

MEMORANDUM

TO: File

FROM: W. Fletcher, J. Brown

SUBJECT: TELCOMP Project

DATE: 16 April 1965

TELCOMP is the name used here to describe a proposed system patterned after JOSS¹ which would provide rapid and versatile computational power to engineers and scientists via a teletypewriter. Immediate and personal interaction of the same type experienced with a private desk calculator coupled with the power and flexibility of a high speed computer is the keynote of this system. The language used to communicate with the system is easy to learn, simple to use and natural for numerical problems. Experience with the JOSS system at RAND Corporation has shown that systems of this sort are extremely useful for a wide variety of engineering and scientific calculations. Our local experience with a similar system² implemented on the Hospital Computer (PDP-1d) shows that the system's ability to do useful computations at the command of the individual engineer or scientist concerned with a problem is indeed impressive but that reliability and documentation must meet very high standards in order to achieve complete acceptance.

Present Versions

Various implementations of JOSS-like systems have been running on the Hospital Computer (PDP-1d) since August 1964. None of these has ever been as complete a system as its parent (JOSS) and the documentation has been quite inadequate. Nevertheless, the system has been used for numerous problems by members of the Physics, Instrumentation, Architecture and MXX Departments. In addition, it has been used as a demonstration model for various people outside of BEN. Raytheon has expressed a strong interest in having a service of this type and seems willing to pay money for it. Recent developments have made it clear that BEN cannot, at this time, engage in any commercial use of the JOSS-like system presently operating on the Hospital Computer. However, there is strong interest in having an implementation of this system that is complete, well documented, available for internal use and available as a service to be sold commercially.

1. JOHNNIAC Open-Shop System, J.C. Shaw, The RAND Corporation, Santa Monica, California.
2. Known variously as: TOLL1, TOPS, TELC, TELCOMP, TELCOMP, TELEMATICS and others.

Proposal for TELCOMP Project

We propose to implement a JOSS-like system on the Research Computer (PDP-1b). The system will be known as TELCOMP. The features of the system will closely resemble JOSS as described in the film "JOSS" from RAND and the paper "JOSS: A designer's view of an experimental on-line computing system" by J.C. Shaw at the 1964 FJCC. The design and implementation of TELCOMP will be aimed at providing a system for simultaneous use by sixteen (16) individuals at separate, remote teletypewriters. A minimum of four (4) hours operation each working day will be provided when TELCOMP is in full swing. During operation of TELCOMP the Research Computer (PDP-1b) will be used exclusively for this service. An operator-customer service person will be present during all operating periods. System status information will be provided to customers at all times.

Hardware Needed

In order to implement the proposed system on the Research Computer (PDP-1b) certain hardware modifications will be needed. When first considered, it was felt that the several hardware changes would require a capital expenditure of about \$20,000. Since then, it has become apparent during discussion of system organization at preliminary meetings that the only hardware necessary is the interfacing equipment to allow the computer to handle up to sixteen (16) teletypewriters. In addition, it seems feasible to implement this interface incrementally. The computer can, at present, handle four teletypes, but the scheme used is not expandable. To expand to eight (8) teletypewriters requires the addition of \$12,800 worth of equipment that can be delivered in about six (6) weeks. Each additional four (4) teletypewriter interfaces cost \$2,800. The TELCOMP system can be initially run using only the present hardware--for a maximum of four (4) teletypewriters.

Teletypewriters can be rented from Western Union or New England Telephone and Telegraph. They can also be purchased from Teletype Corporation, but the capital expense doesn't seem worth it. A rented teletypewriter at the end of a 20 mile private line will cost about \$100/month and about \$65/month for use within BBN's building.

Customers

At present, Raytheon seems extremely eager to have a TELCOMP station. They have a pressing need to be in operation by 15 June 1965. We have informally proposed that we would provide them with a single station on that date. They would receive 2 hours/day for the first month of operation, 3 hours/day for the second month and 4 hours/day subsequently. For this, they would pay a flat monthly rate of \$1400 and would initially contract for three or six months.

Dick Lyon has, in a memo of 17 March 1965, noted the willingness of the Applied Physics Group to underwrite the cost of a TELCOMP station to a certain extent. The amount of service he desires is higher than what we could hope to provide in the near future and the amount he is willing to pay is somewhat lower than our estimates of costs, but his desires and our abilities are not too far apart. Certainly, with a reliable system operating, we can count on some internal support.

In addition to these two customers, Jerry Elkind has expressed a willingness to support a single station for Department 3 if the price is not too high and the quality of service not too low.

The market beyond these three definite contacts must be explored in detail when we have a definite product. Our impression (see article in recent Electronic News) is that the JOSS system at RAND is a tremendous success and that, when engineers have seen what it can do for them, they will demand the service.

Schedule

In order to have a high probability of getting Raytheon as a customer we feel that we must try to deliver a station by 15 June 1965. This date poses some serious problems. A detailed analysis of effort required to do the software and hardware work required to put the complete system into operation shows we need 10.5 man-months. The work load has been broken down and planned in some detail including assignment of each task to a particular person with start and due dates states.

The personnel involved are listed below:

W. Fletcher, J. Brown, T. Strollo, R. Payne, C. Fletcher, S. Bollen, D. Bjorkgren, J. Elkind and J. Hughes.

The commitment of each individual has been computed and is generally consistent with his other obligations. The major question concerns C. Fletcher.

