TRANSMITTAL SLIP | DATE 3/27/86

TO: DDA

ROOM NO. 7D24	BUILDING HQ

REMARKS:

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DDA 86-0606

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DDA 31 MAR 1986

DDA Reg.

FROM: ORD/ISD

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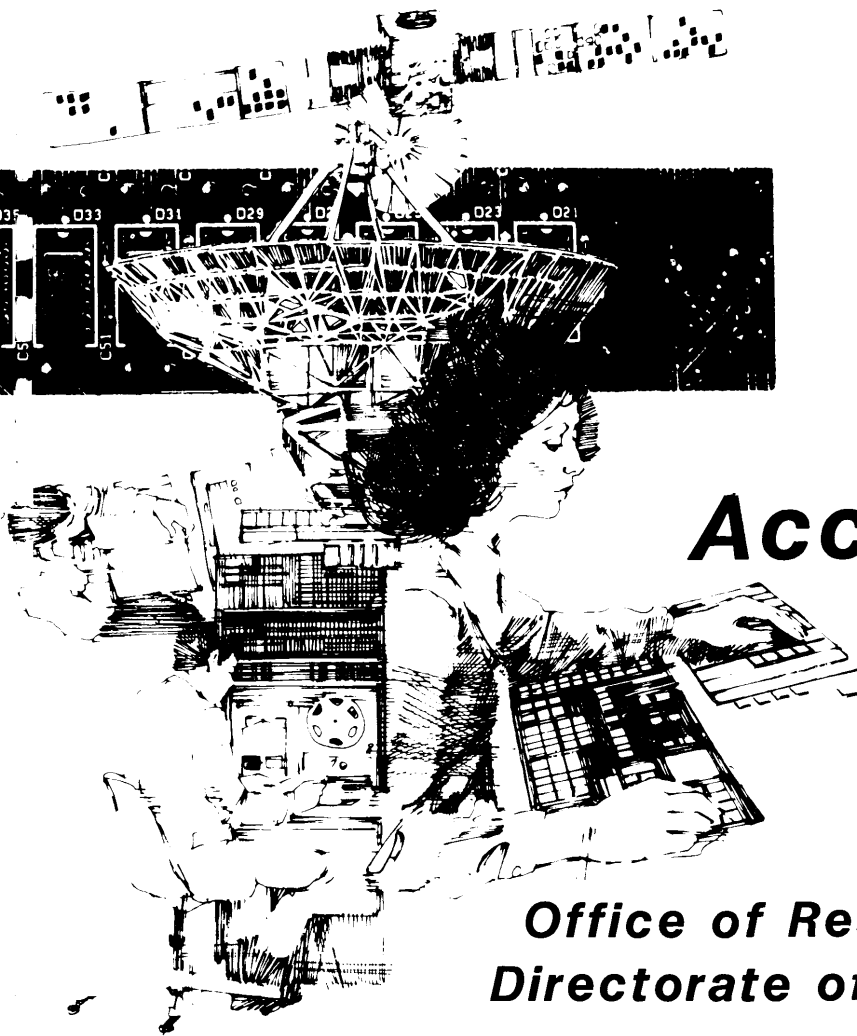
FORM NO. 241
1 FEB 56   REPLACES FORM 36-8 WHICH MAY BE USED.   (47)

1985 Accomplishments

Office of Research and Development
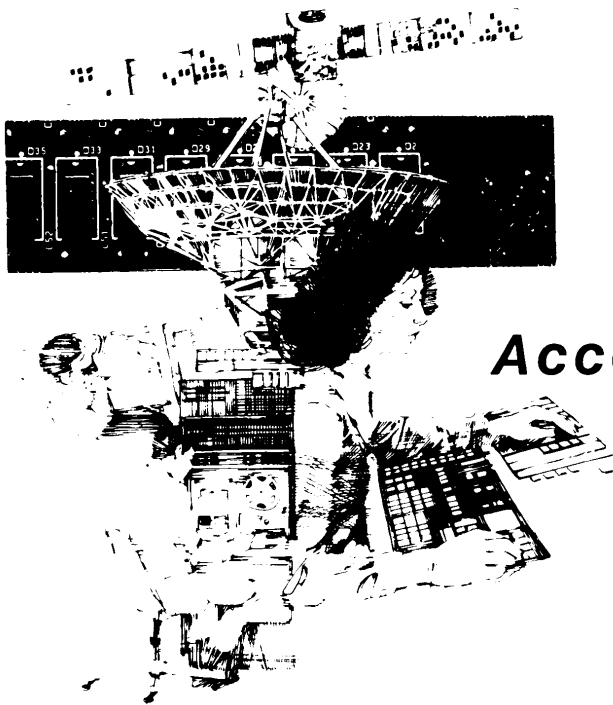## *Directorate of Science and Technology*

44

INTRODUCTION

The Office of Research and Development (ORD) is responsible for research and development of technology that will improve the ability of the CIA to collect, process, analyze, and produce foreign intelligence. In this document ORD presents brief descriptions of some of its significant accomplishments during Fiscal Year 1985.

This document is structured along functional lines; each section is introduced with a listing of the organization's principal programs, a description of its mission, and a list of its staff and their projects. Specific inquiries regarding each project should be addressed to the key person indicated.

This document is the fifth of these annual publications; each edition is published shortly after the close of the fiscal year. Comments and suggestions regarding content, format, and distribution for future editions should be directed to the editor   or to the Director of Research and Development.

STAT

(A BYEMAN appendix to this document is also available.)

1985
Accomplishments

Office of Research and Development

Directorate of Science and Technology

Office of Research & Development

SECRET
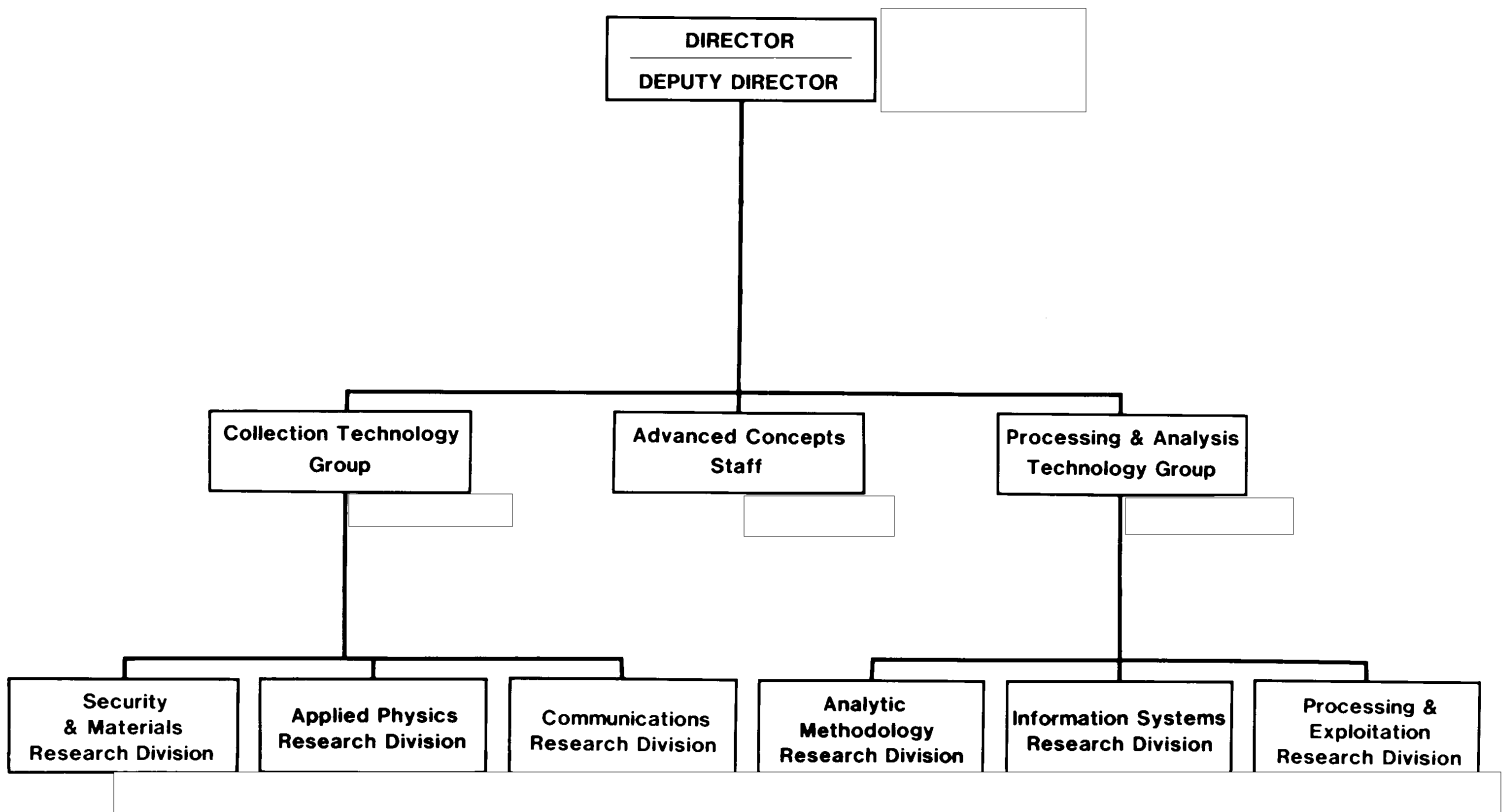
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                        │      DIRECTOR       │
                        ├─────────────────────┤
                        │   DEPUTY DIRECTOR   │
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┌──────────────────┐   ┌──────────────────┐   ┌──────────────────┐
│ Collection       │   │ Advanced Concepts│   │ Processing &     │
│ Technology Group │   │ Staff            │   │ Analysis         │
│                  │   │                  │   │ Technology Group │
└──────────────────┘   └──────────────────┘   └──────────────────┘
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Security & Materials Research Division	Applied Physics Research Division	Communications Research Division	Analytic Methodology Research Division	Information Systems Research Division	Processing & Exploitation Research Division

