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Semiannual Technical Summary

Graphics

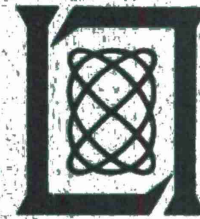
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GRAPHICS

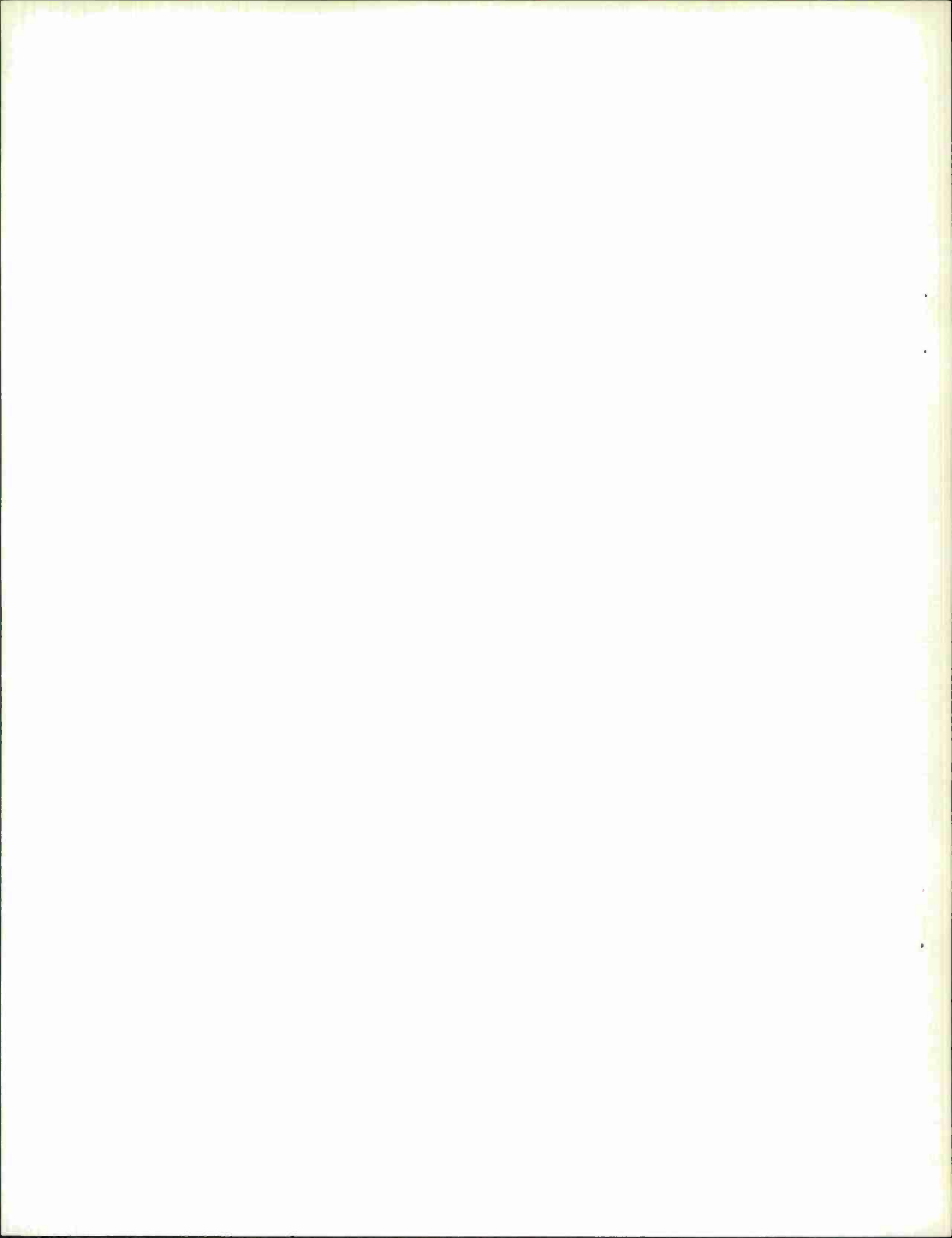
SEMIANNUAL TECHNICAL SUMMARY REPORT
TO THE
ADVANCED RESEARCH PROJECTS AGENCY

1 DECEMBER 1966 - 31 MAY 1967

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MASSACHUSETTS



SUMMARY

The objective of the Graphics program at Lincoln Laboratory is the development of computer hardware and programs which will enable users to work on-line in an interactive mode employing graphical techniques for the input, manipulation and representation of graphical data. The work includes the investigation of problems related to using a time-shared computer, such as TX-2, for graphics, and the design of general-purpose system programs to provide graphics capability for a variety of scientific, military and control problems.

