RECOMMENDATIONS FOR ON-LINE COMPUTER FACILITIES FOR NAL

G. Burleson
Northwestern University

C. Y. Chien
Johns Hopkins University

T. Jenkins
Case Western Reserve University

S. Lindenbaum
Brookhaven National Laboratory

D. Meyer
University of Michigan

D. Miller and S. Derenzo
Lawrence Radiation Laboratory

R. Mischke
Princeton University

P. Patel
McGill University

F. Pipkin and J. Tenenbaum
Harvard University

and

D. Rust
Argonne National Laboratory

ABSTRACT

We recommend in this report the basic system of computers which NAL should purchase for use with on-line experiments in Area 2.

Because computer technology is changing rapidly, the 1970 summer-study group concerned with on-line computer facilities decided to confine its attention to that equipment which will be needed to adequately run experiments in Area 2 at the time the accelerator comes into operation. On reviewing the proposals for counter and spark-chamber experiments, we found rather remarkable uniformity in the computer needs of the various groups, although details of how to accomplish the task varied somewhat. Essentially every proposal for Area-2 beams requested an on-line computer. We

believe the recommendations that we are making are therefore valid, independent of which experiments are eventually approved to run.

We have assumed that Area 2 will have four operating beams for counter experiments. One should assume that these will contain experiments which are running a large fraction of the time, and the experiments which follow these in the beam will take the remaining computer time debugging and pretesting programs. Some amount of time might be available for rerunning data tapes taken previously. However, this would be incidental to the operation, and we would expect most groups would want to take their data to their home institutions if extensive reprocessing is needed.

Four possible configurations were considered. These were costed by Al Brenner on the basis of DEC equipment since price lists were available and many members of the group were familiar with the equipment. The configurations and their costs were

1.	4X PDP-15 stand-alone systems	$512K-$567K
2.	4X PDP-15 hooked to 1 PDP10I	$1.2M - 1.4M
3.	4X PDP-10 stand-alone systems	$1.35M - 1.84M
4.	4X PDP-15 hooked to a large computer (370/165 or 7600) used 1/5 time.	$1.25M - $1.30M

Details of what these systems include are available from Al Brenner. To summarize, each system was made adequate in peripherals and core to operate within the limits of the capabilities of its configuration without being lavish. Options 2, 3, and 4 are approximately equivalent in computing power. Option 1 would have to be supplemented by additional computing capabilities on-site. It would not provide sufficient information in most experiments to properly diagnose the status of the experiment during the run.

Some comments should be made on these prices. They are present list prices without discount. The computer market is changing rapidly so that a year from now when the money must be committed there may be significant changes. It is impossible to define exactly equivalent systems so that from a financial standpoint there is no significant difference between 2, 3, and 4. An analysis based on equipment of another company could reverse the order of these costs.

Conclusions

The group unanimously agreed that option 4 was not desirable for the following reasons:

1. If the main computer goes down, the entire experimental program in Area 2 would be seriously impaired or shut down. (This problem also exists for option 2 in its pure form.)

2. Option 4 would be the most difficult in which to integrate a computer from an outside group from the standpoint of both hardware and software.

3. In spite of the inherent capabilities of the large computer, it was felt that it would be the least flexible system to expand with the minimum expense and interruption of service.

4. It could not be operational until a couple of years after the accelerator was running because of fiscal as well as technical problems. The long-range desirability of this mode of operation will depend on economic factors difficult to assess at this time.

In reviewing the first three options, it was felt that it would be too rigid to choose any of the three options unmodified. The feeling was that option 3 offered the maximum flexibility in that individual experimental groups would be least likely to get in each other's hair and was most easily expanded. It also offers the easiest programming situation of the four options since a maximum fraction of the programs can be in Fortran, and there is virtually no systems programming required. A combination of options 2 and 3 seems most likely to develop with perhaps a few stand-alone small computers from outside groups. It will also be desirable for some small machines of outside groups to be hooked to larger machines purchased by NAL. The configuration would depend on the needs of the first approved experiments and undoubtedly on budget contingencies.

We recommend that approximately $1.6 M be allocated to on-line computer equipment and that this equipment be on-site and available for software checkout 6 months before experiments are scheduled to start. Additions will have to be made to this basic configuration as more beams are brought on. A reasonable attempt should be made to standardize on one or two computer types although as the technology advances, one must obviously be flexible in this regard.