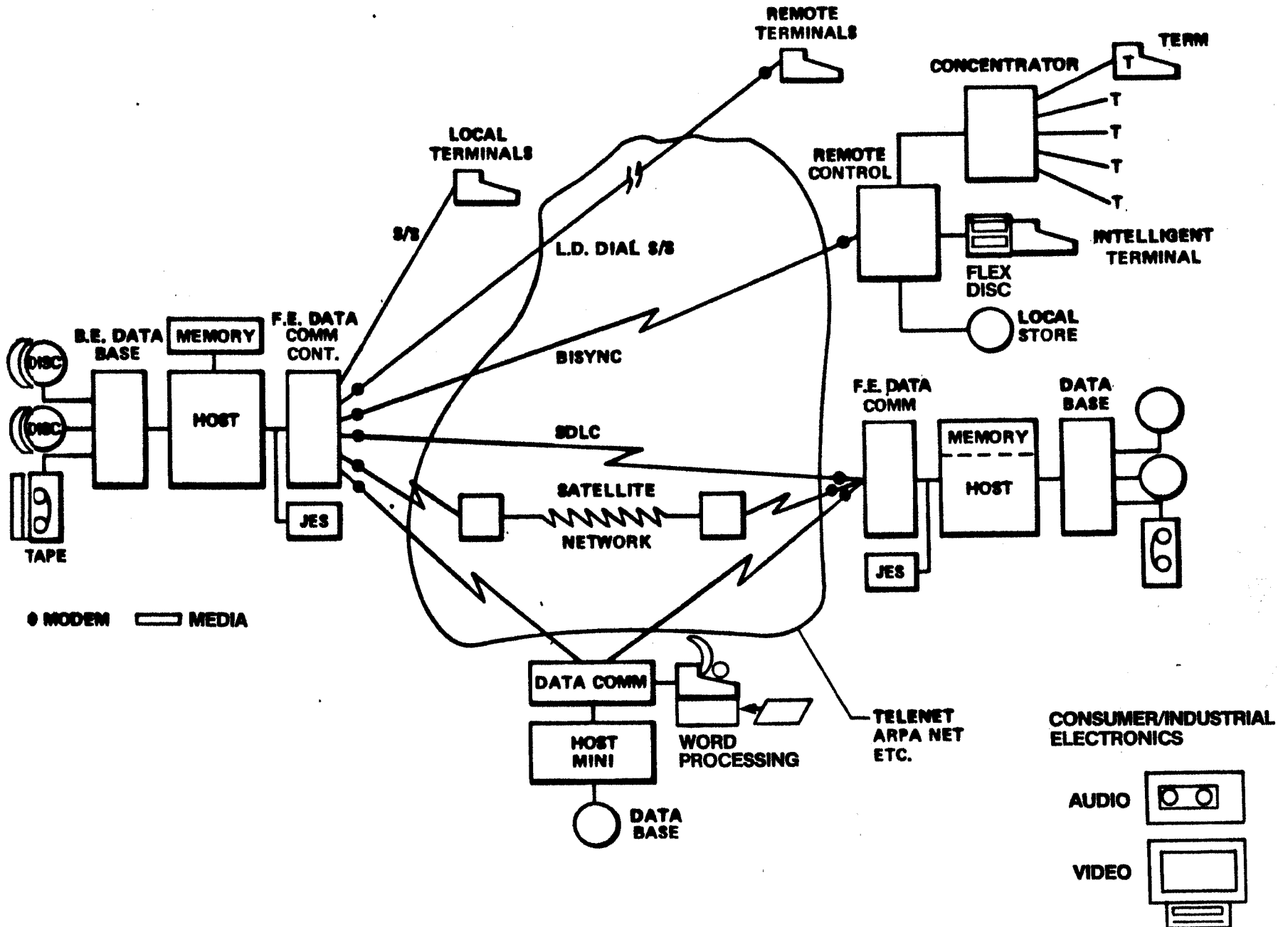


INFORMATION STORAGE TECHNOLOGY

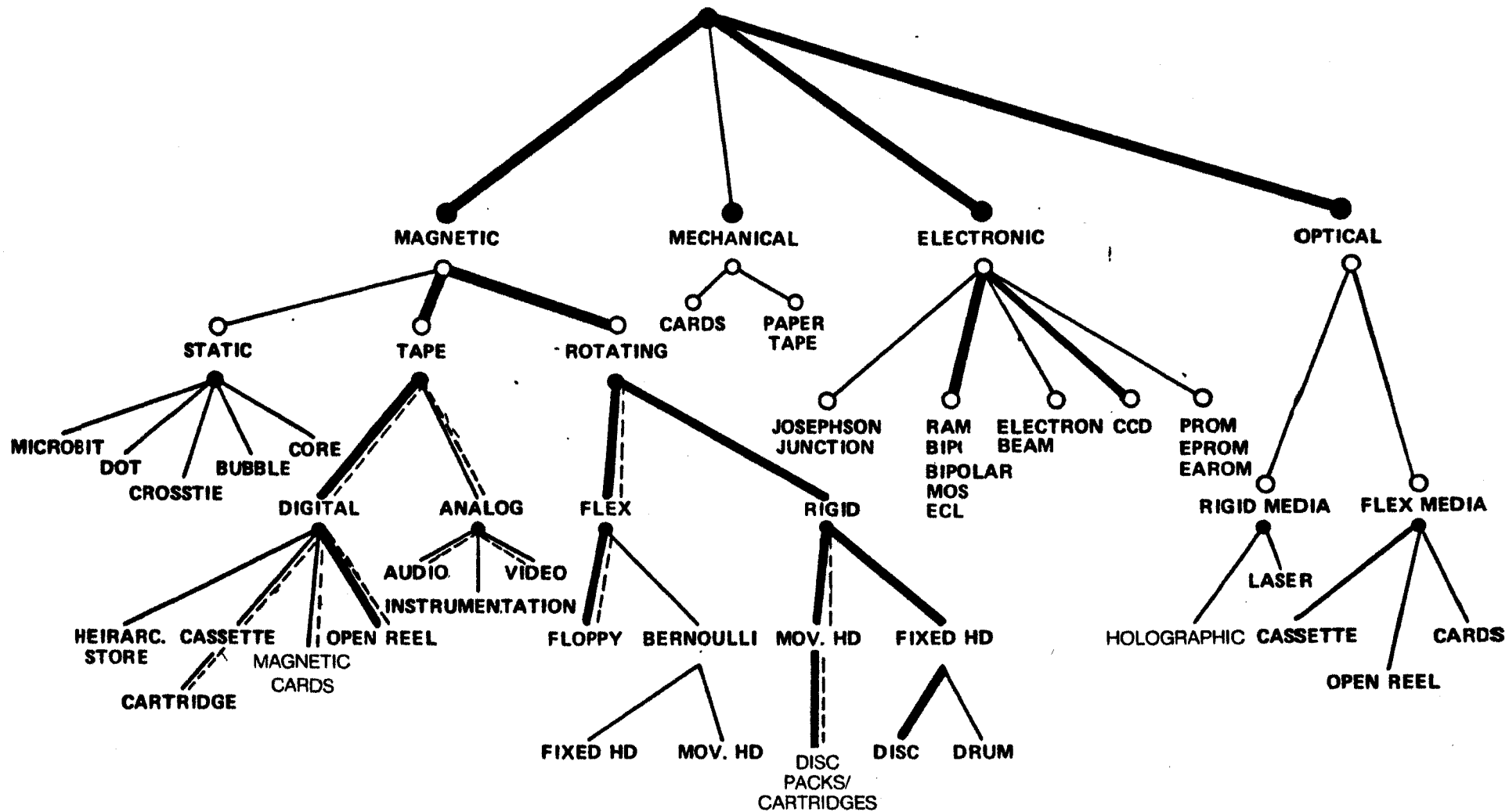
EVOLUTION

Steven H. Puthuff

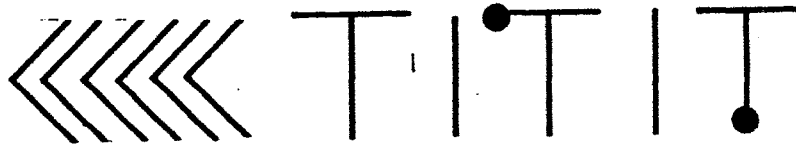
MEMOREX INFORMATION STORAGE AND COMMUNICATIONS



