QUARTERLY PROGRESS REPORT

No. 104

JANUARY 15, 1972

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

RESEARCH LABORATORY OF ELECTRONICS

CAMBRIDGE, MASSACHUSETTS 02139

The Research Laboratory of Electronics is an interdepartmental laboratory in which faculty members and graduate students from numerous academic departments conduct research.

The research reported in this document was made possible by support extended the Massachusetts Institute of Technology, Research Laboratory of Electronics, by the following agencies.

Joint Services Electronics Programs (U.S. Army, U.S. Navy, U.S. Air Force)

Contract DAAB07-71-C-0300

U.S. Army—Research Office—Durham

Contract DAHC04-71-C-0039

Contract DAHC04-69-C-0042

U.S. Navy—Office of Naval Research

Contract N00014-67-A-0204-0019

U.S. Air Force—Electronics Systems Division

Contract F19628-69-C-0044

Contract F19628-70-C-0064

U.S. Air Force—Office of Scientific Research

Contract F44620-71-C-0051

U.S. Coast Guard

Contract DOT-CG-13446-A

National Aeronautics and Space Administration

Grant NGL 22-009-013

Grant NGL 22-009-016

Grant NGL 22-009-304

Grant NGL 22-009-337

Grant NGR 22-009-091

Grant NGR 22-009-421

Grant NGR 22-009-526

Contract NAS1-10693

Contract NAS8-27733

National Institutes of Health

Grant 5 PO1 GM14940-05

Grant 3 PO1 GM15006-03S2

Grant 5 TO1 GM15000-05

Grant 5 TO1 HD-00111-07

Grant 5 RO1 NS04332-09

National Institute of Mental Health

Grant 5 PO1 MH13390-05

National Science Foundation

Grant GK-28282X

Grant GP-28679

Grant GP-14589

Grant GP-20769

Grant GP-21348 Grant GP-24254

National Bureau of Standards

Grant 1-35857

U.S. Atomic Energy Commission

Contract AT (11-1) -3070

Bell Telephone Laboratories Inc. (Grant)

World Health Organization

Grant R/00348

M.I.T. Lincoln Laboratory Purchase Orders CC-544, CC-570, A-6270

Associated Press (Grant)

Boston City Hospital Purchase Order 10656

B-D Electrodyne (Grant)

M.I.T. Sloan Fund for Basic Research

Grants 241 and 616

California Institute of Technology

Contract 952568

Support of projects is acknowledged in footnotes to the appropriate sections.

THIS DOCUMENT HAS BEEN APPROVED FOR PUBLIC RELEASE AND SALE; ITS DISTRIBUTION IS UNLIMITED.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY RESEARCH LABORATORY OF ELECTRONICS

QUARTERLY PROGRESS REPORT No. 104 January 15, 1972

Submitted by: H. J. Zimmermann G. G. Harvey S. J. Mason

THIS DOCUMENT HAS BEEN APPROVED FOR PUBLIC RELEASE AND SALE; ITS DISTRIBUTION IS UNLIMITED.

INTRODUCTION

This report, the hundred and fourth in a series of quarterly progress reports issued by the Research Laboratory of Electronics, contains a review of the research activities of the Laboratory for the three-month period ending November 30, 1971. Since this is a report on work in progress, some of the results may not be final.

Following our custom of the past several years, in this issue of January 15, 1972 we preface the report of each research group with a statement of the objectives of the group. These summaries of our aims are presented in an effort to give perspective to the detailed reports of this and ensuing quarters.