+---------------------------+ ID#403

| d | i | g | i | t | a | l | **i n t e r o f f i c e m e m o r a n d u m**

+---------------------------+

Subject: **Museum Update and Response to Fujitsu**

To: Dick Berube, PK3-2/M18
Dick Flaherty, MK1-2/H32
Roy Gould, PK3-2/M36
Andy Knowles, ML10-2/A52
Bob Lane, MK1-2/B11
Ken Olsen, ML10-2/A50

Date: 8 JAN 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 1/29/79

Fujitsu is sending some parts for our museum. They have an exhibit which includes a working demonstration of their first relay computer. Also, they have panels of various technologies, along the lines of our first panel...but not as good (I'm biassed at putting the first panel together). These parts will be a valuable addition. I would believe the right thing is to send chapters 5, 6, 7, 9, 16, and 21 on modules, 18-bit, 12-bit, 2 on 16-bit, and 36-bit computers to cover the documents (Mary Jane has these). For parts, should we send a building block, system module, core stack from PDP-1 or 8, and a hex or quad module from a PDP-11 model, and perhaps a DECtape unit? Roy, can you get the parts together?

I read that someone called Davis wants to make a computer museum and Dick Berube is helping. Furthermore, it's only going to cost 10K$. We need his help because this is about how much we spend now per year. What's the story? We need a worker (if this person is one) as opposed to a dreamer (like the ones like Ken and I and others) who'll put some exhibits together. Also, I don't see that we need another keeper-manager (Mary Jane and Roy are fine).

Bob Lane is exploring how much it will cost to refurbish several PDP-8's with the smoked glass and pedestal mounting. Here, the British Science Museum has repeatedly asked for one and I thought they had one. We could use a number of them for the Smithsonian and for exhibits (e.g., field offices) and I intend to buy one personally.

It's about time to consider building a really good memory display. It should include cores and stacks from our various machines before they get lost (Dick Flaherty has promised to collect them... and I would hope we can find the original 1K stack that was used on the first PDP-1 that was bought from RCA. The exhibit should also include drums, disks and tapes. It seems imperative to do this, just to test whether we have a reasonable inventory of the parts we have (including the Whirlwind drum and mag tape).

I can get Museum Collections (Division of Time Inc.) to make copies of simple antique calculating devices (e.g., Napier's Bones or slide rules. These might be a really great series of give-away marketing gimmicks.

Roy, let's talk and then get together with the other people on this memo and see

if we can continue on and add a panel to the Distributed Museum this year and get ourselves a good inventory? (I'm worried about losing some critical parts.)

GB0003/59

d i g i t a l i n t e r o f f i c e m e m o r a n d u m

Subject: Museum Thoughts

To: File
Date: 6/20/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: Brig Bell, ML12-1/A51
Gwen Bell, ML12-1/A51
Mary Jane Forbes, ML12-1/A51
Wayne Furman, MR2-4/M38
Chris Landry, ML11-4/E53
Dick Schneider, ML11-4/E53
Dave Simler, MR2-4/M16
Russell Turner, ML12-1/A51

Having spent some time looking through the prints, it seems clear to me that we should concentrate on content and quality of the individual displays. Thus, I want to keep a really simple strucuture, and get some nice cases for the pieces. The sketch for the layout is essentially alternative 13 in the plans. (See attached) The pieces to get on display are:

Real Computers (non-operational)
Real Computers (operational)
Case of Calculators
Case of Computer Logic taken from original Distributed Project
Gallery of all DEC Computer Consoles

REAL COMPUTERS

Whirlwind (non-operational, balcony, roped off)
Photo for background as in the current display to give the scale and depth. Use real parts to give it a 3d and real look. These would include:

- 1-bit each of all the registers in a bank as done in 12-1
- 1024 word core memory
- drum, perhaps with a glass cover
- mag tape also displayed somehow
- flexowriter
- a crt showing part of the console if we can find one
- paper tape reader, if possibly
- some lights and switches panels

- miscellaneous photos mounted somewhere
- writing explaining whirlwind
- perhaps a case to house some documents and possible block it off

TX-0 (non-operational, balcony, roped off)
I talked with John McKenzie who operated TX-0. He is retired and lives at 53 Lodgelawn Lane, Lexington, 862-5125. He can help get the TX-0 into a shape it can be viewed. Brig and Russell should contact him and get him to help with the

work. He can work all next week except Tuesday. They should call him on Friday and pick him up for Monday and start to work to get the TX-0 into displayable condition. It would have:

the crt installed
paper tape reader on the console
flexowriter
anything else that's needed to make it look operational

miscellaneous photos mounted somewhere
writing explaining it
perhaps a case to house some documents and possible blockage

Classic-8 On a Pedestal (non-operational, downstairs, roped off)
Here, I'm not sure that we have one we want yet. It is imperative to have it in the right form. MJ should start tracking with Bob Lane, Gary Cole, or Jim Milton.

PDP-1 (Operational, downstairs, roped off)
includes the CRT so that Spacewar can be played...use the one from Inforonics

LINC (Downstairs, operationality up to LDP)

MINC (Downstairs, operationality up to LDP)

CASE OF CALCULATORS

Currently being worked on in exhibit form by GB and the Museum Crew. All the parts will be kept in GB office until the exhibit is ready. Photos to be available, but sizes are known now. The "Story of Calculators" will be built around polished descriptions of the individual pieces.

CASE OF LOGIC

This is the current logic exhibit that has been in Westfield. It will be brought back and put in the permanent cases.

CONSOLE GALLERY

This would go on side wall and represent each of the machines instead of having the actual machine. I would also like to have a family tree worked into this somehow. We would first collect the consoles and then work out the display. It could also have pictures. This probably can't get further than the design this summer. The 25 to 35 consoles:

1A,1B,1C,4,7,9,15	7
5,8,s,i,m or e,a	6
linc, linc 8, 12, minc	4
6,ka,ki,kl	4
11/20,05,40,45,60,70,03,34,23	9
780	1

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Brig Bell	ML12-1/A51	Gwen Bell	ML12-1/A51
Mary Jane Forbes	ML12-1/A51	Wayne Furman	MR2-4/M38
Chris Landry	ML11-4/E53	Dick Schneider	ML11-4/E53
Dave Simler	MR2-4/M16	Russell Turner	ML12-1/A51

+---------------------------+ GB0003/66

| d | i | g | i | t | a | l | **interoffice memorandum**

+---------------------------+

Subject: **Parts for Museum**

To: Rene' L. Roy WO/S61

Date: 7/6/79 Fri
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

We would appreciate your dismantling and sending the following parts to our staging area in Marlboro (location for shipping: MR2-LA, contact Wayne Furman or Dave Simler).

PDP-1 - Teletype punch
Centronics paper tape reader
Front panel console

PDP-5 - Front panel console

PDP-7 - Front panel console
2-55 Tape units

Let me know if there is a problem in shipping the above to Marlboro by July 20! We are working under a "Grand Opening" deadline.

Dave Simler has probably contacted you already - they do want the LINC-8 and PDP-12.

GB:swh

September 26, 1979

Dear fellow Digital Computer Museum workers:

Please accept my personal thanks for your contribution in the design, construction, contribution of parts, and opening of the Digital Computer Museum. The museum is something that I think we can all be proud of, and I hope history and the response from our fellow workers at Digital will show this to be true. I hope it has been as personally satisfying to you as it has to me to work on a project that should have this lasting significance.

It seems to me there are many opportunities for it to be used now and in the future for various Digital functions, and I hope you and our contemporaries will take advantage of the facility.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0004/62

P.S. We note already a response to fill the space with more exhibits and there are requests to use the facility...therefore, this is not the end, but the beginning.

GB0005/7

d i g i t a l **interoffice memorandum**

Subject: **Museum Committee Agenda - November 5**

To: Dick Berube, PK3
Mary Jane Forbes, ML12-1/A51
Chris Landry, ML11-4/E53
Grant Saviers, ML3-6/E94
Joe Savignano, MR1-3/A47
Dick Schneider, ML11-4/E53
Peggy Sullivan, MR2-4/M16

Date: 10/15/79 Mon
From: Gordon & Gwen Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236
EMS: @CORE

1. Response to date - Questionnaire Analysis — Gwen & Gordon
2. Current Maintenance - Joe
3. Date and Goals for Public Opening - Dick Berube
4. Second Museum Lecture
5. Phase Two - What Is It?

Posters - Chris Labelle

Towers, other cases, and furnishings

Disk and Tape Exhibit - Grant

Operating Lab Exhibit - (+Joel inputs) Peggy

Any other uses - (+Joel inputs) Peggy

GB:swh

CC: Joel Schwartz - MR2-4/M51

+---------------------------+
| d | i | g | i | t | a | l | **interoffice memorandum**
+---------------------------+

Subject: **Digital Computer Museum - Phase Two**

To: Charlie Conn, ML11-4/E53
Mary Jane Forbes, ML12-1/A51
Chris Landry, ML11-4/E53
Jamie Parker, ML12-1/A51
Grant Saviers, ML3-6/E94
Joe Savignano, MR1-3/A47
Peggy Sullivan, MR2-4/M16

Date: 11/7/79 Wed
From: Gordon & Gwen Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Job list resulting from meeting Nov. 5, l979

Person responsible	Task
JP	Current maintenance/improvement
	See that all artifacts are clean and kept clean.
	Have diffuser lights installed in cases.
	Collect all changes on existing documentation and see that these are carried out.
	Contact people in charge of maintenance of working machines and learn as much as possible about them. See if PDP-l can play Christmas carols -- and check on space war with Stan Shultz.
	Start a log of all visitors to the museum (read through questionaires).
JP/CL/GB	Sort through materials in staging area. Pack display care, ship Classic-8's and 5 to Northboro, put non-flammables in Marlboro.
JP	Photograph and catalog all artifacts sent to Northboro that aren't already cataloged.
JP/CL/GB	List all artifacts for classics gallery.
JP	Maintain listing of all material in Marlboro storage
	BROCHURE - QUICK MUSEUM GUIDE
JP	Prepare a draft brochure idea (information for one piece of paper -- folded) with "what is the museum", floor plan maps, notes of special displays, material available (posters, Wilkes tape) and how one gets access to museum. Draft by Dec 7 for GGB. (Designers not brought in until later.)
	POSTERS
GB	Corrections on DEC tree to C Conn by Dec. 1
CC	Ideas for calculator posters -- better readability/content.
JP	Contact Burton Harrison, president of the SEE Corp on purchase of Pascal calculators by DEC and potential sale/distribution of calculator posters by the SEE

company.
JPCheck on poster prices, etc. re selling posters in museum.

MUSEUM OFFICE/MARLBORO

CLMuseum desk specs for purchasing. Check out the organization of the museum side with Jamie.
JPWork out museum office space - plan, assess needs.
MJF Phone for museum office in Marlboro.

MUSEUM TOURS

JPCheck on all inquiries of school groups to date, and if computer classes arrange tours. Do as an experiment with written evaluation forms by teachers and students and evaluate prior to Mar. l5.
Investigate appropriate DEC sales and customer training groups for museum tours.

PS/JP LDP display

Plan the utilization of one tower with displays and Labelle system; work toward Feb. l installation. Plan LDP "real live working lab" exhibit.

GGB/JP CALCULATOR TALK/DISPLAY

Prepare Labelle talk and appropriate display for one tower.

CL/JP/GB LOGIC TALK

Have three towers (two listed above) modified for Labelles. Decide on artifacts for display and any text.

CLASSICS GALLERY

GB/CL List all units to be displayed...Nov. 30.
JP Gather / clear all units.
CL Design gallery prelim - Jan. 4.
GGB/JP Edit all blurbs - text - Feb. l.

CL/JP/GB COFFEE TABLES

Decide on artifacts for display. Nov. 30.
Modify tables
Edit any blurbs/ install. by Feb. l.

GS/JP DISK EXHIBIT

Collect artifacts for one case (2 feet by 4 feet; 2 shelves) -- prepare documentation. Any large freestanding artifacts (the RAMAC) can go on the wall between the PDP l and the 8. Prepare a l0 minutes labelle talk and artifacts for a 2 foot square shelf. Coordinate with JP or GGB on how much can be done prior to May l. JP will collect, catalog, and store any pieces that you identify.

OPENING AND LECTURE

GBInvite Stibitz or Arthur Barks for lecture on May 1.
JPDo research on Stibitz lecturer and plan one tower for a display of his/her works, etc. to be completed Mar. l.

JP/MJFStart keeping a listing of people to be invited.

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| d | i | g | i | t | a | l |
+---------------------------+

interoffice
memorandum

SUBJ: DEC CONTRACT BADGE

TO: Mary Bonner ML2-2/A18

Date: 1/17/80 Thu
From: Gordon Bell
Dept: OOD
MS: ML12-1/A51 Ext: 223-2236
EMS: @CORE

Please issue a CONTRACT BADGE to Gwen Bell. She is in charge of the Digital Computer Museum at the Marlboro Digital Facility. In this capacity, she is required to visit many of the DEC facilities in Massachusetts in the search of information and hardware.

Cost Center 383
24 hours a day
From 1/1/80 thru 1/1/81

_____
Gordon Bell GB1.S1.22

DRAFT 8/21/80 Thu 3:25

Digital Computing Museum
for the preservation of computing history.

PROPOSED PROGRAM

Collections and archives: maintain 50/50 DEC/non DEC--triple number of artifacts shown and stored. Develop a catalog.

Tours and visitors: Move from an average of three special tours per week (Fall 80) to three special tours per day, plus a large number of ad hoc tours.

Exhibits:

Ground floor lobby - Set up with permanent exhibits.

Elevator spaces -- Established for travelling exhibits that will change.

Stairwell -- Established with a time line of the history of computers -- with computer portraits and appropriate artifacts starting with 1936 to the present day.

Corridor to cafeteria -- Expansion of pre-computer computing device exhibits.

TX-0 and Whirlwind exhibits enhanced and documented. TX-0 should run with demonstration programs that are documented with video-tape before it is once more decommissioned.

Software - incorporated and explained in exhibits.

Computer art. The Cohen mural, painted in 1980, will be complemented by a second mural in 1982, and a piece of computer generated and user activated music in 1981. Art will be added on a yearly basis.

Viewing room on triangular office with full set of 10 one-hour video tapes of pioneer computer lectures and a number of 10-15 minute audio-visual user-activated tapes including the Whirlwind film, the EDSAC film, the logic talk, the calculator talk, the LDP talk, and a film on how the Cohen mural was made.

Museum store will have moved from the lobby desk to the second triangular spaced room and will serve the visitors and Marlboro working population with books, audio and visual tapes, replicas of calculating devices, photographs, slides, postcards, posters, wall charts, and various computer history and computer user articles.

Events:

Quarterly pioneer computer lecture series will conclude with the tenth machine and the second series will feature pioneering software efforts.

Yearly event on computer and the arts.

Yearly event honoring a DEC history-making object, e.g., the April 80 VAX party. Other candidates: 20 years of 36-bits or 12-bits; or CAD; 10 years of RSTS, RT11, M, the LA's, VT's, Disks, DECnet.

Alumni gatherings for the TX-0 and PDP-1 to run programs and do video tapings.

Bi-annual event with publication of each DEC Press book in the history series.

Occasional scheduling for meetings for educational groups, eg., Sept. 27th meeting of ASTC committee preparing an exhibit on "The Computer in the Pocket." Suggest CBI board meetings, and other groups hosted by museum.

Gordon Bell, Keeper
Gwen Bell, Assistant Keeper

GB1.S5.65

February 15, 1980

Mrs. Gwen K. Bell
Page Farm Road
Lincoln, MA 01773

Dear Gwen:

It is my pleasure to appoint you Assistant Keeper of the Digital Equipment Corporation's Digital Computer Museum at the Tower Building at One Iron Way, Marlboro, Massachusetts. We look for you to set up and manage all phases of this exciting project that will trace the evolution of computing. As such, you will design and lay out the exhibits and displays, schedule lectures, handle museum publications and, in general, do everything that is required to establish an interesting and representative display of computing history.

Digital's resources are available to assist you in your ambitious schedule, to open the museum at Digital's Board meeting, September 22, 1980. The resources include our purchasing functions so as to be able to obtain equipment and supplies.

More specifically, the original term of this appointment is the calendar year 1980 and, while such appointment neither designates you as an agent or an employee of Digital Equipment Corporation, you are to be granted the honorarium of one dollar ($1.00) per year. Of course, you shall be reimbursed all of your expenses in this activity in accordance with our existing policies.

Let me extend my personal appreciation for this most gracious contribution of your time to this undertaking of such importance to Digital. Please feel free to call upon me if I can be of help.

Very truly yours,

Shel Davis
Vice President, Personnel

Draft 8/21/80 Thu

Digital Computer Museum: Plan for the Future

To date, the Museum has primarily existed as a volunteer effort. The budget has been allocated for one employee plus the use of consultants specialized projects, and the presentation of lectures. All direction and administration of the Museum has been done on a volunteer basis as an experiment.

The activities generated in the first year have shown that there is a demand for the lectures and interest in the exhibits both on the part of the company's employees and the computing community.

Is this the time to establish the Museum as a self-contained entity with non-profit status and its own Board of Directors?

The advantages of non-profit status is that the Museum could then accept gifts (especially artifacts) from individuals who could obtain a tax deduction; it would be taken more seriously by the community as an educational service for computer experts (and we could maintain it for "adults only"); and it would more likely gain more contributions.

The administration and direction of the Museum has related to calling an informal review committee together on a quarterly basis. Advantages accrue from having a formal board that would meet semi-annually to evaluate and review exhibits and programs. It is suggested that the board would have the following 13 members:

5 outside DEC
- computer historian
- director of a science or technology center
- director of Charles Babbage Institute
- computer scientist
- .....

5 DEC employees
- President of the Corporation
- Manager of Marlboro Facility
- Publisher of DEC Press
- R & D leader
- Industrial design leader

3 ex-offico members
- Keeper
- Director
- Executive Secretary

Staffing and budgets would grow in workable increments for the next three years.

August 20, 1979

British Science Museum
Jane Raimes, Assistant Keeper
South Kensington London SW72DD
ENGLAND

Dear Jane:

We can give you a Classic PDP-8 (circa 1965) that we believe was the first minicomputer. It would sit on some pedestal (we'll supply if you want) and is approximately 2 1/2' high and 20W wide x 30" deep. Do you still want it?

We're in the throes of opening our own Digital Computer Museum in Marlboro, Massachusetts this fall. It includes a reasonably good collection of calculators; a logic exhibit; MIT's Whirlwind and TX-0; MIT's LINC, a LINC-8, PDP-12, and our MINC Laboratory series evolution, a PDP-1 (first Spacewar), a PDP-8, and a collection of artifacts from our machines.