INFORMATION STORAGE TECHNOLOGY



BUBBLE MEMORY TECHNOLOGY



INFORMATION—CYLINDRICAL DOMAINS IN FERRO MAGNETIC FILM
TECHNOLOGIES

- PERMALLOY BAR
- BUBBLE LATTICE
- CONTIGUOUS DISK
- CURRENT ACCESS
- WALL DOMAINS

ADVANTAGES

- NON-VOLATILE
- DENSITY— 1.5×10^7
- FEW PROCESS STEPS
- REMOVABLE MEDIA

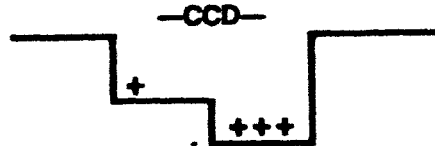
DISADVANTAGE

- SHIFT SPEED—100K—300K BPS

DEVELOPED BY

- | | | |
|-------------------|------------|-----------------|
| • HEWLETT-PACKARD | • TI | • SPERRY/UNIVAC |
| • IBM | • ROCKWELL | • SINGER |
| • AT&T | • INTEL | |
| • BURROUGHS | • NATIONAL | |
| • NEC | • PLESSEY | |
| • PHILIPS | • HITACHI | |
| • SIEMENS | • FUJITSU | |

CHARGE-COUPLED DEVICES



INFORMATION STORED VIA CHARGE
IN POTENTIAL WELL MOS STRUCTURE

ADVANTAGES

- PROVEN TECHNOLOGY
- DATA RATE—5-10 M BPS
- ACCESS TIME—1 MS

DISADVANTAGES

- VOLATILE
- COST

DEVELOPED BY

• PRODUCT

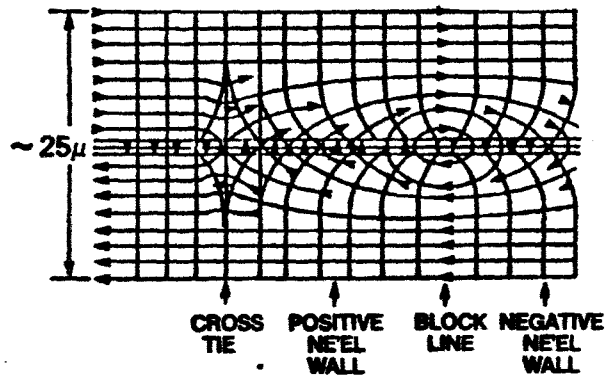
FAIRCHILD
TI
INTEL
NCR
NEC

• LAB ONLY

RCA
IBM
PHILIPS
NATIONAL
TRW

MOTOROLA
TOSHIBA
SONY
MITSUBISHI

CROSSTIE MEMORY



NI-FE THIN FILM—GLASS SUBSTRATE

ADVANTAGES

- NON-VOLATILE
- DATA RATE—20 MB/S
- DENSITY— 10^8 - 10^9 B/IN²
- FEW PROCESS STEPS

DISADVANTAGES

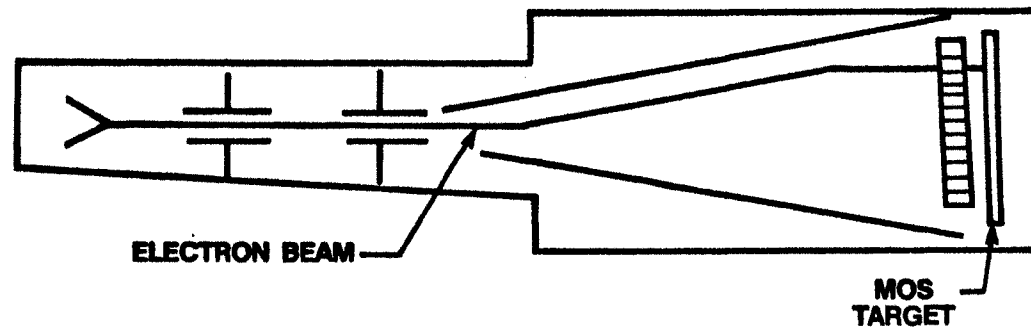
- NEW TECHNOLOGY

DEVELOPMENTS—

- NAVAL ORDINANCE LAB

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ELECTRON BEAM MEMORY



ADVANTAGES

- ACCESS TIME—10 μ S
- NON-VOLATILE
- DENSITY— 8×10^6 B/IN.²
- DATA RATE—10 M BPS

DISADVANTAGES

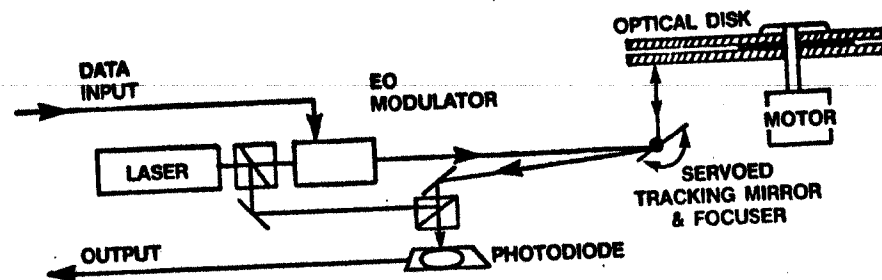
- COMPLEX CONTROL ELECTRONICS
- PRECISION POWER
- DIFF. READ/WRITE RATE
- LIFETIME
- RECIRCULATE MEMORY

DEVELOPED BY

- SRI
- MICROBIT (CDC/EXXON/SPRAGUE/AMDAHL)
- GENERAL ELECTRIC

TECHNOLOGY EVOLUTION AT MEMOREX

OPTICAL DISC STORAGE



ADVANTAGES

- HIGH AREA DENSITY
(1250 MB/SIDE - 12 IN DISC)
- NON-CONTACT RECORDING
- LOW COST POTENTIAL
50 MICROCENT/BIT

DISADVANTAGES

- READ ONLY
- NEW TECHNOLOGY

DEVELOPED BY:

