MEMOREX PRIVATE

Technical - Administrative

STORAGE PRODUCTS INC.

A Potential Joint Venture Between

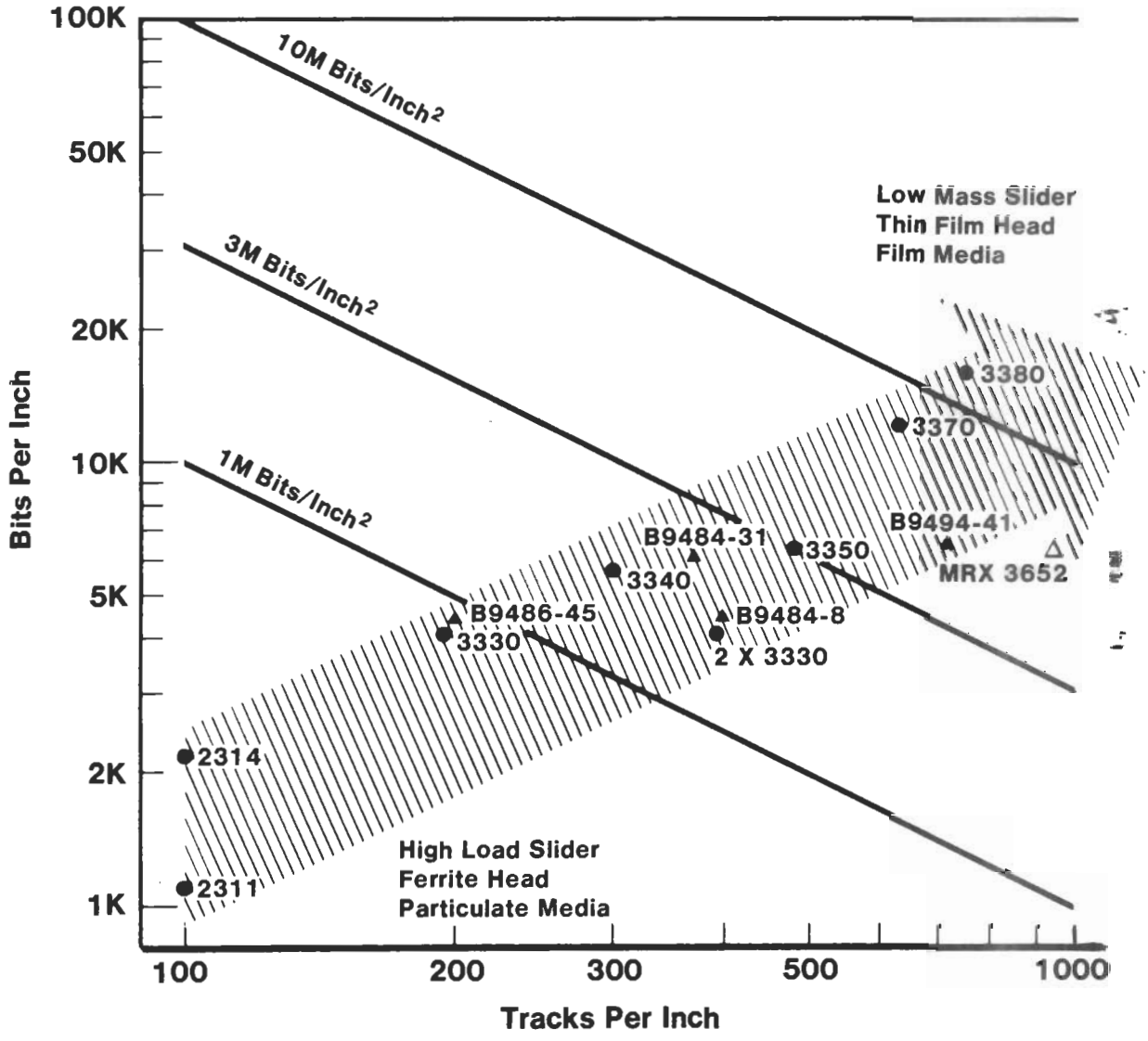
Burroughs, Inc.