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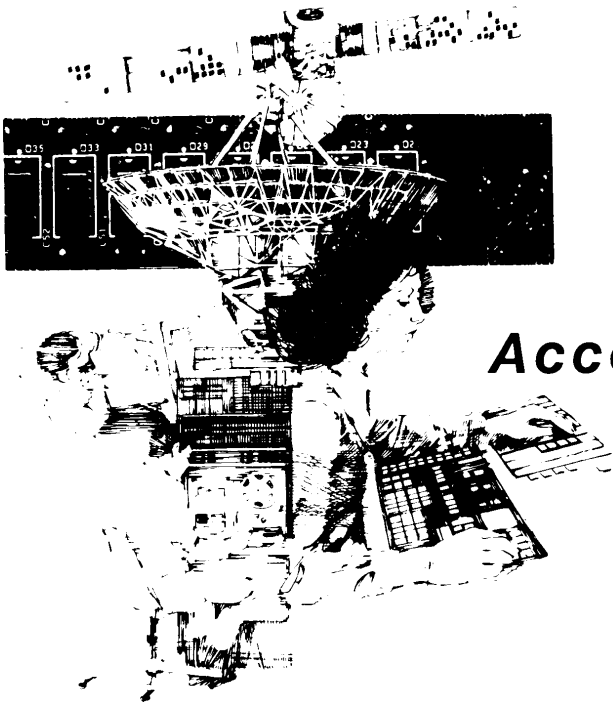
1985
Accomplishments

Advanced Concepts Staff

ADVANCED CONCEPTS STAFF

PROGRAM AREAS

ADVANCED CONCEPTS

25X1

Novel Communication Concepts

Modeling Concepts
Political/Economic Studies
Novel Materials
Audio Surveillance Concepts
New Communications Collection Techniques
Parallel Processors
Data Base Research

ADVANCED CONCEPTS STAFF

INTRODUCTION

The primary mission of the Advanced Concepts Staff (ACS) is to investigate new problems facing the Intelligence Community, to study the application of emerging technology to these problems, and to foster the advance of embryonic technologies to a status where they may be exploited for intelligence purposes.

Personnel in the Advanced Concepts Staff are from ORD, other Agency components, and the Intelligence Community, industry, and academia. These individuals are mature, respected researchers who are not bound by the formal ''requirements process'' in their pursuit of new ideas. The blend of diverse, motivated experts contributes to the overall innovation of the Office of Research and Development.
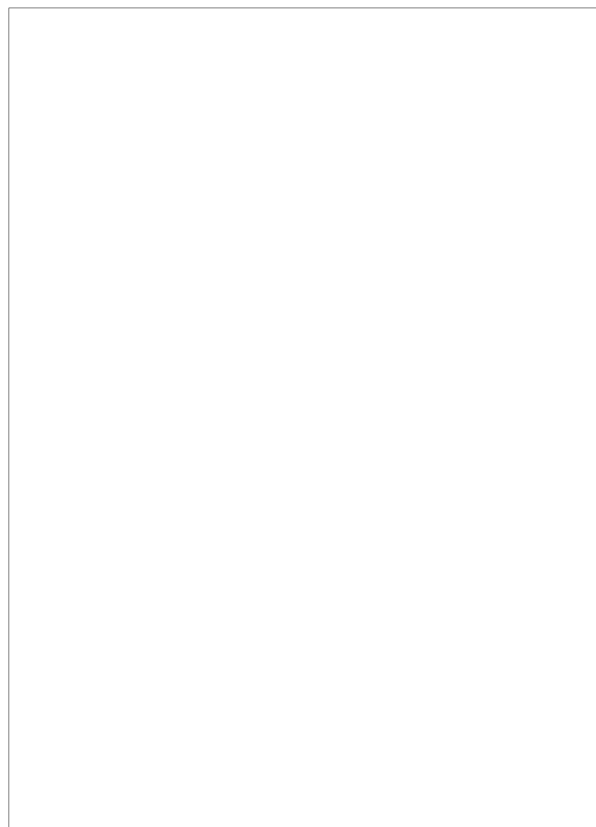
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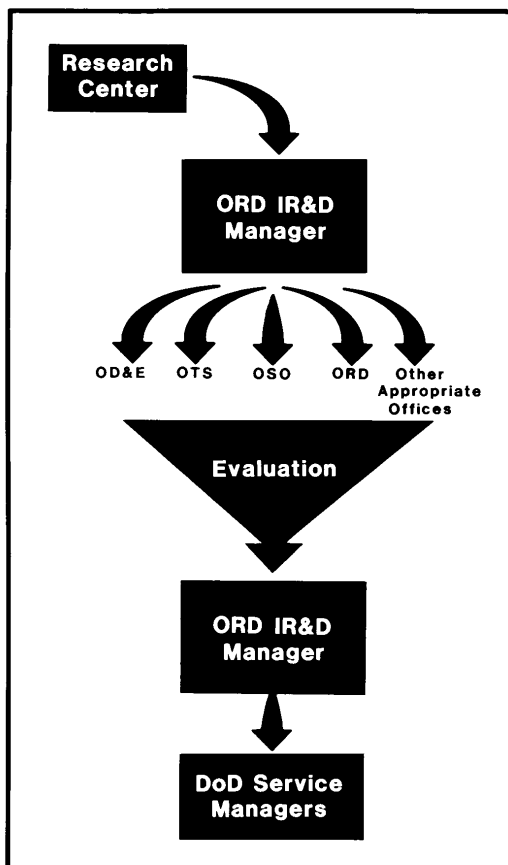
CY-85 Review Activity of 43 IR&D Centers

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┌─────────────────────────────┐
│  Research                   │
│  Center                     │
│                             │
│       ORD IR&D              │
│       Manager               │
│                             │
│  OD&E  OTS  OSO  ORD  Other │
│                     Appropriate
│                     Offices │
│                             │
│       Evaluation            │
│                             │
│       ORD IR&D              │
│       Manager               │
│                             │
│    DoD Service              │
│    Managers                 │
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DS&T Distribution & Review Process

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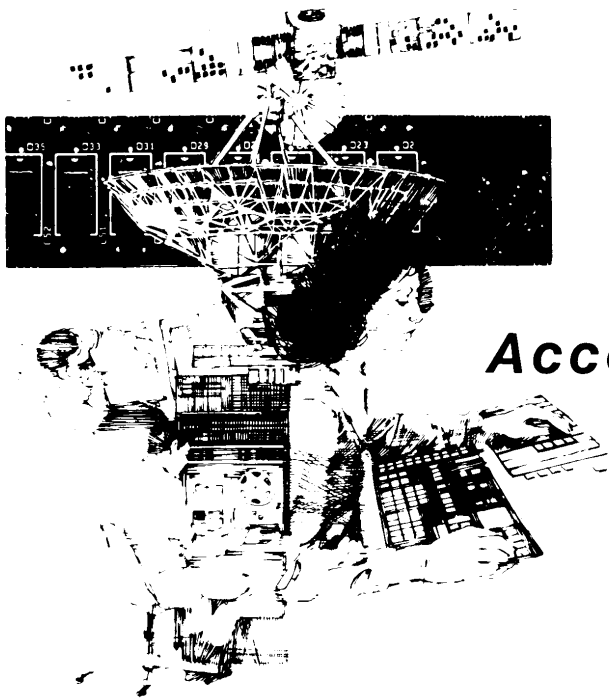
1985
Accomplishments

