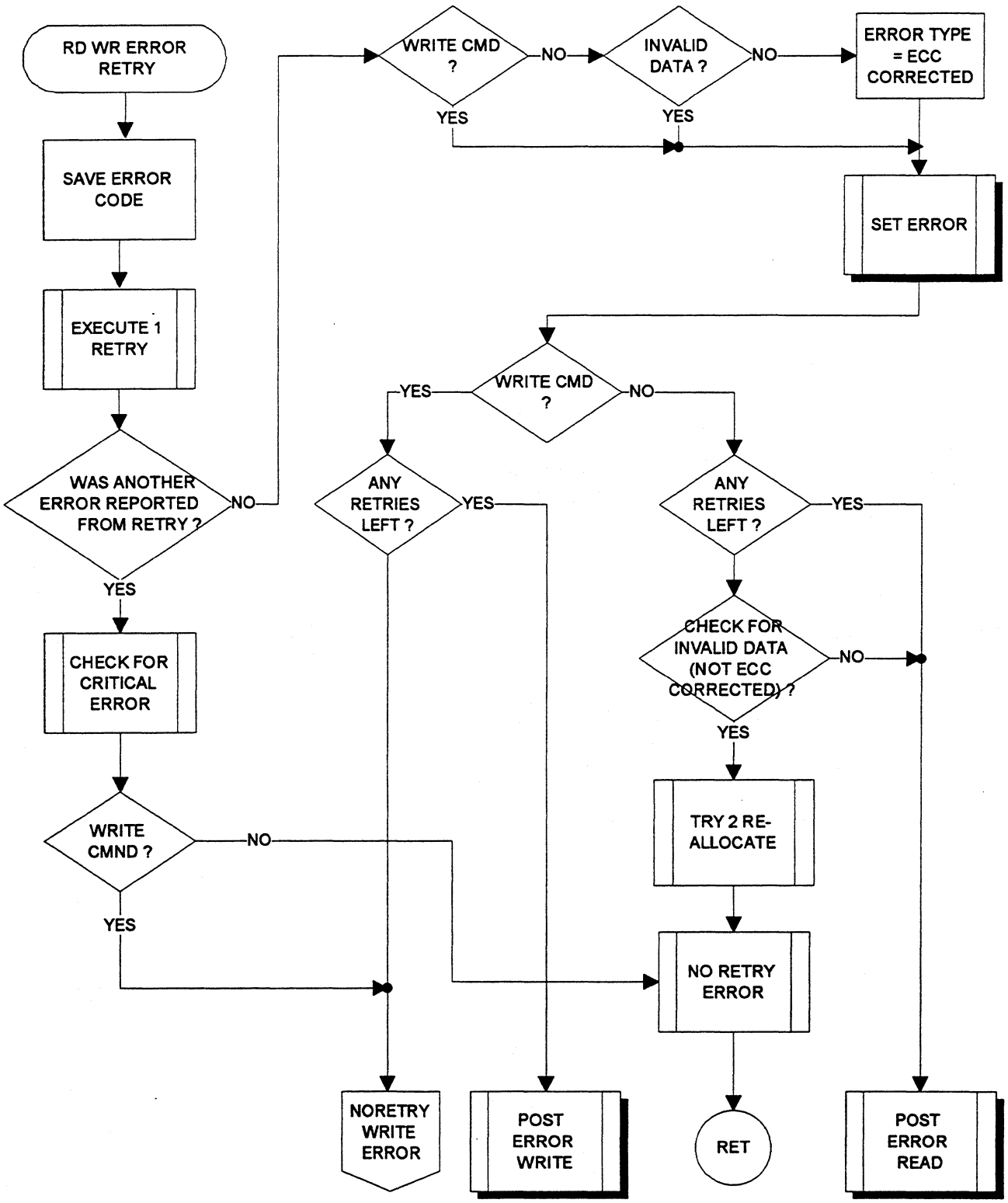
Error Recovery Algorithm

C:\ABC\CHART\RW_RETRY.AF3

Tuesday, May 24, 1994

5:30 PM

RD_WR_ERROR_RETRY



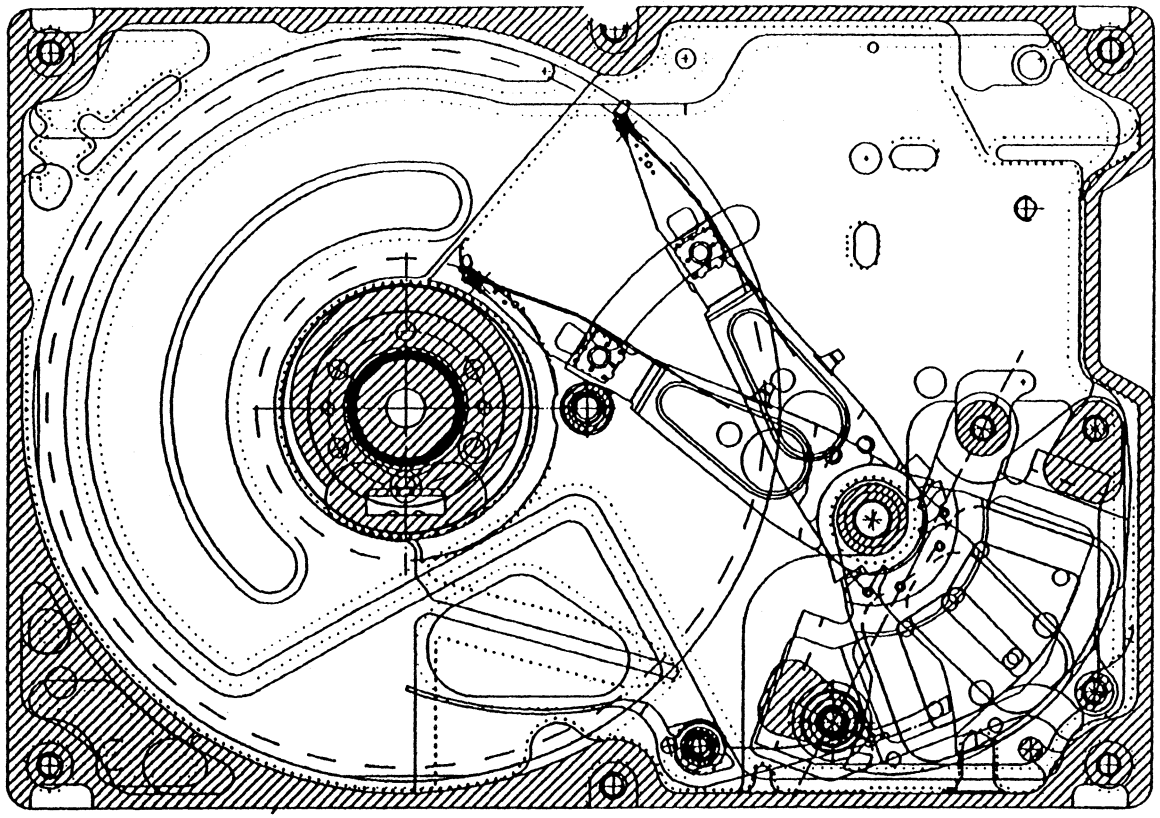
ROADRUNNER VS THUNDERBOLT HDA SELECTION

- **ROADRUNNER HDA**
  - LOWER INERTIA ACTUATOR, LESS VCM MAGNET
  - 3600 RPM SPINDLE MOTOR
  - 14 MS ACCESS TIME
  - MAVERICK USES RRR PCB

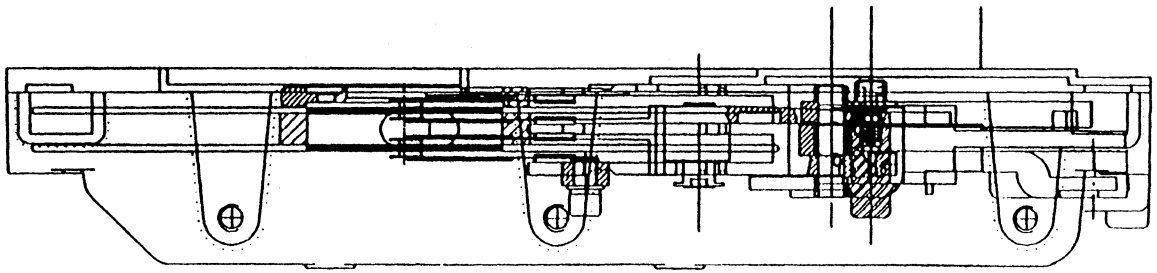
- **THUNDERBOLT HDA**
  - HIGHER INERTIA ACTUATOR, MORE VCM MAGNET
  - 4500 RPM SPINDLE MOTOR
  - 12 MS ACCESS TIME
  - FLAT FLY HT PROFILE: LOW SKEW RANGE

FOCAL DESIGN AREAS ON MAVERICK

- VCM: SLOW ACTUATOR TO 14 MS ACCESS TIME
- SPINDLE MOTOR: THUNDERBOLT MOTOR AT 3600 RPM
- AIRLOCK: PERFORMANCE AT 3600 RPM
- DESIGN FOR PUSHPIN SERVOWRITING
- GAIN DISK SPACE BY USING 50% HEAD VS 70% HEAD
- REDUCE COST IN MECHANICAL DESIGN WHERE POSSIBLE



MAVERICK 540 MB



VCM DESIGN

- DESIGN SPECIFICATIONS
- TORQUE CONSTANT
- MAGNET VENDORS : (SUMITOMO, SHINETSU, TDK)
- SEEK TIME DATA

LC250 — VCM design parameters :

10/13/93

1. Per analysis on Thunderbolt HDA design data, with the minimized modification on VCM to eliminate two pieces of lower magnet, the LC-250 VCM design parameters are shown in this table:

2. Data may be optimized subject to testing results.

	LC250 - 1D	LC250 - 2D
VCM total height	14.70 mm	14.70 mm
Magnet	NEOMAX36 (2X)	NEOMAX36 (2X)
Magnet thickness	3.23 mm	3.23 mm
Upper magplate thickness	2.60 mm	2.60 mm
Lower magplate thickness	2.60 mm	2.60 mm
Coil thickness	2.04 mm	2.04 mm
Clearance	0.495 mm	0.495 mm
Airgap	3.04 mm	3.04 mm
B in airgap	5400 Gauss	5400 Gauss
PC - load line slope	0.871	0.871
Copper coil diameter	0.155 mm	0.163 mm
No. of turns	234	273
Coil resistance	15.7 ohms	15.7 ohms
Moving mass of J	49 g-cm^2	59 g-cm^2
Ave. seeking time	14 ms	14 ms
Ave. power dissipation	TBD	TBD
Stroke angle	0.4194 rad.	0.4194 rad.
Torque constant	712 g-cm/amp	787 g-cm/amp

TTK

To: Ross Pace

cc. Jeremy Cowperthwaite, Frank Houghton, Eric Wang

From: Ting Kuo 11/5/93

Subject: LC250 E1.2 VCM TORQ CONSTANT MEASUREMENT DATA

Based on TB MP HDA, the new lower fluxplate has been implemented into VCM with only two pieces of magnets at the upper fluxplate.

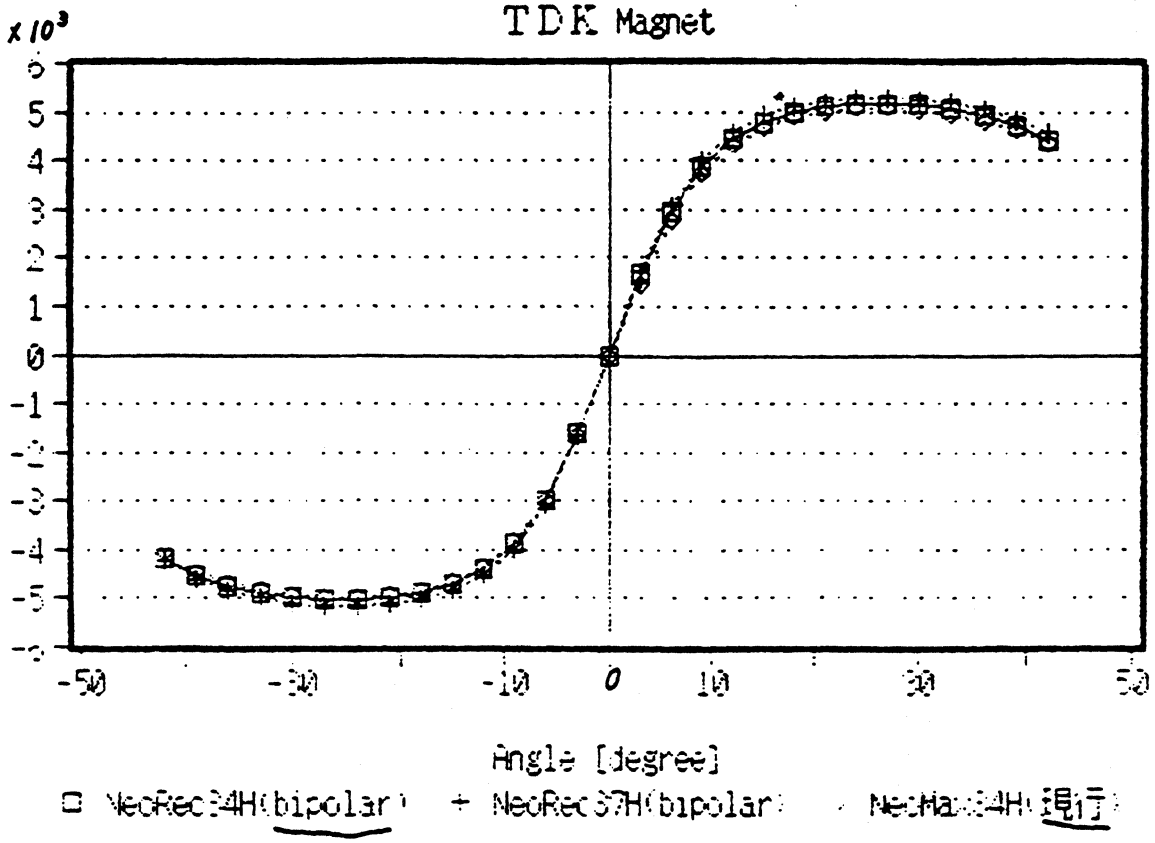
VCM torq constant measurement data are summarized as this table:

	Torq. Constant g-cm/amp	Coil Resistance ohms	Mass moment of Inertia g-cm^2
1 Disk	730 g-cm/amp	16.36 ohms	48.25 g-cm^2
2 Disk	829 g-cm/amp	16.06 ohms	57.28 g-cm^2

Note: 1. Torq Const. is obtained from the testing data in middle zone between OD and ID.
2. .Resistance is measured at terminal end of flex cable.
3. TB MP troq const. is 950 g-cm/amp and 1050 g-cm/amp on 1 disk anf 2 disk respectively.
4. Fig.1 and Fig.2 show 1 disk VCM data, Fig3 through Fig.5 show 2 disk VCM data.
5. Due to load cell signal is very sensitive to the electrical signal, the modulation was observed on Fig.2 through Fig.5, this is induced by microstepping motor commutation state - corresponds to the predetermined step - 0.18 deg. * 10 = 1.8 deg.
6. No signaficant torq. const. difference observed between CW and CCW. — This is good.

