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CONFIDENTIAL

July 10, 1957

DIGITAL COMPUTER CORPORATION

Boston, Massachusetts

I. PROPOSAL

It is proposed that American Research and Development Corporation finance the organization of a new company tentatively named Digital Computer Corporation which initially will manufacture and sell transistorized digital building block units used by manufacturers and operators of digital computing equipment in developing and testing digital circuitry and components. At a later date, it is anticipated that Digital Computer Corporation will expand its activities to include the manufacture and sale of related accessory items such as precision low voltage power supplies and specialized computer terminal equipment. Eventually the company should be in a position to develop and produce specialized digital systems.

Management for this proposed endeavor initially will be provided primarily by Mr. Kenneth H. Olsen and Mr. Harlan E. Anderson, two young technologists currently associated with the M.I.T. Lincoln Laboratory. In the near future, however, it is anticipated that a third management member will be brought into the proposed new company to help manage its business affairs. Messrs. Olsen and Anderson are outstanding scientists in this rapidly growing new technological field but they have never before been responsible for a business operation.

A significant but quantitatively undefined market exists for the products of the proposed new company. There is little direct competition at the present time but the rapid development of digital technology suggests that keen competition can be expected in the near future.

It is recommended that \$250,000 be made available by ARD to the proposed new company with \$100,000 of this amount to be invested at this time, \$70,000 in 70,000 shares of \$1 par value common stock representing 70% of the equity and \$30,000 in a 6% 10-year subordinated note. When and if needed and approved by American Research, the additional \$150,000 would be made available to Digital Computer Corporation in units of \$25,000 in the form of 6% subordinated notes with no additional equity consideration. 20,000 shares of \$1 par value common stock representing 20% of the equity would be given Messrs. Olsen and Anderson in recognition of their technological contributions to the new company and 10,000 shares representing 10% of the equity would be authorized but retained by the company treasury to attract future management talent.

It is recommended that the American Research Board of Directors authorize the organization and financing of Digital Computers Corporation as outlined above, subject to further detailed investigation and consideration by its Executive Committee.

## II. DESCRIPTION OF PROPOSED NEW COMPANY

Digital Computer Corporation will be organized to commercialize certain new digital techniques which have been developed primarily at the M.I.T. Lincoln Laboratory. These techniques are based upon the utilization of transistorized circuits and magnetic core circuits which have been perfected and tested at a cost of several hundred thousand dollars in Government research funds. Initially the company will exploit these techniques by manufacturing and selling digital building block units. These units are small "electronic black boxes" which generate test signals that are fed into components and circuits of digital computing systems to test the behavior and reliability of these systems. Similar digital building block units are utilized to receive test signals from such equipment to permit interpretation of its behavior and reliability. By plugging together various combinations of digital building block units, simplified special purpose digital computing systems can be rapidly constructed which are useful to engineers and scientists in developing improved systems of logic for large general purpose computers. Most computer engineers utilize these units in their development work and most computer manufacturers routinely purchase them in quantities of five to twenty units per creative engineer.

About eight years ago a line of vacuum tube digital building block units was developed at M.I.T. Lincoln Laboratory and subsequently was exploited commercially by the Burroughs Corporation. These units have been widely used and have played a significant role in many developments in the general purpose computer field during subsequent years. However, the uses of this vacuum tube equipment generally have been limited to small special purpose systems because of its large size, large power requirements, inherent limited scope of performance, large heat output, and comparative unreliability of vacuum tube circuits.

With the development of transistorized circuitry for general purpose computers at M.I.T. Lincoln Laboratory in recent years, a line of transistorized digital building block units has been developed to complement the Burroughs vacuum tube units and eventually to replace them. These new transistorized units have many advantages including greater reliability, higher speed, increased versatility, smaller size, lower cost, lower power requirements, and a substantial reduction in air conditioning requirements to dissipate the heat produced by vacuum tubes. These units currently are in the final stages of design at M.I.T. Lincoln Laboratory and are believed to be superior to any competitive products now commercially available.