and

Memorex Corporation

July 31, 1980

Technology Review—Moving Head Disc Drives



Environmental Implications of Technology

- Costs are escalating

Example: Disc substrate production

2311 to 3350 requires conventional lathe → $ 25 K

3370 requires new technique → $275 K

Example: Slider production

3350 (Winchester) production line costs $1-2 M

3370 (thin film) production line costs $10-20 M

Example: Read/write amplifier - see Exhibit 1

2311 to 3330 used "off the shelf" discrete circuits

beyond 3350 requires custom analog LSI

Example: Logic family - see Exhibit 2

	gates/in^2 (board level)	Speed Power Product pico joules
Industry	20	4 to 7 +++
IBM	1200	<2

- Number of viable vendors reduced

  Example: More than 20 companies attempted to enter disc drive markets in early 70's. Survivors:

  Memorex
  MPI (CDC/Honeywell)
  STC
  ISS ? (Univac)
  Century ? (Xerox)

  Example: Thin film heads and media

Memorex MPI STC Japanese	will succeed
ISS Dastek AMC Infomag	questionable

  Example: Recent 8" and 14" non-removable disc products

Memorex Shugart Assocs. MPI Japanese	will succeed
Priam Shugart Tech. IMI etc.	questionable

? WHO ARE THE VIABLE VENDORS FOR THE 80'S ?

Other Environmental Factors

- IBM has lowered the price umbrella (in steps?)

2311	cost $3 K	price	$27 K	9 x cost
3350(B2)	cost $8 K	Initial price	$50 K	6 x cost
		Current price	$32 K	4 x cost

- Competitive arena shifting from hardware to software and systems capability.

  Example: IBM now separately pricing portions of operating system.

  Example: DEC RP05/6 same technology and components as IBM 3330 class machine with differentiation achieved through interface and system control.

  Example: MPI's SMD, MMD and FMD devices are being used in a variety of competitive EDP products.

- As storage devices become commodity products, control over timing and configuration of these products can be a market advantage.

  - 2 to 3 years lead time (see Exhibit 3)

  - Most configuration choices arbitrary

- $M for R & D (1979)

	Total	Disc Storage
Memorex	28	21
Burroughs	169	?
IBM	1360	150-300
MPI	17-34	17-34
STC	33	25-30

One Early Recognition Of This Environment

- 1976 CDC and Honeywell form M.P.I.

  Fundamental objective to produce low-cost, high quality rotating memory products for the parent companies through realizing economics of scales in manufacturing, engineering, applied research and advanced development.

- 1979

  "There is no question of its (MPI's) No. 1 position in OEM disk drives"

  J. N. Porter, July 197[illegible]
  1979 Disk/Trend Report
  Page MFGR-4

An Example*

Assumptions:

- Program Life - 5 years
- Product Demand

Memorex	400 Spindles/Mo.
Beta	200 Spindles/Mo.
Total	600 Spindles/Mo.

- Venture Ownership

Memorex	2/3
Beta	1/3

- Common Disc Product - Unique Interfaces Only
- 100% Equity; No Liabilities
- Single Spindle 659 Equivalent Drive (i.e., MRX 2 X 3350)
- Memorex OEM Product Derived From Memorex End-User Product

  Beta Product Developed Using Commercial Technology (i.e., Heads and Discs)

  PCBS Sourced From Existing Facilities

*See Exhibit 4 for detailed analysis

Summary

	Memorex	Beta
Separate Manufacture		
• Standard Product Cost	$6250	$7200
• Fully Loaded Product Cost	$7450	$9192
• Total Assets	$ 17 M	$ 12 M
Joint Manufacture		
• Standard Product Cost	$5717	$5717
• Fully Loaded Product Transfer Price	$7047	$7330*
• Product Cost Savings Over Separate Manufacture (5.0 yr. Program Lifes)	$ 9.3 M	$22.3 M
• Royalty*	$ 3.4 M	-
• Ownership Share of Total Assets	$15.0 M	$ 7.5 M

*Assumes a royalty of 4% in compensation for Memorex technology differential. Royalty will go to zero when Memorex receives sufficient compensation for its media, head and device technology differential. Estimated at $10 million.