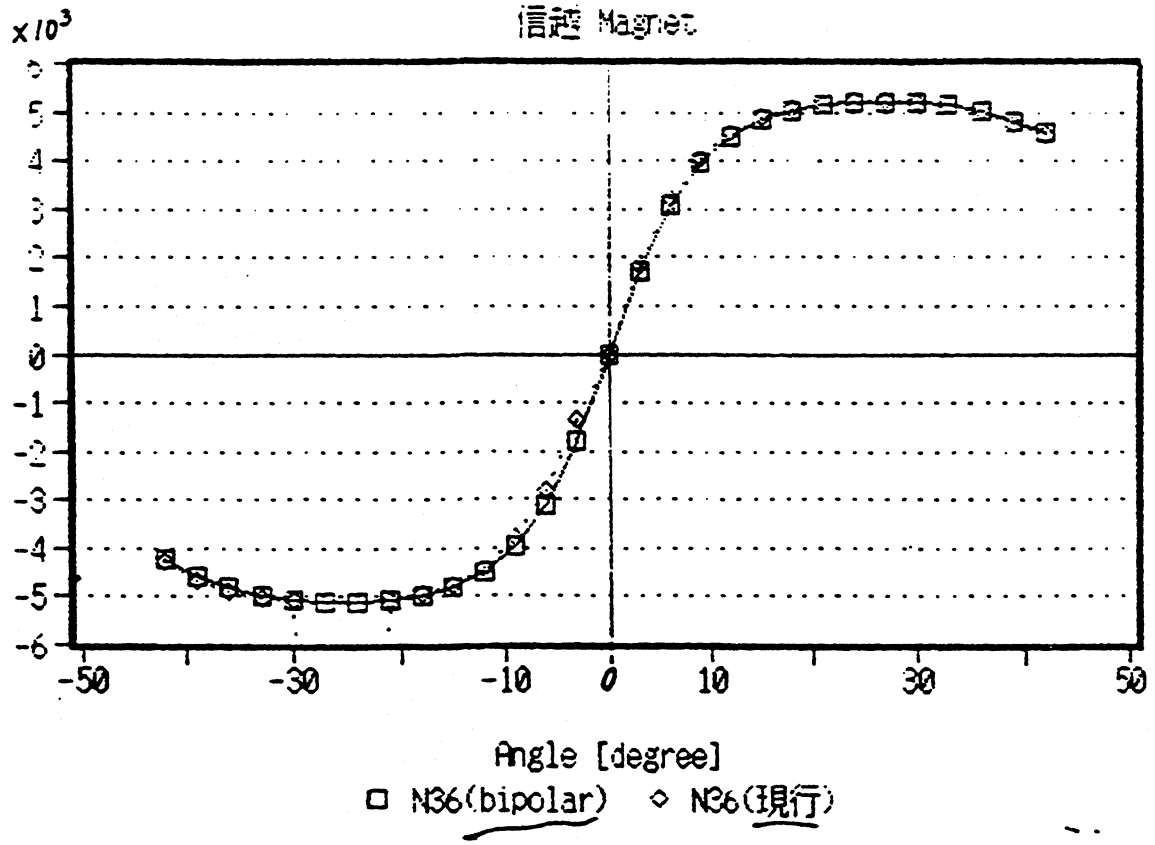
Maverick用 Magnet 着磁力

TDK Magnet



Maverick用 Magnet 着磁力

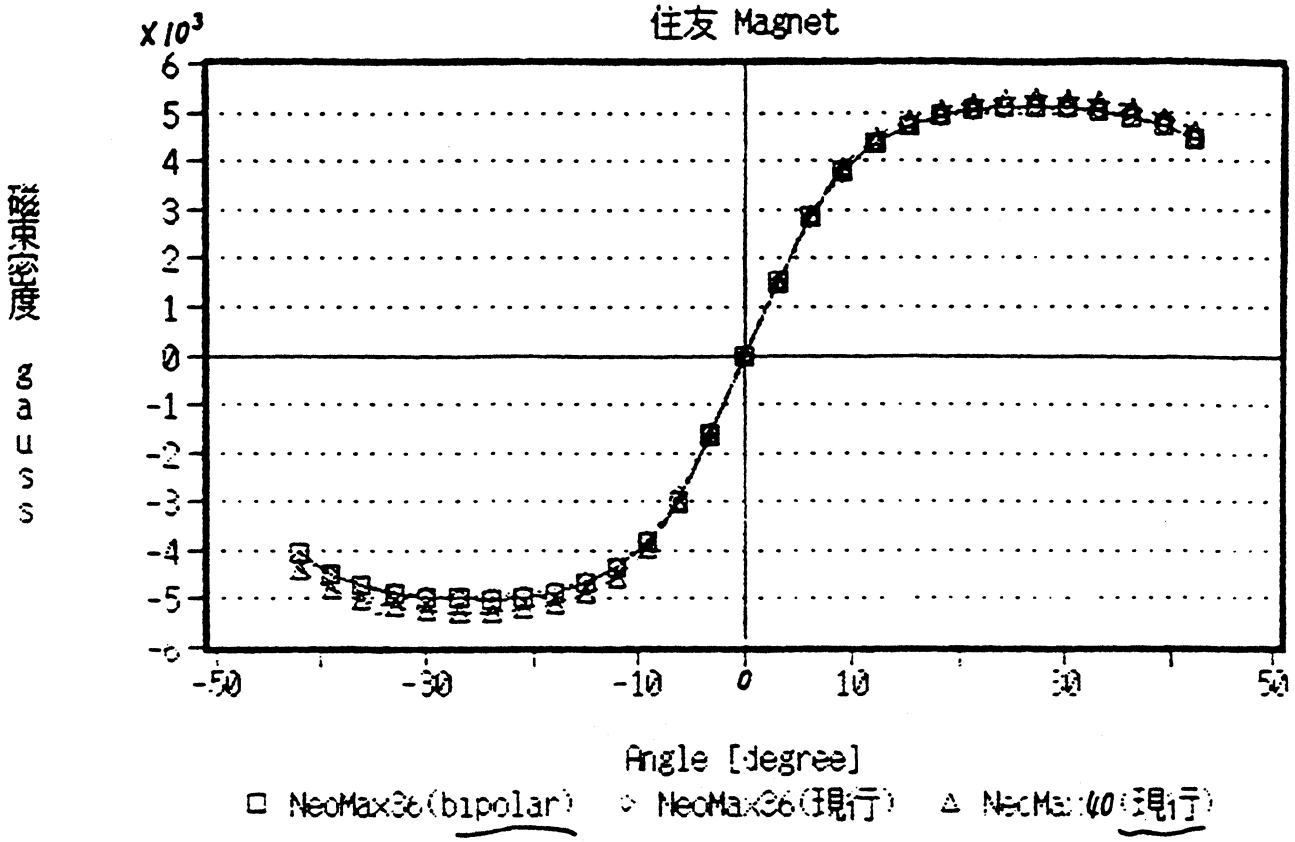
信越 Magnet

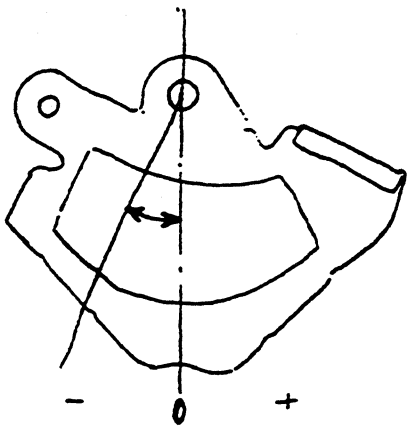


SUMITOMO

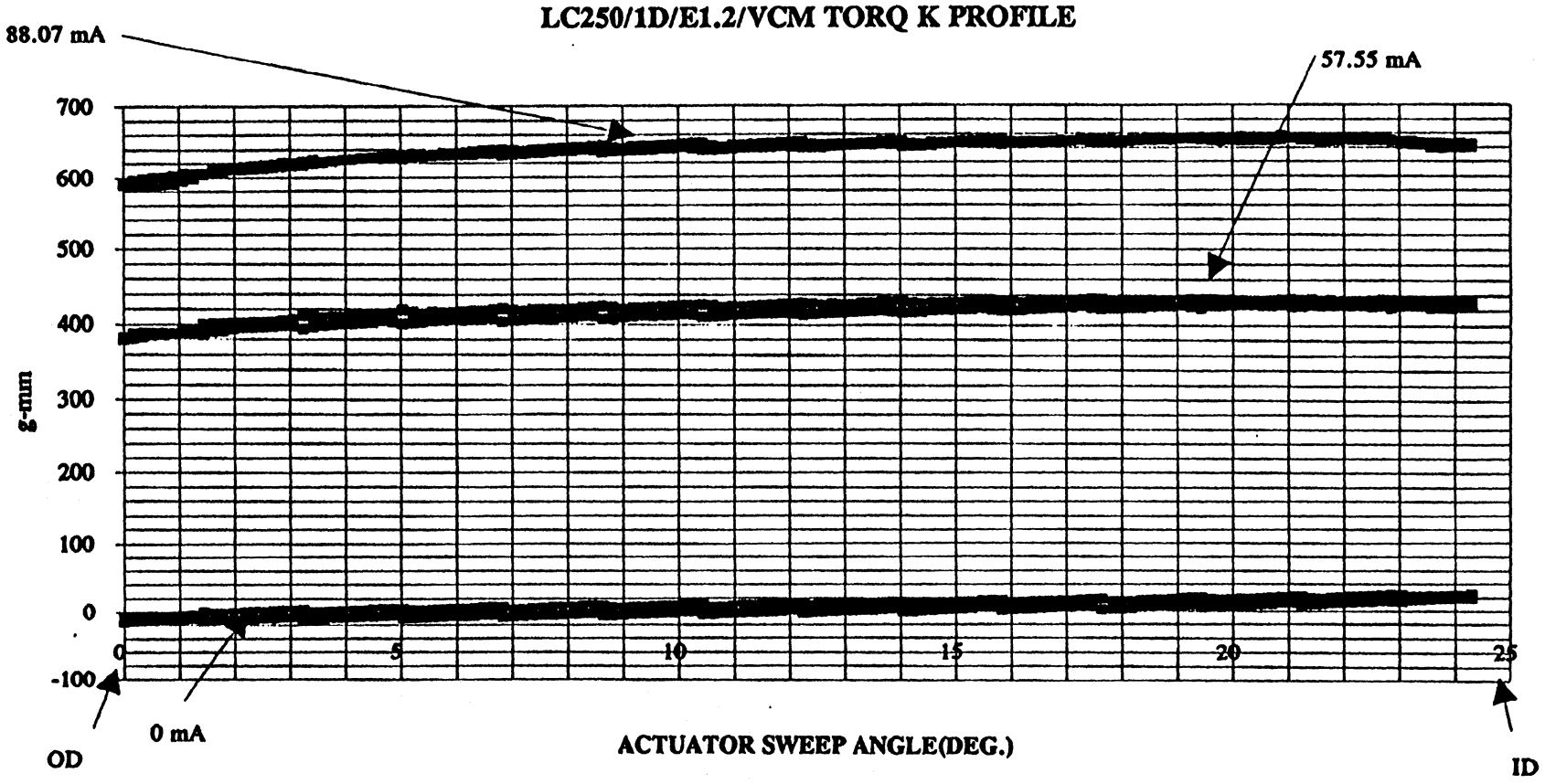
Maverick用 Magnet 着磁力

住友 Magnet

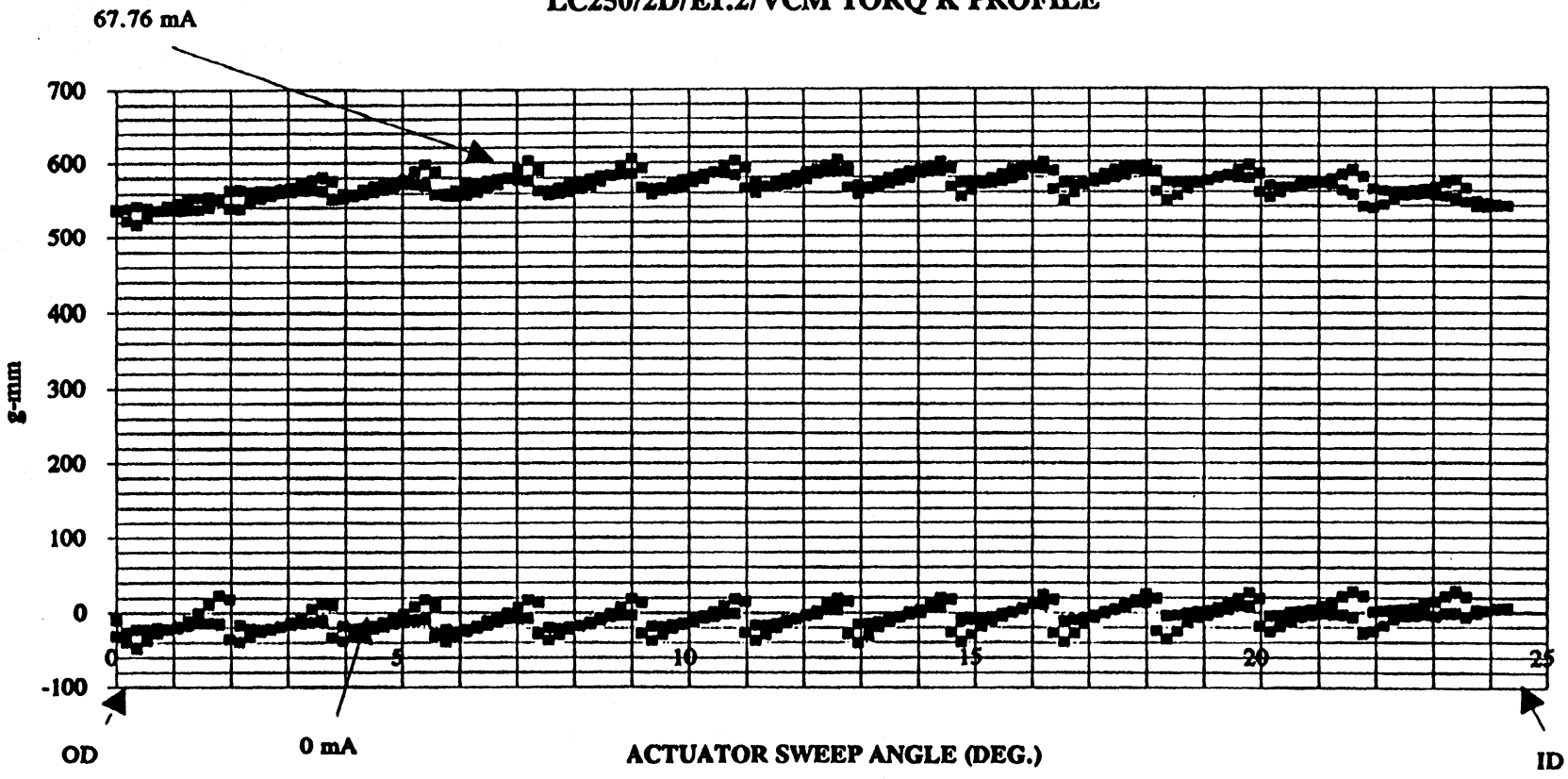




Angle


LC250/1D/E1.2/VCM TORQ K PROFILE
88.07 mA
57.55 mA
700
600
500
400
300
200
100
0
-100
g-mm
0
5
10
15
20
25
0 mA
OD
ACTUATOR SWEEP ANGLE(DEG.)
ID