What's the chance of borrowing some parts from the Science Museum for a year?

Sincerely yours,

Gordon Bell
Vice President
Engineering

GB:mjf
GB0004/36

October 11, 1979

Jane Raimes
Assistant Keeper
British Science Museum
South Kensington
London SW7
ENGLAND

Dear Jane:

We are sending the PDP-8 to the Science Museum to your attention. Also, I'm enclosing the specification we use in describing it at our exhibit.

Sincerely yours,

Gordon Bell
Vice President
Engineering

GB:mjf
GB0005/3

Enclosure

CC: Bob Lane - DEC

September 2, 1980

Richard Buxton
North European Regional Support
Digital Equipment Co. Ltd.
42-44 Portman Road
GB-Reading, Berkshire RG3 1JW
ENGLAND

Dear Richard,

Thanks for the information on the PDP8 serial no. 2. The Museum now has a table top 8 on display and has no money. However, 8's are in demand as museum pieces -- we've supplied one to the British and Canadian science museums. I suggest that you store it -- don't throw it out -- since I believe there are going to be more and more requests for these in museums. If you want to ship it to the US, then we can store it here.

I'm enclosing a copy of our latest newsletter and brochure. Do hope that you get the chance to see the Digital Computer Museum.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S6.28

Enclosures: Museum Newsletter + Brochure

STAFF	FY 80	FY 81	FY 82	FY 83
Keeper	v o l u n t e e r			
Director	volunteer	.5	.5	1.0
Secretary	v o l u n t e e r		.5	1.0
Archivist	volunteer	.25	.5	.5
Coordinator	1.0	1.0	1.0	1.0
Shopkeeper	-	.25	.5	1.0
Tour guides	-	.5	1.0	1.0
Plant Eng	volunteer	.1	.25	.25
Field Service	v o l u n t e e r			
BUDGET (in 1,000)				
Salaries & space	22	85 k*	125	180
Exhibits & artifacts	55	35	45	60
Events	25	40	40	40
Non-profit admin	--	30**	10	15

* 30K over budget + ** 30K not budgetted.

Gordon Bell, Keeper
Gwen Bell, Assistant Keeper

GB1.S5.71

April 21, 1981

Jean Sammet
IBM
Federal Systems Development
Bethesda, MD 20034

Dear Jean,

As Keeper of the Digital Computer Museum, I asked Gwen to look at and review the history section of the AFIPS TAXONOMY for our possible use. Enclosed is a copy of the review that she is sending to the Committee, although I don't think it is something for CR.

Let me urge you to not change the numbering system on Computing Reviews to that in the taxonomy. I don't think it's even 12 percent better as you might predict in using 9 nodes instead of 8 as in CR; and, like Grace Hopper, I've always hated those people who changed the order codes in the middle of the night. I have a written review of the taxonomy that I intend to submit to the committee and CR, in which I urge a recall of the taxonomy.

We're working hard to structure history accurately in the Museum, so that our visitors will have greater understanding of evolution. We've got the first handle on a genealogical and taxonomic structure and would be happy to share it with you if you are interested.

Do hope that you can schedule a visit to the Museum sometime that you are in the Boston area. Digital helicopters fly from Logan to Marlboro and Gwen could arrange your transport this way. Our next lecture, June 25, is John Brainerd on the University of Pennsylvania machines; and then David Edwards on the Manchester machines on September 9. But there is plenty to see without combining it with a lecture; and more everyday.

Sincerely yours,

Gordon Bell
Vice President, Engineering
Keeper, Digital Computer Museum

GB:swh
GB2.S5.35

Enclosure (1)

DRAFT FROM 7/81

THE DIGITAL COMPUTER MUSEUM

date: 1990

from: The Director's Office

After more than a decade of operation, the Digital Computer Museum encompasses the entire information processing family tree with a complementary program, document, photograph and film library. (see fig. l) Housed in a 120,000 square foot building, historic artifacts of computing, video- and audio- presentations by the engineers and programmers working on historic machines, examples of benchmark computer applications, and a library of relevant books, manuals, photographs, and programs are on display and available for reseach purposes. Classrooms, viewing rooms, and a computer data-base system provides resources for resident scholars, short-term seminars, and lecture series.

The collections have been built up from gifts from industry, universities, government agencies, and individuals. All materials more than 15 years old are considered for the collection. This formula is also The Annals of Computing History to verify collectable materials. The artifact collection started in 1973, grew to more than 500 pieces in 1981, is currently at 5,000 and continues to grow. The film and photo library was inaugerated in 1981 and is now the pre-eminent historic resource collection. The book and program library were opened in full scale on moving to the present site in 1987, although collections began in 1981. The site has sufficient space to expand to double or triple its 120,000 square foot facility.

The Digital Computer Museum is unique. It cannot be likened to Science Museums that emphasize visitor numbers by attraction exhibits, for example the live Muppet show was the outstanding draw of the last decade at Science Museums that then hope the public will also look at serious exhibits. Nor can it be likened to industry-related museums that allow specific companies to outfit exhibits that fundamentally become self-advertisements. Nor can it be likened to experiential museums that attract children and parents to find out and experiment for themselves. The Digital Computer Museum is most like a well-developed natural history museum, where collections are classified to show entire branches of the plant and animal kingdom and whole societies. The collection of the Digital Computer Museum tells the story of the "natural" history of information processing, pieces are added to the story not for their intrinsic value but because they have a place in that history. Because this is such a large field, the Museum like the great Museums of the late-nineteenth century virtually requires an ark to hold its population.

AUDIENCE: The audience is drawn from three levels.

The primary audience is the serious connoiseur of computing history. Exhibits, library facilities, serminars, lectures, and a visiting scholar program are geared to their needs. While their numbers are not large, their participation is absolutely essential to maintaining predominance in the field. A visiting scholar program provides one way for some of the pioneers of computing, computer historians, and computer artists and

musicians to be in residence and add to the richness of the environment.

The secondary audience includes all people who want or need some understanding of the evolution of computing. This includes most computer scientists, programmers, and engineers as well as other professionals employed in, or being trained for the computer industry. Special seminaras, lectures, half-day and one-day programs provide over-views of the historic evolution of computing. Members of the IEEE, AFIPS, and other professional organizations, customers of Digital and other computer companies, and retirees from the computer field are attracted to exhibits, the library, and the Museum's special programs and facilities.

The tertiary audience is made up of families of the first two groups, museum goers, and others who want to find out what the museum is all about. No attempt is made to amuse or attract this audience via low-level fun and games. But, experience shows that these people come and learn from quality exhibits.

SELECTION OF A PERMANENT SITE

Because Digital Equipment Corporation had the foresight to fund the establishment of the Museum, in 1981 they had the unique opportunity to benefit from planning a site for its long-term home.

A Museum building, itself, has very special needs: large exhibit halls with controlled lighting, theater type areas, and facilities for the public are important considerations.

Considering audience factors, four different sites were evaluated: Marlboro, Maynard, the Bedford/128 area, and central Boston/Cambridge. From the point of view of what was known in 1981, the best sites seemed to be Maynard or near the Bedford 128 location. The wild card affecting these sites is clearly the availability of a building.

Figure 2 shows the weighting of the site selection criteria, and some scenarios affecting location.

FIG. 2 SITE SELECTION CRITERIA

	Relative Weight	Marlboro	Maynard	Bedford	Boston	Other
AUDIENCE						
DIGITAL						
Primary	5	15	20	10	5	__
Secondary	4	12	12	16	4	__
Tertiary	2	4	8	6	2	__
NON-DIGITAL						
Primary	5	5	10	15	20	__
Secondary	2	2	4	6	8	__
Tertiary	1	1	2	3	4	__

SUMS 37 56 56 43

FOUR SCENARIOS

Marlboro: Although it was known that the audience would have to be attracted to the site, the Marlboro campus facility of Digital was selected. A special museum building was erected on the site, tied into corporate displays in MR-2 and the use of public spaces in MR-1 and 3, especially after hours. With guest facilities for resident scholars and with on-site classes given by WPI and Northeastern, Marlboro became a center for computer history.

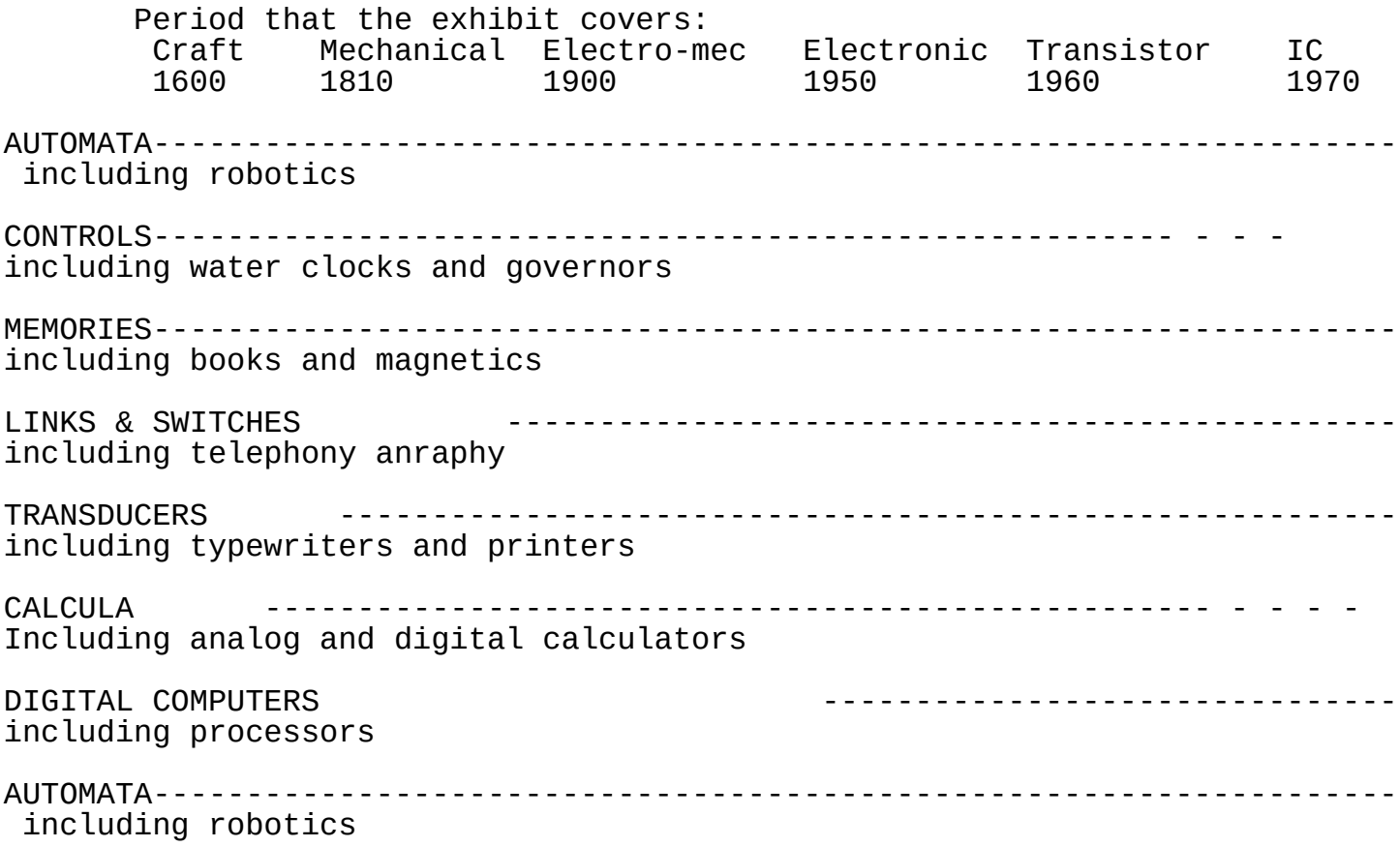
Maynard: , the Marlboro campus facility of Digital was selected. A special museum building was erected on the site, tied into corporate displays in MR-2 and the use of public spaces in MR-1 and 3, especially after hours. With guest facilities for resident scholars and with on-site classes given by WPI and Northeastern, Marlboro became a center for computer history.

Maynard: Two scenarios seemed appropriated: (1) The "Mill" centralized Digital's continued interest/support of the independent Museum, housing it adajcent to Corporate Headquarters, and Engineering. (2) A proper Museum was built in down-town Maynard providing life to the town and its redeveloped center and mall.

Bedford: Site and facility are independent. A site was developed (1) adjacent to Digital's Educational Services facility, (2) near the National Historic Park, (3) on Route 128, based on the following kind of facility, (1) an old shopping center, (2) new building, (3) reclaiming Lincoln Labs, or (4) something else. It became a center of activities for the large number of computer people within a half-hour of the Museum.

Boston: Much to everyone's surprise, the Digital Computer Museum was given a building in Boston. The following two choices seem to represent the polar possibilities: (1) The site is a well-kept secret, about like the glass flowers, and it is a peaceful oasis for computer buffs. (2) Along with the Aquarium the Museum has become one of the chief attractions in the downtown area although we have not comprimised any historic standards.

Fig. 1: The Collections



CLASS CALCULA

ORDER	FAMILY -complexity	GENUS -structure	SPECIES
Analog	single part	drawing instruments	protractor, pen etc.
		fixed rule	proportional rules
	2-3 part	gunter rule	gunter rule
		sector	sectors
		slide rule	straignt, circular, spiral, log-log
		level reference	gunnery level
		integrator	mileage reader
	multiple part	drawing instruments	pantograph
		level reference	quadrant, sextant etc
		integrator	planimeter, etc.
	complex	level reference	auto-pilot
		equation solver	harmonic analyzer etc tide predictor, etc
	programmable	diff. analyzer	Bush, Hartree
		analog computer	Genl Precision, etc.
Digital	single register	stone, bead	counting table, abacus, soroban, etc
		Pascal wheel	Pascal wheel, strip, keyed wheel
	two register	tab indicator keyed wheels	Burroughs
	3-4 register	stepped wheel	Leibniz, arithmometers automatic stepped wheel

	rotary	Baldwin, Odhner, Curta, etc.
	motor-driven wh.	Monroe, Friden etc
	battery electronic	"pocket" calcs.
complex	tabulator	Hollerith census, Powers-Samas
	equation-solver	ABC machine, pocket calculators,
	relay calculators	Bell Labs I difference engines
programmable	relay calculators	Bell Labs II-IV, Z3-4
	analytic engine	Babbage, Harvard MKs
	tabulator	Hollerith, Powers,etc
	plug-board	ENIAC
	battery electronic	pocket

CLASS MEMORY ORDER -interface	FAMILY -technology	GENUS -structure of access	SPECIES
Non-mech.	Physical state	Fixed-permanent	stone marks, Napiers
		Fixed-erasable	Quipu, beads, abacus
Writable or Readable	Paper	Fixed	
		Linear	scroll
		Cyclic	rolodex
		Random	book
	Mech. stable	Fixed	switches
		Linear	piano roll
		Cyclic	drum, disk
		Random	card
	Chem. stable	Linear	microfilm
		Random	microfiche, videodisc
	Magnetic	Random	rope
	Electric charge	Random	capacitor
	Electronic	Random	diode, semicon. rom
Writable & Readable	Mech. stable	Fixed	calculator registers
		Random	Zuse memory
	Wave storage	Cyclic	mercury, optical, & magneto-strictive
	Electric charge	Cyclic	Atanasoff drum
		Random	Williams tube, capacitor, semicond.
	Magnetic flux	Linear	tape, wire
		Linear-cyclic	datacell

		Cyclic	fixed-head disk, drum
		Cyclic-linear	disk
		Random	core, disk
Electronic	stable	Fixed	flip/flop, relays, stepping switches
		Random	semiconductor array, relay array
Chemically	stable	Linear	photo store

11/30/81 Mon 13:58:55

THE DIGITAL COMPUTER MUSEUM

from The Director's Office

Dateline 1990

After more than a decade of operation, the Digital Computer Museum's collections encompass the entire information processing family. It has evolved to be similar to a well-developed natural history museum, where collections are classified to show entire branches of the plant and animal kingdom and whole societies. The collection of the Digital Computer Museum tells the story of the "natural" history of information processing with exhibits. Because information processing is such a large field, the Museum, like the great Museums of the late-nineteenth century, virtually requires an ark to house all its specimens. In cooperation with the archival projects of the Charles Babbage Institute, the Museum serves the scholar in researching topics in the history of computing.

This monumental achievement can be credited to a well thought out plan and policy articulated in early 1982. The clear identification of the audience, selection of a permanent location and building site, and conceptualization of an interpretive program for the collections provided the necessary direction for communicating the goals and ideas for the future.

Dateline 11/30/81

PROJECTED AUDIENCE

The audience is comprised of three parts. One group is the serious connoiseur of computing history. Exhibits, library facilities, seminars, lectures, and a visiting scholar program are geared to their needs. While their numbers are not large, their participation is absolutely essential to maintaining preeminence in the field. A visiting scholar program provides one way for some of the pioneers of computing, computer historians, and computer artists and musicians to be in residence and add to the richness of the environment.

Another group includes all people who want some understanding of the evolution of computing. Most computer scientists, programmers, engineers and professionals employed in, or being trained for the computer industry belong to this group. Special seminars, lectures, half-day and one-day programs provide overviews of the historic evolution of computing. Members of the IEEE, AFIPS, and other professional organizations, and retirees from the computer field are attracted to exhibits, the library, and the Museum's special programs and facilities.

The third group consists of families of the first two groups, museum goers, and others who are curious about the museum. Experience has shown that

these people come and learn from quality exhibits. The Museum's exhibits are designed to communicate the history of computing and not to engage visitors in amusements.

LOCATION

Comparison of four different locations within Greater Boston suggest varying opportunities for the Museum.

Marlboro, in the building in which the Museum started: A pattern of visitors that evolved was never disrupted by moving the Museums location. The location on Route 495, close to the Massachusetts Turnpike, and within an hour of Boston, is isolated from other cultural or educational facilities. The site itself is outside of town and accessible only by automobile. Thus, the facilities must be developed to attract the visitor who will make a special trip and invest a half day in the trip.

Maynard, the home base of Digital Equipment Corporation and the "mini computer" capital of the world: The town is not on any main route, but within 45 minutes of most of the "computer engineering" community of Boston. All sites would be in a "downtown" with some bus transportation.

Route 128, the "high tech" nucleus of the sixties: 128 is the center of the computer community within Boston, and accessible to the interstate highway system. A number of building sites would be possible in the vicinity.

