

**DOCKETED**

Volume I  
Pages 1 to 181  
Exhibits MIT 1 to 16

IN THE UNITED STATES DISTRICT COURT  
FOR THE NORTHERN DISTRICT OF ILLINOIS

----- X

THE MAGNAVOX COMPANY	:	
SANDERS ASSOCIATES, INC.	:	
	:	
v.	:	CIVIL ACTION
	:	74-C-1030
	:	
BALLY MANUFACTURING CORPORATION	:	CONSOLIDATED WITH
MIDWAY MFG. CO.	:	CIVIL ACTION
EMPIRE DISTRIBUTING, INC.	:	74-C-2510
CHICAGO DYNAMICS INDUSTRIES, INC.	:	
	:	
-----	:	X

IN THE UNITED STATES DISTRICT COURT  
FOR THE SOUTHERN DISTRICT OF NEW YORK

----- X

MIDWAY MFG. CO.	:	
	:	
v.	:	
	:	CIVIL ACTION
	:	74-Civ.-1657-CBM
	:	
THE MAGNAVOX COMPANY	:	
SANDERS ASSOCIATES, INC.	:	
	:	
-----	:	X

**FILED**  
APR 29 1976

IN THE UNITED STATES DISTRICT COURT  
FOR THE NORTHERN DISTRICT OF CALIFORNIA

----- X

ATARI, INC.	:	
	:	
v.	:	
	:	CIVIL ACTION
	:	75-1442-WTS
	:	
THE MAGNAVOX COMPANY	:	
SANDERS ASSOCIATES, INC.	:	
	:	
-----	:	X

*DORIS O. WONG ASSOCIATES*  
*Certified Shorthand Reporters*

31 MILK STREET, BOSTON, MASSACHUSETTS 02109  
TELEPHONE: 426-2432

DEPOSITION of MASSACHUSETTS INSTITUTE OF TECHNOLOGY by JOHN ALEXANDER MCKENZIE and of JOHN ALEXANDER MCKENZIE individually, taken pursuant to the Federal Rules of Civil Procedure, before Jonathan H. Young, Registered Professional Reporter and Notary Public in and for the Commonwealth of Massachusetts, at Room E19-758, Ford Building, Massachusetts Institute of Technology, 50 Ames Street, Cambridge, Massachusetts, on Tuesday, October 28, 1975, commencing at 10:10 a.m.

PRESENT:

Neuman, Williams, Anderson and Olson (by Theodore W. Anderson, Esq. and James T. Williams, Esq.), 77 West Washington Street, Chicago, Illinois 60602, for The Magnavox Company and Sanders Associates, Inc.;

Thomas A. Briody, Esq., Corporate Patent Counsel, Director, Patent and Licensing Department, The Magnavox Company, 1700 Magnavox Way, Fort Wayne, Indiana 46804, for The Magnavox Company;

Fitch, Even, Tabin and Luedeka (by Donald L. Welsh, Esq. and A. Sidney Katz, Esq.), 135 South LaSalle Street, Chicago, Illinois 60603, for Bally Manufacturing Corporation, Midway Mfg. Co., and Empire Distributing, Inc.;

Threedy and Threedy, Registered Patent Lawyers (by Edward C. Threedy, Esq.), 111 West Washington Street, Room 1406, Chicago, Illinois 60602, for Chicago Dynamics Industries, Inc.;

Flehr, Hohbach, Test, Albritton and Herbert (by Thomas O. Herbert, Esq.), 160 Sansome Street, 15th Floor, San Francisco, California 94104, for Atari, Inc.;

PRESENT: (Cont.) 1205

Louis Etlinger, Esq., Corporate Patent Counsel,  
and Richard I. Seligman, Esq., Assistant  
Patent Counsel, Sanders Associates, Inc.,  
Daniel Webster Highway, South, Nashua,  
New Hampshire 03060, for Sanders Associates,  
Inc.;

Kenway and Jenney (by Robert J. Horn, Jr., Esq.),  
24 School Street, Boston, Massachusetts; and  
Arthur A. Smith, Jr., Esq., General Counsel,  
Office of Sponsored Projects, Room E19-722,  
77 Massachusetts Avenue, Cambridge,  
Massachusetts 02139, for the Massachusetts  
Institute of Technology.

<u>FIT No.</u>	<u>Description</u>	<u>Exp. Item</u>
1	Subpoena served on Massa- chusetts Institute of Technology.	12
2	Subpoena served on John A. Adkinson.	13
3	July 3, 1953 issue of Tech Talk.	33
4	Logbook used from December 15, 1951 to March 17, 1952.	63
5	Logbook used from March 12, 1952 to August 15, 1952.	64
6	Logbook used from August 15, 1952 to October 29, 1952.	65
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8	Page of handwritten notes on yellow paper made by Mr. Adkinson.	39

I N D E X

Examination of:

Direct

John Alexander McKenzie

(Mr. Welsh)

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E X H I B I T S

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4 2-A	Logbook used from September 15, 1961 to March 12, 1962.	63
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I N D E X (Cont.)

E X H I B I T S (Cont.)

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P R O C E E D I N G S

I N D E X (Cont.)

E X H I B I T S (Cont.)

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District of Illinois in Chicago; that case having been consolidated with The Magnavox Company et al versus Seeburg, I believe it's Corporation, et al, Action No. 74-C-3110 in the same court.

A notice of taking depositions was also served on behalf of Hiway Mfg. Co., plaintiff in an action in the U. S. District Court for the Southern District of New York, against The Magnavox Company and Seeburg Mfg. Corp., Inc., defendants, Civil Action No. 74-Civ.-1577-RDK.

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P R O C E E D I N G S

1  
2 MR. WELSH: Let the record show that  
3 these depositions are being held pursuant to  
4 notice in different actions in three different  
5 courts.

6 The first action is The Magnavox  
7 Company and Sanders Associates, Inc. versus Bally  
8 Manufacturing Corporation et al, the other  
9 defendants including Midway Mfg. Co., Empire  
10 Distributing, Inc. and Chicago Dynamics  
11 Industries, Inc., in Civil Action No. 74-C-1030  
12 in the U. S. District Court for the Northern  
13 District of Illinois in Chicago; that case having  
14 been consolidated with The Magnavox Company et al  
15 versus Seeburg, I believe it's Corporation, et al,  
16 Action No. 74-C-2510 in the same court.

17 A notice of taking depositions was  
18 also served on behalf of Midway Mfg. Co., the  
19 plaintiff in an action in the U. S. District  
20 Court for the Southern District of New York,  
21 against The Magnavox Company and Sanders  
22 Associates, Inc., defendants, Civil Action No.  
23 74-Civ.-1657-CBM.

24 Mr. Herbert, would you indicate the

1 other action.

2 MR. HERBERT: A notice was also served  
3 in the action pending in the United States  
4 District Court for the Northern District of  
5 California, Civil Action 75-1442-WTS and  
6 captioned Atari, Inc. versus The Magnavox Company  
7 and Sanders Associates, Inc.

8 MR. ANDERSON: We will state for the  
9 record that that case has been or is being  
10 transferred to the Northern District of Illinois  
11 pursuant to a decision of Judge Sweigert, as of  
12 last Friday. I don't know if the actual order  
13 has been entered or not.

14 Do you know, Mr. Herbert?

15 MR. HERBERT: Not to my knowledge.

16 MR. WELSH: Before we proceed with this  
17 deposition, I'd like to bring up two other  
18 matters, Mr. Anderson. One is to confirm that  
19 the other depositions in this matter noticed by  
20 Defendants in the Illinois Action No. 74-C-1030,  
21 for depositions in New Hampshire of Sanders  
22 Associates, Inc., scheduled for November 17, are  
23 being rescheduled at your request to commence  
24 on the 19th of November; with the agreement that

1 should it be necessary to continue them beyond  
2 the 21st, that we will resume on the following  
3 Monday, which I believe will be the 22nd, to run  
4 through that Wednesday if necessary.

5 on the 19th MR. ANDERSON: That's not quite  
6 accurate, Mr. Welsh. As I told Mr. Schumacher  
7 yesterday when he and I talked -- I believe he's  
8 in your office, and is of record in that case in  
9 Chicago -- which we have not seen yet. We had

10 requested MR. WELSH: Yes. The possibility of doing

11 that at the MR. ANDERSON: It's our position that  
12 discovery is closed in the Chicago case and was  
13 closed as of October 15; and I indicated to him,  
14 as I'm sure you know, that our case will come up  
15 on November 4 on other matters, and I think at  
16 that time you can raise the question of your  
17 right to continue depositions after the closing  
18 of discovery. If the court does find that you  
19 can take those depositions, then I advise Mr.  
20 Schumacher that both Mr. Williams and I have  
21 another commitment in the U. S. District Court  
22 in Kalamazoo, Michigan for the 18th; that we are  
23 free on the 17th, and if you wish to go for one  
24 day, that's acceptable to us; but we suggest that

1 it's probably preferable to start on the 19th.

2 We have no further agreement beyond  
3 that. *like to be present. View at 10:00 AM*  
4 *previous* MR. WELSH: We're agreeable to commence  
5 on the 19th. *2:00 PM THAT'S CORRECT. OF*  
6 *COURSE,* However, we would like to request, as  
7 we had previously, that prior to those depositions  
8 we be permitted to inspect the remaining documents  
9 at Sanders which we have not seen yet. We had  
10 requested of Mr. Williams the possibility of doing  
11 that at the end of this week, if there were time  
12 after the depositions scheduled for this week;  
13 and he advised us that it was not convenient.  
14 The 17th apparently being open, then we would  
15 like to request that that document inspection be  
16 scheduled for that day in Nashua. *SAME HOUR OF*

17 *the same* MR. ANDERSON: Well, I think any day  
18 next week would be preferable to us. As you know,  
19 we both have to be in Kalamazoo on the 18th.

20 *you want* MR. WELSH: As I indicated to you in  
21 California, we have depositions scheduled at this  
22 time starting on Wednesday of next week; and we  
23 have a call on another matter on Monday, and of  
24 course the call in this matter on Tuesday. So

1 next week would not be convenient for us.

2 I believe Mr. Williams indicated that  
3 he'd like to be present. When we were there  
4 previously, only he was there.

5 MR. ANDERSON: That's correct. Of  
6 course, you've had the better part of a year to  
7 look at those documents. We'll discuss it at a  
8 break and advise you sometime in the course of  
9 the day today.

10 MR. WELSH: Fine; thank you.

11 The witnesses, parties, indicated in  
12 the notice of each of the --

13 MR. ANDERSON: Mr. Welsh, one other  
14 point as long as we're still on preliminaries.  
15 You've noticed a great many people for this  
16 proposed deposition, all for the same hour of  
17 the same day; and I presume you don't want 10  
18 more people in the room at the same hour and the  
19 same date. Can you give us the order in which  
20 you want them, some idea of at what frequency  
21 you want them to appear?

22 MR. WELSH: We'll be very happy to do  
23 that at some time sufficiently prior to the  
24 actual day to enable you to advise the people.

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1 MR. ANDERSON: All right.

2 MR. WELSH: Now, the persons indicated  
3 in the various notices were Massachusetts  
4 Institute of Technology -- and that's pursuant to  
5 Rule 30(b)(6) of the Federal Rules of Civil  
6 Procedure -- and Mr. John A. McKenzie. Subpoenas  
7 were served on both named parties; and I have  
8 here a copy of the subpoena served on  
9 Massachusetts Institute of Technology, with  
10 return of service, which I would like to have  
11 marked as MIT Deposition Exhibit 1.

12 [Subpoena served on Massa-  
13 chusetts Institute of  
14 Technology, marked MIT  
Deposition Exhibit No. 1  
for identification.]

15 MR. WELSH: Is anyone in this room  
16 appearing on behalf of Massachusetts Institute  
17 of Technology in response to the subpoena?

18 MR. HORN: Well, I'm appearing as  
19 counsel for MIT; and Mr. McKenzie is appearing  
20 as the witness.

21 MR. ANDERSON: Mr. Horn, was any  
22 designation filed at all in response to the  
23 subpoena designating --

24 MR. HORN: I believe there were informal

1 discussions. I was not personally involved in  
2 them.

3 MR. WELSH: I have here a copy of a  
4 subpoena with return of service on Mr. John A.  
5 McKenzie. I'd like to ask the Reporter to mark  
6 this as MIT Deposition Exhibit 2.

7 [Subpoena served on John A.  
8 McKenzie, marked MIT Depo-  
9 sition Exhibit No. 2 for  
identification.]

10 MR. WELSH: Would you swear the witness  
11 in, please.

12 [John Alexander McKenzie sworn.]

13 MR. ANDERSON: Mr. Welsh, throughout  
14 this deposition, is Mr. McKenzie testifying both  
15 on his own behalf and on behalf of MIT, as  
16 representative of MIT under Rule 30(b)(6)?

17 MR. WELSH: I am about to ask Mr. Horn  
18 some questions which will answer that question.  
19 I do not know at this point whether he will be  
20 the witness who will testify with respect to all  
21 the subjects.

22 MR. ANDERSON: Well, my question to you  
23 is, I guess: is this a deposition of Mr. McKenzie  
24 or a deposition of MIT which you're now commencing?

1 MR. WELSH: It's the deposition of MIT.

2 MR. ANDERSON: Only?

3 MR. WELSH: Yes.

4 MR. HORN: Well, I might --

5 MR. WELSH: Mr. Horn may have something  
6 to say.

7 MR. HORN: I might suggest, to save  
8 time for everyone, that it's my understanding that  
9 Mr. McKenzie is the most knowledgeable person in  
10 this area. It would seem to me simpler to  
11 consider it the deposition of both, to avoid  
12 wasting the time of Mr. McKenzie and counsel in  
13 going through it twice.

14 MR. WELSH: I think that's a very wise  
15 suggestion; and I trust you will have no  
16 objection to proceeding that way, Mr. Anderson?

17 MR. ANDERSON: I haven't at the moment.  
18 We'll see as the questions and answers progress.

19 MR. WELSH: Therefore, we will consider  
20 this as the deposition of both MIT -- that is,  
21 Massachusetts Institute of Technology -- and Mr.  
22 McKenzie personally.

23 The subpoena on MIT contained an  
24 Attachment A which was a list of documents and

1 things to be brought to the deposition. In  
2 Paragraph 2 of that attachment are identified:  
3 "All issues of 'Tech Talk' and 'The Tech'  
4 including but not limited to the issues of 'Tech  
5 Talk' of April 25, 1963, July 3, 1963, December 31,  
6 1963 and March 10, 1965 and issues of 'The Tech'  
7 of April 3, 1963, April 24, 1963, May 1, 1963 and  
8 April 22, 1964 and referring to a game known as  
9 'Space War' or to any other game using a computer  
10 and a cathode ray tube display and known existing  
11 or played at Massachusetts Institute of Technology  
12 prior to June, 1972."

13 Have you brought those things or  
14 documents with you?

15 MR. MCKENZIE: Yes. That was handled  
16 through Mr. Smith's office.

17 MR. HORN: Those are the bound volumes  
18 in the corner; and MIT, for convenience of counsel,  
19 has made four copies of the Tech Talk issues,  
20 which would be available for use here. They are  
21 xerographic reproductions. The The Tech issues  
22 were not copied, because they're larger-bound  
23 volumes which didn't fit the reproduction machine  
24 being used; but they certainly, of course, can be

1 copied and copies furnished.

2 MR. WELSH: Do you know if the  
3 Institute is willing to permit these bound  
4 volumes of Tech Talk and The Tech to be marked  
5 as exhibits and retained for use at any trial in  
6 these matters?

7 MR. HORN: Well, I guess they could be;  
8 but I think the Institute would prefer that  
9 copies be marked, because those bound volumes  
10 are the master file copies from the office of  
11 Tech Talk and from the offices of The Tech. So  
12 that's there basic file set. Certainly there  
13 would be no objection to counsel checking on any  
14 question of the accuracy of the reproduction;  
15 but unless it's essential to counsel, I think  
16 we'd prefer that copies be used.

17 MR. WELSH: Mr. Anderson, would you  
18 stipulate to the use of copies of portions of  
19 these bound volumes in place of marking the  
20 original volumes, such copies to have the same  
21 force and effect as the originals and to be  
22 usable in place of the originals?

23 MR. ANDERSON: Well, certainly we wish  
24 to cooperate with the Institute as much as possible;

1 but those copies obviously are not satisfactory.  
2 They're made by a process that does not reproduce  
3 halftones and photographs at all adequately; and  
4 I think would not be satisfactory.

5 As you know, Rule 30 is clear in a  
6 situation of this kind, that if the person  
7 producing the materials requests their return,  
8 the officer shall mark them, give each party an  
9 opportunity to inspect them and copy them, and  
10 return them to the party producing them; and the  
11 materials may then be used in the same manner as  
12 if annexed to and returned with the deposition.  
13 Any party may move for an order that the original  
14 be annexed to and returned with the deposition  
15 to the court pending final disposition of the  
16 case.

17 Now, we would like to be assured that  
18 the originals will remain available to us if  
19 necessary even to take into court. If we can  
20 have an agreement to that effect, and if  
21 satisfactory copies can be prepared, we're  
22 willing to forego marking the originals, defacing  
23 the bound volumes, at this time and marking  
24 satisfactory copies.

1 Mr. Horn?

2 MR. HORN: Well, there would certainly  
3 be no objection to making them available for  
4 copying by any process that counsel desires; and  
5 we would indeed appreciate not having the master  
6 file copies marked, but certainly they'd be  
7 available for inspection or comparison or copying  
8 by any process you'd like.

9 MR. ANDERSON: Mr. Welsh, can you  
10 provide us with accurate reproductions by some  
11 technique? I haven't seen the originals yet,  
12 but I've seen the Xerox copies.

13 MR. WELSH: As you are aware, we  
14 produced and had marked as exhibits in the  
15 depositions last week in California certain copies  
16 of The Tech, or copies of certain issues of The  
17 Tech, and Tech Talk. Specifically, there were  
18 marked as Exhibit 2 in the Samson deposition on  
19 October 21 a color Xerox copy of a Tech Talk  
20 issue dated April 25, 1963; as Exhibit 4, an  
21 issue of Tech Talk dated March 10, 1965, each of  
22 those containing four pages; and as Exhibit 5  
23 an issue of Tech Talk dated December 31, 1963,  
24 also four pages.

1           Before going on with these, I'd like  
2 to ask if you would be willing to stipulate that  
3 the bound volumes of The Tech and Tech Talk  
4 which were produced here this morning contain  
5 original copies of issues of those publications  
6 which were published on or about the dates they  
7 bear here at the Institute, and that these bound  
8 volumes are records kept in the normal course of  
9 business of the Institute, so that it will be  
10 unnecessary to call persons to testify.

11           MR. ANDERSON: As I understand it, the  
12 originals are in this room, over in the corner  
13 there.

14           MR. WELSH: Yes.

15           Would you stipulate as I have just  
16 requested?

17           MR. ANDERSON: Why not open them up and  
18 let me see them, and give me copies, if you will,  
19 of the same quality that you have? It's a week  
20 ago now that you first pulled out those colored  
21 copies. If you'll give me a set of colored  
22 copies, and if we can compare them with the  
23 originals, I'm prepared to stipulate.

24           MR. WELSH: All right. I will do that

1 with respect not only to these exhibits, but  
2 another issue of Tech Talk, that of July 3, 1963,  
3 which was not marked in the San Francisco  
4 depositions; and reduced copies of the issues of  
5 The Tech which were specified by date in the  
6 notices of deposition and the subpoena.

7 I'd like to request, of course, on  
8 behalf of my clients reimbursement for the cost  
9 of these copies if you wish to retain them. I  
10 believe we have an understanding regarding  
11 reimbursement for costs of copies furnished  
12 already. This is somewhat different, in that  
13 these copies were obtained other than on the  
14 Xerox machine in our office.

15 Would you be willing to make such  
16 reimbursement?

17 MR. ANDERSON: Well, I think our  
18 understanding is only with respect to discovery  
19 documents that the respective parties have seen  
20 and wish copied; and I think if it's your desire  
21 to put into evidence documents that are not to  
22 be physically made a part of the record and you  
23 wish to substitute copies, I'd see no reason why  
24 you wouldn't -- in accordance with the Rules --

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1 provide the copies and provide us with a copy.

2 MR. WELSH: Well, I'd be perfectly  
3 willing to provide the copies to be examined.  
4 If you wish additional copies, I have them; so  
5 that you will not have to go to the trouble of  
6 having them reproduced, that we went to. But  
7 I think, if you wish copies of your own, a  
8 reimbursement would be appropriate.

9 MR. ANDERSON: Are they that expensive,  
10 Mr. Welsh?

11 MR. WELSH: They are expensive. I  
12 don't know what you mean by "that expensive."

13 MR. ANDERSON: Well, we have about 10  
14 lawyers in this room billing about a dollar a  
15 minute apiece.

16 MR. WELSH: Do I take it that you're  
17 unwilling, then, to make such reimbursement?

18 MR. ANDERSON: I'm unwilling to quibble  
19 with you over those reimbursements, Mr. Welsh.  
20 Tender your bill. I'd like the copies now; and  
21 if I can have them now I'll pay you whatever you  
22 paid to get them.

23 MR. WELSH: Okay.

24 I now hand you what was marked as

1 Exhibit 2, and a copy in color Xerox of that  
2 same issue of Tech Talk.

3 MR. ANDERSON: Well, you're providing  
4 me with a set to keep, as I understand it.

5 MR. WELSH: That's right.

6 MR. ANDERSON: These are mine to keep?

7 MR. WELSH: Well, not the exhibit. The  
8 extra copy.

9 MR. KATZ: You can compare them.

10 MR. ANDERSON: Do you have my set handy?

11 MR. WELSH: It's there. It's the  
12 unmarked -- I believe it's --

13 MR. ANDERSON: It has a label on it.

14 MR. WELSH: And the other one?

15 MR. ANDERSON: I see; all right.

16 MR. WELSH: You have handed me back  
17 Exhibit 2.

18 Do you wish to comment on each one of  
19 these -- that's Samson Deposition Exhibit 2 --  
20 would you wish to comment on each one of these  
21 as you examine them and compare them with the  
22 originals; or would you wish to wait until you  
23 have examined all of them?