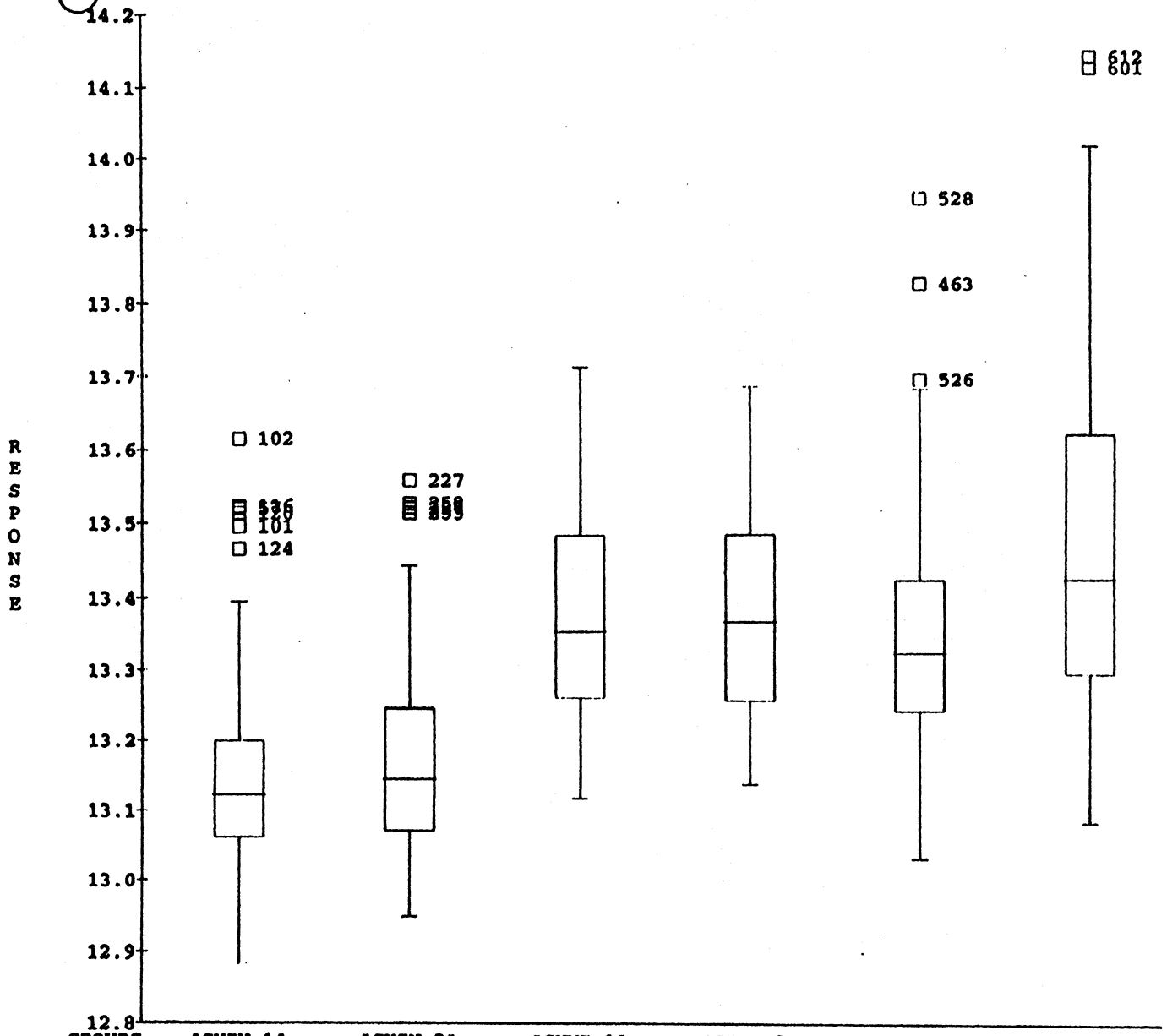
LC250/2D/E1.2/VCM TORQ K PROFILE



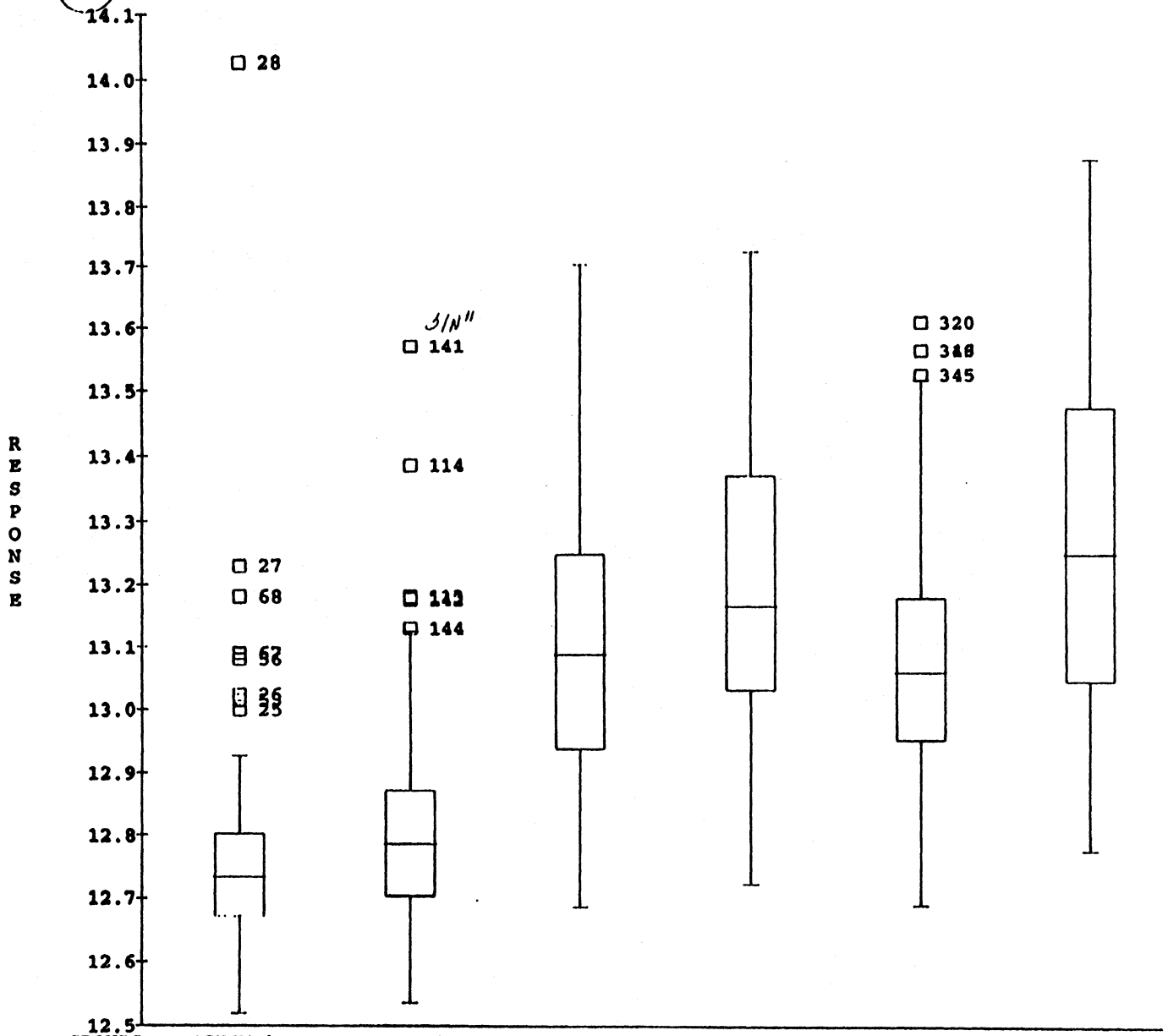
TTK 11/5/93

2. Otc

ARST_2D_MAGNET_BOX_GRAF Data from table: @MAVERICK@SS04120TEMP 12-APR-94 11:27 Page 1



GROUPS	"SHIN-1"	"SHIN-2"	"SUMI-1"	"SUMI-2"	"TDK-1"	"TDK-2"
# Pts	124	134	95	56	121	82
Mean	13.147452	13.164179	13.370126	13.374286	13.343207	13.459671
IQR	0.1365	0.173	0.222	0.2265	0.181	0.326



GROUPS	"SHIN-1"	"SHIN-2"	"SUMI-1"	"SUMI-2"	"TDK-1"	"TDK-2"
# Pts	68	76	86	54	71	51
Mean	12.770735	12.815645	13.118895	13.197389	13.072972	13.268216
IQR	0.1305	0.1695	0.309	0.337	0.225	0.427

SPINDLE MOTOR

DESIGN TRADE-OFFS

- TB, RRR OPTIONS
- STARTING TORQUE
- RUNNING CURRENT

JMC 4/19/94

SPINDLE MOTOR PARAMETER CALCULATIONS (rev 1)

SP REV 01: TB, 10000 ITERATIONS

INPUT:	*25*	*C*			
PARAMETERS	**VALUES**	**UNITS**	**SYMBOLS**	**DIST**	**DISTRIBUTION TYPE**
number of heads	4		H		
gram load	7.0	g	g		
gram load tolerance	0.5	g	dg		
coefficient of friction	2.0		u		
start radius	18.7	mm	R		
HDA internal temperature increase	20.0	C	dTh		
inertia	388	g*cm^2	J		
rotation speed	3.600	krpm	W		
detent torque (max estimated)	10.0	g*cm	Td		
running torque (max estimated)	20.0	g*cm	Tr		
torque constant (rms)	170.0	g*cm/A	Kt	X	NORMAL
torque constant tolerance	5.0	%	dKt		
torque constant vs temp slope	0.08	%/C	SKt		
motor resistance	9.0	ohm	Rm	X	NORMAL
motor resistance tolerance	10.0	%	dRm		
sense resistance	0.33	ohm	Rs		
driver Vsat typical slope	0.74	V/A	mt		
driver Vsat 3 sigma slope	1.14	V/A	m3		
driver Vsat typical intercept	0.74	V	Vit		
driver Vsat 3 sigma intercept	0.86	V	Vi3		
driver Vsat intercept	0.77	V	Vi	X	TRUNCATED NORMAL
supply voltage	12.00	V	V	X	UNIFORM
pos supply voltage tolerance	10	%	dV+		
neg supply voltage tolerance	10	%	dV-		

SPINDLE MOTOR PARAMETER CALCULATIONS (rev 1)

SP REV 01: TB, 10000 ITERATIONS

OUTPUT:	*25*	*C*			
PARAMETERS	**VALUES**	**UNITS**	**SYMBOLS**	**DIST**	**FORMULAS**
ambient temperature change	0	C	dT		OUTPUT temp (Ta) - INPUT temp
torque constant (rms)	167.3	g*cm/A	Kta	X	Kt-((dTh+dT)*(SKt/100)*Kt)
motor resistance	9.7	ohm	Rma	X	Rm*(1+(dTh+dT)/(234.5+Ta))
mechanical time constant	1.40	s	tm	X	((J/1000*100^2))*Rma)/((Kta/(102*100))^2)
required starting torque (max)	112.1	g*cm	Trs		H*(G+dG)*U*(R/10)
available starting torque (min)	146.5	g*cm	Tas	X	(0.90586*Kta*Ia)-Td
available current	1.033	A	Ia	X	(V-Vi)/(Rma+Rs+m)
required starting current	0.730	A	Is	X	(Trs+Td)/Kta
run current	0.120	A	Ir	X	Tr/Kta
back EMF const (rms)	1.72	V/krpm	Ke	X	(Kta)*((2*Pi*1000)/(102*100*60))
back EMF (rms)	6.18	V	E	X	(Ke)*W
driver Vsat slope	0.85	V/A	m	X	((m3-mt)/(Vi3-Vit))*Vi+((mt*Vi3)-(m3*Vit))/(Vi3-Vit)
driver Vsat at starting	1.65	V	Vsts	X	(m*Ia)+Vi
driver Vsat at running	0.87	V	Vstr	X	(m*Ir)+Vi
headroom voltage	3.75	V	Vh	X	V-Vstr-E-(Ir*(Rma+Rs))
start motor input power	5.166	W	Psm	X	(Is^2)*Rma
run motor input power	0.878	W	Prm	X	(Ir)*(E+Ir*Rma)
motor efficiency	84	%	n	X	(E/(E+Ir*Rma))*100
start driver input power	8.760	W	Psd	X	V*Is
run driver input power	1.435	W	Prd	X	V*Ir

SP REV 02: RRR, 10000 ITERATIONS

INPUT:	*25*	*C*			
PARAMETERS	**VALUES**	**UNITS**	**SYMBOLS**	**DIST**	**DISTRIBUTION TYPE**
number of heads	4		H		
gram load	7.0	g	g		
gram load tolerance	0.5	g	dg		
coefficient of friction	2.0		u		
start radius	18.7	mm	R		
HDA internal temperature increase	20.0	C	dTh		
inertia	388	g*cm^2	J		
rotation speed	3.600	krpm	W		
detent torque (max estimated)	10.0	g*cm	Td		
running torque (max estimated)	20.0	g*cm	Tr		
torque constant (rms)	200.0	g*cm/A	Kt	X	NORMAL
torque constant tolerance	5.0	%	dKt		
torque constant vs temp slope	0.08	%/C	SKt		
motor resistance	13.6	ohm	Rm	X	NORMAL
motor resistance tolerance	12.2	%	dRm		
sense resistance	0.33	ohm	Rs		
driver Vsat typical slope	0.74	V/A	mt		
driver Vsat 3 sigma slope	1.14	V/A	m3		
driver Vsat typical intercept	0.74	V	Vit		
driver Vsat 3 sigma intercept	0.86	V	Vi3		
driver Vsat intercept	0.77	V	Vi	X	TRUNCATED NORMAL
supply voltage	12.00	V	V	X	UNIFORM
pos supply voltage tolerance	10	%	dV+		
neg supply voltage tolerance	10	%	dV-		