- PHILIPS/MCA
- RCA
- XEROX
- EXXON
- AMPEX
- CORNING GLASS
- OMEX

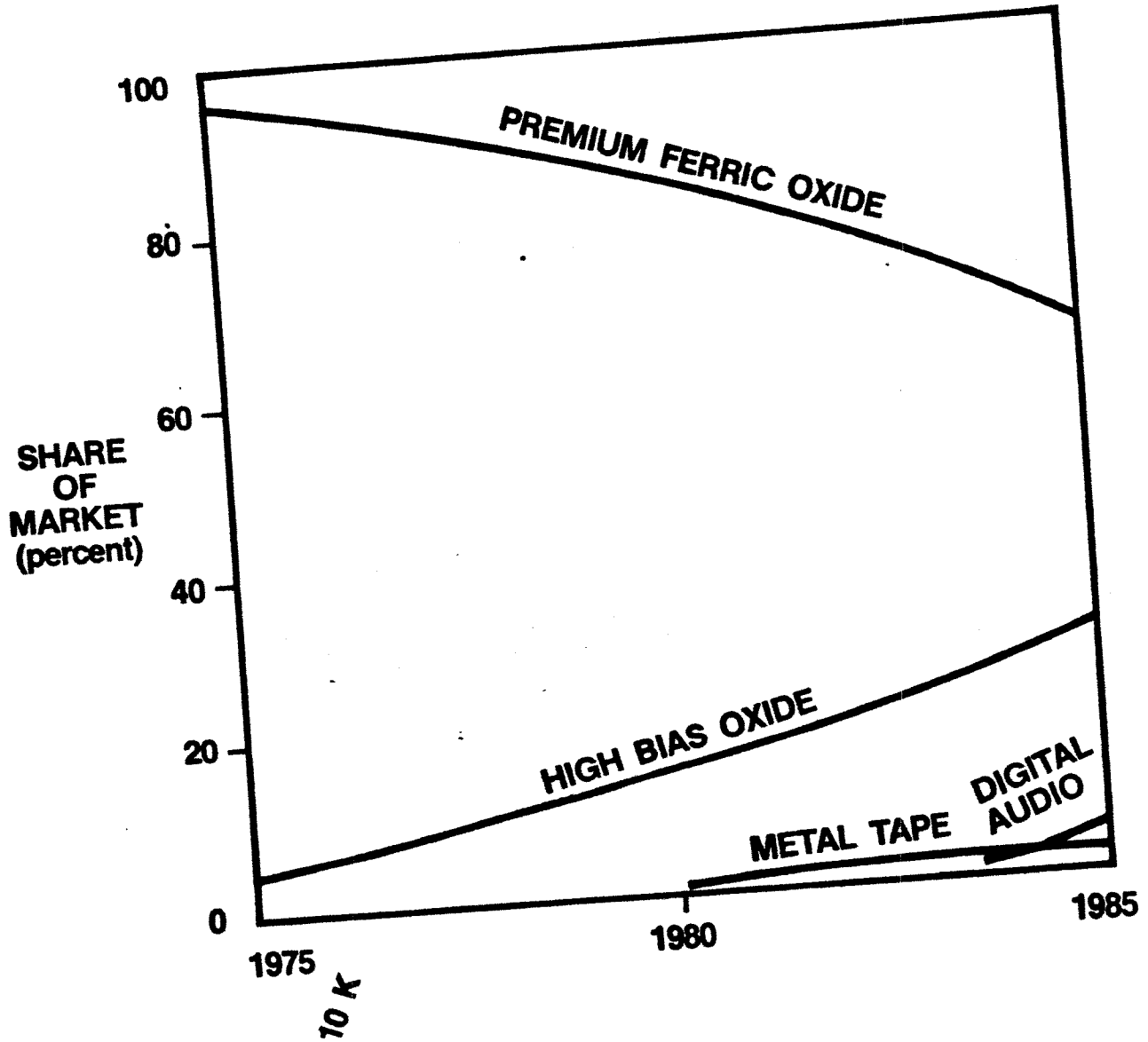
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RANDOM ACCESS MEMORY TECHNOLOGY

TYPE	ACCESS TIMES (NS)	CHIP SIZE	APPLICATION
JOSEPHSON JUNCTION	0.2		MILITARY
ECL	10-30	256B (1977)	BUFFER
TTL	40-100	1K, 4K	BUFFER
N-MOS	50-350C	1K, 4K, 16K	MAIN FRAME
PL	50-100	1K, 4K, 16K	MAIN FRAME
SOS	100	1K	PERIPHERALS
MOS	150-350	4K, 16K	SMALL MAIN FRAME
C-MOS	300-500	1K	SMALL MAIN FRAME
D-MOS	} { 100 NS	65K (1978)	
DOUBLE DIFFUSED MOS			
V-MOS			
V-NOTCH MOS	} { 100-200 NS	262K (1980)	
GTL—GOLD TRANSISTOR LOGIC			
	10NS		

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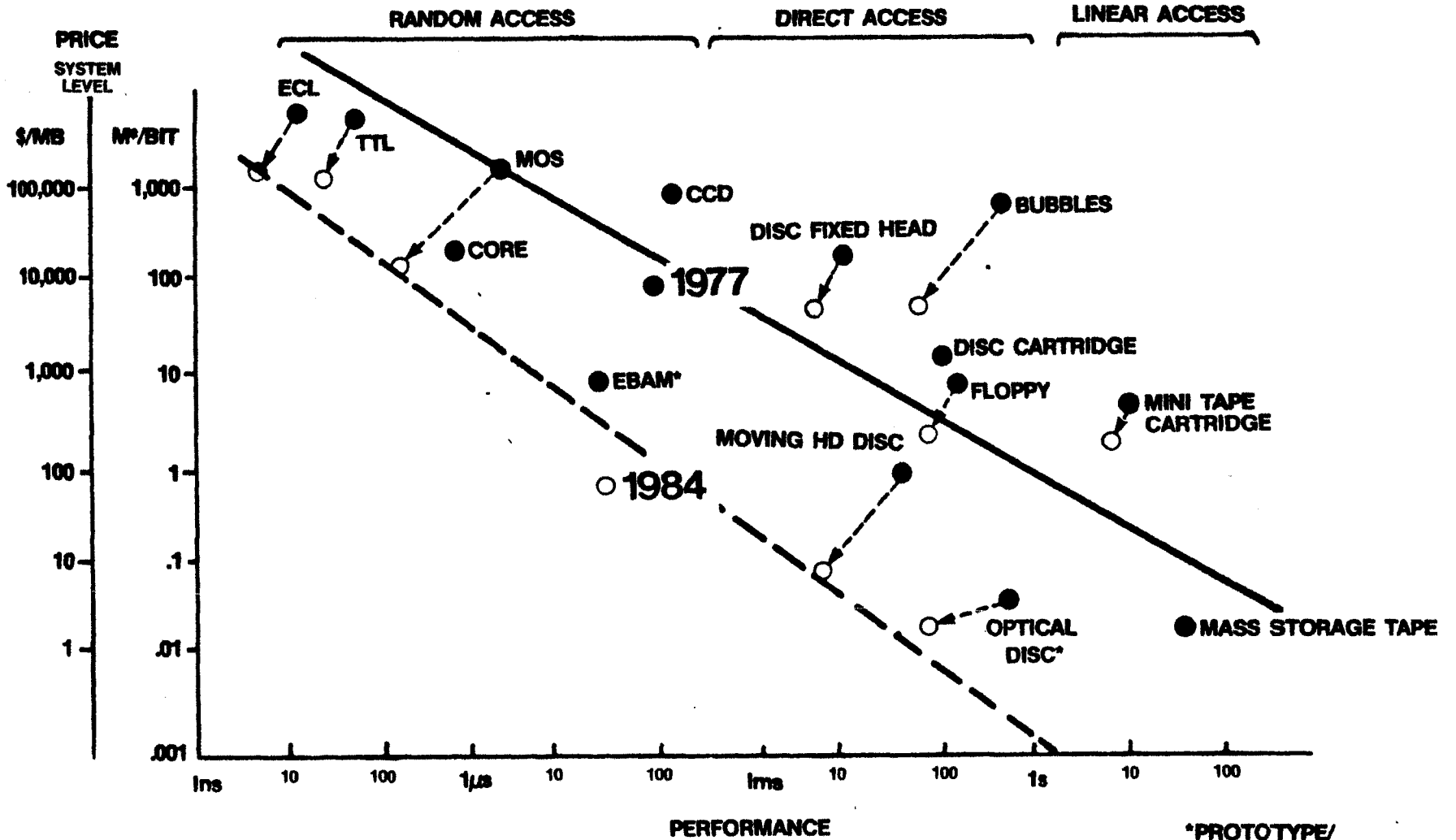
AUDIO TAPE TECHNOLOGIES