During the last reporting period, the following has been accomplished. A general-purpose front-end system has been designed based on the VITAL system. VITAL itself has been expanded to allow a compiler to control the scanning of a source program and outputting of messages. An ALGOL-like language, LABGOL, has been implemented; with the addition of means for building and manipulating a store of explicit relations between objects and their attributes, a new language, LEAP, has also been specified. The new hybrid conic generator has been operated successfully on-line.

Accepted for the Air Force
Franklin C. Hudson
Chief, Lincoln Laboratory Office

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GLOSSARY

ALGOL	High-level algebraic problem-solving language
APEX	TX-2 time-sharing executive
LABGOL	An ALGOL-like language constructed for the TX-2 using VITAL
LEAP	Extension of LABGOL, including associative language
LISP	A list-processing language
VITAL	A compiler-compiler system

GRAPHICS

I. GRAPHICAL SERVICE SYSTEM

The APEX display executive has operated satisfactorily this quarter, requiring only minor attention. The Input Interrupt executive programs have not been extensively used but will be exercised in applications work during the next quarter.

Some progress has been made on extracting the table-driven syntax portion of the VITAL system for general-purpose use. A number of unexpected considerations arise in such a job, but a preliminary front-end system is almost complete. It should receive initial trials next quarter.

Preliminary work on trial applications in satellite weight and balance design and relativistic graphic views have been programmed.

II. VITAL

Facilities have been added to VITAL which will allow a compiler-writer to control the process of scanning a source program and to output meaningful error messages and compiled program information to the user as follows:

- (1) The compiler can record and reset the pointers which indicate the line and word to be read by the next scan command.
- (2) The compiler can specify that scan commands are to read text from the on-line keyboard rather than from the prestored directive.
- (3) The compiler can output text, numbers, dictionary words, sections of the directive and directive line identifications.

Some things that a compiler can be made to do with these new facilities are: (1) Output symbol tables, label tables, etc. (2) Output formatted listings (for example, with block structure indicated by indenting). (3) Allow macros in the source language program. (4) Allow certain errors to be corrected on-line without necessitating recompilation. (5) Compile programs as they are typed.

These additions to VITAL should aid debugging of source programs by providing the user with information about his compiled program. They also allow a compiler to interact with the on-line user, which should make VITAL more useful for certain applications.

The VITAL compiler-compiler system on TX-2 has been used to implement a compiler for an ALGOL-like language, called LABGOL. In addition to a basic algebraic language, LABGOL has formatted numerical input-output, a display output sublanguage and a matrix manipulation sublanguage. LABGOL has been used, for example, to write a program which displays three-dimensional objects as they would appear if they were moving at a relativistic speed with respect to the observer.

The LABGOL language has been extended to include a facility for building and manipulating a complex information base in a high-level computer language. The information base consists of a store of explicit relations between objects. This extended version of LABGOL is called LEAP (Language for the Expression of Associative Procedures).

III. NEW DISPLAY SEQUENCE

The curve drawing portion of the new display executive has been exercised further this past quarter and a test program which operated this display within the time-sharing system has been written. The complete display system of curve generator, character generator and control logic should be finished during June. Modifications to the time-sharing system display executive for handling this new hardware have been planned and partially coded.

IV. PDP-338 REMOTE TERMINAL

Programming of the PDP-338 remote display console has continued during the past quarter. Because the TX-2 hardware interface is not finished, the two computers have not yet been tested together. The programs are ready and completion of the hardware is expected next quarter. Debugging the interfaces and associated software can then begin.

V. COMPUTER NETWORK STUDY

The TX-2 link to the Systems Development Corporation Q-32 time-shared computer has been exercised with demonstration programs during the past quarter. One demonstration, for instance, accepts typed input at TX-2, processes this text with a LISP program at SDC, and returns the LISP output to TX-2 for numerical processing. Data will be gathered on the link's operation during the next few months.

To date, only demonstrations have been run on the TX-2 to SDC network link. The network contractor has been asked to investigate the service facilities needed to make this link useful to general users. Until the problems of documentation, service facilities and instructional methods are solved, it is unlikely that a remote networked computer will be of much practical value to the general user.

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14. KEY WORDS			
graphical communication		man-machine	
TX-2		display systems	
time sharing			