SPINDLE MOTOR PARAMETER CALCULATIONS (rev 1)

SP REV 02: RRR, 10000 ITERATIONS

OUTPUT:	*25*	*C*			
PARAMETERS	**VALUES**	**UNITS**	**SYMBOLS**	**DIST**	**FORMULAS**
ambient temperature change	0	C	dT		OUTPUT temp (Ta) - INPUT temp
torque constant (rms)	196.8	g*cm/A	Kta	X	Kt-((dTh+dT)*(SKt/100)*Kt)
motor resistance	14.6	ohm	Rma	X	Rm*(1+(dTh+dT)/(234.5+Ta))
mechanical time constant	1.52	s	tm	X	((J/1000*100^2))*Rma)/((Kta/(102*100))^2)
required starting torque (max)	112.1	g*cm	Trs		H*(G+dG)*U*(R/10)
available starting torque (min)	116.9	g*cm	Tas	X	(0.90586*Kta*Ia)-Td
available current	0.712	A	Ia	X	(V-Vi)/(Rma+Rs+m)
required starting current	0.621	A	Is	X	(Trs+Td)/Kta
run current	0.102	A	Ir	X	Tr/Kta
back EMF const (rms)	2.02	V/krpm	Ke	X	(Kta)*((2*Pi*1000)/(102*100*60))
back EMF (rms)	7.27	V	E	X	(Ke)*W
driver Vsat slope	0.85	V/A	m	X	((m3-mt)/(Vi3-Vit))*Vi+((mt*Vi3)-(m3*Vit))/(Vi3-Vit)
driver Vsat at starting	1.37	V	Vsts	X	(m*Ia)+Vi
driver Vsat at running	0.86	V	Vstr	X	(m*Ir)+Vi
headroom voltage	2.35	V	Vh	X	V-Vstr-E-(Ir*(Rma+Rs))
start motor input power	5.620	W	Psm	X	(Is^2)*Rma
run motor input power	0.890	W	Prm	X	(Ir)*(E+Ir*Rma)
motor efficiency	83	%	n	X	(E/(E+Ir*Rma))*100
start driver input power	7.446	W	Psd	X	V*Is
run driver input power	1.220	W	Prd	X	V*Ir

AIRLOCK

- OPENING / CLOSING SPEEDS AT 3600 RPM
- VANE BALANCE
- SHOCK TESTING

S/N 52107, 1disk drive, 4/8/94								
A/L OPEN/CLOSE SPEED ON UPPER-LIMIT SPRING TORQ. 0.20g-cm								
SPEED=RPM								
S. = START, F = FULLY, O = OPEN, C = CLOSE								
1.BEFORE BOSS CUT								
	Drive sits horizontally				Drive stands vertically			
Sample	S.O.	F.O.	S.C.	F.C.	S.O.	F.O.	S.C.	F.C.
1	2843	3061	2238	2013	3158	3333	2381	2189
2	2927	3158	2290	2097	3225	3370	2521	2325
3	3000	3208	2325	2113	3191	3352	2564	2362
4	3061	3243	2307	2105	3174	3389	2390	2205
5	2985	3208	2325	2181	3260	3508	2419	2290
Ave.	**2963.2**	**3175.6**	**2297**	**2101.8**	**3201.6**	**3390.4**	**2455**	**2274.2**
2. AFTER BOSS CUT (2mm)								
	Drive sits horizontally				Drive stands vertically			
Sample	S.O.	F.O.	S.C.	F.C.	S.O.	F.O.	S.C.	F.C.
1	2777	2970	1973	1807	2955	3125	2214	2054
2	2752	2941	2000	1875	2752	2926	2174	2000
3	2727	3061	2127	1980	2857	3030	2222	2083
4	2740	2898	2142	1986	2816	3045	2113	1967
5	2702	2884	2120	1960	2843	3076	2307	2054
Ave.	**2739.6**	**2950.8**	**2072.4**	**1921.6**	**2844.6**	**3040.4**	**2206**	**2031.6**
3. NON-OP SHOCK TESTING								
3.1. Equipment								
	* Drop tester and fixture							
	* High speed camera							
	* Storage scope							
	* Accelerometer, charge amplifer and calibrator							
3.2 Result								
	* Pass per spec. - 70G/11ms/Half sine on the position as Fig.1.							
	* Pass @ 107G/11ms/Half sine on the position as Fig.1.							
	* 107G is the max. peak was reached on this setup.							

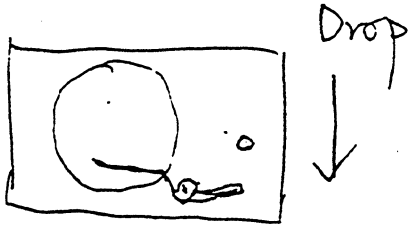


Fig.1

AIRLOCK BALANCING DATA
4/10/94

1. On TB, Balancing requirement is within 0.020 gm-cm. (spindle motor is 4500 rpm)

2. On MV, Balancing requirement is within 0.010 gm-cm. (spindle motor is 3600 rpm)

DAMAGE BOUNDARY TESTING RESULTS SUMMARY							5/27/94
DRIVE S/N	SHOCK @	Failed @	Shock /Duration	Failed Mechanism			
62038	X	128 ips	338G/1.9 ms	Disk shift			
22146	X	152 ips	366G/2.2 ms	=			
42058	Y	175 ips	453G/2.0 ms	=			
42074	Z	160 ips	456G/1.9 ms	=			
22189	Minus X	152 ips	424G/1.8 ms	Disk Shift			
22148	Minus Y	169 ips	380G/2.4 ms	=			
62003	Minus Z	159 ips	401G/2.1 ms	=			
Note:							
1. Shock applied starting at 53 ips @ 137G/2.0 ms.							
2. Multiply shocks applied before drive failed. (about 10 ips increased per step)							
3. Lightning drive failed at 197 ips in Minus X, 228 ips in Z. (For Ref.)							
4. Final report will be submitted by WestPak by next Wednesday.							
5. 540 MB drives are used for this testing.							

PUSH PIN SERVOWRITER

MECHANICAL HDA CHANGES

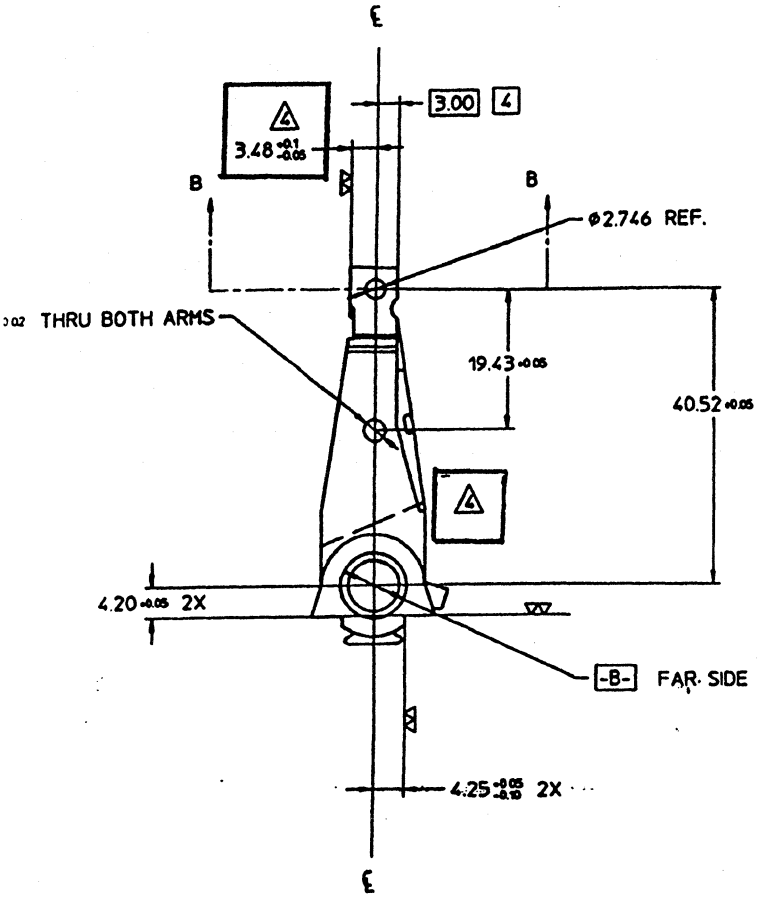
- ACTUATOR ARM
- BASE
- SEALS

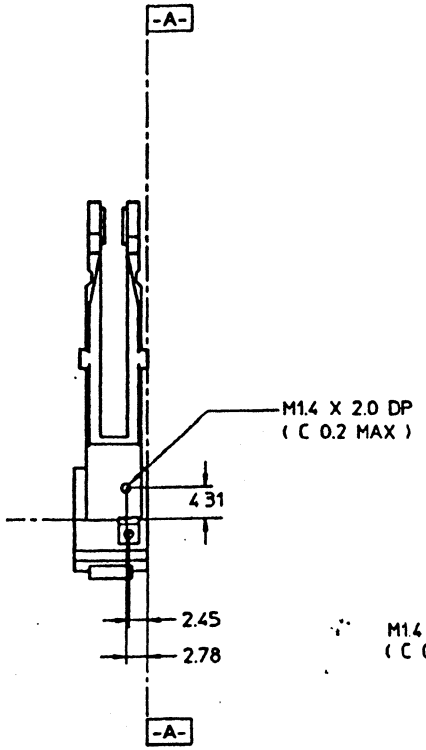
JMC 4/19/94

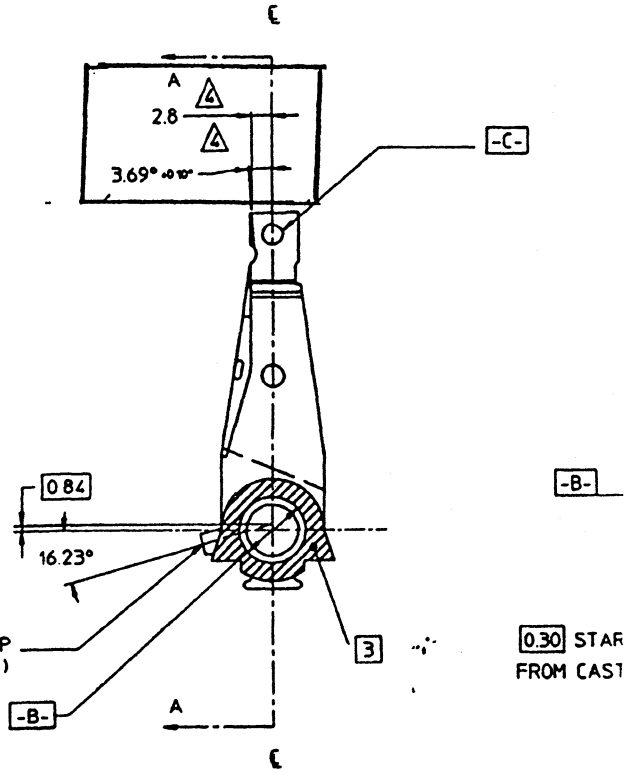
S

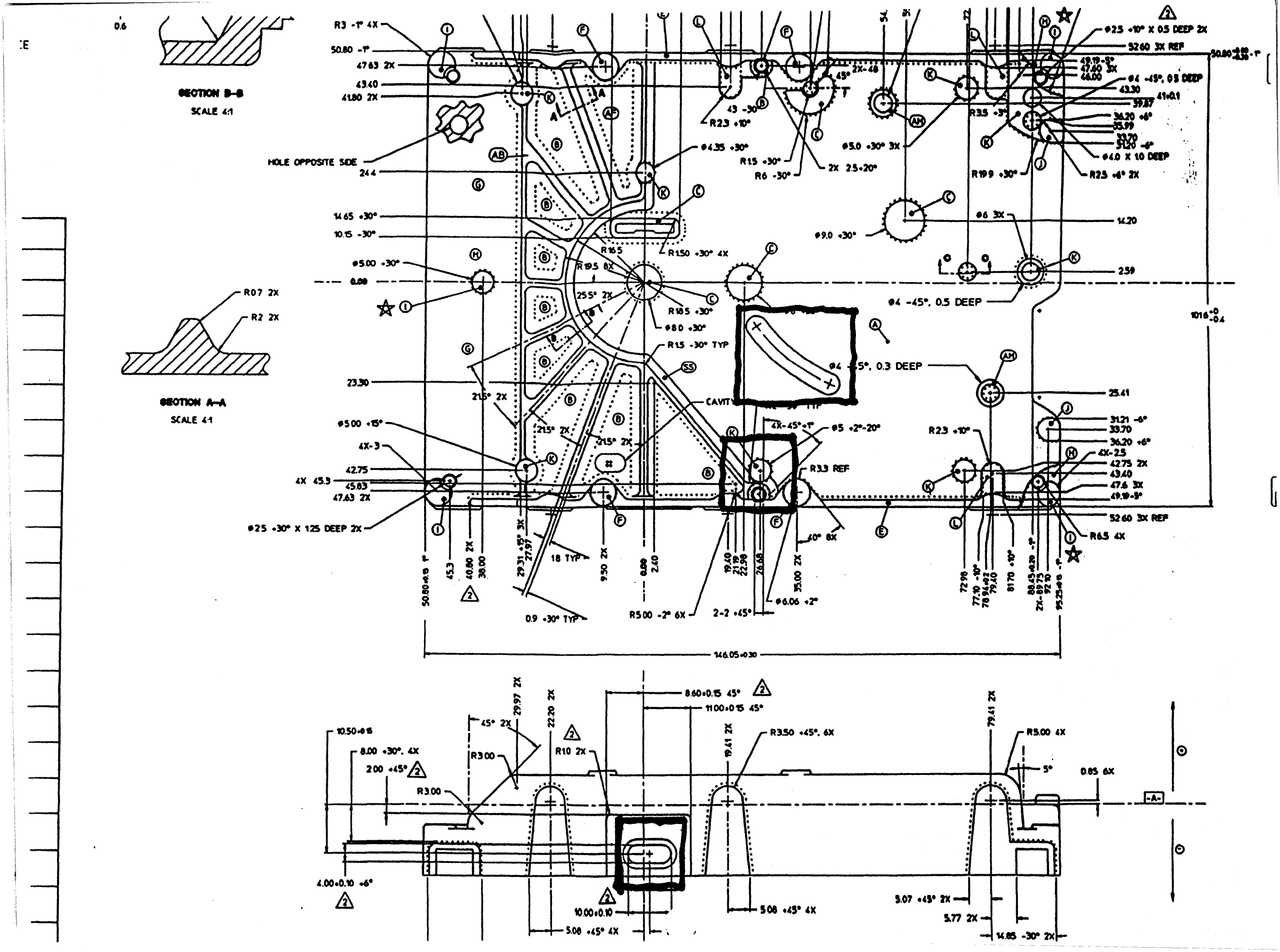
ENOTES LATEST ECO CHANGE AND REVISION LEVEL