Boston or Cambridge, the center for the cultural institutions. While most students and tourists are confined to these settings with a large number of competiting cultural institutions.

Each location has its inherent attractions and difficulties. The critical decision point is the availability of a building with appropriate financing to make the Museum happen.

MUSEUM BUILDING

A Museum building has very special needs:

At least 120,000 square feet

60,000 square feet of exhibit halls with controlled lighting, temperature and humidity control, divided into at least ten different units ranging in size from 3,000 to 10,000 square feet, and including a theater for about 300 people, small meeting rooms and theaters for 12-100; space for a library,

store; restaurant; workshops for exhibit development; and facilities to allow for a flow of the public.

Parking for cars and buses.

Issues regarding MR-2 (using the present building)

Legal/financial. Two alternatives were considered. 1) Immediate acceptance of the entire building as a gift that would require raising a matching one-third from others for its renovation/endowment (as required by IRS regulations for public foundations). The Museum would lease back portions of the building to Digital or DECUS with their gradual withdrawal by 1989. 2) The separation of the building into three condominiums, each of two floors, to be given to the Museum in three stages: 1983; 1986 and 1989 at which time the Museum owned the entire building. At the time of the acquisition of each portion of the property one-third matching donations of $1.2, $1.5, and $2 million were attracted and divided equally between exhibit renovation and endowment.

Space. The configuration of the building and its associated property into a Museum poses the following issues:

Cost-effectiveness: if the expense to transform it into a Museum would be greater than building anew or looking for another site.

Appropriate timing of major spaces during the 10 year development period.

Establishment of free visitor flow throughout the space to encourage viewing many exhibitions, while maintaining use of part of the building for the other tenants.

Integration and use of computers and technology for interpretation and control of the Museum itself.

INTERPRETIVE PROGRAM

The draft catalog (attached) lists all the artifacts according to one taxonomy. Other classification concepts are useful in builing exhibits. The two in conjunction are designed to provide a rich interpretive experience. For example, the first major exhibit, the Pioneer Computer Timeline, is actually based on one of the major chapters of the catalog and features two of the more significant artifacts of the collection: the Whirlwind and the Atanasoff-Berry Computer. The ideas for further exhibitions are listed below.

Interactive computing: The TX-0, PDP-1, PDP-11/45 and other machines capable of running and demonstrating interactive programs.

Super computers: Texas Instruments's ASC, Control Data's 6600, IBM's Stretch, University of Illinois's ILLIAC IV, etc. -- standing as scuplture with associated films, photos and other interpretive materials.

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Evolution of card programmed processing from a working Jacquard loom to a l950's card room and inclusive of other examples.

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Computer ancestors in the craft generation, between 1600 and 1800, providing a feeling for the whole technological context of the era.

Computing in the transistor generation during the sixties.

Computer graphics, arts, and music exhibits with permanent listening galleries, halls for changing exhibitions and laboratory demonstrations.

Computing in space -- on-board computers and what they do.

Mechanical calculating -- from the Pascaline to Lehmer's number sieves, with opportunities to operate the calculators.

Games and gambling -- playing with numbers in simple early games, the totalisator machines of the 30s, classic chess programs and other games of skill and chance.

Developing appropriate levels of interpretation through signage and/or a/v materials, and communicating a direction and flow to the exhibit space without a personal tour guide is critical in the development of the exhibition program. The standardized text panels and catalog entries provide scholarly documentation that needs to be supplemented with interpretive story lines. Video equipment and comfortable seating is needed to allow the use of the films that are being developed.

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00 BURT DECGRAM ACCEPTED S 18769 O 531 10-NOV-81 14:48:28
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* d i g i t a l *
****

TO: CONTRIBUTIONS COMM: DATE: TUE 10 NOV 1981 12:01 PM EST

FROM: GORDON BELL
cc: DIGITAL MUSEUM DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: COMPUTER IN SCIENCE & TECHNOLOGY CENTERS (MUSEUMS)

	Historical Pres.	Application for Visitors	Operational for Museum displays	High-level "Magnet-school"	DEC rep.
SCI. MUSEUM, LONDON	***	*			*
SMITHSONIAN	*				
NAT'L MUSEUM OF SCI. TECHNOLOGY, OHAWA	**	**	*		**
LOS ANGELES SCI. MUSEUM	*	*			(IBM)
MARYLAND SCI. CENTER	*	**	*		(IBM)
BOSTON SCI. MUSEUM	*	*			(HONEY WELL)
BOSTON CHILE MUSEUM		**	*		*
CAPITAL CHILD MUSEUM	*	**			**
OMSI	*	**		**	**
LAWRENCE HALL OF SCI.		*		*	
TORONTO SCI. CENTER		***	*		*
CHICAGO MUSEUM					

OF SCI. & IND.			(IBM & BIG NEW FUNDS)
	*	*	
DEUTSCHES MUSEUM	*		
FRANKLIN INSTITUTE (?)			

Gwen and I put this together to aid in understanding future requests from these folks. Hope it's useful to you.

GB3.S2.36

Gwen Bell
Page Farm Rd., Lincoln, Ma., 01773

EDUCATION: Clark University, Ph.D., 1967; Harvard University, M.C.P., 1959; University of Sydney, Fulbright Scholar, 1957-8; University of Wisconsin, B.S., 1955.

PROFESSIONAL EMPLOYMENT: Director, Digital Computer Museum, 1981-present; Social Science Editor, Pergamon Press Inc., 1978-1980; Editor, EKISTICS, 1973-1978; Visiting Associate Professor, Graduate School of Design, Harvard University, 1972-73; Assistant Editor, EKISTICS, 1959-1972; Associate Professor, Department of Urban Affairs, University of Pittsburgh, 1966-1973.

PROFESSIONAL ACTIVITIES: Advisory Board: Contact, Journal of Urban and Environmental Affairs, Canada; EKISTICS, Athens Greece; Urban and Regional Planning, Pergamon Press, Oxford.

Consultant: Global 2000 Report, Council on Environmental Quality, 1979; Neighborhood revitalization, Kettering Foundation, 1978; United Nations Environment Program in Southeast Asia, 1975; National Housing Bank of Brazil, 1973.

Lectured on Planning at a large number of universities.

COMMUNITY SERVICE: New England Conservatory of Music, Trustee, 1975-80: Member, Exeuctive Committee 1976-8; Member, Presidential Search Committee, 1976-7.

BOOKS; Strategies for human settlements, University Press of Hawaii, 1976; Urban Environments and Human Behavior, Dowden Hutchinson & Ross, 1973; Human Identity in the Urban Environment, with J. Tyrwhitt, Penguin Books, 1972.

Numerous journal articles on planning and urban development.

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

December 20, 1980 - OPERATIONS COMMITTEE APPROVED THE CHARTER OF THE DIGITAL COMPUTER MUSEUM

Preserve artifacts relating to the history of computing;

Carry on a lecture and educational program;

Loan artifacts and consult on exhibits;

Prepare exhibitions and arrange tours;

Provide a resource on computer history;

Develop and sell museum-related products;

Make the Museum a center of interest and activity; and

Investigate non-profit status.

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

August 18, 1981 - OPERATIONS COMMITTEE MINUTES

The Operations committee approved the proposal to establish the museum as a public non-profit corporation. Our intent is to support the museum on a continuing, stable basis and to treat it the same way as other important programs of the Corporation.

****

Presented: "Why can the Digital Computer Museum be Number One?"

Today: We are number one in quantity and quality of computer exhibits.

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

PIONEER COMPUTER EXHIBITS IN MUSUEMS AROUND THE WORLD

Museum	Date & Machine
Science Museum, London	1840s Babbage Analytical Engine
replica Smithsonian	(partial)
piece, Boston Museum of Science	
prototype adder + teletype, DCM	**1939 Bell Labs Relay Calculator**
replica, Deutsches Museum	1941 Zuse, Z3
drum + breadboard, DCM	**1940 Atanasoff-Berry Calculator**
pulley for bedstead, DCM	**1943 Colossus**
Harvard, IBM	1944 Harvard Mark I
Smithsonian, DCM	**1946 ENIAC**
DCM (loan from Science Museum)	**1949 EDSAC**
	1949 EDVAC
Manchester Univ., DCM	**1949 Manchester Mark I**
Smithsonian, DCM	**1950 Whirlwind**
Smithsonian	1951 IAS Computer
Science Museum, London	1950 Pilot ACE

DCM = Digital Computer Museum

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

ARTIFACTS ON DISPLAY AT THE DIGITAL COMPUTER MUSEUM

*** = WORTH A TRIP
PDP-1 operational with Spacewar
IBM 7030 "The Stretch"
TX-0, first transistor computer
Apollo Guidance Computer
LINC, first personal computer
Enigma, WWII cipher machines

** = WORTH A DETOUR
Bendix G-15
CDC 6600, Serial Number 1
LGP-30
PDP-8
Harold Cohen murals and "turtle"
Powers-Samas card system
Hollerith 1890 census machine (replica)
Texas Instruments ASC
Jacquard Loom Mechanism
Thomas arithmometer
Tinker Toy Computer
Napier's Bones
CDC 160A
Williams tube memory

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

NUMBERS AND SOURCE OF CATALOGUED ARTIFACTS

(Many computer systems have a large number of separate artifacts that, in fact, can be exhibited or loaned and treated as separate items. In this listing they are treated as one. The entirety of Whirlwind is one item, and a single transistor with its own serial number is also one item.)

Number	Different Donors	Artifact
21	14	Computers
57	21	Computer components
39	21	Computer options
52	28	Memories
57	23	Calculators
..	48	Photographs and documents
TOTAL 226	*	

* From approximately 150 different donors.

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

December 23, 1981 - APPLICATION SUBMITTED TO IRS

March 1, 1982, advanced ruling approved, with final determination on June 26, 1984.

Determination will be primarily based on:

DIVERSIFIED BOARD OF DIRECTORS

ONE-THIRD OF THE SUPPORT FROM THE PUBLIC

ACCESSIBILITY BY THE PUBLIC

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

INITIAL BOARD OF DIRECTORS

Term	
1984	Charles Bachman, Cullinane Associates
1985	C. Gordon Bell, Digital Equipment Corporation
1984	Gwen Bell, Digital Computer Museum
1985	Harvey Cragon, Texas Instruments
1985	Robert Everett, MITRE Corporation
1986	C. Lester Hogan, Fairchild Camera and Instrument
1986	Ted Johnson, Digital Equipment Corporation
1984	Andrew C. Knowles, Digital Equipment Corporation
1986	John Lacey, Control Data Corporation
1986	Pat McGovern, Computerworld
1985	George Michael, Lawrence Livermore National Laboratories
1984	Robert Noyce, Intel
1985	Kenneth H. Olsen, Digital Equipment Corporation
1986	Brian Randell, University of Newcastle
1986	Edward A. Schwartz, Digital Equipment Corporation
1984	Michael Spock, Boston Children's Museum
1985	Erwin Tomash, Dataproducts and Charles Babbage Institute
1984	Senator Paul E. Tsongas

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

1982-1983 FUNDRAISING

Raise $250,000 to match Digital's FY83 and FY84 budgeted contribution of $500,000 for the FY83 and FY84.

Numbers	Category			Return
50	Corporate Founders	@ $2500		$125,000
300	Individual Founders	@ $250		75,000
400	Corporate Members	@ $125	50,000	
1000	Members	@ $25		25,000
	TOTAL			275,000

STRATEGIES

DIRECT MAIL
- 2250 Letters April, 1982-(rec'd 40,300 by May 20)
- 4500 Letters & Reports, June, 1982
- 6000 Letters & Brochures, September, 1982
- 6000 Followups October, 1982

BROCHURE DISTRIBUTION

PERSONALIZED CORPORATE CAMPAIGN

SPECIAL GRANT APPLICATIONS

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

1982 FUNDRAISING PLAN

		Projected returns	
MAIL CAMPAIGN			
APRIL - 2,250 Letters (750 inside DEC)	200-400	$30,000 -	$50,000
JUNE - 4,500 Reports + letters (repeat mailing + list of Annals of Computing History & Digital Press Computer History Book purchasers)	250-400	35,000 -	50,000
SEPT - 6,000 Brochures + letters (repeat mailing + Museum - developed list)	300-600	40,000 -	55,000
OCT - 6,000 followups	300-600	25,000 -	55,000
BROCHURE DISTRIBUTION In the lobby & at conferences such as DECUS and SIGGRAPH.			
JUNE - DECEMBER	200	5,000 -	10,000
PERSONALIZED TARGETTED CORPORATE CAMPAIGN Including special packet of reference materials and some presentations.			
JUNE - DECEMBER			
40 Corporations		100,000	
100 Corporate Annual members		12,500	
50 Individual Founders		12,500	
TOTALS - Stated goal		260,000	340,000

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

FUNDRAISING WILDCARDS

Mail support for inserts or other promotion from:
DECUS
ComputerWorld

Large scale grants ($50,000 or more) from:
AFIPS HISTORY COMMITTEE
NATIONAL SCIENCE FOUNDATION

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

EXPENSES		FY 83	FY 84
Labor (including overhead)		165 (20)	210 (25)
Exhibits and Programs		125 (20)	95 (35)
Store		20	30
Archives and Publications		65	70
Other		25 (20)	30 (20)
Total		410 (60)	435 (75)
INCOME			
Digital Equipment Corp	250 (60)	250 (80)	
Founders	200	45	
Membership	65	145	
Store/interest/functions	35	50	
		545 (60)	475 (80)
Surplus	145	20	

() Contributions by Digital through the cost center but not necessary to account to IRS.

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

STAFF ANALYSIS

FUNCTIONS	FY 79 & 80	FY 81 & 82	FY 83
DIRECTOR	GORDON BELL	GWEN BELL	
ADMINISTRATOR	MARY JANE F.	GWEN BELL	
SECRETARIAL SUPPORT	MARY JANE	SUE HUNT	
CURATOR	GORDON BELL	GWEN BELL	
EXHIBIT COORDINATOR	GWEN BELL	JAMIE PARKER	
PROGRAM COORDINATOR	GWEN BELL	JAMIE PARKER	CHRIS RUDOMIN
COMPUTER MAINTENANCE		JAY MCLEMAN	
ARCHIVIST	GORDON BELL	GWEN BELL--TRINKAUS-RANDALL	
PUBLICATIONS	GORDON BELL	GWEN BELL	
FUNDRAISING	GORDON BELL	GWEN BELL	
MUSEUM STORE			CHRIS RUDOMIN
TOUR GUIDES	GORDON BELL	4 STAFF + 20 VOLUNTEERS	
LEGAL COUNSEL			JIM DAVIS

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

COMPARATIVE STATISTICS

MUSEUM	OPERATING BUDGET*	ATTENDANCE	SPACE IN SQUARE FEET	
			Exhibits	Total
Museum of Science Boston, est. 1830	4,000,000	900,000	113,000	279,000
Corning Glass Museum established 1951	3,163,000**	550,000	20,000	40,000
Museum of Science & Technology, Ottawa established 1966	4,200,000	700,000	112,000	140,000
Lawrence Hall of Science Berkeley, est 1968	3,000,000	285,000	30,000	117,000
MIT Museum established 1980	294,000**	4,500	11,000	26,000
Digital Computer Museum FY 82	250,000**	10,000	4,000	5,000
FY 83	400,000**		8,000	10,000

* Exclusive of capital funds and acquisitions.

** Exclusive of a number of overhead expenses given "in kind" including rent and maintenance.

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

SPACE ANALYSIS

SHARED SPACE		
(in lobbies and cafeteria)	4,000	square feet
Pioneer Computer Timeline		
TX-O		
Super Computers		
CREATED SPACE		
Archives 9/1/82	800	square feet
PRIME SPACE (rentable)		
Offices (1/82)	500	square feet
Four Generation Gallery (6/82)	2,000	square feet
Offices (9/82)	500	square feet
Interactive Computing	2,500	square feet
TOTAL	10,300	square feet

FUTURE SPACE NEEDS FY 1985-1986

Primary and Secondary Memories	2,500	square feet
Card computing	2,500	square feet
Archives	1,000	square feet
Analog computing	1,000	square feet
AN/FSQ-7 & other military computers	1,000	square feet
	8,000	square feet

POLICIES

* Preserve the history of computing.

"You must feel like the Director of the Museum of Natural History when he started to collect bones."

Jan Adkins, National Geographic

* Expand "oral" history via lectures and seminars by computer pioneers:

"There is no history, only biography."

Andy Knowles

* Make the machines themselves focal points:

"Well-engineered machines speak eloquently of their own elegance. Museum designers can't equal them."

Frank Oppenheimer, Director
The Exploratorium, San Francisco

* Interpret exhibits for the computer community:

"Hey, this Museum is for us big kids."

George Michael
Lawrence Livermore Laboratories

* Involve the primary audience:

"The Museum does not have to convince the computer community to support the museum because its artists are worthy; they <u>are</u> the artists."

Harold Cohen
Creator of the Museum's murals

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

STRATEGIES

1979 Built first exhibits; Held first lecture.

1980 Formed collections and exhibit policies;
Opened for viewing by appointment.

1981 Organized the public non-profit foundation.

1982 Open to the public from 1-6 Sunday through Friday.

Raise $125,000 from the "public."

Establish archives.

Start a research program.

1983 Obtain accreditation from American Association of Museums.

Plan an endowment program.

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

EXPENSES	FY 83	FY 84	
Labor (including overhead)		165 (20)	210 (25)
Lectures - 6 per year		25	30
Exhibits (one new gallery)		80 (20)	40 (35)
Store	20	30	
Publications (inc. fundraising)		30	40
Archives (start up)		35	30
Office Staff Support (legal, accounting, travel, etc.)		45 (20)	55 (20)
Total	400 (60)	455 (80)	

INCOME			
Digital Equipment Corp		250 (60)	250 (80)
Founders	200	45	
Membership	65	145	
Store/interest/functions		35	50
	545 (60)	475 (80)	
Surplus	145	20	

() Contributions by Digital through the cost center but not necessary to account to IRS.

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

1982-1983 FUNDRAISING

Raise $250,000 to match Digital's FY83 and FY84 budgeted contribution of $500,000 for the FY83 and FY84.

