SofTech, Inc.
391 Totten Pond Road
Waltham, Massachusetts 02154

July 18, 1969

Mr. R. G. Mills, Director
Information Processing Center
MIT Room 39-565

Dear Dick:

I enclose two copies of an informal proposal for the completion
of Multics AED. As I mentioned to you, the proposal has not yet been
passed upon by our legal counsel, but I do not expect any drastic changes.
Jorge and I have talked with Corby about the plan, and except for a wish
to consider in more depth the segment/entry name problem, his initial
reaction was good. I am sending him a copy of the proposal for further
study.

Please let me know if you need more information of any kind.

Very truly yours,

Douglas T. Ross
President

DTR/elm

Enclosures

cc:√F. J. Corbato

INFORMAL PROPOSAL

FOR

COMPLETION OF MULTICS AED

Submitted To:

Mr. R. G. Mills, Director
Information Processing Services
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139

by

SofTech, Inc.
391 Totten Pond Road
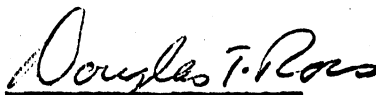Waltham, Massachusetts 02154

July 17, 1969

SofTech, Inc.
391 Totten Pond Road
Waltham, Massachusetts 02154

Informal Proposal for Completion of Multics AED

I.   SUMMARY

In response to a request from M. I. T., SofTech, Inc. proposes to supply manpower to complete the initial bootstrap of the Public AED-1 Compiler for the AED-0 Language to the Multics System and to provide basic user and support documentation. The plan of work is proposed in two stages: the month of August, and after August. During August, SofTech will be able to apply extra skilled manpower, a crucial program may be completed by the Multics staff, acceptance tests can be devised, experience can be gained with initial tests of AED programs in Multics, and remaining work can be estimated more closely. After August a more normal three-man effort with supervision will complete the work. SofTech also agrees to provide maintenance for the resulting system for one year at per diem consulting rates on an as-needed basis.

M. I. T. computer and office facilities will be supplied by M. I. T. during August. It is estimated that 20 man-weeks will be charged at an estimated cost of $20,000. ($1,000 per man-week.) After August the rate per man-week will be somewhat higher. It is now estimated that an additional 44 man-weeks plus 7 secretary-typist-weeks will be required to complete the job. Thus the total cost of the project is expected to be about $70,000 total, including August, and that the work will be complete by mid-December.

Douglas T. Ross
President

July 17, 1969

II. CURRENT STATUS

A "Half-Bootstrap" from the 7094 CTSS to 645 Multics is now running, but it contains two known bugs and has not been updated to correspond with the 7094-to-360 system, which is taken as standard. Reworking of this system must be completed before final bootstrapping of Phase 3 programs can begin, although some Phase 1 and 2 programs are unaffected by the needed changes and thus can be bootstrapped with the present system.

About 75 percent of the run-time library needed for the compiler has been bootstrapped and checked out in the 6.36 environment. Assuming the 6.36 does indeed correspond with the 645 environment, these programs can be used directly. Two major programs must be written: the IOBCP interface to the file system and the ASMBL package for free format output.

Most of the insert files needed for the compiler have been done, but some must still be done. A few compiler files have already been bootstrapped but will not be used since their status is uncertain.

III. THE SEGMENT/ENTRY PROBLEM

AED procedures have only a single name, but in the Multics environment must be represented as segment/entry names. In the already-completed bootstrapping of most of the AED Library, the character ":" was added to the Half-Bootstrap character set and a combination of AED insert files and synonym statements performed the desired transformation without alteration of the original AED source programs. When this device was attempted for programs of the compiler proper, however, the large number of entries involved, made this scheme unworkable.

An alternate solution to the problem has been proposed by Mr. Charles Garman of the Multics staff, in which the corresponding operation will be performed by the Multics binder, slightly altered. The scheme seems straight-forward and Mr. Garman's familiarity with the binder should make it possible to make and debug the needed changes before mid-August when Multics testing of AED should begin. This proposal is predicated on the assumption that this work will in fact be accomplished by that time.

IV. PLAN OF WORK

Completion of the initial full bootstrap of the AED-1 Compiler for the AED-0 language from the 7094 CTSS to the GE 645 Multics system involves five phases:

1. Orientation of new staff.
2. Completion of the Half-Bootstrap on the 7094.
3. Bootstrapping of programs and assembly in Multics.
4. Debugging of Multics AED.
5. Completion of documentation.

Based upon current status, the total job has been estimated to require a total of 60 man-weeks of programming and debugging time and 10 man-weeks for documentation to be completed in 20 calendar weeks. These figures are based upon the job being performed by a team of three programmers with part-time supervision by Dr. J. E. Rodriguez, chief architect of the AED Compiler. The estimate must be tentative, however, because much of the work will depend upon access to the 7094, 360, and 645 computers at M.I.T., and the performance characteristics of Multics for this work are essentially untested at this time. Furthermore, a key item (the mapping of simple procedure names into segment/entry names) has not yet been programmed and checked out by Mr. C. Garman of the Multics staff.