CE FROM P/N 39-101640-01 REV. 06
BURRS ALLOWED FROM MACHINING PROCESS.
TUM A IS INDICATED BY SHADED AREA.
NTERLINE DEFINED BY 3.00 MM DIMENSION TO FEATURE SHOWN.
LESS OTHERWISE SPECIFIED. ALL HOLES TO HAVE A . 3 MAX X 45° CHAMFER








SECTION B-B
SCALE 4:1
SECTION A-A
SCALE 4:1
R3 -1° 4X
50.80 -1°
47.63 2X
43.40
41.80 2X
HOLE OPPOSITE SIDE
24.4
14.65 +30°
10.15 -30°
ø5.00 +30°
0.00
R07 2X
R2 2X
23.30
ø5.00 +15°
4X-3
42.75
4X 45.3
45.63
47.63 2X
ø25 +30° X 125 DEEP 2X
50.80+0.8 -1°
45.3
40.80 2X
38.00
29.31 +15° 3X
27.97
18 TYP
9.50 2X
0.00
2.40
0.9 +30° TYP
R5.00 -2° 6X
19.40
21.19
22.90
26.68
2-2 +45°
35.00 2X
ø6.06 +2°
40° 8X
146.05+0.30
R165
R150 +30° 4X
R19.5 8X
25.5° 2X
R18.5 +30°
ø8.0 +30°
R1.5 -30° TYP
21.5° 2X
21.5° 2X
21.5° 2X
CAVITY
4X-45°+1°
ø5 +2°-20°
R3.3 REF
ø4.35 +30°
R1.5 +30°
R6 -30°
2X 2.5+20°
43 -30°
R23 +10°
45°
2X-48
ø5.0 +30° 3X
ø9.0 +30°
ø6 3X
14.20
25.9
ø4 -45°, 0.5 DEEP
ø4 -45°, 0.3 DEEP
25.41
R23 +10°
31.21 -6°
39.70
36.20 +6°
4X-2.5
42.75 2X
43.40
47.6 3X
49.19-5°
52.60 3X REF
R6.5 4X
72.98
77.19 -10°
79.40
81.70 +10°
88.45-0.29 -1°
2X-89.75
92.10
95.25+0.6 -1°
ø2.5 +10° X 0.5 DEEP 2X
52.60 3X REF
49.19-5°
47.60 3X
46.00
ø4 -45°, 0.5 DEEP
43.30
41+0.1
39.87
36.20 +6°
35.99
33.70
31.21 -6°
ø4.0 X 10 DEEP
R23 +6° 2X
R35 +5°
R19.9 +30°
1016+0 -0.4
8.60+0.15 45°
11.00+0.15 45°
29.97 2X
22.20 2X
45° 2X
R3.00
R10 2X
19.41 2X
R3.50 +45°, 6X
79.41 2X
R5.00 4X
5°
0.85 6X
-A-
10.50+0.8
8.00 +30°, 4X
2.00 +45°
R3.00
4.00+0.10 +6°
10.00+0.10
5.08 +45° 4X
5.08 +45° 4X
5.07 +45° 2X
5.77 2X
14.85 -30° 2X

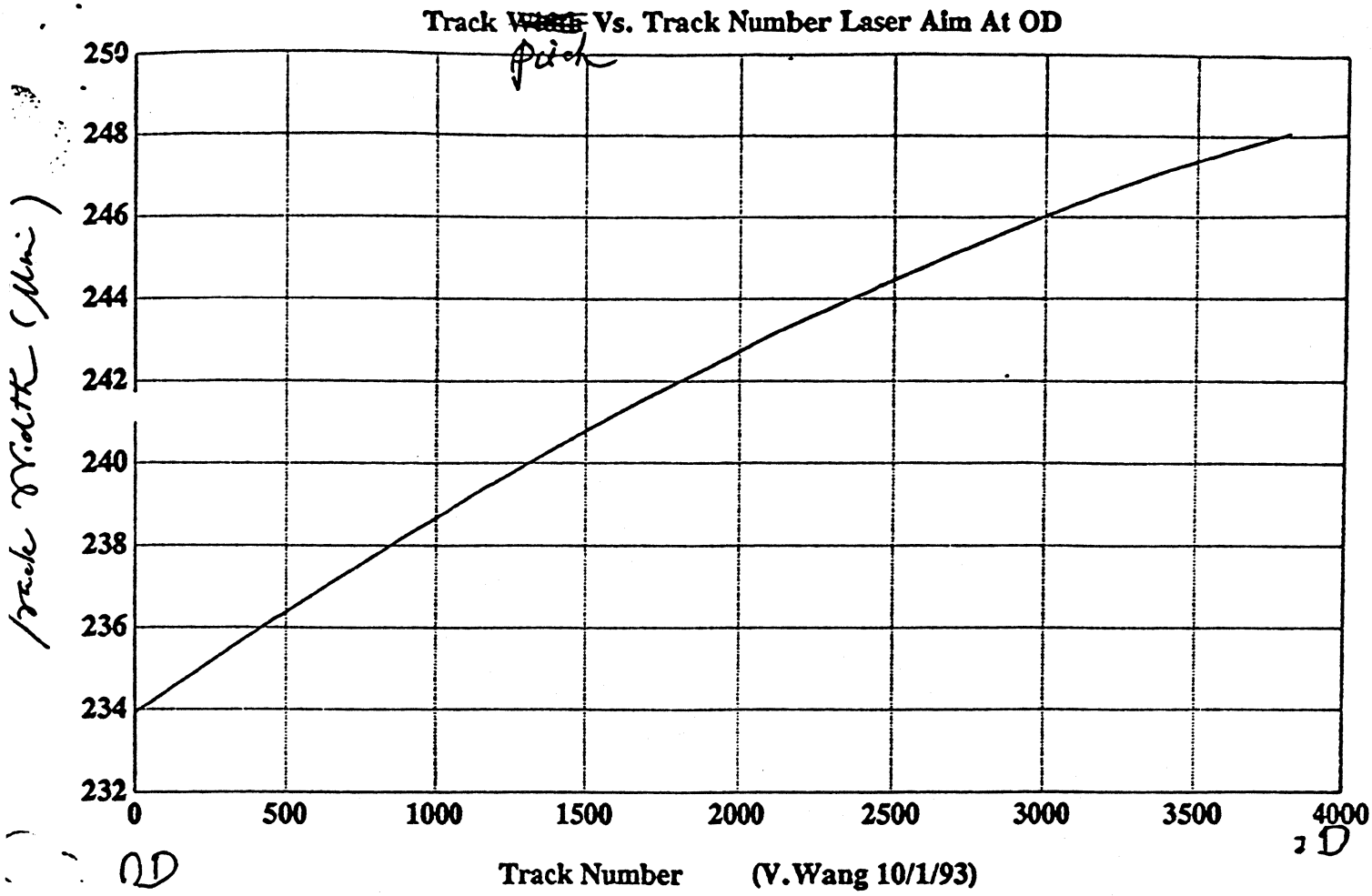
PUSH PIN SERVOWRITER

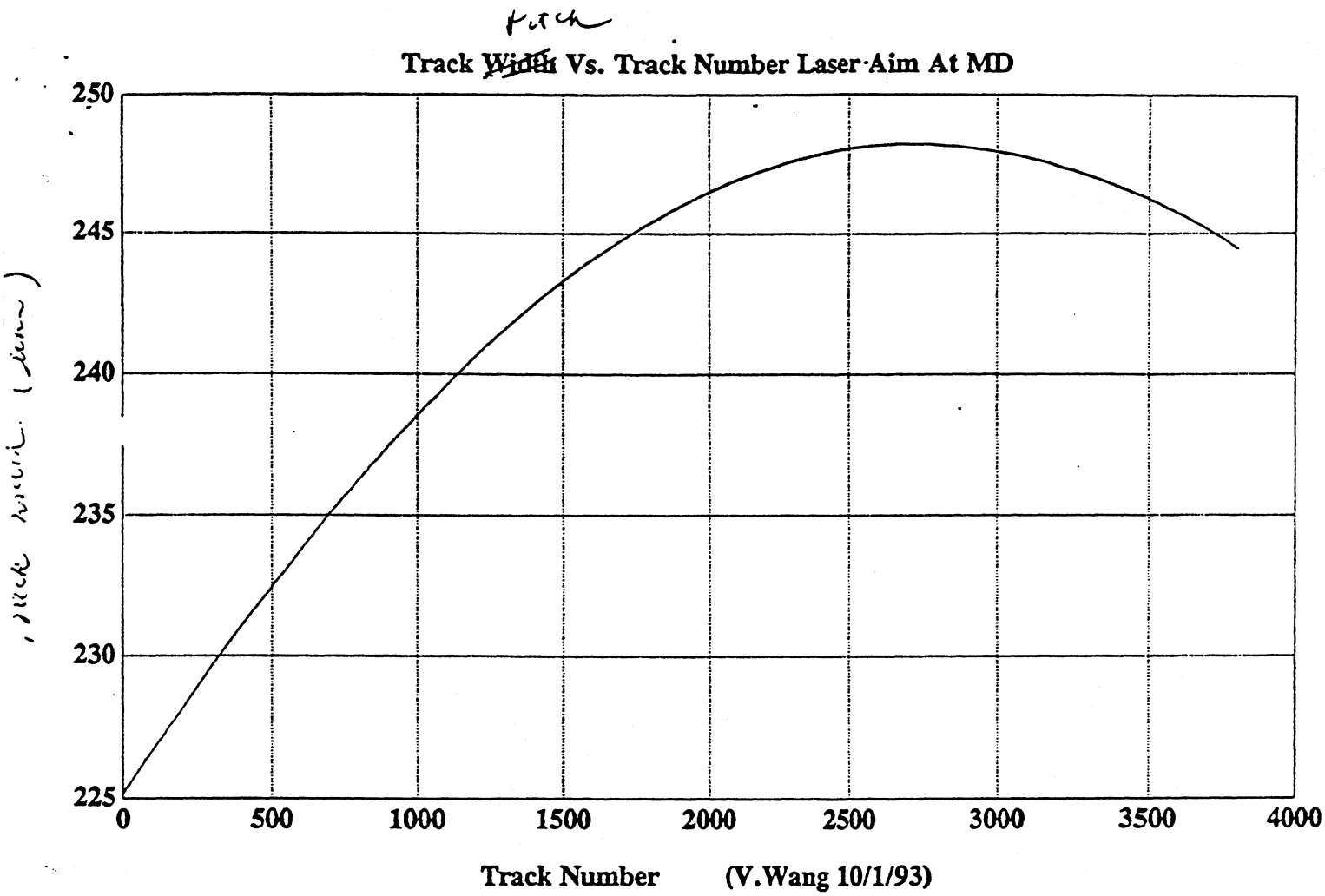
VERIFICATION DATA

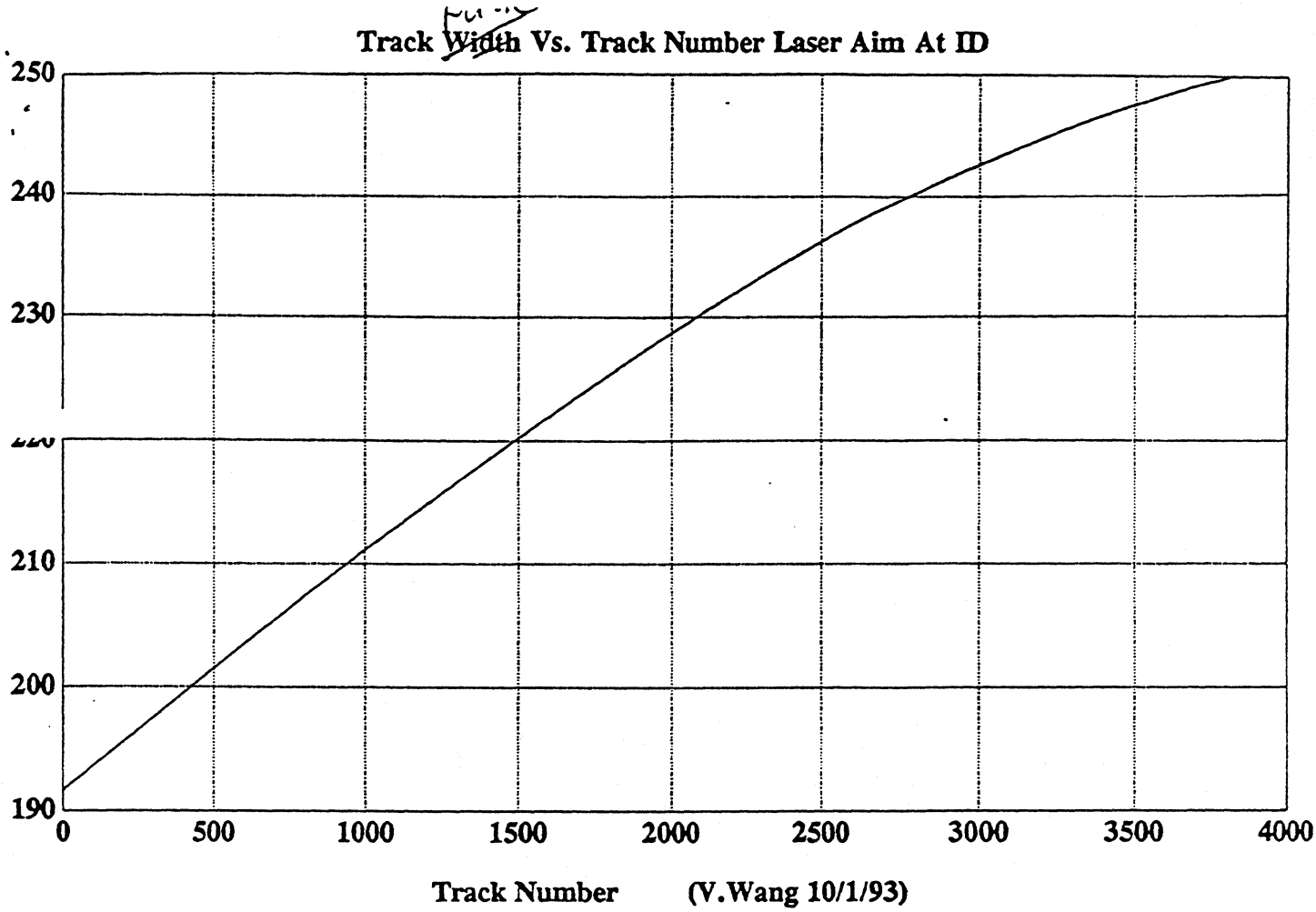
- TRACK SQUEEZE
- AC TMR
- TRACK PITCH ERROR