After its program is under way on digital building block units, Digital Computer Corporation plans to introduce certain specialized items of computer terminal equipment and a line of precision low voltage power supplies used to provide the electrical power needed to operate the digital building block units. These items are reasonable accessory products in view of the fundamentally interdependence of the units. Subsequently, Digital Computer Corporation also plans to broaden its activities to include the development, manufacture and sale of special digital systems. The prospects for the company in this latter field cannot be clearly foreseen at this time but this

area appears to offer great promise after Digital Computer Corporation has established its "bread and butter" line of business.

It is proposed that Digital Computer Corporation be organized in September, 1957 after the technical leaders of the company, Messrs. Olsen and Anderson, resign their present positions at M.I.T. Lincoln Laboratory. The company will initially operate out of American Research's office but very shortly thereafter will set itself up in small manufacturing facilities somewhere in the greater Boston area. About three months will be required to procure essential components and construct prototype models of the new digital building block units and obtain initial orders, and perhaps an additional three months will be required to secure significant market acceptance. Thereafter, manufacturing operations will be expanded as necessary to meet market demand.

Sales will be carried out through manufacturers representatives who will be retained throughout the United States. At first, however, most of the direct sales effort will come from the founders of the company who already know where sales can be made.

### III. MANAGEMENT PERSONNEL

In addition to the fact that the field of digital computers is a rapidly growing area of technical activity, American Research is encouraged to propose the organization of Digital Computer Corporation because of its regard for the two scientific founders of the company. Both are competent young men who appear to possess the personal characteristics required to successfully undertake the difficult task of organizing a new technological company in a competitive field.

The founders, Kenneth H. Olsen and Harlan E. Anderson, occupy responsible positions at M.I.T. Lincoln Laboratory developing modern digital techniques. They have had direct personal responsibility for the spending of several hundred thousand dollars of Government funds in the development of new digital technology and have administered moderately large technical groups in this endeavor. Both are eminently qualified on the basis of their education and technical experience although neither has yet had the opportunity of participating significantly in matters of general business administration.

These men have worked together at M.I.T. Lincoln Laboratory for over five years and, in addition to technological development work, have done cost estimating, manpower estimating, and internal scheduling for projects at M.I.T. Lincoln Laboratory and for a large prime contract held by IBM. Their experience includes the application of digital techniques (including computer programming) to many types of military problems. They have participated in studies of the economic feasibility of various applications of digital computers and have performed liaison work (i.e. selling) on behalf of M.I.T. Lincoln Laboratory with several military organizations and major aircraft companies.

Kenneth H. Olsen is 31 years old, married, and the father of two children. He holds BS and MS degrees in Electrical Engineering from M.I.T. During the War he attended the U.S. Navy radar school and served approximately one year

on active duty in the fleet. Before that he studied machine shop practice and worked in a tool shop.

Since graduating from M.I.T., Mr. Olsen has worked exclusively at M.I.T. Lincoln Laboratory and its predecessor, the M.I.T. Digital Computer Laboratory. His MS thesis, which was done at the M.I.T. Digital Computer Laboratory, played a key part in the initial practical demonstration of magnetic core memory. The circuits and techniques which he developed at that time now are commonly used in many large general purpose computers.

In 1952 Mr. Olsen was assigned full responsibility for designing and building the Lincoln Memory Test Computer. With a group of eight engineers and ten technicians, this 3500 vacuum tube computer was completed in 11 months-- an amazingly short period of time. This computer currently is operated 24 hours per day and is believed to be the fastest computer in routine operation.

During 1954 Mr. Olsen was in residence at the manufacturing plant of IEM as the M.I.T. Lincoln Laboratory representative and the U. S. Air Force quality control engineer during the manufacture of the first SAGE computer. He returned to M.I.T. Lincoln Laboratory in 1955 where he organized a group of technologists to initiate the development and construction of a new computer using transistors rather than vacuum tubes. This work resulted in the development of the techniques and technology which Mr. Olsen now proposes to commercialize in Digital Computer Corporation.

Harlan E. Anderson is 27 years old, married, and the father of two children. He was born and raised in the Mid-West where he attended the University of Illinois, receiving a BS degree in Engineering Physics in 1951 and an MS degree in Physics in 1952. He then joined the staff of the M.I.T. Digital Computer Laboratory which subsequently became part of M.I.T. Lincoln Laboratory.