24 MR. ANDERSON: It's of no consequence

1 to me.

2 MR. WELSH: Well, I believe there is a  
3 request pending for a stipulation with respect to  
4 the bound volumes themselves. You have those in  
5 front of you; and representations have been made  
6 on behalf of MIT with respect to what those are.

7 Before we go further with the  
8 comparison of the copies which we have obtained  
9 with certain issues in those bound volumes, are  
10 you willing to stipulate as I requested?

11 MR. ANDERSON: It appears to us that  
12 the document that was marked Samson Exhibit 2 --

13 MR. WELSH: That's correct.

14 MR. ANDERSON: -- is the same as the  
15 copy which you have now handed me for my own use;  
16 and both of those appear to be the same four  
17 pages that are contained within the bound volume  
18 entitled "Tech Talk, Volume 8 through Volume 9,  
19 July 1963 through June 1965."

20 MR. WELSH: Now, those four pages of  
21 Exhibit 2 were merely connected together by a  
22 paper clip, were they not? Is that true?

23 MR. ANDERSON: I don't know. The  
24 exhibit?

1 MR. WELSH: Yes.

2 MR. ANDERSON: I don't know.

3 MR. WELSH: The one I just handed you.

4 Well, I'd like to staple those four  
5 pages as you handed them back to me together.

6 MR. ANDERSON: Well done.

7 MR. WELSH: Thank you.

8 I have requested a stipulation with  
9 respect to these bound volumes which have been  
10 produced here and parts of which you're comparing  
11 with the copies that I'm furnishing.

12 MR. ANDERSON: Just a minute. Mr.  
13 Williams tells me that I read the wrong volume  
14 number into the record just now. He switched  
15 volumes on me. Actually, Exhibit 2 is contained  
16 in the red bound volume labeled "Tech Talk,  
17 Volume 6 through Volume 7, July 1961 through  
18 June 1963"; and not the Volumes 8 and 9 as I  
19 indicated.

20 MR. WELSH: I'm still asking you, Mr.  
21 Anderson, for a stipulation with respect to all  
22 of these bound volumes. I will later ask if you  
23 will agree that the copies that I furnished are  
24 true copies; but I would like before we proceed

1 to ask if you would stipulate that these bound  
2 volumes one of which you just identified, but I'll  
3 read the identifying label on each volume -- one  
4 is Tech Talk, Volume 6 through Volume 7, July  
5 1961 through June 1963; Tech Talk, Volume 8  
6 through Volume 9, July 1963 through June 1965;  
7 The Tech, No. 84, 1964-65; The Tech, No. 83, 1963-  
8 1964; and The Tech, 82, 1962-1963.

9 I ask you now if you will stipulate,  
10 Mr. Anderson, that those are, first of all,  
11 volumes of MIT publications kept in the normal  
12 course of business of that institution.

13 MR. ANDERSON: We have a witness here,  
14 I gather, for the purpose of identifying what  
15 these are. I would suggest that you take  
16 advantage of Mr. McKenzie's presence here.

17 MR. HORN: Well, I wonder if possibly  
18 I might say something that might save the time  
19 of counsel and the witness.

20 I'm informed, although I have not  
21 personally checked it, but certainly counsel  
22 easily could, that in addition to these bound  
23 volumes, which are kept in the offices of The  
24 Tech and Tech Talk, both of these publications

1 are also available in the Hayden Library; the  
2 bound volumes of The Tech being available in the  
3 basement of the Hayden Library and Tech Talk  
4 being available in the archives section of the  
5 library. I'm not personally familiar with the  
6 dates involved in this case; but perhaps that  
7 would make some of these questions moot.

8 MR. WELSH: I might say that in speaking  
9 with Mr. Arthur Smith, who is patent counsel  
10 employed by MIT and who was unable to be here  
11 because he had some hearings this morning, that  
12 he is prepared to produce persons who can testify  
13 with respect to these bound volumes. It's my  
14 understanding that Mr. McKenzie has had nothing  
15 to do with those; and if you're unwilling to  
16 stipulate as I have requested, then it will be  
17 necessary to call these other people. You have  
18 these copies with that representation of counsel  
19 for the Institute. You have them to examine now.

20 I ask again if you are willing at this  
21 time to stipulate that these are original copies  
22 of the publications which were published on or  
23 about the dates that they bear in the bound  
24 volumes, and that they have been kept in the

1 normal course of business of the Institute in  
2 their respective places that Mr. Horn indicated.

3 MR. ANDERSON: No. I have no way of  
4 knowing that they've been kept in those bound  
5 volumes since the dates they bear; and I don't  
6 think they're subject to the Business Records  
7 Act. Therefore, whether they're kept in the  
8 regular course of business or not is totally  
9 immaterial. They bear no date of binding and no  
10 information that I can see as to when they were  
11 bound.

12 MR. WELSH: I had hoped that you would  
13 be willing to stipulate to this in the interests  
14 of saving our time and that of employees of the  
15 University. However, in view of your apparent  
16 unwillingness to do this, I will ask Mr. Horn:  
17 was Mr. McKenzie produced as a witness on behalf  
18 of the Institute to testify with respect to  
19 Paragraph C of Attachment B of the subpoena,  
20 which calls for publication of Tech Talk and The  
21 Tech during the years 1963 and 1964, retention  
22 of issues of Tech Talk and The Tech published  
23 during 1963 and 1964, and custody of retained  
24 1963 and 1964 issues of Tech Talk and The Tech

1 from 1963 until the present time?

2 MR. HORN: Well, I don't believe that  
3 the Institute had envisioned that there was going  
4 to be a controversy over such a formal detail;  
5 but as you indicated, I think Mr. Smith did check  
6 as to the availability of people who could  
7 testify, at least presently, as to the arrange-  
8 ment of documents at The Tech and Tech Talk.  
9 That could be done; although it does seem that  
10 it's an unnecessary step. But if it turns out  
11 that due to failure of counsel to agree and it  
12 is necessary, the Institute can arrange to do  
13 that.

14 MR. WELSH: It's up to Mr. Anderson  
15 at this point.

16 Having heard Mr. Horn, Mr. Anderson,  
17 do you persist in your unwillingness to stipulate  
18 with respect to these records which are available  
19 here for you to examine at this time?

20 MR. ANDERSON: Well, I don't know what  
21 you mean by "stipulate." I'll agree to any  
22 reasonable stipulation based on facts that are  
23 represented to be true; but as I pointed out to  
24 you, with respect to, say, the Tech Talk red bound

1 volume containing Volumes 6 and 7 and the other  
2 one containing Volumes 7 and 8, I see no evidence  
3 of when it was bound.

4 Can you say the date on which it was  
5 bound, Mr. Welsh?

6 MR. HERBERT: If I might interrupt --

7 MR. ANDERSON: You've asked me to  
8 stipulate that it was bound on the date it bears,  
9 or some such thing.

10 MR. WELSH: I think that your  
11 characterization of these two volumes was wrong.  
12 You said 6 and 7, and 7 and 8; and I believe  
13 they're Volumes 6 and 7, and 8 and 9.

14 MR. HERBERT: If I may interrupt, Mr.  
15 Anderson, would you be willing to stipulate that  
16 the various issues of Tech Talk were actually  
17 published by the Institute on or about the dates  
18 set forth on the individual issues, and that the  
19 copies we have are true copies, genuine copies,  
20 of the individual issues as published?

21 MR. ANDERSON: Yes. I'll stipulate  
22 to that, subject only to the possibility that  
23 there is an error that would show up from a  
24 word-for-word comparison -- a contingency that

1 I don't anticipate.

2 MR. HERBERT: Would you go along with  
3 the same stipulation with respect to individual  
4 issues of The Tech?

5 MR. ANDERSON: Yes. I'll go along with  
6 the same stipulation as to that, provided we  
7 see them and make the comparison as Mr. Welsh  
8 gets to them.

9 MR. WELSH: I find that agreeable also.

10 MR. HORN: Well, the Institute is  
11 appreciative that counsel has been able to reach  
12 agreement.

13 MR. WELSH: I now hand you, Mr.  
14 Anderson, Samson Deposition Exhibit 4; which is  
15 a color Xerox copy of the March 10, 1965 issue  
16 of Tech Talk, which I will also staple together  
17 in place of the paper clip.

18 MR. ANDERSON: And you have a copy for  
19 us also?

20 MR. WELSH: Yes.

21 MR. ANDERSON: Off the record.

22 [Discussion off the record.]

23 MR. ANDERSON: Yes. Exhibit 4 from  
24 the California depositions appears to conform to

1 the copy that you have just handed me for our  
2 use; and that appears to conform to the  
3 corresponding four pages dated March 10, 1965  
4 which are bound in the red book labeled "Tech  
5 Talk Volume 8 through Volume 9, July 1963 through  
6 June 1965."

7 MR. WELSH: I now hand you the four  
8 pages of Exhibit 5 to the Samson deposition,  
9 which is a Xerox color copy of the issue of  
10 December 31, 1963. I've stapled the pages  
11 together; and hand you also with it a copy.

12 MR. ANDERSON: All right. I make the  
13 same observations with respect to Exhibit 5.

14 MR. WELSH: I now hand you two copies  
15 in color Xerox of the Tech Talk issue of July 3,  
16 1963 and ask you to make the same comparison  
17 with respect to these; these not having been  
18 marked as exhibits previously.

19 MR. ANDERSON: Yes. We've made a  
20 comparison of the Tech Talk for July 3, 1963 as  
21 appearing in the bound volume with the two  
22 copies that you've handed us; and I would merely  
23 note for the record that there are some longhand  
24 entries on the third page which appear to be

1 inconsequential as far as these proceedings are  
2 concerned.

3 For the record, might I also note that  
4 that's true of Exhibit 2 on the second page;  
5 there are some longhand entries that appear to  
6 relate to a credit union account, and have no  
7 relevance as far as I know to these proceedings.

8 MR. WELSH: Did those same entries  
9 appear in the bound volumes?

10 MR. ANDERSON: They appear in the bound  
11 volume. They are just barely visible on the  
12 exhibit, not legible on the exhibit.

13 MR. WELSH: I'd like to ask the Reporter  
14 to mark this July 3, 1963 issue of Tech Talk as  
15 MIT Deposition Exhibit 3.

16 [July 3, 1963 issue of Tech  
17 Talk, marked MIT Deposition  
18 Exhibit No. 3 for identifi-  
cation.]

19 MR. WELSH: I'm now going to hand you  
20 copies of The Tech which were marked at the  
21 San Francisco depositions, and note that these  
22 were obtained from the microreproduction  
23 laboratory at the Institute and are all reduced  
24 copies, The Tech having had a larger size, at

1 least at the time of its publication and as  
2 appears in the bound volumes which you've  
3 examined.

4 MR. ANDERSON: April 3, 1963 is Samson  
5 Exhibit 6?

6 MR. WELSH: That's right.

7 MR. ANDERSON: Okay; thank you.

8 MR. WELSH: That's the one I just  
9 handed to you.

10 MR. ANDERSON: I've made the same  
11 comparison.

12 MR. WELSH: You've made the comparison;  
13 and you have the same comments to make that you  
14 made with respect to the others?

15 MR. ANDERSON: Correct.

16 MR. WELSH: I hand you now Exhibit 7  
17 from the Samson deposition in San Francisco, and  
18 a copy of that.

19 MR. ANDERSON: We've made the  
20 comparison of Samson Exhibit 7, and will have the  
21 same agreement.

22 MR. WELSH: And I now hand you Samson  
23 Deposition Exhibit 8 and a copy, and ask you to  
24 make the same comparison with the corresponding

1 issue of The Tech in the bound volume.

2 MR. ANDERSON: We've made the  
3 comparison, and will have the same agreement.

4 MR. WELSH: That's with respect to  
5 Samson Exhibit 8; correct?

6 MR. ANDERSON: That's correct.

7 MR. WELSH: I now hand you Samson  
8 Deposition Exhibit 9 and a copy of it, and ask  
9 you to make the same comparison with respect to  
10 that.

11 MR. ANDERSON: With respect to Samson  
12 Deposition Exhibit 9, we'll have the same  
13 agreement.

14 MR. WELSH: Do I understand correctly,  
15 Mr. Anderson, that we're in agreement that these  
16 copies which have been marked as Samson  
17 Deposition Exhibits 2, 4, 5, 6, 7, 8 and 9 and  
18 MIT Deposition Exhibit 3 may be used and  
19 substituted for the originals in further  
20 proceedings in this matter and have the same  
21 force and effect as the originals; subject to  
22 correction of any errors if they should appear?

23 MR. ANDERSON: And our right to future  
24 access to the originals if we want them.

1 MR. HORN: Surely.

2 MR. WELSH: Mr. Horn, again referring  
3 to Attachment B of the subpoena which was marked  
4 as MIT Deposition Exhibit 1 -- that is the  
5 subpoena that was served on the Institute --  
6 there were stated in Paragraphs A and B of  
7 Attachment B the subjects of "The Use, Construction,  
8 Manner of Playing or Manner of Operation of a  
9 Game Known as 'Space War' or of any other game  
10 using a computer and a cathode ray tube display  
11 and known, existing or played at Research  
12 Laboratory of Electronics or at any other place  
13 at Massachusetts Institute of Technology prior  
14 to June, 1972."

15 Who is the person designated to  
16 testify on behalf of Massachusetts Institute of  
17 Technology with respect to that subject matter?

18 MR. HORN: Mr. McKenzie.

19 MR. WELSH: Is he also the person  
20 designated to testify with respect to the subject  
21 matter of Paragraph B? That is, "Records such  
22 as logbooks showing the use of a Digital  
23 Equipment Corporation computer, Model PDP-1,  
24 at Research Laboratory of Electronics at

1 Massachusetts Institute of Technology during the  
2 period from January 1, 1961 through June, 1963,  
3 the manner of keeping such records, and the  
4 storage and custody of such records, from 1961  
5 until the present time."

6 MR. HORN: Well, he certainly is the  
7 man that has the logbook with him. Whether he  
8 has personal knowledge of all those things, I  
9 don't know.

10 MR. MCKENZIE: Yes. It happened during  
11 my association with the machine.

12 MR. HORN: Well, from the witness'  
13 answer, he appears to fit it all.

14 MR. WELSH: Thank you.

15 This might be a good time to take a  
16 break of a few minutes before we begin with Mr.  
17 McKenzie.

18 [Recess.]

19 MR. WELSH: Now we shall proceed with  
20 the deposition now being taken with Mr. McKenzie  
21 testifying on behalf of Massachusetts Institute  
22 of Technology with respect to the subjects of  
23 Paragraphs A and B of Attachment B of the  
24 subpoena served on the Institute, and also

1 personally with respect to the subpoena, MIT  
2 Deposition Exhibit 2.

3  
4 JOHN ALEXANDER MCKENZIE,

5 a witness called for examination by counsel for  
6 Bally Manufacturing Corporation, Midway  
7 Manufacturing Company and Empire Distributing,  
8 Inc., having been first duly sworn, was examined  
9 and testified as follows:

10 DIRECT EXAMINATION

11 BY MR. WELSH:

12 Q Would you state your full name, Mr. McKenzie,  
13 please.

14 A John Alexander McKenzie.

15 Q Where do you live, Mr. McKenzie?

16 A In Lexington, Mass.

17 Q Do you have a street address and number there?

18 A Yes. 53 Ledgelawn Avenue, Lexington 02173.

19 Q I hand you Deposition Exhibit 2 and ask if you  
20 were served with a copy of that document.

21 A Yes. I have the document.

22 Q Are you employed, Mr. McKenzie?

23 A Yes. I'm employed at MIT.

24 Q MIT being --

1 A Massachusetts Institute of Technology.

2 Q Massachusetts Institute of Technology. It may be  
3 referred to as MIT also; I think everyone knows.

4 A From now, okay.

5 Q From now on.

6 Are you employed by a particular  
7 department?

8 A Yes. I'm employed by the Research Laboratory of  
9 Electronics.

10 Q Could you describe a little bit about that  
11 laboratory, what its function is?

12 A Yes. Well, it came into being at the end of  
13 World War II when they were disbanding the  
14 wartime activities; and they thought they had a  
15 good nucleus of research people around, and they  
16 wanted to maintain some sort of affiliation.

17 The lab was formed at that time.

18 MR. ANDERSON: I object to the answer  
19 as not responsive to the question and as lacking  
20 a foundation. There is no basis for this witness'  
21 knowledge of what was going on at the end of  
22 World War II in this circumstance.

23 Q I might note, Mr. McKenzie, that if Mr. Anderson  
24 should object from time to time, unless your own

1 counsel -- that is, Mr. Horn -- should advise you  
2 otherwise, it would be appropriate for you to go  
3 ahead and answer the question to the best of your  
4 knowledge.

5 A I understand.

6 Q How long have you been employed by Research  
7 Laboratory of Electronics?

8 A May I qualify that and say that I first came to  
9 MIT in 1946, to the Servomechanisms Laboratory;  
10 and at the time that we operated the TX-0 and  
11 the PDP-1 computer, they were operated as a joint  
12 facility, co-sponsored by the Research Laboratory  
13 of Electronics and the Electronics Systems  
14 Laboratory, which at that time was the current  
15 name of the formerly Servomechanisms Laboratory.  
16 I was personally paid, my salary was split between  
17 the two.

18 Q During what period of time was it split?

19 A We started with the TX-0 computer in July of 1958;  
20 and we maintained that status until sometime,  
21 possibly, 1965, '66 -- I couldn't say within two  
22 or three years -- at which time RLE picked up all  
23 of the support of the joint facility.

24 Q By "RLE," do you mean Research Laboratory of

1           Electronics?

2    A       I do.

3    Q       When did the Servomechanisms Lab change its name  
4           to Electronics Systems Lab?

5    A       I would have to guess on that one.

6    Q       Well, was it --

7    A       I couldn't tell you within five years. I think  
8           it was prior to -- it was prior to 1958.

9    Q       So during the period --

10   A       The period in question, it was Electronics  
11           Systems Lab. My initial employment was the  
12           former name.

13   Q       Did you have any occasion to become familiar with  
14           Research Laboratory of Electronics prior to that  
15           July 1958 time?

16   A       No. At that time I was fully paid by Electronics  
17           Systems Laboratory.

18   Q       When did you first become employed at -- did you  
19           say you first came here in 1946?

20   A       November 1946.

21   Q       During the period of November 1946 and July 1958,  
22           what position did you hold at the Servomechanisms  
23           Lab or Electronics Systems Lab, depending on what  
24           name it was called?

1 A I went through the various categories, starting  
2 from technician through project technician, during  
3 that period.

4 Q What did you do before that 1946, November, date?

5 A I was at Raytheon, Waltham, Mass., for a period  
6 of about one year. Prior to that I was in the  
7 Service, Navy, during the War.

8 Q And what did you do at Raytheon?

9 A We were doing production test on radar equipment.

10 Q Do you have any formal education?

11 A Yes. Before going into the Service, I attended  
12 Lowell Institute School, which was under the  
13 auspices of MIT. It was evening courses conducted  
14 by MIT professors. It was a two-year course  
15 which was followed up by supplementary courses  
16 open to the graduates of the two-year courses.

17 During my time in the Navy, I attended  
18 the radar school at various places.

19 Q And what course of study did you follow at that  
20 institute school?

21 A I started out and had credit for the mechanical  
22 course. Following the service in the Navy and  
23 radar school, all of the supplementary courses  
24 which I took pertained to electronics and computers.

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1 Q Have you received any degrees?

2 A No.

3 Q What were your duties as a technician, starting  
4 in 1946, at the Servomechanisms Lab?

5 A I was on the project that was affiliated with  
6 the Instrumentation Lab, who were doing fire  
7 control for a dual five-inch gun which was  
8 situated out at Fort Heath in Winthrop. The  
9 Servomechanisms Laboratory had what I guess would  
10 be called a subcontract to do the servomechanisms  
11 control -- that is, the hydraulic and the  
12 electronic interface, control of the mount,  
13 governed by the radar input that the Instrumenta-  
14 tion Laboratory was handling.

15 That was one of several projects. They  
16 each lasted a year or two.

17 Q Can you tell us briefly what were the other  
18 projects?

19 A One project was probably one of the major ones.  
20 We had a contract to do the instrumentation for  
21 the Brookhaven National Laboratory. That was a  
22 first venture into instrumentation, nuclear  
23 instrumentation, and higher-speed frequencies for  
24 pulse control. And that was the lead into the

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1 digital field.

2 Q What do you mean by "the digital field"?

3 A The digital field I think of now is where  
4 control circuits, everything is represented by  
5 ones and zeros; as opposed to analog.

6 Q What were your duties as project technician?

7 A That occurred during the Brookhaven project.

8 Q Did your duties change as your position changed  
9 from technician to project technician?

10 A Yes. I think, beyond that, we had a project to  
11 design, test evaluation, to test and evaluate  
12 the fire control of a B-58, which was coming  
13 through at that time; and we made up test  
14 equipment which recorded all of these events  
15 with the information going onto mag tape, which  
16 was able to be read back and processed by a  
17 computer that night.

18 Previous to that time, everything was  
19 put onto strip charts; and the evaluation was  
20 rather long-term. This made it a one-day  
21 turnaround. The field test of that was conducted  
22 at Eglin Air Force Base. I went down as one of  
23 two participants maintaining the sale of that  
24 equipment.

1 Q When you became employed jointly by RLE and  
2 Electronics Systems Lab in July of 1958, what was  
3 your position as you started that employment?

4 A Just to backtrack a couple of months, while I was  
5 at Eglin Air Force Base I was brought back  
6 somewhat prematurely to go out to Lincoln  
7 Laboratory and participate in getting ready the  
8 TX-0 computer, which was to be moved to the MIT  
9 campus during the summer of 1958.

10 Q What is Brookhaven National Laboratory?

11 MR. ANDERSON: I object. The question  
12 is irrelevant.

13 Q Does Brookhaven National Laboratory have any  
14 affiliation with MIT?

15 A MIT is one of a number of universities who  
16 participate. Now, in what degree they participate,  
17 I don't know. MIT make use of their facilities.  
18 The Laboratory for Nuclear Science does go down  
19 there quite often.