In view of these uncertainties, and in view of the fact that office quarters for the full SofTech staff will not be available until September 1, we propose to alter the original plan to add the part-time services of Mr. C. G. Feldmann and Mr. J. F. Walsh to the Multics task during the month of August and part of September, if M.I.T. office space can be made available. The addition of approximately 5 man-weeks of their time to the project will save approximately 4 man weeks of additional effort from the total job, because of their extra skills, and also will shorten the total job by about 2 calendar weeks. In addition, SofTech overhead during the month of August will be lower so that still further savings accrue to M.I.T. Finally, if Mr. Garman can complete the segment/entry name task early in August, and if initial Multics running tests can be made, then more accurate estimates for job completion after September 1 will be possible.

Based upon this revised schedule of manpower assignments, the estimated man weeks to be applied to the Multics AED Project are as follows:

	Programming + Supervision	Direct Secretary
August	20	-
September	17	1
October	12	1
November	10	3
December	5	2
Total	64 man weeks	7 man weeks

V. WORK TO BE DONE

1. Update and complete the half-bootstrap compiler (CTSS).

2. Complete run-time library: ASEMBL and IOBCP plus a few minor library functions. (CTSS, Multics).

3. Compile and bootstrap 76 AED machine independent programs (CTSS).

4. Write and compile 5 AED machine dependent initialization programs (CTSS).

5. Prepare, macro-preprocess, and compile 4 AEDJR-generated tables (CTSS, 360-65).

6. Write, compile, and assemble 7 AED and Assembly utility Programs (CTSS, Multics).

7. Assemble, test, and debug entire AED-1 System in the Multics environment (Multics with CTSS for changes).

8. Pass acceptance tests or enter maintenance period.

9. Complete documentation.

VI. M.I.T. FACILITIES REQUIRED

Since M.I.T. computer facilities will be used, two offices will be required in the Information Processing Center, along with access to computer console facilities. (After October 1, only one office will suffice.) SofTech will supply secretarial services needed for documentation.

Computer resources needed are estimated as follows:

	Computer Time	Storage	Console Hours
CTSS	7 hours	1000 records	200 hours
Multics	15 hours	proportional but unknown	
360-65	1 hour	none	none

Also three CTSS Programmer numbers and three Multics Programmer numbers, with good access will be required for the total job.

It is assumed that SofTech will not be involved in the billing for any of these M.I.T. facilities needed to perform the work (except to confirm amounts used).

VII. DOCUMENTATION

SofTech agrees to supply to M.I.T. the full source listings of all programs of Multics AED, suitably annotated to allow personnel trained in the intricacies of the system to understand its operation. In addition, documentation comparable to and parallel with (on a document-to-document basis) that prepared for the Public AED release for the IBM 360 computer (except possibly for neat hand-drawn rather than drafted figures) will be supplied. Included in this documentation will be an appropriate section for the Multics manual describing how to use Multics AED. Documents will be supplied in a form suitable for reproduction.

VIII. NON-EXCLUSIVE RIGHTS

SofTech will have full rights to unrestricted further use of programs and documents developed under this contract except for direct sale as a product. In particular, improvements in the AED compiler which may be incorporated into Multics AED for the first time may be transferred to other AED compilers or may be used in other AED systems without restriction.

IX. ACCEPTANCE TESTING

Organized test cases exist at present only for a subset of AED language features. During the month of August, additional tests will be devised in an effort to arrive at a test base (not necessarily exhaustive) that can be agreed to by both M.I.T. and SofTech as an acceptable criterion for completion of the Multics AED compiler in working form. It is to be understood that like any large software system, Multics AED never can be expected to be completely bug-free, so that these test criteria will be geared only to give as complete a test as possible of those features and constructs most likely to be used by AED programmers. In any case, the job will be judged completed (and the maintenance period begun) whenever

the applied manpower to keep the system running, including correcting
known bugs, reaches a level of one man-week billed per two calendar
weeks.

X. MAINTENANCE

SofTech agrees to provide maintenance assistance for the initial
Multics AED System on a per diem basis at its standard consulting rates
for a period of one year from completion of this contract.

XI. AUGUST BILLING ESTIMATES

SofTech Annual Overhead is estimated at   161 percent
  Assume 30 percent reduction in August due to
  lower rent and omitted overhead salaries   = <u>48 percent</u>
    Estimated August overhead   = 123 percent

Estimated total salaries (August only) $ 8,000
      Overhead   (August only) at 123 percent <u>$ 9,850</u>
                                        $17,850
        Profit at 12 percent   <u>$ 2,150</u>

August Estimated Total Charge for 20 man weeks $20,000

Hence SofTech will charge actual man weeks applied at $1,000/man week
for the month of August.

XII. PROPOSAL RECONSIDERATION

During August, a number of aspects of the after-August phase must
be clarified. It is understood that all estimates in this proposal for the
after-August phase are tentative and non-binding.