Applied Physics Research Division

APPLIED PHYSICS RESEARCH DIVISION

PROGRAM AREAS

MICROWAVE COMMUNICATIONS

Advanced Microwave and Millimeter Components

SIGNAL PROCESSING

Microprocessors
Signal Processing Chips
Signal Processing Architectures

ELECTRO-OPTICAL SENSORS

DATA STORAGE

Optical Disk Recorders
Optical Tape Recorders

SOLAR CELLS

Laser Gyroscopes

COLLECTION TECHNOLOGY GROUP

APPLIED PHYSICS RESEARCH DIVISION

INTRODUCTION

The Applied Physics Research Division (APRD) has been chartered to develop technology applicable to future collection systems to be developed primarily by OD&E. The Division's efforts are grouped under two broad areas: optics/electro-optics and electronics. Included in these areas are projects on fiber optics gryos; solar cells; optical disk and tape recorders; advanced microwave and millimeter circuits; and high-speed, low-power integrated circuits. These projects have been designed to support the technology needs of both Agency and national level programs.

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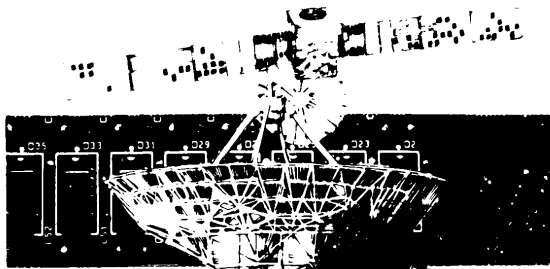
1985
Accomplishments

Communications Research Division

COMMUNICATIONS RESEARCH DIVISION

PROGRAM AREAS

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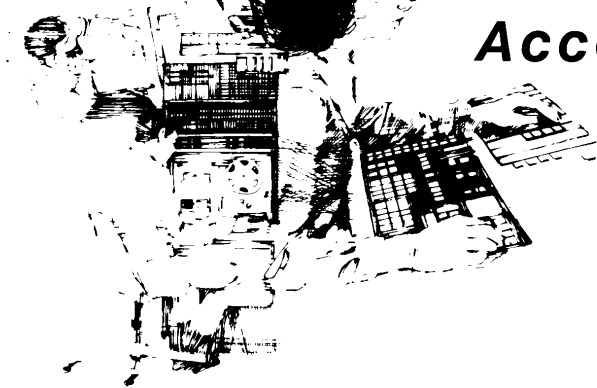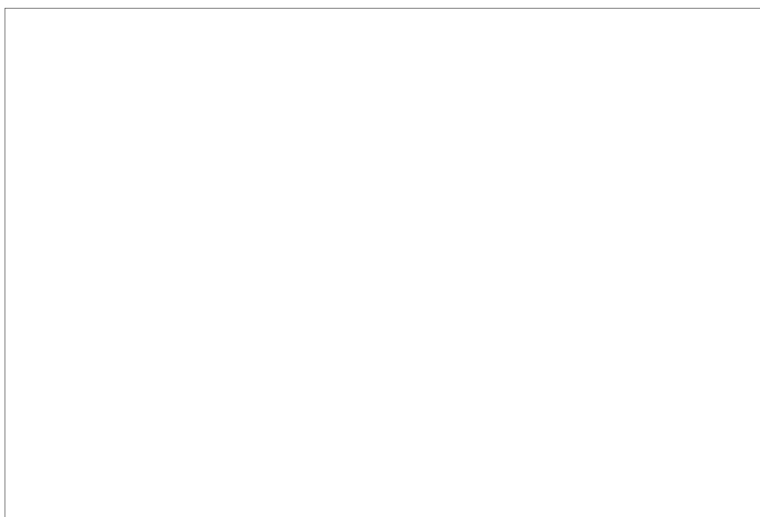
TECHNICAL OBSERVABLES

Millimeter Wave Technology

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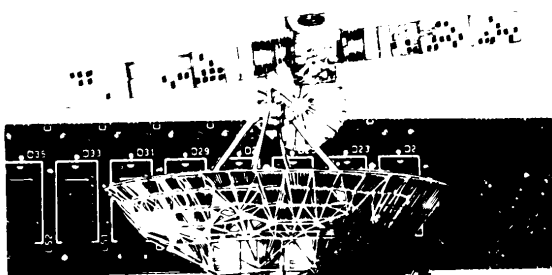
1985
Accomplishments
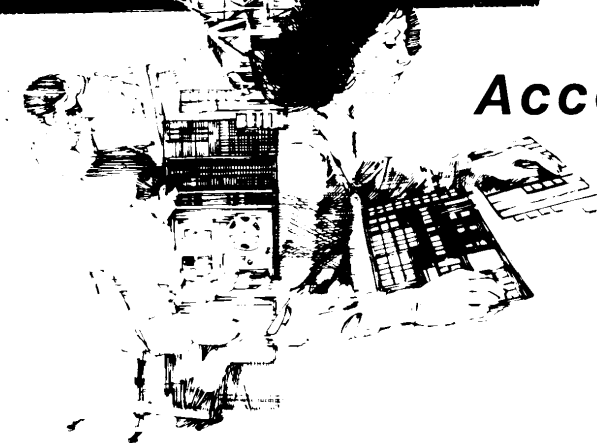
Security and Materials Research Division

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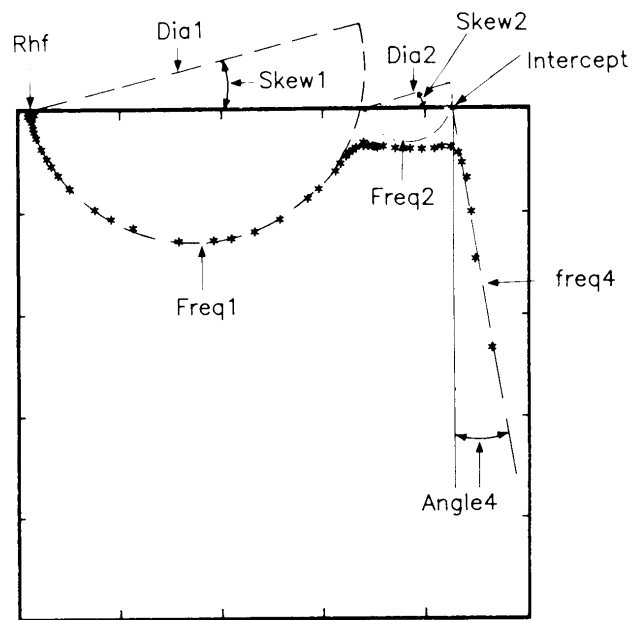
RESISTANCE. ohms

AC COMPLEX IMPEDANCE ANALYZER AND DATA

The left side of the photograph shows the hybrid HP-4792A LF Impedance Analyzer. The light brown box on the workbench next to the analyzer holds the constant temperature bath where the batteries are placed during measurement. The analyzer measures the complete battery impedance spectrum from 10^{-3} Hz to 100 kHz. The graphic representation of the reduced impedance data plotted as reactive vs. resistance illustrates the characteristic parameters of battery impedance used in the decision tree model.

Where:

Rhf = the resistance of the electrolyte

Dia 1, Dia 2, Skew 1, and Skew 2 = measures of the lithium anode passivation

Freq 1 and Freq 2 = frequencies of maximum reactance due to lithium anode passivation

Intercept and Angle 4 = measures of the impedance contribution from the cathode, and

Freq 4 = frequency dependency of the cathode impedance.