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DIGITAL STORAGE TECHNOLOGY

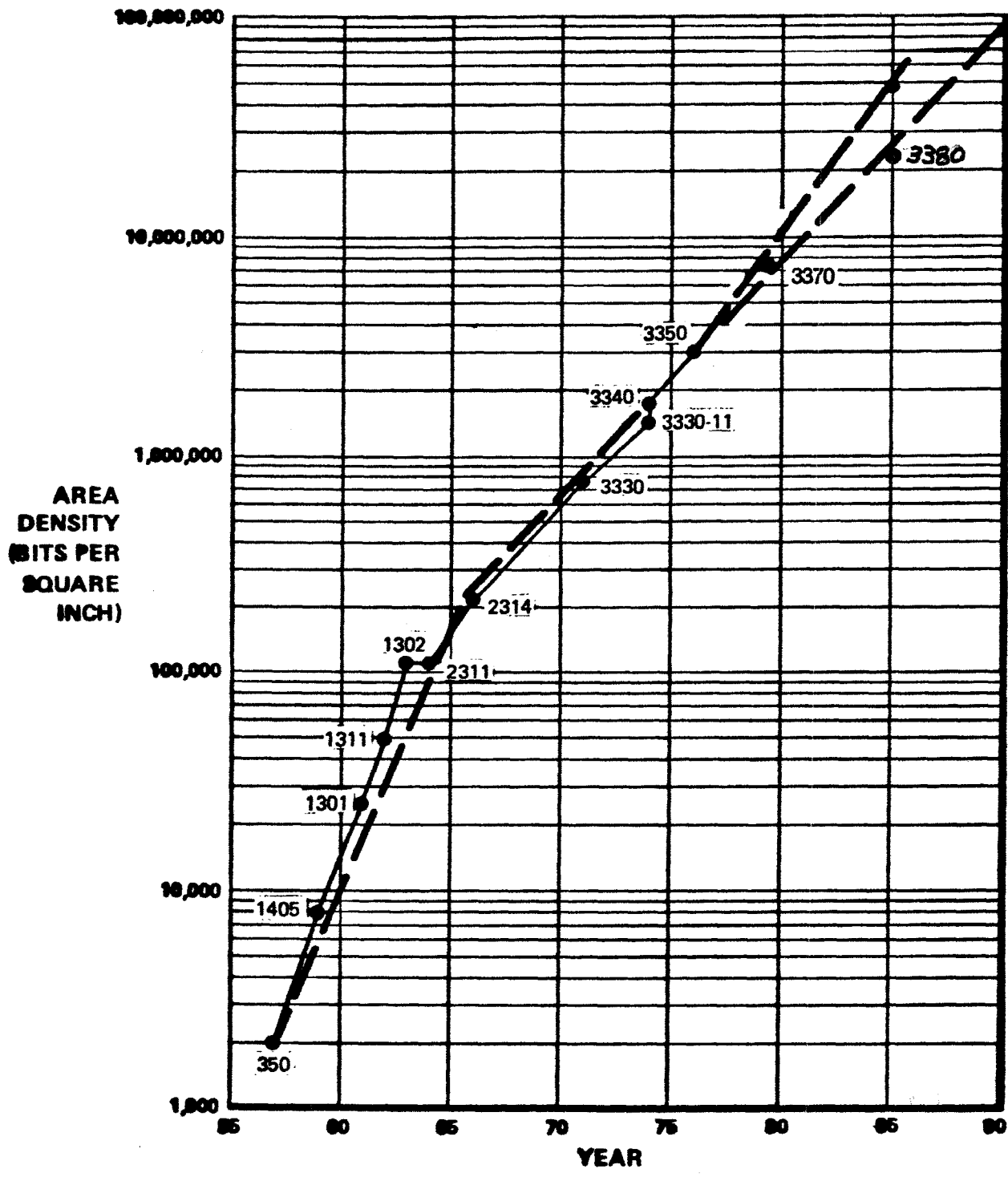
PRICE/PERFORMANCE TRENDS



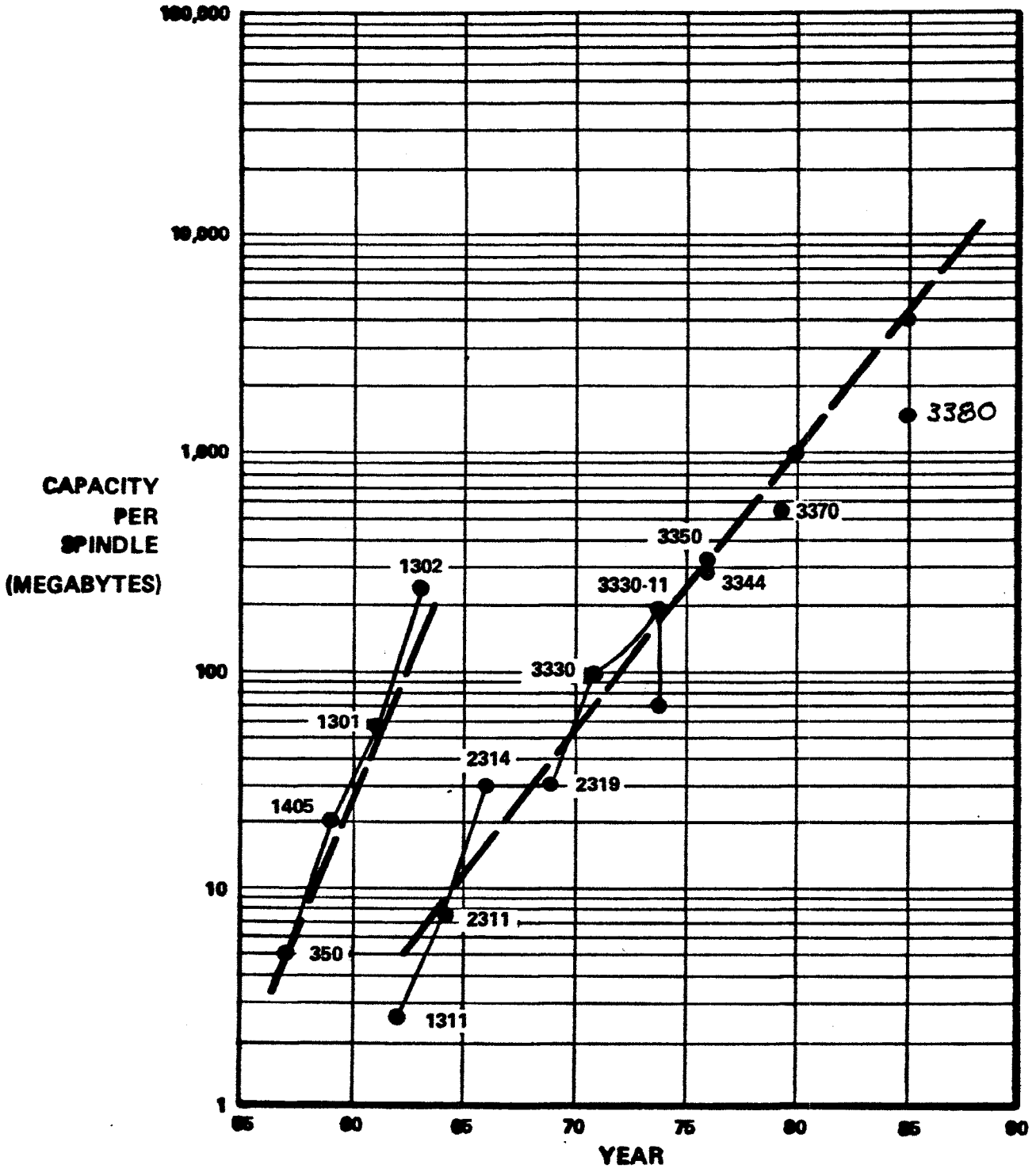
*PROTOTYPE/
EXPERIM. ONLY

EVENT						
DISC FILE	SERVO	CODE	CLOCK METHOD	CORRECT CODE	ERASE ELEMENT	MRX DISC
55						
350	ELECT SERVO	NRZI	CLK TRK	NO	YES	
1405	HYDRAULIC					
60						
1301						