Initially Mr. Anderson worked under the direction of Mr. Olsen on the logical design of a high speed digital computer used to test the new magnetic core memory subsequently adopted for the SAGE system. After completion of this task he performed circuit development work associated with the utilization of high speed electronic switches in conjunction with magnetic drums.

In 1955 Mr. Anderson became a member of the M.I.T. Lincoln Laboratory systems office which was responsible for the specifications used by IEM in manufacturing the SAGE computer. During this period he had administrative supervision of eight engineers, most of whom were older than he, and his responsibilities included technical design and justification studies, cost estimating for contract changes, and industrial liaison.

During the last year and a half Mr. Anderson has been active in planning new systems to be associated with the SAGE system. This responsibility has broadened his contact with the U. S. Airforce at many levels and has brought him into close working contact with such organizations as the Rand Corporation and the Boeing Aircraft Company. His work involves advising the U. S. Air Defense Command how to use electronic computers effectively and requires extensive travelling on behalf of M.I.T. Lincoln Laboratory to attend technical meetings related to the SAGE system.

Messrs. Olsen and Anderson recognize that their lack of business experience is a handicap in organizing and administering a new business venture. They agree with American Research's requirement that a third management member be brought into Digital Computer Corporation within the next few months to assume primary responsibility of the business operations of the company. Several candidates for this position are under consideration by American Research staff but no definite selection has yet been made. Until this position is filled to American Research's satisfaction, one or more members of the American Research staff will work closely with Messrs. Olsen and Anderson to help supervise the business management of the company and to approve the expenditure of all funds.

#### IV. COMPETITION

At the time of its formation, Digital Computer Corporation will have only two known direct competitors, both of which are small companies offering products of limited technological interest. One is an organization named Navigation Equipment Company which produces a limited line of digital building block units with specialized characteristics and the other is a company named Digitronics, Inc. which is attempting to become a manufacturer of similar units. Neither of these organizations appears to possess the technological skills attributed to Digital Computer Corporation.

However, the field of digital computing is an exceedingly active one at the present time and there can be little doubt that substantial competition will develop in the future. The Burroughs Corporation may choose to up-date its outmoded line of vacuum tube digital building block units and thereby make itself a worthy competitor. More likely, however, other competent small companies may enter the business in a manner similar to Digital Computer Corporation. Successful survival will depend upon outstanding creative technological competence, an aggressive sales effort, high quality precision manufacturing, and adequate financial support. These prerequisites are well within the capabilities of Digital Computer Corporation.

#### V. PROJECTED FINANCIAL PERFORMANCE AND REQUIREMENTS

Management forecast of sales by the proposed new company during its first five years by product categories is presented in Table I. This forecast anticipates a sales volume of \$196,000 the first year, approximately 60% of which will consist of digital building block units. Thereafter, sales are expected to increase to \$580,000 the second year, \$1,050,000 the third year and \$4,050,000 the fifth year. Although continued growth is projected for all product categories, major expansion is expected to occur in special digital systems. Because the likelihood of achieving success in this particular product category cannot be reliably forecasted at this time, the significance of the overall sales forecast necessarily diminishes substantially for each subsequent year.

Estimated profit and loss statement of Digital Computer Corporation, based upon the sales forecast discussed above, is presented in Table II. This estimate indicates that the proposed new company should break even during its first year of existence but that it should be earning approximately 10% after taxes on net sales by the end of the third year.

The capital required to initiate operation of the proposed company is estimated to be \$134,000 as shown in Table III. However, American Research's historical experience indicates that more capital usually is required to organize a new company than is initially forecasted by its founders and hence American Research recommends that \$250,000 of capital be made available to Digital Computer Corporation. \$100,000 would be provided the new company initially and the remaining \$150,000 would be provided as needed in the future, subject to the approval of the American Research Executive Committee, if the initial success of the new company indicated that further capital investment was merited.