Summary Of Cost Savings Areas

- Shared overhead
- Higher purchase volume
- Learning curve cost reductions
- Reduced development expense
- Reduced EC, warranty and service costs
- Reduced spare parts cost
- Reduced start-up costs
- Higher volumes from earlier market entry

Additional Cost Savings Potentials

- Increased vertical integration
- Reduced facilities/staff and/or additional resources available
- Common state of the art research

In-House Media Capability

- Lower cost
- Rapid response to technology change
- Allows head and disc trade-offs
- Source control

Philosophy For SPI

- The low cost and high quality developer and manufacturer of auxiliary on line storage products and subsystems for parents.

- All parents agree to purchase all auxiliary on line storage from SPI if and only if:

    1. SPI manufactures the product
    2. SPI is reasonably price competitive
    3. SPI can deliver within a reasonable time frame

  The test of these criteria is over a product life cycle so that short term market anomalies do not impact long term success of SPI.

- SPI will manufacture on an interim basis all interim products assigned to it by the parents; however, the parents must move to common products at the earliest possible date.

- SPI will quote on the development and manufacture of unique products at the request of either parent.

- Parents will have improved system performance to allow better direct competition with IBM.

Interim Products Assigned To SPI

Memorex

660 family	2314 class disc drives
367X and 677	3330 class disc drives and controls
365X	3350 class disc drives and controls
601 family	Non-removable 14" disc drives
101/201 family	8" rigid disc drives
55X/65X family	8" floppy disc drives
14" disc production	Coated discs only, no packs

Burroughs

9383 family	2X and 4X 2314 class disc drives, 2X 3330 class disc drives and controls
9387 family	Trident disc drives and controls
9494 family	Non-removable 4X 3330 class disc drives
9470 family	Head per track disc family
9489 family	8" floppy disc drives and controls
9480 family	14" cartridge disc drives and controls

Future Product Scope

TF head and media rotating magnetic storage

Optical (video) storage

Bubbles

On line library storage

etc.

General Structure of SPI

- Separate corporation, incorporated in California
- Management of SPI will be responsibility of Board of Directors
  - Exercised thru CEO appointed by majority of BOD
- BOD membership proportional to parent ownership
  - Memorex desires to maintain majority ownership
  - Initial ownership % established through transfer of assets to include cash if necessary
- SPI to be operated at minimum profit level
  - About 3% PBT on sales revenue
  - At traditional growth rates may not be self-financing
- Unanimous BOD consent required for:
  - Transactions between SPI and any one parent not involving the sale of product which exceeds $250,000 per year
  - Authorization and issuing any capital for SPI
  - Selling and/or transferring a substantial portion of SPI's assets
  - Changing the purpose, by-laws, Certificate of Incorporation, or Corporate Policies of SPI

Corporate Policies of SPI

Policy No. 1	Product Transfer Prices to Owners
Policy No. 2	Definition of Full Cost Adder (FCA)
Policy No. 3	Product Standard Cost (PSC)
Policy No. 4	Research and Development
Policy No. 5	Field Bills of Material and Field Change Instructions (FBM)
Policy No. 6	Spare Parts Obsolescence Caused by FMB's
Policy No. 7	Warranty
Policy No. 8	Refurbishment and Repair
Policy No. 9	Order Processing and Forecasting
Policy No. 10	Owner Unique Programs
Policy No. 11	Manufacturing Start-up Costs for Common Products
Policy No. 12	Owner Built Products Incorporated Into SPI Products
Policy No. 13	Spare Parts Responsibility
Policy No. 14	Accounts Receivables
Policy No. 15	Manufactured Parts Procurement From Owners
Policy No. 16	Quality Assurance
Policy No. 17	Product Cost - Pre-Production Units
Policy No. 18	Procurement Specification on SPI Products
Policy No. 19	Utilization of Excess Inventory (Piece Parts & Sub-Assemblies)
Policy No. 20	Engineering Changes & Requests For Action
Policy No. 21	SPI/Owners Purchase Agreement
Policy No. 22	Proprietary Protection
Policy No. 23	Planning Committee

Capitalization of SPI

- Each parent contributes assets in proportion to ownership
  - PP & E at net book value
  - WIP and raw materials at book value
  - Any other assets as agreed by parents
  - No accounts receivable
  - No liabilities
- Excess WIP and raw material of any one parent to be consigned to SPI
- Potential Memorex contributions

  San Tomas Complex (less Building 12)
  Administration, Recording Technology Center, 14" Drive & Controls Manufacturing, 14" Drive & Controls Engineering, Warehouse