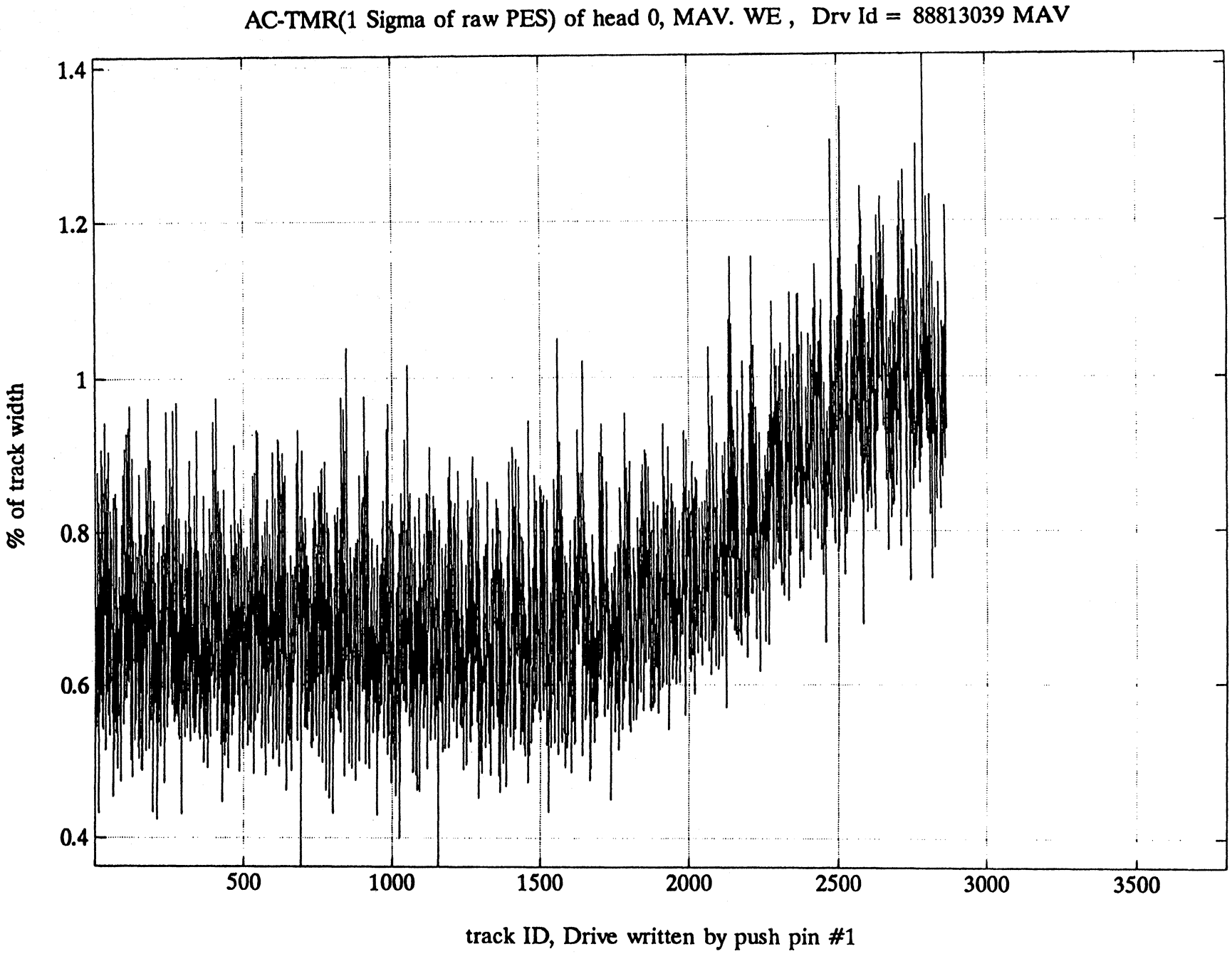
JMC 4/19/94

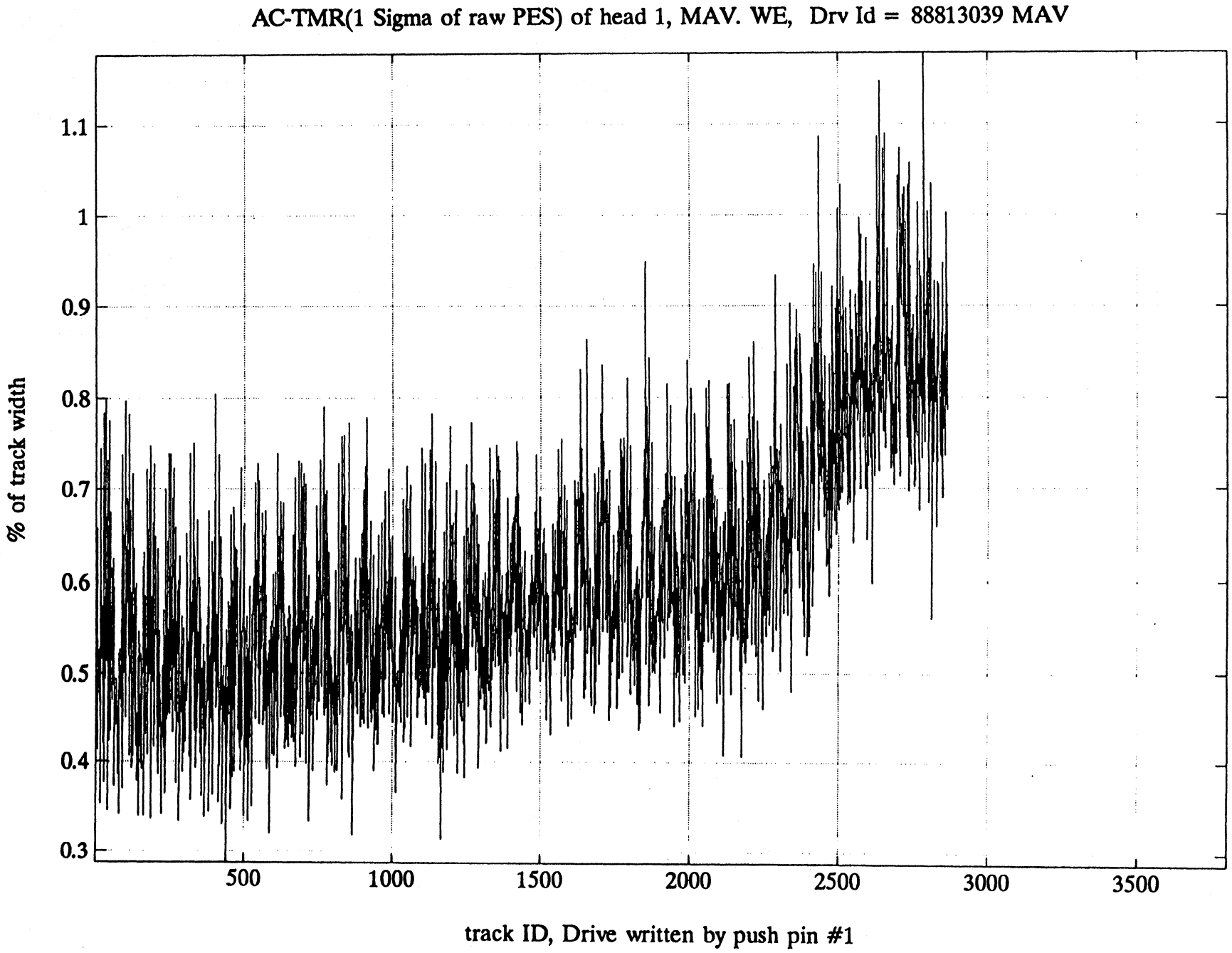
Track Center to Track Center.

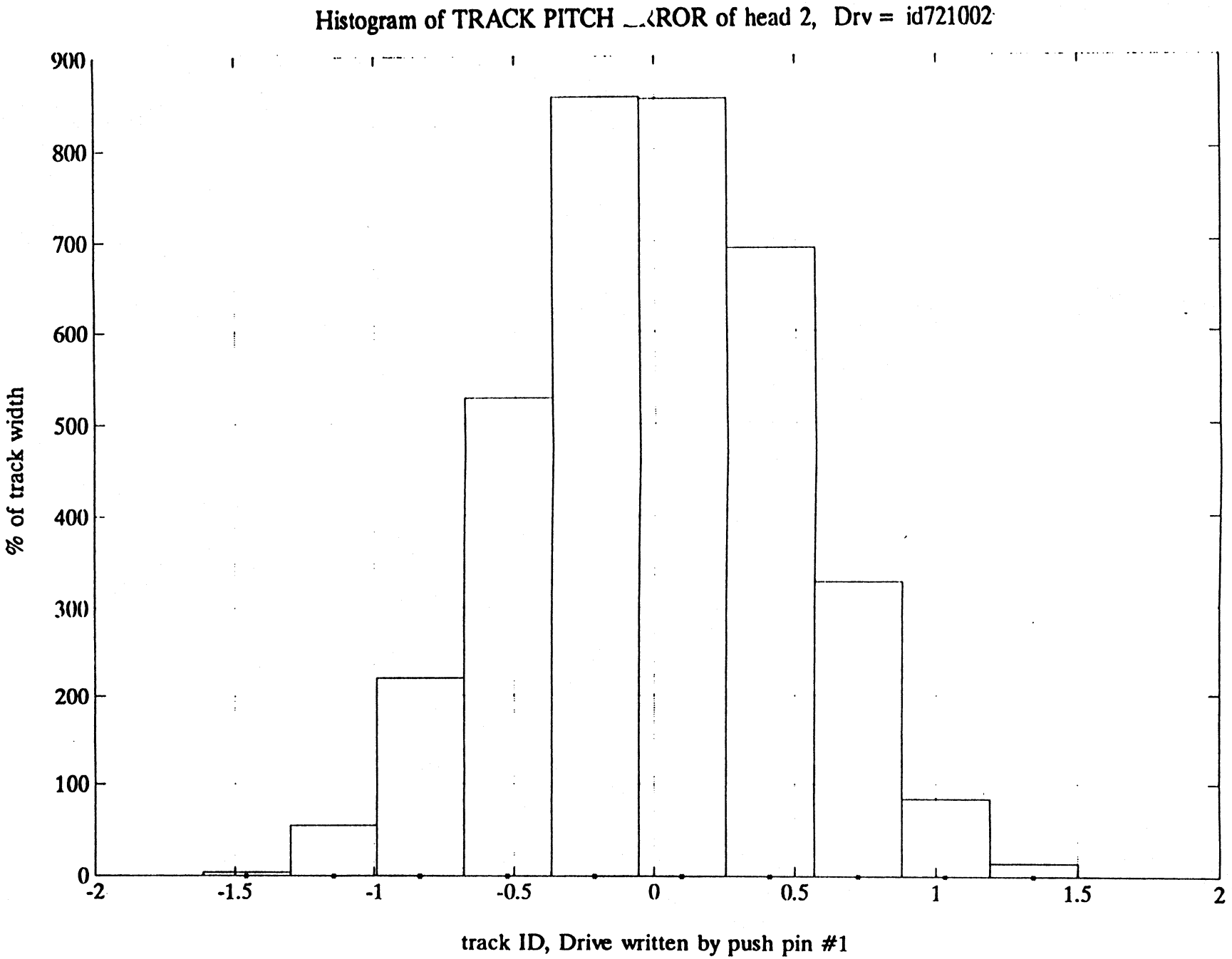


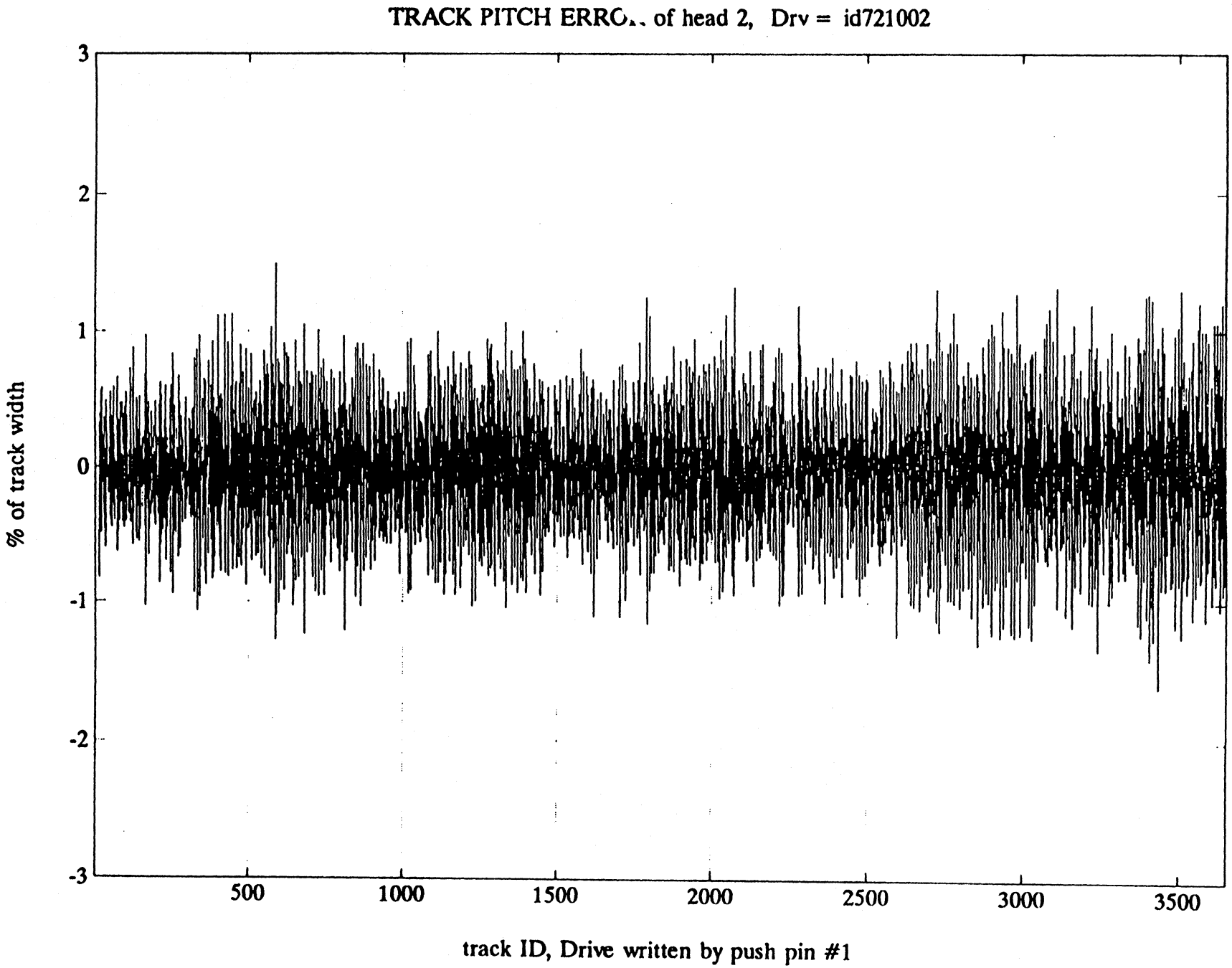

Track Width Vs. Track Number Laser Aim At MD
250
245
240
235
230
225
0
500
1000
1500
2000
2500
3000
3500
4000
Track Number
(V.Wang 10/1/93)