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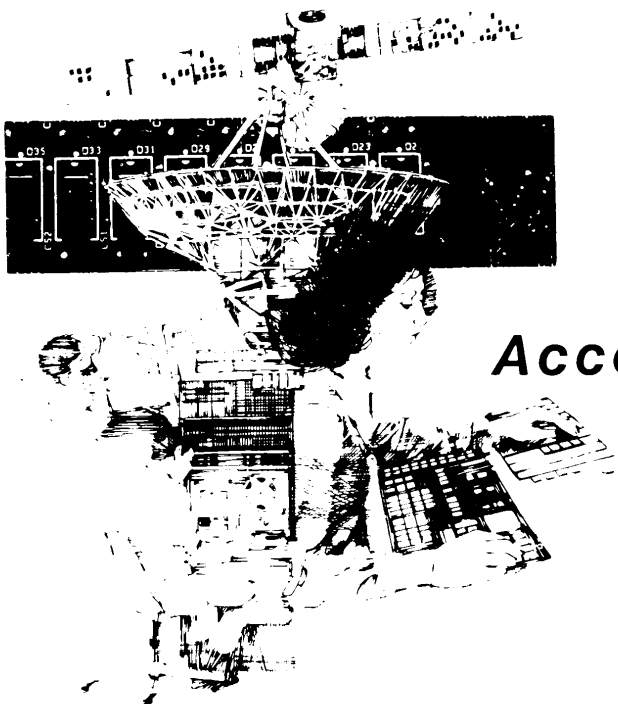
1985
Accomplishments

Analytic Methodology Research Division

ANALYTIC METHODOLOGY RESEARCH DIVISION

PROGRAM AREAS

MILITARY ANALYSIS

POLITICAL ANALYSIS

GEO ECONOMIC RESOURCE ANALYSIS

PERSONAL SECURITY AND COUNTERMEASURES

COUNTERTERRORISM/COUNTERINTELLIGENCE

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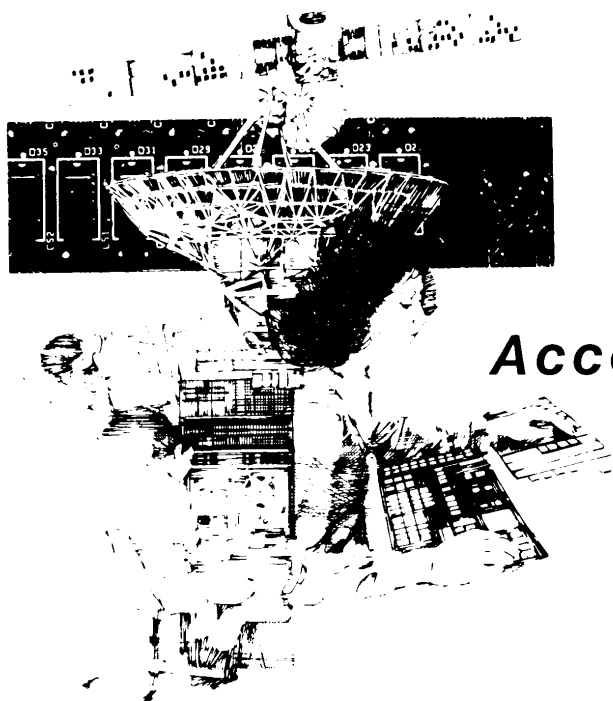
1985
Accomplishments

Information Systems Research Division

INFORMATION SYSTEMS RESEARCH DIVISION

PROGRAM AREAS

INFORMATION SYSTEMS

Computer and Network Architecture
Computer Security
Analyst Tools
Advanced Text Search and Retrieval
Data Base Management
Computer Aided Instruction
Artificial Intelligence
User Interfaces
Geographic Information Systems

PROCESSING AND ANALYSIS TECHNOLOGY GROUP

Information Systems Research Division

INTRODUCTION

The Information Systems Research Division (ISRD) conducts research and development in computer science and information systems for the entire spectrum of the Agency's technical, analytical, and administrative activities. The Division pursues projects in two general categories: projects to provide more immediate product-oriented results in support of specific applications, and projects to investigate the potential utility to the Agency of new or emerging information science technologies.

Currently the Division is pursuing projects addressing problems in computer security, advanced text search and retrieval, and data base management. Other areas of activity include automated aids for language training, user interfaces, fiber-optic bus technology, geographic information system development, Hypercube computer architecture, and an Artificial Intelligence center for development of prototype Artificial Intelligence systems.

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RULE-BASED RETRIEVAL OF INFORMATION BY COMPUTER (RUBRIC)

STAT

KEY PERSON:

CONTRACTOR:

BENEFITING ORGANIZATIONS: FBIS, DI

PROBLEM

Each day FBIS routinely processes massive amounts of unstructured narrative text documents from a variety of sources. These documents are examined for content in a number of topic areas and are indexed according to formal guidelines. Although the coding schemes used by FBIS ensure general consistency of indexing, the current procedures employed by FBIS are very labor intensive and do not adequately meet all the requirements of the users. Substantial improvement is needed in the processing of these large document databases.

Another problem confronting FBIS, and the Agency, is the lack of a text retrieval system that would enable analysts to peruse large amounts of unstructured narrative text. Many commercial text retrieval systems are now available, but the retrieval languages provided by these systems require that the documents be structured in a pre-defined format, a situation that is not currently cost effective for either FBIS or the Agency.

PROBLEM SOLUTION

In an attempt to overcome the drawbacks of existing information retrieval (IR) systems, ORD has developed a research prototype system called Rule-Based Retrieval of Information by Computer (RUBRIC). This system was designed to help IR analysts gain access to large full-text databases. The main goals in developing this prototype were that (l) the query language should allow the user to express his or her needs in a conceptually straightforward manner, and (2) the system should be able to provide partial matching of queries to documents.

To achieve these goals, RUBRIC draws upon the rule-based (If...Then) paradigm used in Artificial Intelligence (AI). The system supports hierarchies of rules that define the inter-relationship between concepts (e.g., terrorism and car bombing) that the analyst expects to appear in a typical document. The lowest level concepts (e.g., explosion) in a hierarchy of rules define theme categories, such as terrorism, that may not actually appear in a document.

The RUBRIC environment provides analysts a number of tools that help with the construction and evaluation of rules and with the assessment of retrieval results. Overall, RUBRIC provides a friendly interactive environment for the efficient and effective development of queries that (l) give better precision and recall than those based on commercial structured information retrieval systems (e.g., LEXIS, DIALOG, or MEDLARS), (2) are more easily understood by the user than statistical methods, and (3) do not require the complex processing associated with natural language methods. ORD is currently performing a requirements analysis for FBIS to integrate RUBRIC into their working environment.

PAYOFF

The RUBRIC system will make it possible for IR analysts to process the increasing amount of material available to them. More consistent coding of the material will result in improved productivity; at the same time, analysts will have improved access to archived material. In addition, when new topics of interest arise, analysts will be able to retrospectively retrieve information from databases.

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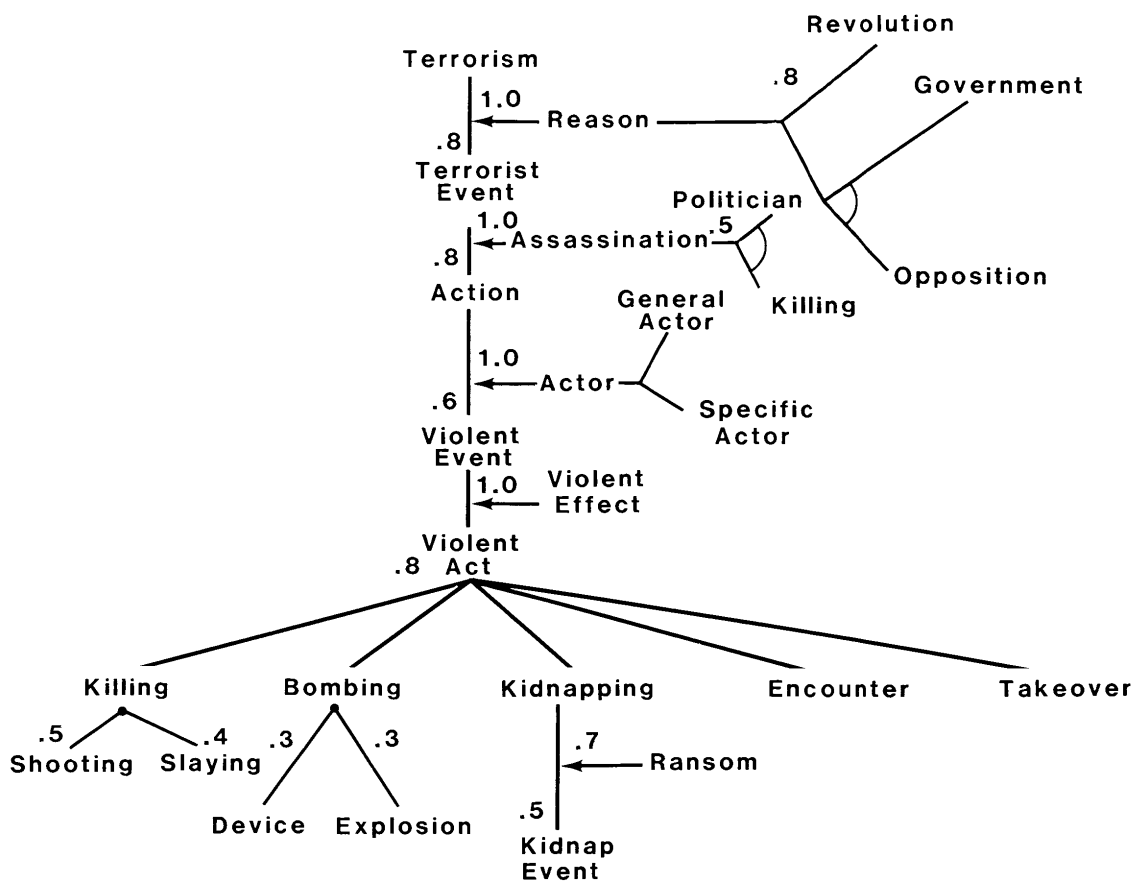
EXAMPLE OF HIERARCHY OF RULES WITH PROBABILITY WEIGHTS NOTED