  Recording Components Division Complex (Memorex Drive, Buildings M & N)
  Rigid Discs Administration, Manufacturing, Engineering

  Orchard Park Complex
  8" Disc Drives Administration, Manufacturing, Engineering

  Santa Ana Manufacturing - Floppy Manufacturing

  Nogales, Arizona & Mexico - Sub-Assembly

  Eau Claire, Wisconsin - PWB Manufacture
- Estimated value of Memorex assets

- PP & E*	$36 Million (Net Book Value)
- WIP & inventory	$72 Million (FIFO Book Value)

- Potential Burroughs Contributions*

  Westlake Village
  Winnipeg
  Glenrothes
  Guadalajara
- No Treasury Function
  - Parents pay on shipment
  - Cash to finance asset growth provided by parents in proportion to ownership.

*Value of assets contributed by each parent could be negotiated depending on the lease status of the buildings involved.

- The transfer price to a parent is calculated as

  Price = Constant (Product Standard Cost + Full Cost Adder)

  = k (PSC + FCA)

- Product Standard Cost (PLC)

  PLC is the standard direct cost calculated on the basis of performance in the last two quarters of the prior year. It includes labor, material and variable factory overhead costs as defined in Corporate Policy #3.

- Full Cost Adder (FCA)

  The FCA is intended to recover the budgeted fixed period costs. These costs are defined in Corporate Policy #2 and include among others fixed factory overhead, R & D (Corporate Policy #4), administration, EC, FBM, etc. costs.

- Constant (k)

  A constant factor provides the agreed upon profit margin.

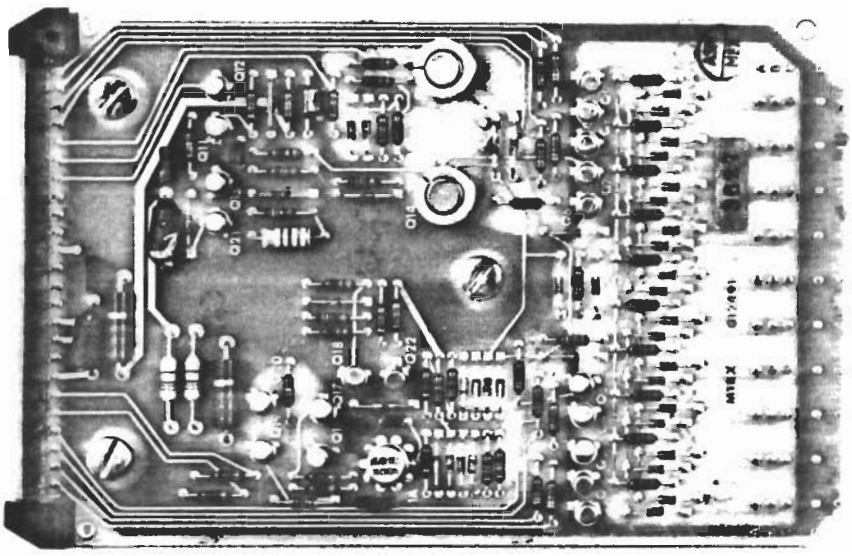
- Planning Committee
  - Elected by BOD
  - Approves Common Research Budget (i.e., non-product design)
  - Approves Common Development Budget (i.e., product related)
  - Recommends technology and product programs to SPI management

- Expense Absorption
  - Common expenses included in FCA
  - Actual held to within ± 5% of ownership by separate billing of parent with insufficient absorption
  - Unique expenses funded by specific parent

Summary Of Protection For Minority Owners

- Unanimous BOD required for key transactions (see pg. 12)
- Each parent has rights to SPI technology if dissolved
- Unique interfaces exclusive to a parent
- Provisions for protection of proprietary data
- Minority parent has audit right
- Specific rights with regard to SPI shares
  - Put option in event of merger/acquisition of one parent
  - Right of first refusal on all other share transactions
- Either parent can buy out other at book value if contract defaulted
  - bankruptcy or liquidation is default
- Minority parent has right to resident planners.

