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COMPUTING AT APL: GUEST EDITOR'S INTRODUCTION

APL's computing capabilities have been and will continue to be essential to its technical work. Computer usage spans many diverse applications that have no common software base. Computing needs in support of these applications are research- rather than production-oriented. While some problems exist for which the required processing is inherently number crunching, for others interactive or hands-on processing is a natural approach. No single application dominates the computing and information systems at APL.

The typical operating mode in APL facilities is a time-shared multiuser configuration with both batch and interactive processing, rather than a single-user mode. Several languages, including Fortran, PL/I, APL, and C, are used; furthermore, application packages and software developed at other institutions are adapted for use at APL. In addition to normal security and privacy considerations, APL must comply with regulations for processing classified military data. Existing major computing machines are mainly IBM, DEC, and SEL with peripherals from a wide variety of suppliers as necessary for specific applications.

Most software development is performed directly by scientists and engineers, with few professional programmers employed. In many cases this software has a limited useful lifetime and evolves substantially during its use. It is often undesirable to invest extensive resources to optimize a code for a given machine or compiler.

MAJOR COMPUTING FACILITIES AT APL

APL has over 33 computing facilities¹ that make extensive use of computers. Historically, the F. T. McClure Computing Center has housed the Laboratory's major computing resources. Today, the facilities range from general-purpose computing services in the Computing Center to special-purpose computer applications, as in the AMPTE Charge Composition Explorer Science Data Center. The facilities are used to develop hardware and software, to analyze models and model systems, to perform signal processing, and to process administrative data. Within these facilities, there are over 215 major computers, with thousands

of microprocessors embedded in equipment. In total, they occupy over 55,000 square feet, more than 7% of APL's total usable space. In addition, many computers (e.g., personal computers and word processors) are dispersed throughout APL in laboratories, offices, and test sites. While most of the computer hardware is general purpose, many facilities have been equipped with special-purpose application software and peripheral equipment. Table 1 summarizes some of the overall statistics.

Table 1—APL computer hardware by processing unit (Jan 1984).

Mainframe computers	2
Military computers	51
Midcomputers*	32
Minicomputers	113
Analog computers	4
Array processors	14
Personal desktop computers	339
Word processors	62
Terminals	670
Microcomputers	100,000(?)

*Midcomputers are midway between minicomputers and mainframe computers.

IN THIS ISSUE

The articles in this issue are grouped into two main categories: (a) technical projects that make use of computer technology, and (b) the computing facilities used in support of specific programs. Immediately following this introduction is a glossary of computing terms used frequently throughout the issue, plus some interesting phrases commonly used in the industry.

The articles concerning the use of computing technologies begin with the application of computers in the Transit Navigation Satellite System. A spacecraft computer, designed, built, and deployed by APL, with associated ground support, is described. Next, a specific fault-tolerant computing project provides insight

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into transient computer faults that can be very disruptive to computer operation. The next three articles describe intriguing projects that are in process: the use of computer-aided instruction with personal computers to assist the handicapped, and some early experiences with the new Department of Defense high-order programming language, Ada.²

The first set of facility articles shows examples of how APL uses special-purpose computing to support ocean research and magnetospheric particle space research. The second set discusses the history of the F. T. McClure Computing Center and three current activities: the APL programming language, networking, and graphics.

SUMMARY

The emphasis at APL is to place the computing capability in the hands of the engineering and scientific staff and to provide them with a set of tools that can be used without the necessity of computer specialists. The trend is similar to the automation phenomenon that is evolutionizing the business community operations. APL will continue to seek innovative applications of computer technology to meet important national needs.

NOTES

¹ Generally, a computing facility is a room in which the primary activity is computing.

² Ada is a registered trademark of the U.S. Government (Ada Joint Program Office).