20 Q Does Lincoln Laboratory have any affiliation with  
21 MIT?

22 MR. ANDERSON: I object on the ground  
23 of irrelevance and immateriality.

24 A Yes. They are situated in Lexington, Lincoln,

1 Concord, Mass.; and they are a group doing  
2 sponsored research, I would say principally for  
3 the Defense Department.

4 Q Is Lincoln Laboratory a part of the Massachusetts  
5 Institute of Technology?

6 A It started out that way. I think they have --  
7 I forget the exact title they use now. It's  
8 part of, but not -- academically, it ties in.  
9 It provides some sites for theses. But it's one  
10 of the sponsored research labs, but not in the  
11 same sense that RLE is. It has a somewhat  
12 independent status.

13 Q You referred to the TX-0 computer.

14 MR. WELSH: That's "TX dash zero."

15 MR. ANDERSON: I don't think he referred  
16 to a "TX dash zero," Mr. Welsh.

17 Q Did you use the term "TX dash zero"?

18 A I did not say "TX dash zero." It has never been  
19 referred to in any fashion other than TX-0. In  
20 literature, it would be referred to as "TX dash  
21 zero," as later sequences were "TX dash one,"  
22 "dash two."

23 The TX-1 was not -- it was not built.  
24 It was a paper study.

1 Q What was the TX-0?

2 A It was a computer designed with two reasons in  
3 mind. They had a large 65,000-word, 36-bit word-  
4 length core memory that they wished to evaluate.

5 Secondly, they wanted to test  
6 transistors in switching circuits both from the  
7 point of view of circuit design and reliability.  
8 They found that if they put a little bit more  
9 logic into the computer, they could have a rather  
10 simple -- rather than just a test bed for these  
11 devices, they could actually have a minimum  
12 computer there. And it actually did perform  
13 some useful work.

14 MR. ANDERSON: I have to object to the  
15 line of questioning and the narrative answers,  
16 and the fact that the witness is referring to  
17 what "they" did, and this appears to be hearsay  
18 and lacks a foundation.

19 Q Had you had anything to do with computers prior  
20 to this summer of 1958 period when you stated  
21 you came back to work on the TX-0?

22 A That would be about the spring, about Easter of  
23 that spring. That was my first affiliation with  
24 computers.

1 Q And where did you have that affiliation?

2 A I went out to Lincoln Laboratory and stayed with  
3 the computer.

4 Q You stated the TX-0 was moved from Lincoln  
5 Laboratory to MIT. Is that correct?

6 A That is correct; July of 1958.

7 Q Did you have anything to do with that move?

8 A Yes.

9 Q What did you have to do with it?

10 A Well, we had a great deal of support from Lincoln  
11 Laboratory; but it was brought into MIT. And  
12 Lincoln Laboratory did participate setting up;  
13 and it was left that I maintained the machine.  
14 It was under the direct control of -- I had one  
15 person over me. Mr. Earl Pughe was in charge,  
16 and I was the second one.

17 Q Where was the TX-0 located?

18 A We installed it in Building 26, Room 248.

19 Q What was Mr. Pughe's position at that time?

20 A He was DSR staff.

21 Q Could you tell us what "DSR" meant?

22 A Division of Sponsored Research.

23 Q Was the TX-0 at that time, when it was first  
24 moved in July of '58 to Building 26, under the

1 supervision of or part of the RLE?

2 A We were jointly supported by Electronics Systems  
3 Lab and RLE on a 50-50 percent basis.

4 Q What were your duties initially in July of 1958  
5 when the TX-0 was transferred to Building 26?

6 A We maintained the machine and helped the new  
7 users learn about the machine; and a big part of  
8 that was, the interesting thing about this  
9 particular machine was, that they could attach  
10 their rack of equipment to the computer and have  
11 the rack of equipment controlled by the computer  
12 and get an input from their equipment to the  
13 computer and vice versa, an output from the  
14 computer to their equipment. I had to assist in  
15 this type of operation, because I was the  
16 knowledgeable one.

17 Q For what period of time did you remain in that  
18 position, with the duties of maintaining the  
19 TX-0 and helping new users?

20 A About a year from that period, say the summer of  
21 1959, Earl Pughe left and Professor Jack Dennis  
22 was put in charge of the TX-0. At that time, we  
23 became -- we began a phase of expanding and  
24 modifying the machine. He designed the logic,

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1 and I implemented it; and over a period of time  
2 we built the machine.

3 Q So you actually did design work --

4 MR. ANDERSON: I object to the question.  
5 It's not in accordance with the testimony, and  
6 it's leading.

7 A I implemented the design. Professor Dennis did  
8 the logic design. From a hardware point of view,  
9 I implemented it, using proper modules.

10 Q What were your periods of working in Building 26  
11 on the TX-0 during this first period when you  
12 were under Mr. Pughe from July of '58 until the  
13 summer of '59? How often did you work?

14 A It was a full-time job, eight hours a day,  
15 40-hour week. During that interval, the machine  
16 broke down; it was the end of the thesis period.  
17 It was not unusual to come back at night or  
18 Sunday and repair, fix, something on the machine.

19 Q From the summer of 1959, when Professor Dennis  
20 came to be in charge of the TX-0, how long did  
21 you continue to work under him?

22 MR. ANDERSON: I object. I don't think  
23 there's any foundation for that question, whether  
24 he worked under Mr. Dennis or not.

1 A I'd have to answer this by leading into the  
2 activity from -- the TX-0 led into the modifications  
3 and building a time-sharing system on the PDP-1;  
4 and that activity started about 1962. So that  
5 the -- well, 1963. So that the TX-0 activity  
6 started to drop, and more of the same type of  
7 activity in rebuilding the PDP-1 became our  
8 principal objective. That was carried on under  
9 Professor Dennis until, possibly, sometime in the  
10 late Sixties; which at that time, it was pretty  
11 much completed.

12 Q Did you report to Mr. Dennis when he first came  
13 and Mr. Pughe left?

14 A Well, he was my nominal supervisor; yes.

15 Q And did he continue as your supervisor until the  
16 late Sixties?

17 A There was an interim period when he left and was  
18 now with Project MAC, which was a different group.

19 There was an interval that we had  
20 various DSR staff members who were doing some of  
21 the design work and implementing some of the  
22 changes for the time-sharing system on the PDP-1.

23 MR. WELSH: Could I have that answer  
24 back, please?

[Answer read.]

1

2 A At that time, we had sort of a joint relationship.  
3 I had the day-to-day operation of the facility,  
4 and they were more specialized.

5 Q And you had the day-to-day operation from, during  
6 the --

7 A From the start, pretty much.

8 Q That's July of 1958?

9 A Yes.

10 Q Until what period of time?

11 A Up to today.

12 Q Is the TX-0 computer still in existence?

13 A Yes.

14 Q You referred to a PDP-1?

15 A Right.

16 Q Is that still in existence?

17 A Yes.

18 Q And do you still have the day-to-day operation  
19 with respect to both of those computers?

20 A Yes; though I'm doing other things now.

21 Q Does anyone else share the responsibilities that  
22 you have in that regard?

23 A I have a technician who works for me, who is  
24 assisting in the operation if I'm not there.

1 Q Now, I believe you stated that your duties were  
2 to maintain the machine and help new users.

3 A That was the TX-0, yes.

4 Q And did you have the same duties with respect to  
5 the PDP-1?

6 A Yes. You'll have to distinguish. When they had  
7 formal course activity, they did have an  
8 instructor who took care of the students. I was  
9 more associated with the research groups.

10 Q What was Project MAC?

11 A It was founded to spell out the design of the  
12 time-sharing system, which might be a utility-  
13 type system; that is, with a large number of  
14 terminals, large number of users. I think the  
15 MAC -- they've given it different names. One was  
16 Multiple Machine Access for Computation; Multiple  
17 Access Computation.

18 Q That's what "MAC" stands for?

19 A Well, they would never spell it out. Different  
20 things.

21 Q Did you have anything to do with that --

22 A No.

23 Q -- project?

24 A No.

1 Q Do you recall when that project first came into  
2 being?

3 MR. ANDERSON: I object to the question.  
4 It's irrelevant and immaterial; lacks a foundation;  
5 and the witness has said he had no connection with  
6 it, if I understood him.

7 A It would have been the middle --

8 MR. ANDERSON: Speculative.

9 A Just beyond the middle Sixties.

10 Q Are you familiar with a -- do you remember more  
11 specifically when that was?

12 A Couldn't tell you, no, offhand.

13 Q Are you familiar with a publication at MIT called  
14 Tech Talk?

15 A Yes. I receive it every week.

16 Q How long have you been receiving it?

17 A I think I was here before Tech Talk; but I  
18 couldn't tell you when the first volume came out.

19 Q What is Tech Talk?

20 A It's an in-house newsletter, possibly.

21 Q By "in-house," do you mean within the Institute?

22 A Yes.

23 Q Did you have occasion to read it every week when  
24 you received it?

*Doris O. Wong Associates*

1 A I did, yes.

2 Q Do you recall any items in Tech Talk with respect  
3 to Project MAC?

4 A I'm sure there were, yes.

5 Q Do you recall any?

6 A I couldn't tell you. Well, normally, when any  
7 new group, especially something of that size,  
8 starts up, there would be something informative.  
9 How it was presented or what section -- I'm sure  
10 it said something about the computer configuration  
11 that they had. They've had two different  
12 machines. They had an interim machine, and then  
13 they went to their GE machine, which was built  
14 to their specification.

15 Q What was the interim machine?

16 A They had an IBM machine. I don't know which  
17 series.

18 Q I hand you what has been marked as MIT Deposition  
19 Exhibit 3 and ask if you could tell us what that  
20 is.

21 A Yes. This gives an announcement of the award of  
22 something over \$2,000,000 to MIT --

23 MR. ANDERSON: I object to the witness  
24 merely reading from the document. The question

*Doris O. Wong Associates*

1 is improper; the answer is improper. If you  
2 want to use this document to refresh his  
3 recollection, then use it in the proper manner.

4 Q Having read this document, which is a copy of the  
5 July 3, 1963 issue of Tech Talk, does it refresh  
6 your recollection as to when Project MAC  
7 originated at MIT?

8 A Yes; and at that time Professor Dennis went there  
9 full time. That is, he left us; but his time  
10 would be split between academic duties. His  
11 research activity transferred with his start of  
12 this project.

13 Q Now, did you state that Professor Dennis came  
14 back to --

15 A There was an interim period of a year or two that  
16 he was interested in the implementation of his  
17 design.

18 Q And who were the staff members of DSR who  
19 I believe you stated came in during the period  
20 when Mr. Dennis was at MAC?

21 A The first one was Natalio Kerlenevitch.

22 Q And do you remember any others?

23 A Yes. He was followed by William Plummer.

24 Q Any others?

*Doris O. Wong Associates*

1 A No. Following William Plummer, I became solely  
2 in charge.

3 Q And that's fully in charge of what?

4 A Of the TX-0, PDP-1, computer facility.

5 Q Do you remember when that was?

6 A Because of funding problems, Plummer left  
7 sometime in late 1960 and joined Professor Dennis  
8 at Project MAC.

9 Q Have you remained in charge of that facility since  
10 that time?

11 A Yes.

12 Q You mentioned a PDP-1 computer. What was the  
13 PDP-1?

14 A PDP-1 was a computer built by the Digital  
15 Equipment Corporation, Maynard, Massachusetts;  
16 commonly referred to as DEC.

17 Q That's D, E, C?

18 A D, E, C.

19 And our machine was Serial No. 3. It  
20 was a gift to the Electrical Engineering  
21 Department by Digital Equipment Corporation.

22 Q When was the PDP-1 computer given by DEC to the  
23 Double-E Department?

24 A It was delivered September 15, 1961.

1 MR. ANDERSON: I notice the witness is  
2 reading from some notes. Can we have those  
3 identified?

4 THE WITNESS: I copied that from the  
5 logbooks, the computer logs.

6 Q Did you do that in order to refresh your  
7 recollection as to dates of occurrences?

8 A Yes.

9 Q Involving the PDP-1?

10 A Yes.

11 Q Were you present when the PDP-1 was delivered?

12 A Yes.

13 Q Where was it delivered?

14 A It was installed in -- I'd have to backtrack.  
15 I don't have a room number. There was an interim  
16 period when it was stored diagonally across the  
17 hall on the second floor of Building 26, Room 260,  
18 which is the current room. That room wasn't  
19 vacated for about three or four weeks. We had it  
20 in Professor Minsky's area; which was on the  
21 same floor around the corner.

22 Q You referred to this paper in front of you as a  
23 list of entries in logbooks?

24 A Yes.

1 Q What are those logbooks?

2 A We customarily list both the TX-0 and the PDP-1,  
3 keep a book on the console. When a user picks  
4 up his time, he enters his name and the time  
5 that he's on the machine; he enters the time  
6 when he leaves. If he has encountered any  
7 malfunctions of the machine, he makes appropriate  
8 comments. And we usually note what action we  
9 have taken to remedy the malfunctions.

10 Q You say there was a log kept with respect to  
11 each of the TX-0 and the PDP-1 computers?

12 A Yes.

13 Q What was the purpose of keeping those logbooks?

14 MR. ANDERSON: I object to the question.  
15 It's speculative, asks for opinion; lack of  
16 foundation.

17 A Well, these malfunctions, the problems may be of  
18 such an intermittent nature that they only occur  
19 very infrequently; and you have to build up a  
20 history of these things. We have to differentiate  
21 between a catastrophic figure and something that's  
22 just become, in terms, freaky intermittently.

23 And secondly, we had on both machines  
24 a do-it-yourself operation where the users would

1           come in and turn on the machine. They weren't  
2           allowed to turn on the machine until they had  
3           read the logbook to see that it was safe to turn  
4           on. And we didn't have communication with the  
5           users who would use it.

6                        This was a 24-hour operation around  
7           the clock; and it gave us some indication as to  
8           what had been the problem.

9    Q       Was this a regulation for the use of each of  
10           these computers?

11                       MR. ANDERSON: I object to the question  
12           as vague and ambiguous. I don't know what you  
13           mean by "this."

14   A       It was not a regulation. It's something that  
15           Lincoln Laboratory had done on the TX-0; and we  
16           just continued the practice. It's continued to  
17           this day on most RLE computers.-- all RLE  
18           computers with which I'm familiar.

19   Q       Were users of the TX-0 and PDP-1 computers  
20           instructed to make entries in the logbooks?

21   A       Yes. A new user was instructed to do so.

22   Q       And who instructed him to do that?

23   A       Normally, I would be the one.

24   Q       And has this practice taken place from the time

1 the PDP-1 was first put into use until the present  
2 day?

3 A Yes, that's correct.

4 Q Was the practice followed, do you know?

5 A Yes. Generally speaking, yes. Couldn't vouch  
6 for, you know -- we've had some users who  
7 probably didn't. But, yes.

8 Q Were you present to see the users actually make  
9 entries into the logbook?

10 A Yes. The place where we had the most problem is  
11 with the people doing formal course work.  
12 Sometimes that would have been entered as a  
13 course, period, rather than individuals; though  
14 we tried to get the individuals to privately  
15 register.

16 Q Did you personally make entries in the logbooks  
17 yourself?

18 A Yes; mostly in connection with remedying  
19 maintenance problems.

20 Q Have any of the logbooks been retained from the  
21 period when the PDP-1 was first acquired?

22 A Yes. I've maintained all of the logbooks.

23 Q You personally have maintained the logbooks?

24 A They have been in the file cabinet in our area.

1 Q Was that an area under your supervision?

2 A My supervision, as to the day-to-day operation.  
3 The times we had Professor Dennis, he had an  
4 office down the hall.

5 Q Where were they kept?

6 Have they been kept to this day?

7 A They've been kept in these file cabinets;  
8 possibly moved around from time to time as we  
9 expanded, but always in a standard-type file  
10 cabinet.

11 Q Were you asked to bring any of those logbooks  
12 to the deposition today?

13 A According to the attachment, I was asked to  
14 bring them.

15 Q That's the attachment of the subpoena?

16 A The subpoena.

17 Q Did you bring any of those logbooks?

18 A Yes, I did.

19 Q Would you produce those at this time, please.

20 MR. WELSH: Mr. Horn, it would be very  
21 desirable to have these particular records  
22 available to present to the court. I wonder if  
23 it would be possible to obtain the agreement of  
24 the Institute to marking them as exhibits with

*Doris D. Wong Associates*

1 the understanding, of course, that we'll see  
2 that they're returned when the litigation is  
3 completed.

4 MR. HORN: Could I speak off the record  
5 with the witness for a moment?

6 MR. WELSH: Sure.

7 [Discussion off the record.]

8 MR. WELSH: When we were off the record,  
9 Mr. McKenzie indicated that --

10 MR. ANDERSON: As long as you have Mr.  
11 McKenzie --

12 MR. WELSH: Okay.

13 Q Would you state what you stated.

14 MR. ANDERSON: In answer to your  
15 question.

16 THE WITNESS: All right. I think I  
17 know the sense of the question, at least.

18 Our interest in the logs, and I think  
19 I should say my interest in the logs, would be  
20 that at the end of this academic year we expect  
21 to be phasing out the PDP-1 computer; and during  
22 that interval I'm sure that there will be an  
23 interest in having somebody write a history of  
24 the TX-0. We have done a similar memo brochure

1 on the TX-0; and it would be most worthwhile at  
2 that time to have access to these notes, logs.

3 MR. WELSH: We would certainly be  
4 willing to make copies and provide copies for use  
5 for that purpose, if that would be satisfactory  
6 to you; again, with the understanding that when  
7 the litigation is terminated we'll see that the  
8 original books are returned.

9 MR. HORN: That would be acceptable to  
10 the Institute.

11 MR. WELSH: Fine; thank you very much.

12 I'd like to ask the Reporter now to  
13 mark this first book, which is a bound book  
14 containing some 152 numbered pages and on the  
15 outside front cover there's the label "Massachu-  
16 setts Institute of Technology Computation Book"  
17 with the legend "PDP-1" in a space entitled  
18 "Name" and with the number 1 appearing in a space  
19 entitled "Number"; which also contains the  
20 notation "Used from 9-15-1961 to 3/12 1962" as  
21 MIT Deposition Exhibit 4.

22 [Logbook used from September 15,  
23 1961 to March 12, 1962,  
24 marked MIT Deposition Exhibit  
No. 4 for identification.]

1 MR. WELSH: Next, I'd like to ask the  
2 Reporter to mark as MIT Deposition Exhibit 5  
3 another bound booklet containing 152 numbered  
4 pages; and on the outside front cover, the legend  
5 "Massachusetts Institute of Technology Computation  
6 Book," in a block entitled "Name" the legend  
7 "PDP-1"; in a block entitled "Number" the number 2;  
8 also containing the notation "Used from 3-12 1962  
9 to 8-15 1962." That also contains a label stating  
10 "Property of the Research Laboratory of  
11 Electronics. This notebook is provided for use  
12 to record research notes, graphs and data,  
13 et cetera, and is to be returned to Room 26-244  
14 upon your termination from the laboratory."  
15 That's Exhibit 5.

16 [Logbook used from March 12,  
17 1962 to August 15, 1962,  
18 marked MIT Deposition  
19 Exhibit No. 5 for identifi-  
20 cation.]

19 MR. WELSH: Next I'd like to ask the  
20 Reporter to mark as MIT Deposition Exhibit 6  
21 another bound volume containing 152 numbered  
22 pages, and which on the outside front cover  
23 contains the label with the title "Massachusetts  
24 Institute of Technology Computation Book"; in a

1 block entitled "Name" contains a name, Ralph E.  
2 Butler, which appears to have been crossed out;  
3 and the notation "PDP-1." Under a legend in a  
4 block entitled "Number" appears the number 1875;  
5 and beneath that block is the number 3. Also,  
6 on a line entitled "Course," appears the legend  
7 "PDP-1"; and there is a statement "Used from  
8 8/15/62" -- "19" with a blank -- to "Oct 29,  
9 1962."

10 [Logbook used from August 15,  
11 1962 to October 29, 1962,  
12 marked MIT Deposition  
13 Exhibit No. 6 for identifi-  
14 cation.]

15 MR. WELSH: The next produced by the  
16 witness is a loose-leaf notebook having on its  
17 outside front cover the legend "PDP 1 Log" and  
18 inside contains a number of loose-leaf pages  
19 which are not numbered, but which bear dates  
20 from January 1, 1963 on the first page to  
21 June 28, 1963 on the last page.

22 Would you please mark this as MIT  
23 Deposition Exhibit 7. I think it can be marked  
24 on the front cover.

[Logbook used from January 1,  
1963 to June 28, 1963,  
marked MIT Deposition  
Exhibit No. 7 for identifi-  
cation.]

*Doris O. Wong Associates*

1 MR. WELSH: I think this might be a  
2 good time to break for lunch. It's 12:20. Off  
3 the record.

4 [Luncheon recess.]

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*Doris D. Wong Associates*

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AFTERNOON SESSION

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MR. HORN: Perhaps I should just note that during the luncheon recess the witness, Mr. McKenzie, mentioned to me that the record may indicate that his top and final position throughout the period of time which has been discussed was as project technician; whereas in actual fact he became a staff member. So that I just wanted to mention that, whether or not that's a relevant detail, the record may not be completely clear in that respect.

13  
14  
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MR. WELSH: I think that -- thank you. We did not complete the discussion as to what positions he held after 1956. I believe that he stated that he was technician through project technician during the period of 1946 to 1956.

18  
19

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JOHN ALEXANDER MCKENZIE, Resumed

20  
21  
22

THE WITNESS: I think I stated that I went through the levels from technician to senior project. I don't think I mentioned the word "senior."

23  
24

DIRECT EXAMINATION, Continued

BY MR. WELSH:

1 Q Subsequent to that date, Mr. McKenzie, did you  
2 hold other positions in your employment at RLE?

3 A Yes. This was still jointly ESL and RLE, and  
4 would have been the period 1958-59. The activity  
5 on the TX-0 involved more than an eight-to-five-  
6 type activity. It was quite a large amount of  
7 overtime. And I transferred at that time to a  
8 salary job as engineering assistant, classified  
9 at MIT as the exempt category.