1311						
1302						
2311		FM				630
65						
2314			VFO			630
70						620
3330	V COIL	MFM		ECC	NO	3660
						3670
75						3675
2340						3640
2350						3650
80						
3370	MULTIPLE ACTUATORS	CODE COMPRESSION THIN FILM HEADS	VLSI HIGH SPEED VCO THIN FILM MEDIA	EECC		3652 36XX
85						
90						

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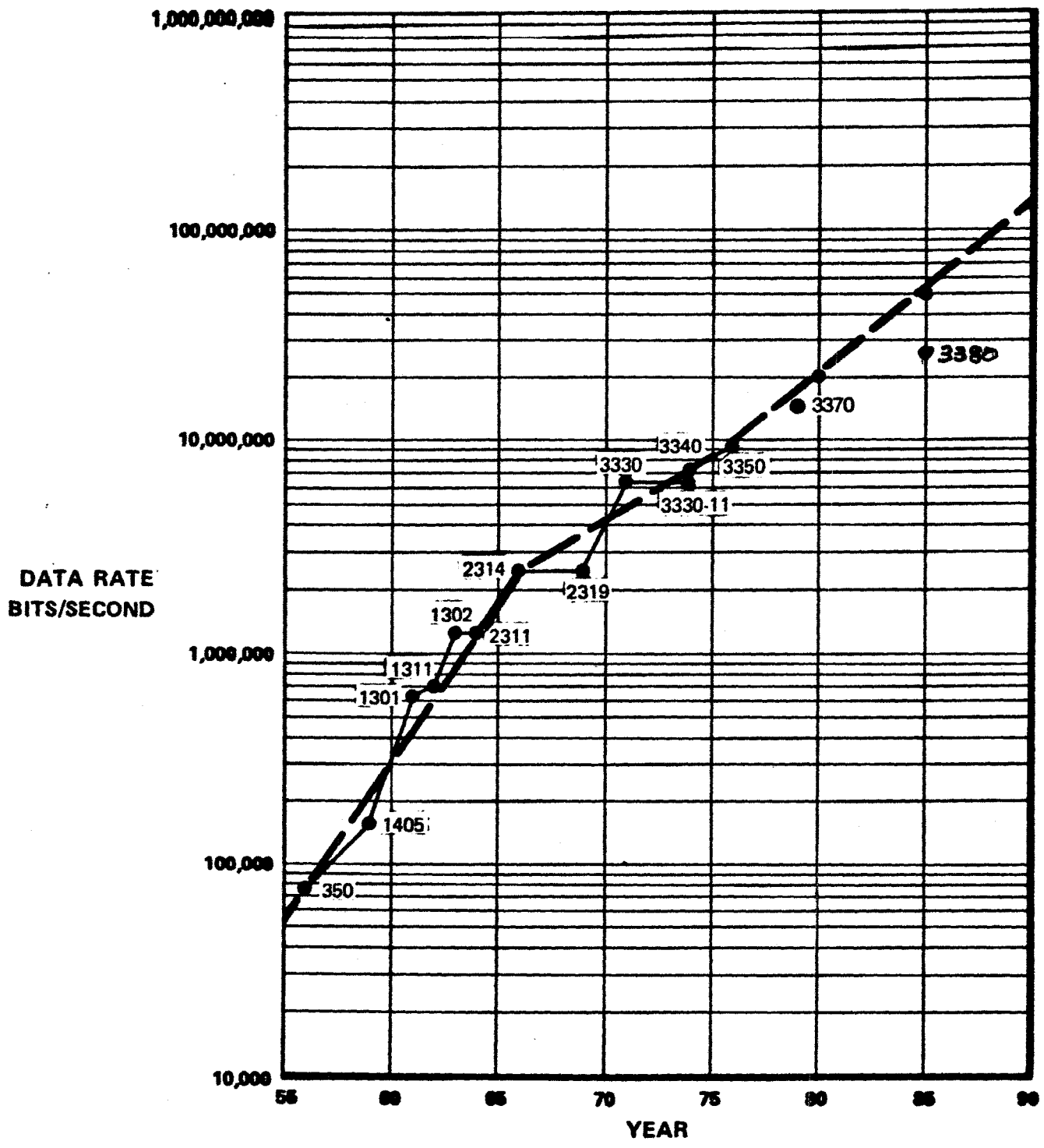


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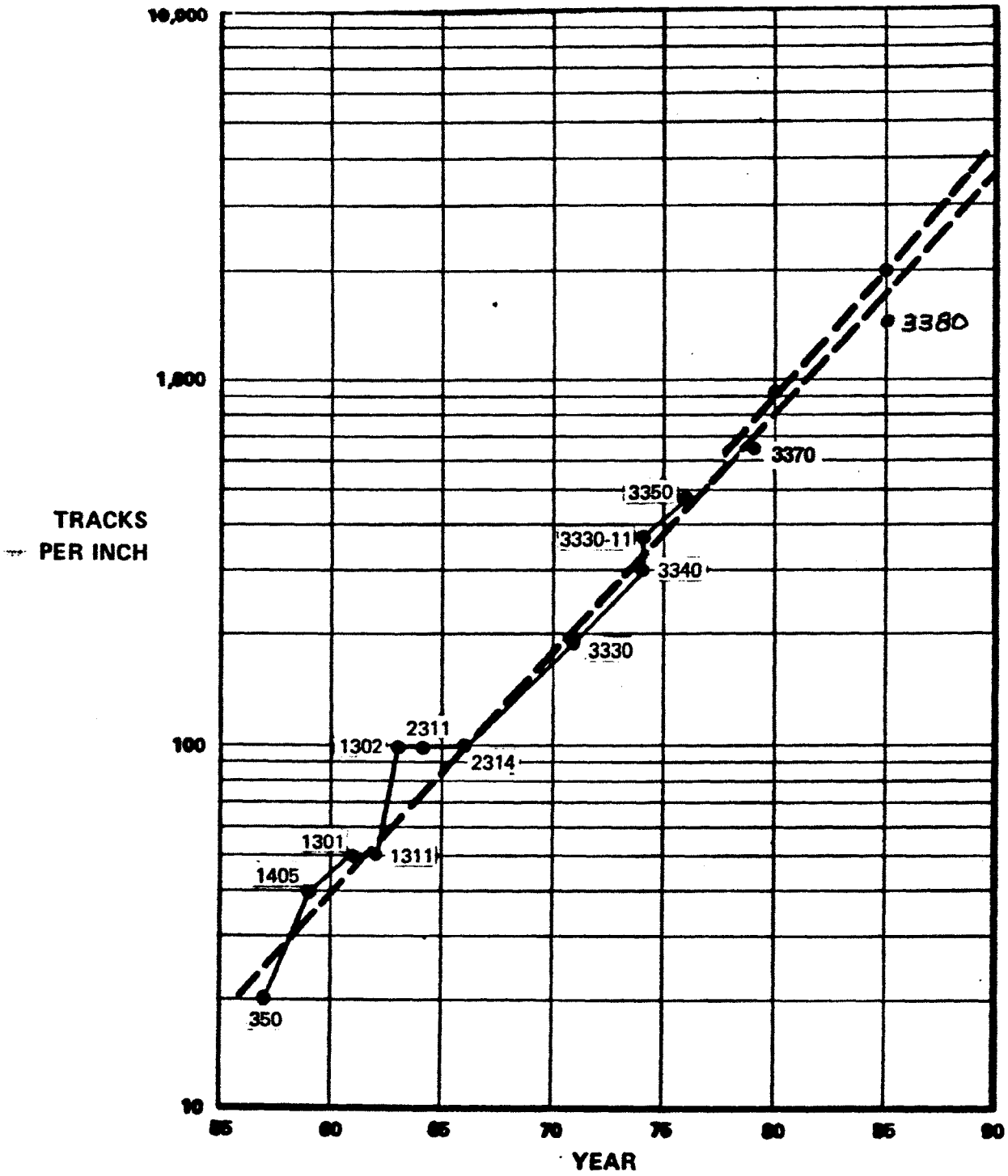


15,000 BPI
1,400 TPI

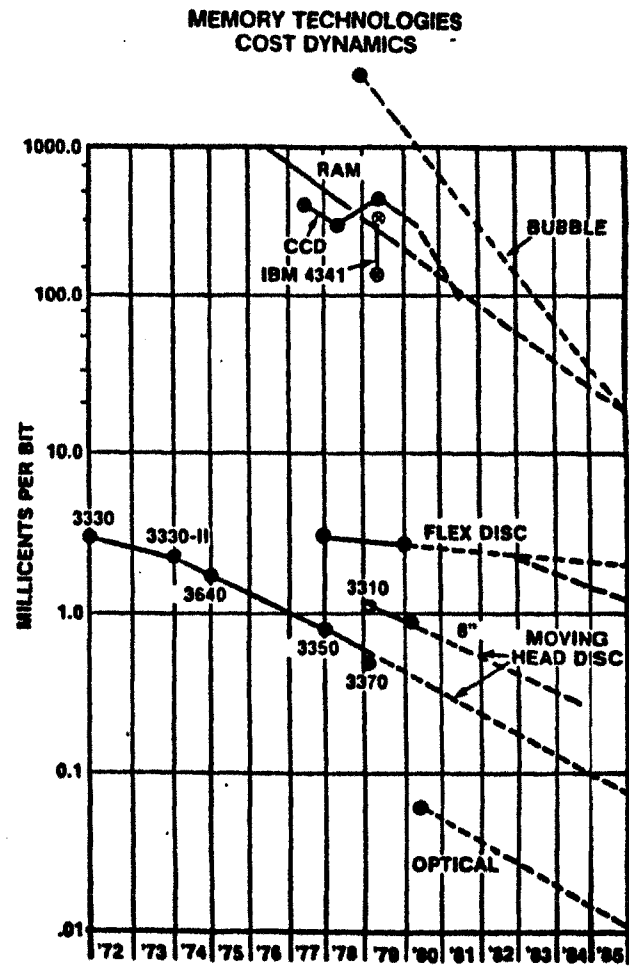
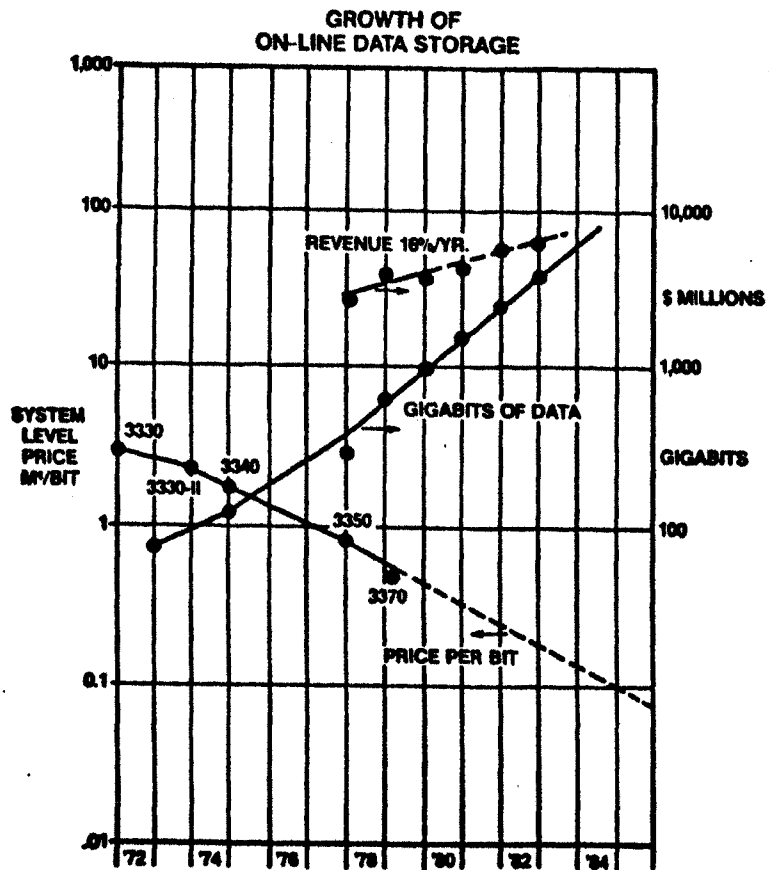
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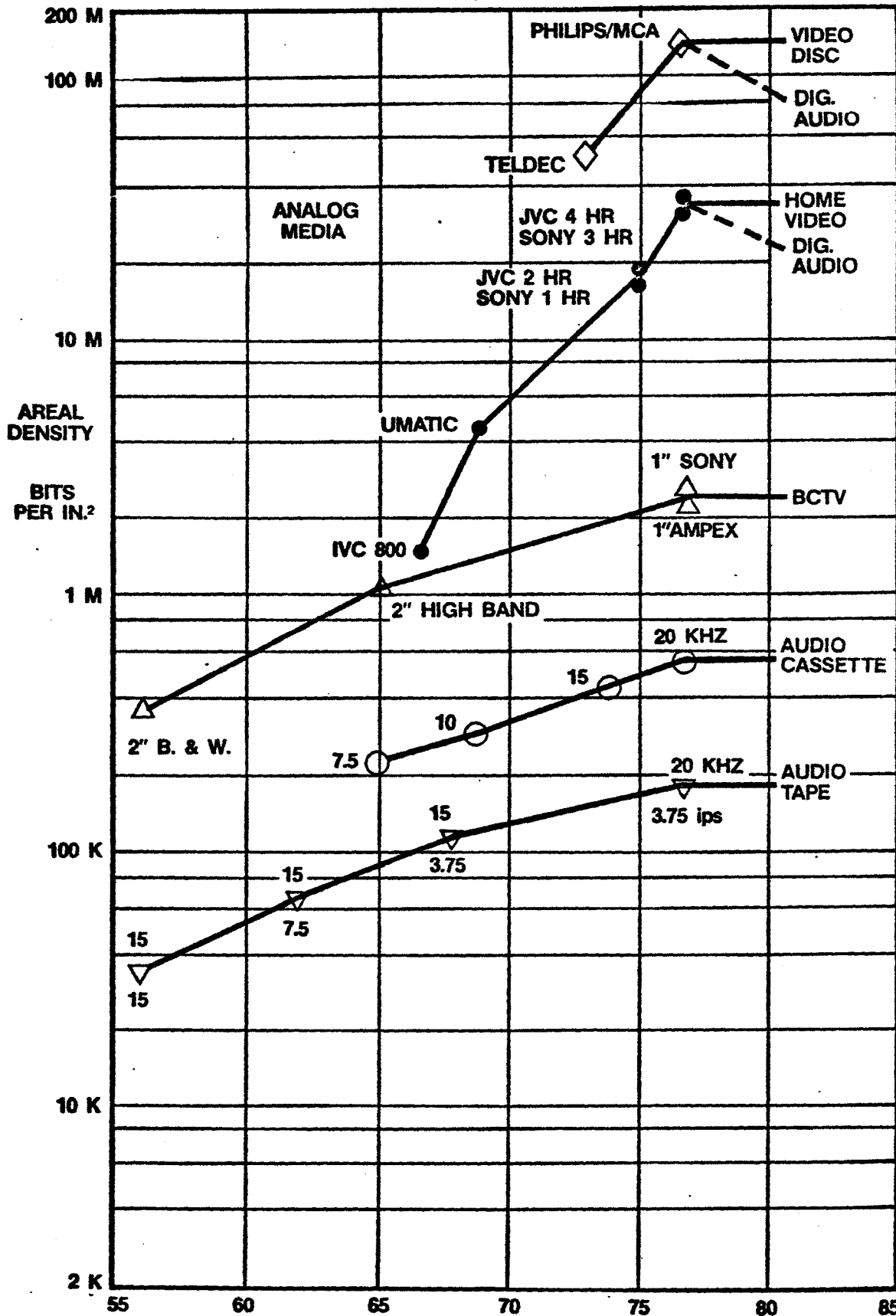


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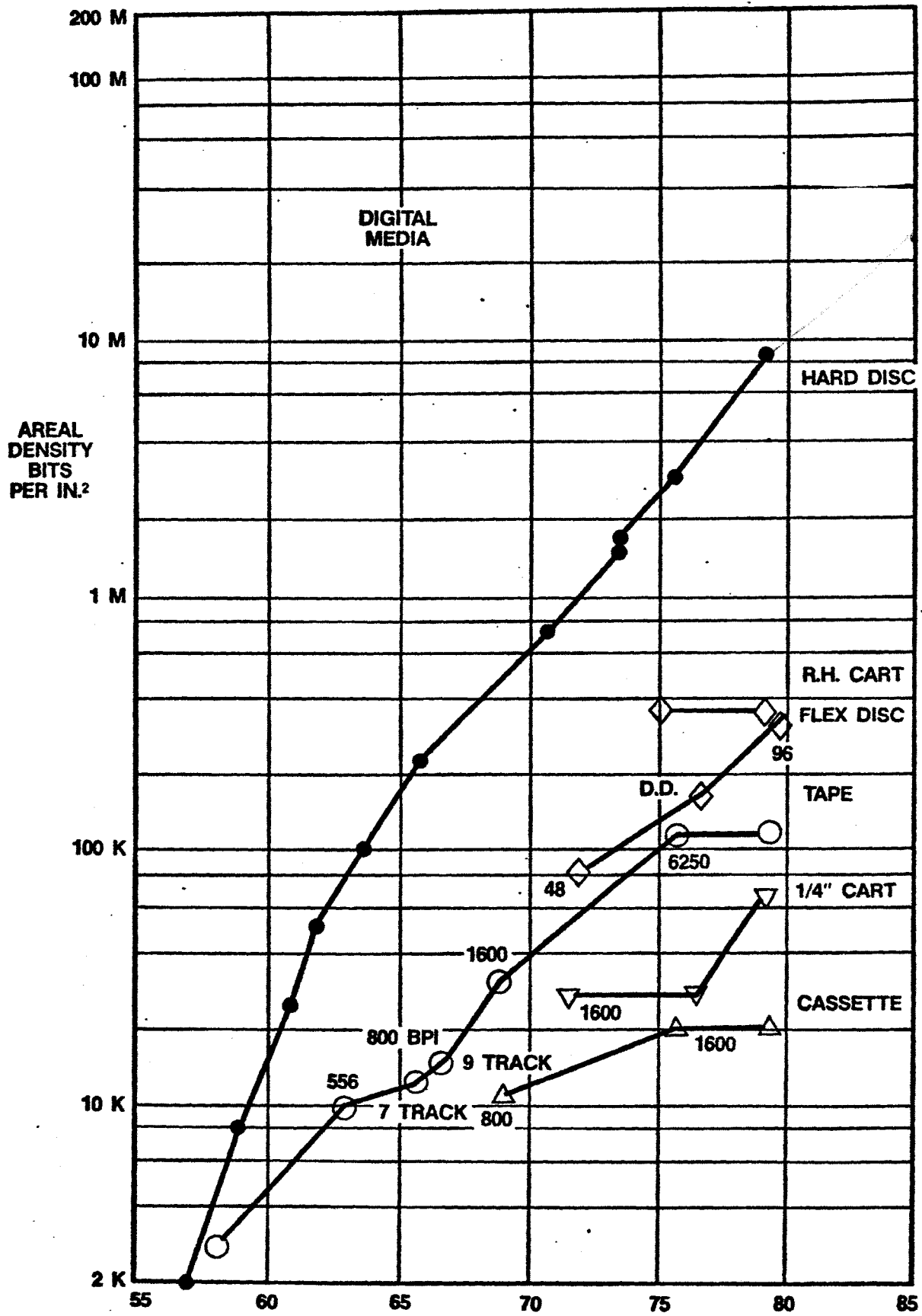
MOVING HEAD DISC TECHNOLOGY PROJECTIONS

	TODAY	1981	1985
BITS PER INCH	6250	12500	25000+
TRACKS PER INCH	480	960	2000+
AREA DENSITY (b/in ²)	3x10 ⁶	1.02x10 ⁷	5x10 ⁷ +
AVG SEEK (ms)	20	8	4
DATA RATE (Mbits/sec)	9.58	20	50
HEAD TRK WIDTH (milli-inch)	1.2m	0.7m	0.3m
COATING THICKNESS (microinch)	35	8	4
CAPACITY/SPINDLE (MByte)	317	1000	4000+
PRICE PER BIT (millicent)	0.828	0.375	0.1

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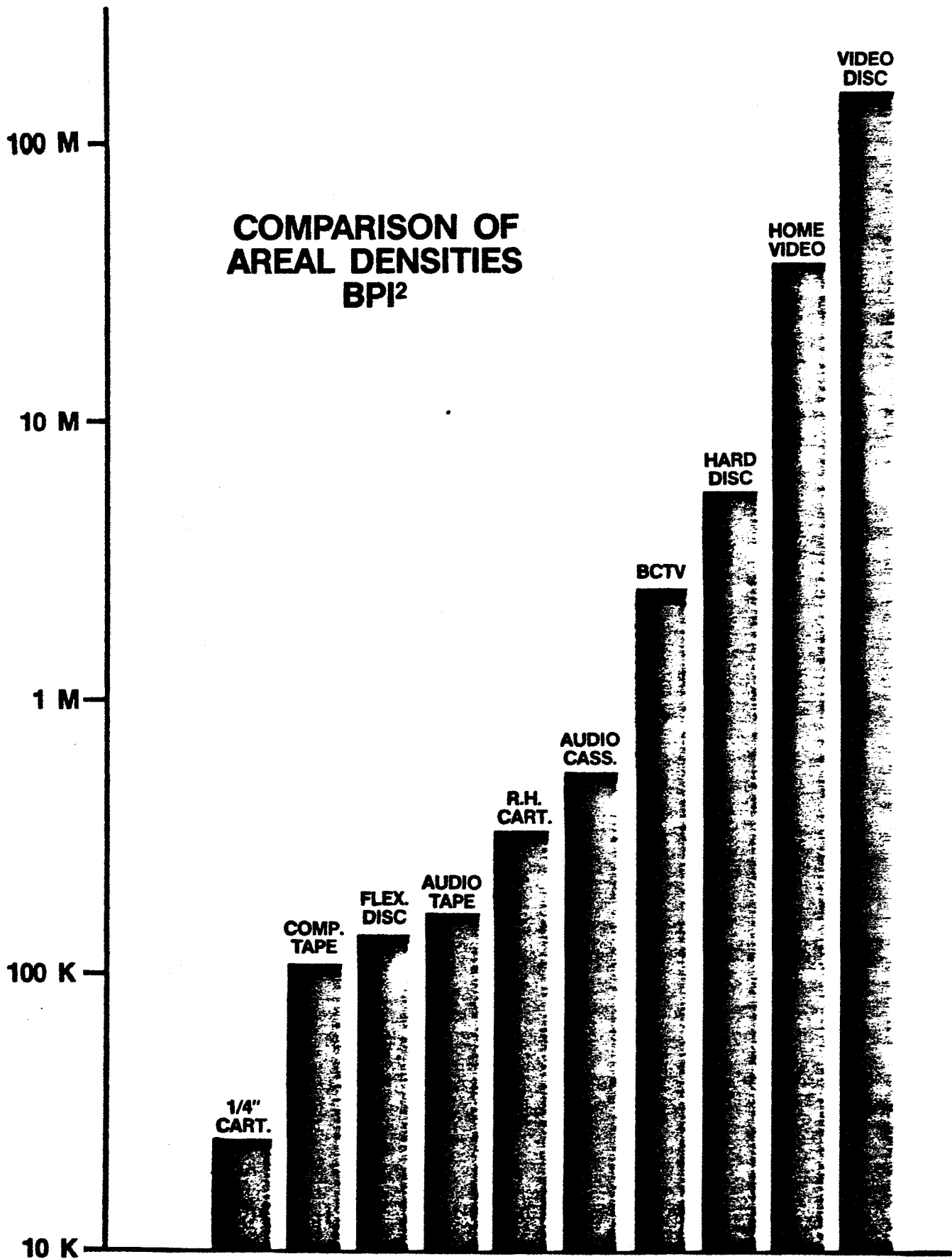


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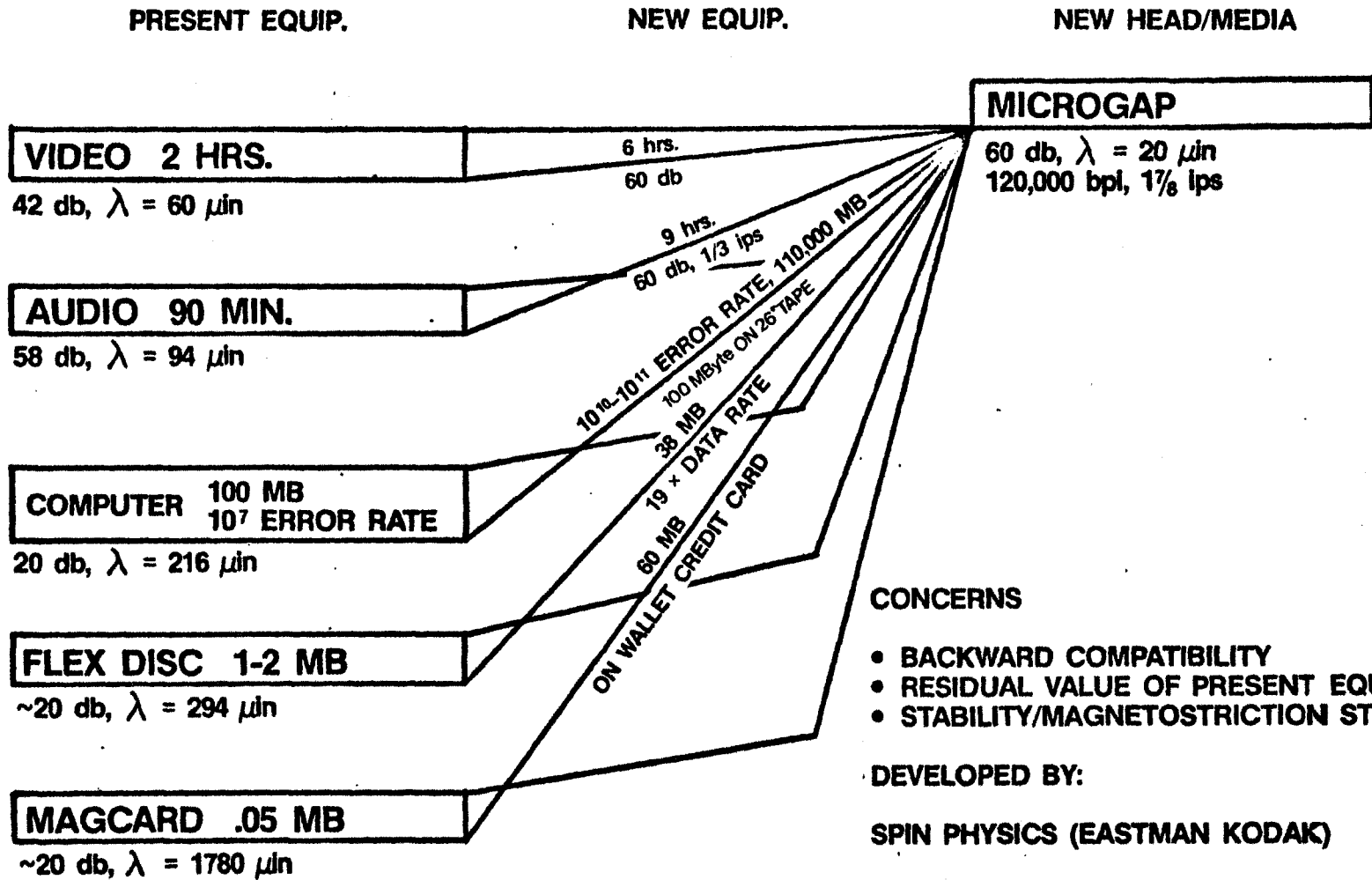
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COMPARISON OF AREAL DENSITIES BPI²



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MICROGAP RECORDING



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