Track Width Vs. Track Number Laser Aim At ID
250
240
230
220
210
200
190
0
500
1000
1500
2000
2500
3000
3500
4000
Track Number
(V.Wang 10/1/93)


AC-TMR(1 Sigma of raw PES) of head 0, MAV. WE , Drv Id = 88813039 MAV
% of track width
1.4
1.2
1
0.8
0.6
0.4
500
1000
1500
2000
2500
3000
3500
track ID, Drive written by push pin #1


AC-TMR(1 Sigma of raw PES) of head 1, MAV. WE, Drv Id = 88813039 MAV
% of track width
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
500
1000
1500
2000
2500
3000
3500
track ID, Drive written by push pin #1


Histogram of TRACK PITCH ERROR of head 2, Drv = id721002
900
800
700
600
500
400
300
200
100
0
% of track width
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
track ID, Drive written by push pin #1


TRACK PITCH ERRO.. of head 2, Drv = id721002
3
2
1
0
-1
-2
-3
% of track width
500
1000
1500
2000
2500
3000
3500
track ID, Drive written by push pin #1

DISK SPACE GAIN WITH 50 % HEAD

- CRASH STOP CHANGE

- TRACK LAYOUT

SECTION 3 TRACK SPECIFICATIONS

The Maverick disk drives are shipped from the factory as "hard sectored" drives. That is, all physical sector addresses are written on the disks before the drives are shipped. As a result, sector size and number of sectors per track are not user selectable. The information given in this section is the physical format of Maverick as it is defined at the factory prior to shipment.

Note that the physical format is in contrast to the logical format of the drive, which is how the drive appears to the host system.

3.1 Track Locations

	Gap Centerline	Outside Corner of Slider	Inside Corner of Slider
Disk edge radius	1.8700 in		
Disk chamfer radius	1.8550 in		
Outermost OD stop compressed radius	1.8505 in	1.8546 in	
Nominal OD stop uncompressed radius	1.8043 in		
Innermost OD stop uncompressed radius	1.7992 in		
System data (5 cyl.)	1.7992 in		
Zone 1 outside radius	1.7972 in		
Zone 15 inside radius	0.8301 in		
Media certified inner radius	0.8310 in		
Outermost Boundary Landing Zone (Touch Air Lock Worst Case)		0.8265 in	
Outermost ID stop uncompressed radius	0.7684 in	0.7915 in	
Nominal ID stop uncompressed radius	0.7627 in		
Innermost ID stop uncompressed radius	0.7573 in		
Nominal ID stop compresses radius	0.7227 in		
Innermost ID stop compresses radius	0.7173 in		0.6450 in
Disk spacer outside radius + tolerance	0.6309 in		
Spindle hub radius + tolerance	0.6309 in		
Pivot-to-spindle distance	2.3987 in		
Head arm length (pivot to center gap)	2.3390 in		

Table 3-1. Track Locations

The actuator sweeps out of an angle of 26.2475° from crash stop to crash stop. This is measured from a line passing through the pivot and the geometric center of the slide gap. From the start of servos to the end of servos the minimum angle is 24.4490°.

CRASH STOP DEFLECTION TESTING RESULTS

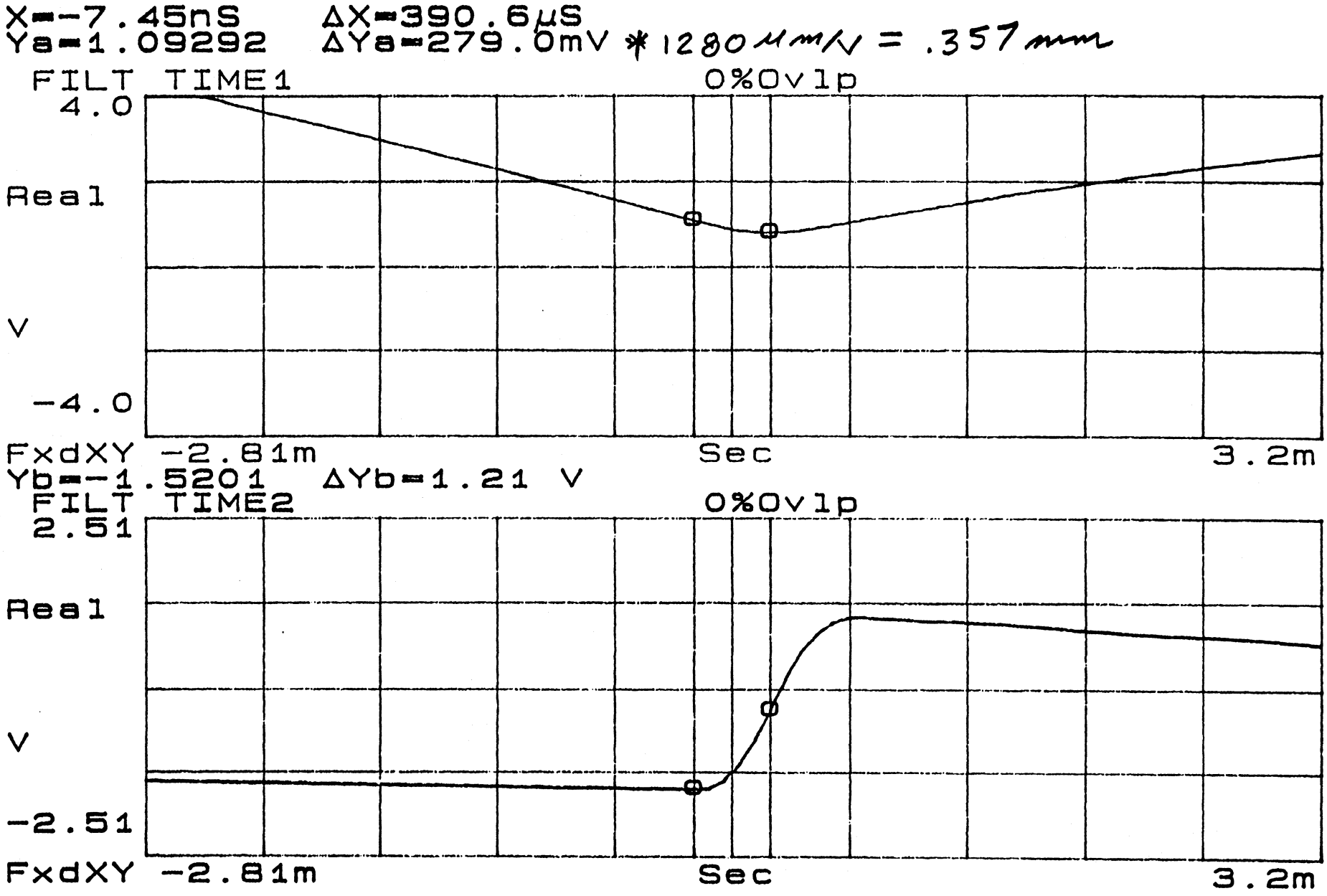
By : Frank Houghton December 2 , 1993

Distribution : Ross Pace

TESTING DESCRIPTION :
A Maverick drive without disk was instrumented to determine crash stop deflection after a run away impact from the actuator arm . The laser interferometer was used to measure the crash stop displacement .

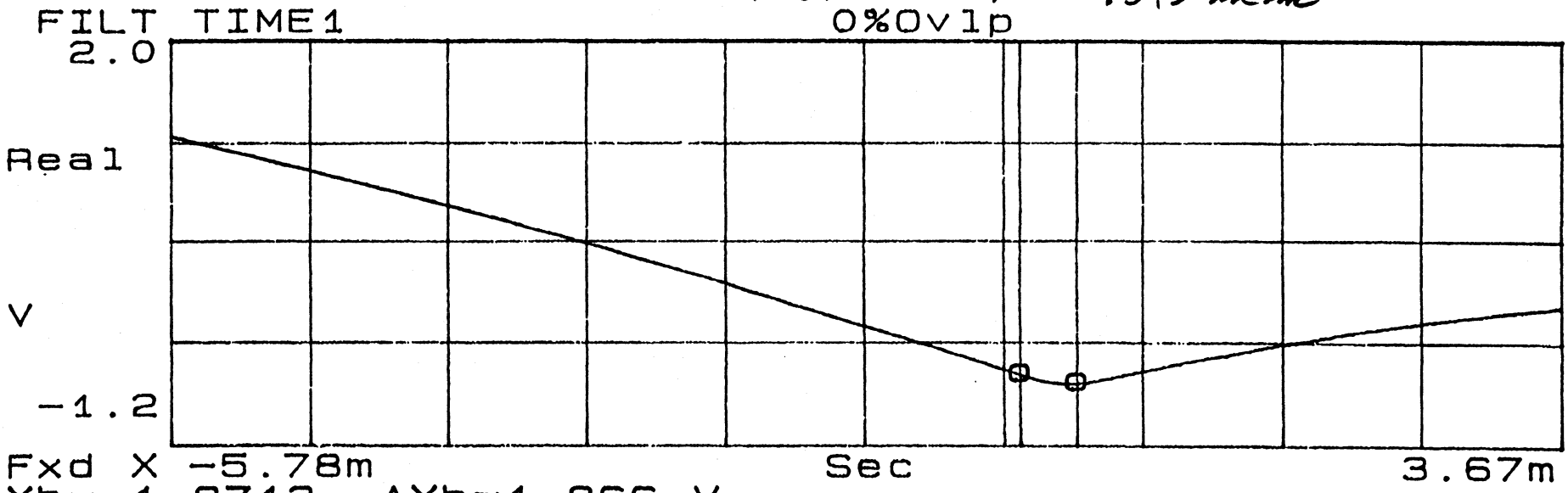
TEST RESULTS :
Under .6 amps of actuator coil current (max. coil current) the crash stop deflects .350 mm in the two disk Maverick drive .

EQUIPMENT used :
- Laser interferometer
- H-P spectrum analyzer
- Current probe

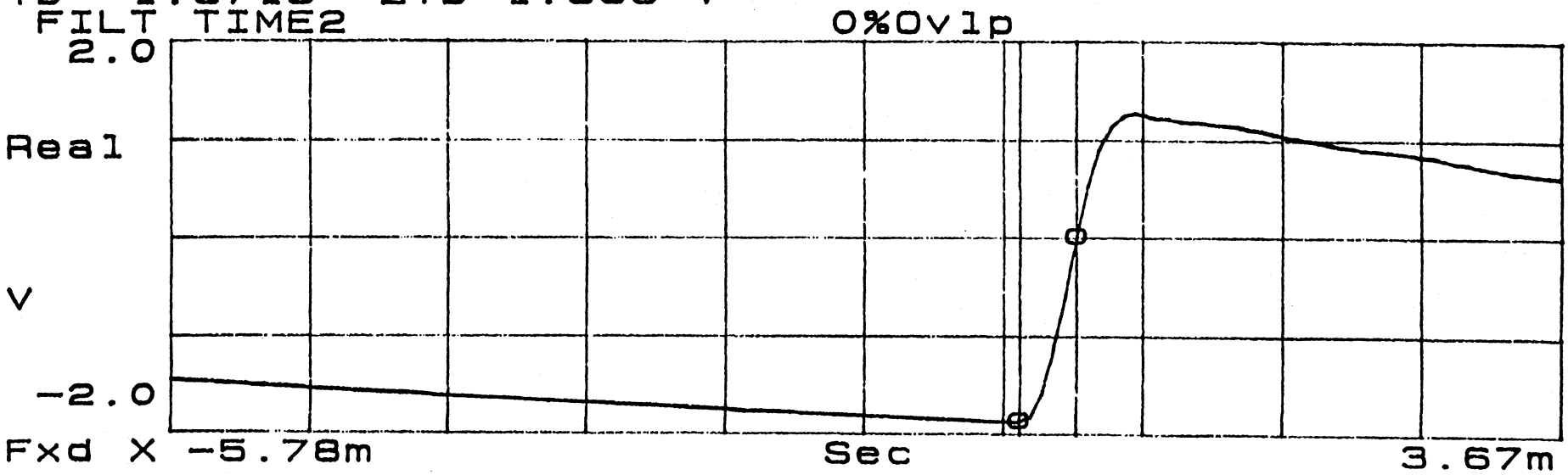

X=-7.45nS ΔX=390.6µS
Ya=1.09292 ΔYa=279.0mV * 1280 mm/V = .357 mm
FILT TIME1
0%Ovlp
4.0
Real
V
-4.0
FxdXY -2.81m
Sec
3.2m
Yb=-1.5201 ΔYb=1.21 V
FILT TIME2
0%Ovlp
2.51
Real
V
-2.51
FxdXY -2.81m
Sec
3.2m