Computer use projections indicate that there will not be significant hardship imposed due to the computer time used to implement TELCOMP. Use during the past three months supports this projection.

The effort necessary would be expended over a three month period. A preliminary one-user system would be provided to Raytheon on 15 June 1965, but the sixteen user system (operating with 4 users) would not be completed and checked out until 15 July 1965. Actual availability of sixteen user-lines would occur gradually as sales require. As long as the total number of users is four or less no new hardware is needed. A six week lead time will be required to jump from 4 to 5 users, but thereafter expansion to each new line will require no lead time for hardware.

Motivation

Some motivations for and against this project are listed below. A subset of the motivations for this project would be satisfied by any particular outcome but all the arguments against apply in any case.

For

1. Establish contact with potential customers for research and development contracts.
2. Contribute support to PDP-1b costs.
3. Create a long-term steady use for the PDP-1b so that a more suitable machine can be obtained for research.
4. Market test of TELCOMP as a product.
5. Provide a useful service to BBN scientists and engineers.
6. Satisfy desires of several BBN staff members to explore commercial applications.

Against

1. Diversion of personnel from other jobs.
2. Cost.
3. Commitment of computer time.

Cost Analysis

The costs of the man-time necessary to implement TELCOMP have been computed and are outlined below:

Total Hours	1856
Direct Salary	\$11,126
Including Overhead:	20,924
Including OH + G/A	25,862
Computer time	15,000
(200 hrs. at \$75)	

As shown in Exhibits A, expenses and incomes have been calculated under two different basic assumptions. The first states that TELCOMP would be reasonably successful, continue active at the 4 hour/day rate for one year, and eventually have ten users. Under this set of assumptions, at the end of one year BBN would have made a profit of \$17,000 on an investment of \$24,000 and contributed approximately \$53,000 to the operation of the PDP-1b computer.

A second set of assumptions was used in calculating the profitability to determine how badly BBN could be hurt if TELCOMP was totally unsuccessful. For this pessimistic outlook it was assumed the total customers were Raytheon and two BBN departments for only a three month period. Even under these severely pessimistic assumptions, BBN would recover all costs except \$2,800.

Conclusion

The potential advantages to EBN of undertaking this project so far outweigh the possible losses, even for only moderate success, that we feel the project should be undertaken immediately. Any appreciable delay could easily cost us our one outside customer and seriously undermine our competitive position. We must assume, of course, that others will undertake similar projects soon. (Adams will offer some such service in September 1965.) A great success of the project and subsequent entry of EBN into this business on a grand scale has not been projected, but should be considered as a possible outcome.

We propose that:

1. EBN commit a \$12,000 budget to pay direct salary costs necessary to implement TELCOMP.
2. EBN assign a \$12,000 hardware budget to be committed to the purchase of additional teletype interface hardware as soon as sales warrant.
3. Project review occur on the following dates with the stated goals:
 - a. 15 May 1965 --system specifications complete
user's manual complete
programming started
program schedule complete
 - b. 15 June 1965--single user system in operation 2 hours/day
 - c. 15 July 1965--four user systems in operation 3 hours/day
4. TELCOMP project start immediately.

EXHIBIT A

A. Reasonably Successful Operation

1. Assumptions:

- a. Craig Fletcher can be brought to Cambridge for 2 months.
- b. 1 day/week of either J.C. or S.W. can be obtained.
- c. Use of computer during the first 2 months is free.
- d. Use of computer in steady state is at \$25/hour.
- e. Raytheon, Physics, and NMI are committed for 6 months and will continue use for 1 year.
- f. Investment in programming is amortized in 12 months.
- g. After 3 months 4 more users will be found. After 6 months, 3 additional.
- h. Equipment to enable more users will be amortized in 12 months.
- i. Steady state operating expenses \$2700/month.

2. Cost

	income	expenses
Use of PDP-1b computer 4 hours/day for 1 year at \$25/hour		\$52,800
Investment in programming (not including OH)*		12,000
Cost of additional equipment (not including G/A)*		12,000
Operating expense:		32,400
a. communication lines	\$8,400	
b. labor not including OH	24,000	

TOTAL Expenses

\$109,200

Raytheon, Dick Lyon, Jerry Elkind, 1400x12x3	\$50,400
4 users for 9 months, 1400x4x9	50,400
3 users for 6 months, 1400x3x6	25,200

TOTAL Income

\$126,000

Net Profit

\$ 16,800

* Note: All costs of development written off in 12 months.

B. Unsuccessful Operation

1. Assumptions--Shut down after 3 months

- a. same
- b. same
- c. same
- d. Use of computer steady state = 0 (not presently used and hasn't been for 3 months)
- e. Raytheon committed for 3 months at \$1400/month; Physics and NMI committed for 3 months at \$1000/month
- f. programming same
- g. no more users
- h. no more equipment
- i. operating expense total = \$1000

2. Cost

Use of PDP-1b computer for 3 months

Investment in programming

Cost of additional equipment

Operating expenses:

- a. communication \$300
- b. labor \$700

income expenses

0

\$12,000

0

\$ 1,000

TOTAL Expenses

\$13,000

Raytheon, 1400x3

\$ 4,200

2 EBN Departments, 1000x2x3

\$ 6,000

TOTAL Income

\$10,200

Net Loss

\$2,800

WFF:JBB:jes