Numbers	Category	Return	
50	Corporate Founders	($2500)	$125,000
300	Individual Founders	($250)	75,000
400	Corporate Members	($125)	50,000
1000	Members	($25)	25,000
	TOTAL		275,000

STRATEGIES

DIRECT MAIL

2250	Letters April, 1982 -	27,500
4500	Letters & Reports, June, 1982	
6000	Brochures & letters, September 1982	
6000	Followups October, 1982	

BROCHURE DISTRIBUTION

PERSONALIZED CORPORATE CAMPAIGN

SPECIAL GRANT APPLICATIONS

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

DIGITAL COMPUTER MUSEUM CATALOG

INTRODUCTION

The second duchess of Portland, born in 1714, was an insatiable shell collector. She never found a satisfactory artistic arrangement for the specimens until she hired a student of Linnaeus (1707-1778), the father of botanical classification systems. Then the collection was rearranged according to a taxonomy illustrating evolution and relationships between family members.

The collection of the Digital Computer Museum, relating to the whole family tree of computers from their earliest origins, also needs a disciplined classification scheme. Those who have tried to understand computer evolution have intuitively considered a tree structure -- the basis of taxonomies -- but none have been fully developed for the purpose (Bell and Newell, 1971; Bell, McNamara and Mudge, 1978; Rogers, 1980; Science Museum, 1975, Sieworek, Bell and Newell, forthcoming). The National Science Foundation tree of early computers shows roots and connections but does not name branches. A number of partial systems and som upon terms exist for defining a classification system. The classification system in Computing Reviews works very well for the extraordinarily broad range of materials including "mathematics, engineering, the natural and social sciences, the humanities, and other fields with critical information about all current publications in any area of the computing sciences" (Sammet, 1980). The work of the AFIPS Taxonomy Committee, Taxonomy of Computer Science and Engineering, provides a convuluted semi-lattice covering all possible issues (AFIPS Taxonomy Committee 1980). Other trees look at only a part of computing (Weizer 1981, Sammet 1969). The evolutionary model has also resulted in the identification of generations (Rosen, 1969).

Generations are the primary organizing element for the collection and the catalog. The first four sections present the pre-computer generations. The fifth section is devoted to the pioneer computers that spanned the revolutionary bridge. The remainder of the catalog and collection is open ended; inclusive of all historic generations, i.e., at least one generation removed from the present technological generation.

THE GENERATIONS

Within the broadly accepted idea of technological generations, clear criteria can be identified to mark each one. These are listed below with examples shown in Table 1.

* A new base technology;
* A new machine structure;
* Satisfaction of a newly perceived need;
* Resulting in significantly different use of computing devices.

TABLE 1. THE GENERATIONS

PRE-COMPUTER GENERATIONS

TECHNOLOGY	MANUAL	CRAFT 1620	MECHANICAL 1810	ELECTRO-MECHANICAL 1900
MACHINE	Abacus	Tables Gunter's Rule	Planimeter Jacquard loom	Hollerith census machine, Friden calculator
NEED	Taxes	Trade Exploration	Industrial Land Division	Census Business
USE	Counting	Arithmetic Navigation	Surveying Weaving	Sorting Accounting

COMPUTER GENERATIONS

TECHNOLOGY	ELECTRONIC 1950	TRANSISTOR 1960
MACHINES	Whirlwind UNIVAC 1 ERA 1101	CDC 160, IBM 7090, IBM 1401 PDP-1
NEED	Defense Weather prediction	Space Science
USE	Firing Tables Weather Forecasting Management	Simulation Training programmers Accounting

---

Generational change is modelled by a series of distinct steps with a new base technology at a significantly different level. The technology base never meets the aspirations and dreams of mankind because perceived needs are continually rising. A new base technology only creates a higher takeoff plane. (Maslow, 1943) With each new invention, one or two prominent people often note that it will fulfill all future computational needs; but each time the demand for more computational power only grows.

A number of ideas and machines are designed and even built out-of-phase with a technology. Ideas that occur before their time often lie dormant in an inventor's notebook until the technology evolves to match the idea. Later historians illuminate these early concepts, showing the contemporary entrepreneurs that they are not originators but only implementers of ancient ideas. In the mid-twentieth century, some letters of Wilhelm Schickard dated 1624 were unearthed. These contained the drawings for the first known digital machine to perform calculations. (Cohen 1980) It is doubtful that these ideas transmitted from Schichard to his friend Kepler influenced any of the mechanical calculators that were subsequently developed. Blaise Pascal, whose single-register, mechanical calculator of 1645 was widely known, appears to have invented this machine totally on his own, as a young man intrigued with a mechanical solution to the problems of accounting, with which his father occupied himself. The inventors who actually develop a baseline machine for a technology are often tinkerers, not scholars searching the literature for ideas.

Increasingly, computing devices are not the sole result of one invention but the convergence of many. As a set of benchmark ideas coalesce into a new machine relating to a new technological generation, then additional, incremental inventions result that also become part of the technological base. A new generation is marked after the project has proven itself, shown not to be a fluke, and has added a new layer to the technological base. The Computer Revolution and beginning of the electronic generation saw the use of vacuum tubes in the ENIAC on a scale of magnitude never before experienced and the invention of magnetic core memory on Whirlwind. Since a generation is a convergence of inventions, its emergence cannot be marked by a single event. A clustering of events, including patents, publications, and start-up dates are used to somewhat arbitrarily select a particular year.

Three pre-computer generations and three computer generations are clearly distinguished. Although calculating activities started with early civilization, it was not until the seventeenth century that a variety of calculating devices were invented and used. The collections begin in 1620 with the beginning of the "Craft Generation". Prior to that computation was carried out manually, in much the same manner for all of history. Defining computing power as the product of processing rate and memory size, a 20 order of magnitude increase can be measured from the time when people used stone-based, single

register devices to the 1980s. The most significant increase -- a revolutionary change -- occurred with the beginning of the computer era. Before then, memory size was essentially constant at one. Afterwards, computing power began to increase at roughly twice the exponential rate of all past generations.

A generation is named for its predominant technology. The starting date of a generation is set not by the idea leading to a project that triggers the generation, but by the incorporation of a technology into a new product, concurrent with significant use. In most cases devices from a previous generation continue to be designed, manufactured, and used, often supplying a base on which the new generation is built. The electronic computer generation is marked at 1950. By that time the ideas of ENIAC had been replicated and the first commercial machine, the ERA 1101, was announced to the market. In the Computer Age, the naming conventions given by industry have been used, and they seem to accurately fit the model.

Table 1 lists representative needs, uses and inventions for each of the generations. During the pre-computer generations, evolution was exponential -- each period being about half as long as the one preceding it. The rapid change is similar to manufacturing learning curves, whereby a particular unit cost declines by 10-20% each time the cumulative number of units of a given type built doubles.

THE TAXONOMY

A taxonomy has been developed in parallel with the collection and the exhibits at the Digital Computer Museum. The taxonomy's basic framework is the PMS classification that describes the structure of computers (Siewiorek, Bell and Newell forthcoming). PMS allows any computing or software structure to be described hierarchically in terms of eight basic information processing primitives, but it does not deal with functional behavior, such as program interrupts that are not implied by a structure. The PMS system is generally used to provide a structural representation of the components of digital computer systems. In contrast, the Museum taxonomy classifies only whole computing systems and their antecedents. The following compares the two breakdowns:

TABLE 2. COMPARISON OF MUSEUM TAXONOMY AND PMS

MUSEUM TAXONOMY CLASS - CODE	CODE - PMS
Memories - M	M - Memories
Controls - K	K - Controls
Transducers - T	T - Transducers
Links & Switches - S	S - Switches
	L - Links
Calcula - D	D - Data Operation
	P - Processor
Digital Computer - C	C - Computer
Robotics - R	

The criterion defining the tree is the structure of the computing device, not the organization that made it or the purpose that it was meant to fulfill. To make an analogy with the animal kingdom, if the bone structure of a horse is that of a fine race horse then it would be classified as such; it would not matter if it were bred by the government and used to pick up garbage. In computing, the EDSAC, built at Cambridge University, is classified as neither an English nor a university computer, but as an EDVAC-related machine in the same family as the Maniac and ILLIAC. Thus, differentiation by manufacturers, countries, or intended users is not part of the taxonomy.

The classical scientific taxonomy system with its seven levels has been adopted to organize and classify all species of related inventions. The two top levels, kingdom and phylum, are technology and information, respectively. The Museum collection displays seven classes within the phylum of information. Each of these seven classes is broken down into order, family, and genus, and then identified by species. Table 3 lists the criteria used for the breakdown of the classes. Specific descriptions for each of the classes are found throughout the catalog.

Table 3. (in process)

Criteria used in differentiating orders, families, and genus.

CLASS	ORDER (Technology)	FAMILY	GENUS
Memory	Machine interface	Storage material	Structure of access movement
Controls	*	Degree of complexity	*
Transducers	*	Phenomena/material	*
Links & Switches	*	Degree of complexity	*
Calcula	Analog or Digital	Degree of complexity	Structure
Digital Computers	*	*	*
Robotics	*	*	*

* - To be determined.

Memory is probably the oldest class, starting with early markings on caves and continuing as a significant part of both computers and automata, and also as all kinds of human-readable aids to the brain. See Table 4 for more complete explanations.

Controls are rooted in early analog devices, such as the Greek water clocks, and have been significant in the mechanization process. At the beginning of the nineteenth century, card controlled looms introduced sophisticated pattern control to the industrial process through the use of a larger scale memory data-set than hitherto used. Card control ended with a great flourish in the early nineteen sixties with the tabulating machines. Again, with the advent of the computer on a chip, earlier technologies of control devices are rapidly becoming obsolete, being replaced by the "on-board" micro-processor.

Transducers take information in one form and put it into another. They are often associated with memory systems, allowing their replication; for example, printing use type (a transducer) to duplicate the information in books (a memory device). Transducers began with the movable type and include the teleprinter, tape transport, telephone, and television. These machines are becoming more and more sophisticated and less and less distinguishable from computers.

Calculators, other than the manual bead devices, did not develop until the 19th century and have been virtually displaced by computers. In the PMS notation, these are the data operators carrying out arithmetic operations. Either calculators have become embedded in computers or miniaturized computers have been embedded in what have traditionally been considered calculators. The taxonomy of Class Calcula is explained in the text. (See Table 5.

Links and switches evolved out of the needs of a large number of subscribers all desiring the use of a single system. The first telegraph was a simple device transferring information from one place to another. But the growth of telegraphy and telephony systems in the late nineteenth century created a need to establish elaborate networks linked together with a switching system. Computers still depend on linking and switching for cross communication.

Digital computers emerged in the late nineteen forties from a combination of calculator, control, transducer, links and switches, and memory technologies. The section "Pioneer Computers" shows the combination of elements that was adopted by the first 16 machines, many of which were patched together based on different technologies. Class Digital Computer is certainly more than the sum of these parts, as the parts have converged and been modified and molded into a new phenomenon.

Robotics actually started very early with man's desire to replicate life and took the form of doll-like automata. The experimentation in the sixteenth century however only served as entertainment for kings and in travelling sideshows. The ideas for what automata might do ranged far beyond the technology of the time. It was not until the second half of the twentieth century, that robots have become economically utilitarian. With smaller and more powerful computers, on board machines for sensing as well as calculating and thinking, robots will become more widespread in the future. This class is presently not included in the collection; but will be included in the future.

Each class, like a species, starts within a given generation, flowers, and dies or is incorporated within another class. Each started almost as an independent thread but is beginning to merge into one or two dominant classes: computer and automata. Figure 1 illustrates the potential scope of the collections, indicating the period in which each class emerged and for those, becoming extinct, the time of their gradual demise.