This figure shows a hierarchy of rules defined by an individual analyst. Each analyst constructs his or her own theme category (in this figure, terrorism). The hierarchy of rules gives the analyst the advantage of being able to search large data bases with computer technology instead of with the currently used manual search procedures. The numbers in the figure correspond to the amount of relevance (probability value) that an analyst may attach to key words (e.g., explosion) that would define the theme category.

KNOWLEDGE-BASED GEOGRAPHIC INFORMATION SYSTEM

STAT

KEY PERSON:

CONTRACTOR:

BENEFITING ORGANIZATIONS: OIT, CPAS, OGI, OIA

PROBLEM

Current Agency geographic information systems lack the ability to answer complex queries. These systems can display areas of the world using data from the World Data Bank (WDB), a computer-readable map of the world containing political and geographic borders, rivers, roads, railroads, major islands, and major lakes. However, the systems do not know what the lines used by the WDB mean, e.g., that one line represents the boundary between two countries, while another line represents a river. They can calculate the distance between two selected points but cannot determine the distance via roads between two cities because they do not understand what a road is. They can display the locations of a list of cities but cannot infer that European NATO cities are cities in countries that are in NATO and in Europe. This lack of understanding on the part of current geographic information systems places on the user the burden of translating graphic representations into real-world features.

PROBLEM SOLUTION

During 1984, ORD restructured the World Data Bank to meet Agency needs and determined what geographic information was required by Agency analysts. A prototype knowledge-based geographic information system, known as KBGIS, was then developed that represented, stored, and utilized this information to answer complex geographic queries and to display the results graphically. The amount and type of data available to the system was expanded by developing two other data bases, one containing statistical information and the other inferential information. Integrating these three data bases made it possible to use them in combination to answer questions that one data base alone could not answer. This prototype system demonstrated that KBGIS can analyze a query, retrieve pertinent information, make appropriate inferences and calculations, and display the results.

A production KBGIS now being developed will reside on the Agency's mainframe computer and will be accessible to analysts through their PC workstations. A significant improvement made to the operational system in 1985 was a totally redesigned query language. A hierarchical menu provides an environment in which it is easy for a user to understand the essence of the data model and to develop queries. Once a query has been completely specified, an estimate of the time the system will take to respond is displayed—information which should be useful to the analyst in scheduling his or her time. With KBGIS, the geographic knowledge base (GKB) can be augmented with information from a user's personal data base that does not exist in the GKB; e.g., the course of a submarine over a specified period of time at specific time intervals. The production KBGIS will be delivered to OIT/DI in 1986.

PAYOFF

KBGIS will give analysts timely access to information that is now difficult to obtain. Complex queries can be answered quickly and conveniently. Questions that now require research by geographers will require only a query of the system. In addition, questions that are now not asked at all because of the perceived difficulty of obtaining an answer will be answered in a timely and understandable way.

UNCLASSIFIED
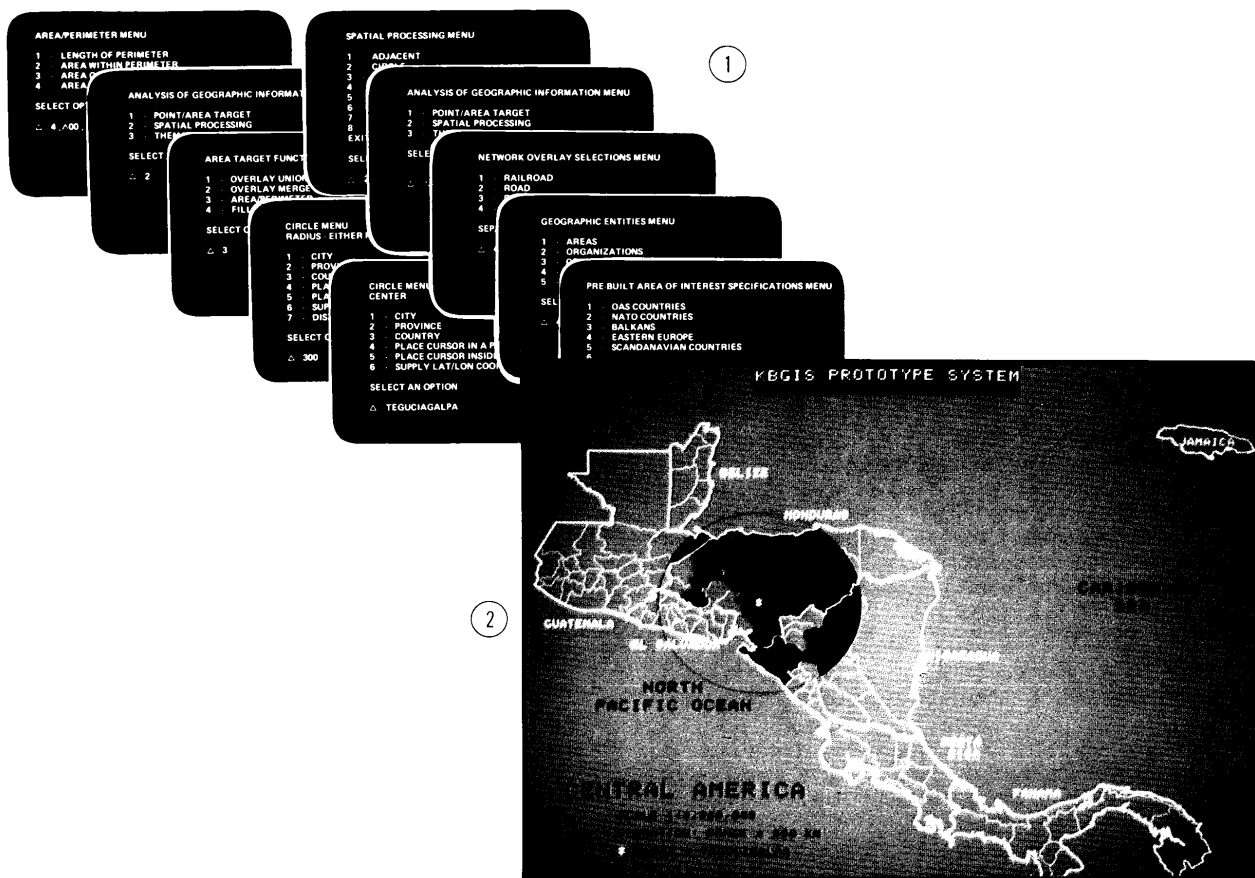
KNOWLEDGE-BASED GEOGRAPHIC INFORMATION SYSTEM

Figure 1: This is an example of a series of query building menus from the KBGIS. The system was asked to show, graphically, all the provinces having an area greater than 100,000 acres that lie within a 300-kilometer radius of the Honduran provincial capital of Cuscatleu, Tegucigalpa.

Figure 2: All Central American countries other than Mexico are displayed and named in white. The provincial boundaries of these countries are displayed in yellow-green. The location of Tegucigalpa is highlighted in orange. All provinces satisfying the specified query are shaded in black and the 300-kilometer-radius circle is seen, faintly, in black.