FAH
12/

X=-7.45nS ΔX=390.6μS Y=2.0 V
Ya=-648.78m ΔYa=68.21mV * 5120 mm/V = .349 mm

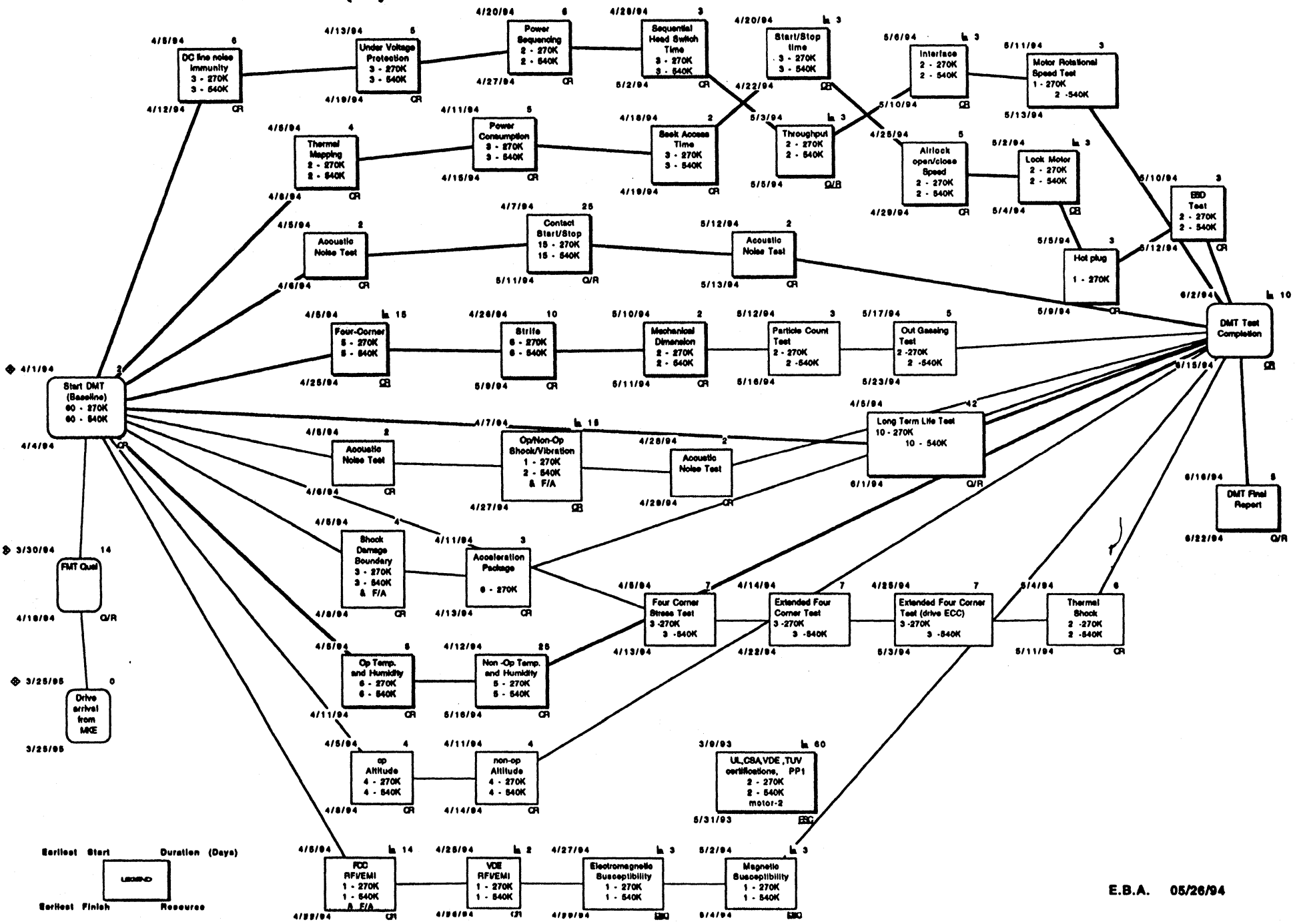


Yb=-1.8713 ΔYb=1.866 V



COIL INPUT - 100 mA

Maverick (AT) Product P2 DMT PEnd REV 1.1



E.B.A. 05/26/94

Quantum
Quality/Reliability Engineering
Summary of the Maverick LC270/540 MByte Drive DMT Results

Test Description	sample size	number passed	number failed	Tested data	Spec.	Margin	Corrective Action/ Remarks
2.0 -Baseline Test							
- NEKO std	62	62	1	Error 46: Excessive soft error rate			
- NEKO die shrink	30	30	0				
2.1 - Acoustic Noise							
- Sound Pressure	24	24	0	up= 32.3	idle - 34 dBA	1.7	
				dn= 30.6		3.4	
				up= 35.9	random seek -	3.1	
				dn= 34.3	39 dBA	4.7	
- Sound Power	24	24	0	up=4.05	idle - 4.5 Bels	0.45	
				dn= 3.69	(max)	0.81	
				up= 4.72	random seek -	0.28	
				dn= 4.62	5.0 Bels (max)	0.38	
2.2 - DC Line Noise Immunity Test	8	8	0	Passed			
2.3 - Under Voltage Protection	4	4	0	Passed			
2.5 - Power Sequencing	4	4	0	Passed			
2.7 - Start/Stop Time	6	6	0	Passed	start - 10s (nom)		
					stop - 10s (nom)		
2.8 - Sequential Head Switch	6	6	0	Passed	4.5ms (nom)		
					6.0ms (max)		
2.9 - Power Consumption							Data being analyzed.
270MB (one disk)					Pwr (idle)=3.6w		
					Pwr (r/w)=4.0w		
					Pwr (sk)=5.5w		
540MB (two disk)					Pwr (idle)=3.6w		
					Pwr (r/w)=4.0w		
					Pwr (sk)= 5.5w		
2.10 - Seek Access Time	6	6	0	Passed	single track seek = 5.0ms		
					rand avg seek (read) = 14.0ms		
					rand avg seek (wr) = 16.0ms		
					full stroke seek = 28 ms		
2.15 - Mechanical Dimen	2	2	1		length dimension showing excessive gasket overhang		
3.1 - Four Corner Test	30	26	4	4-Error 22: Sequencer timeout			Drives in F.A. being analyzed.
				* Alternate Voltage limit startup failure			Q/R and DE investigating issue.
				(No specific limit for the above. Customer requirement)			
3.2 - Strife Test	14	14	0	Passed			
3.3 - Op. Temp/Humidity	10	10	0	Passed			
3.5 - Electromagnetic Susceptibility Test	2	2	0	Passed			

Quantum
Quality/Reliability Engineering
Summary of the Maverick LC270/540 MByte Drive DMT Results

Test Description	sample size	number passed	number failed	Tested data	Spec.	Margin	Corrective Action/ Remarks
3.6 - Magnetic Susceptibility Test	2	2	0	Passed			
3.7 - Op vibration	3	3	0	2.0 G	1.0 G	1.0 G	
3.8 - Non-op vibration	3	3	0	3.0 G	2.0 G	1.0 G	
3.9 - Op Shock	3	3	0	30 G	10 G	20 G	
3.10 - Non-op Shock	3	3	0	120 G	70 G	50 G	
6.1 - Radiated Emissions	4	4	0	Passed	CISPR Limits	4 dBuv	
6.3 - UL/CSA/TUV	2	2	0	Passed			

Compatibility Test Engineering
Maverick Testing for Compaq

- **Pre-Mass Pro Drives now being tested.**
  - CTE startedtesting with earliest versions through PMP.
  - 40 drives in test. Approximately 70% through PMP Matrix.
- **Two ROM versions being tested concurrently.**
  - Both ROM codes 5 and 6 are in the test matrix.
  - Most testing to date has been on ROM 5 (no significant problems). ROM 6 testing is focused on validating maturity.
- **New Tests from Compaq have been incorporated.**
  - Compaq FixedTest
  - DOS62.BAT
- **"Smoothest new product testing we've ever had"**

Quantum

Maverick AT ROM 5 PMP MATRIX

#REFI				MAVERICK AT COMPATIBILITY TEST MATRIX																								
		*		*	*	*	*			*	*	*																
MINE		FUNCTIONALITY	DOS 6.2 ALLDOS	DOS 6.0	DOS 5.0	DOS 3.3	WINDOWS 3.1 (DOS 6.0)	WINDOWS 3.0 (DOS 5.0)	OS/2 1.3	OS/2 2.0	OS/2 2.1	SCO UNIX 3.2.4	POWER ON/OFF	WARM BOOT	SPEEDSTOR II 6.09	NORTON UTILITIES 6.09	QA PLUS 5.11	BENCHMARK TESTING	COMPAQ QUAL1	COMPAQ QUAL2	COMPAQ T-STRESS	COMPAQ FIXED	COMPAQ T DISK	DOS62.BAT	
SYSTEM HOST		I		IIA1	IIA4	IIA9	IIA2	IIA8	IIA10	IIA11	IIA12	IIB1	IV1	IV2	IV3	IV4	IV5										
CMPQ PRESARIO #1		■	■						■							■				■	■	■	■	■	■	■	■
CMPQ PRESARIO #2		■																	■	■	■	■	■	■	■	■	■
CMPQ PRESARIO 486/66		■		■						▒	■						■		▒	■	■	■	■	■	■	■	■
CMPQ DSKP I 486/33 #1		■	■		■							■						■		▒	■	■	▒	■	■	■	■
CMPQ DSKP I 486/33 #2																											
CMPQ DSKP PROL 486/66 #1		■				■				■			■							■	■	■	■	■	■	■	■
CMPQ DSKP PROL 486/66 #2																											
CMPQ DSKP PROL 486/66 #3		■																		■	■	■	■	■	■	■	■
CMPQ DSKP I 486/66 #1																											
CMPQ DSKP I 486/66 #2		■					■							■						■	■	■	■	■	■	■	■
CMPQ DSKP I 486/66 #3		■																		■	■	■	▒	■	■	■	■
CMPQ DSKP XE 586/60		■					■	■			■								■	■	■	■	■	■	■	■	■
CMPQ DSKP M 486/33																											
CMPQ DSKP M 486/50 #1																											
CMPQ DSKP M 486/50 #2																											
CMPQ DSKP M 486/66																											
CMPQ DSKP M 586/50																											

Maverick AT ROM 6 PMP MATRIX

#REF!				MAVERICK AT COMPATIBILITY TEST MATRIX																							
		*		*	*	*	*				*	*	*														
MINE		FUNCTIONALITY	DOS 6.2 ALLDOS	DOS 6.0	DOS 5.0	DOS 3.3	WINDOWS 3.1 (DOS 6.0)	WINDOWS 3.0 (DOS 5.0)	OS/2 1.3	OS/2 2.0	OS/2 2.1	SCO UNIX 3.2.4	POWER ON/OFF	WARM BOOT	SPEEDSTOR II 6.09	NORTON UTILITIES 6.09	QA PLUS 5.11	BENCHMARK TESTING	COMPAQ QUAL1	COMPAQ QUAL2	COMPAQ T-STRESS	COMPAQ FIXED	COMPAQ T DISK	DOS62.BAT
SYSTEM HOST				IIA1	IIA4	IIA9	IIA2	IIA8	IIA10	IIA11	IIA12	IIB1	IV1	IV2	IV3	IV4	IV5								
CMPQ PRESARIO #1																											
CMPQ PRESARIO #2		■			■			■				■		■					■	■	▒	■	▒	■
CMPQ PRESARIO 486/66																											
CMPQ DSKP I 486/33 #1																											
CMPQ DSKP I 486/33 #2																											
CMPQ DSKP PROL 486/66 #1																											
CMPQ DSKP PROL 486/66 #2		■	■						▒						■				■	■	▒	■	■	■
CMPQ DSKP PROL 486/66 #3																											
CMPQ DSKP I 486/66 #1																											
CMPQ DSKP I 486/66 #2																											
CMPQ DSKP I 486/66 #3		■		■																■	■	■	■	■	▒
CMPQ DSKP XE 586/60																											
CMPQ DSKP M 486/33																											
CMPQ DSKP M 486/50 #1		■				■				■						■				■	■	■					
CMPQ DSKP M 486/50 #2		■					■				■		▒				■						■	■	■
CMPQ DSKP M 486/66																											
CMPQ DSKP M 586/50																											

Maverick AT ..OM 5 PMP MATRIX

#REF!			MAVERICK AT COMPATIBILITY TEST MATRIX																											
		SLAVE	MAVERICK	PIONEER 170	MAVERICK	ROADRUNNER	MAVERICK	THUNDERBOLT 270	MAVERICK	CONNER CFS 210	MAVERICK	CONNER CFS 420A	MAVERICK	CONNER CFA 540A	MAVERICK	SEAGATE ST3655	MAVERICK	SEAGATE ST3385	MAVERICK	SEAGATE ST3550	MAVERICK	WD AC2250	MAVERICK	WD AC2340	MAVERICK	MXT 540A	MAVERICK			
		MASTER	MAVERICK	MAVERICK	PIONEER 170	MAVERICK	ROADRUNNER	MAVERICK	THUNDERBOLT 270	MAVERICK	CONNER CFS 210	MAVERICK	CONNER CFS 420A	MAVERICK	CONNER CFA 540A	MAVERICK	SEAGATE ST3655	MAVERICK	SEAGATE ST3385	MAVERICK	SEAGATE ST3550	MAVERICK	WD AC2250	MAVERICK	WD AC2340	MAVERICK	MXT 540A	MAVERICK			
SYSTEM HOST			IIA1	IIA4	IIA9	IIA2	IIA8	IIA10	IIA11	IIA12	IIB1	IV1	IV2	IV3	IV4	IV5														
CMPQ PRESARIO #1																														
CMPQ PRESARIO #2																														
CMPQ PRESARIO 486/66															1															
CMPQ DSKP I 486/33 #1																														
CMPQ DSKP I 486/33 #2																														
CMPQ DSKP PROL 486/66 #1																														
CMPQ DSKP PROL 486/66 #2																														
CMPQ DSKP PROL 486/66 #3																														
CMPQ DSKP I 486/66 #1																														
CMPQ DSKP I 486/66 #2																														
CMPQ DSKP M 486/33																														
CMPQ DSKP M 486/50 #1																														
CMPQ DSKP M 486/50 #2																														
CMPQ DSKP M 486/66																														
CMPQ DSKP XE 586/60																														

Maverick AT ...OM 6 PMP MATRIX

#REF!

MAVERICK AT COMPATIBILITY TEST MATRIX

SYSTEM HOST	MASTER	SLAVE	MAVERICK	PIONEER 170	MAVERICK	ROADRUNNER	MAVERICK	THUNDERBOLT 270	MAVERICK	CONNER CFS 210	MAVERICK	CONNER CFS 420A	MAVERICK	CONNER CFA 540A	MAVERICK	SEAGATE ST3655	MAVERICK	SEAGATE ST3385	MAVERICK	SEAGATE ST3550	MAVERICK	WD AC2250	MAVERICK	WD AC2340	MAVERICK	MXT 540A	MAVERICK
	J			IIA1	IIA4	IIA9	IIA2	IIA8	IIA10	IIA11	IIA12	IIB1	IV1	IV2	IV3	IV4	IV5										
CMPQ PRESARIO #1																											
CMPQ PRESARIO #2																											
CMPQ PRESARIO 486/66																											
CMPQ DSKP I 486/33 #1																											
CMPQ DSKP I 486/33 #2																											
CMPQ DSKP PROL 486/66 #1																											
CMPQ DSKP PROL 486/66 #2																											
CMPQ DSKP PROL 486/66 #3																											
CMPQ DSKP I 486/66 #1																											
CMPQ DSKP I 486/66 #2																											
CMPQ DSKP I 486/66 #3																											
CMPQ DSKP M 486/50 #1																											
CMPQ DSKP M 486/50 #2																											
CMPQ DSKP M 486/66																											
CMPQ DSKP XE 586/60																											

Compatibility Test Engineering
Maverick Testing for Compaq

Next on the Test Plan

- **Complete the Compatibility Matrix**
- **Network Testing**
  - Novell Netware 3.12 and 4.01
- **Features Testing**
  - Power Management
  - DMA
  - LBA
  - PIO

Quantum