FIGURE 1: THE COLLECTIONS

```
              Period that the exhibit covers:
              Craft   Mechanical  Electro-mec   Electronic  Transistor  IC
               1600     1810          1900         1950        1960     1970


MEMORIES
              MMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM
MMMM
including books and magnetics

CONTROLS      KKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKK K K
including water clocks, and governors

LINKS & SWITCHES
              SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS
including telephony and telegraphy

TRANSDUCERS   TTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTT T T T
including typewriters and printers

CALCULA        DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD D D D D
including analog and digital calculators

DIGITAL COMPUTERS
              CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
including processors

ROBOTICS  RR R R R R           R    R   R   R   R     RRRRRRRRRRRRRRRRRRRRRRR
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Kim Igoe

Dear Kim Igoe,

Enclosed please find the questionnaire and check for $350 necessary to go forward with the Museum Assessment Program.

To help you, I am enclosing three sets of everything along with the MAP questionnaire: one for the AAM and one for each of the two on-site surveyors that you suggest. I have tried to be as complete as possible so that the surveyor can come to the site prepared and so that we can plan the visit to really get into some depth and set some priorities for ourselves. I believe that the trustees and I have a good idea of where we want to be some years hence; and now the question is the best, most efficient road to get there.

For the above reasons, I would like a surveyor who has helped an institution grow -- from an idea to a major established museum. Personally, Mike Spock is very helpful to have on our Board for this very reason -- he keeps warning me of the various pitfalls of growth along the way. Mike actually suggested that we start the MAP procedures and I am sure that he will be happy to be helpful in this project, provided he is in town, and I will be asking his advice about the final selection of a surveyor.

If possible, I would like to get some names before Christmas and select a person and a date for early in the year, so that we can compile all the information and have a report and our own proposal in the mail to The Computer Museum's Board in the spring.

Thank you for your help,

Cordially,

Gwen Bell

The Director is responsive to the Board of Directors following through on its requests and policies with the assistance of the personnel at the Museum.

The Director directly oversees the work of the Exhibits and Archives Coordinator, the Programs Coordinator, and the Store Manager. Much interaction is required in the programs area as new events and programs evolve requiring decisions unique to each.

A large portion of time is needed in the area of fundraising, writing letters and proposals and generally creating goodwill for the Museum.

The Director also oversees the publicaton of four reports annually. An assistant for Publications and Photographs will aid in the tasks of running down details, layout, proof-reading, and editing.

Approximately one day a week must be spent in preparing for the monthly meeting with the Executive Committee of the Board of Directors. The Director is a member of this committee which sets policy, watches the budget and generally keeps the museum on track in matters legal and financial.

The Director may assist in other projects as needed, give tours, and must be available to settle personnel problems as they arise.

10/24/82 Sun
TO: Staff

NOTHING BETWEEN THE CRACKS

PRIORITIES:

Short term:
Today, get overheads and all material for presentation to HOCC.
Get materials to Reno for Winter Report -- it must move.
Schedule Oct. Nov. - see below

Longer term:

Schedule all mailings and make sure people get things on time: we keep the members happy. Harry Huskey invitations should be out on time, with insert letter to "Locals". - Chris and Geri schedule this -- from doing the labels to stuffing etc. using the store women and Bill as appropriate.

Increase membership and financial support.

- At least 25 personalized letter's go out a week -- signed by me or some member of the Board -- to get major acquisitions and get things moving. (Geri let's keep a log of the numbers of personalized letters that go out each week for big bucks. Geri, it's your job to keep me at this and make sure they go out.)

- The December 9th, Pray, Mr. Babbage party should be used for a big membership drive. Chris, your main job is to get the publicity out for this and pull the whole party together. (Huskey should more or less take care of itself...without alot, and Bits and Bites is about done.) The goal should be 100 new members from Pray, Mr. Babbage. Invitations need to go in the mail on November 12th -- want you to use a great big mailing list (get our friends at DG etc., lots of internal Digital -- lets rethink the use of lists). They must send in money for tickets. $5. each for members (who may bring one friend for $5); non-members need to become members for $25 and then pay $5 for themselves and a friend.) -- Get me to call Charlie Conn today and set up a meeting for Friday, when we have all the details of the party and get them to design invites for free, must be done fast to go to the printers by the 5th for a week turn-around. This whole thing has to be quick and dirty, but with lots of style. I want to talk to you and Jamie about it for 15 minutes today. Then lets put

the whole thing in final shape on Friday.

- Jamie, after the Pioneer Timeline is complete, then you must drive the planning for the lobby floor space, and the proposals for all the viewing and video equipment.
-

The Office Manager reports to the Director, the secretary to the DEC Operations Committee and a DEC Supervisor. Reporting to the Office Manager are the Secretary, Business Manager and Store Manager. (This area needs clarification from Gwen.)

A. Management of office
   1. Supervise secretary
   2. Supervise Business Manager
   3. To ensure smoothly-running operations, act as interface to Digital service organizations such as Facilities, Field Service, Payroll, Personnel

B. Assist Director with Fundraising

1. Goal - coordinate 100 solicitation letters per month (over $100)
   a. Director provides lists of persons/groups to whom letters will go
   b. edit Director's letters for format, accuracy, style
   c. input list into list processing
   d. mail letters
   e. copy to correspondence file
   f. copy to Office Manager's Monthly Solicitation file (green folder in O.M.'s desk by month)
2. Month-end Membership Report
   a. for Executive Committee
   b. shows how many new members in each category
   c. includes list of all current solicitations
   d. who responded
   e. what results
   f. filed in Executive Committee Book (white book in Business Manager's Office)

C. Manage Annual Cost Center Budget
1. WHAT -- $60,000 from DEC
   a. includes O.M.'s salary
   b. aviation expenses
   c. supplies from Stationery
   d. miscellaneous shipping
   e. other
2. HOW --
   a. make up budget
   b. track it monthly
   c. keep Director aware of status
3. Budget overrun -
   new process to be worked out with Director to voluntarily reduce contribution from DEC to compensate

Other activities of the Office Manager

A. Proposed installation and management of 11/45 computer connected to all museum users
    1. in location off lobby
    2. work with Field Service of DEC to install
    3. obtain correct programming for each function
        a. accounting
        b. correspondence
        c. members lists
        d. mailings
        e. librarian-archivist procedures
        f. program dates
        g. others

B. General Assistance
    1. mailings
    2. travel arrangement
    3. museum events and functions
    4. others

C. Supervision of Store Manager (?)

Floppies used:

A. GERI - correspondence and other
    1. filed in O.M.'s office (2 drawer file, under Floppies)

B. BUDGET - Director's floppy
    1. updated monthly
    2. filed in Executive Committee Book (white) in Business Manager's office
    3. contains Monthly Membership Report

C. SOLCI
    1. filed in O.M.'s desk in "solicitation" folder
    2. contains Update Form
        a. updted monthly solicitation lists
        b. positive or negative responses recorded
        c. paper file - left desk drawer under "Project - Solicitations over $100

The Business Manager reports to the Director.

The main function of the Business Manager is to free the Director, Exhibit
Coordinator, Programs Coordinator, and Office Manager from bookkeeping and other money related chores.

From the Business Manager's viewpoint the Museum is divided into four areas: Director's Office, Exhibit Center and Archives, Program Center, and the Resource Center.

The Business Manager performs the following tasks areas and they relate to the four larger areas of the Museum mentioned above: payroll, insurance, bank accounts, bookkeeping and accounting, budget, taxes, state and federal reporting, store management, bill paying, invoicing, money handling, preparing for audit, relations with vendors, petty cash, and keeping track of fundraising. Also photography, report editing, and tasks for special events.

Payroll. Shawmut Automated Payroll Service -- Contact is Thomas Chatelier, 292-2197. In Payroll File see sample forms for: New Employee Setup for both salaried and hourly employees; Employee Revision Form for any change e.g. salary change, tax status; Employee Prelist (comes from Bank each payday, to be filled in with hourly employees' hours listed. Time cards are collected every 2 weeks. Employee Prelist Total is stapled to Prelist and must be into Bank by 2 p.m. on Monday following the end of pay period. Pay period is Sunday through Friday, biweekly. Checks are processed on Tuesday and can be picked up at the bank on Wednesday a.m.
Bus. Mgr. has key to the bank pouch. (More bank forms can be obtained from the bank when needed.)

All employees must fill out a W4 Form for Federal withholding tax and a M4 Form for State withholding tax. These forms may be obtained from the IRS Center in Holyoke.

Other forms: Employee Reference Card from bank will verify pay status of a new employee or that revisions have been made to the pay status of an existing employee.

Insurance. Two areas--Museum Insurance and Health Insurance.

Museum Insurance includes: 3 polices with Johnson & Higgins, 3 Center Plaza, Boston -- Joan Goldberg 742-5300

Director's and Officers' Liability

Underwritten by Chubb; includes areas of Embezzlement, Limits on Personal Liability, and others.

Blanket Excess Liability Policy

Underwritten by Fireman's Fund: includes areas of Bodily Injury, Automobile Liability, Workman's Compensation, and others.

Commercial Insurance Program (biggest area)

Underwritten by Federal Insurance Co. (Chubb): includes areas of Property and Building Losses, Bodily Injury (visitors, accidents), Employee Dishonesty, Personal Property.

Health Insurance Group # (or Employer #) is 26232. Plan Administrator is MSP (Multiple Security Program); Claim Office is John Hancock Mutual Life Insurance Co, St. Louis Group Claim Office, 13523 Barrett Parkway Drive, Building #2, Suite 250, Ballwin, MO 630ll, Telephone # 314/821/3002.

Health Insurance or more correctly called Small Group Insurance Plan includes: accident, hospital, dental, mental, surgical, $10,000 Term Life, long term disability, $10,000 accidental death and dismemberment.

Claim forms include: Statement of Claim (to Dr. or hospital)
Dental Claim Form
Group Hospital Insurance Form (to hospital)
plus Claims Filing Instructions.

Contact at MSP (Plan Administrator) is Vivien A. Benning, Contracts Service Coordinator at MSP Insurance Trust, P.O. Box 786, Boston, MA 02117, Tel. No. 421-5000.

To enroll new employee in plan two forms must be filled out and mailed to Vivien Benning: John Hancock/ MSP Group Insurance Enrollment Card and John Hancock/MSP Statement of Health.

Bank Accounts. The Business Manager maintains 3 accounts, writing checks, keeping registers , and reconciling bank statements for each.

All are at the Shawmut Community Bank, Marlboro West Branch; Manager, Susan Smith 485-6697.

l. A deposit account for VISA and Mastercharge sales. Account #294-4146.

2. A membership account (checking) formally called Non-DEC Contributions;
an interest bearing account; the general operting fund (the largest acct.)
Account # 275-959-4

3. Store and Events (checking) account; deposits from store, play, etc.
Account # 275-960-8. Out of this account comes money for store inventory, food for special events, expenses for any money-making event.

For Investment Information the contact is Gail Chadwick at the Framingham Office, 620-1100 X362--info on IRAs, CDs, etc.

Bookkeeping and Accounting. For each of four areas of museum there are income and expense records in file folders.

Budget. On Floppy kept in Gwen's Executive Committee Notebook, in pocket in back. Monthly Budget Report shows Projected, Year to Date, For Current Month, Total, Deviation. Income and Expenditures for all 4 areas.

Fiscal Year runs July l through June 30.

Taxes. Federal ID # is 042-747-017 (also called Employer ID # and Tax ID #.)

The most important filing is Tax Exempt Filings for Federal Form 990 and Schedule A; and for State Form PC. These are filed after close of Fiscal Year and a period of 5 months is allowed for filing. (The due date for the Museum would be November l5.)

Quarterly Sales Tax Form ST9Q (State form)

Withholding Taxes: Federal Form 941E--Quarterly Return of Withheld Federal Income Tax. (Museum has not yet filed with State in regard to withholding income taxes.)

We are in an Advanced Ruling Period with the IRS until June 1984. The IRS will give permanent tax exempt status to the Museum at that time if in the probationary period it maintains a 2-l ratio (For every $2 that is contributed by corporations, there is $1 from the public).

Store--info from Carole.

Bill Paying. Invoices come in and are 1. grouped by when they are to be paid, 2. o.k.'d by person initiating the expense securing as much info about it as possible, and 3. paid out of correct account.

Invoicing. Use invoice form. Mostly for dinners done for groups. Copy goes in Receivables folder. When paid goes in account folders.

Petty Cash. Taken out of membership account when needed. See Petty Cash file folder. Usually an expense voucher is filled out and must be ok'd.

Audit. Coopers and Lybrand do the auditing (gratis) after the FY is over. The Business Manager supplies the raw data from the income and expense files. Contacts at C&L are Scott Eston and Ed Gillis, 1 Post Office Square, Boston (574-5000). All information should be given to C&L in September so that tax forms will be ready by the November deadline for filing.

Relations with Vendors. The policy of the Museum is to pay bills promptly when due. They may be potential members of the museum or possible contributors of money or goods for special events.

Keep track of fundraising. Important to watch the income and to go slow on outgo, keep expenses down, and process deposits quickly when income is less.

The Business Manager is for the present the official photographer for the museum. Equipment is kept in the Twilight Zone and in the file cabinet in the Bus. Mgr.'s office. Equipment includes:

Cameras Nikon F body Serial #6972015
Nikon F Viewfinder Serial #497271

Lenses Nikkor-UD Auto 1:3.5 f=20mm Serial #434267
Micro-Nikkor-P Auto 1:3.5 f=55mm Ser #648625
Nikkor-P Auto 1:2.5 f=105mm Serial # 428755
Nikkor-Q Auto 1:4 f=20cm Serial # 198738

Accessories Nikon M2 (extender?)
Nikon HS-4 lens shde for 105mm
Nikon K1, K2, K3, K4, K5 (filter holders)
Aetna Close Up Lens #1 52mm
Aetna Close Up Lens #2 52mm
Nikon hot shoe

Davis and Sanford Model B Floating Action tripod
Panrite Universal tripod head
Mole-Richardson light stand
Larson Soff - Box flash diffuser
Larson Reflectasol Clamp

Studio FlashNorman 800 Flash Power Supply & Power Cords
(3) Norman Lh 2000 Flash heads
Norman aluminum light stand
Background stands
PC Synch cord

Good contact for photo advice is Steve Spellman, Brownstone Group,
Brookline. He is a professional photographer and also a Founder member of
the Museum.

The Bus. Mgr. has done some report editing and performed tasks for special

events (such as stage mgr. for play).

Floppies are stored in "Software" file folder and are as follows:

Budget — Monthly budgets.

TWIT — Archives expense voucher, purchase order forms, invoice forms, list processing, etc.

DHB 001 — Notes to financial reports (taxes), other tax information, receipt form, information about Report.

File Folders contain procedures for payroll, preparing taxes according to printed instructions, accounting system. There are no printed instructions for most procedures but easily learned by a newcomer.

Legal Advice: Jim Davis at Bingham, Dana, and Gould, 100 Federal Street, Boston, specializing in legal affairs for non-profit organizations. (Expensive) Clerk of our Board of Directors. Sends copies of any legal or tax filings to Davis for locating potential problems.

Darman Wing, DEC Legal Department, Secretary to Executive Committee; also gives general advice

Legal information is filed in bottom drawer of file cabinet.

From DHB: Procedures for Processing Museum Store Sales, Procedure for Handling Money Given to Museum, Museum Store Purchasing of Inventory & Supplies, Procedure for Handling Money Given to Museum, Procedure for Handling Accounting for Functions. MB will go over these procedures when time permits.

June 6, 1983

Brian Randell

Dear Brian,

Gordon and I are both home for the summer. And I am beginning to feel relaxed, rested and ready to face the new opportunities ahead.

Oliver Strimple has been here for the last three weeks and I believe is quite excited to come to the States for a year. He is not interested in a "historic" gallery per se, but in doing a thematic gallery with an historic approach. He will probably do one on "The Computer and the Image" that will open in November 1984. If all goes well, Oliver will come January 1984 and leave a year later. It is not yet fixed with his director so please don't talk about it.

Jamie, Beth, Meredith, Bruce McIntosh (designer), and I will be working on revamping the present materials to do an integrated historic exhibit (using video) and being much more involving. This will open (with luck) on May 11.

As the Chairman of the exhibits committee, I think it would be a very good idea if you would/ or could call a meeting sometime in the winter to review what we will be doing (before it is done). The best time would be between November 1 and February 1. We'll work out a way to bring you over.

Then I think that a meeting of the committee on May 13th - Saturday - to review Oliver's ideas would also be a good idea.

The committee is made up of you, Ken Olsen, George Michael, and Eugene Fairfield (who declined). See enclosed letter. I will see if we can get an alternative IBMer, or a least, I. Bernard Cohen. Any other ideas? Let me know your preference on this.

CBI Bibliography. I'm enclosing my critique. It was written on just an awful terminal that we had in Gordon's hotel room in California. But the job got done. We approached the same problem from different angles.

Books at the store. Books still make up 25-30% of the purchases at the store; but for the amount of inventory and diversity that we must keep any individual title moves quite slowly. Yet, we believe that this is an important element in our stock and perhaps over the years, people will get into the habit of buying from us. (But, I believe that your remark on books at Sturbridge probably were much less costly and technical books than we carry.) Books like Randell, History of Programming Languages, History of Computing in the Twentieth Century, etc. are not impulse purchases. The best selling books are: Computing Catastrophes ($11.95 paper); Soul of a New Machine ($7 paper); Discovering Computers ($10.95 for children);

($10 paper). But the people who find the historical book that they want at the museum are very happy.

Thanks for coming,

Cordially,

Gwen Bell
Director

November 7, 1983

Andy Knowles
Nourse Road
Bolton, Massachusetts 01740

Dear Andy,

"If we invested money in the future rather than the past, then what?"

Each time I invest "in the past" -- it has future payoff.

The idea of a computer museum started for me, at Carnegie doing research for Computer Structures, a computer science reference that I consider mostly history. Allen Newell and I collected materials and objects from the past machines so that we could use them to build theories. The Unibus and general registers both came out of this work, and I can remember inventing the concepts by building an encompassing theory of past structures. Some of the architecture of the 11 and then the overall goals of the VAX grew out of a knowledge of the past. When I returned to Digital in 1972, I knew the truth of the statement: "Those who forget history are doomed to repeat it."

One goal at Digital was to build an engineering group who stayed at the cutting edge and this required understanding other views, including history. I started close associations with Universities (who fundamentally teach history), then put together Computer Engineering so that all the engineers in the growing organization could have a ready-reference to Digital's computer evolution, and finally helped establish the museum right in the middle of an engineering/marketing area of DEC. Although The Computer Museum itself is leaving, I hope that DEC keeps their own collection of historic machines on display.

Fred Brooks famous book, The Mythical Man Month, required reading for many engineering students, grew out of his historical observations from designing the 360 system software. It is a classic on the nature of organizations and work, especially with regard to large software developments. Neither Fred Brooks or I market books as history, but rather as fundamental understanding.