10 Q Engineering assistant?

11 A Yes.

12 Q Subsequent to that period of time, 1958-1959,  
13 did you hold any other positions?

14 A Yes. About eight years ago, it would be the  
15 order of 1966, the Electronics Systems Lab  
16 dropped their support. I became wholly supported  
17 by RLE, and was given a staff position as DSR  
18 staff, as differentiated from the academic staff.

19 Q Did you have a title?

20 A It would be DSR staff.

21 Q And do you still hold that position?

22 A Yes, I do.

23 Q And did you hold it continuously during that time?

24 A Yes.

*Doris O. Wong Associates*

1 Q From the period of 1959 to 1966, did you remain  
2 as engineering assistant?

3 A Yes, I did. The dates are approximate, within a  
4 year.

5 Q Going to a time since the PDP-1 was acquired by  
6 MIT -- that is, the one at RLE -- and the logbooks  
7 that were maintained with respect to use of that  
8 computer, where were those logbooks kept?

9 A I have some nine file cabinets. They were kept  
10 in file cabinets.

11 Q Were they under your control?

12 A Yes. Not solely. They were locked -- they were  
13 open. It was a file cabinet that would be open  
14 during the day and would be closed at night.  
15 Part of that time we had a secretary who had  
16 access.

17 Q Did you supervise the use of the logbooks?

18 A They were of no real interest to anyone after  
19 they became filled. They were put away chiefly  
20 for historical reasons.

21 Q Were they retained in your custody, then?

22 A Yes; in the same fashion that I've described.

23 Q And has that been true up to the time when you  
24 brought them in today?

*Doris O. Wong Associates*

1 MR. ANDERSON: I object. You're leading  
2 the witness.

3 A There was no interest in them from my point of  
4 view at least until I met you in July. Since that  
5 time, I've maintained lockup security on them.

6 Q Has anyone else had control of the custody of  
7 those logbooks other than you?

8 A No.

9 Q Did you place these logbooks into the storage  
10 place in the filing cabinets when the use of them  
11 was finished, or when the logbooks were filled?

12 A Yes. It could have been one of the technicians.  
13 In general, the technicians went and obtained a  
14 new logbook. The reference to Butler on one of  
15 them, he was a technician at that time. He  
16 requisitioned a new book. He probably put the  
17 old one away.

18 Q To your knowledge, have any entries been made in  
19 any of these Exhibits 4, 5, 6 and 7 subsequent to  
20 the time when they were filled and placed into  
21 storage?

22 MR. ANDERSON: I object. You're leading  
23 the witness.

24 A To my knowledge, there have been no entries.

*Doris D. Wong Associates*

1 Q Are these logbooks in the same condition or in a  
2 different condition than they were when they were  
3 placed into storage?

4 A They would be in the same condition.

5 MR. ANDERSON: Objection.

6 THE WITNESS: Excuse me. I don't mean  
7 to respond quite so soon.

8 MR. ANDERSON: That's all right.

9 Q Did any of these logbooks ever leave the  
10 laboratory, that you know of?

11 MR. ANDERSON: Objection. You're  
12 leading the witness.

13 A The four that appear as exhibits were hand-  
14 carried by me in the presence of Mr. Welsh and  
15 Mr. Katz over to microreproduction, which is a  
16 facility of the Graphic Arts Service of MIT, and  
17 left there to be copied. By "copied," I believe  
18 Xeroxed.

19 Q Were you present when they were left?

20 A I was present when they were left. We left  
21 together.

22 Q Did you hand them to somebody there?

23 A The person who was working, covering the counter  
24 at that time, gave a receipt to you, I believe --

1           you, Mr. Welsh, paid cash for the work. And it  
2           was directed that the logbooks would be returned  
3           to me.

4   Q       Were they subsequently returned to you?

5   A       Yes, they were. December -- I'm sorry. I have a  
6           date. It was the middle of the next week. I  
7           think there's -- the voucher says July 29, and I  
8           think they were delivered on the 30th.

9   Q       Did you remove from one of your cases there a  
10          document as you were answering that question?

11   A       Yes. I kept this; I kept the package intact  
12          until Mr. Robert Shaw, in Mr. Smith's office,  
13          came over to see me in connection with the  
14          deposition, at which time we opened the package  
15          and I showed him the logs.

16   Q       Did that paper which you just took out of your  
17          case accompany the package?

18   A       It was the shipping paper.

19   Q       May I see it, please? Could you tell us what that  
20          is?

21   A       It appears as though when the order was given  
22          that this was one of, possibly, triplicate or  
23          something like that, the first copy probably, I  
24          think one copy, I believe you got as a receipt.

1 One copy probably stayed as a work order, and  
2 this was the copy which was left to return the  
3 articles in question, I believe.

4 Q So the copies, or the exhibits themselves, were  
5 returned to you by some delivery service at MIT?

6 A Yes. I noted that they were received by a  
7 technician who works with me, John Connolly. He  
8 did not open it.

9 Q Now, the dates appearing on Exhibits 4, 5 and 6  
10 extend from 9-15-61 to 3-12-62 in the case of  
11 Exhibit 4; 3-12-1962 to 8-15-1962 in the case of  
12 Exhibit 5; and 8-15-1962 to October 29, 1962 in  
13 the case of Exhibit 6. Then the pages on  
14 Exhibit 7 begin January 1, 1963 and extend  
15 through June 28, 1963.

16 Do you know whether there is any logbook  
17 or other type of log similar to these to cover  
18 the period of use of the PDP-1 from October 29,  
19 1962 until January 1963?

20 MR. ANDERSON: I object. I object to  
21 your characterizing the documents; I object to  
22 your using the documents in your characterization  
23 of them as a framework for any interrogation  
24 when there's been no testimony at all about these

1 four documents that you've marked as exhibits.  
2 There's been no evidence as to what they are or  
3 what's in them or what the dates mean or anything  
4 else. The question is objectionable for lack of  
5 a foundation, lack of any evidence that this  
6 witness has knowledge of those dates or what they  
7 mean.

8 A I noticed when I reread the logs to refresh my  
9 memory that we did not fill the one which we  
10 would call Book 3. It terminates on Page 76,  
11 just about half the book.

12 Q You mean the entries terminate?

13 A The entries terminate there. At that time, we  
14 apparently went to the PDP-1 log. It may well --  
15 I speculate now -- it may well have been for  
16 political reasons that we wanted to give a little  
17 bit more publicity to the DEC machine. I'm sure  
18 that one of the students who was working out  
19 there brought back this rather good-looking  
20 notebook, and some suggestion was made that it  
21 might look good to use that.

22 As to what happened to the missing  
23 sheet, the book became crowded and some sheets  
24 were taken out. I have looked around a little

1 bit for them, but I have not found them.

2 Q Exhibit 7: is that the book that you touched  
3 when you said "this good-looking notebook"?

4 A The red, yes. I do know that the machine was up  
5 and not down during this interval. We've had  
6 times later when we were down for modifications.  
7 The machine was active during that interval.

8 Q And during what interval are you referring to?

9 A That is the difference between October 29 and,  
10 I think it's '62, and I believe it's January 1,  
11 1963.

12 Q Did you review these logbooks -- that is,  
13 Exhibits 4, 5, 6 and 7 -- in preparation for  
14 giving your testimony at this deposition?

15 A Yes, I did.

16 Q Referring to Exhibit 4, could you turn to the  
17 pages where there are entries, starting with the  
18 first page, and tell us what is contained on  
19 those pages?

20 A Yes. The heading starts "Friday, September 15,  
21 1961. 1500. PDP-1 delivered to Room 26-260.  
22 Movers, Palmer, Concord."

23 MR. ANDERSON: I object to your asking  
24 this witness to read from the documents. They

1 speak for themselves. This witness is to testify  
2 as to facts known to him; and if you want to use  
3 a document to refresh his recollection, do so.  
4 But don't have him read from the document. That's  
5 not his testimony.

6 Q What types of entries are contained on that page --  
7 not the entire entry itself; but just the type of  
8 entry?

9 A This particular entry was mine. I received the  
10 equipment.

11 The next entry, I testified earlier  
12 that the machine was temporarily across the hall.  
13 It turned out that on the following Tuesday we  
14 moved it to 26-269, Professor McCarthy's office;  
15 and the note: "Construction work underway in  
16 Room 26-260." We needed some additional power  
17 outlets.

18 Q Is that an entry --

19 A That's my writing.

20 Q -- dated September 19, 1961?

21 A That's correct. Tuesday, September 19, 1961.

22 Q And did you make that entry?

23 A It's mine.

24 Q And how do you recognize it as an entry that you

1           made?

2    A       Well, I'd have to say it's just the way that I --  
3           it's lettered, rather than script. It's mine.

4    Q       Do you recognize that as your lettering?

5    A       Right.

6                        I think the next entry, about the people  
7           from DEC who came down to check out the machine,  
8           it's the same type of lettering. I have initialed  
9           that entry. This would have been Friday,  
10          September 22.

11   Q       Are those your initials that appear over to the  
12          right-hand edge of that paper?

13   A       Yes.

14   Q       "JAM"; is that correct?

15   A       Right. I would commonly use that.

16   Q       Were all of the entries on that page yours?

17   A       No.

18   Q       How far down the page did your entries go?

19   A       Two thirds of the way down.

20   Q       Could you read the last line of the entry which  
21          was yours, or the last sentence?

22   A       All right. "Please leave instruction list card  
23          on console. They are scarce now, but they will  
24          be available to everyone shortly."

*Doris O. Wong Associates*

1 Q Do you recognize the handwriting or initials of  
2 any other persons on that page?

3 A Yes.

4 Q Whose?

5 A I see the initials of Alan Kotok. The initials  
6 are AK; mentioned that he turned the machine off.

7 Q Does that entry have an hour indicated?

8 A Yes.

9 MR. ANDERSON: I object. It's hearsay  
10 as to this witness; irrelevant.

11 A It's 1923 of the same date, September 22.

12 Q Were you present when that entry was made?

13 A No; because he said he's turned the power on. If  
14 I had been there, the power would have been on.

15 Q Did you ever see Mr. Kotok make any entries in  
16 the book?

17 A Oh, yes. He was a user for a long period of time.  
18 Previous to this, he had worked with the TX-0.

19 Q Do you recognize the handwriting or initials of  
20 any other persons on that page?

21 A Yes; Peter Samson was the next user.

22 Q And is an hour indicated as to --

23 A Yes. 1927, he went onto the machine.

24 Q Did you ever see Mr. Samson make any entries in

1 the logbooks?

2 A Yes. He commonly used the machine over a number  
3 of years.

4 Q Do you recognize those entries of 1927 and the  
5 next one as being in his handwriting?

6 A It was characteristic of his style, yes.

7 Q Were you familiar with his style?

8 A Now that I see it, I am.

9 Q Did you refresh your recollection --

10 A I didn't think of it in those terms before.

11 Q Do you recognize any other handwriting or initials  
12 of any person?

13 A Yes. He was followed by Robert Wagner.

14 Q And what hours were entries made by him?

15 MR. ANDERSON: I object. It's hearsay  
16 as to this witness.

17 A 2350. That continued to 0130.

18 Q Did you observe Mr. Wagner ever making entries  
19 in the logbooks?

20 A Yes. He had also been a user from his freshman  
21 days.

22 Q Do you recognize his handwriting from observing  
23 it?

24 A I must say, his was not as distinct.

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1 Q As whose?

2 A As Samson's.

3 Q Do you recall the names of other users of the  
4 PDP-1 during the period covered by these logbooks?

5 MR. ANDERSON: I object to the question  
6 in that the term "logbook" is a word that only  
7 Mr. Welsh has used, to the best of my knowledge.

8 Q Is "logbook" a term familiar to you?

9 MR. ANDERSON: Lack of foundation.

10 A That is what it's commonly called.

11 Q These Exhibits 4, 5, 6 and 7?

12 A Yes.

13 MR. WELSH: Could you read the question  
14 now?

15 [The following was read:

16 "Q Do you recall the names of other  
17 users of the PDP-1 during the  
18 period covered by these logbooks?"

19 A Probably over a hundred names. Some of them,  
20 I can start the list. Dan Edwards. Robert  
21 Saunders. Steven Russell. Stewart Nelson.  
22 Steven Piner.

23 There was some thesis activity at the  
24 latter part. There was one name that appeared,

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1 Michael Wolfburg would be in that category. Gary  
2 Wong.

3 Is that sufficient, or shall I continue?

4 MR. ANDERSON: Am I correct that the  
5 witness has been reading from a list?

6 THE WITNESS: No, no, no. Not at all.

7 MR. ANDERSON: Do you have them written  
8 on that piece of paper in front of you?

9 THE WITNESS: No.

10 MR. ANDERSON: May I see that, please?

11 Thank you.

12 Q Referring to Exhibit 4, does that cover any  
13 particular period of usage of the PDP-1 at RLE?

14 A Yes. This pertains to the first usage of the  
15 machine.

16 Q Does the book itself contain information as to  
17 what period of usage it relates to?

18 A That is the dates on the front cover.

19 Q Do those dates appear anywhere else in the book?

20 A Well, as we go through, on the day we log we  
21 should find that the final entry, Monday,  
22 March 12, would be in agreement -- it is -- with  
23 the terminating date on the front cover.

24 Q Was the date on which the entry was made entered

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1 into the logbook on such day?

2 A Yes.

3 MR. ANDERSON: I object; lack of  
4 foundation, hearsay.

5 Q Who entered the dates in the books?

6 A If I came in in the morning, 7:30 or eight  
7 o'clock, I entered it. If there had been a  
8 continuation of users, the users themselves  
9 probably would enter the date. If it went after  
10 midnight, they probably, sometimes, would have  
11 put in a new date. If it ran over the weekend,  
12 they probably would have put in the date.

13 Q You say "probably."

14 A It's pretty informal. In most cases, that would  
15 be true.

16 Q Did you check the book, Exhibit 4, to see that  
17 the dates were placed --

18 MR. ANDERSON: I object. You're  
19 leading the witness.

20 A I know from custom. I'm talking from what is  
21 customary procedure. I did not look at it from  
22 that aspect.

23 Q Was there also a custom with respect to time in  
24 the entries in this book, Exhibit 4?

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1 A If you're referring to the 24-hour time for  
2 schedule purposes, our schedule showed a 24-hour  
3 schedule. It was easier to schedule users around  
4 the clock without worrying about whether they  
5 meant 3:00 a.m. or 3:00 p.m.

6 Q By "24-hour schedule" you mean --

7 A European time; zero to 24 hours, 2400.

8 Q Starting at when?

9 A It had been carried over from the TX-0 computer.

10 Q And when did the 24-hour designation begin each  
11 day?

12 A At midnight.

13 Q Do you have any reason to believe that any other  
14 than the usual custom was followed regarding the  
15 entries that appear in these logbooks, Exhibits 4,  
16 5, 6 and 7?

17 A I think that these books were typical of what  
18 went before and what has followed.

19 Q And do you know of any time when the custom which  
20 you mentioned was not followed?

21 A No.

22 Q Do the pages of these logbooks contain references  
23 to time?

24 A Yes.

1 Q What do those references mean, or what do those  
2 entries mean?

3 A The intent was that when a user came on the  
4 machine he would indicate the hour that he picked  
5 up the machine and the hour that he turned the  
6 machine over to another user, or turned the power  
7 off, locked the doors.

8 Q Was that also a custom which was followed?

9 A Yes. That was pretty much encouraged, to the  
10 best of our ability, always.

11 Q And who encouraged it?

12 A Well, I did. But it was, there again, rather an  
13 informal setup.

14 Q Referring now to Exhibit 5, if you'll examine  
15 that and tell us what that is.

16 A This is the second logbook in the series that  
17 we've kept on the PDP-1; the period from 3-12-1962  
18 to 8-15-1962.

19 Q Was the same custom followed with respect to  
20 entries in that book that you described with  
21 respect to entries in Exhibit 4?

22 A That would be true.

23 MR. ANDERSON: Objection. You're  
24 leading the witness.

1 Q I hand you now Exhibit 6 and ask you to describe  
2 what that is.

3 A This is the third in the series of books which  
4 we kept on the PDP-1. By "books," I mean  
5 logbooks. It was used from the period 8-15-1962  
6 through October 29, 1962.

7 Q Was the custom followed with respect to making  
8 entries in that book the same or different when  
9 compared with the custom followed with respect to  
10 Exhibits 4 and 5?

11 A It was the same practice. That was a continuing  
12 practice.

13 Q Did that practice also continue through the  
14 making of entries in Exhibit 7?

15 A Yes. That is true.

16 Q Could you describe Exhibit 7 for us and tell us  
17 what that is.

18 A Yes. The binder is a red binder. The front  
19 cover has the letters, white, PDP, 1, Log.

20 It's a loose-leaf notebook with pre-  
21 printed format, with columns for user's name,  
22 time on, off, comments; and provision for  
23 recording the elapsed time of the clock.

24 Q Are the entries on the pages of Exhibit 7 the

1 same or different than the entries on the other  
2 exhibits, 4, 5, and 6?

3 MR. ANDERSON: I object to the question  
4 as vague, ambiguous, indefinite; lack of a  
5 foundation, confusing.

6 A It contains the same type of information as the  
7 previous logbook.

8 Q And was the same or different custom followed in  
9 making the entries in Exhibit 7 as was used in  
10 connection with entries in Exhibits 4, 5 and 6?

11 A It was still the same custom in effect.

12 Q The subpoena served upon you in Attachment A  
13 referred to a game known as Space War. Is that  
14 term familiar to you?

15 A Yes, it is.

16 Q When did you first become familiar with that term?

17 A I know that it was one of the first efforts on  
18 the PDP-1 after we obtained the display, the  
19 computer display option.

20 Q What computer display are you referring to?

21 A This is the standard DEC Type 30 display.

22 Q Was that display delivered with the PDP-1 when it  
23 was originally delivered on September 15, 1961?

24 A No.

1 Q When was the Type 30 display delivered?

2 A The display was installed December 29, 1961.

3 Q Is there an entry to that effect in any of the  
4 logbooks?

5 A Yes, there is.

6 Q Could you tell us which logbook, and on what page?

7 A I do not have, I did not make a reference in my  
8 notes as to which page. I wanted an accurate date.  
9 Well, I can find it.

10 MR. ANDERSON: Let the record show the  
11 witness read that date from the yellow sheet of  
12 notes he has in front of him.

13 A That was . . .

14 MR. ANDERSON: Well, I'd be happy to  
15 have the yellow sheet of notes marked as an  
16 exhibit before we're finished. I think that would  
17 be appropriate.

18 THE WITNESS: Sure.

19 A Shall I read the entry?

20 Q Yes. Could you tell us what page it's on?

21 A Page 86. This is Exhibit 4.

22 Q Could you read the entire entry, including the  
23 hour?

24 A The date is not on the top of the page. The head

entry is "Friday." There is some in-between activity. And in my writing -- there again, it's lettered rather than script -- "1300 DEC installed display. Okay to use. Repeated display of a single point will burn CRT." I had that underlined. "Light pen okay. Working on sequence break." And initialed "JAM."

The entry with that, "1715 power off, sequence break will require more work. Machine okay." Again initialed, "JAM."

Q Did you make those entries?

A I did.

Q Do you recognize that as your handwriting?

A Yes.

Q And those initials as your initials?

A Yes, they are.

Q Now, you stated that the page -- I believe it was 86 -- of Exhibit 4 only contained the notation "Friday" at the top?

A Yes.

Q How did you determine the date of December 29, 1961 which you gave earlier?

A The facing page, Page 87, is headed "Saturday, December 30, 1961."

1 Q Do you mind if we mark the page of notes which  
2 you have made as an exhibit? I don't know; is  
3 there a Xerox, if you wish to -- you have no  
4 objection?

5 A I have no objection.

6 Q Okay.

7 MR. WELSH: Could we mark that page as  
8 MIT Deposition Exhibit 8.

9 [Page of handwritten notes  
10 on yellow paper made by Mr.  
11 McKenzie, marked MIT Deposi-  
12 tion Exhibit No. 8 for  
13 identification.]

14 [Discussion off the record.]

15 Q Would you explain what the page of notes which  
16 has been marked as Exhibit 8 and which is now  
17 being copied is?

18 A Yes. I scanned the logbooks which you've  
19 designated.

20 Q Designated Exhibits 4, 5, 6 and 7?

21 A 4, 5, 6 and 7; and put down page numbers and a  
22 heading as to what might be of interest in the  
23 testimony, what I anticipated might be questions  
24 asked me.

Q And you made those entries on Exhibit 8 at the  
time you were examining Exhibits 4, 5, 6 and 7?

1                   MR. ANDERSON: I object. You're leading  
2                   the witness.

3    Q           Is that correct?

4    A           Yes; within the last couple of weeks.

5    Q           How soon after the DEC Type 30 display was  
6                   delivered on December 29, 1961 did you become  
7                   aware of Space War?

8    A           I know that it came up early that spring. My  
9                   first work no doubt would have been that when I  
10                  came in one morning they were still working on it;  
11                  and I picked up the machine, or possibly they  
12                  wanted a little bit more time. In general, I  
13                  reserved the first hour for myself. They were  
14                  hot on something; they probably negotiated with  
15                  me, and as bargaining power showed me what they  
16                  were doing. That would have been early in '62.

17   Q           When you say "they," did you have reference to  
18                  particular individuals?

19   A           Some of the people who were most involved would  
20                  have been Peter Samson, Daniel Edwards, Alan  
21                  Kotok. Steven Russell I did not see as frequently.  
22                  He was a Harvard student, and was not around  
23                  during the day. I knew of him, I had met him;  
24                  but not frequently. There were others; a boy named

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1 Graetz.

2 Q How do you spell that?

3 A G-r-a-e-t-z. His initials, I've later learned,  
4 are JM. I never knew him by any name other than  
5 Shag.

6 Q JN?

7 A JM, Michael. J. Michael.

8 Wagner and Saunders were also in that  
9 group. I could go on.

10 Q That's Robert Wagner?

11 A Robert Wagner. Robert Saunders. Steven Piner  
12 would have been part of the group.

13 Q Did the logbooks reflect -- that is, Exhibits 4  
14 and 5, which cover the period of the spring  
15 following December 29, 1961 -- reflect the  
16 activity of the users in connection with Space  
17 War?

18 MR. ANDERSON: I object. It's  
19 speculative, opinion, hearsay.

20 A My notes that have been referred to as Exhibit 8,  
21 I have a notation that Page 9 has a reference to  
22 Space War.

23 Q And that's Page 9 of which?

24 A My notes show Book 1; Exhibit 4. My reference is

1 Book 1.

2 Q You say Page 9?

3 A That's what I have.

4 Q I ask you to look at Page 9, if you could, and --

5 MR. THREEDY: I believe it's Book 2.

6 It would be the next exhibit.

7 MR. ANDERSON: Mr. Threedy, would you  
8 like to testify?

9 MR. THREEDY: Only going back to Chicago.

10 MR. ANDERSON: I'll have to concur in  
11 that observation.

12 Q Do you know the approximate date?

13 A No. I couldn't talk about the date. I have  
14 another, what I call the second reference, on  
15 Page 17. Somehow I missed -- I don't pick it up  
16 right now.

17 MR. HERBERT: I think, in the interests  
18 of speeding this up, that the witness has  
19 misread his own notes. These references are to  
20 Book 2 in the copy I have.

21 THE WITNESS: You're right; thank you.

22 MR. THREEDY: That was my interjection,  
23 too, Mr. Anderson.

24 THE WITNESS: Yes. This looks better;

1 thank you. On Page 9 of Book 2, which is  
2 Exhibit 5.

3 MR. ANDERSON: I object to the witness  
4 reading from Book 2 just as much as I objected to  
5 him reading from Book 1. It's hearsay, opinion,  
6 unauthenticated testimony.

7 A The entry is on Tuesday, March 20, and the time  
8 1907. "Mann, M-a-n-n, off." And a blank line,  
9 and then the entry "Spaceship stockholder round  
10 robin."

11 Q Do you know who made that entry?

12 MR. ANDERSON: I object. You haven't  
13 established that this witness has any recollection  
14 of the event at all.

15 A The initials are not very clear; RMF. There have  
16 been hundreds of students going through there.  
17 This one, Fiorenza is this one. We may find a  
18 later entry that his name is tied in with the  
19 initials. I'm not sure.

20 Q Does the phrase "Spaceship stockholder" --

21 A "Round robin."

22 Q -- "round robin" mean anything to you?

23 A Well, all of the participants had been playing  
24 Space War that evening, the way I would interpret

1 it.

2 MR. ANDERSON: I object to this witness  
3 interpreting the document. It's hearsay; it's  
4 not evidence of any knowledge of this witness or  
5 testimony that's properly coming from this witness.  
6 I object to the entire series of questions in the  
7 proceedings.

8 Q Had you heard the phrase "spaceship" used in  
9 connection with the playing of Space War on the  
10 PDP-1?

11 A I was aware, as I testified earlier, that they  
12 were writing the program. Very often I had to  
13 chase them off the machine the next morning,  
14 while they were still active writing the program.

15 Q And this was shortly after the delivery of the  
16 CRT 30 display?

17 MR. ANDERSON: I object to the question.  
18 The testimony is just to the contrary.

19 A It was early in 1962.

20 Q And do you recall that yourself, apart from these  
21 logbooks as they might reflect that?

22 MR. ANDERSON: I object. You're first  
23 feeding the witness your statements, and then  
24 asking him to verify them in a leading question.

1 A I was aware of their great enthusiasm for the  
2 game; and they made me aware, they were proud of  
3 their activity, and their achievements, and made  
4 me aware of what was going on.

5 Q Could you fix that activity in time apart from  
6 the reference to the logbooks?

7 A Yes.

8 Q How could you do that?

9 A I have some punched paper tapes that I found in  
10 our archives.

11 Q And have you brought those punched paper tapes  
12 in response to the subpoena?

13 A Yes, I have.

14 Q Served today?

15 Now, you say "you found in our archives."

16 A This is the file cabinets testified to earlier.

17 Q And in whose custody or under whose control was  
18 that file cabinet at the time that you selected  
19 these tapes to bring them to this deposition?

20 A It was under my control.

21 Q And when did you select them to bring here?

22 A The attachment to the subpoena directed me to  
23 bring this type of information.

24 Q So you did it after the subpoena was served?

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1 A Yes.

2 Q The return of service on Exhibit 2 indicates that  
3 it was served on you on October 17, 1975; is that  
4 the correct date?

5 A I cannot tie down the date.

6 Q Within the last two weeks?

7 A Yes. Oh, yes.

8 Q For what period of time had this file cabinet been  
9 in your custody or under your control prior to  
10 that?

11 A It had been under my control all the time.

12 Q All of the time from the time the PDP-1 was --

13 A No. Perhaps I can best answer this by explaining  
14 why I have custody of these tapes.

15 The Space War game after a few years  
16 became somewhat of a nuisance. That is, the  
17 students would come in and wish to play Space War,  
18 especially Friday nights. This would develop into  
19 an all-night session. And they were not PDP-1  
20 users, but they were MIT students; and it became  
21 somewhat of a nuisance.

22 There was one night in particular where  
23 they apparently had somewhat of a beer party there;  
24 and the system director of the lab brought through

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1 some guests on Saturday morning. The place was  
2 a shambles. His words were, "If you can't clean  
3 up, if you can't handle, control this situation,  
4 I will." So that was the culmination of many  
5 events.

6 The other problem was that in the early  
7 period I talked about there was no formal class  
8 activity, no research activity, on the machine.  
9 It was there wholly for the students. At later  
10 times, when we became busier, there was just too  
11 much activity; and the users themselves asked us  
12 to do something about getting the Space War users  
13 out of there.

14 Q Do you remember when that occurred?

15 A It occurred several times.

16 Q Do you remember --

17 A It was the sort of thing that built up and stopped  
18 and built up and stopped again, partly, three or  
19 four times.

20 The other thing was that other users  
21 wanted to write their own programs. It was not  
22 a different program. It was just copying this  
23 one and putting in embellishments, as it was  
24 sometimes termed. And we wanted to discourage

1 that.

2 Q With respect to the spring of 1962, when you first  
3 became aware of Space War, was the first  
4 occurrence of this nuisance that you just  
5 described, the first occurrence within the first  
6 year?

7 A No. I think it would have been beyond that time.

8 Q Within the second year?

9 A Probably.

10 Q And the other occurrences: were they shortly  
11 thereafter, or --

12 A Oh, maybe a yearly cycle; one- to-two-year cycles.

13 Q I believe you referred to this nuisance in  
14 connection with describing these tapes which you  
15 have just produced.

16 A Well, yes. I confiscated them, because the  
17 activity was tying up the machine. By this time,  
18 what was thought a rather wasteful time.

19 Q Do the tapes bear any dates which might indicate  
20 when they occurred?

21 MR. ANDERSON: I object to the question  
22 as leading, self-serving testimony of the  
23 interrogator.

24 A I have one tape which is labeled "Starting address

1 4 quickie Space War." The date on it is 19 April  
2 '62.

3 Q Are all of the tapes which you've produced here  
4 and which we will mark as exhibits those which  
5 you confiscated in connection with Space War  
6 becoming a nuisance?

7 A These were all that I confiscated, yes; but by  
8 that time different students had their own copies.  
9 It was not by any means all of them, Space War  
10 tapes.

11 Q How many tapes have you produced?

12 A First count, 13. 13.

13 Q Do any of these tapes bear any relation to each  
14 other or to the other tapes?

15 A Yes. I think we have to first distinguish  
16 between source language tapes and binary tapes.

17 Q Are both types of tapes present among those which  
18 you have produced?

19 A Yes, they are.

20 Q Could you describe what source language tapes are?

21 A Yes. The program is first written using the  
22 published mnemonics for each of the instructions.  
23 By that I mean the add instruction, as far as the  
24 computer is concerned, would be 200,000. We used

1 the mnemonic "add," so that the user didn't have  
2 to worry about the numbers for the many  
3 instructions.

4 Q Now, in answering the last --

5 A I guess I was not complete. The second type is --  
6 the program at that period of time was typed in  
7 on an off-line Flexowriter; which coincident with  
8 typing in the code punches a paper tape which has  
9 a series of holes and represents the code of the  
10 characters and numerals. Now, this tape is read  
11 into the computer under control of an assembly  
12 program.

13 Q Now, does that tape have a particular name?

14 A We think of that as the source language tape.

15 Q That's the source language tape; all right.

16 A The assembly program converts the source language  
17 to machine language; and the output of the computer  
18 is a binary tape, where all of the representations  
19 again are reduced to ones and zeros. That is the  
20 program that is read into the computer to run the  
21 game, or program.

22 Q Now, in answering the questions with respect to  
23 the source and binary tapes, you've referred to  
24 another document which you brought from your

1       briefcase. It's the white elongated document in  
2       front of you.

3   A     Oh, this one?

4   Q     Yes.

5   A     Right.

6   Q     Could you tell us what that is, please?

7   A     The first reference that I saw to a source  
8       language tape, which we call the alpha tape, was  
9       dated Space War -- not dated, but headed "Space  
10      War 3.1." It's in four parts here -- it's in  
11     three parts. I believe the third one is a binary  
12     of that. And it's labeled 24 September 1962.

13                I listed the first part of that to see  
14     what it might look like. This was listed on a  
15     Flexowriter last week. That's a listing.

16     Specifically, I ran Part 1 of the three tapes of  
17     the date I mentioned through a Flexowriter and  
18     obtained this listing.

19   Q     Now, would you have any objection to marking these  
20     tapes as exhibits?

21   A     No.

22   Q     And permitting us to keep custody under the same  
23     understanding that we have with respect to the  
24     logbooks?

1 MR. SMITH: I missed the early part of  
2 this, I assume.

3 MR. HORN: We agreed to do the same on  
4 the logbooks.

5 MR. SMITH: Okay.

6 THE WITNESS: Yes, I agree.

7 MR. WELSH: Okay.

8 I'd like to have the Reporter mark as  
9 Exhibit 9-1 the tape that I believe the witness  
10 referred to as designated "Space War 3.1, Part 1."

11 [Punched paper tape  
12 designated "Space War 3.1  
13 Part 1," marked MIT Deposi-  
14 tion Exhibit No. 9-1 for  
15 identification.]

16 MR. WELSH: And could we also mark the  
17 other two tapes to which the witness referred;  
18 one bearing the legend "Space War 3.1 Part 2  
19 24 September 1962" as Exhibit 9-2.

20 [Punched paper tape  
21 designated "Space War 3.1  
22 Part 2, 24 September 1962,"  
23 marked MIT Deposition  
24 Exhibit No. 9-2 for identi-  
25 fication.]

26 MR. WELSH: Also, I now ask the  
27 Reporter to mark as Exhibit 9-3 the third tape  
28 produced by the witness and bearing the legend

1 "Space War 3.1 Part 3" -- the "Part" in each  
 2 case being an abbreviation, "pt" -- and  
 3 parentheses, "Stars," close parentheses, "24 Sep  
 4 '62."

5 [Punched paper tape  
 6 designated "Space War 3.1  
 7 Part 3," marked MIT Deposi-  
 8 tion Exhibit No. 9-3 for  
 9 identification.]

8 Q I believe you then described the elongated sheet  
 9 with the printing on it as the listing for the  
 10 Part 1, which is now Exhibit 9-1.

11 A Yes.

12 MR. WELSH: I would like the Reporter  
 13 to mark this listing as 9-1-A.

14 [Listing of MIT Deposition  
 15 Exhibit No. 9-1, marked  
 16 MIT Deposition Exhibit No.  
 17 9-1-A for identification.]

17 Q Now, I hand you Exhibit 9-1-A and ask first:  
 18 is that a listing of the entire tape, Exhibit 9-1?

19 A Yes. Exhibit 9-1 refers to Part A.

20 Q Part 1?

21 A Part 1, I'm sorry.

22 Q Would you describe what a listing is, please?

23 A Yes. This is a printout, which is the same word,  
 24 of -- it's a copy of instructions of a program.

1 This is something that was written in assembly  
2 language; that is, instruction by instruction,  
3 instruction by instruction, versus an expression  
4 or statement in a higher-level language such as  
5 FORTRAN. And this is the code of the program.

6 Q Was Exhibit 9-1 used in the preparation of  
7 Exhibit 9-1-A?

8 A Yes. This was done recently.

9 Q How recently was that done?

10 A Within a week.

11 Q And how was it done?

12 A I personally fed the Part 1 through a Flexowriter  
13 and obtained the Exhibit 9-1-A, so-called listing.

14 Q Were similar listings prepared back in the period  
15 1961 to '63?

16 MR. ANDERSON: I object. You're  
17 leading the witness.

18 Q At that time, we had no editor program on the  
19 machine. The original tape would have been  
20 prepared on any off-line Flexowriter and the  
21 information typed in in this fashion. This is a  
22 duplicate of the way the program was initially  
23 typed on the off-line Flexowriter.

24 Q And that was back in 1962?

1 A Yes.

2 Q I believe you stated that published mnemonics  
3 were used for each instruction. Where were the  
4 mnemonics for the PDP-1 published?

5 A I think very early in my reading of the logbook  
6 I talked about a 2E of the order card on the  
7 console. That would be what was normally referred  
8 to. They are explained in more detail in the  
9 PDP-1 handbook published by DEC.

10 Q Now, you're holding a document in your hand as  
11 you are testifying in answer to the last question.  
12 What document is that that you're holding?

13 A It's the PDP-1 handbook.

14 Q Where did you obtain that document to bring here?

15 A DEC furnished us the number of these to be  
16 distributed to the PDP-1 users.

17 Q Is that a manual that was furnished to RLE by  
18 DEC?

19 A Yes, probably, to my custody. I would have  
20 handed them out.

21 Q Do you recall when that manual was received in  
22 your custody?

23 A We had several of them. We used to request them,  
24 one or two cartons at a time, as we had more

1 course activity. That eventually ran out. The  
2 machine was not there, you know. They were  
3 bringing out another line of computers; and this  
4 was not their principal interest. And somewhere  
5 in the interim, things became better organized.  
6 We had our own handouts that would give this  
7 type of information.

8 May I correct my earlier testimony?

9 For an example of a mnemonic, I claimed that the  
10 add instruction had the code 20. I worked with  
11 several machines; and it turns out that it's  
12 40 on this one.

13 Q And how did you determine that?

14 A I'm looking at the instruction list in front of  
15 me in the PDP-1 handbook.

16 Q And what page does that appear on?

17 A Page 15.

18 Q I wonder if you would permit us to mark this  
19 exhibit, with the same understanding that we had  
20 with respect to the others.

21 MR. HORN: That would be acceptable.

22 MR. WELSH: Thank you.

23 This would be Exhibit 10. Perhaps you  
24 can make your notation in the white portion of

1 the figure 1; maybe keeping it small, so that it  
2 will appear on the front of the handbook.

3 [PDP-1 handbook published by  
4 DEC, marked MIT Deposition  
5 Exhibit No. 10 for identifi-  
6 cation.]

6 MR. ANDERSON: May I see it, please?

7 MR. WELSH: Sure.

8 Q Referring to Exhibit 9-1, does that exhibit bear  
9 any date?

10 A No.

11 Q You stated it was related to Exhibits 9-2 and  
12 9-3. Do those exhibits bear any dates?

13 A Yes; 9-2.

14 MR. ANDERSON: I object to the question  
15 on the ground that it asks this witness to state  
16 hearsay evidence; no foundation for this witness'  
17 knowledge of when that tape was made or when the  
18 writing was made on the tape. It's objectionable  
19 to ask him questions about those entries unless  
20 you have a foundation. I object for lack of a  
21 foundation.

22 A The dates appearing on 9-2 and 9-3 are  
23 24 September '62.

24 Q Do you know who placed that date on there?

1 A No.

2 Q Does the date have any significance to you?

3 MR. ANDERSON: I object to the question  
4 as relating to hearsay, lacking in a foundation,  
5 contrary to the testimony.

6 A No.

7 Q Is it customary to put dates on tapes?

8 A Yes. May I amplify?

9 Q Yes.

10 A This is because you usually have several versions  
11 of a program during program development; and the  
12 dates keep the tapes in order, so that you know  
13 which is the most up-to-date copy.

14 Q What does the date signify on the tapes?

15 MR. ANDERSON: I object to the question  
16 as a repeated and improper attempt to use hearsay  
17 evidence to rely on documents that are  
18 unauthenticated, to have this witness speculate  
19 and give opinions; and I object on the ground  
20 that there is no foundation for the question.

21 A The practice is to have the work carry the date  
22 that you type the program on the Flexowriter, at  
23 that time. Later, directly into the machine.

24 Q Is that the date when the particular tape is made?

1           MR. ANDERSON: I object to the testimony  
2 of the interrogator, Mr. Welsh. I wish you would  
3 at least only lead the witness and not testify  
4 for him. I object to your leading questions; I  
5 object to the manner in which this is being  
6 conducted.

7 A       The usual practice is that you keep track of your  
8 day's work; and you put that current date on the  
9 tape.

10 Q       Do you have any personal knowledge as to when  
11 these tapes were made?

12           MR. ANDERSON: I object. Which tapes?

13 Q       These tapes; Exhibits 9-1, 9-2 and 9-3.

14 A       I can identify Part 2 as being one of the early  
15 tapes.

16 Q       And how do you so identify it?

17 A       You will note that it's been spliced together.  
18 Now, at that time programs, as I've earlier  
19 indicated, were typed on an off-line Flexowriter  
20 and the paper tape prepared.

21           Sometime within the first year, I do not  
22 have an exact date, an editing program was  
23 prepared called Expensive Typewriter; and you  
24 typed your program into the computer. In general,

1 with all editing programs, the text is stored in  
2 the computer. The nice thing about this is that  
3 you can edit it, correct it line by line, word by  
4 word; and I'll amplify that if necessary.

5           There is a second point, since you  
6 asked me to identify it; the fact that there is  
7 pink tape incorporated into it. If you refer  
8 back to the logs, you will find that I went  
9 through quite a hassle on that. The gray tape  
10 was first available from DEC. I found out that  
11 I could buy the pink tape for about one third the  
12 cost, and we tried to use that. However, the  
13 pink tape proved to be not as opaque; and we had  
14 trouble with the photoelectric reader. And I  
15 think you'll find an entry in the log -- and this  
16 was part of my notes, Exhibit 8 -- that I had  
17 some gray tape on order, and we were hoping to  
18 wait for it.

19           The problem is that at that early time  
20 it was a factory order rather than the pink tape,  
21 which was available on the shelf. The pink tape  
22 was fine for a Flexowriter, where we had  
23 mechanical pin-feed read-in holes. It was not  
24 working very well on the paper tape reader on the

1 PDP-1, where we photoelectrically sensed the hole.

2 Q You say there is an entry on Exhibit 8 in this  
3 regard?

4 A May I call it Book 3 for reference, and then  
5 come back? That would be Exhibit 6, and Page 68.

6 However, previous to this time you will  
7 notice all kinds of almost nasty comments about  
8 this same pink tape.

9 Q Did it have any particular name?

10 A There were . . . .

11 They didn't curse it; but it gave them  
12 a hard time, and they in turn gave me a hard time.  
13 It was a nuisance, to say the least.

14 Q Now, what is the entry that you referred to?

15 A All right. On Page 68 of Exhibit 6, on the page  
16 headed "Friday, 19th of October, PDP-1 users."  
17 There is a supply of pink and yellow one-inch  
18 rolled tape for English tapes. Whenever feasible  
19 in order to make the pink fanfold last until a  
20 supply of gray" -- underlined -- "fanfold comes  
21 through. An order has been placed, but is a  
22 special run and delivery will be delayed."

23 Initialed "JAM." out of

24 Q Now, is that entry made by you? Was that entry

1 made by you?

2 A It is my typical lettering style.

3 Q Do you recognize it as an entry made by you?

4 A Yes.

5 Q What year was that 19th of October?

6 A 1962.

7 Q I believe your testimony just now was in  
8 connection with my question as to whether you had  
9 any way to tell what was the date of when  
10 Exhibit 9-2 was made.

11 A May I continue?

12 Q Yes, please.

13 A Sometime within the first year, the program  
14 referred to as Expensive Typewriter became a  
15 working program, made available. At that time,  
16 you would read in the English tape that I called  
17 the source language earlier -- I'm using the words  
18 interchangeably -- that what you were carrying,  
19 and editing, updating, making corrections. At  
20 that time, you would call for a punchout from the  
21 computer; and it would have been punched out.  
22 It would never be necessary to splice it. It  
23 would be punched out in a continuous piece.

24 Q Does that, coupled with the entry to which you

1 referred, help you determine the date when  
2 Exhibit 9-2 was made?

3 A It helps me determine the date within a year,  
4 the first year, of operation.

5 Q That's of operation of the PDP-1?

6 A Yes.

7 Q First year following September 15, 1961, when it  
8 was first delivered?

9 A Yes.

10 Q So that this tape, then, was made within that  
11 first year?

12 A Yes.

13 MR. ANDERSON: I object.

14 A We could look for references in the log to  
15 Expensive Typewriter. I did not look for that.  
16 It would appear. It was written by Steven Piner.

17 Q Do you have any way of determining when Exhibit 9-1  
18 and 9-3 were made?

19 A When I listed 9-1, the first line came out  
20 "Space War 3.1 24 Sep '62 Part" -- "pt" --  
21 "Part 1." It's listed as "pt point 1, pt period."

22 Q In giving that answer, were you referring to  
23 Exhibit 9-1-A?

24 A Yes, I was.

1 Q Does that indicate to you the date when Exhibit 9-1  
2 was made?

3 MR. ANDERSON: I object. You're leading  
4 the witness.

5 A That would be in accordance with usual practice.

6 May I amplify that a little bit?

7 Q Yes; if you would, please.

8 A At that time, as I indicated earlier, it was  
9 rather a tedious operation editing these tapes;  
10 and it may very well be that he went in and put  
11 in this patch a few days later. You probably  
12 wouldn't go all the way through with changed  
13 dates. Later on, when you were able to do this  
14 on the computer, on line, then you'd be most apt  
15 to update things on a day-to-day basis.

16 Q When you said "he would make this patch" --

17 A I'm sorry. However --

18 MR. ANDERSON: I object to the question,  
19 if it is a question, as asking for speculation.  
20 There's been no foundation for who did this  
21 alleged activity, when it was done, whether it was  
22 done a year later or a few days later, or any  
23 knowledge of this witness as to when it was done.

24 [Question read.]

1 Q -- who did you mean?

2 A I was thinking, whoever prepared that tape.  
3 I would have no knowledge as to who. There were  
4 several people involved with the game, as has  
5 been earlier testified to. I don't know who was  
6 putting in a different feature at that time, or  
7 modifying the program. Could have been anyone.

8 Q Do you know whether it was done at RLE during that  
9 year?

10 MR. ANDERSON: I object; lack of a  
11 foundation. I think the witness has already  
12 indicated his knowledge of this tape.

13 A It was the type of pink tape that we were using  
14 at that time. At that particular time, there were  
15 no other DEC computers at RLE.

16 Q Were there any DEC computers at any other facility  
17 of MIT at that time?

18 A There was one at -- Serial No. 2 went to Bolt,  
19 Beranek and Newman, in Cambridge.

20 The fanfold tape, there again, was not  
21 really the standard. The tape used on the  
22 Flexowriter at that time was generally in a roll;  
23 and the first time we saw the standard tape was  
24 when DEC brought it out. That was why I had so

1 much difficulty obtaining the gray tape which I  
2 wished. It was the sole source at that time.

3 Q When you referred to "this patch," you lifted up  
4 Exhibit 9-2. What did you mean by "this patch"?

5 A The tape starts out, the front end is gray tape.  
6 It has printed on it "Digital Equipment  
7 Corporation Programmed Data Processor"; and in  
8 larger print below that are the letters "PDP-1"  
9 and an arrow which points towards the front end  
10 of the tape. You insert it so that the . . .

11 That first part is followed by a  
12 section which has been spliced into this tape,  
13 using some old-type cellophane tape. It's the  
14 old clear, shiny stuff, not the so-called -- not  
15 the trade name Mystik tape which we use now.  
16 The tape on one side fell off in my hand as I  
17 listed it. Part of it is still here.

18 The first section is followed by a  
19 section of pink tape. The third section goes  
20 back to the same type of tape as the front end.

21 Q By "this patch," then, did you mean the pink  
22 section?

23 A Yes. It was the pink section that makes it  
24 obvious that the tape had been spliced.

*Doris O. Wong Associates*

1 Q Now, I believe you stated that you brought with  
2 you 13 tapes; and we've discussed three of those,  
3 which were described as source tapes. We got to  
4 those when I asked you if there was any relation  
5 of any of these tapes to any of the other tapes  
6 in the group.

7 A Well, some of the, the balance of the tapes  
8 carry later dates. I mentioned the others, since  
9 they were the earliest references.

10 Q Are there any of the remaining 10 that have any  
11 relationship with the first three that we  
12 discussed, Exhibits 9-1, 9-2 and 9-3?

13 A There is a series here that carries the notation  
14 4.0, versus the 3.1 that we saw earlier; and  
15 there is a binary copy of 3.2. We had earlier  
16 discussed 3.1.

17 Q There are the designations 3.1, 3.2 and 4.0. Do  
18 you know what those designations are?

19 A Usually this gives you the sequence of the  
20 modifications to the original program.

21 Q How did you determine the sequence from these  
22 numbers?

23 A The numbers would go consecutively.

24 Q The lower numbers being the earlier tapes?

1 A The low number would be the original source; and  
2 as that was updated, modified, enhanced, they  
3 probably put a trailer, point one, point two,  
4 on it.

5 MR. ANDERSON: I object to the witness  
6 testifying what might have or probably happened.

7 A That's what we --

8 Q Did it actually happen?

9 A It's what we always do.

10 Q Within your knowledge?

11 A I do not know as to these particular tapes.

12 Q But was that the custom?

13 A It is the custom.

14 Q And was it the custom at that time?

15 A Yes, very definitely.

16 Q I see on another one of these 10 tapes that  
17 haven't been marked yet a designation "SPCWR 3.1."  
18 Do you know what that designation is or what that  
19 tape is?

20 A I haven't looked at it. I can identify it as a  
21 source tape, since the binary tapes all carry  
22 the continuous eighth holes. I have not listed  
23 it, and I don't know what it holds.

24 Since there was no date on it, I went

1 to the one that had a date. It could be listed  
2 on a Flexowriter.

3 Q If a listing were made of this, would it show the  
4 date on which it was --

5 A I have no knowledge as to whether the one who  
6 coded that headed it with a date.

7 Incidentally, it would have to be on a  
8 Flexowriter that was compatible with the code --  
9 i.e., the FIO-DEC code.

10 MR. WELSH: I'd like the Reporter to  
11 mark this tape bearing the notation "SPCWR 3.1"  
12 as Exhibit 11.

13 [Punched paper tape designated  
14 "SPCWR 3.1," marked MIT  
15 Deposition Exhibit No. 11  
for identification.]

16 Q Did you prepare any other listings of the tapes  
17 9-1, 9-2 and 9-3?

18 A Part 2, labeled Exhibit 9-2, I did run through  
19 and list on the Flexowriter.

20 Q And did you bring such a list?

21 A I did.

22 Q With you? And may I mark this the same as we've  
23 marked the other exhibits?

24 A Yes.

1 MR. WELSH: Would you mark this listing  
2 as Exhibit 9-2-A.

3 [Listing of MIT Deposition  
4 Exhibit No. 9-2 for identi-  
5 fication, marked MIT Depo-  
6 sition Exhibit No. 9-2-A  
7 for identification.]

8 Q Did that listing bear any date?

9 A No. The tape that was used to obtain the listing  
10 bears the date September, 24 September '62; and  
11 that's been the discussed patched tape.

12 Q Referring now -- first of all, do you have any  
13 binary tape relating to Exhibits 9-1, 9-2 and  
14 9-3?

15 A We determined this was English.

16 I cannot tell from the headings on  
17 the tapes that I do have. It could be in the  
18 collection. I cannot identify it by the number  
19 3.1.

20 Q Referring next to this tape, could you identify  
21 that for us, please?

22 A The tape is pink tape. It is titled, pencilled  
23 on it, the heading "SA4." That means starting  
24 address. "Quickie Space War." And the date  
"19 April '62."

Q Do you know who put that date on there?

1 A No.

2 Q Do you recognize the lettering?

3 A No.

4 Q Are you familiar with the subject matter of that  
5 tape?

6 A I did not attempt to run it on the machine. It  
7 would have required some time.

8 We have since that time modified the  
9 original PDP-1 so that in order to run this tape  
10 we would have to alter some of the programs, some  
11 of the instructions. We have changed the numerical  
12 value of some of the instructions. It would not  
13 run if we just went over there and ran it in. It  
14 would require some time. I didn't take the time  
15 to do it.

16 Q Do you recall when you changed those values such  
17 that this tape would not be run now?

18 A It was during the period that we earlier mentioned  
19 when Professor Dennis was implementing the time-  
20 sharing system on the PDP-1 time. Through the  
21 middle Sixties is the best way to describe it.

22 Q Would that have been before 1966?

23 A Yes, it would be. It was a continuing type thing  
24 from about 1963, when it was brought off the

1 ground, and continued to be improved through '68.  
 2 Q Do you know or do you have any way to determine  
 3 when this tape, which I will ask the Reporter to  
 4 mark as Exhibit 12, came into existence?

5 MR. WELSH: Let me ask him to mark this,  
 6 and then I'll ask him to repeat the question.

7 [Punched paper tape designated  
 8 "SA4 Quickie Space War  
 9 19 April '62," marked MIT  
 10 Deposition Exhibit No. 12  
 11 for identification.]

12 MR. ANDERSON: I object to the question  
 13 as lacking in foundation, based on hearsay or  
 14 worse. You've established no knowledge of this  
 15 witness as to who made it or any of the  
 16 circumstances surrounding it by which he could  
 17 testify as to when it was made.

18 MR. WELSH: Would you read the question  
 19 now, please.

20 [The following was read:

21 "Q Do you know or do you have any  
 22 way to determine when this tape,  
 23 which I will ask the Reporter to  
 24 mark as Exhibit 12, came into  
 existence?"]

A I can only identify it as being during the first

1 year, when we had the pink tape which has been  
2 discussed.

3 Q And that's the first year following --

4 A The first year being -- the machine came in in  
5 1961.

6 Q In September?

7 A September '61.

8 Q Do you know whether the pink tape was available  
9 anywhere else than at MIT other than RLE?

10 A Yes. It was purchased through Carter, Rice,  
11 Storrs, Boston -- Carter, Rice, Bement and Storrs.

12 May I correct that? Carter, Rice,  
13 Storrs and Bement. I gave you the wrong order.

14 Q I believe that in answering that question you  
15 produced some other documents. Would you  
16 describe what those are, please.

17 A Well, this is my card index on my purchases of  
18 fanfold tape.

19 Q And could you explain what those cards represent  
20 or show?

21 A Yes. My chief reason for keeping the cards was  
22 that we were jointly sponsored by RLE and  
23 Electronics Systems Laboratory; and starting in  
24 September of 1962, we began a course activity on

1 the machine. So that I was trying to spread  
2 charges for supplies equally between various  
3 groups with reference as to where I had gone to  
4 purchase the various needs, day-to-day needs.

5 Q Were you responsible for such purchases?

6 A I initiated the orders; and they're placed  
7 through a purchasing agent.

8 Q Are these records kept by you in connection with  
9 such purchases?

10 A Yes. There again, in order to distribute the  
11 cost.

12 Q Now, can you refer to those cards and tell when  
13 you made purchases of the pink tape?

14 A Yes. I have an entry 9-25-61; one carton pink.  
15 Abbreviated, Carter, Rice, RLE. And the price of  
16 the carton, \$32.40.

17 11, '62, two cartons pink. Do you want  
18 the balance of the information for each line?

19 Q No. I was just interested in the times, the  
20 dates, when you purchased.

21 A 1-5-62, three cartons of pink and three cartons  
22 of black.

23 The black was a way to get something  
24 more opaque; but the problem with that was that

1 the black dust and the carbon in there created  
2 more problems, because it was just terribly messy,  
3 and interfered with the optical system.  
4

5 3-22-62, eight cartons of pink.

6 6-25-62, 10 cartons of pink.

7 10-16-62, 15 cartons of gray. And all  
8 of my entries, then on, would be gray tape.

9 Q Did you purchase any pink tape after the June 25,  
10 1962 entry?

11 A Not whenever the other became available.

12 MR. WELSH: I have here another tape  
13 which I would like to ask the Reporter to mark  
14 as Exhibit 13.

15 Rather than ask about each tape, may I  
16 request that we have the same understanding with  
17 respect to all of the tapes?

18 MR. HORN: Yes.

19 MR. WELSH: Thank you.

20 [Punched paper tape, marked  
21 MIT Deposition Exhibit No.  
22 13 for identification.]

23 MR. WELSH: We've been going for a while  
24 now. I would suggest a short recess to give the  
25 witness and the Reporter a break.

MR. ANDERSON: Do you have any idea how

1 much you have left? It's now four o'clock.

2 MR. WELSH: I'd like to go through the  
3 remaining tapes, have them identified and times  
4 indicated as to when they came into existence.  
5 I don't know what other documents the witness  
6 might have brought with him.

7 MR. ANDERSON: You still expect to  
8 finish today, as far as you know?

9 MR. WELSH: Well, I would hope to.  
10 We've checked with the Reporter, who --

11 MR. ANDERSON: Why not have the witness  
12 tell us or lay out what documents he's got right  
13 now, if he has some more? I'd just as soon see  
14 them during the break, if they're being produced  
15 subject to a subpoena.

16 MR. WELSH: Sure.

17 Q Would you mind doing that?

18 A Well, as I read the attachment, it was so broad  
19 that I would have to bring nine file cabinets'  
20 worth of stuff. I tried to pick out things that  
21 were representative. I thought that would be  
22 most useful in pinning down times.

23 I have a complete set of prints of the  
24 PDP-1 computer. It was a standard machine at that

1 time, and would be represented by this set of  
2 prints.

3  
4 MR. WELSH: Since we'll have to stay  
5 on the record for this purpose, I suggest we  
6 return to the five-minute break.

7 MR. ANDERSON: Why not lay the stuff  
8 out during the break, and take a look at it?

9 MR. WELSH: I would like to have him  
10 describe it as he produces it, and mark it as we  
11 go along.

12 MR. ANDERSON: I'd like to look at it  
13 during the break so that I'll have a little  
14 extra opportunity to study them. I see a rather  
15 thick booklet he's pulling out. There's no  
16 reason to waste our time after the break doing  
17 that. Why not let him lay out what he's brought?

18 MR. WELSH: Well, I'll tell you. It's  
19 my deposition. You'll have a chance for cross-  
20 examination; and I would designate the break at  
21 this time.

22 MR. ANDERSON: Mr. Horn, during the  
23 break, could I see the documents that are being  
24 produced pursuant to the subpoena, just so that  
I'll know what we're going to have after the break?

1  
2 MR. HORN: Well, I think it's Mr. Welsh's  
3 show, really. I don't know.

4 MR. ANDERSON: Well, you represent the  
5 witness and MIT; and you're producing documents  
6 here today pursuant to the subpoena.

7 May I ask you this, Mr. Welsh: have you  
8 ever seen any of these documents before we entered  
9 this deposition room?

10 MR. WELSH: Yes. I saw --

11 MR. ANDERSON: Well, why won't you give  
12 me the same opportunity?

13 MR. WELSH: You have had the same  
14 opportunity. You have seen exactly the documents  
15 that I saw; and I have seen no others up to this  
16 point, including the tapes and the manual and so  
17 forth. So I suggest we break for five minutes.

18 MR. ANDERSON: I can't help thinking  
19 that the intention is to prolong these proceedings  
20 rather than expedite them.

[Recess.]

21 MR. WELSH: There appears to be a strong  
22 possibility, Mr. Smith, that we'll not be able to  
23 complete with Mr. McKenzie this evening. Are  
24 there any limitations on how long we can stay here,

1 or how long you and Mr. Horn might be available  
2 to stay? And I haven't even asked the witness  
3 whether he would be willing to stay a little  
4 longer. We were scheduled in the morning at  
5 10 o'clock at Maynard; and depending on how long  
6 we can go tonight, it's possible we might finish.

7  
8 MR. SMITH: Well, we had the conference  
9 room here reserved for tomorrow also, in the  
10 event that it's needed; so that's no problem. I'd  
11 say, within reason, we're available tonight.  
12 What do you have in mind in terms of time?

13 MR. WELSH: It's difficult to estimate;  
14 because we had a rather long break, which we  
15 probably won't usually do. My guess is that the  
16 direct could go another hour and a half, possibly  
17 two hours. If there's going to be cross-  
18 examination -- I was thinking of something on the  
19 order of six, possibly.

20 MR. SMITH: How does that fit?

21 THE WITNESS: I'm flexible.

22 MR. WELSH: Mr. Horn?

23 MR. HORN: I have to get back, but I  
24 believe Mr. Smith can stay.

MR. SMITH: Six would be fine with me.

1  
2 Let's agree to cut off at six, and lap  
3 over to tomorrow.

4 MR. ANDERSON: Could we start early in  
5 the morning?

6 MR. SMITH: Sure.

7 MR. WELSH: What time do you normally  
8 open?

9 MR. SMITH: We normally open at nine  
10 o'clock.

11 MR. WELSH: Okay. Then let's shoot  
12 for that.

13 MR. SMITH: You can get in here before  
14 nine o'clock. The building will be open, I'm  
15 sure, from 8:30 on.

16 MR. BRIODY: Is the witness available?

17 MR. WELSH: Yes. He said he was  
18 flexible.

19 THE WITNESS: May I make a phone call?  
20 I guess there will not be a break until six.

[Discussion off the record.]

21 Q (By Mr. Welsh) I hand you now what has been  
22 marked as Exhibit 13 and ask you, please, to  
23 identify that.

24 A It's a binary tape, pink tape, with a heading

1 "Usual Space War 2-B hyperspace. All switches  
2 off" -- would be the normal mode, although it  
3 doesn't say here.  
4

5 I'm going on now to list the switch  
6 numbers. No. 1, "Angular" -- it just says "Ang" --  
7 "acceleration."

8 2, "light gravity."

9 3, 4, "stars."

10 5, "stick in star."

11 No. 6, "no star on gravity."

12 Q Do those notations on there mean anything to you?

13 MR. ANDERSON: I object. You have not  
14 established any foundation for asking this witness  
15 anything about those notations; and his  
16 interpretations are irrelevant, immaterial,  
17 speculation, hearsay. And I strongly object to  
18 interrogation of this witness about those entries  
19 or what they mean to him.

20 A We commonly had various versions of the program  
21 that were called on, depending on the skill of  
22 the players. For instance, if we had an open house  
23 and had people in from outside, if you had a heavy  
24 gravity, the uninitiated player would have his  
greatest difficulty avoiding being drawn into the

1 bright star, without even worrying about defensive  
2 or offensive action of the other spaceship.  
3

4 On the other hand, if you're skilled  
5 players, it made for a more exciting game if the  
6 gravity of the star was somewhat greater. The  
7 reference to the Switches 3 and 4, stars, it  
8 requires a considerable amount of computer time,  
9 shall we say overhead time, to display the star  
10 field. It doesn't add or detract from the --  
11 well, it doesn't add anything to the game. It  
12 detracts from the point of view that it becomes  
13 somewhat more sluggish if you have to display  
14 all of these stars.

15 The stick and the star would be a  
16 version where, when you're drawn in, you would  
17 stick there. There was another option that  
18 sometimes you might have been thrown out to the  
19 corners. I think this was probably commonly used.

20 In other words, each user had his own  
21 pet version to make the game, to vary the flavor  
22 of the game; the skill required.

23 Q Does that notation on there indicate any  
24 particular version?

MR. ANDERSON: I object to the question.

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1 It's based on hearsay; speculative.

2 A It was one of many versions. It was not unusual  
3 for individuals to have their own game, later, on  
4 DEC tape, when we had magnetic tape, rather than  
5 paper tape. Each one, there have been many  
6 people, who have modified the original game.

7 Q Was 2-B a version or designation for a version?

8 A I cannot tie it down with this alone. Since it's  
9 a binary tape, I cannot list it. I have no way  
10 of identifying it from this.

11 Q Do you have any way of telling when that tape  
12 was made?

13 A No; except that I know that it's within the  
14 period of the problem with the pink tape. It is  
15 punched out on pink tape.

16 Q When you first became aware of the users working  
17 on or using the PDP-1 computer to work on Space  
18 War, did you actually observe the game being  
19 played by them?

20 A Yes. There were many times when I came in in the  
21 morning that they were still playing, having  
22 played all night. It was --

23 Q Did this happen frequently? Did you observe it  
24 frequently?

1 MR. ANDERSON: I object to leading the  
2 witness.

3 A I'm not sure how I can answer the term  
4 "frequently." May I respond in my term, that it  
5 happened many times. And, of course, in open  
6 house and again when we had visitors, it was not  
7 unusual to ask one of these fellows who was often  
8 around to demonstrate his game.

9 Q Did you ever play the game yourself?

10 A Yes, I did. Might I add, I couldn't become as  
11 skilled as they; since I didn't put in these  
12 four-, six-hour sessions during the wee hours of  
13 the morning. It was not usual that I played with  
14 them.

15 Q Was there an original or first version of the  
16 game?

17 A The game was first implemented where the users  
18 controlled the ships from the front console of  
19 the PDP-1; namely, from the switches labeled  
20 "test word." And they are shown in the picture  
21 in the PDP-1 handbook, the console, Page 10;  
22 there's --

23 Q What exhibit number is that?

24 A 10; Exhibit No. 10.

1 Q Thank you.

2 A On Page 10, manual controls, there is a photograph  
3 of the front panel of the PDP-1. The next-to-the-  
4 bottom row of switches is labeled "test word";  
5 and the game was controlled, in the early versions,  
6 each user having four of those switches.

7 Q Would you go on. I believe you were telling  
8 about the first version.

9 A Well, that would be the significant thing about  
10 the first version. The second --

11 Q Excuse me. Before we go on from that, could you  
12 tell what happened when each player played each  
13 one of his switches or activated each one of his  
14 switches?

15 A All right; yes. Each user was given four  
16 switches. One switch would turn his ship in the  
17 clockwise direction; another switch would turn  
18 it counterclockwise. One switch would be used to  
19 fire torpedoes, and a fourth switch to fire the  
20 rockets; that is, to give the ship acceleration.

21 Q Now, you referred in an earlier answer to a  
22 gravity, a heavy gravity. Was there any gravity  
23 effect in connection with the first version?

24 A On the earlier sheet that we listed, I don't know

1 about the first version, I'm sorry --

2  
3 MR. ANDERSON: I object to the witness  
4 referring to documents. If you want to refresh  
5 his recollection, ask him what his recollection  
6 is.

7 Q Before you look at that exhibit, Mr. McKenzie,  
8 I wonder if you recall whether there was gravity  
9 in the first version.

10 A You have to define what "the first version" is.  
11 Now, you have to distinguish what is the first  
12 working version. This thing was brought up  
13 piecemeal. It just doesn't exist all of a sudden  
14 on a certain date. And as it is being developed,  
15 it's developed in modules, you might say; and  
16 then checked out, debugged is the computer term.  
17 The program is debugged, and then refinements are  
18 put on.

19 I do not -- normally, you'd get the  
20 thing working; and then you would add things like  
21 gravity, which would be another problem to have  
22 to worry about. So I would know that, the way  
23 we operate, the first version would not have it.  
24 What is called the first version, I'm not sure  
how anyone can define.

1 Q Well, if it had a meaning to you, I believe you  
2 just said, with the first version, when you were  
3 operating it, it would not have had it --

4 A That's right. But it would be a continuing thing.  
5 Every night the fellows would have added a little  
6 bit more to the program.

7 Q Was a gravity effect added at some time?

8 A Yes.

9 Q When such effect was added, was it always present  
10 or was it optional?

11 A It has appeared both ways.

12 Q In the absence of gravity, and when one of the  
13 spaceships was moving, what happened as it  
14 approached the edge of -- what happened if it  
15 continued its movement without acceleration?

16 A The way the ship is displayed, when the ship  
17 leaves, shall we say, the left-hand edge, it  
18 immediately reappears on the right-hand edge.  
19 The display is thought of as being unfolded, shall  
20 we say; and the left-hand edge and the right-hand  
21 edge are adjacent points.

22 Q When you say "left-hand edge" --

23 A Or the raster of the CRT display. That is the  
24 raster. That's the section of the CRT face which

1 is illuminated; intensified is a better word.

2 Q Did the raster have a shape?

3 A Yes. It was adjustable, within limits. The  
4 specifications in the blue book which we've  
5 looked at I think will indicate that it was  
6 normally set up nine and a quarter by nine and a  
7 quarter.

8 Q Can you find a reference to that in the book  
9 that we've -- that's Exhibit 10?

10 A Yes. On Page 34 of Exhibit 10, it's a continua-  
11 tion of the description of the precision CRT  
12 display (Type 30). At Page 34, it's headed by  
13 a photograph of said display; and the  
14 characteristics are as follows -- to answer the  
15 particular question -- raster size, 9.25 by 9.25  
16 inches.

17 Q Were any points outside of the raster illuminated  
18 during the course of the CRT display?

19 A No. That is the limit of the intensified area.  
20 It is, indeed, the intensified area.

21 Q I believe you described the movement of a space-  
22 ship as it approached the left-hand edge of what  
23 you described as the raster; then it would  
24 disappear from that edge and appear on the

1  
2 A opposite or right-hand edge?  
3 Immediately, as if it were moving to the next  
4 point. The raster that I talked about is actually  
5 made up of 1,024 by 1,024 discrete points; and  
6 the way we present something on the CRT is to  
7 intensify one of these 1,024 by 1,024 points at  
8 a time.

9 Q Are those referred to --

10 A The specification --

11 Q -- in the manual also, Exhibit 10?

12 A In the same page location, it declares 1,024 by  
13 1,024 addressable locations.

14 Q There also appears a statement: "Resolution is  
15 such that 512 points along each axis are  
16 discernible on the face of the tube."

17 Do you know what that statement means?

18 A Yes.

19 MR. ANDERSON: I object to the question.  
20 The document speaks for itself. There's no  
21 foundation for the question; no basis for saying  
22 that this witness wrote that statement.

23 A Yes. The problem comes about that when you  
24 display a point, it's often somewhat defocused.  
Adjacent points would tend to merge, and they

1 couldn't be identified as individual points.  
2 This is worse in some areas of the scope face  
3 than others.

4 Q The statement I just read included the phrase  
5 "on each axis."

6 A Yes.

7 Q What axis --

8 A The location -- the specification said "address-  
9 able locations." Each point is determined by an  
10 address in the Y axis, which is the vertical  
11 axis; and then an address in or location in the  
12 horizontal axis, which would be termed the X axis.

13 Q In the Space War program as you first became  
14 aware of it, were X/Y coordinates used in  
15 determining points of illumination?

16 A Yes.

17 MR. ANDERSON: I object to the question.  
18 I think it's ambiguous. No testimony that this  
19 witness has any knowledge of the internal  
20 workings of the machinery.

21 A That is the way that the information -- that is,  
22 the digital information -- is placed on the  
23 display from the computer. The output of the  
24 computer is the coordinate locations or location

1 of the point that's about to display. The way  
2 that's arrived at, one register, the accumulator,  
3 contains one address. The in-out register,  
4 commonly called the I/O register, contains the  
5 other address. And there are 10 binary digits of  
6 information present in each register. You set up  
7 those registers and then give the display  
8 instruction. At that time, the contents of the  
9 two aforementioned registers are passed to the  
10 computer display; and the point is intensified  
11 in accordance with that information. I can build  
12 on that if necessary.

13 Q Yes. Is there anything in particular that  
14 determines when the point is illuminated?

15 A Yes. The setup time required, the display  
16 instruction requires about 50 microseconds' time,  
17 and the first 40 microseconds are necessary for  
18 setting up the time, setting up the point. That  
19 is, as the display was designed, you clear the  
20 register and load in the new contents. That  
21 means, meant, that the display always had to  
22 return to zero. It's necessary, in order to  
23 display the points, to translate the digital  
24 information passed from the computer to analog

1 information which determines the deflection of  
2 the beam, and finally the intensified point.

3 I should add, I think I gave a number,  
4 a setup time of 40 microseconds; and then the  
5 intensified time is the next 10 microseconds.  
6 That's variable, but that is the standard.

7 Q What do you mean by "intensified time"?

8 A That is intensified. That means that there is  
9 an intensity gate turned on, so that the beam  
10 conducts to the scope face during that period.

11 Q And what turns the beam on?

12 A A display instruction from the computer; one of  
13 the in-out transfer, commonly called IOT  
14 instructions. It's actually IOT07.

15 Q Does that instruction resulting in the intensifica-  
16 tion take any particular form?

17 A No. That instruction passes the information from  
18 the computer, and the rest is hardware-controlled.  
19 That is, the deflection is set up during the first  
20 40 microseconds. Once it's set up, then the  
21 beam is projected to the scope face during the  
22 last 10 -- I guess I'm repeating myself. I'm not  
23 sure how else to say it.

24 Q Is the beam present in the first 40 microseconds?

1 A No, no.

2 Q What determines that the beam is -- what turns  
3 the beam on, then, for the last 10 seconds?

4 A There is a display. That is triggered with a  
5 pulse called display on, which comes from the  
6 machine. And on a runout of a delay, there is a  
7 second delay which turns on the beam current for  
8 the 10-microsecond intensification time.

9 Q Now, you described the first version of Space War,  
10 as you first became aware of that game. Could  
11 you describe the next version as best you recall  
12 it?

13 A There were two things. The first major change --  
14 you may again, for accuracy, say that things were  
15 always being changed -- was an indication in the  
16 log that they had installed a slow-speed clock.

17 Shall I go on; the significance of this?

18 Q Yes. When you gave that answer, I believe you  
19 referred to Exhibit 8, did you not?

20 A Book 2. I can't cross-reference this.

21 Q Well, Exhibit 8 being your list.

22 A I'm sorry. Yes, I did. I looked at that. I was  
23 trying to find a cross-reference so I could point  
24 to something in the book.

1 Q Yes; if you'd go on.

2 A If I could go on to the significance first?

3 Q Yes, please.

4 A The game as it was first played used program  
5 timing. That is, the switches are referenced,  
6 looked at, maybe -- that's not the computer  
7 terminology -- depending on the, quote, program  
8 loop.

9  
10 In order to give a different feel to  
11 the game, and as evidenced by the sensitivity of  
12 the switches, it was found to be interesting to  
13 have a variable clock so that you could have the  
14 program look at the switches and update position  
15 or any interactive-type input more frequently if  
16 you wanted to have a version that appealed to  
17 the skilled operator versus a less sensitive, or  
18 version for a visitor coming in off the street,  
19 shall we say.

20 The clock was used to cause a sequence  
21 break, and that was patched in with some what we  
22 called building blocks, which we had used on the  
23 TX-0. The logic levels were compatible with the  
24 DEC computer, and it was an easy job to interface  
them, since the PDP-1 computer, in Bay 3, had

1 what they call the in-out panel. The machine had  
2 been built with the idea that users could  
3 interface the equipment to the machine.

4 Q And when was that feature of the slow-speed clock  
5 added?

6  
7 MR. ANDERSON: I object; lack of a  
8 foundation. You've established no recollection  
9 of this witness at all in this regard.

10 A In Book 2 --

11 Q That's Exhibit 5.

12 A -- which is Exhibit 5, on Page 109, on Monday,  
13 July 2, 1962 at 1410, "Removed slow-speed clock  
14 from in-out needed to test mag tape nob setting D."

15 I have removed the clock to bring it  
16 back to the TX-0, where we had the mag tape. I  
17 wanted to simulate some instructions for that  
18 and run it under the control of the clock, rather  
19 than tie up the main computer to generate trigger  
20 pulses.

21 Q Did you make that entry?

22 A Yes. It's my lettering, though it's not signed.

23 Q Do you recall the incident specifically?

24 A No. But I do know that one weekend I was quite  
unhappy that they had moved one of the racks of

1 building blocks to the PDP-1 and tried it out.  
 2 I thought I had a notation as to when that was  
 3 done. But at least at this time -- oh, I see.  
 4 Yes. I got ahead of myself.

5  
 6 In Book 1 -- is that the reference?

7 Q Yes. That's Exhibit 4.

8 A March 13; I don't have the page number. That's  
 9 Book 2. It's overlapping there. It should be  
 10 noted that it's Exhibit 5.

11 On the first page, 13 March 1962,  
 12 "Installed rack for lab plug in units on PDP-1  
 13 seems okay." The initials "AK," which would have  
 14 been Alan Kotok.

15 Q Do you recall that incident specifically?

16 A I remember I was a little bit unhappy that he took  
 17 it upon himself to move it, but it was done. I  
 18 think -- well, it was done at 0420. I wasn't  
 19 around to supervise it.

20 Q Do these references which you have made to the  
 21 logbooks refresh your recollection as to these  
 22 incidents?

23 A I know that this was one of the more major changes;  
 24 because it gave a definite different flavor to  
 the game. "Flavor" isn't the word; different sense

1 to the interactive use of the switches.

2 Q That's the slow-speed clock?

3 A Yes. That meant that the program looked at the  
4 state of the switches more frequently or less  
5 frequently, depending on the frequency that the  
6 clock was set.

7 Q And did reviewing the logbooks, and specifically  
8 the entries you referred to, refresh your  
9 recollection about these incidents?

10 A Yes. Later on, not for this project but for a  
11 research group who were going to use the machine,  
12 we built in a clock which we called the ESL,  
13 Electronics Systems Lab, clock. From then on,  
14 that was used.

15 May I go on?

16 Q Yes.

17 A There is one other distinguishing feature between  
18 versions. There is an entry in the log, about  
19 the same time, the same book, Exhibit 5, Page 19 --  
20 I am sorry; it's Page 8. It's March 19.

21 On Page 8, the middle of the page, it  
22 says "Monday 19 March 1962. Clock equals 2694.7."  
23 Some more beyond that, at 0345, "Power off.  
24 Installed user's IOT input to I/O on IOT11."

1 That was initialed RAS, which would have been  
2 Robert Saunders.

3 Q What significance did that entry have?

4 MR. ANDERSON: I object to the question.  
5 It's asking this witness to speculate, to testify  
6 about hearsay. There is no foundation for the  
7 question.

8 Q Does that entry have a meaning to you?

9 A Yes; very significant. The students built up two  
10 control boxes; and at this time the control, some  
11 became optional with a sense switch setting,  
12 determining whether you wanted to take input from  
13 the earlier mentioned test word switches or from  
14 the control boxes. These control boxes, the  
15 state of the switches in the control boxes was,  
16 the term -- the computer term is strobed or  
17 brought into the computer on the execution of an  
18 IOT11.

19 Q What was an IOT11?

20 A The PDP-1 computer, again, had this rather  
21 elaborate input-output system where the user  
22 could develop his own set of in-out transfer --  
23 that is, the IOT -- instructions; so that he  
24 could control input or output, input from or

1 output to, his user's device is the term we like  
2 to use.

3 Q Were control boxes added to replace the switches  
4 of the earlier version?

5 A They were not added as replacement; but I think  
6 rather as an option. Because, if you retained  
7 the switches of the earlier version, it meant  
8 that you could take the program to another PDP-1.  
9 The IOT11 would not be something that's described  
10 in the handbook. This was something that was  
11 generated, although operation for generating it  
12 was allowed. It was decoded in our own hardware,  
13 as a sort of private user input.

14 Q Do I understand correctly that IOT11, then,  
15 refers to the control box option?

16 A That was the instruction that you executed in  
17 your program to transfer the state of the  
18 switches into the control, or the state of the  
19 switches in the control box into the computer;  
20 and the computer then was able to look at this  
21 information and decide which switch was on or off.

22 Q Can you tell from this entry whether control  
23 boxes were being used at the time of the entry?

24 A Yes. That was the reason for putting in, the

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1 motivation for putting in, the IOT11.

2 Q Do you recall any other versions of Space War,  
3 say, during the period from September 1961  
4 through June of 1963 -- that is, the period  
5 covered by the logbooks, Exhibits 4, 5, 6 and 7?

6 A There would be one other significant difference.  
7 On the first version, let me say the earlier  
8 versions, there was no built-in hardware  
9 multiply-divide instruction. We had what DEC  
10 provided as a multiply step. That meant that the  
11 multiply had to be done on a bit-by-bit basis.  
12 This will be evidenced by looking at the listing  
13 of Part 1, Exhibit 9-1. You'll find a --

14 Q The listing, Exhibit 9-1-A?

15 A One of the subroutines is a multiply subroutine  
16 using the multiply step instruction, and what  
17 we'll later see was able to be done with the  
18 multiply instruction, a hardware multiply, at this  
19 time was done -- I want to say "brute force," but  
20 not for the record -- but in a more, I don't know  
21 how to use it without the "brute force." That is  
22 a bit-by-bit test.

23 Q Now, when you say "at this time," are you  
24 referring to the time given --

1 A I think it was in September '62.

2 Q In Exhibit --

3 A 9-1.

4 Q -- 9-1-A?

5 A Yes.

6 Q Could you identify the portion of the program  
7 listing to which you were referring?

8 A The pages are not numbered; but they're tied  
9 together, perforations. One, two, three, four.  
10 On the fourth page, the comment -- we know it's  
11 a comment by the slash -- it's "BB&N multiply  
12 divide subroutine" -- "BB&N" referring to Bolt,  
13 Beranek and Newman, who also had a PDP-1. And we  
14 haven't mentioned it, but we exchanged programs.

15 Q I believe you did mention them as having Serial  
16 No. 2.

17 A They had Serial No. 2, yes; and we exchanged  
18 programs.

19 Q Did you say the entry was "/BBN multiply divide"?

20 A I'm sorry. "Multiply subroutine." I mentioned  
21 earlier, I think, the hardware multiply-divide  
22 option.

23 Q Now, this listing -- excuse me.

24 A This mentions the MUS, which was a multiply step;

1 and it meant that what will later be shown as a  
2 single multiply instruction was expanded into  
3 this much code, about a page of code.

4 Q Does this listing, to the best of your knowledge,  
5 represent the Space War program as of the date it  
6 bears, September 24, 1962?

7 MR. ANDERSON: I object to the question;  
8 lack of a foundation, hearsay, lack of personal  
9 knowledge of the events by any prior testimony.

10 A It ties it down, because it was always of great  
11 interest to make the game run faster. And once  
12 the multiply-divide option was added, it was very  
13 quickly implemented. It was a simple change to  
14 substitute a multiply instruction for the sub-  
15 routine.

16 Q Now, you referred to the option of hardware  
17 multiply-divide. Is that to be distinguished  
18 from software?

19 A That's right. It's a hardware multiply-divide  
20 with a step counter that has the effect of  
21 stepping through this great list of codes and  
22 doing it much faster.

23 Q When you say "that great list of code," you're  
24 referring to Exhibit --

1 A That's the page that I mentioned.

2 Q Page 4 in Exhibit 9-1-A?

3 A That's correct.

4 Q Is that software?

5 A This is software, yes. Well, this is the amount  
6 of code, software, that is necessary to perform a  
7 multiply instruction.

8 Q When you say "this," you're putting your hand on  
9 Page 4 of Exhibit 9-1-A?

10 A Yes. That reference is the earlier period of the  
11 machine.

12 Q Now, could you describe what happened, or how,  
13 the hardware multiply-divide option was added to  
14 Space War?

15 A Yes. We were given the PDP-1 computer; but I  
16 think there were two reasons. I think the hard-  
17 ware, the hardware multiply, was a separate  
18 option. Electronics Systems Laboratory was using  
19 the PDP-1 computer to control an analog computer  
20 in a research project where they were simulating  
21 aircraft performance. Specifically, they were  
22 working with an F-100 -- not that they needed that  
23 information; but the information was available so  
24 they could evaluate simulation using that

1 information.  
2

3 In order to speed up things, they,  
4 Electronics Systems Laboratory, purchased the  
5 hardware multiply-divide; which I guess I earlier--  
6 for \$10,000, I think the price was.

7 Q And that was available for use in Space War?

8 A Well, that immediately made a great deal of  
9 difference. It meant that the Space War program  
10 could run much faster. It appealed, it would have  
11 given more appeal, to the skilled user; since it  
12 was more responsive.

13 Q Do you know when that option was added?

14 A Yes. In the first page of the loose-leaf  
15 notebook there is an entry --

16 Q That's Exhibit 7?

17 A Exhibit 7; I'm sorry.

18 The first page is January 1. The  
19 second page, January 2, my notation, "Automatic  
20 MUL/DIV is in operation." Initialed "JAM."

21 Q Did you make that entry?

22 A I did.

23 Q Did you have anything to do with installing that?

24 A I believe DEC brought it down and installed it  
for us. It was a standard option; there was a

1 space for us to plug in directly. It did not  
2 require any wiring changes.  
3

4 There would have been a couple of  
5 changes; because you had to defeat what had  
6 previously been used as a multiply step. DEC  
7 did the actual installation.

8 Q Were you present when it occurred?

9 A Yes, I was. Yes.

10 Q Do you recall it apart from the entry in the  
11 logbook?

12 A Yes. It was a major addition to our machine.

13 Q And do you have any recollection that it occurred  
14 at about that time?

15 A It was rather early, in the early stages of the  
16 machine.

17 Q And you consider January 2, 1963 to be in the  
18 early stages --

19 MR. ANDERSON: I object to the question.

20 -- of the machine?

21 MR. ANDERSON: Leading.

22 A Yes; considering it was still operating.

23 Q When you observed Space War being played, did you  
24 watch the movement of the various images on the  
cathode ray tube?

1 A Yes.

2 Q Now, you've described the movement of a spaceship  
3 as it approached one edge of the raster as  
4 disappearing and then reappearing on the opposite  
5 edge.

6 A I think we should be more explicit and say that  
7 the same applies to top and bottom as applied to  
8 left and right.

9 Q Did that type of movement occur as the spaceship  
10 reached the edge of the raster in all versions  
11 that you observed on the CRT?

12 A Yes. That's sort of inherent in the programs.

13 Q Was there any version in which, instead of  
14 disappearing off the edge, it went to the edge  
15 and then reversed direction?

16 MR. ANDERSON: I object to the question.  
17 You're leading the witness. He's already  
18 answered the question.

19 A Yes. One of the modifications, additions,  
20 embellishments of the program was the implementa-  
21 tion of the -- the word I'm going to use is  
22 "hyperspace." The action of what happens when  
23 you elect to go into hyperspace, when you are  
24 using the control switches, the test word switches

1 on the front console, if you simultaneously turn  
2 on the counterclockwise and the clockwise  
3 rotation switches, you're immediately thrown into,  
4 quote, hyperspace. That meant that you are  
5 momentarily removed from the display, or the  
6 raster; and it's utilized as a defensive move.

7  
8 The reason for doing this is that if  
9 somebody is about to shoot you down, you can use  
10 this as an evasive tactic. However, it has some  
11 limitations built in; and the variations vary  
12 with the program. It's usually listed at the  
13 front of the program, giving the various waits.  
14 It may have reference, something, to a discon-  
15 nection, something like -- one version, titled  
16 "Orbit," which has come up later; hyperspace  
17 dormant time, hyperspace breakout time, hyperspa-  
18 tially induced velocity, hyperspatially induced  
19 angular velocity, hyperspatial uncertainty and  
20 hyperspace recharge time.

21 MR. ANDERSON: Let the record -- go  
22 ahead.

23 Q Were you referring --

24 MR. ANDERSON: Be my guest.

25 Q Were you reading that answer from a sheet of paper

1 in front of you?

2 A Yes. This makes -- this was more complete.

3  
4 The important thing, I think, is the  
5 concept of this uncertainty. Every time that you  
6 elected to go to hyperspace, the probability that  
7 you would return became less; and so that you  
8 used that option rather sparingly.

9 Q What was the paper from which you were reading  
10 when you gave that answer?

11 A This is a listing which would be the front end  
12 of one version of Space War, which the user  
13 called Orbit. I happen to know that that one  
14 was written by Richard Howell.

15 Q Do you know when it was written?

16 A No. I think, I'm sure we'll see the same; we  
17 probably -- we'll see the same thing in Exhibit 1-A.

18 Q Exhibit 9-1-A?

19 A This was characteristic of it. I think it's  
20 almost the same, word for word.

21 Q And you're referring to the first page of  
22 Exhibit 9-1-A?

23 A Yes, I am.

24 Q Was hyperspace, then, a feature or an option of  
Space War at the time around September 24, the

1 date of the listing, Exhibit 9-1-A?  
2

3 MR. ANDERSON: I object as directed to  
4 hearsay, lacking in foundation. You've not  
5 established that this witness has any specific  
6 recollection of specific dates or times or events.

7 A Yes. That was one of the early options, as the  
8 game continued to be improved.

9 Q Do you have a personal recollection of that?

10 MR. ANDERSON: I object. Of what?

11 MR. WELSH: Of the hyperspace as an  
12 option. I think he said as one of the early  
13 options.

14 A Yes. I cannot pin it down to September '62.  
15 However, I know that the game was quite complete  
16 within the first year; and from then on we only  
17 had what even the user who made the subsequent  
18 versions called embellishments.

19 Q So within your own knowledge, you recall that  
20 hyperspace was a feature within the first year?

21 A Yes.

22 MR. ANDERSON: Can I see the document  
23 that the witness read from that hasn't been  
24 marked?

THE WITNESS: Is that it?

1 MR. WELSH: No.

2 [Document handed to Mr. Anderson.]

3 MR. WELSH: Do you mind if I go on?

4 MR. ANDERSON: Go ahead.

5 Q Now, you've used the term "versions"; and noted  
6 that different versions have had different number  
7 designations.

8 Were there any features that were used  
9 in any of the earlier versions that may have been  
10 options or were options that weren't significant  
11 enough to cause their addition to amount to  
12 another version?

13 MR. ANDERSON: I object to the question.

14 A I couldn't distinguish between versions. I'm  
15 trying to point out -- sorry; I'm interrupting.  
16 I'm trying to point out some of the significant --  
17 well, not significant; some of the major changes  
18 which would help to identify them.

19 Q Do you recall any minor changes?

20 A Well, Richard Howell, that I referenced earlier,  
21 in this Orbit had the concept of angular momentum;  
22 where, when you start to turn the ship, the ship  
23 will start spinning, and you have to apply a  
24 counter, corrective force, to bring it out of the

1 spin. He implemented that. I know it was  
2 discussed earlier. I am not sure whether it was  
3 implemented before him. I know that Orbit did  
4 have it.

5 Q Do you recall any other minor variations, let's  
6 say?

7 A Well, we've had many students; and each student --  
8 not each student, but many students -- have their  
9 own, had their own pet version. I do not remember  
10 anything that I would characterize as significant;  
11 although to them I'm sure they felt that they  
12 added something.

13 Q Or do you recall any that might have been  
14 considered insignificant?

15 A No. Just that many students wanted to have their  
16 own version.

17 MR. WELSH: I'll ask the Reporter to  
18 mark another one of these tapes as Exhibit 14.

19 [Punched paper tape designated  
20 "Space War 3.2," marked MIT  
21 Deposition Exhibit No. 14  
for identification.]

22 Q I now hand you a tape which you've produced in  
23 response to the subpoena and which has been marked  
24 as Exhibit 14 and ask if you could identify that.

1 A It's the tape labeled "Space War 3.2"; and again,  
2 you can tell by the way the holes are punched  
3 that it's a source language, English tape. This  
4 is something that we could list on the Flexowriter  
5 and would produce a listing of the style of  
6 Exhibit 9-1-A. I didn't do that; it could be  
7 done.

8  
9 It also is a tape that has been spliced,  
10 going from pink to gray to pink to gray to pink  
11 to gray. Shall I tie that down a little better?

12 So that would indicate that it was  
13 rather early; during the first year of our  
14 operation.

15 Q The same as the other tape exhibits?

16 A The same would apply to that as applied to 9-2.

17 Q And Exhibit 13 and Exhibit 12?

18 A Yes.

19 Q I'll ask the Reporter -- well, first I'd like to  
20 ask: there are three tapes among the remaining  
21 ones you've produced that have not been marked  
22 yet, that I show you. Do these have any relation-  
23 ship to each other?

24 A Yes. They are each labeled as being the 4.0 TS  
version.

1 Q

Is there any --

2 A

And the date. And the date indicated is 5-4-63.

3

That appears on each of the three tapes. They

4

are labeled Part 1, Part 2, Part 3.

5

6

MR. WELSH: I'd like to ask the Reporter

to mark the one labeled Part 1 as Exhibit 15-1;

7

the one labeled as Part 2 as Exhibit 15-2; and

8

the one labeled Part 3 as 15-3.

9

[Punched paper tape designated  
"Part 1," marked MIT Deposi-  
tion Exhibit No. 15-1 for  
identification.]

10

11

12

[Punched paper tape designated  
"Part 2," marked MIT Deposi-  
tion Exhibit No. 15-2 for  
identification.]

13

14

15

[Punched paper tape designated  
"Part 3," marked MIT Deposi-  
tion Exhibit No. 15-3 for  
identification.]

16

17 Q

I hand you now what have been marked as Exhibits

18

15-1, 15-2 and 15-3 and ask you if you would

19

please identify them, starting with 15-1.

20

MR. ANDERSON: I object to the question

21

as improper, lacking in a foundation, asking this

22

witness apparently to testify about hearsay;

23

lacking any authentication of the exhibits to

24

which you're asking him to refer.

1 A Part 1 is labeled "Space War 4.0 TS," which  
2 stands for time sharing. "D<sup>2</sup>p," and the date  
3 5-4-63.  
4

5 The second tape, identified as Exhibit  
6 15-2, is labeled "Space War 4.0 TS," date 5-4-63;  
7 Part 2.

8 And the third, labeled Exhibit 15-3,  
9 is titled "(Part 3)" and stands for "SW4. TS 5-4-63."

10 I think my first time through I did not  
11 identify Part 1 as being Exhibit 15-1.

12 Q Do you recall the 4.0 version of Space War?

13 A I do not recall the 4.0 version. The interesting  
14 thing here is the TS tied on there. We were  
15 implementing the time-sharing system; and the  
16 program was rewritten to work in the time-sharing  
17 system.

18 Q When did that implementation first occur?

19 A Well, that was an ongoing thing. The first thing  
20 that we needed to implement it was a secondary  
21 storage in the form of a magnetic drum, which we  
22 obtained -- in fact, we obtained from DEC; it  
23 was a DEC option -- a drum built by Vermont  
24 Research, but purchased from DEC. And we,  
Professor Jack Dennis had a student do a master's

1 thesis to interface it to our PDP-1.

2 Q Do you know who that student was?

3 A Gary Wong.

4 Q Do you know when that occurred?

5 A Looking at my notes to expedite things, I have a  
6 reference to new drum wiring; I have an entry,  
7 October 26, 1962. That would be Page 75 of  
8 Book 3, which is Exhibit 6.

9  
10 The checkout of that was an ongoing  
11 thing; and we obviously had to put in the wiring  
12 changes, and it became operational over a period  
13 of time. There are many entries in the log that  
14 had reference to this.

15 Q Do you have an independent recollection of that  
16 occurrence, apart from the log?

17 MR. ANDERSON: I object. What  
18 occurrence?

19 MR. WELSH: The occurrence of the wiring  
20 necessary for the addition of the drum.

21 A Yes. The wiring was installed under my direction.  
22 I participated in the checkout, and I was  
23 responsible for the documentation for all of the  
24 modifications that had -- I had been, all the  
time. The logic design was done by Gary Wong,

1 that I previously mentioned.

2 Q Do you recall when that was done?

3 A I know that after the first year of operation we  
4 began to work towards implementing the time-  
5 sharing system on the PDP-1.

6 Q Was that within the second year after the  
7 operation?

8 A Yes. It started out, some of it had to be  
9 simulated. There were meetings and ideas  
10 projected as to what one might like to have.

11 Actually, the time-sharing system had  
12 been earlier projected for the TX-0; and the  
13 thinking was changed around on the arrival of the  
14 PDP-1. There was a time lapse between the time  
15 it arrived and the reorienting the implementation  
16 directed to the PDP-1.

17 Q Do you have any recollection as to the specific  
18 time?

19 A It was one to two years. It depends what phase-  
20 out you're thinking about.

21 Q Can you refresh your recollection by referring to  
22 your notes or the log?

23 A Yes.

24 In Exhibit 6, Page 75, the heading of

1 the page is "Friday, 26 October '62." At 0835  
2 there is an entry: "Do not turn power on." It's  
3 not initialed, but it's Ralph Butler's writing.  
4 He was a technician working for me at that time.  
5

6 I have an entry at 12 o'clock, 1200;  
7 the following notation: "Ran power wiring to  
8 3Z." This is a location within the computer.  
9 "Tested DC power - okay. Installed nine - 1884  
10 MB buffers. Okay. Installed eight 1130 parity  
11 circuits. Okay." This is initialed "RB/JAM."

12 Circuits; in this case it's "Ckts," as  
13 it's written. I expanded it.

14 Q Does that entry in the notebook --

15 A I have a further entry. "Parity checks okay up  
16 to final 1130 (3 Zebra 6" -- which is the module  
17 location. "This requires further checkout."

18 "1230 Butler McKenzie off." Initials  
19 "JAM."

20 Q And did you make those entries?

21 A They are mine.

22 Q Are those your initials?

23 A Yes.

24 Q Having read that entry, does that refresh your  
recollection as to when the use of the time-

1  
2 A sharing implementation occurred?  
3 Let me say -- let me define it a little bit  
4 further by saying that this was the start of the  
5 work towards the implementation. It's  
6 considerable beyond this. This was leading up  
7 to the interface to the drum. We calculated and  
8 checked parity on the transmission of information  
9 to the drum and back from the drum.

10 When we transferred information to the  
11 drum, we calculated and stored a parity bit with  
12 it. When the information was returned, we  
13 checked to see that that parity agreed with the  
14 stored parity. We recalculated the parity of  
15 the returned transmission and saw that the parity  
16 calculated was in agreement with the previously  
17 calculated parity.

18 Q You said this was the start of the work. Do you  
19 know how long the work took?

20 A Yes. It's still -- up to this summer, there were  
21 still people modifying the software for the time-  
22 sharing system. The hardware was basically fixed  
23 within the first year or two. We had a major  
24 shutdown at the end of one summer; I recall we  
worked over Labor Day weekend, and for about a

1 three-week period rebuilt quite a bit of the  
2 control of the machine. And from then on, the  
3 hardware changed; but these were more in terms of  
4 fixers or something changed on the basis of  
5 something that developed from usage, where we  
6 found something, some feature or some condition  
7 that people wanted to change to make a smoother  
8 operating system.

9 Q Was the drum actually used after this --

10 A The drum is the part of the time-sharing system.  
11 The reason for the drum is that previous to this  
12 time we had one user on the machine; and his  
13 program was resident in the core memory. The drum  
14 gave us the ability to transfer the inactive users'  
15 programs from core to the drum. The user who was  
16 currently running his program image was transferred  
17 into core; and he was given an interval of time  
18 to run, being a user.

19 Q Was the drum ever used during playing of Space  
20 War?

21 A Well, Space War would run as another user  
22 program; and if there were another user going,  
23 that meant that the Space War game shared time  
24 with another user. That led into the annoyances

1 that I earlier spoke about.

2 Q Do you recall when that occurred in relation to  
3 the October 26, 1962 date of Page 75 of Exhibit 5?

4 A Well, a major shutdown for change in the machine  
5 was Labor Day.

6 Q That was Labor Day of what year?

7 A I can't say for sure. It was '62, '63 or '64.

8 I've been changing machines all of this interval.

9 I couldn't pin it down to one year. The log will  
10 show the time that we were out. I think it's  
11 possibly beyond the scope of the log that we have  
12 discussed.

13 Q Was it within that time period which you just  
14 mentioned, '62, '63, '64?

15 A Certainly, yes.

16 MR. ANDERSON: I object. The witness  
17 said he didn't know.

18 Q Does that help you pin down the dates on which  
19 these Exhibits 15-1, 15-2 and 15-3 came into  
20 existence?

21 A It was an effort to try to explain what the TS  
22 label on the tape meant.

23 Q And does that help you determine the date?

24 A Yes. It would put it in that time frame.

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Q Did you state that Exhibit 13 was a binary tape?  
A Yes, it is.

Q I ask you to unfold a few of the topmost layers, very near the top; and ask if there is any English language punchout there.

A Yes. When using Expensive Typewriter, which was the way tapes were edited after the program became available, the title -- that is, the first line -- of your text was punched out in a manner that can be read by the user; and at the same time, since there is no eighth hole, it's considered as leader to the computer. And the title on this one is "Space War 2B 2 April '62."

Q Who determined what was punched out in that portion you described?

A The operator was working with Expensive Typewriter. Before he left the machine, he executed an upper case P, which is shorthand for punch; and the punch would type out the contents of his text buffer. The reason for doing this was so that you could -- I'm sorry. This is not an English tape; this is a binary tape. Backtrack a little bit. The English tapes had the same notation. This is a binary tape. He had read in

1 a source language tape, assembled under control  
2 of the assembler, assembly program; and the  
3 leader of the tape which is produced carries the  
4 title, corresponding to the first line of the  
5 English text.  
6

7 The balance of the tape is a binary  
8 tape, which is machine language. This is  
9 something that you could read into a PDP-1  
10 computer, and is the program. Machine language,  
11 it's called.

12 Q Who determined the title as punched out in the  
13 leader?

14 A That's a default option in the program. Sometimes,  
15 if you're assembling a series of tapes, sometimes  
16 you might not want to bother with a title on each  
17 one; but if you don't do anything about it, this  
18 comes about pretty much automatically.

19 Q Was this customary in the use of the computer?

20 A Yes. At that time, that was the only way you  
21 could get a program to read into the computer,  
22 was to punch out a paper tape, binary language  
23 tape.

24 Q In accordance with that custom, did the date  
appearing on the leader have any significance?

1 A

2 Yes. I've earlier testified that the pink tape  
3 was used during that first year; and the date  
4 would be something that, as I've stated, was the  
5 first line of his text, which would be similar  
6 to the style of Exhibit 9-1-A. In this tape,  
7 if the paper tape which was listed to produce  
8 this Exhibit 9-1-A were assembled by the program,  
9 all of the contents of the first line would appear  
10 in a format similar to the format in Exhibit 13.  
11 If you have a lengthy line, I think there is a  
12 termination character, sometimes a slash; if not,  
13 up to the first carriage return.

14 Q

15 And this first line included the portion which  
16 you read to us from the leader of Exhibit 13?

17 A

18 It's true of Exhibit 13. I referenced Exhibit  
19 9-1-A as to style rather than any connection  
20 between the two. The only thing was an effort  
21 to explain the style.

22 Q

23 Referring to Exhibit 15-1, you read the lettering  
24 on there. Do you know who put that lettering on  
there?

25 A

I do not know.

26 Q

Do you recognize the lettering?

27 A

No.

1 Q Referring to Exhibit 15-2, do you know who put  
2 that lettering which you read previously on there?

3 A No. May I refer to 15-1. The notation "D<sup>2</sup>P"  
4 would be the style that the fellows would use  
5 for "DDP"; and that would be initials of, that  
6 would be represented, that would represent the  
7 party "DDP." I do not offhand recollect who  
8 that was.

9 Q Do you know whether that lettering was present  
10 when you confiscated the tapes?

11 A Yes. Yes, it was. I have not altered any of  
12 these notations.

13 Q So all of these tapes, except for the exhibit  
14 markings, are in the same condition as they were  
15 when you first obtained them?

16 A That's true.

17 Q And all of the lettering and writing that now  
18 appears on them, except exhibit markings, was on  
19 there --

20 MR. ANDERSON: I object to leading the  
21 witness.

22 A Let me qualify that. At the time I confiscated  
23 them, there was no knowledge that they were  
24 pertinent. Since I've realized that they were

1 pertinent, I have kept them in even tighter  
2 security. I put them out -- I made them not  
3 available to users following the time they were  
4 confiscated. However, I did not monitor them  
5 all that interval.  
6

7 MR. WELSH: I now ask the Reporter to  
8 mark another one of these tapes produced by the  
9 witness as Exhibit 16.

10 [Punched paper tape designated  
11 "Quickie Space War make  
changes before playing,"  
marked MIT Deposition Exhibit  
No. 16 for identification.]

12 Q I now hand you what has been marked as Exhibit 16  
13 and ask if you can identify that, please.

14 A The tape is a gray tape with the title "Quickie  
15 Space War"; and there is an additional notation,  
16 "Make changes before playing." "11/" which means  
17 Location 11; and the instruction "Law I 34" and  
18 "16/20,000" and "10/Law I 10." There is another  
19 notation, "Works 12/29/64."

20 Q Do you recognize any of the handwriting or  
21 lettering that you've just read?

22 A No.

23 Q Would you explain what the various notations  
24 beneath the punched line are.

1  
2 MR. ANDERSON: I object. Do you want  
3 to finish?

4 Q If you know; if they have any meaning to you.

5 MR. ANDERSON: I object to the question  
6 as requiring this witness to testify as to  
7 hearsay, as to speculation, without foundation in  
8 the record. The witness has testified he did not  
9 make the entries, and he doesn't know who did.  
10 The questioning is improper and a continued  
11 practice of impropriety; which seems to be  
12 reflected in this proceeding -- for lack of a  
13 judge, I guess.

14 Q Testifying in regard to Exhibit 16, it's a gray  
15 fanfold tape. It is a binary tape. And the  
16 notation means that the person planning to read  
17 it into the computer, after it's read into the  
18 computer, you should modify the Location 11 so  
19 that it will contain the new instruction "Law  
20 I 34."

21 The other notation, "16/," means that  
22 you should modify the contents of Location 16 in  
23 the program to contain the number constant  
24 20,000.

And the notation "10/" means that the

1 user should modify the contents of Location 10  
2 to the new instruction "Law I 10." This means,  
3 that could easily be referenced in regard to  
4 some of the things we've looked at earlier. You  
5 notice in these early locations on Exhibit 9-1-A,  
6 for instance, the first locations in the program  
7 are constants which you modify to give a different  
8 feel to the game. Somebody had discovered that  
9 these changes modified the ones that had been  
10 built in when the program was assembled.

11 The idea for having all of this is so  
12 that people can vary the weight -- the term  
13 "weight" is often used -- of these constants to  
14 change, possibly, the time in hyperspace; or any  
15 of the things, constants, indicated on Page 1 of  
16 Exhibit 9-1-A.

17 Q Was there any custom with respect to noting  
18 changes placed on tapes that were used in playing  
19 Space War?

20 A Well, doing it this way meant that you didn't  
21 have to have several different tapes. Whoever  
22 had this knew that he could make the game more  
23 interesting from his point of view by depositing  
24 this change into the computer by the front

1 console, or via one of the utility programs;  
2 which allowed you to modify the contents of core  
3 memory. And then he ran his program.

4 Q I believe you stated this was a binary tape.

5 A Yes. I've identified that by the continuous  
6 series of eighth holes, eighth-hole positions,  
7 being punched.

8 Q Does it have a leader with a title information  
9 on it?

10 A Yes, it does; "Space War."

11 Q Would you read it, please.

12 A "Space" -- and this is two words this time --  
13 "War for Ralph." Ralph would be the technician,  
14 Ralph Butler, who worked with me; and he  
15 apparently wanted his own copy, and one of the  
16 fellows assembled this for him and gave it to  
17 him, and indicated by the notation on the front  
18 that he could modify it to suit himself if he  
19 wanted to make the game a little bit more  
20 interesting -- more responsive, possibly.

21 Q Is that Ralph Butler the same one whose name  
22 appears on Exhibit 6 and is crossed out?

23 A Yes.

24 Q When did Mr. Butler work for you? During what

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period?

A

Sometime during the first year of the existence of the PDP-1 at MIT. He was hired to help do the wiring changes for the proposed time-sharing system.

Q

How long did he work under you?

A

Sometime in 1967, possibly.

MR. WELSH: It is two minutes after six.

I thank the witness for staying this extra time and changing his plans, and Mr. Smith for permitting us to continue to stay on.

We'll adjourn to resume tomorrow morning at nine o'clock.

[At 6:02 p.m., the deposition was adjourned to Wednesday, October 29, 1975, at 9:00 o'clock a.m., at the same location.]

- - - - -

C E R T I F I C A T E

I, John Alexander McKenzie, do hereby certify that I have read the foregoing transcript of my testimony, and further certify that said transcript is a true and accurate record of said testimony.

Dated at Cambridge, Massachusetts, this 8th day of December, 1975.

John Alexander McKenzie  
John Alexander McKenzie

Sworn and subscribed to before me this 8th day of December, 1975.

Lillie T. Ferris  
Notary Public

My commission expires:  
3-3-78

Doris D. Wong Associates

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John Alexander III Klegel  
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page 1 of 1

CORRECTIONS - VOLUME III

ERROR

Correction

	<u>ERROR</u>	<u>Correction</u>
p 372, l 24	memory; address	memory address
p 386, l 17		Research Laboratory
p 409, l 19	with	about
l 20	the	a
p 419, l 23	program in	programming
p 424, l 12	place	replace
p 451, l 9	formally	normally
p 457, l 22	if they	at the
p 461, l 3	in	to
p 472, l 9	that knob	the controls
p 474, l 13	have	have been
p 482, l 13	administrative	administratively
p 484, l 3	if it	that it
p <del>487</del> , l 24	program-independent	program dependent
p 500, l 22	At the time	And the timing
p 501, l 15	currents	counters } MR ANDERSON
l 16	currents	counters }
p 508, l 1	looking	losing

John Alexander McHugh  
12-8-75

CORRECTIONS  
VOLUME I, PAGES 1 to 181

	<u>Error</u>	<u>Correction</u>
p 43, l 23	sale	installation
p 49, l 2	built	re built
l 15	the	if the
l 16	.	,
l 17	It	it
l 15, 16, 17	During that interval, if the machine broke down; and it was the end of the thesis period, it was - - -	
p 56, l 7	1960	1960's
p 58, l 2	list	on
l 21	figure	failure
p 62, l 24	TX-0	PDP-1
p 81, l 20	day	date
p 90, l 9	work	word
p 96, l 24	system	assistant
p 98, l 18	wastefol	waste of
p 105, l 6	2E	copy
p 106, l 2	there,	there only product,
p 110, l 17	hoping	having
p 112, l 19	and	for
p 143, l 4	display.	delay that
p 145, l 3	the	their
l 14	have	had
p 155, l 21	was	is
p 157, l 13, 14	discon-nection	constant

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CORRECTIONS  
VOLUME I

	<u>Error</u>	<u>Correction</u>
p 165, l 23	- -	to be done,
p 166, l 20	<del>act</del>	-
p 168, l 19	- -	going on
p 169, l 4	<u>fixers</u>	fixes

## CORRECTIONS VOLUME II

	<u>Error</u>	<u>Correction</u>
p 190, l24	eight	seven
p 193, l4	consumer	computer
l5	consumer	computer
p 200, l11	1960	1960's
p 201, l20	--	switches
p 202, l24	was	has
p 204, l22	minutes	five minutes
p 205, l15	utilization	utilization reports
p 208, l17	and	some
p 211, l18	Factory	faculty
p 215, l12	NERIM	NEREM
l13	NERIM	NEREM
l24	and	or
p 232, l23	curing	curving
p 246, l23	• Any	or any
l24	steps, he	steps. He
p 265, l1	PSL	ESL
l3	course of	courser
p 268, l14	NERIM	NEREM
l15	NERIM	NEREM
p 274, l23	right	late
p 280, l8	see	say
p 282, l8	two to	to a
p 286, l6	This	There

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VOLUME II  
Error

Correction

p 300, l12	ground minus	ground or minus
p 304, l4	generating.	generating carries.
p 306, l1	form of	from
p 310, l7	clearing	clear and
p 315, l14	Except there	Except if there
p 317, l13	one	run
l14	one. The	one when the
p 324, l2	PDP-1	PDP-8
l14	echo	ECL
l22	PDP-1	PDP-9
p 325, l10	echo	ECL
l11	TTO	TTL
p 330, l24	big	brighten
p 334, l1	Stockin	Stockham
p 348, l6	pseudofield	pseudo field
l9,10	one on save	one unsave