In order to help supervise the utilization of these capital funds, American Research will nominate the majority of the members of the board of directors of Digital Computer Corporation and also will nominate the treasurer of the company. Furthermore, Digital Computer Corporation will retain the firm of Lybrand, Ross Bros. & Montgomery as its auditor and will utilize the services of the Shawmut National Bank as its commercial bank. Messrs. Olsen and Anderson will be paid salaries of \$14,100 per year and \$12,300 per year, respectively, which represent increases of \$1500 per year for each man above their present remuneration at M.I.T. Lincoln Laboratory. Although American Research will be exceedingly active in the management affairs of the proposed new company during its formative period, no consulting service fee will be charged through December 31, 1957. After that date, however, ARD reserves the right to request a consulting service fee.

Other considerations which will be covered by contractual arrangements between the principal parties include a stock repurchase agreement whereby any equity owner must offer his equity interest in the company to other stockholders before offering it to an outside potential purchaser should he desire to liquidate his interest in the company. Messrs. Olsen and Anderson also will sign a contract with Digital Computer Corporation agreeing not to compete for a period of three years should they voluntarily withdraw from the company at any time. Should they be released by the company, however, no restriction would be placed on their future employment activities.

## VI. FIELD INVESTIGATION

In order to better inform itself on the potentialities of Digital Computer Corporation and the competence of its technical founders, American Research has discussed the proposed venture carefully with several independent experts to benefit from their appraisals. With one exception, the general reaction has been favorable and the opinion has been expressed that Digital Computer Corporation could be a profitable enterprise. Of course, all expressions of opinion have been hedged by statements that the ultimate success of the undertaking will depend as much upon the overall manner in which it is carried out as upon the basic worth of the idea.

ARD personnel have interviewed the three immediate line supervisors of Messrs. Olsen and Anderson at the M.I.T. Lincoln Laboratory. These gentlemen are Mr. Robert R. Everett, Head of the Digital Computer Division; Mr. Norman H. Taylor, Associate Head of the Digital Computer Division, and Mr. William N. Papian, Leader of the Advanced Development Group of the Digital Computer

Division. These men have known and worked with Messrs. Olsen and Anderson for several years and hold them in high esteem as scientists and as individuals. It was the opinion of these gentlemen that the technology which Digital Computer Corporation proposes to commercialize is definitely ahead of competition, that a potential market exists for transistorized digital building block units, and that Messrs. Olsen and Anderson should make a splendid technological team for developing the potentialities of this product line. No adverse comment of any kind was expressed although none of these gentlemen claimed sufficient business experience to appraise the merit of the proposal from a business viewpoint.

American Research likewise interviewed Mr. J. A. Haddad, General Manager of the Special Engineering Products Division of International Business Machines Corporation in New York. Mr. Haddad, knows Mr. Olsen professionally and has a favorable opinion of him. He stated that the proposed activities of Digital Computer Corporation sounded interesting to him but warned that the capital, personnel, and time required to develop the company from a manufacturer of specialized test equipment into a manufacturer of specialized digital systems might be substantially greater than anticipated. Even without broadening its activities as widely as presently anticipated, however, Mr. Haddad believed that the venture could be meritorious. He specifically stated that IBM itself would not engage in the manufacture of digital building block units since these items did not directly encourage the increased sale of standard IBM products. He stated, however, that IBM might become a customer of Digital Computer Corporation if the products of the proposed company performed as projected.

An interview with Mr. Holton E. Harris, Sales Manager of Reeves Instrument Company in New York sustained earlier opinions that the digital equipment field is expanding rapidly and offers attractive business opportunities in many areas. Mr. Harris foresaw no reason why Digital Computers Corporation should not operate satisfactorily.

The lone dissenting viewpoint was expressed by Mr. John Dyer, Vice President of Airborne Instruments Laboratory, Inc. in New York. Mr. Dyer doubts that a successful new company can be developed in this field with inexperienced management and limited capital funds. He stated that the capital required to become established in the digital equipment business is great and possibly may be beyond the available resources of American Research. He pointed out that Airborne Instruments Laboratory, Inc. itself has been attempting to become established in the digital equipment business but that its efforts thus far have been expensive and disappointing.

American Research also discussed Digital Computer Corporation with Mr. James McDonough, President of Concord Controls, Inc. in Cambridge. This two-year-old company is an offspring of the M.I.T. Servomechanisms Laboratory in much the same manner that Digital Computer Corporation proposes to become an offspring of M.I.T. Lincoln Laboratory. Mr. McDonough believes that Digital Computer Corporation represents a potentially attractive business opportunity and has expressed preliminary interest in the possibility that the activities of his corporation and Digital Computer Corporation might be consolidated into a single entity at some future date. The technological

skills and product interests of both companies are closely allied so that a combination appears worthy of careful consideration. This possibility has no bearing upon the immediate proposal regarding the formation of Digital Computer Corporation but it suggests one expansion route which the company might follow in the future.

## VII. CONCLUSION

The formation of Digital Computer Corporation is speculative and daring but sound reasons exist for believing that the undertaking can be successful. Hence, it is recommended that the American Research Board of Directors authorize its Executive Committee, subject to additional consideration and investigation, to invest as much as \$250,000 in Digital Computer Corporation in accordance with the terms discussed in this memorandum.

DIGITAL COMPUTER CORPORATION

TABLE I

SALES FORECAST FOR FIRST FIVE YEARS

	1st Year	2nd Year	3rd Year	4th Year	5th Year
Digital Building Blocks	\$115,000	\$200,000	\$ 300,000	\$ 400,000	\$ 400,000
Precision Low Voltage Power Supplies	35,000	50,000	100,000	100,000	100,000
Computer Terminal Equipment	10,000	80,000	200,000	500,000	500,000
Special Digital Systems	30,000	200,000	400,000	1,000,000	3,000,000
Miscellaneous	6,000	50,000	50,000	50,000	50,000

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Precision Low Voltage Power Supplies	35,000	50,000	100,000	100,000	100,000
Computer Terminal Equipment	10,000	80,000	200,000	500,000	500,000
Special Digital Systems	30,000	200,000	400,000	1,000,000	3,000,000
Miscellaneous	6,000	50,000	50,000	50,000	50,000

Total \$196,000 \$530,000 \$1,050,000 \$2,050,000 \$4,050,000

Actual: <sup>1958</sup><sub>(10 mos.)</sub> \$ 94,029    <sup>1959</sup> \$ 775,570    <sup>1960</sup> \$ 1,099,799    <sup>1961</sup> \$ 2,648,100    <sup>1962</sup> \$ 6,466,752



DIGITAL COMPUTER CORPORATION

TABLE III

CAPITAL REQUIREMENT FORECAST FOR FIRST SIX MONTHS

<b>Initial Charges</b>		
Legal fees	\$500	
Filing fee and organization tax	200	
Painting and partitioning	500	
Library	200	
Office Supply Stock	300	
Miscellaneous	300	
	<b>Total</b>	<b>\$2,000</b>
<b>Capital Equipment</b>		
Machines	3,800	
Special tools	1,200	
Small tools	500	
Test equipment	2,100	
Office machines	2,300	
Furniture (leased with option to buy)		
Miscellaneous	1,100	
	<b>Total</b>	<b>11,000</b>
<b>Manufacturing Parts</b>		
Transistors	5,000	
Electronic parts	4,500	
Mechanical parts	2,500	
Miscellaneous	3,000	
	<b>Total</b>	<b>15,000</b>
<b>Monthly Operating Cost</b>		
Salaries and wages	7,500/mo.	
Accountant service	200/mo.	
Legal fees	100/mo.	
Rent, insurance, utilities, and miscellaneous overhead	500/mo.	
Travel	1,000/mo.	
Advertising	1,000/mo.	
Office supplies	50/mo.	
Furniture rent	130/mo.	
Miscellaneous	520/mo.	
	<b>Total</b>	<b>11,000/mo.</b>
Three months @ \$11,000/month		<b>33,000</b>
1st Quarter Cash Required		<b>61,000</b>
2nd Quarter Cash Required		<b>13,000</b>
Reserve for Contingencies		<b>60,000</b>
Total Cash Required		<b>\$134,000</b>