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ADVANCED TEXT RETRIEVAL

STAT

KEY PERSON:

CONTRACTOR:

BENEFITING ORGANIZATIONS: FBIS, NPIC, OSO, ORD, SOVA, OCR, OIT, others

PROBLEM

The Agency does not have a rapid text search and retrieval system that enables users to peruse very large volumes of relatively unstructured narrative text. As the textual information and the number of documents being generated and collected continue to expand, the magnitude of the problem of searching through all the data also expands. Furthermore, a lack of common architecture for text retrieval systems forces the Agency to design each of its text retrieval applications individually.

PROBLEM SOLUTION

During 1984, ORD developed a general architecture for full text management. The first prototype, implemented on the Apollo workstation, integrated text processing and retrieval tools to permit interactive browsing of unstructured narrative text.

In 1985 the text retrieval system was converted to a truly portable, efficient system by providing portable window management and communications systems. These systems provide a uniform interface to the operating environment for applications programs by isolating the machine, display, and network dependencies in special interface modules. The text retrieval system can now be used on a variety of machines without changes to most modules. Program maintenance has also been simplified since there is a single version of most programs.

Process control and system-monitoring facilities have been substantially expanded. The index, search, and document-access functions have been respecified to aid in supporting

personal files, annotations, and gateways to other systems. More extensive error detection and handling have also been included. A preliminary test version of the system has been delivered to SOVA/DA.

The testbed retrieval system provides an ideal environment for human factors experimentation, and the initial design of a methodology for human factors experiments is now being investigated. In particular, work is under way to develop a set of experiments comparing various indexing techniques such as RUBRIC and N-Grams (both ORD programs), as well as aspects of the window-based user interface. A number of new modules are also being developed to support experiments, including an experimental control module to select the system configuration for a particular experiment; a calibrated delay module to simulate system performance with considerably larger databases; and a number of programs to collect, format, and analyze the data from an experiment.

PAYOFF

The Text Information Management System will give the Agency a common, powerful, and easily maintainable text retrieval architecture that can be used in various system development projects. The system will improve analysts' productivity by providing an integrated set of text processing and

retrieval tools to permit interactive browsing of text databases. Further, the text retrieval testbed will provide future system planners with empirical data concerning alternative system design issues and the relative merits of various text retrieval hardware and software.
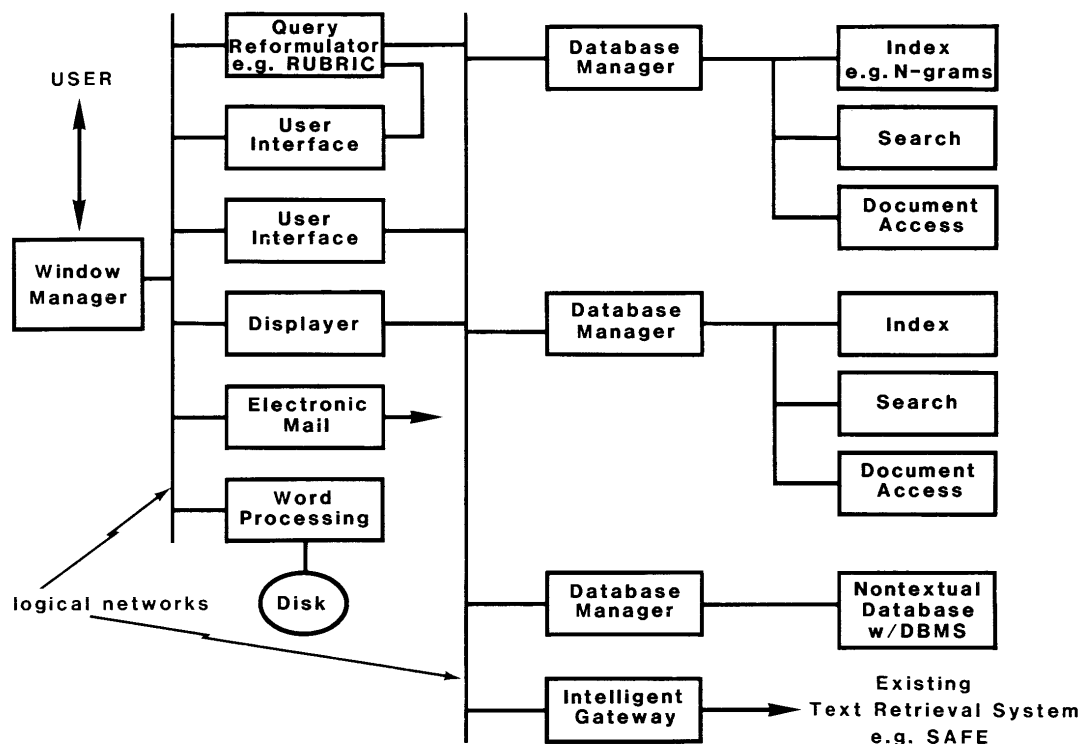
TEXT MANAGEMENT INFORMATION SYSTEM ARCHITECTURE

This figure shows a simplified schematic of the Text Information Management System in modular form. The user works with the system through the window manager by means of a keyboard and a mouse (not shown). Two logical networks provide flexibility in both user services (on the left) and data base servers (on the right). The user has the convenience of working with multiple windows (each with its own editor) to keep track of the text retrieval process from original query to the final document "hit list." The system also contains a system monitor and a system controller (not shown).

*RUBRIC: An ORD-developed system (Rule-Based Retrieval of Information by Computer).
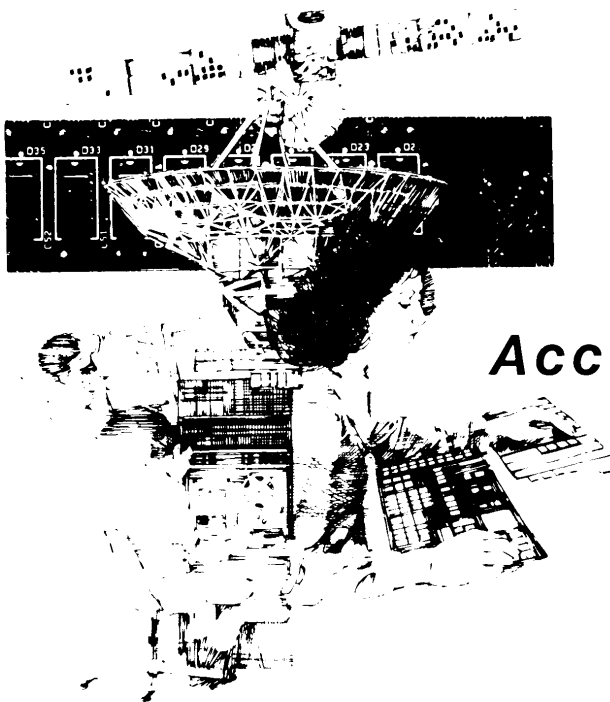
1985
Accomplishments

Processing and Exploitation Research Division

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1985
Accomplishments

Seminars and Symposia

SEMINARS AND SYMPOSIA

INTRODUCTION

An important part of ORD's responsibility is the promotion and promulgation of relevant technology throughout the Agency and the Intelligence Community. One mechanism for accomplishing this function is the sponsorship and presentation of a growing number of technical seminars, meetings, and symposia. ORD has a continuing calendar of such events; in this section we describe the most noteworthy of those which were held in Fiscal Year 1985.

VISITING SCHOLAR LECTURE SERIES

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KEY PERSON:

CONTRACTOR: Various

BENEFITING ORGANIZATIONS: Agency-Wide, Intelligence Community

PROBLEM

Current research in industry and academia often holds great promise for Agency applications. Agency professionals, however, seldom have the time or opportunity to keep abreast of such research. Ways are needed to expose these professionals to advanced research in their fields of expertise.

PROBLEM SOLUTION

In 1982 ORD originated the Visiting Scholar Lecture Series, which brings outstanding scholars from industry and academia to the Agency to lecture about exciting new research of potential application to Agency participants. The 1984-85 Lecture Series was organized as three five-day seminars on aspects of signal processing and related disciplines, with primary speakers selected to represent both the best research in the field and a balance of differing perspectives. Professor Thomas Kailath of Stanford University was selected to assist in the organization of the series. Kailath is internationally acclaimed for his ability to synthesize and exploit concepts from automatic control, communications, and signal processing, particularly as they relate to linear least-squares estimation—a powerful collection of mathematical techniques.

The first seminar examined certain modeling trends developed originally within the automatic control and navigation communities. Kailath presented exciting new work by which these primarily linear techniques are being extended to such fields as signal detection, data transmission, and antenna design. Representing a different point of view, Harold Sorenson of the University of California at San Diego discussed non-linear modeling techniques and applications.

In the second seminar, Kailath discussed his current research in architectural structures; Professor David Casasent of Carnegie-Mellon University surveyed current promising research in optical device implementations; while Earl Swartzlander, a well-known digital designer from TRW, Inc., critiqued this work in light of developing electronic technology.

In the third seminar, Kailath—ably assisted by several former students who have applied his work at IBM and Hughes—discussed new algorithmic work in exact least-squares methods for adaptive signal processing; Professor David Messerschmidt of the University of California at Berkeley and John Treichler, an Agency contractor, assessed these and alternative techniques for a variety of applications.

Researchers from the Intelligence Community, industry, and the national labs participated in these seminars. Response was so positive that the program will continue under the joint sponsorship of the NSA National Cryptographic School and possibly other agencies.

PAYOFF

This program brings the best minds in a given field together to discuss problems of particular interest to the Intelligence Community (IC). Agency and IC professionals have the opportunity to discuss their technical problems, within security constraints, with leading researchers. Conversely, these same researchers are exposed to (generally unclassified) IC research interests in such a way as to peak their own interest in similar problems. This, in turn, benefits the Agency's long-term research program by stimulating related academic and industrial research and by fostering cooperation and interaction between research offices in different components of the Intelligence Community.

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CONCURRENT PROCESSING SYMPOSIUM

STAT

KEY PERSON:
CONTRACTOR:

BENEFITING ORGANIZATION: Intelligence Community

PROBLEM

The Agency has updated its computer center regularly, but the complexity of its analytical problems has grown even faster. New technology has made huge amounts of data available for analysts, who need more powerful and faster computers to facilitate the searching and analyzing of large textual databases in real time. In addition, industry is using supercomputers for analytic modeling, and our analysts must have comparable tools to use these models. This is especially true for analyzing similar models produced by foreign countries.

PROBLEM SOLUTION

One solution to these problems is the use of supercomputers, where dramatic breakthroughs and improvements occur regularly. The first step in understanding how these breakthroughs can benefit the Intelligence Community is to familiarize Intelligence Community scientists and managers with the state of the art in concurrent processing machines and supercomputers.

To do this, a Concurrent Processing Symposium was sponsored by CIA and funded by DARPA; administrative support was provided by the BDM Corporation. The symposium was held on 15-17 July at the West Park Hotel, Tysons Corner, and on 18 July at CIA Headquarters. The two hundred fifty attendees were primarily from CIA but also from other government agencies in the Intelligence Community, including DARPA, Navy (NRL, NSWC), DOE, NSA, and FBI, as well as from the White House National Security Council, Air Force, and the AI Steering Group of the Intelligence Research and Development Council.

The three-day unclassified sessions were held to present (1) the currently available hardware; (2) applications for which the machines are intended and currently being used, including unclassified applications of interest to the IC; and (3) architectures and hardware that will be available within two years.

Speakers were drawn from major corporations involved with the hardware and architectures, university professors involved with the research, and government agencies. Topics ranged from an overview of conventional and emerging architectures to a discussion of applications, modeling, and simulations on supercomputers.

On the fourth day, panel discussions were held on classified applications of multiprocessors that would benefit the IC. Panel members presented their problems; manufacturer representatives gave a quick estimate of how their architectures would handle the problems.

The conference was videotaped and a conference *Proceedings* was compiled. Both are available upon request.

PAYOFF

The symposium was highly successful. Managers and scientists have been made aware of currently available hardware and architectures and how supercomputers can assist them with their particular problems. Enthusiasm has been generated about the benefits to the Intelligence Community of both current and future developments in supercomputers and concurrent processing machines. In addition, much beneficial interaction occurred among people from corporations, universities, and the government. Responses to evaluation forms rated the symposium as excellent. A follow-on symposium was suggested to cover future developments in architectures and software.

CONCURRENT PROCESSING SYMPOSIUM

AGENDA

STAT

MONDAY
Orientation
⬚⬚⬚⬚⬚⬚ ORD, CIA
    Symposium Chairperson

Welcoming Address
    Mr. R. E. Hineman, Deputy Director for
    Science & Technology, CIA

Overview of Conventional Supercomputer
  Architecture
    Dr. Signey Fembach, Consultant

Applications on Conventional Supercomputers
    Dr. John Connelly, Director of Office of
    Advanced Scientific Computing, NSF

Overview of Emerging Architectures
    Dr. Stephen Squires, DARPA

TUESDAY
Cray Architecture
    Dr. W. Jack Woriton
Modeling and Simulation on the Cray
    Dr. Ralph Brickner, Los Alamos
ETA Systems
    Dr. Charles Purcell
Denelcor HEP
    Dr. Burton Smith
Convex C-1
    Dr. Steve Wallach
Floating Point Systems FPS-264
    Dr. John Gustafson

LUNCHEON SPEAKER: Dr. William O. Baker,
Foreign Intelligence Advisory Board and Retired Chairman of
the Board, AT&T Bell Laboratories—"The Dimensions of the
Information Age"

Flex/32
    Dr. Nicholas Matelan
Warp Architecture and Applications
    Dr. H.T. Kung, Carnegie-Mellon University; Bruce Roberts,
      GE; A. D. Toll, Honeywell

Hypercube Architecture
    Dr. G.C. Fox, CalTech and JPL
Intel iPSC
    Dr. Cleve Moler
IBM RP3
    Dr. Greg Pfister

WEDNESDAY
Butterfly
    Dr. Randy Rettberg, BBN
Teradata Database Machine
    Dr. Phil Neches, Teradata
Fast Data Finder
    Dr. Kwang-i Yu, TRW
Ultracomputer
    Dr. Allen Gottlieb, NYU
Massive Memory Machine
    Dr. Richard J. Lipton, Princeton
Connection Machine
    Dr. Howard Resnikoff, Thinking Machines
LUNCHEON SPEAKER: Dr. Gary Demos,
Digital Productions

Concurrent Processing at TRW
    Dr. Charles Childress, TRW
Vision and Data Fusion
    Dr. Dan Dudgeon, MIT Lincoln Labs
Photointerpretation & Cartographic Data Bases
    Dr. Azriel Rosenfeld, University of Maryland
Benchmarking and Performance Engineering
    Dr. James Browne, University of Texas

WRAP-UP PANEL AND AUDIENCE DISCUSSION—TOPIC:
Factors Which Help Determine the Best Architecture for a
Given Application

THURSDAY
Panel #1: Imagery and Computer Graphics
Panel #2: Statistical Modeling and Fast Text Search
Panel #3: Past, Present, Future Needs in the
      Intelligence Community

TEXT RETRIEVAL CONFERENCE

KEY PERSONS:

CONTRACTOR: None

BENEFITING ORGANIZATIONS: CIA and other
Government Agencies

PROBLEM

ORD currently is supporting research and development into a number of information retrieval projects, including N-Grams, RUBRIC, Advanced Text Retrieval, and NoteCards, all of which are described in this Accomplishment Book. There is much interest in the strengths and limitations of each of these information retrieval techniques and how they compare. Are these projects all necessary or are they duplicating the same work?

PROBLEM SOLUTION

To address these issues, a Text Retrieval Conference was held to examine in detail the strengths and limitations of each of the information retrieval techniques and to identify their applications, concepts, and technologies.

The conference, which was held on 15 and 16 January 1985 at the Arlington Hyatt Hotel, was attended by seventy people. Most of the participants were from CIA; but the FBI, NSA, DARPA, and other organizations in DoD were also represented. Corporations and universities were represented by their employees who are currently doing text retrieval work for the Agency.

Formal presentations were given on N-Gram Indexing, Architectures for Text Retrieval and Handling, RUBRIC, and NoteCards. Presentations were made by the principal investigators from PAR Technology Corporation, Advanced Information and Decision Systems, the University of Utah, and Xerox SIS. The presentations were divided into two parts: nontechnical to present the overall flavor of the project, and technical to describe the project in detail.

To afford the opportunity for "hands on" experience, demonstrations of the project systems were held in a separate room. These demonstrations ran concurrently with the presentations, during breaks, and during the evening.

On the last day presentations were made by ORD and customers on the future needs and requirements of the Agency. A technical exchange followed in which the principal investigators described where their research is heading and speculated on the future. The meeting concluded with panel discussions on topics previously covered by each of the contractors.

The luncheon speaker, Dr. Bruce Croft, Professor, Computer and Decision Sciences Department, University of Massachusetts, Amherst, gave an informative presentation relating the past, present, and future of text retrieval. The conference was videotaped and a *Proceedings* was compiled. Both are available upon request.

PAYOFF

The objectives of the conference were achieved. Insight was gained into the strengths and limitations of each of the text retrieval projects, as well as into the differences and similarities between them. The differences were justification that each project has its own important contribution; the similarities

provided a basis for future and continued joint work between contractors. The conference also generated additional interest in these projects from other offices in the Agency and other government agencies.

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TEXT RETRIEVAL CONFERENCE

AGENDA

15 JANUARY (morning)—NONTECHNICAL PRESENTATIONS

Welcome by Dr. Philip K. Eckman, Director, ORD

STAT — Opening Remarks by ☐ C/PATG/ORD

Program Overview: Ten-minute introduction to projects by each
COTR, followed by a 25-minute overview by principal investigator.

STAT — ☐ COTR, ISRD/PATG
   Mr. Ray D'Amore, PAR Technology

STAT — ☐ COTR, ISRD/PATG
   Dr. Richard M. Tong, Advanced Information & Decision Systems

STAT — ☐ COTR, ISRD/PATG
   Dr. Lee Hollaar, University of Utah

STAT — ☐ COTR, AMRD/PATG
   Mr. William Liles, Xerox SIS

15 January (afternoon)—TECHNICAL PRESENTATIONS, with questions and answers at the end of each presentation.

   Mr. Clinton P. Mah, PAR Technology
   Dr. Richard M. Tong, Advanced Information & Decision Systems
   Dr. Brian P. McCune, AI&DS
   Dr. Lee Hollaar, University of Utah
   Dr. Frank G. Halasz, Xerox PACC

DINNER SPEAKER: Dr. W. Bruce Croft, Professor, Computer & Decision Sciences Department, University of Massachusetts

16 JANUARY

Presentation by ORD and Customers on Future Needs and Requirements of Agency

STAT — ☐ Senior Scientist, PATG/ORD

Technical Exchange
   Technical presentations by principal investigators on where research is heading and speculations on the future.

Panel Discussions on Previous Topics by Each Contractor

UNCLASSIFIED SS-7

CONFIDENTIAL

ARTIFICIAL INTELLIGENCE SYMPOSIUM

25X1

KEY PERSON:

CONTRACTOR:

BENEFITING ORGANIZATION: Intelligence Community

PROBLEM

Artificial intelligence (AI) is concerned with giving information systems more human-like abilities (such as seeing, hearing, planning, reasoning, or explaining their own behavior). Recent progress in artificial intelligence has generated considerable interest throughout the Intelligence Community in applying AI technology to the collection, processing, analysis, and production of intelligence. However, developing successful applications will require both broad Community awareness of AI technology and in-depth experience in the use of AI tools and techniques.

PROBLEM SOLUTION

In conjunction with the Artificial Intelligence Steering Group of the Intelligence Research and Development Council, ORD has sponsored annual symposia on Intelligence Applications for Artificial Intelligence. These symposia are intended to raise the general level of awareness of the Community concerning the science and technology of artificial intelligence and to stimulate thinking about how AI might best be applied to the Community's information problems.

The third AI Symposium was held on 19, 20, and 21 March 1985 at DIA Headquarters. Over 600 persons attended from the Community, industry, and academia. The Symposium featured technical presentations by AI researchers; summaries of major government programs, such as the Joint National Intelligence Dissemination System and the Software Engineering Institute; continuous product demonstrations by hardware and software vendors; and classified problem-examination sessions called Special Interest Working Groups. There were nine such working groups: Data Support to the Analyst, Image Understanding, Signal Processing/Analysis, Dissemination and Language Understanding, Strategic Defense, Indications and Warning, Collection Management, Decisions Under Uncertainty, and Training. Results of the discussions within each group were reported to the entire assemblage to assist in defining requirements areas for AI applications.

PAYOFF

The three AI Symposia have been highly successful in creating a broad awareness of the potential benefits of artificial intelligence for the Intelligence Community. A fourth symposium is planned for 1986. This continuing exposure to the most recent developments in AI will help the Community use its limited resources most effectively in coping with an increasing amount and variety of information.

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ARTIFICIAL INTELLIGENCE SYMPOSIUM

AGENDA

Keynote Speakers

John D. Macartney, Colonel, USAF, Commandant, Defense Intelligence College

James A. Williams, Lieutenant General, USA, Director, Defense Intelligence Agency.

Dr. Philip K. Eckman, Chairman, AI Steering Group, Office of Research and Development, Central Intelligence Agency.

Dr. Saul Amarel, Rutgers University

Technical Papers

Joint National Intelligence Development Staff
    Tom Bushbach, JNIDS
Architecture and Technology for a Strategic Surveillance Analysis System
    David S. Spain, Advanced Information & Decision Systems, Inc.
Reporter
    John Woods, TRW
A Knowledge-Based System for Space Threat Warning
    Christine A. Montgomery, Logicon, Inc.
Utility of Artificial Intelligence in Missile Typing
    Benjamin R. Peek
LES: A Generic Expert System
    Walton A. Perkins, Lockheed
Applications of Expert Systems to Training
    David L. Young, Mystech Associates, Inc.
Expert System Training at DEC
    Gerhard Friedrich, Digital Equipment Corporation
Big Oz: An Intelligent Information Management System for Analysts
25X1   [   ] CIA
AI Systems for Interpretation of Synthetic Aperture Radar
    Bobby Hunt, Science Applications International Corporation

Threat Assessment Tools for Operational Platforms
    Glen R. Allgaier, Naval Ocean Systems Center
The Artificial Intelligence Enemy Course of Action Evaluation Aid
    Michael L. Donnell, Science Applications International Corp.
Warning Analysis
    John McCreary, National Warning Staff
Inference Theory and the Value of Evidence
    David A. Schum, Rice University
Evidential Reasoning for C^3I
    John D. Lowrance, SRI International
Collection Management Enhancement
    Richard Scott, GTE
A Weapon System Model Using AI Techniques
    R. Allen Riley, Los Alamos National Laboratory
Distributed, Cooperating Expert Systems for Signal Understanding
    Mark A. Williams, DELFIN Systems
NoteCards: An Information Structuring Aid for Analysts
    Williams Liles, XEROX
An Evolving System for Image Understanding
    Julius F. Bogdanowicz, Hughes Aircraft

ARTIFICIAL INTELLIGENCE MANAGEMENT SEMINARS

25X1

KEY PERSON:

CONTRACTOR:

BENEFITING ORGANIZATION: Intelligence Community

PROBLEM

The popular media has recently reported many successful applications of Artificial Intelligence (AI). Claims have been made that AI programs have discovered mineral deposits, interpreted oil drilling charts, performed medical diagnoses as accurate as those performed by physicians, correctly interpreted passages of text, and configured computer components and systems. AI appears to be one solution to the Intelligence Community's problem of coping with both the increasing collection of data and the scarcity of technically qualified analysts. However, the Community's managers and programmers lack the familiarity with AI technology they must have before they can assess the actual prospects and limitations of Artificial Intelligence.

PROBLEM SOLUTION

In conjunction with the Artificial Intelligence Steering Group of the Intelligence Research and Development Council, ORD sponsored a series of instructional seminars to investigate the potential applicability of AI technology to intelligence problems. These seminars were organized to bring managers and programmers from the Agency and other Intelligence Community organizations up to date on the prospects and limitations of AI for the Community's information-handling problems. The seminars consisted of a series of six three-day courses attended by a total of 148 mid- and senior-level managers; a four-week knowledge engineering course attended by 18 programmers; a two-day software engineering course attended by 24 technical managers; and ten sessions on "AI Tools for Building Expert Systems" (with demonstrations by vendors) attended by a total of 52 different programmers and technical managers. Leading AI researchers from Yale University, University of Texas, University of Pittsburgh, and Ohio State University taught the courses.

During 1986 ORD will sponsor two-week courses on LISP programming, Logic programming, and knowledge engineering. The courses will focus on providing skill training in these AI areas for Agency scientists and engineers.

PAYOFF

Evaluations from participants in the seminars indicated that they perceived these seminars to be valuable and informative. AI was seen as showing promise of helping to resolve some problems but was not seen as a solution or a "quick fix" for all problems. Many participants suggested continuing such seminars in order to inform new managers about the most promising areas for detailed study and to help technical programmers focus on those areas. The knowledge gained from AI seminars will also help in preparing statements of work and in evaluating proposals pertaining to AI applications. Furthermore, an informed management will facilitate technology transfer, which should benefit the entire Intelligence Community.