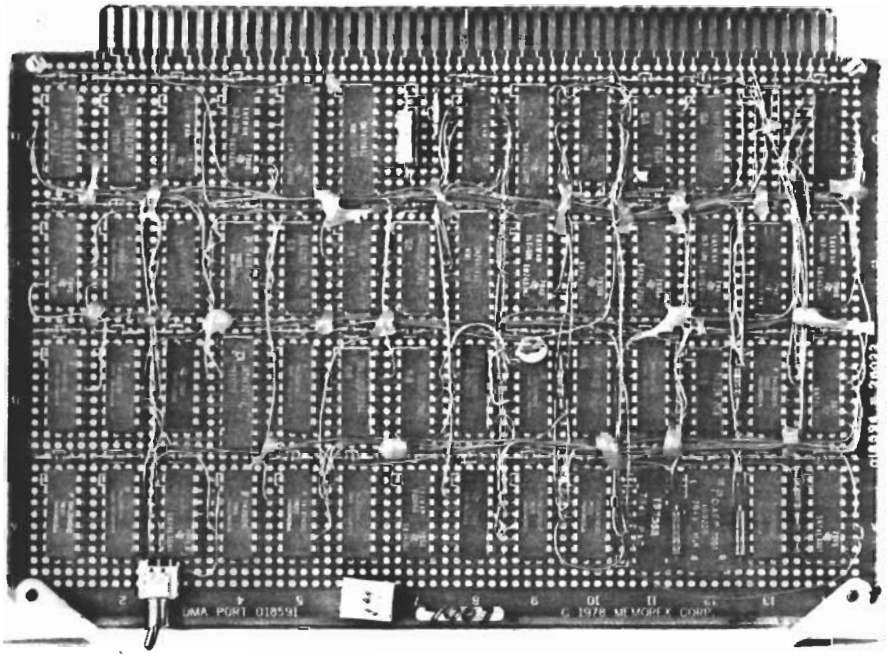
EXHIBIT 1. ANALOG CIRCUIT TECHNOLOGY



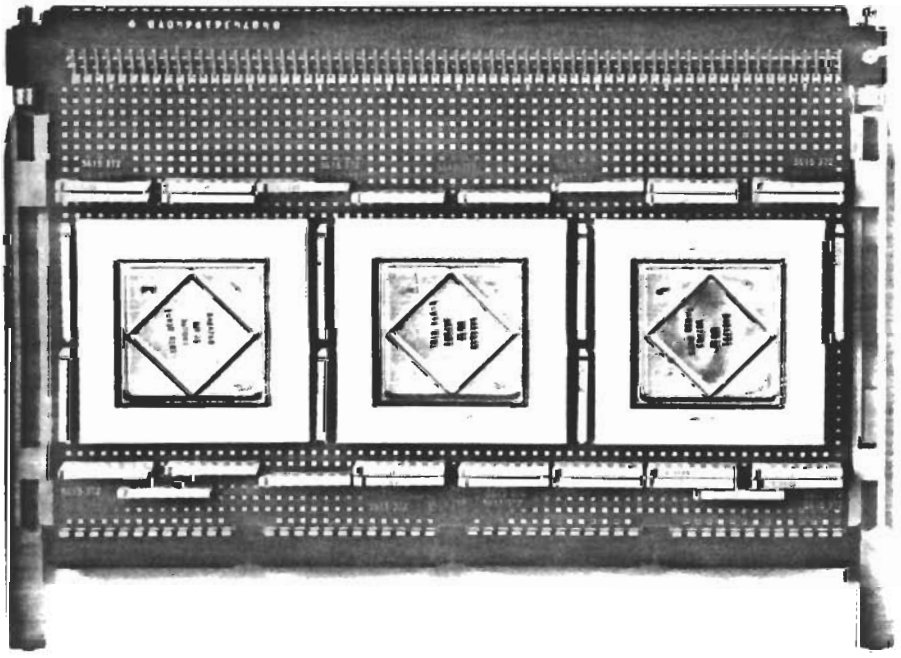
1975
STATE OF THE ART
READ/WRITE CIRCUIT

