software age

FEBRUARY 1969

You probably aren't our kind of engineer.

No offense intended. We just know what we want.

We're computer memory specialists. If you know our products, you know we're good.

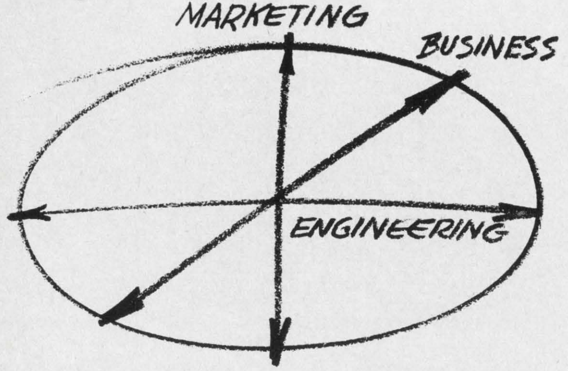
Not surprisingly, we're growing fast.

So we need engineers. Good minds. Good technical backgrounds. But that's not all.

You see, back when we were small we learned an important lesson. Each of our engineers had to get involved in everything: research, design, costing, marketing, production – you name it. Being involved, they became committed. And worked better for it.

That's how we got our reputation for doing what we do better than anyone else. We intend to keep it.

That's why we take such a close look at all applicants for our engineering positions. We'll talk to you about interests and aspirations and experience. And, at some point along the line, we'll draw this diagram:



It's the essence of what we mean by our kind of engineer. An interest in and understanding of all aspects of our company's activities. You could call it balance. Whatever it is, it works for us.

* * *

What can we offer you?

First, a good salary. (We want the best and we're willing to pay for it.) Second, the opportunity to advance rapidly along either engineering or administrative lines. (Lots of outfits will tell you this, then stick you in an isolation ward. We mean what we say.) Third, the opportunity to grow with the best engineering staff in the industry. Fourth, the satisfaction and pride of seeing the products you work on produced and sold.

* * *

We make memory systems and stacks and planes and printed circuits. We're looking to the future with research in plated wire and films. And we're in the process of introducing a brand new product: MAC 16, a compact, inexpensive Multi-Application Computer. Our division is going to keep right on growing. And we'll need even more of our kind of engineers.

If we sound like your kind of company and if you have an M.E. or E.E. degree and computer-related experience, let's get together.

Write me a letter: Mr. E. A. Gage, 6201 E. Randolph Street, Los Angeles, California 90022. Or, call me collect at (213) 722-6810.

Naturally, we're an equal opportunity employer.

LOCKHEED ELECTRONICS COMPANY
Data Products Division • Lockheed Aircraft Corporation

How far could you be a year from today at Xerox?

We can only give you an idea.

Because when you join Xerox, it's the beginning of an unpredictable interaction. You, with your unique set of interests and abilities. And Xerox, with EDP involved in nearly every phase of our operations.

You might start programming in sales, with systems analysis an increasing part of your job. Or manufacturing, where developing disc-oriented software might be a big part of your work. Or accounting, market research, or engineering where the scope is equally as broad and tangents interesting. Too, you'll get exposure to a variety of sophisticated systems, like our integrated Production Planning and Inventory Control System that oversees everything from inventory and bills of material to scheduling and workload distribution. Or, perhaps work on a long-range strategic competitive planning model.

As you become involved, you'll go deeper and deeper into the many phases of our operation . . . discovering how vital EDP is to Xerox. And uncovering — or discovering — areas where EDP's never penetrated.

The possibilities are intriguing. So is the potential. Because the kind of EDP exposure Xerox offers can open many doors to advancement. To programming specialization. Systems analysis. Functional specialization in one of the areas in which you've become interested. Even into management.

A college degree and/or experience with IBM 360 series systems using COBOL, the Univac 1108 using FORTRAN or COBOL, or IBM 7000 series using COBOL or AUTOCODER is desired. If you are interested in this rapidly growing field, give us the opportunity of listening to your ideas and aspirations.

These openings are in Rochester, New York. Please send your resume to M. H. Hartigan, Dept. MZ-69-B1, Xerox Corporation, P.O. Box 1995, Rochester, New York 14603.
An Equal Opportunity Employer (m/f)

XEROX

PROGRAMMERS/SYSTEMS ANALYSTS

consider the advantages of a career in connecticut

Come to Connecticut and enjoy sailing on the ocean, hunting and fishing in the rolling countryside, skiing in Vermont, a day trip to New York City or historic Boston . . . golf, tennis, camping or what-have-you. It's all within easy reach when you join up with P&WA's Information Systems Department. For this is the place to combine the daily challenge of an action-oriented career in Business Information Systems with the four season stimulation of leisure-time living in Connecticut.

Pratt & Whitney Aircraft is the world's leading producer of dependable jet engines. Now, more than ever, continuing expansion, diversification and promotion from within afford every opportunity for healthy growth and achievement for EDP professionals with up to ten years experience. Attractive openings exist at all levels of responsibility; preference will be given to applicants with recent experience using assembly language and/or COBOL.

A multiplicity of projects vary from simple card systems to complex on-line systems involving such projects as a Full Production Information System, Automated Financial Analysis and Reporting, and an Integrated Material Control System, including procurement, forecasting and scheduling. Tools include 360 models 20, 30, 40, and 50; tapes and random devices; data collection equipment; on-line facilities; DOS and OS.

If this sounds like your kind of action, why not send your resume to Mr. H.M. Heldmann, Professional Placement, Office A-43, Pratt & Whitney Aircraft, East Hartford, Connecticut 06108. An equal opportunity employer.

Pratt & Whitney Aircraft
U
DIVISION OF UNITED AIRCRAFT CORPORATION
A

software age

FEBRUARY, 1969 Vol. 3–No. 2

Copyright 1969, PRESS–TECH, Inc.

CONTENTS **PAGE**

Publisher ____ David W. French
Advertising Manager ____ Norman Brodsky
Production Manager ____ Betsy Pavkovich
Director of Circulation ____ Cheryl Miller
Circulation Manager ____ Judith Arnopolin

Circulation of this issue more than **110,000**

SOFTWARE AGE is published monthly
by PRESS–TECH, Inc.
P. O. Box 2076
2211 Fordem Ave., Madison, Wis. 53701
(608) 244–3561

Subscription free to qualified readers. Others, $10/yr. Individual copies, $1. Foreign subscriptions, $15/yr.

Main Sales Office: Norman Brodsky (Adv. Mgr.), P. O. Box 2076, *Madison, Wisconsin* 53701—Telephone (608) 244–3561.

Gerald Green, 60 E. 42nd, *New York, N. Y.*—Telephone (212) 697–5356.

Richard Faust, 9800 S. Sepulveda Blvd., *Los Angeles, California* 90045—Telephone (213) 776–0100.

Boston, Massachusetts 02021—Telephone (617) 542–1466.

Richard D. Clemmer, 27 Acoma Lane, *Collegeville, Pennsylvania* 19426—Telephone (215) 489–9141.

Richard Faust, *Palo Alto, California*—Telephone (415) 327–8340.

CONTROLLED CIRCULATION POSTAGE
PAID AT MADISON, WISCONSIN

THE HONEYWELL MAN:

a generation ahead

Conceiving today the computer techniques of tomorrow . . . the new ideas, the innovations that enable Honeywell to maintain its competitive edge . . . adding new impetus to Honeywell's growth in America's fastest growing industry.

The Honeywell Man is ahead of his contemporaries in other ways. Honeywell's unprecedented growth provides unlimited opportunities for personal advancement. And, today, opportunities are better than ever at Honeywell. New facilities have been added or started. The Technology Center in Waltham, Massachusetts, has been expanded. Requirements for Technical Specialists exist at all levels . . . with special emphasis on the following areas:

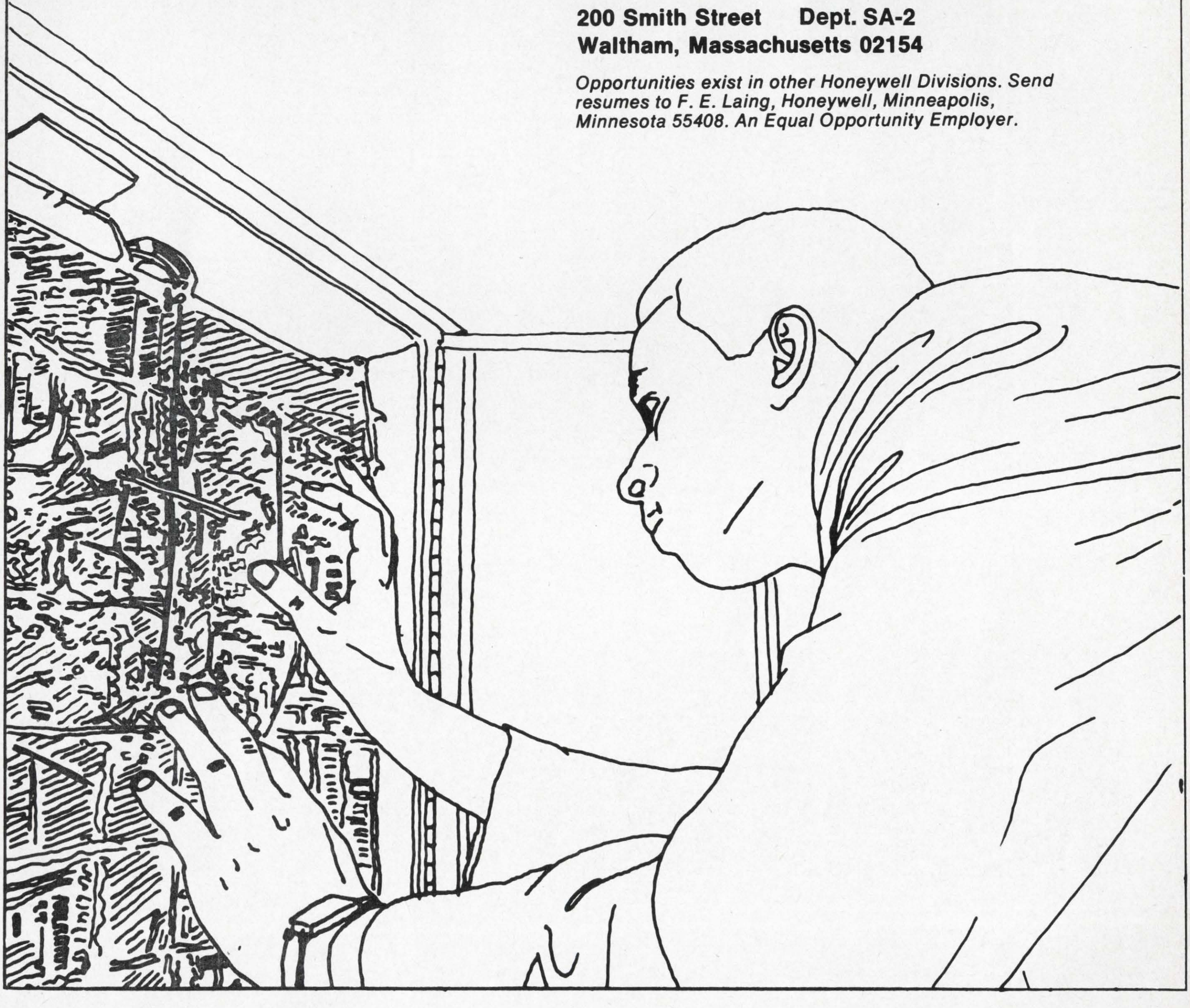
SOFTWARE SPECIALISTS:
☐ Mass Storage ☐ Communications Software ☐ Compiler Design ☐ Compiler Techniques ☐ Monitor Systems ☐ Data Management ☐ Software Language Development ☐ Software Product Test ☐ Operating Systems Software Design ☐ Software Technical Writers

Please forward your resume to Mr. Stephen Edmonds.

The Other Computer Company:
Honeywell

200 Smith Street Dept. SA-2
Waltham, Massachusetts 02154

Opportunities exist in other Honeywell Divisions. Send resumes to F. E. Laing, Honeywell, Minneapolis, Minnesota 55408. An Equal Opportunity Employer.



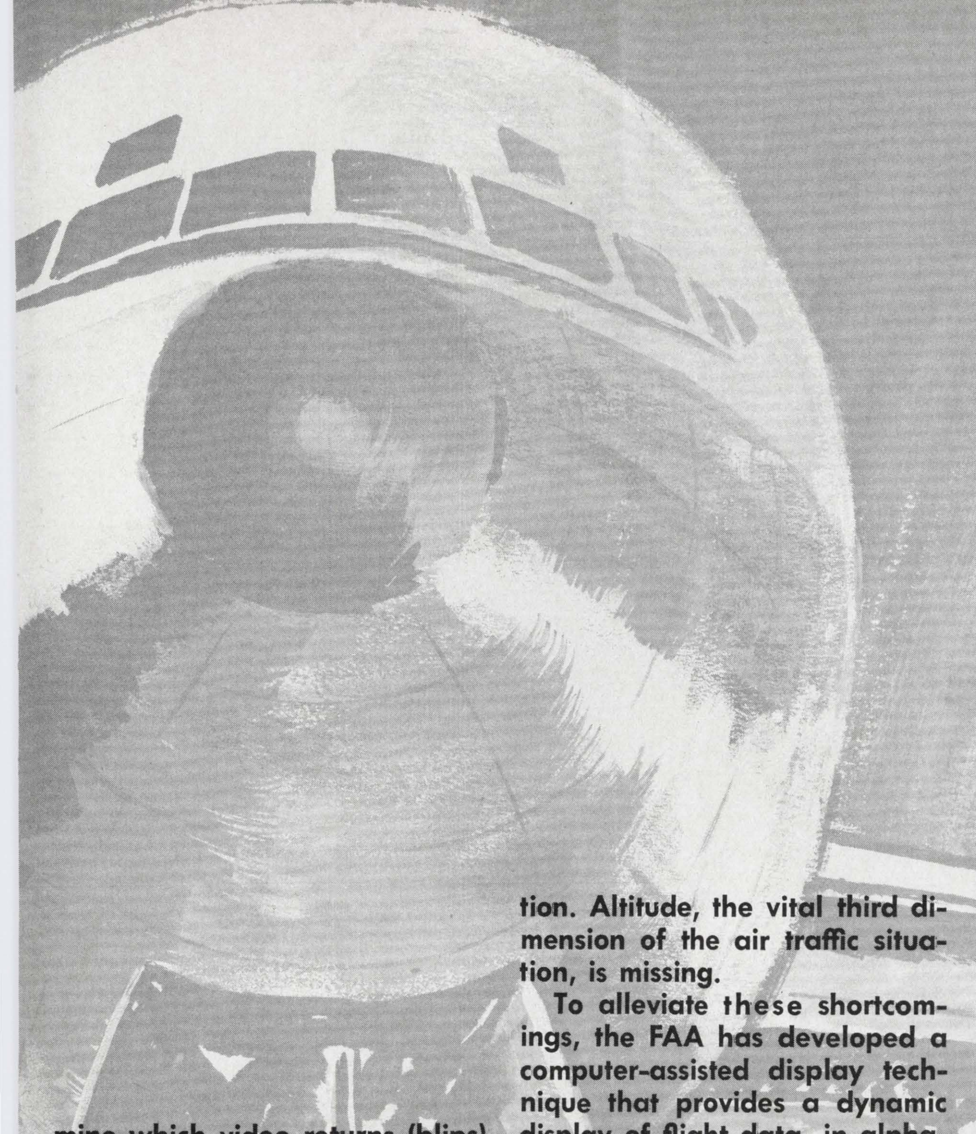
DATA PROCESSING IN THE NEV

■ The rapid growth of aviation activity has created a need for improved air traffic control capabilities. Recent improvements in air traffic control systems have been directed toward achieving increased efficiency in the utilization of airspace, and increased traffic-handling capability with no compromise to safety. A significant development is the introduction of automatic data processing techniques to provide direct assistance to the air traffic radar controller.

Through radar observation, pilot reports, and flight plans the controller follows those aircraft on instrument flight rules (IFR) in his area of jurisdiction. He keeps the aircraft safely separated by voice radio instructions to the pilots. As a flight progresses through various sectors of the airspace, control responsibility for the aircraft is transferred (handed off) from one controller to another.

The airspace surveillance required by an air traffic control ground facility is provided by radar and beacon sensor systems. The radar and beacon equipment both derive aircraft position (azimuth and slant range) information from the antenna orientation and the time delay between transmitted and received pulses of r–f energy. Whereas the radar receives reflected energy, the beacon equipment triggers and receives signals from a transponder aboard the aircraft. The transponder reply signals can be coded to convey aircraft identity and altitude. However, the sensor data must be presented to the controller in such a manner that he can readily assimilate it. The conventional radar plan position indicator (PPI) has several shortcomings:

1. The controller has to deter-



The photos on these pages show a central air traffic control facility for New York's airports. The photos were shot while the facility — called a Common IFR Room — was being installed. The room features a system that provides alphanumeric flight data directly on the controller's radar display. This system's performance and flexibility are enhanced by use of digital computers and real time data processing techniques.

mine which video returns (blips) on the radar scope correspond to aircraft of interest to him.

2. He must then keep the identity of each aircraft properly associated even in congested traffic or clutter areas where many video returns appear in proximity.

3. With the radar PPI he has a two dimensional representation. Altitude, the vital third dimension of the air traffic situation, is missing.

To alleviate these shortcomings, the FAA has developed a computer-assisted display technique that provides a dynamic display of flight data, in alphanumeric (letters and numbers) form, directly on the radar scope. This technique provides the controller with aircraft identity and altitude information continuously associated with the proper video returns. A prototype system, the advanced radar traffic control system (ARTS), has been in operation for several years at the terminal facility in Atlanta, Georgia.

A second installation, the New York Center beacon alphanumeric (NYCBAN) systems, located at the FAA air route traffic control center (ARTCC) on Long Island, was put into operation early in 1967. A new control facility, serving the New York terminal area, is now opera-

ORK COMMON IFR ROOM

ROBERT H. ANDERSON

If you've ever had the urge to program today's most powerful computers...

now is the time to make your move!

We have key positions open on a number of our programming teams. Opportunities for you to work with our powerful 6000-series systems, and the new super-scale 7600. Computers of this size will be one of the fastest growing segments of the industry for years to come. Right now, you have a rare opportunity to get in on the ground floor. Choose from openings in the Minneapolis area, at Palo Alto, California and a number of other locations.

Have you programming expertise along lines such as machine and assembly languages / real-time telemetry / data reduction / time sharing / communications / linear programming / management information systems / executive systems? If so, let's get together.

Have you experience in fields such as steel, petroleum, finance, insurance, education? If you have, we are even more eager to talk to you.

Have you programmed big systems? If your answer is yes, Control Data is your next logical move up.

Have you the educational background — usually a degree in an appropriate discipline, coupled with two years or more experience? (Possibly including A/D conversion, software design, graphics and remote terminals?) If so, this is your chance to make the most of your know-how.

If we're talking your language, phone or write directly to:
R. D. Higgons . . . Special Systems Division, Control Data Corporation,
4201 Lexington Avenue North, St. Paul, MN 55112; Phone 612-631-0531

To investigate other opportunities, nationwide, send your résumé to B. E. Grylewicz,
Control Data Corporation, 8100 34th Avenue South, Minneapolis, MN 55440.


CONTROL DATA
7600

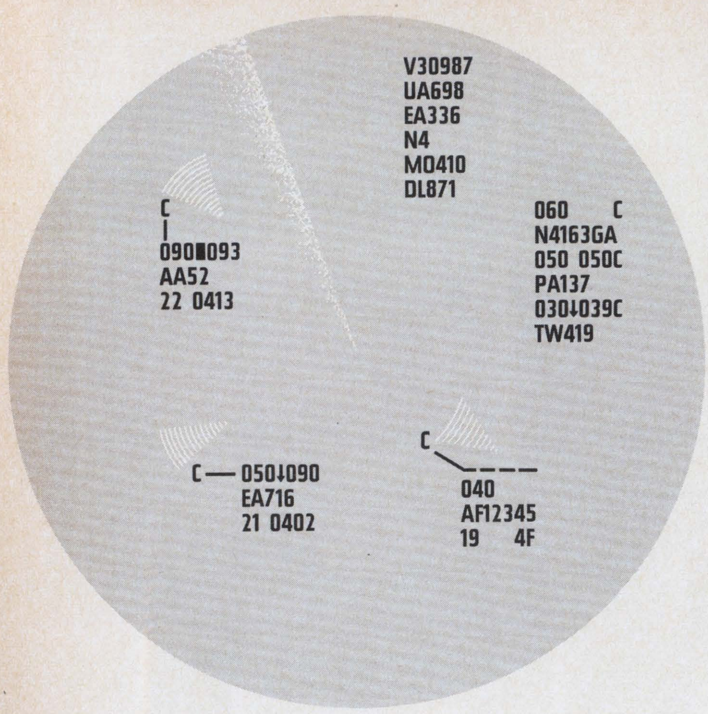
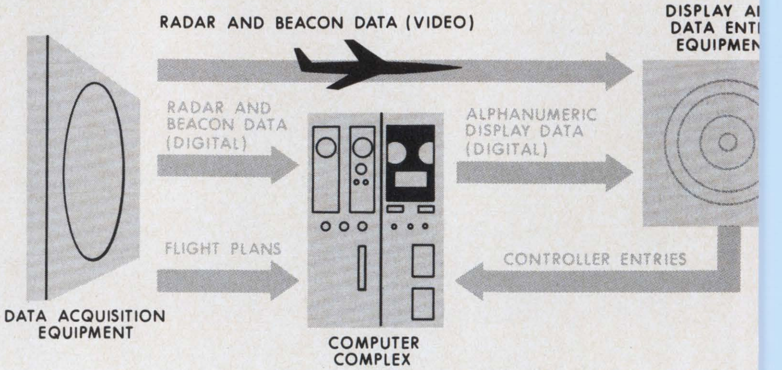


Fig. 1—Computer-controlled alphanumeric flight data is superimposed over normal video on the controller's radar scope. The three alphanumeric "tags" shown in this illustration are automatically following radar and beacon video returns. Relocatable data tables (upper right guadrant) display pending flight and aircraft in holding patterns. (Video map, ground clutter, interference, and noise, which complicate the real radar display, have been omitted for clarity.) Fig. 2 (below) shows the two information paths to the display equipment: a direct video path that provides sensor data in the normal manner; and a digital path, via the computer for alphanumeric data.



tional. It is the data processing capability of this facility, the Common IFR Room, that is the subject of this article.

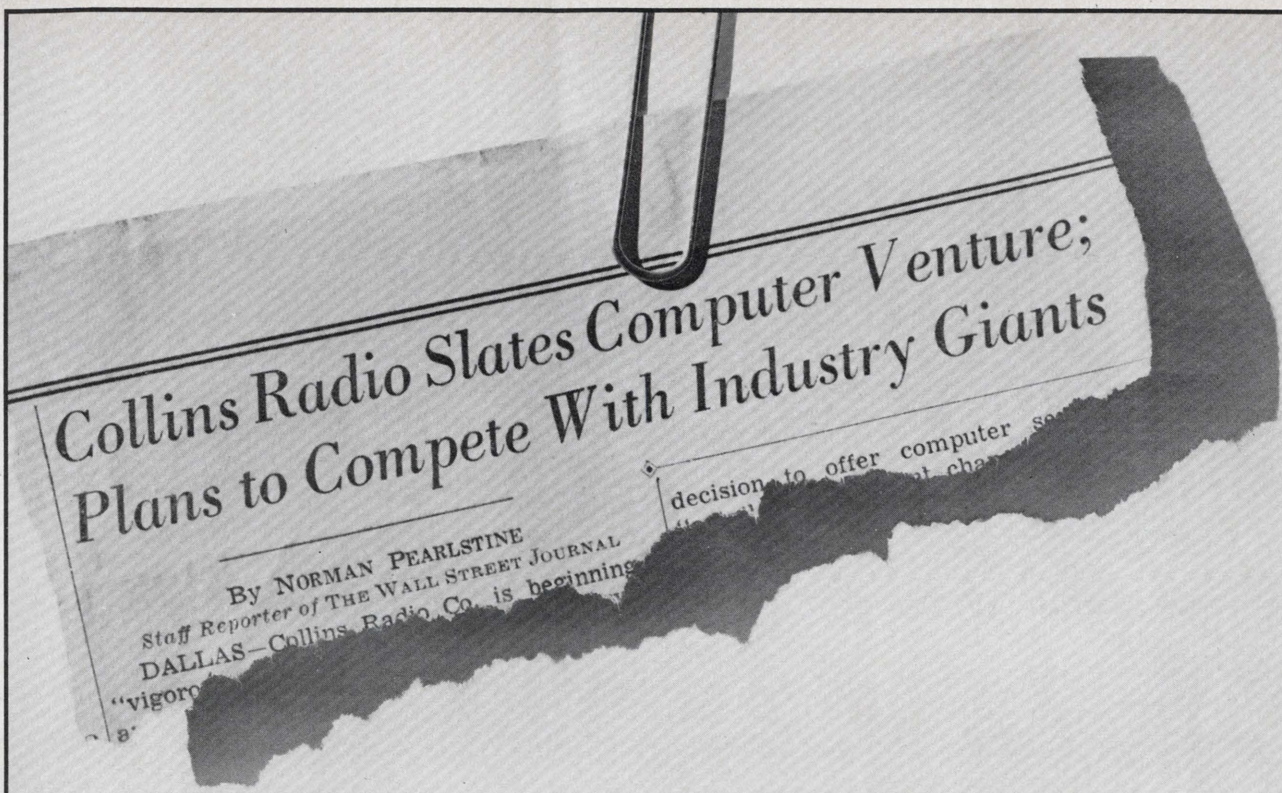
Common IFR Room. The New York terminal area is one of the busiest air traffic control complexes in the world. It encompasses three major airports and numerous satellite airports each of which accommodates instrument flight traffic. The control of terminal operations has been divided among three separate control facilities with a portion of the available airspace assigned for the exclusive use of each. The operating quarters (IFR Rooms) have been located at Kennedy International, Newark, and LaGuardia Airports.

These installations are being combined to provide a common centralized terminal area control facility located at Kennedy International Airport. A common IFR room will permit more efficient utilization of airspace, and will minimize delays by providing flexibility in the routing and control of flights. From this central control room, arrival and departure operations at all of the airports can be controlled on a fully integrated basis. Since controllers for the different airports work side-by-side in the same room, it becomes much simpler to coordinate their actions. It is not necessary to waste valuable airspace to provide buffer zones between operations controlled by separate facilities. Furthermore, personnel controlling aircraft in the same general proximity actually share the same displays, including large-screen displays, which provide a common reference source for all control teams.

The individual controller radar scopes and two large-screen radar displays are all augmented with alphanumeric capability. Under computer control, pertinent flight data, including aircraft identity and altitude, is electronicaly superimposed as tag-like data blocks adjacent to the appropriate radar video returns (see Fig. 1). The alphanumeric tags automatically follow the video while the aircraft maneuver through the terminal area.

There are significant advantages in having identity and altitude continuously associated with the radar presentation. Even a skilled controller, adapt at interpreting the radar picture, presently expends considerable effort just to identify the video returns of aircraft under his control. He also relies on pilot reports for altitude information. The amount of attention and communication required increases rapidly with the number of radar targets involved. By assisting the controller in this task, the alphanumeric display system permits him to focus more of his attention on the problem of controlling aircraft. In addition, it reduces the amount of controller-pilot communication required.

A secondary benefit is the manner in which this display technique facilitates aircraft handoffs within the Common IFR Room. When responsibility for an aircraft is transferred from one man to another, the controller initiating the handoff



Collins Radio Slates Computer Venture;
Plans to Compete With Industry Giants

By Norman Pearlstine
Staff Reporter of The Wall Street Journal
DALLAS—Collins Radio Co. is beginning
"vigor

decision to offer computer se

Collins' New Data Program Creating New Opportunities

Collins' C-8500 C-System gives users the first completely integrated system with virtually unlimited expansion capability.

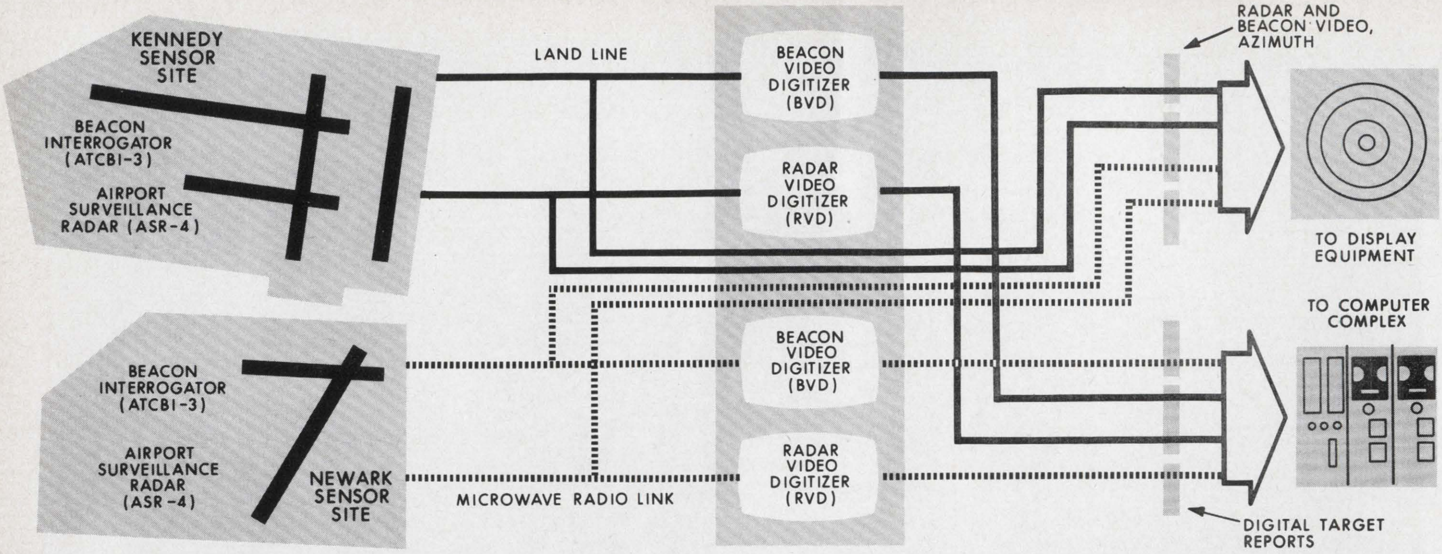
This new concept in computer applications is creating exceptional career opportunities for: Programmers, Hardware Diagnostic Programmers, Circuit Design Engineers, Memory Design Engineers, Digital System Engineers, Digital Systems Analysts, Logic Design Engineers, Mechanical Engineers, Data Systems Analysts and Applied-Systems Analysts/Programmers.

Engineers, Physicists, Mathematicians, and those with degrees in other physical sciences (1 to 5 years experience) will find an outstanding opportunity to learn and progress rapidly in the data field, even without previous data experience.

Please send your resume in confidence to Manager of Professional Employment, Dept. 102, Collins Radio Company, Dallas, Texas 75207; Cedar Rapids, Iowa 52406; Newport Beach, California 92660; or Toronto, Ontario.

an equal opportunity employer

COLLINS



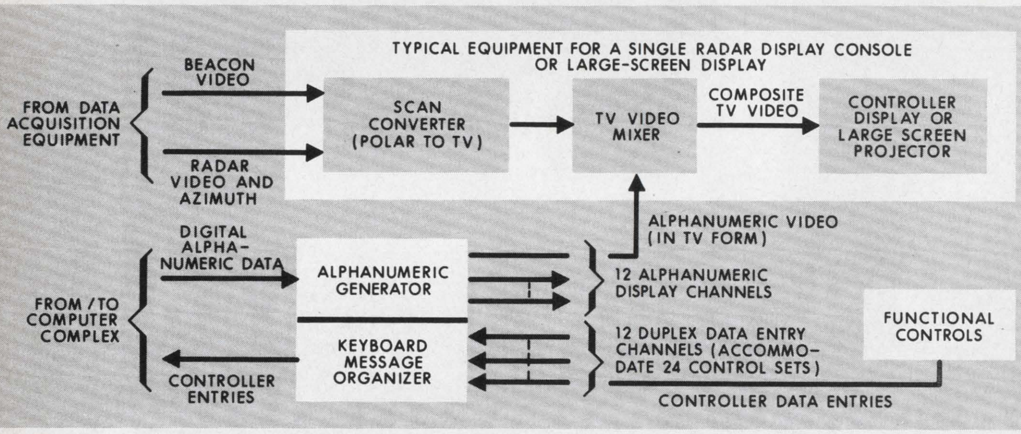


Fig. 3 — Major items of data acquisition equipment. Radar and beacon sensors at Kennedy and Newark airports transmit data to digitizing equipment at the Common IFR Room at Kennedy.

In Fig. 4, alphanumeric video and scan-converted radar and beacon video are mixed to provide a composite TV display picture. The Common IFR Room will be equipped initially with 8 RBDE-5's and two large-screen displays.

pushes a button to cause the tag for the aircraft to appear on another controller's display. The recipient then pushes a button to signify that he has accepted control of the aircraft. Permanent transfer of control and alphanumeric data is thereby accomplished by the computer, with little or no verbal exchange of aircraft target information.

System Configuration. The hardware for the Common IFR Room system includes data acquisition equipment, display equipment, and a computer complex (Fig. 2).

Data acquisition equipment—Surveillance of the volume of airspace comprising the New York terminal area is provided by radar and beacon sensors (Fig. 3) located at two sites: Kennedy and Newark Airports. Each site is equipped with an airport surveillance radar (ASR-4) and a beacon interrogator (ATCBI-3). The radar and beacon systems provide a 60-mile radius of coverage from each site. Wideband transmission media feed the radar and beacon video, trigger signals, and antenna azimuth from the sensor sites to the Common IFR Room facility. The Kennedy radar uses a land line, while a radio microwave link is employed for the remote Newark site.

The beacon system acquires data for transponder-equipped aircraft. Many commercial aircraft presently have transponders capable of reporting identity and altitude. It is anticipated that all commercial aircraft operating in the United States will have transponders within several years. The radar provides redundant coverage for these aircraft and also accommodates aircraft that do not have transponders. The latest beacon transponders are capable of transmitting any one of 4096 discrete identity codes as selected by the pilot. This permits the aircraft to be assigned a unique code. However, some transponders still in use are limited to 64 codes, and the same identity code is often assigned to more than one aircraft. Transponders equipped for altitude re-

Where in the world would you like to work?

THE BEST OPPORTUNITY MAY BE IN YOUR OWN CITY!

American Computer Personnel and its affiliates are management consultants with extensive experience in the data processing field. We specialize in the recruitment of professional personnel for hundreds of leading computer users from coast to coast.

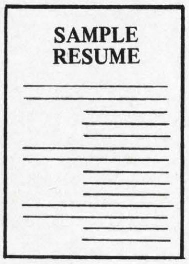
We know where the best data processing opportunities are located through our regular contact with our client companies. We visit client locations as often as possible to evaluate organizational environments, operational objectives, personnel requirements, and personal incentive programs.

Our careful evaluation of each opening enables us to provide you with selective exposure to a wide range of unusual opportunities. Many of these positions have never been advertised and some are listed with us on an exclusive basis.

Our current file includes positions ranging up to $16,000 for COBOL, BAL and PL-1 programmers; $22,000 for systems engineers and analysts; $25,000 for computer salesmen; and $30,000 for data processing managers and executives.

You may be qualified for one of these outstanding positions, but you cannot be considered unless you write, call or visit one of our offices now. There is no obligation to you of any kind.

Just send us your resume or complete the confidential inquiry form in this magazine. If you want to develop a new resume, circle our number on the reader service card and we will send you a Sample Resume with our compliments.



Contact the office nearest you today!

EAST COAST

JOHN TUTUNJIAN
AMERICAN COMPUTER PERSONNEL
641 LEXINGTON AVENUE
NEW YORK, NEW YORK 10022
(212) 758-3760

MIDWEST

WILLIAM H. LEINBACH
AMERICAN COMPUTER PERSONNEL
430 N. MICHIGAN AVENUE
CHICAGO, ILLINOIS 60611
(312) 729-0610

WEST COAST

LORNE D. EVJE
COMPUTER PERSONNEL AGENCY, INC.
12 GEARY STREET
SAN FRANCISCO, CALIFORNIA 94108
(415) 982-0840

Affiliated offices being established in other major cities.

A C P

AMERICAN COMPUTER PERSONNEL, INC.

430 NORTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60611 • (312) 729-0610

ALL INQUIRIES HELD IN STRICT CONFIDENCE

ALL FEES PAID BY CLIENT COMPANIES

For more information, circle No. 11 on the Reader Service Card

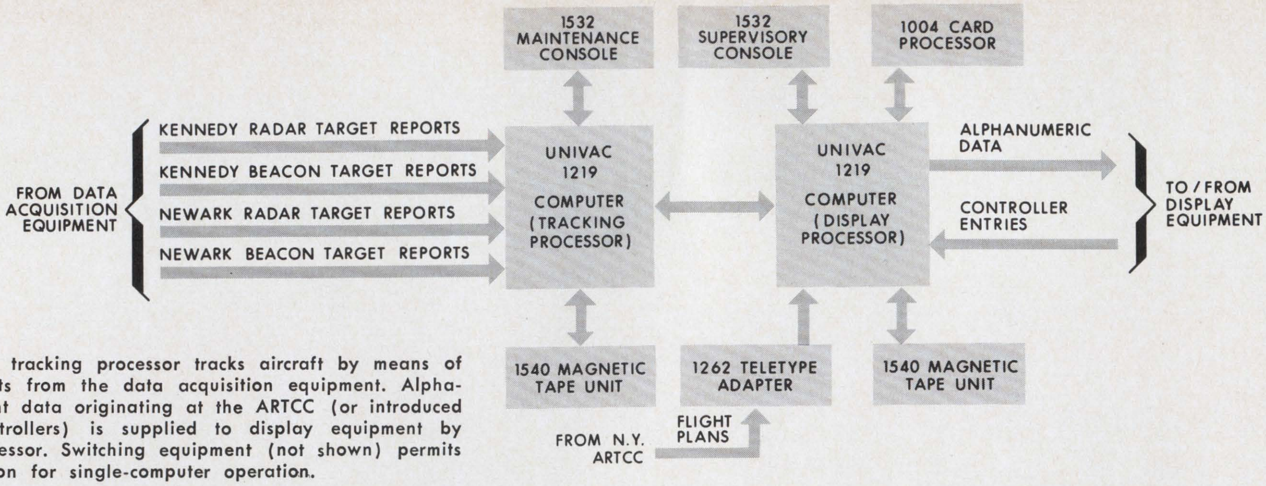


Fig. 5—The tracking processor tracks aircraft by means of target reports from the data acquisition equipment. Alphanumeric flight data originating at the ARTCC (or introduced by the controllers) is supplied to display equipment by display processor. Switching equipment (not shown) permits reconfiguration for single-computer operation.

porting transmit data that is encoded directly from a pressure-sensing altitude transducer in the aircraft. The transmitted altitude data is measured in 100-ft increments with respect to a standard pressure of 29.92 inches mercury.

Analog radar video, although suitable for PPI displays, cannot be used directly by the digital computer complex. Therefore, a radar video digitizer (RVD) is employed for each radar to convert the analog data into digital form. The RVD quantizes the video signal, correlates returns from successive radar pulses, detects radar targets, and determines target range and azimuth. It provides the computer with target reports in digital form containing the range and azimuth of each detected target.

Beacon replies are in the form of coded pulse trains. Like radar video, these signals are unsuitable for direct processing by a computer. For each beacon system, a beacon video digitizer (BVD) isolates the replies, correlates replies from successive interrogations, detects beacon targets, and determines target range and azimuth. For each detected target, the BVD provides a digital target report to the computer. In addition to range and azimuth, the target report includes transponded identity code and altitude when this information is received in ungarbled form.

Display equipment—The Common IFR Room is equipped with radar bright display equipment (RBDE-5) modified to include alphanumeric capability (Fig. 4). In addition, the standard 22-inch and 16-inch display consoles are supplemented with large screen projection displays. Eight individual consoles and two 9-by-12-ft display screens provide a composite picture of radar and beacon video and computer-processed alphanumeric flight data.

The radar display utilizes a storage tube scan-conversion principle whereby the sensor video is converted from its original polar (range and azimuth) form into a television-type rectilinear scan before it is displayed. The resulting bright high-resolution (945 lines) presentation does not require a low ambient light environment usually necessary with radar displays. Since each display unit is essentially a TV monitor, alphanumeric data originating in the computer complex must be changed into TV form before it can be displayed. This task is performed by an alphanumeric generator, which accepts coded digital data from the computer complex and converts it into TV form signals. Alphanumeric TV signals from the generator are then mixed with radar and beacon TV signals from a scan converter, and the resulting composite is dis-

ASSIGNMENT: DESIGN OR PROGRAM A COMPLETE ORDER ENTRY SYSTEM ON LINE TO A 360/65

How does that grab you !?

If that assignment brought a glint to your eye, read on. There are more. *Like designing or programming a data base for over 300,000 parts . . . or mathematical and simulation models of VTOL aircraft . . . or software in support of a real-time data acquisition and reduction system, airborne computers or a major retrieval system for technical data.* We could go on, but that will give you the idea.

If this is the kind of career excitement you relish, maybe you should get involved with us. Get involved with far-out programs that will hone your abilities to a fine edge. You'd be joining an innovative group dedicated to producing the most advanced VTOL aircraft—high-speed TurboTrains—and high-performance marine vehicles. *And the computer systems to support them.*

Your tools will be bright and shiny. Our inventory includes UNIVAC 1108's and IBM 360's with graphics and teleprocessing.

If you're ready for new maturity, we want to talk careers with you. We have exceptional assignments at all levels of experience for: **Programmers and Analysts in both Commercial and Scientific fields.**

Send your resume in confidence, stating salary requirements, to:

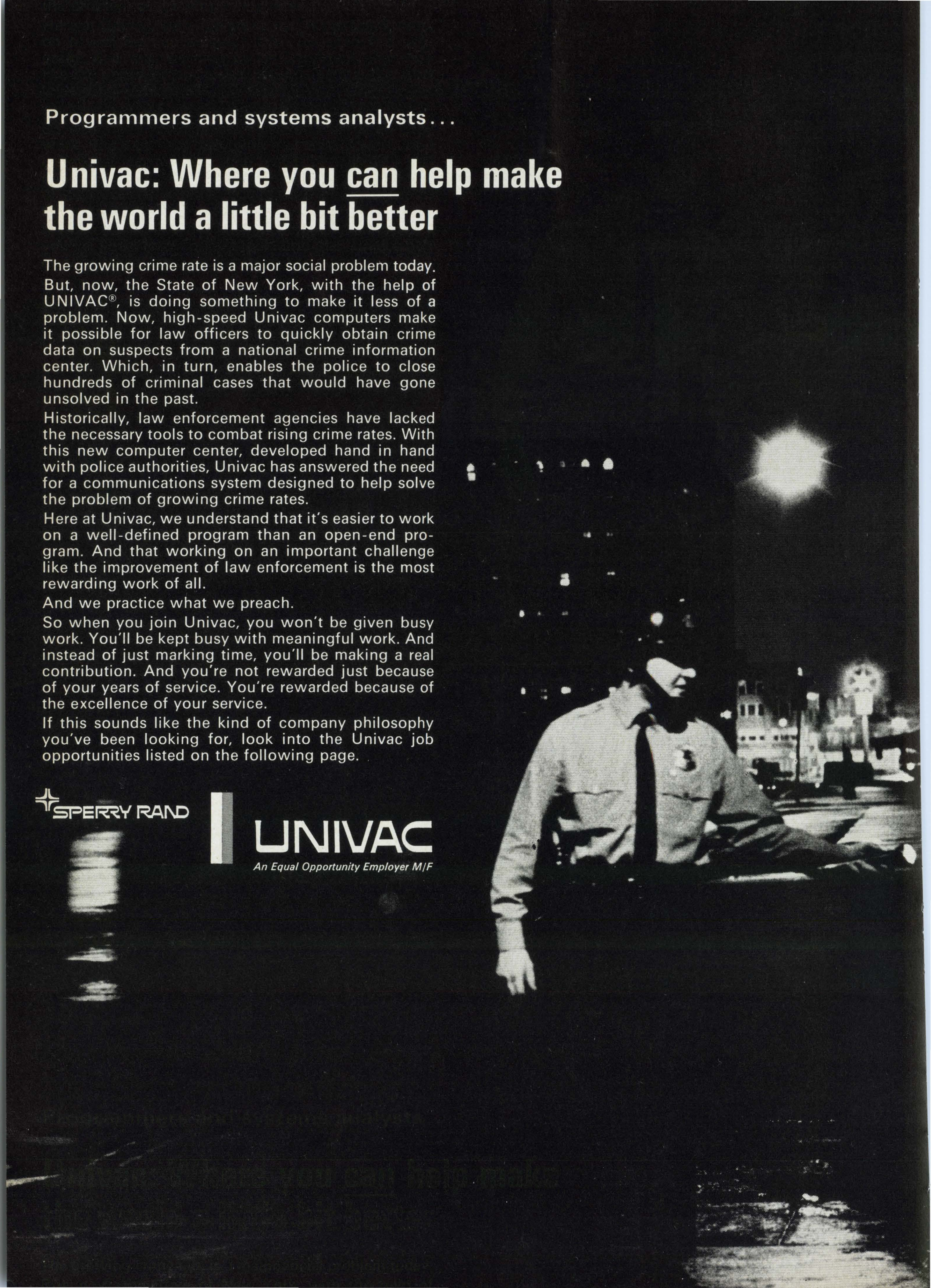
MR. LEO J. SHALVOY, PROFESSIONAL EMPLOYMENT.

Sikorsky Aircraft

DIVISION OF UNITED AIRCRAFT CORPORATION

STRATFORD, CONNECTICUT

An Equal Opportunity Employer



Programmers and systems analysts...

Univac: Where you can help make the world a little bit better

The growing crime rate is a major social problem today. But, now, the State of New York, with the help of UNIVAC®, is doing something to make it less of a problem. Now, high-speed Univac computers make it possible for law officers to quickly obtain crime data on suspects from a national crime information center. Which, in turn, enables the police to close hundreds of criminal cases that would have gone unsolved in the past.

Historically, law enforcement agencies have lacked the necessary tools to combat rising crime rates. With this new computer center, developed hand in hand with police authorities, Univac has answered the need for a communications system designed to help solve the problem of growing crime rates.

Here at Univac, we understand that it's easier to work on a well-defined program than an open-end program. And that working on an important challenge like the improvement of law enforcement is the most rewarding work of all.

And we practice what we preach.

So when you join Univac, you won't be given busy work. You'll be kept busy with meaningful work. And instead of just marking time, you'll be making a real contribution. And you're not rewarded just because of your years of service. You're rewarded because of the excellence of your service.

If this sounds like the kind of company philosophy you've been looking for, look into the Univac job opportunities listed on the following page.

SPERRY RAND

UNIVAC

An Equal Opportunity Employer M/F

played. The alphanumeric generator has twelve independent alphanumeric video channels individually addressable by the computer complex. Each display console or large screen projector receives and displays flight data blocks from one or more alphanumeric channels. In addition, common data, in the form of single symbols at the position of each controlled aircraft in the system, is distributed to all display channels.

The displays are updated by the computer complex every two-and-one-half seconds to provide a dynamic picture of air traffic. Between times, the current alphanumeric video for each display channel is recorded on a magnetic drum within the alphanumeric generator. This video is then played back cyclically in synchronism with the TV raster to maintain a flicker-free display.

The manual controls that are present at each operating position enable the controller to introduce commands, alphanumeric data, and aircraft position coordinates into the computer complex. These controls include command pushbuttons, an alphanumeric keyboard and a cursor control. Nine broad command categories are defined for use by controllers in the Common IFR Room, and each can be further qualified by up to ten specific *modifiers,* called *functions.* Supplemental data, such as aircraft identity or assigned altitude, is entered through the alphanumeric keyboard when required. The cursor control is used to position a small movable cursor symbol on the display. The position coordinates of this cursor symbol can be entered into the computer for the controller to specify the location of an aircraft or a data block.

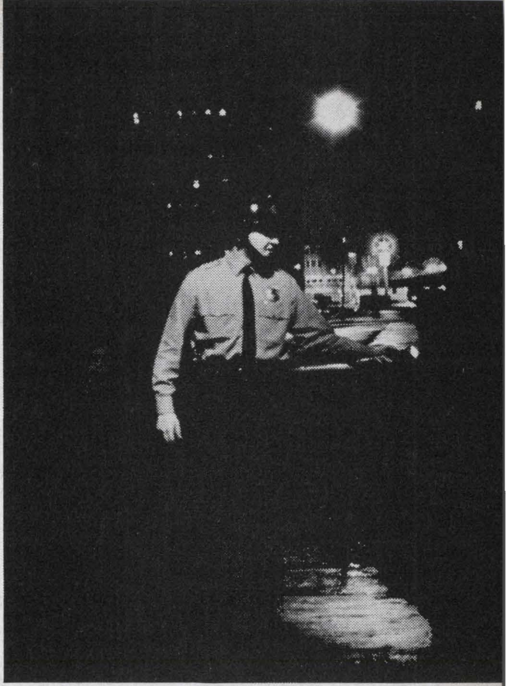
Computer complex—The computer complex (Fig. 5) tracks the sensor inputs, associates flight plan data with tracked aircraft, and supplies alphanumeric information to the controller displays. Two UNIVAC® 1219 general-purpose digital computers provide the system with a capability for arithmetic computation, logical decision-making, data storage, and over-all system coordination.

The computer complex includes other equipment items commonly found in a data processing application. Magnetic tape units provide permanent storage for the computer programs, and are used to load the programs into computer memory. In addition, selected data obtained during system operation is recorded on magnetic tape for future processing and analysis. The input–output console, containing a low-speed printer, typewriter keyboard, and paper tape facilities is provided to permit the watch supervisor to communicate with the computers. This console, designated the supervisory console, is used to enter variable parameters (such as time or altimeter setting) required by the system. High-speed printing and punched card capability for the 1219 computers is provided by an on-line 1004 card processor.

The computer complex is connected to a teletype circuit, which originates in the air route traffic control center located at Long Island–McArthur Airport. A computer at the center transmits flight plan data for future flights to the Common IFR Room. The serial teletype signal is converted into parallel digital format by an adapter and fed into one of the 1219 computers. Automatic insertion of flight plan data is a significant advance over previous prototype alphanumeric systems, because it relieves the controller of the task of manually entering this data via a keyboard.

Data is transferred between the 1219 computers and the other devices by means of high-speed digital input or output channels. Each computer has 16 bidirectional channels to accommodate concurrent communication with all of the hardware in the computer complex as well as with the data acquisition and display equipment. The system configuration has been made flexible by a manual cable-switching arrangement that allows each external device to be connected to either computer. Normally both computers share the data processing load. One, the tracking processor, performs an aircraft tracking function, while the second, the display processor, provides alphanumeric data to the display equipment. However, if one 1219 should be unavailable, the system can be reconfigured to operate with reduced capability in a single-computer mode.

The computers perform data processing functions under the control of stored instruction sequences (programs). This a real-time system—



it keeps pace with events in the air traffic environment. The tracking processor and the display processor, although they exchange data, are completely independent asynchronous computers. They execute their programs simultaneously, thereby providing a parallel processing capability. Within each computer, however, the internal processing tasks are performed on a time-shared basis. To accomplish this, the sequence of instructions associated with each major processing task is organized into a module called a subprogram. In addition, each computer employs an executive control subprogram that performs no processing of its own, but serves to control the execution of the task subprograms. The subprograms are not executed in a fixed sequence. Rather, selection of a task depends upon an assigned priority scheme that adapts to changes in the system's processing load and permits the processor to respond to asynchronous external demands. Some tasks are executed on the basis of a fixed time interval, while others depend upon the completion of prerequisite processing or external events.

Data Inputs. The principal inputs to the computer complex are target reports, flight plans, and controller entries.

Target report messages enter the tracking processor through independent input channels from each of the four video digitizers. To facilitate efficient target report processing and tracking, each digitizer also transmits sector mark messages at 11.25-deg intervals of antenna azimuth rotation. Thus the 360-deg azimuth scan is divided into 32 sectors of convenient size for segmented, real-time processing. Approximately once per sector (125 msec), all newly received target reports are examined for format and completeness. They are ordered by sector and stored in the computer's core memory for subsequent use by

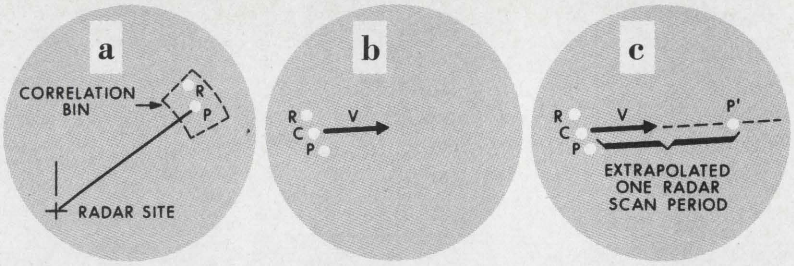


Fig. 6—Tracking. For correlation, the track is associated with the new sensor target report by beacon identity match or by position. Positioned correlation (a) finds target report *R* within bin, centered about predicted track position *P*. For correction, (b) present position C is calculated along with velocity vector *V*, using damping factors dynamically related to track-data reliability. For prediction (c) track is extrapolated along velocity vector to *P'*, a scan period in the future. *P'* becomes new position of bin when track is processed on next scan.

High-speed digital data processing equipment will play an important role in the New York Common IFR Room which is shown in the photo while equipment was being installed and tested during October. The two large screen displays (one shown illustrated in the photograph) and eight display consoles provide a composite picture of sensor video and the computer-processed alphanumeric information.

the tracking function. Depending upon the density and distribution of air traffic, and the presence of noise and clutter, numerous target reports may be received in some sectors and few in other sectors. However, sufficient storage is provided in the tracking processor to accommodate 48 target reports per sector from each radar digitizer plus 24 target reports per sector from each beacon digitizer. Because of the tracking technique, the reports received in the most recent sixteen sectors must always be available.

Flight plan messages received via teletype line from the New York ARTCC are automatically fed into the display processor. A flight plan includes aircraft identity, route, estimated time of arrival (ETA) or departure (ETD), aircraft type, approach fix, departure or destination airport, and assigned beacon code. The display processor verifies the format and content of the flight plans and stores them in core memory for future use. Since this data may be received considerably in advance of the flight arrival or departure time, the display processor provides storage space for 250 flight plans.

The ETA or ETD of each stored flight plan is periodically checked by the display processor. Ten minutes before the aircraft is due to arrive or depart, the flight plan data is examined and the computer determines which controller will be initially responsible for the aircraft. Although active tracking does not begin at this time, the computer assigns a track number, and causes the aircraft identity to be displayed in a tabular STORE list on the appropriate controller's radar display. This informs the controller of the pending arrival or departure and allows him to plan for it.

Controller entries transmitted as digital messages originating at the controller data entry devices (keyboard, cursor, etc.), are channeled into the display processor. These message contains category and function elements that describe the action desired by the controller as well as amplifying data in the form of alphanumeric and cursor coordinates. After the parity and format of a message is validated, the message is interpreted and executed by the display processor program. A controller entry affecting the

in any language...
in every way...
in EDP placement...

ESP IS NUMBER

RPG ARGUS SPS A
MAP COBOL BAL S
ODER ALC JOVIAL
FAP FORTRAN SAP NEAT
SALTRITE QTAM ALGOL S
FARGO RPG ARGUS SPS A
CODER MAP COBOL BAL S
EASYCODER ALC JOVIAL
RTRAN SAP NEAT
TE QTAM ALGOL S
RPG ARGUS SPS A
MAP COBOL BAL S
ODER ALC JOVIAL
RTRAN SAP NEAT
TE QTAM ALGOL S
RPG ARGUS SPS A

ESP has many more offices than any other EDP agency.

ESP has offices in many more cities than any other EDP agency.

ESP network has many more placement directors than any other EDP network.

ESP serves many thousands more EDP installations than any other EDP agency.

ESP places many thousands more EDP personnel than any other EDP agency.

This all adds up to a great number of advantages you would not find at other EDP agencies.

First, because of our superiority in size and range, we offer you infinitely more exceptional career opportunities than you could find elsewhere.

Second, with a broader selection from which to choose, you are far more likely to find the ideal situation you've wanted.

Third, whether that position is in your own city or in some other city, ESP has a placement director who will work for you in that area, personally, confidentially and professionally.

Fourth, our placement directors, like you, are computer professionals with years of impressive experience. They understand your software, your hardware, your problems and your goals.

Fifth, none of these advantages, none of these services cost you one red cent because companies assume our fees.

We proudly and confidently recommend our service to you as the most effective method for advancing your career. Let us show you how. Send for our free booklet, "The EDP Achievers".

ESP CHICAGO: Robert Sutton
333 N. Michigan Ave. Suite 901 (312) 641-6440
ESP CLEVELAND: John Davis
666 Euclid Avenue Suite 635 (216) 241-0325
ESP DETROIT: Larry Scott
1601 Fisher Building (313) 872-7855
ESP KANSAS CITY: Robert Spachman
TenMain Center Suite 370 (816) 421-4200
ESP LOS ANGELES: Roc Camp
3700 Wilshire Blvd. Suite 510 (213) 380-9650
ESP MINNEAPOLIS: Gary Brumfield
1722 Midwest Plaza 801 Nicollet Mall (612) 338-6714
ESP MONTREAL: Cyril Lewis
Place du Canada (514) 878-1741
ESP ORANGE (Calif.): Bruce Evans
500 South Main Street (714) 543-9366
ESP PHILADELPHIA: Gary Kaplan
1819 J. F. Kennedy Blvd. Suite 427 (215) 561-4720
ESP PITTSBURGH: Jeff Martin
428 Forbes Ave. Suite 2204 (412) 391-6450
ESP PORTLAND (Ore.): Mike Dalton
1600 S. W. Fourth Avenue (503) 226-6755
ESP SAN DIEGO: Pat Dorough
707 Broadway (714) 239-0811
ESP SEATTLE: Hugh McKay
400 108th Ave. N. E. (Bellevue) (206) 455-1555
ESP TORONTO: Hugh Mah
250 Bloor Street East (416) 964-9111

additional offices to open soon

ELECTRONIC SYSTEMS PERSONNEL

esp

For more information, circle No. 10 on the Reader Service Card

tracking function is relayed by the display processor to the tracking processor.

Tracking. Each aircraft of interest to the Common IFR Room is automatically tracked by the tracking processor so that the alphanumeric data tags will follow the sensor video on the controllers' displays. Through scan-to-scan correlation of radar and beacon target reports, the tracking function computes dynamic position and velocity for each aircraft and associates flight data with the proper aircraft. As many as 250 aircraft can be tracked simultaneously. Tracking of each aircraft (target) is accomplished with the target reports from a single radar-beacon site. Aircraft under the jurisdiction of Kennedy and LaGuardia controllers are tracked utilizing only the Kennedy radar and beacon reports. Those under the jurisdiction of Newark controllers are tracked via Newark radar and beacon reports. This approach avoids inter-radar correlation difficulties resulting from antenna misalignment, propagation anomalies, and slant-range corrections.

Tracking (Fig. 6) is accomplished by associating new radar and beacon target reports with previous track information, determining the present position and velocity of the aircraft, and predicting where the radar should see it next. Three basic processes (correlation, correction, and prediction) are performed for every track once each radar scan.

The correlation process (Fig. 6a) determines which new target report is associated with a tracked aircraft. Correlation is accomplished primaraily on the basis of positional proximity. A two-dimensional (range, azimuth) bin, or gate, is formed around the predicted position of the track. The new target reports are searched to find if any of them fall within the bin. In the ideal case, one, and only one, report is found, and unique correlation is achieved. Due to sensor and digitizer noise, aircraft maneuvers, and tracking compromises this does not always occur. Ambiguous situations are logically resolved by the tracking subprogram by comparison of the assigned and reported beacon codes, when necessary. During correlation, beacon reports are normally used in preference to radar reports. Radar reports are used, however, when no valid beacon report is received or when the controller specifies that a particular aircraft is to be tracked by radar only.

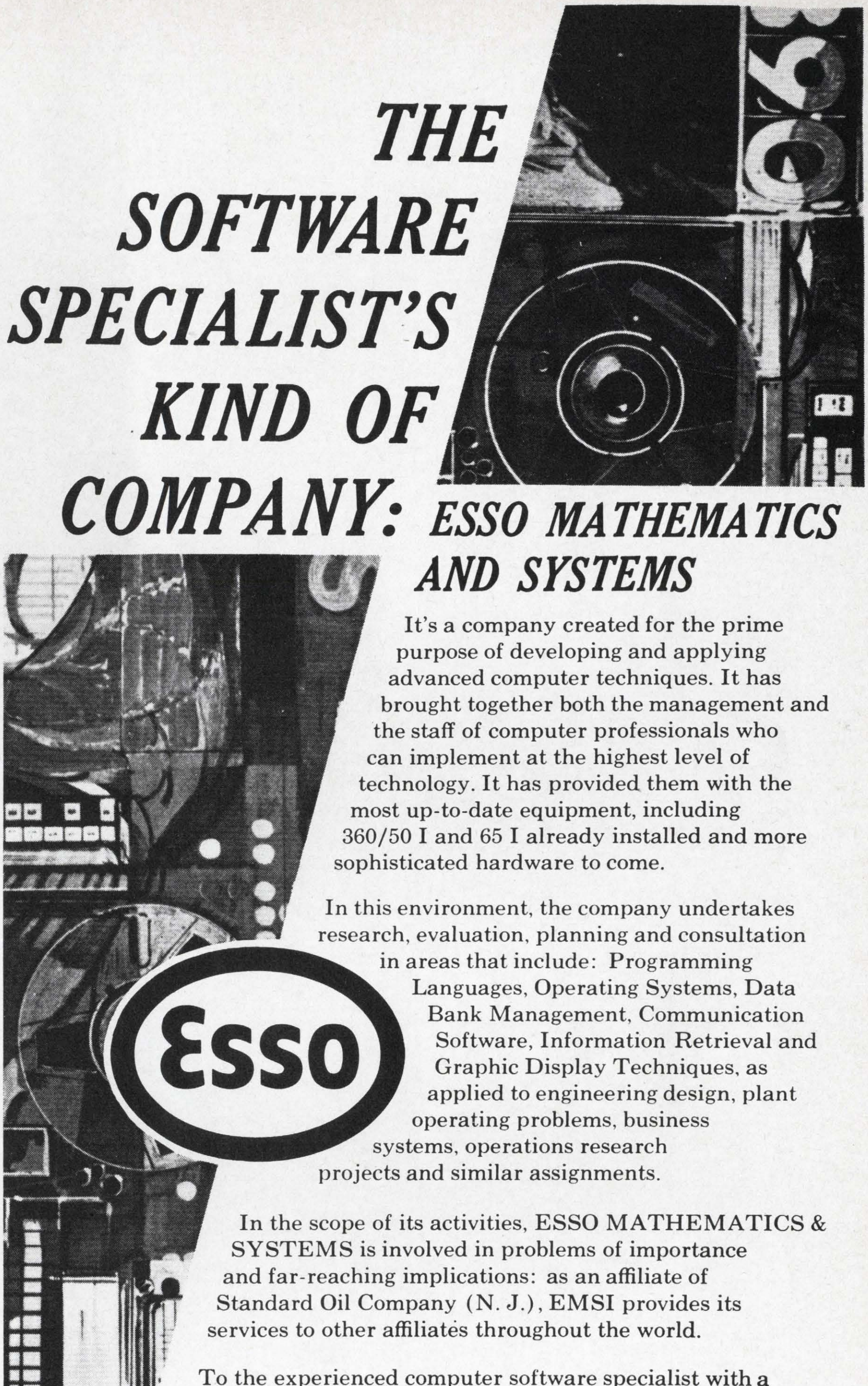
The bin-size parameters depend upon the history of the track. An *initial* track, less than three scans old, requires a large bin to ensure correlation because its position and velocity are still unreliable. For a *normal* track, with a history of successful correlation, the bin becomes progressively smaller as the ability to predict future positions increases. However, if an aircraft with a normal track should perform a sudden maneuver, the next target report may fall outside the primary correlation bin. To enable the tracker to detect the maneuver and follow the aircraft, a secondary correlation procedure, utilizing a much larger bin, is attempted. Successful secondary correlation results in a *trial* track, which branches away from the original track. If the trial track then correlates on the succeeding scans, it becomes the main track, and the original is discontinued. Otherwise, the trial track is eliminated. The primary and secondary correlation bin sizes are optimized for aircraft having speeds less than 600 knots and turning accelerations up to 1 g.

As a result of correlation, either a track is associated with a unique target report or else unsuccessful correlation is indicated. In the former case, the target report is used to update the track data through a process called correction (Fig. 6b). The corrected position (X_C, Y_C) in Cartesian coordinates is calculated by combining the predicted position (Y_P, Y_P), which was obtained during the previous scan, and the reported position (X_R, Y_R) from the correlated target report, as follows:

$$X_C = X_P + \alpha(X_R - X_P)$$

$$Y_C = Y_P + \alpha(Y_R - Y_P)$$

The factor α is a smoothing parameter whose value $(0 < \alpha \leqq 1)$ is a function of the previous history of a track. It determines how much the track position will be influenced by a new target report. Initially, a unity value of α is used to make a track responsive to the reported data. However, as a track accumulates a history of successful correla-



Connecticut Careers for

- **PROGRAMMERS**
- **DATA PROCESSING DESIGN SPECIALISTS**

Now is the time to investigate the stimulating positions immediately available within our rapidly expanding System Center near Hartford and convenient to New Haven. These are truly groundfloor opportunities with a leader in the field of advanced computer technology, and many other sophisticated space-age projects.

DATA PROCESSING DESIGN SPECIALISTS—Requires degree and experience with on-line and real-time systems. Formulate system concepts design and execute systems for information retrieval, communications switching, and graphics. Experience in quantitative comparative evaluation of alternative system designs and in preparation of technical proposals and report writing is desirable.

PROGRAMMERS—Requires degree and experience with large, medium, or small scale computer information systems applications based on random access techniques. Emphasis on assembly language programming, use of real-time direct inquiry software, the creation and check out of operating systems and compilers and the production of automated graphics.

TO INTERVIEW, please forward your resume, stating present salary, to Mr. R. S. Wellington, Personnel Dept., Hamilton Standard, Windsor Locks, Conn. 06096.

Hamilton Standard

U

DIVISION OF UNITED AIRCRAFT CORP.

A®

An Equal Opportunity Employer

tion, the value of α progressively decreases, and the smoothing effect becomes more pronounced. That is, more emphasis is placed upon preducted position, and noise components in the input data are filtered out.

The correlation process also calculates a new velocity for the track. The corrected velocity $(\dot{X}_C, \dot{Y}_C)$ is derived from the previous velocity $(\dot{X}'_C, \dot{Y}'_C)$, as follows:

$$\dot{X}_C = \dot{X}'_C + \frac{\beta}{\Delta t}(X_R - X_P)$$

$$\dot{Y}_C = \dot{Y}'_C + \frac{\beta}{\Delta t}(Y_R - Y_P)$$

The smoothing parameter β performs the same function in the velocity correction that α performs in the position correction. Its value $(0 < \beta \leqq 1)$ is, likewise, a function of the track history. The term Δt is the elapsed time since the track was last corrected.

After a track has been correlated and corrected, the new corrected position and velocity are used to predict its probable position for the next radar scan (Fig. 6c). The predicted position is required because it (1) serves as the position of the correlation bin on the succeeding scan and (2) is used to update the position of the alphanumeric tag on the controller's display. The prediction process is a linear extrapolation:

$$X_P = X_C + (\dot{X}_C)T$$

$$Y_P = Y_C + (\dot{Y}_C)T$$

where T is the period of the last radar scan. (If the aircraft velocity has a significant tangential component, a minor adjustment to T is required.) If a track fails to correlate during the current scan, no corrected data is calculated, and the track is extrapolated on the basis of the previous position and velocity information. This process is called *coasting* the track.

Track initiation can be either automatic or manual. Automatic initiation (acquisition) takes place if, after correlation is completed, there are any remaining uncorrelated target reports within a sector. If, on two successive scans, an uncorrelated target report is found, which has a discrete beacon code that is identical to the assigned code of a pending track in the tabular STORE area on a controller display, the

Callahan offers you more than a salary survey

EDP PLACEMENT FACTS

AVERAGE SALARIES TELL YOU NOTHING

Now you can determine exactly how you compare with your contemporaries. This FREE booklet lists typical backgrounds of all professionals in the EDP field. This includes their year of graduation, types of experience, present salary and bona fide accepted offers.

CALLAHAN CENTER FOR COMPUTER PERSONNEL

1819 JFK Blvd., Suite 414, Blvd. Bldg.
PHILADELPHIA, PA. 19103
Phone: (215) 561–1950

Exclusive EDP representative of the International Personnel Recruiters, Ltd.

For more information, circle No. 14 on the Reader Service Card

!

PROGRAMMERS SYSTEMS ANALYSTS

Nationwide

With the continued implementation and further sophistication of our unique National Marketing Analysis System (NMAS), Input, Inc. is now able to bring the nation's complex and ever-changing computer community into remarkable focus. Through the mass of exclusive information available to us through NMAS and by employing an innovative "search and solve" technique, our staff of trained consultants can lock in on the myriad complexities of your specific career requirements with an accuracy unparalleled in the field.

Fields covered include digital hardware design, systems analysis and programming of software, management information systems, and a variety of sophisticated scientific and commercial applications. We welcome your inquiries. Contact Mr. Lincoln Bouve or Mr. William Caine at 202/298–7510 for additional information or submit resume in confidence. Client companies assume all fees.

input, inc.

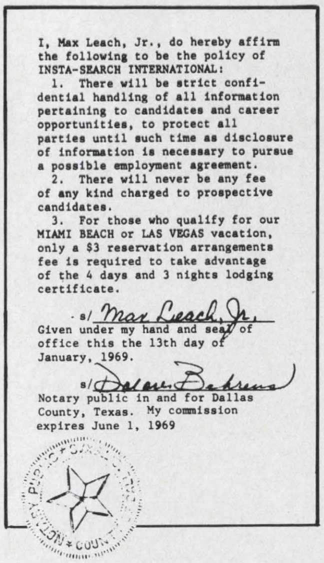
815 connecticut avenue, n. w.
washington, d. c. 20006
e.o.e./mf suite 1200

NOT NOW "JOB HUNTING?" THEN YOU MIGHT QUALIFY FOR A FOUR DAYS AND THREE NIGHTS MIAMI BEACH OR LAS VEGAS VACATION, WHILE FOLLOWING OUR ADVICE:

NEVER LOOK FOR A JOB AGAIN

. . . LET THE JOB "LOOK" FOR YOU!

This incredible bit of advice could never before have been soundly given. But now (or in the future when a job change might be more of a possibility), you don't have to drain yourself emotionally and physically as you make out resumes and fill out different forms for employment agencies and recruiters. And you don't have to pay $10, or $18, or $25 per year to be "computer matched," either.



I, Max Leach, Jr., do hereby affirm the following to be the policy of INSTA-SEARCH INTERNATIONAL:

1. There will be strict confidential handling of all information pertaining to candidates and career opportunities, to protect all parties until such time as disclosure of information is necessary to pursue a possible employment agreement.
2. There will never be any fee of any kind charged to prospective candidates.
3. For those who qualify for our MIAMI BEACH or LAS VEGAS vacation, only a $3 reservation arrangements fee is required to take advantage of the 4 days and 3 nights lodging certificate.

s/ Max Leach, Jr.

Given under my hand and seal of office this the 13th day of January, 1969.

s/ Dolores Behrens

Notary public in and for Dallas County, Texas. My commission expires June 1, 1969

Mail Today For Free Kit!

©1969 Max Leach, Jr.

You have a right to be skeptical, but grant for a moment, if you will, that this is FACT. It would mean that you could give 100% to your job, 100% of the time without going through the mental gymnastics of "Should I be looking for a better job, or shouldn't I?" It would mean that if you were qualified for a better job, THAT JOB WOULD COME LOOKING FOR YOU — you wouldn't have to go looking for it! ISN'T THAT WHAT YOU WOULD REALLY LIKE?

WHO IN THE WORLD COULD POSSIBLY KNOW WHERE IN THE WORLD ALL THOSE JOBS ARE — AND WHO QUALIFIES FOR THEM?

This is the quest and purpose of INSTA-SEARCH® INTERNATIONAL. This tremendously expanding organization has exploded on the employment scene in major cities with such dramatic and thorough techniques that it is highly probable that employers needing your particular type of skill and training are already known to INSTA-SEARCH® INTERNATIONAL. Basically, it's who *WE* know that counts.

What does INSTA-SEARCH® INTERNATIONAL do?

(1) Uncover present *and* future job openings involving your particular talents, knowledge, and background.

(2) *Constantly* match these career opportunities to YOU while you are still employed. You will *not* be forgotten. Your abilities will not be overlooked. Nor will the career opportunities be misplaced. We use a half-million dollar computer to make sure. But the computer is *not* the end!

(3) We bring the Career Opportunity to you, the Candidate, when you are qualified for it and only when it appears to be to your advantage to investigate it.

THIS SERVICE FREE — ABSOLUTELY NO OBLIGATION

The overwhelming dollars and "sense" side of our service is this: THERE IS *NO* FEE TO YOU — NOT NOW — NOT EVER! The only way you can lose is to deliberately avoid using our modern, efficient arsenal of "job-uncovering" techniques. But even if you *do* use INSTA-SEARCH® INTERNATIONAL to "bring a job to you," you are under *no* obligation to do anything further about it.

HOW YOU CAN QUALIFY FOR A MIAMI BEACH OR LAS VEGAS BONUS!

If you send for your Insta-Search Candidate kit — which has everything you need to start following our advice — within 10 days, and you are between ages 21 and 65, we will include free details as to how you *and your spouse* can enjoy 4 days and 3 nights lodging at an ocean front Miami Beach hotel, or a fabulous Las Vegas hotel (meals and transportation not included). If you decide to take advantage of our accommodations, you pay only a $3 reservation arrangements fee. That surely beats an $80 hotel bill, doesn't it? And the privilege of using the certificate won't expire for a year. Complete details are yours as a bonus for prompt action, so send today for your Insta-Search Candidate kit to INSTA-SEARCH® INTERNATIONAL, room 2159, 1940 Hi-Line Drive, Dallas, Texas 75207.

INSTA-SEARCH
INTERNATIONAL

Room 2159
1940 Hi-Line Drive
Dallas, Texas 75207

Date________________

Please send me absolutely free and without obligation your INSTA-SEARCH® Candidate kit and details on how I can enjoy the MIAMI BEACH/LAS VEGAS Bonus.

NAME________________ OCCUPATION/TITLE________________

HOME ADDRESS________________

CITY________________ STATE________ ZIP________

☐ Please send our company free and without obligation your INSTA-SEARCH® Employer kit.

COMPANY NAME________________ ATTENTION:________________

COMPANY ADDRESS________________

CITY________________ STATE________ ZIP________

For more information, circle No. 16 on the Reader Service Card

flight data is removed from the STORE area and displayed at the reported position. Active tracking will then be automatically initiated. Automatic acquisition of arriving aircraft occurs at a range of 45 to 60 miles. Departing aircraft are acquired several miles after takeoff.

Tracks are automatically terminated by the computer when they are no longer required. After prediction, the position of each track is checked to see if it satisfies the geographic criteria for automatic termination.

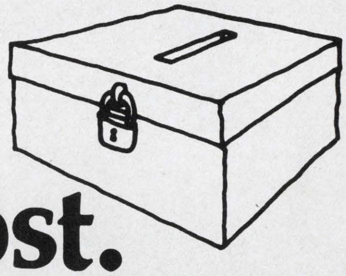
Display Data. The display processor transmits updated alphanumeric data to the display equipment every two-and-one-half seconds to provide the controller with a dynamic current picture of the air traffic situation. Flight data is presented to the controller in one of several formats depending on whether the aircraft is being actively tracked or is displayed in a tabular list. Each tag, tabular item, or single symbol to be displayed requires a digital message from the computer specifying the location, format, and content of the display data.

The location information in a digital display message can be specified in either of two x, y coordinate systems: *display* coordinates or *system* coordinates. Tabular data, positioned in display coordinates, appears at an absolute location on the display screen. The fixed 512 by 512 display coordinate grid is independent of the radar range-scale and off-center controls on the display. The radar-related alphanumeric tags and symbols, however, are keyed to a system coordinate grid. This grid, 2048 miles square, is entered at the Kennedy radar site. System coordinates, specified to the nearest 1/8 n.m., are referred to the southwest corner of the grid. Alphanumeric data in system coordinates, like the sensor video display, is sensitive to radar range-scale and off-center controls. Therefore, it remains in registration with the radar picture.

The alphanumeric tag, which accompanies an active track (Fig. 7a), is positioned according to coordinates predicted by the tracking processor. A leader connects the tag to a single symbol, which represents the tracked position of the aircraft. This symbol is an alpha character that uniquely denotes the cognizant controller. A velocity vector with length proportional to the calculated track speed may also be displayed by controller selection. The tag can contain as many as 21 alphanumeric characters arranged in three rows, each holding a maximum of 7 characters.

The top row displays assigned altitude and reported beacon altitude expressed in hundreds of feet. Also displayed in the top row, when necessary, is a controller-entered arrow which indicates that the aircraft has been cleared to climb or descend. When an arrow is not present, the display processor automatically monitors the beacon altitude reported by the aircraft. If it differs from the assigned altitude by 200 ft or more, a blinking square symbol is displayed to alert the controller to the altitude discrepancy. The altitude reported by the beacon transponder must be corrected by the display processor before it is displayed. For aircraft flying below 18,000 ft. it is necessary to compensate for the difference between local barometric pressure and the reference pressure (29.92 inches Hg) used by the aircraft altitude sensor.

this plain, simple lockbox will help you find that better job at the Spring Joint Computer Conference without fanfare ...and without cost.



Everyone's coming to the Spring Joint Computer Conference searching for new ideas. A lot of EDP people will also be searching for new positions.

And Software Age will help you. Our cost free Resume Center will let you advance your career without subjecting you to the perils, pitfalls and problems of job hunting. We'll protect your privacy, let you keep full control and charge you nothing.

Here's how it works:

1. You hand pick the companies. Fill out the special resume form at the Center, listing your hotel room and local telephone number, or bring your own resumes. Companies in all areas and fields will be represented in the Resume Center. A free copy of SOFTWARE AGE will be given you so that you may study the ads of the participating companies.

2. Free resume duplication service. Our Remington R-2 operators will photocopy the special resume or your own one page resume FREE of charge and return ALL copies to you.

3. You hand deposit your resume. Next, you'll drop your resume in the lockbox of the company you're interested in. Only the company interviewer has the key.

4. You make your own appointment, your own arrangements. If the company interviewer is interested in you, he will leave a message at your hotel or at home for you to give him a call. You will set up the interview with him at your convenience. All arrangements are made by you and the company. No one else. There's no middleman, and no cost to anyone. You or the company.

EMPLOYMENT MANAGERS
— EDP MANAGERS

For information on how your company can participate in the S/A Resume Center at the Statler Hilton in Boston, during the SJCC May 14th through May 16th, fill out coupon below.

Att: Mr. David W. French, Publisher
Software Age Magazine
2211 Fordem Ave., Madison, Wis. 53701
Tele: 608–244–3561

Dear Mr. French: Please send me detailed information on participating in the S/A Resume Center, during the SJCC.

Name____________________

Title____________________

Address____________________

Company____________________

Phone____________________

City & State____________________

software age resume center

Statler Hilton Hotel, Park Square, Boston
Wednesday, May 14th, Noon to 7 PM; Thursday, May 15th, 9 AM to 7 PM; Friday, May 16th, 9 AM to 3 PM.

The S/A Resume Center is operated by SOFTWARE AGE Magazine, 2211 Fordem Ave., Madison, Wis. 53701/David W. French, Publisher

a

K——030↓063
EA123
18 0401

030	Assigned altitude — 3000 ft
↓	Cleared to descend
063	Reported beacon altitude — 6300 ft
EA123	Eastern Air Lines Flight 123
18	Aircraft speed — 180 knots
0401	Reported beacon code
K	Responsible controller (JFK final approach controller). Also indicates tracked position of aircraft.

b

EA123

EA123	Eastern Air Lines Flight 123

c

060↓068B
EA123

060	Assigned altitude — 6000 ft
↓	Cleared to descend
068	Reported beacon altitude — 6800 ft
B	Holding fix (Bohemia holding pattern)
EA123	Eastern Air Lines Flight 123

Fig. 7 — Alphanumeric display formats. A tag for an active track (a) contains up to 21 characters. The tag is attached to track position symbol by a leader. A velocity vector indicates heading of the aircraft. Indicator bars (not shown in illustration) can be displayed above tag to denote a special kind of status such as emergency, attention, handoff, or coast. Each item in tabular *Store* list (b) consists of identity of a pending flight. List is ordered according to time of arrival or departure. Each item in the tabular *Hold* list (c) refers to an aircraft assigned to a holding pattern. Removing tags from these tracks reduces alphanumeric congestion around a holding fix. This list is arranged by chronological order of entry.

The middle row of characters contains the aircraft identification. For a commercial airliner, this normally consists of the airline initials and flight number. The bottom row of alphanumerics is used to display information that is somewhat less significant to the controller. This row is time-shared to permit accommodation of four data items. Tracker-derived aircraft speed and controller-entered *scratch pad* data are displayed alternately for short periods of time (8–16 sec). The display of reported beacon code and computer-assigned track number is similarly alternated.

Directly above the alphanumeric tag there is space for the display of two horizontal bars. A solid upper bar is used to mark a track that requires special attention or handling. It is automatically displayed as an alert when the associated aircraft is transmitting an emergency beacon code. A dashed lower bar indicates that the track is involved in a handoff action between controllers. A solid lower bar indicates that the track is being coasted on the basis of historical velocity information. The alphanumeric tag and leader can be offset in different directions from the track position symbol. To minimize the overlap of tags in congested areas of the display, the computer periodically checks the relative positions of all tags and adjusts the offset to reduce superposition of alphanumerics.

Each item displayed in the tabular STORE list (Fig. 7b) of pending flights consists solely of the aircraft identification. The list is automatically ordered according to the ETA or ETD of the flights. A second tabular display list is available when it becomes necessary for the controller to discontinue active tracking of flights assigned to a holding pattern. Each item in this HOLD list has a format consisting of two rows of alphanumerics (Fig. 7c). The data content is identical to the first two rows of the active track tag, except that an additional letter is included to denote the holding fix. HOLD items are listed according to their chronological order of entry. At the option of the controller, the STORE and HOLD lists can be located at any convenient place on the display screen.

Conclusion. The Common IFR Room and previous installations (ARTS, NYCBAN) demonstrate the applicability of electronic data processing techniques to air traffic control alphanumeric display systems. The digital computer data handling and processing capabilities are sufficient to meet the real-time requirements of the most complex air traffic environment, as exemplified by the New York terminal area. Furthermore, a general-purpose computer with a stored program provides significant benefits in the form of system flexibility, which cannot be matched by special-purpose, fixed-logic hardware. The system can be improved by altering program instructions rather than redesigning equipment. ■

Reprinted by Permission
Sperry–Rand Engineering Review

Use this form to tap into the nation's largest computer file of top jobs

The National Manpower Register computer-based placement service is the largest employer-sponsored system of its kind. It provides a network of 87 offices throughout the nation — all of which have key contacts with leading employers in their area. Over 6500 employers with openings for computer professionals are represented. The NMR system does **not** charge either employers or applicants a fee to enter their qualifications and requirements into the on-line computer data base.

In no case does an applicant pay a placement fee, or any other costs.

Fill in the form and send it immediately with a copy of your current resume to NMR, at the address below.

(It is most important that your information be complete and accurate and that you TYPE or PRINT LEGIBLY.)

Name	Date	Have you ever registered with NMR before?	If so, when?
Address		Where Can You Be Reached During Interview Days? Phone:	
City/Zip	State	Referred By: Software Age	
Home Phone (Include Area Code)	Business Phone (if OK to use)	Present Or Most Recent Employer	

I will NOT relocate ☐ **I will consider opportunities in:** ☐ North East ☐ Mid Atlantic ☐ South ☐ Midwest ☐ Southwest ☐ Calif. ☐ Northwest

Prefer: ☐ Metro. area ☐ Medium town ☐ Rural are **Other:** ____

Education

Degrees (List)	Major Field	Year Degree Earned	College or University

For Office Use Only

Registration Number ☐☐☐☐☐☐ Initial of Last Name ☐

Employment Information

Position Desired

Present or Most Recent Position	From	To	Title

Duties & Accomplishments

Previous Position	Employer	City/State	From	To

Duties & Accomplishments

Previous Position	Employer	City/State	From	To

Duties & Accomplishments

General Information **(Summarize your overall qualifications and experience in your field. List any pertinent information not included above.)**

Current Annual Base Salary	Total Years Of Experience	Date Available	Employed ☐	Unemployed ☐	Self-Employed ☐

Level of Security Clearance:	U.S. Citizen ☐	Non U.S. Citizen ☐	My Identity May Be Released To:	Any Employer ☐	All But My Present Employer ☐	No Employer ☐

National Manpower Register.635 Madison Avenue, New York, N.Y. 10022

For more information, circle No. 18 on the Reader Service Card

EDP Managers

Have You Got:

IDEAS—

other EDP managers might find useful?

GRIPES—

you'd like to get off your chest?

SUGGESTIONS—

for equipment or devices "somebody ought to invent"? Or how to attract, select or train EDP personnel? Or things your corporate management ought to know about EDP?

If You HAVE

and if you're able to express them interestingly and concisely in about 1,000 words . . .

software age

will provide you a forum—AND a small honorarium!!

A new monthly feature of SOFTWARE AGE will consist of a selected contribution from an EDP *manager* to appear in a new column entitled "Executive Routine"—a column BY and FOR the people with ultimate responsibility in EDP.

Send your contribution—OR your ideas on subjects to be taken up in this column—to:

EXECUTIVE ROUTINE
software age
2211 Fordem Avenue
Madison, Wisconsin 53701

executive routine

Jerome T. Murray

■ Your installation is large and unusual. Each of six departments has a computer dedicated to its needs. There are six computers in all and they share a common I/O device pool which is facilitated by switching units. The Operations Research department has just sent you a deck of punched cards with the request that they be put on magnetic tape using a special program which they have sent with the input cards. The OR department claims the run will take 2 hrs. 30 min., it is now 1:30 p.m. and the DP department closes for the day at 5:15. There is no overtime. You know the following:

1. Five computers are now processing.
2. A payroll is processing in the computer dedicated to the manufacturing department.
3. The program in the manufacturing department's computer is using the CRT for output.
4. The program that runs for 4 hrs. 30 min. receives OCR input.
5. The credit department's computer is immediately to the right of sales department's.
6. The program in the personnel department's computer will run for 1 hr.
7. A classification program is running in the computer next to the budget department's.
8. The program that runs for 4 hrs. outputs punched cards.
9. The sort program runs 30 min.
10. The computation program outputs on the printer.
11. The file update program receives input from a remote terminal.
12. A 3-hr. program is running in the computer next to the one whose program receives paper tape input.
13. The classification program is running in the first computer.
14. A 1-hr. program is in the computer next to the one whose program receives MICR input.
15. The program running in the credit department's computer outputs on disk.

You must determine which computer is using magnetic tape and which is using the card reader so that you can determine whether or not it is possible to run the program on the OR department's computer today. They want to know and they are asking YOU!

By starting with statement 13 and working systematically we can construct the table above. Computer 5 will free the card reader in 30 min. and the magnetic tape output will be free in 1 hr. The OR department's run can be accommodated comfortably this afternoon.

Let's take a closer look at the

SOLUTION

Computers	1	2	3
Departments	Personnel	Budget	Manufacturing
Programs	classification	computation	payroll
Output	magnetic tape	printer	CRT
Timings	one hour	three hours	four hours thirty minutes
Input	paper tape	MICR	OCR

Computers	4	5
Departments	Sales	Credit
Programs	file update	sort
Output	punched card	disk
Timings	four hours	thirty minutes
Input	remote terminal	card

CAREER MEMO

To the Computer Professional

Does your present position lack pride of accomplishment? . . . If so, it is time for a change. Professional Opportunities presently exist in:

SOFTWARE DEVELOPMENT
SYSTEMS DESIGN
PROGRAMMING
REAL TIME SYSTEMS
TIME SHARING
MANA. INFO SYSTEMS
ENGINEERING
MATHEMATICS
OPERATIONS RESEARCH

Your confidential inquiry is welcome. Call or write, Robert L. Keilholtz or Donald Wayne,

EVERETT KELLEY ASSOCIATES, INC.
Suite 1300—121 S. Broad St.
Philadelphia, Pa. 19107
215—KI 6-5240

Placement of Computer Professionals since BINAC.

NATIONAL EMPLOYMENT ASSOCIATION SERVICE MEMBER

logic of the table: (Computers are #1 . . . #5)

Clue	Argument
1.	Statement 13 fixes the program on #1.
2.	Statements 13 and 7 fix the department on #2.
3.	Statement 3 fixes the output for #3.
4.	Statements 3, 5 and 7 fix the department for #1.
5.	Statement 6 and Clue 4 fix the timing for #1.
6.	Statement 14 and Clue 5 fix the input for #2.
7.	Statements 2, 3, 5, 10, 15 and Clue 2 fix the program and the printer as output for either #2 or #4—assume the output and program are fixed for #4.
8.	Statement 8 may only apply to fix a condition for #2.
NOTE:	If Clues 7 and 8 hold their assumptions, no program may be found that is consistent with #2's other known features, hence:
9.	Clue 7 should identify #2, not #4.

Proceeding in this manner the whole table may be completed and the relations sought identified. ■

RSVP **RSVP SERVICES**

EMPLOYMENT AGENCY
FOR
COMPUTER
PROFESSIONALS
Serving

- **PHILADELPHIA**
- **NEW JERSEY**
- **NEW YORK**
METROPOLITAN AREA

RECRUITMENT • SELECTION • VOCATIONAL TRAINING
PLACEMENT FOR COMPUTER ORIENTED COMPANIES

Experienced Programmers and Analysts from these areas may call collect anytime (24-hour answering service)

N. J. (609) 667–4488
Phila. (215) 922–3993
OR SEND RESUME TO

HOWARD LEVIN
Director
RSVP SERVICES
Suite 714
One Cherry Hill Mall
Cherry Hill, N. J.
08034

Two of every seven E.D.P. people reading this ad are underpaid.

That is, they're making less money than they should be making.

Because no matter how good you are, if the conditions aren't right, you could go through your career unchallenged and unfulfilled.

Let National Personnel Consultants help you decide whether to keep your present job—or move on to other things. We're a coast-to-coast network of 85 of the nation's finest personnel organizations working together to find opportunities for you, wherever they exist.

And if you do accept a position with one of the companies who come to us for qualified people, they'll pay all fees and expenses. Your only investment is a stamp, and the time it takes you to send us your resume, present salary and requirements and some idea of what you'd like to do and where you'd like to do it. All information is held in strictest confidence.

So, if you're good at what you do, we'll place you where you can do it even better.

NPC NATIONAL PERSONNEL CONSULTANTS A SYMBOL OF PUBLIC TRUST

NATIONAL PERSONNEL CONSULTANTS
Suite 20, 381 N. York Rd., Elmhurst, Illinois 60126

Are you **multi-plexed** or just **per-plexed**

about the direction of your career? Take heart.

Our personnel specialists know WHERE the action is. They are the marketplace where your talents and the world's leading corporations meet.
The MANAGEMENT SCIENTISTS consultant utilizes imaginative research, thorough analysis and depth evaluation techniques to put your objectives in realistic perspective. Most important, he works ACTIVELY on your behalf and no time is wasted in directing you to the most rewarding career opportunities.

At present we are recruiting for talented professionals in

- **TIME SHARING/REAL-TIME**
- **SOFTWARE DEVELOPMENT**
- **OPERATIONS RESEARCH**
- **SYSTEMS DESIGN**
- **BUSINESS/SCIENTIFIC PROGRAMMING**

Send us your resume, in confidence, including salary history and geographical preference. We will do the rest.

Management Scientists, Inc.

101 Park Ave.—Dept. SA 2-69
New York, N. Y. 10017—(212) 532–7710

Exclusively: DATA PROCESSING & MANAGEMENT SCIENCES
Career Planners—Recruitment Specialists

DOCUMENTATION

IN A FINANCIAL ENVIRONMENT

F. Stuart Magie
Assistant Vice President
Union Bank
Los Angeles, California

■ Unfortunately, it has been the general experience in data processing installations from coast to coast that documentation has been overlooked. Some data processing installations have little or no documentation concerning individual programs or even whole systems. Other installations have documentation such as card or magnetic tape layouts and even, in some instances, system flow diagrams. But usually this documentation is not accurate because it has not been kept updated by the individual Programmer or Analyst when modifications have been made to programs. Lack of documentation becomes a very expensive problem when one considers the length of time required for a new Programmer to understand an existing operational program and attempt modifying its logic. This problem is magnified by our current data processing growth. Turnover of technical personnel is also a large problem. Therefore, good documentation of programs and systems must be made a firm and necessary rule for all installations to follow. Naturally, data processing people usually plan and estimate completion dates based on time required for definition, logic, coding, testing, and implementation and, therefore, leave little or no time for correctly documenting the results of their efforts.

HISTORY OF DOCUMENTATION

During the 1940's and 50's, some documentation was kept in various Tab Operators' desks. This documentation was in the form of tabulating steps and diagrams of wired panels. When a Tab Operator was required to run a specific job, it often became necessary for a panel board to be wired for controlling the tab machine. In performing the specific function required for the system, usually a wiring diagram could be found and more times than not all types of special notes and lines would be written on the diagram. Sometimes Operators would write memos for their reference when running various jobs. In some installations a run flow was required to be created and these documents were placed in the tab run book. Very often updating to these procedures would be lacking if Operators were to leave the installation and the people assigned to various tasks were not aware of certain undocumented procedures. In some cases it took two or three runs to straighten out the procedures, and so it went until the advent of the 1st generation computers in the late 50's. At this time, technicians changed from wired panels and found that they had to construct their processing problems using stored programs. In this case, wired-panel diagrams were no longer necessary and coding sheets were substituted as documentation for the various runs with a few people creating run flows, much as in the Tab days. Documentation went along this way until the early 1960's and the release of second generation equipment. At this time more concentration was applied to documentation. Coding sheets, as well as assembly listings, were usually kept in various Programmers' desks as documentation. Also it became very evident that computer run instructions were now required. This documentation was usually made as each person saw fit. With the advent of third-generation equipment, it becomes even more necessary that good documentation be created because it is now many times more complex for a Programmer to debug someone else's program, or for an Analyst to understand existing systems without proper documentation. Third-generation computers have allowed technicians to do more and more work within a computer, thereby demanding that documentation be created to assist other technicians in following logic and/or system flows. One of the most expensive situations an installation can find itself involved in is that of requiring modification to be made and in having little or no documentation for the current Programmer to refer to. Sometimes this problem can force a complete re-write of the program. Proper documentation and the enforcing of documentation rules will greatly reduce this problem which reduces costs and creates a more professional environment for the technician.

DATA PROCESSING DOCUMENTATION FORMATS

Most data processing people agree to the fact that documentation is a necessary requirement, but what type of documentation should a data processing installation have?

1. System Flow Diagram

   Each processing system should have a complete diagram of the

ANALYSTS

Start at the TOP

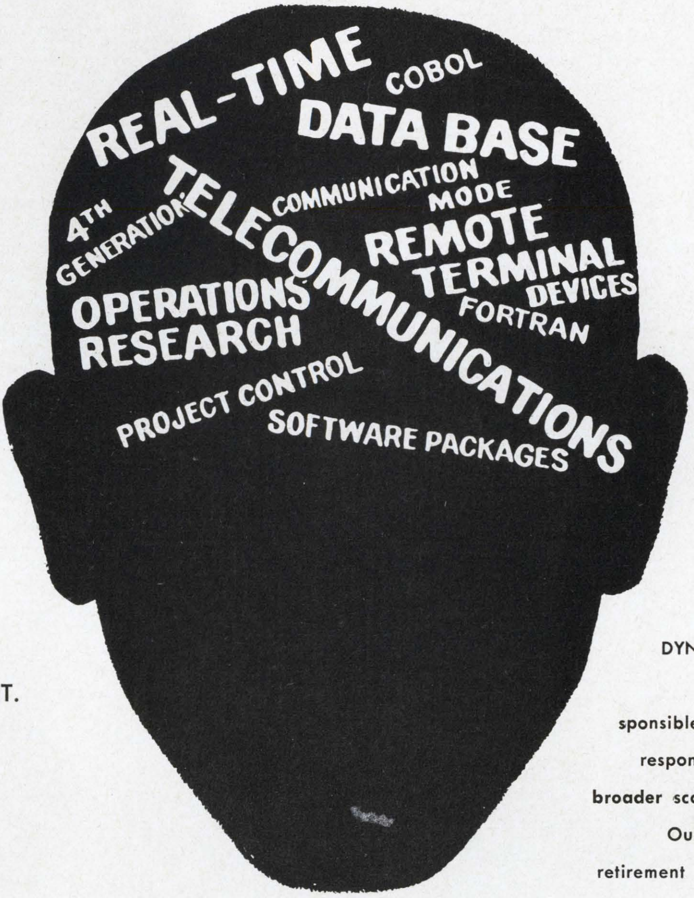
and GO even HIGHER

ANYTHING YOU HAVE DONE . . . YOU CAN DO BETTER

HERE IS AN OPPORTUNITY TO ACCOMPLISH BEYOND ANYTHING YOU HAVE DONE IN THE PAST . . . WHERE YOUR SUCCESS IS NOT ONLY MEASURED BY FINANCIAL REWARDS BUT BY SOLID PROFESSIONAL ACHIEVEMENT.

YOU

That's who the rest is up to . . .



THE EQUIPMENT

We currently have the IBM 360 Systems and the Honeywell 200 Series Systems. We are planning for Real-Time and Telecommunications using IBM and Honeywell third and fourth generation systems. The languages utilized are COBOL and FORTRAN.

THE COMPANY

DYNAMIC, one word that describes our present and future. Growth is responsible for these positions, and will be responsible for your advancement into a broader scope of responsibility and authority. Our salaries, fringe benefit programs, retirement plan and brand new offices make us more than desirable—WE'RE IRRESISTABLE.

THE POSITIONS

LEAD ANALYST

Highly skilled individual with at least 2 years experience as a project analyst demonstrating outstanding ability as an analyst.

PROJECT ANALYST

Well informed individuals with 3 years or more experience as a senior analyst.

SENIOR ANALYST

Knowledgeable, self-starting individuals with a minimum of 2 years experience as a junior analyst.

Please send your own resume, OR send the enclosed mail-in resume, to

Mr. L. F. Krizka

222 North Dearborn Street
Chicago, Illinois 60601

an equal opportunity employer

BLUE CROSS

BLUE SHIELD

® Registered service marks of the American Hospital Association
® Registered service marks of the National Association of Blue Shield Plans

Figure 1

PROGRAM LOGIC NARRATIVE

PROGRAM: XYZ-01

NAME: Jones—Smith—Jones Recon Accounts

MAIN ROUTINE:

This routine reads the master file, transaction file, and compares account numbers. At the same time, a computation is made multiplying rate X units. If the transaction account number is less than the master, a branch is made to a routine called CREATEMSTR. If the account numbers are equal, a branch is made to UPDATEMSTR. If the transaction account number is greater than the master, a branch is made to WRITEMSTR.

CREATEMSTR:

This routine will add one (1) to a counter then move the hours field to a hold hours work area. A move is made of the units from the transaction record to a hold units work area. A check is made for the record codes A through D. If the record is an "A", a branch is made to AROUT. If the record is a "B", a branch is made to BROUT. If the record is a "C", a branch is made to CROUT. If the record is a "D", a branch is made to DROUT.

UPDATEMSTR:

A one (1) is added to the master counter. A one (1) is added to the transaction counter. The master record hours are moved to hours work area. The transaction hours are added to the master work area. The master units field is moved to a units work area. The transaction record units are added to the units work area. A calculation is made by multiplying the rate from the master record X the hours in the hours work area. The result is added to the grand total dollars counter. A branch is made to WRITEMSTR.

WRITEMSTR:

A one (1) is added to the master counter. The hours are added to hours counter. The units are added to the units counter, and record is moved to the output WRITEMSTR record area. A branch is made back to MAIN.

flow of the system from Data Control Clerk thru each computer operation and back to the Data Control Clerk. This flow chart, in order to be meaningful to the particular installation, should be created in a standard manner that is adopted by that particular installation. One easy-to-follow format is illustrated in Figure 1. (XYZ is the system number. The next two digits are the number given to the program, followed by a two-digit number, channel and drive or "SYS" device.)

2. General Narrative of the Total System

   A general narrative of the complete data processing system should be created and should include a "picture" of the total system from the User thru the Data Control Clerk and Computer Operations back to the User. It should include such things as input/output schedules, number of computer operations, methods for balancing and clerical procedures, etc. A typical systems narrative is shown in Figure 2.

3. Detail Program Abstract

   Detailed documentation should be found in the form of a narrative or program abstract written for each computer operation. The abstract should describe in detail that particular operation. A standard method for writing abstracts should be established for the installation in order to simplify the effort for Analysts and Programmers to read abstracts and thereby know what is to be found within the program. It has been my experience that the abstract should start by defining the name and number of the system, followed by the name and number of the particular program within the system. Next should be a short description of the objective (or the problem solved by) this particular program step. After the objective there is a description of all input files, possibly with a note to "See attached record layout" or simply a listing of the individual fields that must be contained in the files and the length of each field specifying whether they are alpha or numeric. When all input files are defined, the next section of the abstract will contain a description of all output files in the same manner as described above. This section also refers to any output reports produced by this particular computer step. This can be done by

Figure 2

GENERAL NARRATIVE OF TOTAL SYSTEM

The Jones–Smith–Jones Recon Accounts is a contract collection system designed primarily toward Recon Accounts Contracts. The system produces payment coupons, which, on receipt of payment, are used to update the Master History File. The system produces the required accounting reports needed for delinquent collection and general accounting.

The overall system is divided into six programs:

1. Edit and Capture
2. Correction
3. Transaction Sort
4. Update
5. Report Sort
6. Report

The Edit and Capture Program will read the incoming new accounts, changes, and monetary transactions, producing a capture tape and a Proof List. The Proof List is used for balancing purposes and the capture tape is used as input to the Correction Program.

After the Proof List has been balanced and the corrections have been keypunched, the capture tape and correction cards are used as input to the Correction Program, which creates an activity tape and final balancing totals. When all input has been balanced, the activity tape is sorted, producing a sorted transaction file.

The sorted transaction and the master are the input files to the Update Program which produces the new master and the report file. The report file is a print formatted file with additional information in each record allowing proper sorting and print spacing.

The system presently provides the following reports at the indicated times:

Daily	*Weekly*	*Monthly*
Cash Proof List	Trial Balance	Name and Address List
Final Balance List	Billing Summary	Mortgage Receivable
File Maintenance List		Tract Status
Un-Processed Items		
Detail Activity		
Delinquent Notices		
Delinquency Aged List		

Input due in daily at 6:00 p.m.

Figure 3

PROGRAM ABSTRACT

SYSTEM NAME:
Jones–Smith–Jones Company

SYSTEM #:
XYZ

PROGRAM NAME:
Jones–Smith–Jones Recon Accounts

PROGRAM #:
01

OBJECTIVE:

This program shall format and print the Recon Accounts which are to be generated every week by the Customer Services Department. As information is added to, changed, or deleted from the master file, each transaction shall be recorded in the Recon Accounts Register.

The program will identify data cards with pertinent data missing or with incorrect entries with the use of a flag—either a lozenge which will indicate a warning or an asterisk which will indicate a transaction unacceptable for processing. The transactions marked with a lozenge are to be processed despite the error, but the transactions marked with an asterisk are to be rejected entirely.

At the end of the report, the program will write a Recon Accounts Total Page. This page will be a summary of the cards processed. Cards will be listed by card code and trans code. Total units and amounts will be taken on cards which are applicable.

INPUT:

See attached Record Layout.

OUTPUT:

See attached 1403 Print Layout.

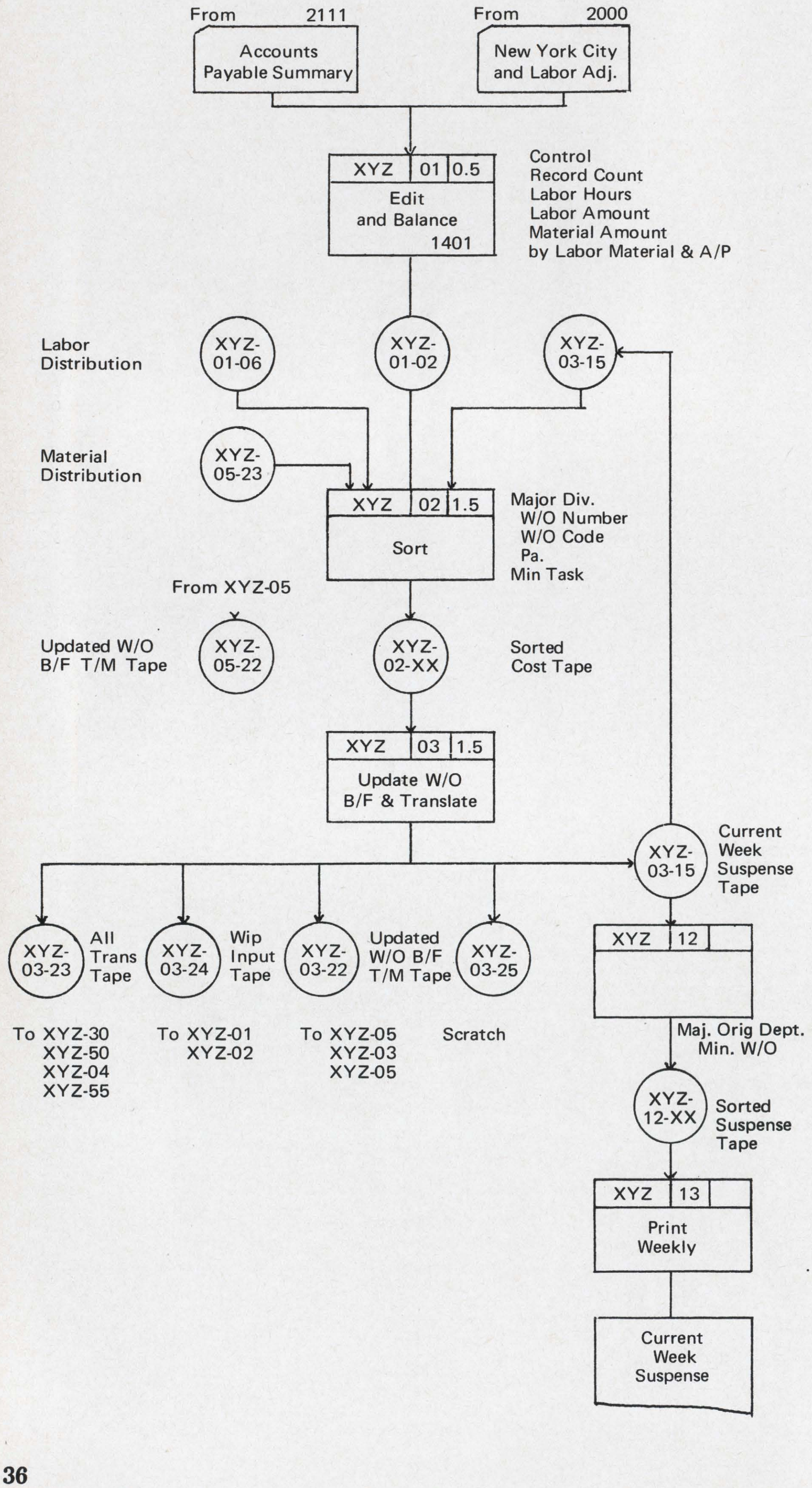
John Quincey Doe
Systems Analyst

JQD:icw
MM/DD/YY

DATA PROCESSING FLOW CHART

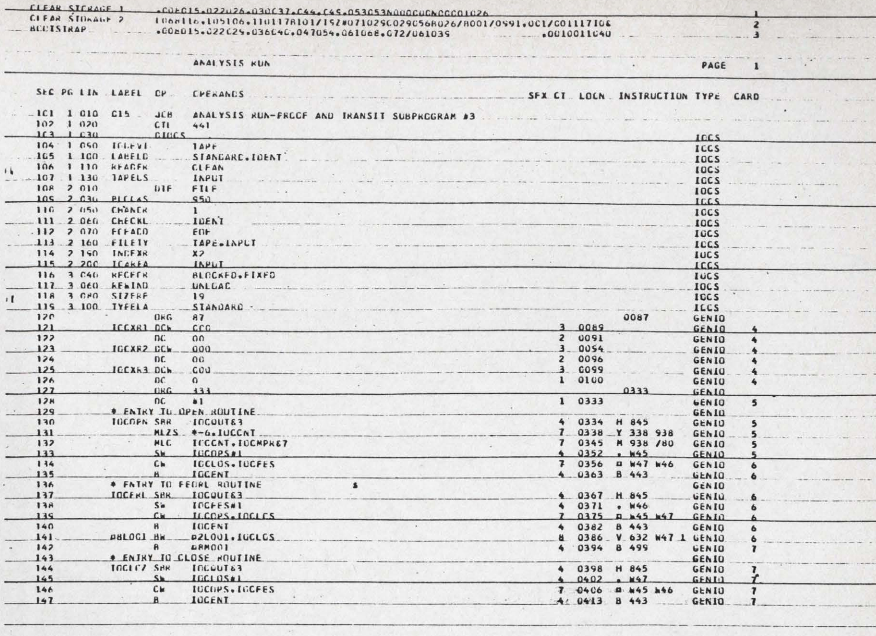
The diagram below is a typical example of standard production flow techniques that is to be employed by Systems Analysts and Programmers when finalizing production flow documentation.

*The three numerical blocks given in the processing flow are respectively: System Number, Program Number, and Estimated Average Run Time.



simply stating "See attached report layout" or defining on the abstract the physical appearance that the output report must take. After the output files have been fully described, the last section of the abstract should indicate the problems that must be solved by the computer program. There are various ways of describing or establishing the problem. Some Analysts describe the problem by decision tables or a matrix type of table. Other Analysts may prefer to establish the problem through use of a narrative. No matter how the problem is described, it should communicate enough detail for the Programmer to create and construct the proper logic to build the necessary program. Figure 3 displays a typical abstract.

4. Detailed Program Logic Narrative
   During the last six to ten years attempts have been made at documenting the logic of a computer program. One of the most popular documentation methods is for the Programmer to save and file his "logic diagram"; that is, if he has created a logic diagram. Not all Programmers create logic diagrams when constructing a program. Some write rough logic summaries, others draw very crude boxes, and still others are able to create small programs as they are coding. These diagrams, etc., are usually never updated after the program is completed. I have found a successful method for obtaining a definition of the program and logic is to require all Programmers, after completing a program (that is to say, when the program is implemented into production), to write a narrative describing their program. In order to enforce this rule, a program is not accepted without the "Logic Narrative". See Figure 4 for an example of a logic narrative.
5. Current Program Listing
   A listing of the present production program must be retained as documentation for the program. This listing will be produced by the final assembly and filed with the other documentation. See Figure 5.



```
CLEAR STORAGE 1     .C0EC15.022026.030C37.C44.C45.053C53N000C0CNCCC01026              1
CLEAR STORAGE 2     1068116.105106.110117B101/1S2#071029C029C56B026/B001/0S91.0C1/C01117I06   2
BOOTSTRAP           .C0E015.022C29.036C40.047054.061068.072/061039          .0010011040   3

                    ANALYSIS RUN                                                   PAGE  1

SEC PG LIN  LABEL  OP    OPERANDS                              SFX CT LOCN INSTRUCTION TYPE CARD

101  1 010  C15    JOB   ANALYSIS RUN-PROOF AND TRANSIT SUBPROGRAM #3
102  1 020         CTL   441
103  1 030         DIOCS                                                            IOCS
104  1 050  IOLEVI       TAPE                                                       IOCS
105  1 100  LABELD       STANDARD.IDENT                                             IOCS
106  1 110  READER       CLEAN                                                      IOCS
107  1 130  TAPELS       INPUT                                                      IOCS
108  2 010         DTF   FILE                                                       IOCS
109  2 030  BLOCAS       950                                                        IOCS
110  2 050  CHANER       1                                                          IOCS
111  2 060  CHECKL       IDENT                                                      IOCS
112  2 070  EOFADD       EOF                                                        IOCS
113  2 160  FILETY       TAPE.INPUT                                                 IOCS
114  2 190  INDEXR       X2                                                         IOCS
115  2 200  IOAREA       INPUT                                                      IOCS
116  3 040  RECFOR       BLOCKED.FIXED                                              IOCS
117  3 060  REWIND       UNLOAD                                                     IOCS
118  3 080  SIZERF       19                                                         IOCS
119  3 100  TYPELA       STANDARD                                                   IOCS
120                ORG   87                                            0087         GENIO
121         IOCXR1 DCW   000                                 3  0089                GENIO  4
122                DC    00                                  2  0091                GENIO  4
123         IOCXR2 DCW   000                                 3  0094                GENIO  4
124                DC    00                                  2  0096                GENIO  4
125         IOCXR3 DCW   000                                 3  0099                GENIO  4
126                DC    0                                   1  0100                GENIO  4
127                ORG   333                                           0333         GENIO
128                DC    #1                                  1  0333                GENIO  5
129         * ENTRY TO OPEN ROUTINE                                                 GENIO
130         IOCOPN SBR   IOCOUT&3                            4  0334  H 845         GENIO  5
131                MLZS  *-6.IOCCNT                          7  0338  Y 338 938     GENIO  5
132                MLC   IOCCNT.IOCMPR&7                     7  0345  M 938 780     GENIO  5
133                SW    IOCOPS#1                            4  0352  , W45         GENIO  5
134                CW    IOCLOS.IOCFES                       7  0356  ¤ W47 W46     GENIO  6
135                B     IOCENT                              4  0363  B 443         GENIO  6
136         * ENTRY TO FEORL ROUTINE                                                GENIO
137         IOCFRL SBR   IOCOUT&3                            4  0367  H 845         GENIO  6
138                SW    IOCFES#1                            4  0371  , W46         GENIO  6
139                CW    IOCOPS.IOCLOS                       7  0375  ¤ W45 W47     GENIO  6
140                B     IOCENT                              4  0382  B 443         GENIO  6
141         ØBLOC1 BW    Ø2L001.IOCLOS                       8  0386  V 632 W47 1   GENIO  6
142                B     ØBM001                              4  0394  B 499         GENIO  7
143         * ENTRY TO CLOSE ROUTINE                                                GENIO
144         IOCLCZ SBR   IOCOUT&3                            4  0398  H 845         GENIO  7
145                SW    IOCLOS#1                            4  0402  , W47         GENIO  7
146                CW    IOCOPS.IOCFES                       7  0406  ¤ W45 W46     GENIO  7
147                B     IOCENT                              4  0413  B 443         GENIO  7
```

Figure 5

6. Test Data

   In order for the Programmer to positively assure that the program functions as per specifications, test data must be created. Usually "static" test data is created by the Programmer and "systems" test data supplied by the User or by the Analyst. The test data that most thoroughly "checks" the program should be maintained on file, not only card decks, but a listing of the test data and the results. Whenever a change is made to the program the test data can be rerun and thereby prove if the new version of the program is correct.

7. Record Layouts and Sample of Input and Output Reports

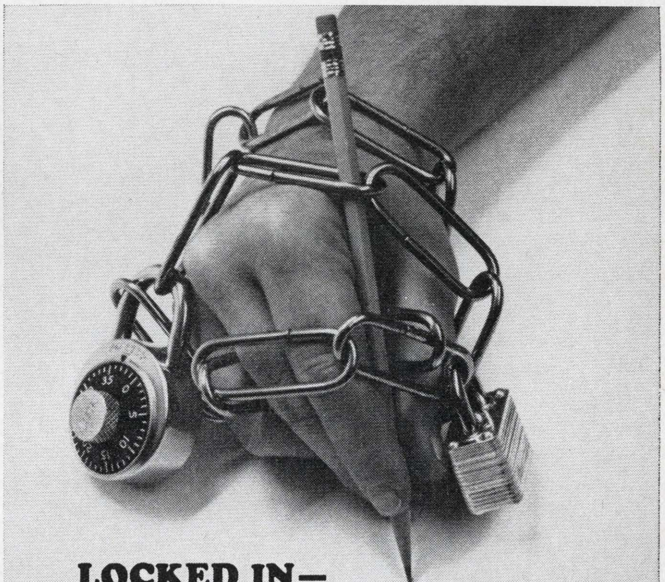
   The record layout of all files must be included either with the abstract or filed by themselves with each program within a system. Also samples of the printed output should be filed as well as samples of the input documents. In this section of the file, one other piece of documentation must be kept and that is Keypunch Operator punch instructions. See Figures 6 and 7 for samples of this type of documentation.

8. Computer Operator Instructions

   Clear instruction must be created for the Computer Operator to follow when running each program. Two copies are usually made: One is filed in the documentation book and the other is forwarded to the Computer Operations Department with the program. See Figure 8.

9. Miscellaneous Documentation

   Any other documentation should be kept as miscellaneous documentation and filed. This documentation may be memos and letters from and to the User or



Customer of this particular system.

10. Data Control Instructions

    If the system requires any manual handling prior to keypunching, and also requires clerical handling after computer operations, special clerical instructions must be written. Clerical balancing and handling is usually done by a section sometimes called Data Control. Instructions for balancing input and/or output must be included in this section of the documentation.

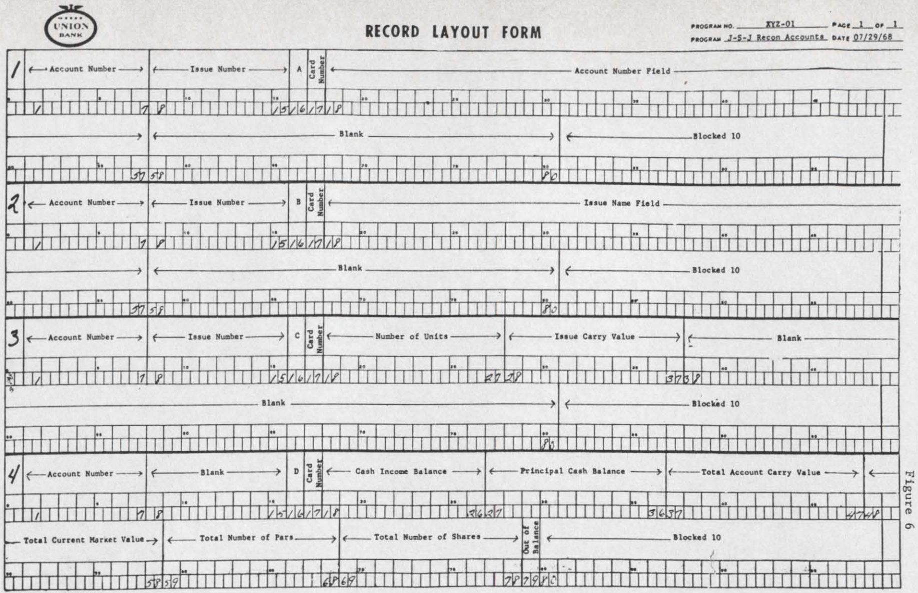
If the above documentation is created at the proper time and kept on file, it makes the job of modifying a system or program 50 to 75 percent easier.

As can be seen, control over documentation of this type could become very cumbersome. Some installations have created a documentation library. In this library binders and books are maintained containing all the documentation as described above. Also, files for source and object decks can be contained in the library. In a larger installation it becomes necessary to assign one or two people to act as Source Documentation Librarians, their job being that of maintaining all the documentation and keeping track of who has withdrawn the documentation. This position is also a fine starting point for Programming trainees.

STANDARD DOCUMENTATION LIBRARIAN

In most cases, it is necessary to require the Programmer or Analyst to update documentation when a program is being modified or changed. If the installation can afford a Librarian, he or she should be given the responsibility of seeing that all documentation is updated and changed when modifications are implemented. Some of the duties that can be controlled by a Data Processing Librarian are:

1. *Communications:* Any memo requesting changes to programs or requesting new programs or systems to be updated can be controlled by the Librarian. In these instances, the Librarian can bring such requests to the attention of the Systems Manager or Data Processing Manager. If these requests are substantial, the Librarian can keep track of who has been assigned to the modification or new program creation. As the programs are created and implemented, the Librarian will account for the fact that all documentation has been received and is on file. We have found it successful in our installation to establish a rule that no one can implement a new or revised program in the



UNION BANK

RECORD LAYOUT FORM

PROGRAM NO. XYZ-01 PAGE 1 OF 1
PROGRAM J-S-J Recon Accounts DATE 07/29/68

1 ← Account Number → ← Issue Number → A Card Number ← Account Number Field →
1 7 8 15 16 17 18
→ ← Blank → ← Blocked 10
57 58 80

2 ← Account Number → ← Issue Number → B Card Number ← Issue Name Field →
1 7 8 15 16 17 18
→ ← Blank → ← Blocked 10
57 58 80

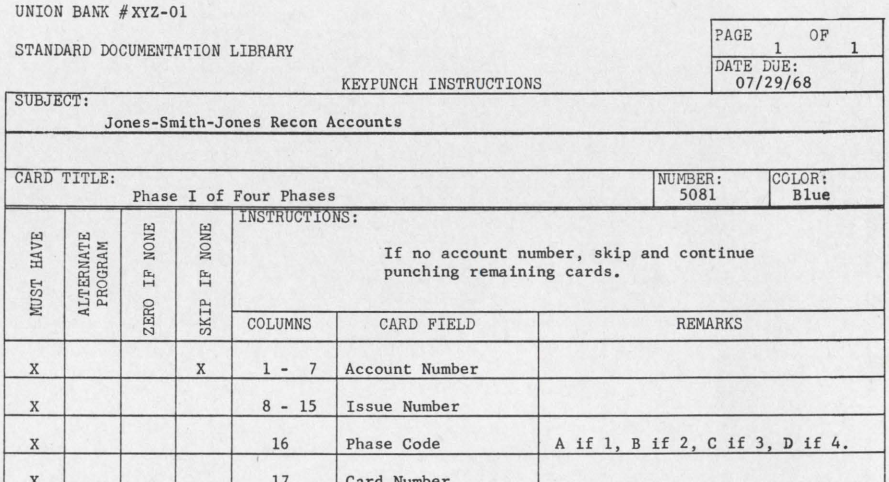
3 ← Account Number → ← Issue Number → C Card Number ← Number of Units → ← Issue Carry Value → ← Blank
1 7 8 15 16 17 18 27 28 37 38
Blank → ← Blocked 10
80

4 ← Account Number → ← Blank → D Card Number ← Cash Income Balance → ← Principal Cash Balance → ← Total Account Carry Value → ←
1 7 8 15 16 17 18 36 37 36 37 47 48
Total Current Market Value → ← Total Number of Pars → ← Total Number of Shares → Out of Balance ← Blocked 10
58 59 68 69 78 79 80

DP-5566 (REV. 12/67)

Figure 6

Figure 7



UNION BANK #XYZ-01

STANDARD DOCUMENTATION LIBRARY

KEYPUNCH INSTRUCTIONS

PAGE 1 OF 1

DATE DUE: 07/29/68

SUBJECT: Jones-Smith-Jones Recon Accounts

CARD TITLE: Phase I of Four Phases

NUMBER: 5081

COLOR: Blue

INSTRUCTIONS: If no account number, skip and continue punching remaining cards.

MUST HAVE	ALTERNATE PROGRAM	ZERO IF NONE	SKIP IF NONE	COLUMNS	CARD FIELD	REMARKS
X			X	1 - 7	Account Number	
X				8 - 15	Issue Number	
X				16	Phase Code	A if 1, B if 2, C if 3, D if 4.
X				17	Card Number	
X		X		18 - 57	Account Number	Fill in with zeros.
				58 - 80	Blank	Blank.

DP-7286 1/66

Computer Operations Department. This function is performed by the Librarian only. The Computer Operations Department will not accept programs from anyone except the Standard Documentation Librarian.

2. *Technical Manuals and Magazines:* The Librarian will also maintain and control a library of computer manufacturers' technical manuals as well as technical magazines and articles found in data processing publications. Anyone requiring a manual or description of a specific machine or system may receive information from the Librarian as to whether publications are available concerning the subject in which they are interested.
3. *Security of Information:* The Librarian is responsible for the total security of program source decks and all systems documentation. The files holding source decks and program documentation are always locked. In this manner no one but authorized personnel will be working with program listings or source decks.

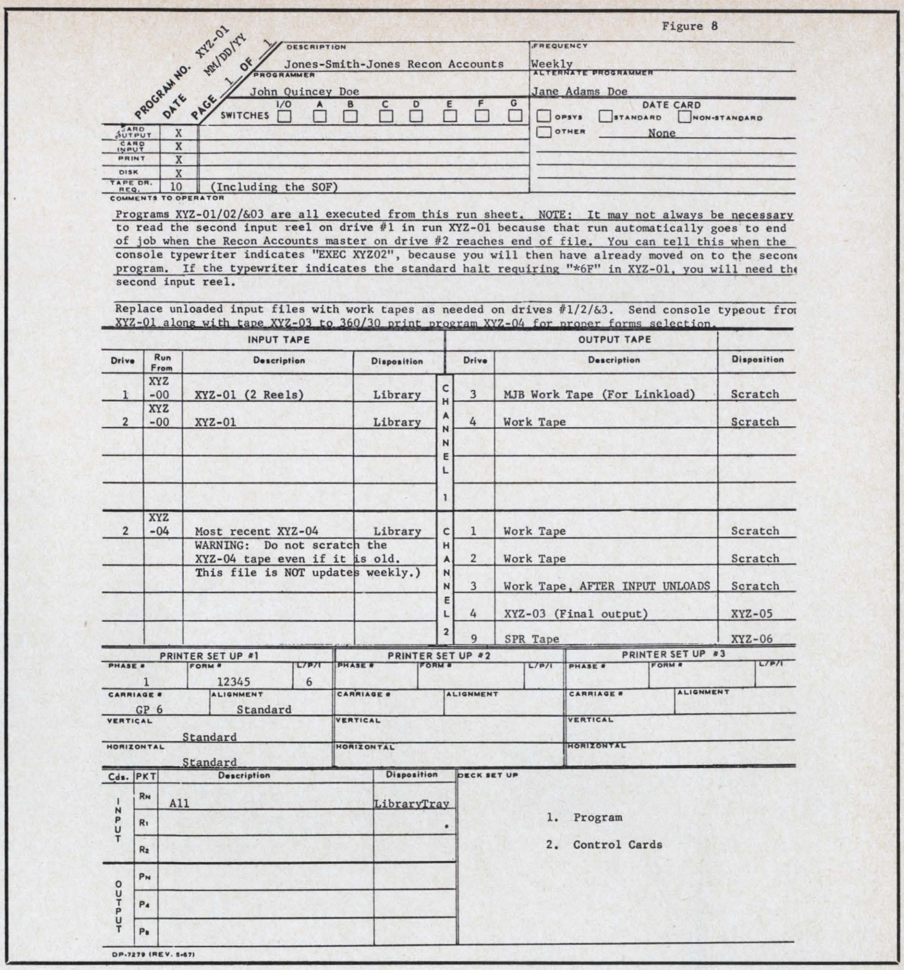


Figure 8

PROGRAM NO. XYZ-01
DATE MM/DD/YY
PAGE 1 OF 1

DESCRIPTION: Jones-Smith-Jones Recon Accounts
FREQUENCY: Weekly
PROGRAMMER: John Quincey Doe
ALTERNATE PROGRAMMER: Jane Adams Doe

SWITCHES: I/O ☐ A ☐ B ☐ C ☐ D ☐ E ☐ F ☐ G ☐

DATE CARD: ☐ OPSYS ☐ STANDARD ☐ NON-STANDARD ☐ OTHER None

CARD OUTPUT	X	
CARD INPUT	X	
PRINT	X	
DISK	X	
TAPE DR. REQ.	10	(Including the SOF)

COMMENTS TO OPERATOR

Programs XYZ-01/02/&03 are all executed from this run sheet. NOTE: It may not always be necessary to read the second input reel on drive #1 in run XYZ-01 because that run automatically goes to end of job when the Recon Accounts master on drive #2 reaches end of file. You can tell this when the console typewriter indicates "EXEC XYZ02", because you will then have already moved on to the secon program. If the typewriter indicates the standard halt requiring "*6F" in XYZ-01, you will need th second input reel.

Replace unloaded input files with work tapes as needed on drives #1/2/&3. Send console typeout fro XYZ-01 along with tape XYZ-03 to 360/30 print program XYZ-04 for proper forms selection.

INPUT TAPE					OUTPUT TAPE		
Drive	Run From	Description	Disposition		Drive	Description	Disposition
1	XYZ -00	XYZ-01 (2 Reels)	Library	CHANNEL 1	3	MJB Work Tape (For Linkload)	Scratch
2	XYZ -00	XYZ-01	Library		4	Work Tape	Scratch
2	XYZ -04	Most recent XYZ-04	Library	CHANNEL 2	1	Work Tape	Scratch
		WARNING: Do not scratch the XYZ-04 tape even if it is old. This file is NOT updates weekly.)			2	Work Tape	Scratch
					3	Work Tape, AFTER INPUT UNLOADS	Scratch
					4	XYZ-03 (Final output)	XYZ-05
					9	SPR Tape	XYZ-06

	PRINTER SET UP #1	PRINTER SET UP #2	PRINTER SET UP #3
PHASE #	1		
FORM #	12345		
L/P/I	6		
CARRIAGE #	GP 6		
ALIGNMENT	Standard		
VERTICAL	Standard		
HORIZONTAL	Standard		

Cds.	PKT	Description	Disposition
INPUT	RN	All	LibraryTray
	R1		
	R2		
OUTPUT	PN		
	P4		
	P8		

DECK SET UP

1. Program
2. Control Cards

DP-7279 (REV. 5-67)

SOFTWARE DEVELOPMENT
STATE-OF-THE-ART
Nationwide

We are leading Consultants to Computer Manufacturers, specialized Software Companies and very large users. We specialize in placing you where the action is, where challenges confront you daily. From NOW UNTIL JUNE we must fill demanding posts with: persuasive, creative and technically outstanding Professionals such as:

2 Group Mgr's: Standard Software" $25,000
3 Gen. Mgrs: "Software Test Group" $20,000
5 Sr. O.S. Dev't. Specialists $18,000
2 Mgr's: Lg. Scale "M.I.S. Dev't." $18,000
Many Systems Prog. Up to $16,000
Also Comm. & Scient. Progr/Anal's. Up to $15,000

GENERAL BACKGROUND REQUIREMENTS: 1–15 years experience in the development of: Compilers, I/O Systems, Operating Systems, Programming Languages, Monitors, Shared File Systems, Terminal–Graphics–Communications –Real Time–Time Shared Systems, Mass Memory Allocation.

Write in confidence, including present salary, acceptable locations or call 212-682-6426.

THE HOUSE FOR SOFTWARE SPECIALISTS
Ferguson Personnel Agency, Inc., 41E42, N.Y.C., N.Y.
Consultants in the EDP Field — Gary Vogt, Managing Director

PROGRAMMERS—ENGINEERS

Washington, D.C. • New York • New Jersey • New England • Philadelphia • Chicago • Minnesota • