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Division 6 - Lincoln Laboratory

Massachusetts Institute of Technology

Lexington 73, Massachusetts

SUBJECT: DOCUMENTS ON MAGNETIC CORE WORK

To: Group 63 Staff

From: Joan M. Sullivan

Date: July 16, 1956

Approved: Milliam N. Papian

To Group 63 Staff

Approved: FROM

William N. Papian

Abstract: A partial list of Reports, Theses, Engineering Notes, Articles, and Memoranda on various aspects of the magnetic-core activity is presented.

	Title	Date	Author
Reports			
6R-187	Digital Information Storage in Three Dimensions Using Magnetic Cores	5-16 <b>-</b> 50	J. W. Forrester
6R-192	A Coincident-Current Magnetic Memory Unit (S.M. Thesis)	9-8-50	W. N. Papian
6R-211	A Magnetic Matrix Switch and Its Incorporation Into a Coincident- Current Memory (S.M. Thesis)	6-6-52	K. H. Olsen
6R-216	The 16-by-16 Metallic-Core Memory Array Mclel I	9-25-52	B. Widrow
6R-217	Design of Low-Power Pulse Trans- formers Using Ferrite Cores (S.M. Thesis)	8-29-52	R. D. Robinson
6R-234	Switch for Register Selection in a Magnetic Core Memory (S.M. Thesis)	5-24-54	J. I. Raffel
6R-235	Multi-Coordinate Selection Systems for Magnetic-Core Storage (S.M. Thesis)	8-23-54	R. S. DiNolfo

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Reports	(continued)		
6R-236	Magnetostriction in Ferrites Possing a Square Hysteresis Loop (S.M. Thesis)	1-17-55	P. K. Baltzer

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	Title	Date	Author
Theses	(not in report form)		
	A Magnetic Flip-Flop	5-16-52	R. J. Pfaff
	An Investigation of Magnetic Core Stepping Registers for Digital Computers	8-22-52	R. C. Sims
	Rectangular Hysteresis Loop Materials in a Nondestructive Read System	5 <b>-2</b> 5-53	W. I. Frank
	An RF Readout System for a Coin- cident-Current Magnetic-Core Memory	5-25-53	B. Widrow
	High-Speed Magnetic Pulse Control Circuits for Computer Applications	5-25-53	H. K. Rising
e	Magnetic Amplifiers with High Carrier Frequency	5-25-53	A. L. Pugh, III
	A Study of Single-Pulse Ferrite- Core Stepping Registers	8-31-53	J. B. Ricketts, Jr.
	Temperature Behavior of Ferrites	1-18-54	L. F. Silva
	A Differential Thermal Analysis Study of Synthesized Magnesium Ferrite, Manganese Ferrite, and		*
	Magnesium-Manganese Ferrite	1-18-54	R. A. Maglio
	A Carry-Matrix Counter	5-24-54	G. Lampke
	Transformer Drive for a Coincident- Current Magnetic Memory	8-23-54	E. K. Gates
	Magnetic Drum Writing Circuits Using Magnetic Cores	8-23-54	H. Henegar
	The Incorporation of a Magnetic Matrix Switch into a Multiplanar Coincident-Current Magnetic Memory	8-23-54	A. Hughes
	A Magnetic-Core Memory with External Selection	1-17-55	S. Bradspies

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Theses	(continued)		
	A Transistorized Amplifier-		¥
	Discrimingator for Core Memory Output	5-23-55	F. W. Sarles, Jr.
	A Transistor Selection System		
	for A Magnetic-Core Memory	1-56	G. A. Davidson
	The Application of Transistors to		
	Multiposition Selection Switches	5-24-56	P. G. Griffith
	A Magnetic-Core Test Storage	6-19-56	J. N. Ackley

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Engineering	Notes		
6E-406	Preliminary Tests on the Four-Core Magnetic Memory Array	6-18-51	W. N. Papian
6E-413	Selection Systems for Magnetic-Core Storage	8-7-51	R. R. Everett
6E-422	Rectangular-Loop Magnetic Core Materials	9-4-51	W. N. Papian
6E-438	Binary Counting with Magnetic Cores	12-6-51	D. A. Buck
6E-454-1	Nondestructive Sensing of Magnetic Cores	3-24-53	D. A. Buck
6E-464	A Squareness Ratio for Coincident- Current Memory Cores	7-16-52	D. R. Brown
6 <b>E-</b> 470	Paper on Ferromagnetic and Ferro- electric Memory Devices	8-6-52	W. N. Papian
6E-472	The Mirror: A Proposed Simplified Symbol for Magnetic Circuits	8-14-52	R. P. Mayer
6E-475	A Magnetic-Core Gate and Its Application in a Stepping Register	10-30-52	G. R. Briggs
6E-477	Magnetic and Dielectric Amplifiers	8-28-52	D. A. Buck
6E-488	Delta in Ceramic Array #1	10-14-52	E. A. Guditz
6E-491	Hysteresis Loop Characteristics of MF-1118 for Different Temperatures	10-16-52	C. Morrison
<b>6E-</b> 495	Test Procedure for Ferrite Pulse Transformers, I	11-5-52	E. K. Gates
6E-496	Instructions and Specifications for the Manufacture of 3:1 and 1:1, 0.1 Microsecond Pulse Transformers on Ferrite-Ring Cores	11-3-52	R. E. Hunt
6 <b>E-</b> 500	Switch Core Analysis I	11-4-52	A. Katz E. A. Guditz
6E-512	A Method for Acceptance Testing of Ferrite Core Production Lots	12-4-52	P. K. Baltzer

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Engineering	Notes (continued)		
<b>6E−</b> 518	New Metallic Cores from Magnetic Metals	1-2-53	A. D. Hughes
6E-519	General Ceramics Materials MF-1348B and MF-1359B	1-5-53	B. Smulowicz
6E-523	Core DriversModel V and VI	2-10-53	H. Boyd
6E-529	Matrix Driving with Unidirectional Pulses	2-25-53	D. A. Buck
6E-530	Magnetic Materials for High-Speed Pulse Circuits	2-27-53	D. R. Brown
6E-531	Driving Current Margins on Memory Test Setup I	3-6-53	S. Fine
<b>6E</b> −532	Nucleation of Domains of Reverse Magnetization & Switching Character- istics of Magnetic Materials	3-9-53	J. B. Goodenough N. Menyuk
<b>6E-</b> 533	Effect of Current Pulse Duration on the Pulse Response of MTC Memory Cores	3-10-53	P. K. Baltzer
<b>6E-</b> 539	An Approach to a Rationale in Fer- rite Synthesis: Evaluation of Magnetic Moments	4-28-53	L. Gold
6 <b>E</b> -540	A Fast-Core Tube Register	4-27-53	K. H. Olsen R. Pfaff
6 <b>E</b> -544	Circuit for Measuring Switch Time, Rise Time, etc., (Switch-Time Comparator)	5-11-53	B. Gurley
6 <b>E</b> -545	Dependence of Coercivity and Stress Hysteresis on Nucleation of Domains of Reverse Magnetization	5-14-53	J. B. Goodenough
6 <b>E-</b> 548	Preliminary ReportTemperature Effects in MTC-type Ferrite Cores	6-26-53	J. D. Childress
6E-559	A Free Energy Model for the Hysteresis Loop	6-16-53	A. L. Loeb

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Engineering	Notes (continued)		
<b>6E−</b> 563	Specifications for a Ferrite Memory Core	6-30-53	D. R. Brown

Note: This series discontinued under date of July 28, 1954.

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	Title	Date	Author
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6 <b>M-</b> 1371	Magnetic Core Activity	1-15-52	W. N. Papian
6M-1381	Magnetic-Core Memory Matrix Analysis (Effect of Driver Impedance)	1-24-52	D. A. Buck
6 <b>M-149</b> 0	Procedure for Receiving Magnetic Cores	5-16-52	D. R. Brown
6M-1529	Conference on Magnetic Core Switching Phenomena	6-16-52	A. Katz
6M-1582	High-Speed Magnetic Pulse Control Circuits for Computers (Thesis Proposal)	8-6-52	H. K. Rising
6 <b>M-1</b> 650	The Effect of Size of Metal Cores on Pulse and Hysteresis Measurements	9-25-52	R. F. Jenney
6M-1664	Conference on Thin Evaporated Metal Films	10-6-52	A. L. Loeb
6 <b>M-1</b> 676	Polishing Specimens of Ferrites	10-14-52	F. E. Vinal
6M-1681	Uniformity Tests on Ferrite Cores	10-21-52	J. H. McCusker
6M-1741	Metallographic Studies of Ferrites	12-4-52	D. R. Brown
6M-1767	An RF Readout System for a Coinciden Current Magnetic-Core Memory (Thesis Proposal)		B. Widrow
6 <b>M-</b> 1785	Testing of Magnetic Cores	1-7-53	A. D. Hughes
6M-1806	Pulse Tests of the RCA Victor Ferrite, XF-96	1-22-53	B. Smulowicz
6M-1811	Coordinate Conversion with Memory-Core Matrix	1-27-53	D. McCann
6M-1830	MF-1326-B, F-291, Life Test No. 1 Initial Tests	2-6-53	J. R. Freeman
6M-1883	Magnetic-Core Matrix Switch Adder	3 <b>-9-</b> 53	C. J. Schultz
6M-1893	Hysteresis Test Results from Five New Glenco Ferroelectric Materials	3-10-53	C. D. Morrison

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Memoranda	(continued)		Fig. 1
6 <b>m-</b> 1929	AD HOC Conference on FeNi	3-25-53	D. A. Buck J. B. Goodenough
		ř	A. L. Loeb N. Menyuk
6 <b>M-</b> 1943	Testing Cores for WWII	3-30-53	J. McCusker
6 <b>M-</b> 1957	Procedure for Preparing and Strip- ping Wires for MTC Memory Planes	4-6-53	E. A. Guditz
6 <b>м-</b> 1987	First Note on Pulse Transformers for Memory Drivers	5-27-53	F. Durgin E. K. Gates
6 <b>M-</b> 1989	MF-1326-B, F-291, Life Test No. 2	4-21-53	J. R. Freeman
6 <b>M-</b> 2110	A Linear Selection Magnetic Memory Using an Anti-Coincident Current Switch	5-8-53	K. H. Olsen
6M-2160	Energy Dissipation in Square+Loop Ferromagnetic Materials with Specifi Application to Switch Cores	e 5-12-53	N. Menyuk
6 <b>M-</b> 2162	WWI Address Selection Systems, P.B. No. 61	5-6-53	J. L. Mitchell
6 <b>M-</b> 2167	First-Order Cancellation Residue in Rectangular Memory Arrays	5-15-53	D. A. Buck
6 <b>M-</b> 2186	Two Methods of Reducing Delta Noise	5 <b>-2</b> 2-53	S. Fine
6 <b>M-</b> 2195	Further Work on Nondestructive Read System	5-27-53	W. I. Frank
6M-2197	Read-Out and Digit Plane Driving Systems, P.B. No. 62	5-28-53	W. J. Canty S. Fine
6 <b>M-</b> 2219	Testing of Individual Cores in MTC Memory Planes	6-16-53	A. D. Hughes
6 <b>M-222</b> 5	The Construction of Memory Planes for the MTC Memory	6-10-53	E. A. Guditz
6 <b>M-</b> 2240	A Magnetic Core Test Storage	6-15-53	K. Olsen

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6 <b>M-</b> 2248	Tests of Some Magnetic-Matrix Switch Operating Modes	6-17-53	J. L. Mitchell R. S. DiNolfo
6M-2254	Sensing the Slope of Magnetic Memory Output	6-19-53	K. H. Olsen
6 <b>M-22</b> 75	Equation of Motion for a Cylin- drical 180° Domain Wall	7-30-53	P. K. Baltzer
6 <b>M-</b> 2291	Proposal for Reducing the Number of Tubes Used in Driving a Magnetic Matrix Switch	7-9-53	J. I. Raffel
6 <b>M-</b> 2314	Readout-Noise Reduction in a Magnetic-Core Memory	7-23-53	S. Fine
6 <b>M-</b> 2316	Proposed Sense Winding for a 64 x 64 Memory Plane	7-23-53	W. J. Canty
6 <b>M-</b> 2319	Procedure for Handling Cores During Testing Program	7-23-53	W. J. Schallerer
6M-2348	Switch-Core Design and Power Loss	8-7-53	J. I. Raffel
6M-2351	Sensing Winding Geometry	8-6-53	J. I. Raffel S. Bradspies
6 <b>M-2</b> 383	Testing the Magnetic-Core Memory System in a Computer	9-18-53	B. Widrow
6 <b>M-2</b> 384	A Large Planar Switch for Register Selection in a Magnetic-Core Memory (Thesis Proposel)	8-31-53	J. I. Raffel
6 <b>M-</b> 2412	An Analytical Review of Neel's Molecular Field Theory of Ferri- and Ferromagnetism	9-16-53	A. L. Loeb
6 <b>M-</b> 2420	Interpretation of Memory-Core Specifications	9-22-53	D. R. Brown
6M-2442	Ferrite Synthesis	9 <b>-15-</b> 53	F. E. Vinal
6M-2473	B-H Loop Squareness in the Magnesium-Manganese Ferrites	10-22-53	J. B. Goodenough

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6 <b>M-</b> 2474	A Theory of Ionic Ordering, Tetragons Phase Formation, Magnetic Exchange, and Lamellar Precipitation Due to Covalent Forces in Spinels	5-7-54	J. B. Goodenough A. L. Loeb
6 <b>M-</b> 2514	The Incorporation of a Magnetic Matrix Switch into a Multiplanar Coincident-Current Magnetic Memory (Thesis Proposal)	11-12-53	A. D. Hughes
6 <b>M-</b> 2568-1	Pulse Response of Ferrite Memory Cores	9-20-54	J. R. Freeman
6 <b>M-</b> 2598	Transformer Drive for a Coincident- Current Magnetic Memory (Thesis Proposal)	1-5-54	E. K. Gates
6 <b>M-</b> 2602	Stress Effects in Ferrites and Generalization of Switching Coefficient for Non-Square Materials	1-6-54	N. Menyuk
<b>6M-</b> 2634	Multi-Coordinate Selection Systems for Magnetic-Core Storage	1-19-54	R. S. DiNolfo
6 <b>M</b> -2649	Graphical Summary of Core Data in the MgO-Fe <sub>2</sub> 0 <sub>3</sub> -MnO System	1-25-54	J. B. Goodenough
6 <b>M-</b> 2674	A Comparison Between Square-Loop Metals and Ferrites for High-Speed Pulsed Operation	2-4-54	D. R. Brown D. A. Buck N. Menyuk
6 <b>M-</b> 2692	Ferrite Synthesis, II	2-11-54	F. E. Vinal
6 <b>M-</b> 2736	Core Memory Using External Bit Selection	3-18-54	J. I. Raffel
6 <b>M-</b> 2755	Core DriversModel V and Model VI Applications, Limitations, and Modifications	5-1-54	J. D. Childress
6 <b>M-</b> 2762	A Magnetic-Core Memory with External Selection (Thesis Proposal)	4-6-54	S. Bradspies

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6M-2803	Magnetic-Core Shift Register Evaluator	5-3-54	C. J. Schultz
6 <b>M-</b> 2804	Effects of Tape Thickness and Tem- perature on Flux Reversal of 4-79 Molybdenum Permalloy	5-3-54	N. Menyuk
6M-2839	One One or the Other	5-28-54	R. P. Mayer W. N. Papian
6 <b>M-</b> 2840	Test Results on the DCL Memory Plane	5-28-54	E. A. Guditz
6M-2873	Basis for Release of Ferrite Memory Core Specifications	6-17-54	D. R. Brown
6M-2880	Evaluation of Ferroxcube Cores	6-28-54	P. A. Fergus
6M-2919	Sensing Winding Geometry and Information Patterns	7-22-54	J. I. Raffel
6 <b>M-</b> 2943	X-Ray Equipment for Magnetic Research	7-29-54	D. Tuomi F. E. Vinal
6 <b>M-</b> 2945	Current Calibrator (Chopper Model)	8-10-54	J. D. Childress
6 <b>M-</b> 2969	Tentative Cathode Estimates for $256^2 \times 33$ and $128^2 \times 33$ Core Memories	8-6-54	W. J. Canty J. L. Mitchell
6 <b>M-</b> 3005	Bondeze Magnetic Wire for Memory Plane Construction	8-27-54	A. Bowen E. A. Guditz
6 <b>M-</b> 3035	An Investigation of Some Parameters which Influence the Magnetic Charac- teristics of Ferrites	9-20-54	P. K. Beltzer
6 <b>M-</b> 3059	Thoughts on Incremental Permeability	9-17-54	J. B. Goodenough
6 <b>m-</b> 3097	Description of Memory Test Setup IV	10-11-54	E. A. Guditz
6 <b>M-</b> 3107	High-Speed Core Driver	10-21-54	S. Bradspies
6 <b>M-</b> 3185	A Theory of Pervoskite-Type Manganites (La,M(II), MnO <sub>3</sub> )	11-30-54	J. B. Goodenough

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6 <b>M-</b> 3215	Conference on Ferrimagnetism	11-12-54	J. B. Goodenough P. K. Baltzer F. E. Vinal
6 <b>M-3</b> 252	Paramagnetic Behavior of Ferrites Containing two Kinds of Magnetic Ions	1-17-55	N. Menyuk
6 <b>M-</b> 3316	Transistor Circuits for Driving Coincident-Current Memories	1-21-55	K. H. Olsen
6 <b>M-</b> 3390	Memory Plane Margins: DCL-2-720 Cores vs S-1 Cores	2-21-55	J. L. Mitchell
6M-3417	A Transistorized Amplifier Discrimina- tor for Core Memory Output Sensing (Thesis Proposal)	3-7-55	F. W. Sarles, Jr.
6 <b>M-3</b> 505	Experiments on a Three-Core Cell for High-Speed Memoires		J. I. Raffel S. Bradspies
6 <b>M-</b> 3526	X-Y Tests on Memory Plane Units	4-11-55	J. W. Schallerer
6 <b>M-</b> 3530	Improved Memory Cores Produced in Lincoln Laboratory	4-13-55	F. E. Vinal
6 <b>m-</b> 3654	Procedure for Stripping Wires for 64 x 64 Memory Plane Modules	6-7-55	E. A. Guditz
6 <b>M-</b> 3699	Specifications for 64 <sup>2</sup> Memory Plane Module Frame	6-20-55	E. A. Guditz L. B. Smith
6M-3717	A Transistor Selection System for a Magnetic-Core Memory (Thesis Proposal)	6-27-55	G. A. Davidson
6 <b>M-</b> 3805	Mod. III Current Calibrator	8-9-55	R. A. Pacl
6M-3820	EMAR: An Experimental Memory Address Register	8-10-55	W. A. Clark
6 <b>M-</b> 3856	Pulse Transformer Amplifier	9-7-55	M. M. Cerier
6 <b>M</b> -4064	Remarks on Domain Patterns Recently Found in BiMn and SiFe Alloys	12-27-55	J. B. Goodenough
6 <b>M-</b> 4089	Geometry of Magnetic Memory Elements	1-18-56	J. D. Childress

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<b>6М-4</b> 137	Memory Core Heating by Switching at High Frequencies	1-31-56	J. D. Childress
6 <b>M-</b> 4153	The Noise Problem in the Coincident- Current Memory Matrix	2-13-56	J. D. Childress
6 <b>M-</b> 4218	A Sequential-Access Three-Microsecond Core Memory	3-8-56	R. L. Best T. H. Meisling
6 <b>M-</b> 4298	Proposed Research Program on Thin Film	4-17-56	A. L. Loeb
6 <b>M-</b> 4328	The Influence of Chemistry on B-H Loop Shape, Coercivity, and Flux- Reversal Time in Ferrites	5-16-56	J. B. Goodenough
6 <b>M-</b> 4362	Magnetization Reversal in Thin Films	6-4-56	D. O. Smith

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#### Collections

Group 63 Seminar on Magnetism Memoranda covering the Introduction and Lectures I to LV and Appendices I to VII have been released for the academic year 1952-1953.

A. L. Loeb N. Menyuk

Memorandum covering Lecture I of Vol. 2 has been released. Seminar was discontinued after Lecture I of Vol. 2.

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Proceedings of the Wescon Computer Sessions, August 25-27, 1954,
Los Angeles, California.

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Menyuk, Norman, "Magnetic Materials for Digital-Computer Components II. Magnetic Characteristics of Ultra-Thin Molybdenum-Permalloy Cores," <u>Journal of Applied Physics</u>, Vol. 26, p. 692, June 1955.

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Smith, Donald O., (abstract on) "A Vibrating-Coil Magnetometer and its Application to the Study of the Curie Point of Magnetite," Proceedings of the Conference on Magnetism and Magnetic Materials, American Institute of Electrical Engineers, October 1955.

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Goodenough, John B., "Theory of the Role of Covalence in the Perovskite-Type Manganites (La,M(II))MnO<sub>3</sub>," Physical Review, Vol. 100, No. 2, pp. 564-573, October 15, 1955.

Smith, Donald O., "Development of the Vibrating-Coil Magnetometer and Its Application to Magnetite," Technical Report 102, Laboratory for Insulation Research, MIT, November 1955.

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