Computer Generations, marking technological time, are the main organizing principle. The Computer Museum provides the best place to gain an understanding of this powerful idea. Each generation's new technologies, startup companies, and new products are listed and displayed. For example over 100 minicomputer startups are recorded at the beginning of the third generation, and now the fourth shows a similar pattern for micro-based companies. Analyzing winners, losers, and also-rans provides some insight on what is happening today. This is in a paper (which you might want to look at) that attempts to provide insight on today's industry.

The Computer Museum, although presently marketed as a historical museum, has another, and probably more important role: providing basic understanding for a variety of levels of visitors. Everytime I visit the museum, I get insight relevant to a current problem. A month ago while looking at the Honeywell 116, a very early IC machine, ideas jelled about board size, pins and function. Just last week I observed that nearly all of the micros repeated, for the third time, the time worn memory management evolution path that began in 1960 with Atlas, which we followed with the 10 in the 60's, and then again with minis in the early 70's.

At another level, four very bright kids from a New Hampshire prep school spent three hours trying to find out everything they could about old computers -- and their teacher felt this helped their fundamental understanding of computing. I continue to get statements from my friends in the U. K. when we tour the galleries together about how the Science Museum turned them on to science and technology.

Andy Van Dam, Professor of Computer Science at Brown and founder of ACM's Siggraph illustrated the importance of learning from the past in a wonderful two hour lecture composed of about 20 films on computer graphics to an audience of about 100 on a beautiful autumn Sunday. He gave his time and was able to get the films because it was for the Computer Museum's archives. Twice he noted how viewing the films had moved him and others to action, even though they were historical: Sketchpad and the Englebart system at SRI. I'll even conjecture that if the later film had been preserved and shown more widely, then the human interface would have evolved more rapidly. It is even possible that the work at Xerox Parc which post-dated SRI's work would have been unnecessary. Bob Kusik, one of DEC's CAD managers sat by me and remarked that the modern work is better, but NOT that much better considering 20 years has gone by; things would have gone much faster if people had built on earlier work. This is a major facet of the Museum and one which I'll bet your company will use sometime. If you support The Computer Museum you are supporting an important educational institution for the present and future generation of engineers, programmers, artists, and hackers who will make history.

In the fall of 1970, when The Computer Museum took its first non-Digital donation, we decided it was much better to try to learn from the whole past of computing, just not our own. People who stay insular don't have a see the alternatives. Looking at other peoples good and bad ideas provides perspective on your own. Being industry-wide is most economical and ecumenical. It's not a job to leave solely to IBM who invests a great deal in preserving its own history. Their excellent multi-million dollar presentation at 590 Madison Avenue exhibit claims they built the first stored program computer (the SSEC -- and they omit Eckert and Mauchly or Wilkes) and that Wang and RCA invented the core memory (while J. Forrester holds the main patent). The Computer Museum provides the story of all the companies, not just the big ones, but the wide range of people, ideas and companies that made the world's most exciting industrial adventure.

Museum's are the ultimate in the future: they provide immortality of all kinds. Look at baseball club owners supporting the Hall of Fame as well as training camps, or the Corning Glass Museum next to the Steuben factory which millions have visited. The PDP-1 playing spacewar -- elevates it to a famous status as the first computer game. Lawyers come there and prove that all the war game ideas existed in 1961-2: this keeps many games in the public domain. Many have commented on seeing the first mini, the PDP-8, in The Science Museum, London, along with Jacquard's Loom, Babbage's Difference Engine, Watt's Steam engine, etc. At The Computer Museum: the Apollo computer that went to the moon, the Altair (the first home computer with a company now hardly in existence), Whirlwind, other machines and the display of the Noyce patent and Fairchild planar process that really made the industry we know, all pay homage to seminal efforts. The Computer Museum provides stature to our industry, can't we afford it?

To make the Museum more contemporary, a major exhibition on the computer and the image is being planned and curated by Oliver Strimpel, a young Phd astrophysicist who's the computer section curator at The Science Museum. It will let the public and specialized or non-technical computer professionals into some of the "secrets" of computer graphics. Lewis Schure is giving the exhibit a working paint machine; HP is giving it a high-speed plotter controlled by a new touch sensitive screen personal computer; SIGGRAPH is providing all their tapes; **how would you feel about providing some display of a Lexidata product?**

It's not an either/or choice between the past and future. Tradeoffs between supporting, understanding, and preservation at the Museum versus many other lines on a corporate P&L such as engineering, marketing, PR, sales, library, personnel, corporate relations or the line that buys all the memorabilia to make everyone feel good for an instant. (It may be fitting that all of the four battery operated clocks given to me while at DEC have now stopped.) Or on a personal level between investments, tax shelters, luxury consumer items, or other giving. Charitable giving to a cause in which you believe -- or the Museum that immortalizes and improves your industry -- is the ultimate in tax shelters.

At last May's Board of Director's meeting, the notion was expressed that the Museum should develop some income-generating activities. As a result, the store (with no capitalization -- only bootstrapping) has grown from a thousand dollars a month in June 1982; to triple by January 1983; and we expect about $8-10K a month, mainly from mail order. With some capitalization and high level advice, the museum's retail and service activities could provide significant income and educational service. **We sure could use your marketing expertise here -- what about a couple of hours of your time to review the plan?**

The Museum is reaching more than 100 million people this year via the media. Each article, tv spot, and radio interview educates more people about computers. The first issue of Perspective the magazine you started at DEC, used the museum for the source of its cover and an article on the first personal computer, the Whirlwind. Data General,

Fairchild and other companies have also used materials. In addition, the more popular magazines -- Ms., American Airlines Magazine, TWA Magazine as well as Channels 2 and 7 have major items based on the museum in October and November. In addition, the Museum sells the services of the use of its space a artifacts for litigation information, commercial television (such as 60 Minutes), historic exhibits in corporate headquarters (such as ADP), and helps with materials for centennial productions (Burroughs and NCR). The Museum is about the most comprehensive source for materials on any historic aspect of computing.

In a fiercely competitive world, The Museum is something we can do together and point to with pride. Everyday visitors enjoy and learn from the exhibits and more companies are supporting it with artifacts and money. Thus, it's the best hobby I've had. Given the infinity of displays, archives and research it needs, there's plenty of room for everyone to have it as a hobby too. Les Hogan got all the material for a major display on the chip. **Hope you too find something in this letter that you feel like becoming active in doing.**

The Computer Museum is a pleasant club; old friends meet there -- including machines and people -- and enjoy companionship while learning. Just recently, Bill Gates, founder and technical leader of Microsoft and Alexander Schure, President of NYIT and a computer graphics pioneer, support it, along with about 1000 others from Amdahl to Zuse. You may have different tastes but its a club to me and a number of others where we meet sociably and unlike other clubs, the "dues" are totally tax deductable. The Museum can do right in the long run, doesn't really have to make its deadlines. But right now, I hope that you will agree with me, that it would be a good idea to get out of DEC and moved into Museum Wharf. To do this, it will take money. I don't have a salary; but I'm going to give the maximum that I can this year -- and still take a tax deduction, (I'm giving one-third of my income). Now I don't expect this of anyone else. **But as a member of the Board of Directors, I hope that you would be one of the people commemorated on the "brass plaque -- or equivalent".**

I would really like to spend some time with you and your associates at Lexidata and Fred Adler if you want to discuss any aspects of the Museum in more detail and why I feel it is a significant investment in the future, not the past. The current museum is an excellent setting for this and the new location, assuming you help us, will be even more accessible to all.

Basically, we need your help. I'd like to proceed in a way to obtain it. **What you say?**

Sincerely,

Gordon Bell

I wrote this letter in response to the following probe:

"If we invested money in the future rather than the past, then what?"

Each time I invest "in the past" -- it has future payoff.

When I left DEC and went to Carnegie in 1966, Allen Newell and I collected materials and objects from the past machines to build theories. This resulted in a book entitled, Computer Structures, that influenced at least two generations of computer architects. I can remember inventing the concepts of the DEC Unibus and general registers by building an encompassing theory of past structures. The overall goals of the VAX grew out of a knowledge of the past. When I returned to Digital in 1972, I knew the truth of the statement: "Those who forget history are doomed to repeat it." I now see the semicomputer companies repeating history as they build microcomputers. We pay dearly for their education.

One of my main goals at Digital was to build an engineering group who stayed at the cutting edge. This required understanding other views, including history. I started close associations with Universities (who fundamentally teach history), then put together the book, Computer Engineering, a ready-reference to Digital's computer evolution, and finally helped establish the computer museum right in the middle of an engineering/marketing area of DEC. Although The Computer Museum itself is leaving, I hope that DEC keeps their own collection of historic machines on display.

I am not alone in this approach. After Fred Brooks led the software team on the IBM 360, he generalized his experience in The Mythical Man Month, a required book for many engineering students. It is a classic on the nature of organizations and work, especially with regard to large software developments. Neither Fred Brooks or I market books as history, but rather as fundamental understanding.

THe Computer Museum is constructed to help understand the evolution of computing. Computer Generations, marking technological time, are the main organizing principle. Each generation's new technologies, startup companies, and new products are listed and displayed. At the beginning of the third generation, over 100 minicomputer startups are recorded--with at most, 7 winners. Now the fourth shows a similar pattern for micro-based companies. Analyzing winners, losers, and also-rans provides some insight on what is happening today. I've written an analysis of this phenomena which I'd happily make available to

anyone.

Everytime I visit the museum, I get insight relevant to a current problem. A month ago while looking at the Honeywell 116, a very early IC machine, ideas jelled about board size, pins and function. Just last week I observed that nearly all of the micros repeated, for the third time, the time worn memory management evolution path that began in 1960 with Atlas, which we followed with the DECSYSTEM 10 in the 60's, and then again with minis in the early 70's.

I'm not the only one that learns, a dozen high school students came to an esoteric lecture on coding in the nineteen thirties given by Donald Davies of England's National Physical Laboratory. Asked if they got anything from it; they replied that they were going to use some of the ideas on setting secure codes for the school's computer. I continue to get statements from my friends in the U. K. when we tour the galleries together about how the Science Museum turned them on to science and technology. And now I see it at The Computer Museum: Just last week four very bright kids from a New Hampshire prep school spent three hours trying to find out everything they could about computers.

Andy Van Dam, Professor of Computer Science at Brown illustrated the importance of learning from the past in a wonderful two hour lecture composed of about 20 films on computer graphics. Twice he noted how viewing these historic films had moved him and others to action. I'll even conjecture that if these films of a mouse controlled computer from the early sixties had been shown more widely, then this kind of human interface would have evolved more rapidly. One of DEC's CAD managers sat by me and remarked that the modern work is better, but NOT that much better considering 20 years has gone by. But no place has existed where the objects, films and programs of the past were available. The Computer Museum provides this for the present and future generation of engineers, programmers, artists, and hackers who will make history.

In the fall of 1970, when The Computer Museum took its first non-DEC donation, we decided it was necessary to be industry-wide and international. IBM invests a great deal in preserving its own history, but their excellent multi-million dollar presentation at 590 Madison Avenue exhibit claims they built the first stored program computer (the SSEC -- and they omit Eckert and Mauchly or Wilkes to whom the international community give the credit). The Computer Museum provides the story of all the companies and all nationalities, not just the big ones, but the wide range of people, ideas and companies that made the world's most exciting industrial adventure.

Museum's are the ultimate in the future: they provide immortality of all kinds. Look at baseball club owners supporting the Hall of Fame as well as training camps, or the Corning Glass Museum next to the Steuben factory which millions have visited. The PDP-1 playing spacewar in Museum elevates it to its appropriate fame as the first computer game. Lawyers come there and prove that all the war game ideas existed in 1961-2: this keeps many games in the public domain--and you with more companies to venture in. At The Computer Museum: the Apollo computer that went to the moon, the Altair (the first home computer with a company now hardly in existence), MIT's Whirlwind, and the display of the Noyce patent for the integrated circuit, all pay homage to seminal efforts. The Computer Museum provides stature to a 100 billion dollar industry, surely we can afford it?

To make the Museum more contemporary as we move to Boston and address a wider audience, a major exhibition on the computer and the image is being planned by a young Phd astrophysicist who's the computer section curator at The Science Museum. It will let the public and specialized or non-technical computer professionals into some of the "secrets" of computer graphics in the big machines behind animation, landsat analysis and real time simulation. The Museum will bring to the public a view inside the industry to help de-mystify it and improve what is called computer literacy.

It's not an either/or choice between supporting the past and future. Tradeoffs between supporting, understanding, and preservation at the Museum versus many other lines on a corporate P&L such as engineering, marketing, PR, sales, library, personnel, corporate relations or the line that buys all the memorabilia to make everyone feel good for an instant. (It may be fitting that the four battery operated clocks given to me while at DEC have now stopped.) Or on a personal level between investments, tax shelters, luxury consumer items, or other giving.

The Computer Museum is the most comprehensive source for materials on any historic aspect of computing. Primary source materials are provided for television, magazine articles, books and scholarly research. The staff work hard to provide the correct information and new insights about evolution of the industry seem to be added daily.

In a fiercely competitive world, The Museum is something we can do together and point to with pride. Everyday visitors enjoy and learn from the exhibits and more companies are supporting it with artifacts and money. Thus, it's the best hobby I've had. Given the infinity of displays, archives and research it needs, there's

plenty of room for everyone to have it as a hobby too. Les Hogan, Fairchild's former president got all the material for a major display on the chip.

With proper support, the Computer Museum will be added to the list of great science and technology museums that every scientist and engineer must visit... along with the non-technical public. It will also greatly enhance Boston as a technology center.

The Computer Museum is a pleasant club; friends meet there -- including machines and people -- and enjoy companionship while learning. Bill Gates, the 28-year old founder and technical leader of Microsoft supports it along with about 1000 others from Gene Amdahl to Konrad Zuse. You may have different tastes but its a club to me and a number of others where we meet sociably and unlike other clubs, the "dues" are totally tax deductable. The Museum can do right in the long run, doesn't really have to make its deadlines. But right now, I hope that you will agree with me, that it would be a good idea to get it moved into Museum Wharf.

I hope I have your support to make this world class museum even better.

Gordon Bell
11/26/83

7 April 1983

Dianna Humphrey
Research Scientist
Control Data Corporation
5500 Interstate North Parkway
Suite 520
Atlanta, Georgia 30328

Dear Dianna Humphrey:

The place we visited was at North Bay, I don't recall the name of the installation. The purpose of the visit was to see one of the last AN/FSQ7's in operation prior to decommissioning. A more important purpose was to select artifacts which will be given to the museum. This display should constitute a major display.

You're right, a curator should never make the mistake I made in the article. As a result of your pointing this out, I've decided to give up my title as curator. I will continue to worry about critical artifacts, the collection, taxonomy and collection policy for the museum, but without title.

The Annals of the History of Computing is published quarterly by AFIPS Press, 1815 North Lynn Street, Arlington Va 22209, and can be subscribed to like any journal. If you're a member of an AFIPS constituent society the price is $18, and if not $25. Individual copies are available through them too.

Enclosed is some information, including one of its quarterly reports, on the Computer Museum. A listing of the artifacts will be published in a future issue of the Report. I hope you'll consider joining.

Sorry for the error.

Sincerely,

Gordon Bell
Vice President, Engineering

GB5.6

THE COMPUTER MUSEUM MEMBER'S FIRST FIELD TRIP TO NORTH BAY AN/FSQ7 SAGE SITE AND TO THE CANADIAN NATIONAL MUSEUM OF SCIENCE AND TECHNOLGY

Gordon Bell

Curator, The Computer Museum

10 October 1982

The first Computer Museum members' Field Trip just returned from a spectacular trip to North Bay Canada visiting the SAGE AN/FSQ7 computer prior to its decommissioning this winter, having been operational since 1962. The "Q7", once known as Whirlwind II, grew out of the Whirlwind project, initially started as an aircraft simulator. Becoming a prototype for air defense, this technology in turn formed the basis of modern air traffic control! (Lesson: what you get may not be what you start for when project aims are high.)

Seventeen museum members made the trip via chartered DECair, including Bob Crago from IBM, one of the key designers; Kent Redmond and Tom Smith, historians stet. writing the SAGE story; Henry Tropp, who is writing an article for the Annals of the History of Computing; and Richard Soloman who photographed and videotaped as part of an MIT Project on the History of Computing. The flying and trip arrangements were flawless. We left Friday noon, 8 October, from Bedford, Mass. for North Bay, arrived and visited the "hole" where we were completely briefed by members of the staff and original installation team, had dinner with the Canadian Air Force leaders, including the Commanding NORAD General (U.S.), flew on to Ottawa where we spent the night prior to visiting the National Museum of Science and Technology and returned Saturday afternoon.

THE Q7

Bob Everett's paper on the Sage computer was published in '57, and the machine was operational in Canada in '62. The machine created many patents as by-products, including perhaps the first associative store (using a drum). The machine is duplexed with a warm standby (I mean warm

since the duplexed machine uses about 1 Megawatt of power to heat 55,000 tubes, 175,000 diodes and 13,000 transistors in 7,000 plugins!). The 6 microsecond, 32-bit word machine has 4 X 64K x 32-bit core memories and about the same memory in 12- 10.7" diameter, 2900 rpm drums, 6 of which are for secondary memory. There is no use of interrupts and i/o is done in an elegant fashion by loading/unloading parallel tracks of the drums with the external world completely in parallel with computing. That is, the i/o state becomes part of the computer's memory state. A single i/o channel is then used to move a drum track to and from the primary core memory.