1980
STATE OF THE ART
READ/WRITE CIRCUIT

EXHIBIT 2. LOGIC CIRCUIT TECHNOLOGY



1980
INDUSTRY
STANDARD
LOGIC CIRCUITRY



1980
IBM
LOGIC CIRCUITRY

EXHIBIT 3. SOME INDUSTRY RESPONSES TO IBM PRODUCTS

	TECHNOLOGY FAMILY		
IBM Code Name	Iceberg 3330-II	Madrid 3350	NFP 3370
BPI (Bits Per Inch)	4040	6250	12000
TPI (Tracks Per Inch)	392	480	635
Areal Density (Mbits/in^2)	1.6	3.0	7.6
Disc	Non-lubricated Added aggregate	Lubricated Minimal aggregate	Lubricated Minimal aggregate
Head	High load slider	Low mass slider	Thin film low mass slider
IBM FCS (First Customer Ship)	April 1974	March 1976	October 1979
Memorex FCS	October 1974	September 1977	Not yet
CDC FCS	June 1974	? 1978	Not yet
Burroughs FCS	? 1976	Not yet	Not yet

EXHIBIT 4. DETAILED EXAMPLE OF POTENTIAL PRODUCT COST SAVINGS

Assumptions

- Program Life - 5 years
- Product Demand

Memorex	400 Spindles/Mo.
Beta	200 Spindles/Mo.
Total	600 Spindles/Mo.

- Venture Ownership

Memorex	2/3
Beta	1/3

- Common Disc Product - Unique Interfaces Only
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  Beta Product Developed Using Commercial Technology (i.e., Heads and Discs)

  PCBs Sourced From Existing Facilities

Product Transfer Price To J.V. Owners:

	Memorex	Beta
J.V. Standard Product Cost/Spindle	$5717	$ 5717
Adders/Spindle	$1125	$ 1125
Profit Mark-Up (3%)	$ 205	$ 205
Royalty (4% of above)	-	$ 283
J.V. Product Transfer Price	$7047	$ 7330
Product Cost of Beta Manufacture		$ 9192
J.V. Product Cost Savings on 12,000 Spindles		$22,344,000

Calculation of Product Cost

		Memorex	Beta	Joint Venture	Comment		
Spindles - per month		400/mo.	200/mo.	600/mo.			
- Program		24,000	12,000	36,000			
Standard Cost/Spindle					MRX	Beta	J.V.
Direct Material	65%	4,062	4,386	3,737	Base	+ 8%	- 8%
Direct Labor	10%	625	625	625	-	-	-
Overhead	25%	1,563	2,189	1,355	Base	-30%	+30%
		6,250	7,200	5,717			
Adders/Spindle*							
Product Development		84	667	111			
Start-Up Cost		83	150	61			
ECO		35	35	35			
Warranty		60	60	60			
Program Admin.		938	1,080	858			
		1,200	1,992	1,125			
Fully Loaded Cost/Spindle		7,450	9,192	6,842			

*See Page 4.3

Calculation of Adders Per Spindle

5 Year Program
($000)

	Memorex	Beta	Joint Venture
Total Spindles	24,000	12,000	36,000
Standard Cost - /Spindle	6,250	7,200	5,717
- Total Program	150,000	86,400	205,812
Product Development Cost	2,000	8,000	4,000
Start-Up Cost	2,000	1,800	2,200
ECO - $35/Spindle	840	420	1,260
Warranty - $60/Spindle	1,440	720	2,160
Program Admin. @ 15% of Standard	22,500	12,960	30,872
Total Product Cost	178,780	110,300	246,304
Fully Loaded Cost/Spindle	7,450	9,192	6,842

Balance Sheet

				Memorex	Beta	Total	Elim.	Joint Venture
Assets								
Inventory	4 turns			7500	4320	11820	(1530)	10290
PP & E	Memorex	Beta	J.V.					
- Land	7 ac	5 ac	8.5 ac	420	300	720	(210)	510
- Building	100K sq. ft.	70K sq. ft.	125K sq. ft.	4500	3150	7650	(2025)	5625
- Equipment				4000	3500	7500	(2000)	5500
- Total				8920	6950	15870	(4235)	11635
Other Assets				500	400	900	(200)	700
Total Assets				16920	11670	28590	(5965)	22625
Liabilities & Equity								
Accounts Payable				3750	2160	5910	(765)	5145
Equity								
- Memorex				13170		13170	(1515)	11655
- Beta					9510	9510	(3685)	5825
Total Liabilities & Equity				16920	11670	28590	(5965)	22625