The main i/o is a scan and height radar that tracks targets and finds their altitude. The operator's radar consoles plot the terrain and targets according to operator switch requests. The computer sends information to be plotted on 20" round Hughes Charactron (vector and alpha gun) tubes or displayed on small alphanumeric storage tubes for supplementary information. Communication lines connect neighboring air defense sectors and the overall command. The operating system of 1 Mword is stored on 728 tape drives and the drums.

The computer logic is stored in many open bays 15' to 30' long, each of which have a bay of voltage marginal check switches on the left side, followed by up to a maximum of 15 panels. The vertical panels are about 7' high by 2' wide and hold about 20 plug-in logic units. The separate right and left half of the arithmetic units are about 30' each or about 2' per bit. Two sets of the AMD 2901 Four-bit Microprocessor Slice would be an overkill for this 32 bit function today. The machine does vector (of length 2) arithmetic to handle the co-ordinate operations. The room with

one cpu, drum, memory is about 50' x 150', and the two cpu consoles, tapes, card i/o. printer room is about 25' x 50'. The several dozen radar consoles are in a very large room.

UNDERGROUND SITE

The enormity of the machine was dwarfed by the underground building which encloses it. The building hollowed out of stone by hardrock miners is 600' beneath the surface, and connected by a 6000' tunnel which can be sealed off in seconds if there are very large, atmospheric disturbances. The building is about 150,000 square feet and has 10 standby 100 Kw generators and an air conditioner that can operate closed loop into an underground pond.

COST AND RELIABILITY

The machine and software cost about $25M in 62 and the site about $25M. The facility costs several million to operate per year, including about $1M to IBM including 10 people. Three people are needed to maintain the software. Initially, one hundred people were used to install the machine and set up its maintainence. When you count the radar, planes, etc. and operational costs, the computer cost is almost an incidental.

The reliability is fantastic! With ONE COMPUTER, AVAILABILITY IS 99.83% and with DUPLEX OPERATION, AVAILABILITY IS 99.97%. Having wondered why such an obsolete computer (somewhere between an 11/44 and 11/70) would be still used, it was clear: the reliability and the overwhelming fixed costs for radar, airplanes, etc. There's a parity bit. Marginal checking and

incredibly conservative design were the key. Each week they regularly replace 300 tubes and an additional 5 tubes that are showing signs of deterioration.

Even though the program is about 1Mword, written in assembly language and Jovial, the key here is the aging and the fact that the program is NOT interrupt driven. The program simply cycles through the job queue every few seconds in a round robin fashion. This is an excellent example of superb software engineering with an incredibly simple overall structure since it is non-parallel, all the bugs that an interrupt driven system would have had are avoided. Users identify overload by the lengthened cycle time. The high reliability demonstrates learning curves as applied to reliability. This obvious notion just occurred to me: since all the software I see is always changing, it doesn't reach ultra-high reliability.

REPLACEMENT

Hughes has installed a new computer that occupies less space than the computer console.

BOTTOM LINE

I doubt if any of the existing personal computers that operate today will either operate or can be found in 20 years, simply because technology will have changed so much in performance and reliability as to make them uneconomical at the personal level. How many of us still repair and use our 10 year old HP35's? Furthermore, all the floppies will have worn out and we'll be glad to be rid of them.

VISIT TO THE NATIONAL MUSEUM OF SCIENCE AND TECHNOLOGY

Although relatively short on space for computing, the 5,000 square feet is still larger than what the Smithsonian allocates. Ted Paull, the section curator has put together an excellent exhibit on computation. They are archiving relevant Canadian artifacts including the FP6000, a circa '60 machine which could timeshare, and was until recently the basis for the ICL products. In addition videotapes, lots of terminals,and animated displays are used to teach about computing principles and history. A very elaborated, animated soup making machine is used to show analogies to computers (recipe/program, ingredients/data, store/memory, chopping,etc/processing, etc.).

The use of computers within the museum was well ahead of any museum I've seen, probably because the staff is small and willing to take risks. Also, the museum is new and not entrenched with traditional museum personnel who themselves may be museum pieces. The museum is run by a VAX-11/750 which sits in an open computation center within the museum, showing what a computer center is like. About 50 terminals are distributed through the Museum. The user applications include: the usual games, Eliza, questions answering, map generation to find your way through the museum, and descriptions of artifacts and technology A visitor can fill out a form on line to comment on the museum... something all museums should have. The administrative applications run by staff include: word processing, administrative reports, scheduling tours, and a large archive accessed by the Database program, Datatrieve. Their goal was originally to not have papers, typewriters or card files except in the exhibits.

As an extra treat, the original director, Dr. David Baird was there visiting and gave us a talk on how he got it together in a short time. He was a professor before being their first museum director, which explains why the museum is so good. He's now building a new museum of Palentology and says he will aim even higher to automate and self learn via computers.

ARCHIVING THE Q7 AND ITS RELATIONSHIP TO THE MUSEUM

I don't think we can do justice to the SAGE story and am delighted that Bob Everett is doing the videotape with various people including the historians, Redmond and Smith who're writing the history, as a follow-on to the Whirlwind story. I would like to encourage MITRE and IBM to decide who's going to be responsible for archiving the history of the project in toto, including saving many relevant artifacts. I will assume we will not take on this very large burden. However, I'd like to get some kind of commitment from Bob and IBM before we finally decide what to do precisely!

Basically, I think it's a worthwhile machine to go after for the Computer Museum because of its completeness into an integrated application. This is a classic, and it has so many historical firsts vis a vis real time, etc. Also there's the obvious relation to Whirlwind.

Here's what I think The Computer Museum should archive:

1. A set of logic schematics.
2. Theory of Programming (the reference manual which has instruction times, their operation, i/o, etc.)

2a. Any other overview documents that help define the system, especially the consoles and radar programming.

2b. I'd like to look at how big the whole set of Theory of... manuals would be. These would be enormously useful to future scholars in understanding precisely where things fit in such a large scale system. Afterall, this about the largest

system ever built by that time.

3. Representative logic bays which have the large array of marginal check switches on the left (facing the bay). Here, I'd like the mag tape control (about 6 + 1 bays) or 12 feet. Alternatively, I'd like two, sawed off sets of bays: switches+logic and 2 logic together... about 4'.
4. 1-713 card reader, 1-723 card punch, 1-718 printer, 1-728 mag tape unit. Here, the idea is that we are moving lots and we might as well take the opportunity to move all this at once rather than later.
5. A 64K core stack in its cabinet (about3 x3 x 8). Not the electronics. This was about the largest stack built and came directly from the large memory work of the tx0 design (used to test it).
6. Spare plugboards (get all they have up to 50 with any wires they have). These are to sell them in the store.
7. 100 Spare plugin units to sell in the store.
8. 2 drums without cabinet. We'll have to sit it somewhere. This is a spare to eventually trade.
9. 2 sets of Sage Radar consoles (I think there are 3 types). One set is for trading.
10. Main CPU console. I talked to Ted Paul about this. This is the left part of the console that has lights and switches to access the registers of the machine. It has a phone in it, and its the half that you stand up to and there's a little lip forming a table.
11. Photographs of the machine as you look down the aisles, in

the console room and in the radar console room

(batteries of radar consoles with people at them).

12. Block diagram of the system with the various parameters on it, showing the duplexed machines.
13. A scale model of the machine. I'd give anything for theirs which would come out of the plexi underground model. Let's try to get this now from them or Mitre. Maybe Mitre can do this with IBM.
14. Site diagram showing the tunnels, hole and building. Photographs of the site door, tunnel, above ground.
15. Patents coming out of SAGE. This is something we'll have to ask MITRE for.
16. An overview of the use of the whole system including the operating system. This is an excellent vehicle to understand real time computing of the earliest kind. It also argues for simple program structures.

The museum would display the console for now and probably the core together near the Whirlwind core. The documents and diagrams are essential for understanding and making the display and for eventual understanding in many years.

THE OTTAWA MUSEUM AND US

COMPUTER USE

This was truly impressive. Ted and his staff have done a great job and have shown us that computers can be used to really run a museum. I haven't seen any museum this far along. This is the right way to do the job. I think a museum should have NO typewriters or file cabinets outside unless they're part of the historical displays. Ultimately, videodisks have to be available to illustrate the whole world if one wants to probe deeper into a subject (eg. a computer). I'd like to provide an exchange service for video tapes and disks dealing with computing. Also, I liked many of his photographs and displays. I'd also like to see us think about building these so as to get history without errors and to show the agreed upon significant events. Getting the errors out of exhibits and showing the relevant events is a terribly hard and tedious project... and it's impossible to do it in very many places. History should not be too geographically dependent.

EXHIBITS

In addition, the 5000 feet of the exhibit is really put together well. I liked the long blurbs and photographs that went with the history. There were logic lab booths that demonstrated adders, ands, etc. I didn't care for the videotape or the talking dummies of pythagoras and ?.

LOGIC TRAINERS AND US

I think we ought to get some logic trainers (either the big faced modules that DEC made for the army, or the logic labs, or possibly even the original set of lab modules) to show how the logic functions are performed. I can argue that logic training was important and we would simply show various forms. We would put a trainer on the wall together with some circuits that could be tested there by anyone who wanted to do it. My tendency would be to put the trainer under glass with some wires leading outside to non-destructable switches. Here, show: AND, NAND, NOT, NOR, OR, an ADDER of 1 or 2 stages, a counter of several bits that advances one anytime anyone does an experiment. This could all be wired up in a single logic lab! If we got some trainers by others, including ones that Ed Fredkin's brother's company made, we could show some impressive stuff, with very little work. The Fredkin/Minsky Muse was initially done this way. Of course, we would put them behind glass and simply allow push buttons in the same way that people operate calculators. This is for next summer and for the students, so we ought to start collecting.

PEOPLE TO GIVE LECTURES AT THE COMPUTER MUSEUM
CGB (GKB 841118; with CGB strike through *updates 020821*)

COMPUTER SYSTEMS
Historical
R M Block
Bauuw
Manchester Machines: Tom Kilburn, Lavington
Nixdorf and German Computers
Early Computers: Brian Randell
An Wang
Early BTL: Gene Felker
Early IBM: Haddad?

Calculators
Early calculators and slide rules: Delhar or Wheatland
Bomar
HP
Sharpe
TI

PCs
Apple: Jobs, Markula, Wozniak, Rosing,
Atari: Forest Mims
BBC Computer:
Commodore: Jack Trammiel, or Chuck Peddle
IBM PC: ~~Don Estridge~~, Bocca Raton
IMSAI
MITS Altair: Bill Roberts
Osborne
Sinclair (Sir Clive)

Palms
Palm, Handspring, Jerry Kaplan
Philadelphia company…

Workstations
Apollo *Poduska*
SUN (*Joy, Bechtolsheim, and McNealy)*
Viatron- Bennett
Xerox: Lampson, Taylor, Thacker
Lisp Machines: Noftsker, Greenblatt,
The Wang WPS
The first IBM MT/ST

Minis (*Note my list of 100 minis…)*
Digital: Olsen, Strecker
DG: ~~Burkhardt~~, DeCastro
IBM
HP
Prime
SAAB or Datasaab
SDS/XDS Palevsky

Tandem

Mainframes
IBM
Amdahl
Honeywell/GE/Multics/
Univac/Eckert
Burroughs/Barton
NCR/???

Supers
Cray
Thornton
Norris
Thorndike/ETA/Lincoln

NEC: Kobayashi
Hitachi
Fujitsu
Illiac IV: Slotnick, Kuck
TI ASC: Cragon
    Burton Smith

Other Computing
Cellular Automata: Fredkin
Cellular Automata: Steve Wolfram
Macro Modules: Clark and Molnar (we want to get a collection)

FPS: Norm Winginstaad

Robotics
SRI Charlie Rosen; *Rosensheim, etc.*

SEMICONDUCTORS/LOGIC
The transisor: schockley, bardeen, brattain
The ic: Noyce, hoerni, Jack Kilby
Mead and Conway
Silicon Compilers: Doerr, Mead, Dave Johannsen
    New ECAD including Prabhu Goel et al for Verilog

Fairchild: Les Hogan, Gene Kleiner
IBM Erich Bloch
Intel/Hoff and ? of Japan
Motorola/68K
Mostek/rams
MOS Technology: 6502 and Chuck Peddle
Parametron: Goto (also Lisp machine)

OTHER COMPONENTS (EG. DISKS, CRT'S)
A/D
Analogic: Bernard Gordon
Analog Devices: Ray Stata

Disks
Al Hoagland
Floppies, Winis Al Shughart

Memories
RCA: Rajman
Early designs: Wang, Forrester, IBM book author Pughe, IBM core inventor

Printing
Irwin Tomash

Other Peripherals
L C Hobbs

Communications
Modems- the Carterfone case
Packet Switching / DARPA Net: Kahn, Roberts, Kleinrock, Frank Heart
Packet Switching British PO: Donald Davies
LANs: Bob Metcalfe

LANGUAGES, DATABASES, EDITIORS, OPERATING SYSTEM

Algol
Dijkstra
Perlis

ADA: Icbidah
APL: Iverson
Basic: Kemmeny and Kurtz, Bill Gates, Microsoft First Micros Basic
C: Ritchie
C++:Grady Booch
C#
Java
Scripting languages:
Cobol: Hopper, Sammet
Fortran: John Backus
LISP: McCarthy
LOGO: Papert
Smalltalk, *Parcplace, Squeak*: Adele Goldberg, *Kay*

Wirth: PL/360, Algol W, Pascal, Modula

Visicalc: Dan Bricklin, Software Arts
    Excel:
    Word etc.
Lotus 1-2-3: Mitch Kapor
EMACS: Stahlman

Gnu tools: Stahlman

Operating Systems
Timesharing: Corbato, McCarthy, Fredkin, Beranek, Boillen (CTSS, Multics)
UNIX: Richie, Thompson
    GNU/LINUX: Stahlman and Linus Torvald
OS 360: Brooks
Tops 10/20, TENEX: Pete Hurley
    OS/8 & RT11 as predecessors to CP/M and MDOS
Gary Kildall, CP/M and PL/M
    MAC OS's
    Xerox stuff, inc
Real Time Operating Systems: VMS, RSX, Dave Cutler
    Windows
    NT: Cutler

Dynabook: Alan Kay

Network (CODASYL) Database: Bachman
Relational Databases: Ted Codd; *Gray*
    Informix
    DB2
    Tandem
    Oracle

DRAFT FROM 7/81

THE DIGITAL COMPUTER MUSEUM

date: 1990

from: The Director's Office

After more than a decade of operation, the Digital Computer Museum encompasses the entire information processing family tree with a complementary program, document, photograph and film library. (see fig. 1) Housed in a 120,000 square foot building, historic artifacts of computing, video- and audio-presentations by the engineers and programmers working on historic machines, examples of benchmark computer applications, and a library of relevant books, manuals, photographs, and programs are on display and available for reseach purposes. Classrooms, viewing rooms, and a computer data-base system provides resources for resident scholars, short-term seminars, and lecture series.

The collections have been built up from gifts from industry, universities, government agencies, and individuals. All materials more than 15 years old are considered for the collection. This formula is also The Annals of Computing History to verify collectable materials. The artifact collection started in 1973, grew to more than 500 pieces in 1981, is currently at 5,000 and continues to grow. The film and photo library was inaugerated in 1981 and is now the pre-eminent historic resource collection. The book and program library were opened in full scale on moving to the present site in 1987, although collections began in 1981. The site has sufficient space to expand to double or triple its 120,000 square foot facility.

The Digital Computer Museum is unique. It cannot be likened to Science Museums that emphasize visitor numbers by attraction exhibits, for example the live Muppet show was the outstanding draw of the last decade at Science Museums that then hope the public will also look at serious exhibits. Nor can it be likened to industry-related museums that allow specific companies to outfit exhibits that fundamentally become self-advertisements. Nor can it be likened to experiential museums that attract children and parents to find out and experiment for themselves. The Digital Computer Museum is most like a well-developed natural history museum, where collections are classified to show entire branches of the plant and animal kingdom and whole societies. The collection of the Digital Computer Museum tells the story of the "natural" history of information processing, pieces are added to the story not for their intrinsic value but because they have a place in that history. Because this is such a large field, the

Museum like the great Museums of the late-nineteenth century virtually requires an ark to hold its population.

AUDIENCE: The audience is drawn from three levels.

The primary audience is the serious connoiseur of computing history. Exhibits, library facilities, serminars, lectures, and a visiting scholar program are geared to their needs. While their numbers are not large, their participation is absolutely essential to maintaining predominance in the field. A visiting scholar program provides one way for some of the pioneers of computing, computer historians, and computer artists and musicians to be in residence and add to the richness of the environment.

The secondary audience includes all people who want or need some understanding of the evolution of computing. This includes most computer scientists, programmers, and engineers as well as other professionals employed in, or being trained for the computer industry. Special seminaras, lectures, half-day and one-day programs provide over-views of the historic evolution of computing. Members of the IEEE, AFIPS, and other professional organizations, customers of Digital and other computer companies, and retirees from the computer field are attracted to exhibits, the library, and the Museum's special programs and facilities.

The tertiary audience is made up of families of the first two groups, museum goers, and others who want to find out what the museum is all about. No attempt is made to amuse or attract this audience via low-level fun and games. But, experience shows that these people come and learn from quality exhibits.

SELECTION OF A PERMANENT SITE

Because Digital Equipment Corporation had the foresight to fund the establishment of the Museum, in 1981 they had the unique opportunity to benefit from planning a site for its long-term home.

A Museum building, itself, has very special needs: large exhibit halls with controlled lighting, theater type areas, and facilities for the public are important considerations.

Considering audience factors, four different sites were evaluated: Marlboro, Maynard, the Bedford/128 area, and central Boston/Cambridge.
From the point of view of what was known in 1981, the best sites seemed to be Maynard or near the Bedford 128 location. The wild

card affecting these sites is clearly the availability of a building.

Figure 2 shows the weighting of the site selection criteria, and some scenarios affecting location.

FIG. 2 SITE SELECTION CRITERIA

	Relative Weight		Marlboro	Maynard	Bedford	Boston	Other
AUDIENCE							
DIGITAL							
Primary	5	15	20	10	5	__	
Secondary	4	12	12	16	4	__	
Tertiary	2	4	8	6	2	__	
NON-DIGITAL							
Primary	5	5	10	15	20	__	
Secondary	2	2	4	6	8	__	
Tertiary	1	1	2	3	4	__	
SUMS			37	56	56	43	

FOUR SCENARIOS

Marlboro: Although it was known that the audience would have to be attracted to the site, the Marlboro campus facility of Digital was selected. A special museum building was erected on the site, tied into corporate displays in MR-2 and the use of public spaces in MR-1 and 3, especially after hours. With guest facilities for resident scholars and with on-site classes given by WPI and Northeastern, Marlboro became a center for computer history.

Maynard: , the Marlboro campus facility of Digital was selected. A special museum building was erected on the site, tied into corporate displays in MR-2 and the use of public spaces in MR-1 and 3, especially after hours. With guest facilities for resident scholars and with on-site classes given by WPI and Northeastern, Marlboro became a center for computer history.

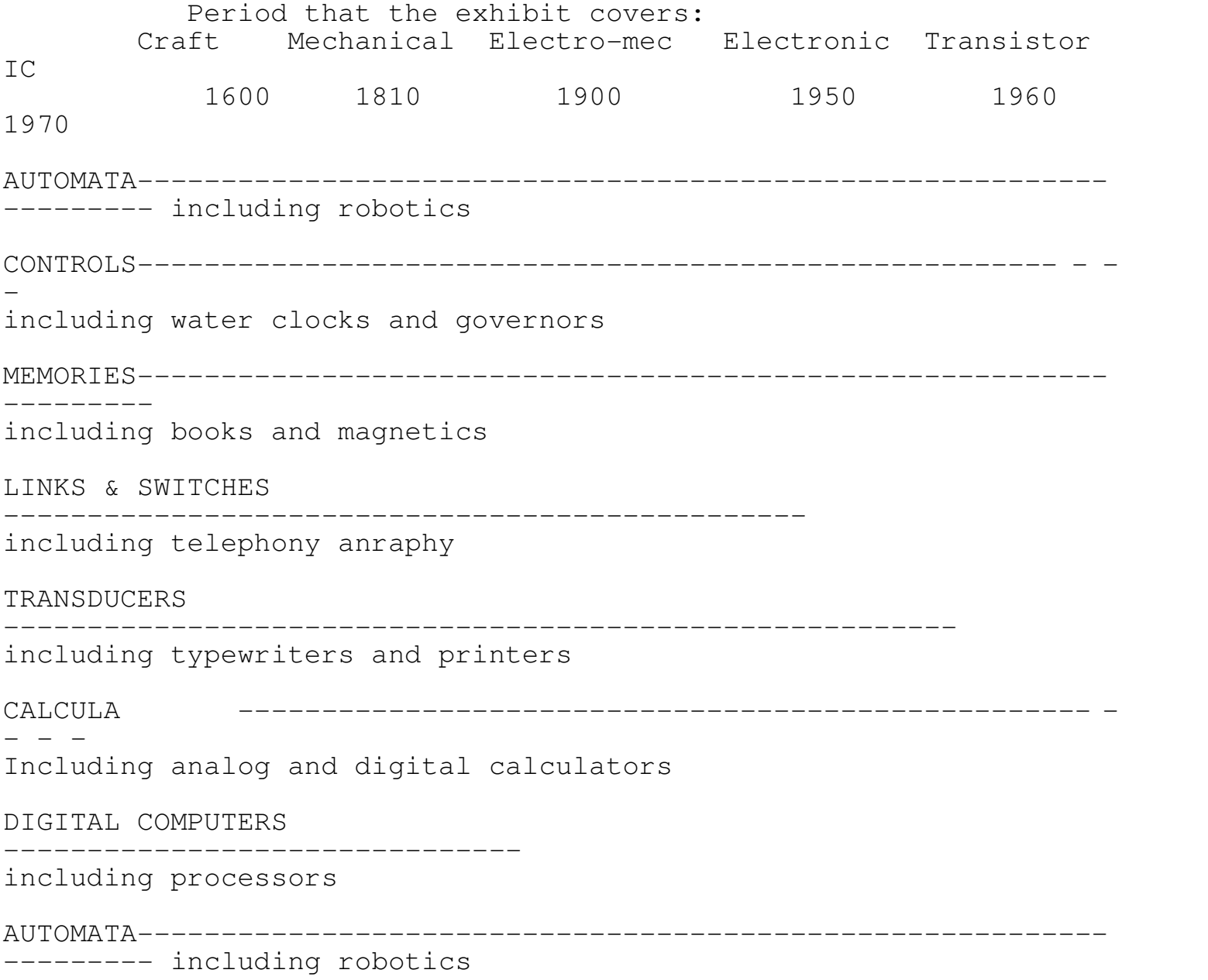
Maynard: Two scenarios seemed appropriated: (1) The "Mill" centralized Digital's continued interest/support of the independent Museum, housing it adajcent to Corporate

Headquarters, and Engineering. (2) A proper Museum was built in down-town Maynard providing life to the town and its redeveloped center and mall.

Bedford: Site and facility are independent. A site was developed (1) adjacent to Digital's Educational Services facility, (2) near the National Historic Park, (3) on Route 128, based on the following kind of facility, (1) an old shopping center, (2) new building, (3) reclaiming Lincoln Labs, or (4) something else. It became a center of activities for the large number of computer people within a half-hour of the Museum.

Boston: Much to everyone's surprise, the Digital Computer Museum was given a building in Boston. The following two choices seem to represent the polar possibilities: (1) The site is a well-kept secret, about like the glass flowers, and it is a peaceful oasis for computer buffs. (2) Along with the Aquarium the Museum has become one of the chief attractions in the downtown area although we have not comprimised any historic standards.

Fig. 1: The Collections



11/30/81 Mon 13:58:55

THE DIGITAL COMPUTER MUSEUM

from The Director's Office

Dateline 1990

After more than a decade of operation, the Digital Computer Museum's collections encompass the entire information processing family. It has evolved to be similar to a well-developed natural history museum, where collections are classified to show entire branches of the plant and animal kingdom and whole societies. The collection of the Digital Computer Museum tells the story of the "natural" history of information processing with exhibits. Because information processing is such a large field, the Museum, like the great Museums of the late-nineteenth century, virtually requires an ark to house all its specimens. In cooperation with the archival projects of the Charles Babbage Institute, the Museum serves the scholar in researching topics in the history of computing.

This monumental achievement can be credited to a well thought out plan and policy articulated in early 1982. The clear identification of the audience, selection of a permanent location and building site, and conceptualization of an interpretive program for the collections provided the necessary direction for communicating the goals and ideas for the future.

Dateline 11/30/81

PROJECTED AUDIENCE

The audience is comprised of three parts. One group is the serious connoisseur of computing history. Exhibits, library facilities, seminars, lectures, and a visiting scholar program are geared to their needs. While their numbers are not large, their participation is absolutely essential to maintaining preeminence in the field. A visiting scholar program provides one way for some of the pioneers of computing, computer historians, and computer artists and musicians to be in residence and add to the richness of the environment.

Another group includes all people who want some understanding of the evolution of computing. Most computer scientists,

programmers, engineers and professionals employed in, or being trained for the computer industry belong to this group. Special seminars, lectures, half-day and one-day programs provide overviews of the historic evolution of computing. Members of the IEEE, AFIPS, and other professional organizations, and retirees from the computer field are attracted to exhibits, the library, and the Museum's special programs and facilities.

The third group consists of families of the first two groups, museum goers, and others who are curious about the museum. Experience has shown that these people come and learn from quality exhibits. The Museum's exhibits are designed to communicate the history of computing and not to engage visitors in amusements.

LOCATION

Comparison of four different locations within Greater Boston suggest varying opportunities for the Museum.

Marlboro, in the building in which the Museum started: A pattern of visitors that evolved was never disrupted by moving the Museums location. The location on Route 495, close to the Massachusetts Turnpike, and within an hour of Boston, is isolated from other cultural or educational facilities. The site itself is outside of town and accessible only by automobile. Thus, the facilities must be developed to attract the visitor who will make a special trip and invest a half day in the trip.

Maynard, the home base of Digital Equipment Corporation and the "mini computer" capital of the world: The town is not on any main route, but within 45 minutes of most of the "computer engineering" community of Boston. All sites would be in a "downtown" with some bus transportation.

Route 128, the "high tech" nucleus of the sixties: 128 is the center of the computer community within Boston, and accessible to the interstate highway system. A number of building sites would be possible in the vicinity.

Boston or Cambridge, the center for the cultural institutions. While most students and tourists are confined to these settings with a large number of competing cultural institutions.

Each location has its inherent attractions and difficulties. The critical decision point is the availability of a building with appropriate financing to make the Museum happen.

MUSEUM BUILDING

A Museum building has very special needs:

At least 120,000 square feet

60,000 square feet of exhibit halls with controlled lighting, temperature and humidity control, divided into at least ten different units ranging in size from 3,000 to 10,000 square feet, and including a theater for about 300 people, small meeting rooms and theaters for 12-100; space for a library,

store; restaurant; workshops for exhibit development; and facilities to allow for a flow of the public.

Parking for cars and buses.

Issues regarding MR-2 (using the present building)

Legal/financial. Two alternatives were considered. 1) Immediate acceptance of the entire building as a gift that would require raising a matching one-third from others for its renovation/endowment (as required by IRS regulations for public foundations). The Museum would lease back portions of the building to Digital or DECUS with their gradual withdrawal by 1989. 2) The separation of the building into three condominiums, each of two floors, to be given to the Museum in three stages: 1983; 1986 and 1989 at which time the Museum owned the entire building. At the time of the acquisition of each portion of the property one-third matching donations of $1.2, $1.5, and $2 million were attracted and divided equally between exhibit renovation and endowment.

Space. The configuration of the building and its associated property into a Museum poses the following issues:

Cost-effectiveness: if the expense to transform it into a Museum would be greater than building anew or looking for another site.

Appropriate timing of major spaces during the 10 year development period.

Establishment of free visitor flow throughout the space to encourage viewing many exhibitions, while maintaining use of part of the building for the other tenants.

Integration and use of computers and technology for interpretation and control of the Museum itself.

INTERPRETIVE PROGRAM

The draft catalog (attached) lists all the artifacts according to one taxonomy. Other classification concepts are useful in building exhibits. The two in conjunction are designed to provide

a rich interpretive experience. For example, the first major exhibit, the Pioneer Computer Timeline, is actually based on one of the major chapters of the catalog and features two of the more significant artifacts of the collection: the Whirlwind and the Atanasoff-Berry Computer. The ideas for further exhibitions are listed below.

Interactive computing: The TX-0, PDP-1, PDP-11/45 and other machines capable of running and demonstrating interactive programs.

Super computers: Texas Instruments's ASC, Control Data's 6600, IBM's Stretch, University of Illinois's ILLIAC IV, etc. -- standing as sculpture with associated films, photos and other interpretive materials.

Personal computing: From the LINC, LGP-30, to Altos, ATARIS, etc. with the potential for user interaction.

Evolution of card programmed processing from a working Jacquard loom to a 1950's card room and inclusive of other examples.

Robotics from deVaucauson's automata through the evolution of industrial robots with demonstrations.

Memory devices, tracing the read-only and write-only memory devices through such use as player pianos to current read/write devices.

Computer ancestors in the craft generation, between 1600 and 1800, providing a feeling for the whole technological context of the era.

Computing in the transistor generation during the sixties.

Computer graphics, arts, and music exhibits with permanent listening galleries, halls for changing exhibitions and laboratory demonstrations.

Computing in space -- on-board computers and what they do.

Mechanical calculating -- from the Pascaline to Lehmer's number sieves, with opportunities to operate the calculators.

Games and gambling -- playing with numbers in simple early games, the totalisator machines of the 30s, classic chess programs and other games of skill and chance.

Developing appropriate levels of interpretation through signage and/or a/v materials, and communicating a direction and flow to the exhibit space without a personal tour guide is critical in the development of the exhibition program. The standardized text panels and catalog entries provide scholarly documentation that needs to be supplemented with interpretive story lines. Video equipment and comfortable seating is needed to allow the use of the films that are being developed.

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

December 20, 1980 - OPERATIONS COMMITTEE APPROVED THE CHARTER OF THE DIGITAL COMPUTER MUSEUM

Preserve artifacts relating to the history of computing;

Carry on a lecture and educational program;

Loan artifacts and consult on exhibits;

Prepare exhibitions and arrange tours;

Provide a resource on computer history;

Develop and sell museum-related products;

Make the Museum a center of interest and activity; and

Investigate non-profit status.

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

August 18, 1981 - OPERATIONS COMMITTEE MINUTES

The Operations committee approved the proposal to establish the museum as a public non-profit corporation. Our intent is to support the museum on a continuing, stable basis and to treat it the same way as other important programs of the Corporation.

****

Presented: "Why can the Digital Computer Museum be Number One?"

Today: We are number one in quantity and quality of computer exhibits.

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

PIONEER COMPUTER EXHIBITS IN MUSUEMS AROUND THE WORLD

Museum	Date & Machine
Science Museum, London	1840s Babbage Analytical Engine
replica Smithsonian piece, Boston Museum of Science	(partial)
prototype adder + teletype, DCM	**1939 Bell Labs Relay Calculator**
replica, Deutsches Museum	1941 Zuse, Z3
drum + breadboard, DCM	**1940 Atanasoff-Berry Calculator**
pulley for bedstead, DCM	**1943 Colossus**
Harvard, IBM	1944 Harvard Mark I
Smithsonian, DCM	**1946 ENIAC**
DCM (loan from Science Museum)	**1949 EDSAC**
	1949 EDVAC
Manchester Univ., DCM	**1949 Manchester Mark I**
Smithsonian, DCM	**1950 Whirlwind**
Smithsonian	1951 IAS Computer
Science Museum, London	1950 Pilot ACE

DCM = Digital Computer Museum

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

ARTIFACTS ON DISPLAY AT THE DIGITAL COMPUTER MUSEUM

*** = WORTH A TRIP
PDP-1 operational with Spacewar
IBM 7030 "The Stretch"
TX-0, first transistor computer
Apollo Guidance Computer
LINC, first personal computer
Enigma, WWII cipher machines

** = WORTH A DETOUR
Bendix G-15
CDC 6600, Serial Number 1
LGP-30
PDP-8
Harold Cohen murals and "turtle"
Powers-Samas card system
Hollerith 1890 census machine (replica)
Texas Instruments ASC
Jacquard Loom Mechanism
Thomas arithmometer
Tinker Toy Computer
Napier's Bones
CDC 160A
Williams tube memory

NUMBERS AND SOURCE OF CATALOGUED ARTIFACTS

(Many computer systems have a large number of separate artifacts that, in fact, can be exhibited or loaned and treated as separate items. In this listing they are treated as one. The entirety of Whirlwind is one item, and a single transistor with its own serial number is also one item.)

	Number	Different Donors	Artifact
	21	14	Computers
	57	21	Computer components
	39	21	Computer options
	52	28	Memories
	57	23	Calculators
	..	48	Photographs and documents
TOTAL	226	*	

* From approximately 150 different donors.

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

December 23, 1981 - APPLICATION SUBMITTED TO IRS

March 1, 1982, advanced ruling approved, with final determination on June 26, 1984.

Determination will be primarily based on:

DIVERSIFIED BOARD OF DIRECTORS

ONE-THIRD OF THE SUPPORT FROM THE PUBLIC

ACCESSIBILITY BY THE PUBLIC

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

INITIAL BOARD OF DIRECTORS

Term	
1984	Charles Bachman, Cullinane Associates
1985	C. Gordon Bell, Digital Equipment Corporation
1984	Gwen Bell, Digital Computer Museum
1985	Harvey Cragon, Texas Instruments
1985	Robert Everett, MITRE Corporation
1986	C. Lester Hogan, Fairchild Camera and Instrument
1986	Ted Johnson, Digital Equipment Corporation
1984	Andrew C. Knowles, Digital Equipment Corporation
1986	John Lacey, Control Data Corporation
1986	Pat McGovern, Computerworld
1985	George Michael, Lawrence Livermore National Laboratories
1984	Robert Noyce, Intel
1985	Kenneth H. Olsen, Digital Equipment Corporation
1986	Brian Randell, University of Newcastle
1986	Edward A. Schwartz, Digital Equipment Corporation
1984	Michael Spock, Boston Children's Museum
1985	Erwin Tomash, Dataproducts and Charles Babbage Institute
1984	Senator Paul E. Tsongas

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

1982-1983 FUNDRAISING

Raise $250,000 to match Digital's FY83 and FY84 budgeted contribution of $500,000 for the FY83 and FY84.

Numbers	Category		Return
50	Corporate Founders	@ $2500	$125,000
300	Individual Founders	@ $250	75,000
400	Corporate Members	@ $125 50,000	
1000	Members	@ $25	25,000
	TOTAL		275,000

STRATEGIES

DIRECT MAIL
- 2250 Letters April, 1982-(rec'd 40,300 by May 20)
- 4500 Letters & Reports, June, 1982
- 6000 Letters & Brochures, September, 1982
- 6000 Followups October, 1982

BROCHURE DISTRIBUTION

PERSONALIZED CORPORATE CAMPAIGN

SPECIAL GRANT APPLICATIONS

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

1982 FUNDRAISING PLAN

MAIL CAMPAIGN		Projected returns	
APRIL - 2,250 Letters (750 inside DEC)	200-400	$30,000 -	$50,000
JUNE - 4,500 Reports + letters (repeat mailing + list of Annals of Computing History & Digital Press Computer History Book purchasers)	250-400	35,000 -	50,000
SEPT - 6,000 Brochures + letters (repeat mailing + Museum - developed list)	300-600	40,000 -	55,000
OCT - 6,000 followups	300-600	25,000 -	55,000
BROCHURE DISTRIBUTION In the lobby & at conferences such as DECUS and SIGGRAPH. JUNE - DECEMBER	200	5,000 -	10,000
PERSONALIZED TARGETTED CORPORATE CAMPAIGN Including special packet of reference materials and some presentations.			
JUNE - DECEMBER			
40 Corporations		100,000	
100 Corporate Annual members		12,500	
50 Individual Founders		12,500	
TOTALS - Stated goal		260,000	340,000

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

FUNDRAISING WILDCARDS

Mail support for inserts or other promotion from:
- DECUS
- ComputerWorld

Large scale grants ($50,000 or more) from:
- AFIPS HISTORY COMMITTEE
- NATIONAL SCIENCE FOUNDATION

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

EXPENSES	FY 83	FY 84
Labor (including overhead)	165 (20)	210 (25)
Exhibits and Programs	125 (20)	95 (35)
Store	20	30
Archives and Publications	65	70
Other	25 (20)	30 (20)
Total	410 (60)	435 (75)
INCOME		
Digital Equipment Corp	250 (60)	250 (80)
Founders	200	45
Membership	65	145
Store/interest/functions	35	50
	545 (60)	475 (80)
Surplus	145	20

() Contributions by Digital through the cost center but not necessary to account to IRS.

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

STAFF ANALYSIS

FUNCTIONS	FY 79 & 80	FY 81 & 82	FY 83
DIRECTOR	GORDON BELL	GWEN BELL	----------
ADMINISTRATOR	MARY JANE F.	GWEN BELL	----------
SECRETARIAL SUPPORT	MARY JANE	---------- SUE HUNT	----------
CURATOR	GORDON BELL	-------- GWEN BELL	----------
EXHIBIT COORDINATOR	GWEN BELL	----- JAMIE PARKER	----------
PROGRAM COORDINATOR	GWEN BELL	----- JAMIE PARKER	-- CHRIS RUDOMIN --
COMPUTER MAINTENANCE			JAY MCLEMAN ---------
ARCHIVIST	GORDON BELL	---- GWEN BELL	-- TRINKAUS-RANDALL
PUBLICATIONS	GORDON BELL	--- GWEN BELL	----------
FUNDRAISING	GORDON BELL	--------- GWEN BELL	----------
MUSEUM STORE			CHRIS RUDOMIN ---
TOUR GUIDES	GORDON BELL	--- 4 STAFF + 20	VOLUNTEERS ------
LEGAL COUNSEL			JIM DAVIS -----

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

COMPARATIVE STATISTICS

MUSEUM	OPERATING BUDGET*	ATTENDANCE	SPACE IN SQUARE FEET	
			Exhibits	Total
Museum of Science Boston, est. 1830	4,000,000	900,000	113,000	279,000
Corning Glass Museum established 1951	3,163,000**	550,000	20,000	40,000
Museum of Science & Technology, Ottawa established 1966	4,200,000	700,000	112,000	140,000
Lawrence Hall of Science Berkeley, est 1968	3,000,000	285,000	30,000	117,000
MIT Museum established 1980	294,000**	4,500	11,000	26,000
Digital Computer Museum FY 82	250,000**	10,000	4,000	5,000
FY 83	400,000**		8,000	10,000

* Exclusive of capital funds and acquisitions.

** Exclusive of a number of overhead expenses given "in kind" including rent and maintenance.

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

SPACE ANALYSIS

SHARED SPACE	
(in lobbies and cafeteria)	4,000 square feet
Pioneer Computer Timeline	
TX-O	
Super Computers	
CREATED SPACE	
Archives 9/1/82	800 square feet
PRIME SPACE (rentable)	
Offices (1/82)	500 square feet
Four Generation Gallery (6/82)	2,000 square feet
Offices (9/82)	500 square feet
Interactive Computing	2,500 square feet
TOTAL	10,300 square feet

FUTURE SPACE NEEDS FY 1985-1986

Primary and Secondary Memories	2,500 square feet
Card computing	2,500 square feet
Archives	1,000 square feet
Analog computing	1,000 square feet
AN/FSQ-7 & other military computers	1,000 square feet
	8,000 square feet

POLICIES

* Preserve the history of computing.

"You must feel like the Director of the Museum of Natural History when he started to collect bones."

Jan Adkins, National Geographic

* Expand "oral" history via lectures and seminars by computer pioneers:

"There is no history, only biography."

Andy Knowles

* Make the machines themselves focal points:

"Well-engineered machines speak eloquently of their own elegance. Museum designers can't equal them."

Frank Oppenheimer, Director
The Exploratorium, San Francisco

* Interpret exhibits for the computer community:

"Hey, this Museum is for us big kids."

George Michael
Lawrence Livermore Laboratories

* Involve the primary audience:

"The Museum does not have to convince the computer community to support the museum because its artists are worthy; they <u>are</u> the artists."

Harold Cohen
Creator of the Museum's murals

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

STRATEGIES

1979 Built first exhibits; Held first lecture.

1980 Formed collections and exhibit policies;
Opened for viewing by appointment.

1981 Organized the public non-profit foundation.

1982 Open to the public from 1-6 Sunday
through Friday.

Raise $125,000 from the "public."

Establish archives.

Start a research program.

1983 Obtain accreditation from American Association of Museums.

Plan an endowment program.

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

EXPENSES	FY 83	FY 84	
Labor (including overhead)		165 (20)	210 (25)
Lectures - 6 per year		25	30
Exhibits (one new gallery)		80 (20)	40 (35)
Store	20	30	
Publications (inc. fundraising)		30	40
Archives (start up)		35	30
Office Staff Support (legal, accounting, travel, etc.)		45 (20)	55 (20)
Total	400 (60)	455 (80)	

INCOME			
Digital Equipment Corp		250 (60)	250 (80)
Founders	200	45	
Membership	65	145	
Store/interest/functions		35	50
	545 (60)	475 (80)	
Surplus	145	20	

() Contributions by Digital through the cost center but not necessary to account to IRS.

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

1982-1983 FUNDRAISING

Raise $250,000 to match Digital's FY83 and FY84 budgeted contribution of $500,000 for the FY83 and FY84.

Numbers	Category	Return	
50	Corporate Founders	($2500)	$125,000
300	Individual Founders	($250)	75,000
400	Corporate Members	($125)	50,000
1000	Members	($25)	25,000
	TOTAL		275,000

STRATEGIES

DIRECT MAIL

2250 Letters April, 1982 - 27,500
4500 Letters & Reports, June, 1982
6000 Brochures & letters, September 1982
6000 Followups October, 1982

BROCHURE DISTRIBUTION

PERSONALIZED CORPORATE CAMPAIGN

SPECIAL GRANT APPLICATIONS

DIGITAL COMPUTER MUSEUM STATUS 5/24/82

THE INTERNET
Arpanet, etc.
HTML
MOSAIC & Apache
Etc.

ALGORITHMS
Bentley
FFT: Cooley and Tukey
R W Hamming
Knuth
Traub
Wilkinson

APPLICATIONS, Etc.
AI
Feigenbaum
McDermott
Dendral: Lederberg
Macsyma: Moses, Wolfram
Newell
Simon
McCarthy
Minsky: LISP
Roger Shank

Business
Banking: B of A, and ERMA at SRI
Banking: Citicorp John Reed ATM

CAD/CAM
Doug Ross: APT
Applicon: Fontaine Richardson
ComputerVision:

Games
Pong: Noland Bushnell
Spacewar Russell, Graetz, Kotok, Sampson
Rocky's Boots
….

Graphics:
Bill Atkinson: MacPaint
James Blinn: JPL; Microsoft
Jim Clark, Silicon Graphics
Pixar: Ed Catmul, Alvey Ray Smith
Evans and Sutherland
Dean Winkler and John Sanborn
Alvey Ray Smith, Lucas
Don Lynn ?
Mandelbrot

Martin Newell
Graphics keeper: Steve Levy's Film and Photo Collection (we need!)
Graphic Wonder: Negroponte
NYIT Alexander Shure (historical)
Steve Benton ?

Laboratory
Wes Clark

Music
Chowning, Mathews, Vercoe, UC/SD ?, Pierce

Real time
Sage Forrester, Everett, Crago
Sabre Max Hopper

Space
Dave Scott, Astronaut
Space Shuttle Person

Speech and Pattern Recognition
Kurzweil Reading Machine
Ken Stevens
Raj Reddy
K S Fu
Rosenfeld

Scientific Computing
Ken Wilson, Cornell
Richard Fineman, Cal Tech

Testing
Alex D'Arbeloff

Typography
Knuth
Mike Parker, Bit Stream
Interleaf
    Warnock & Geschke

Weapons Design
Edward Teller

PROFESSIONAL ORGANIZATIONS

PUBLICATIONS
Auerbach
Datamation
Computerworld: McGovern
Byte: Carl Helmers
UNIX: Yates and testing services

BOOKS

Hackers: Steve Levy
    Dreams: Waldrop
Fire In the Valley
Turing: Hodges
First Fortran Books: McCracken
Edmund Berkely
Wilkes, Wheeler and Gill

FUNDING
AR&D: Doriot
Kleiner, Perkins, etc.
    West coast firms

<u>Government</u>
ARPA/DARPA
DOE
NSF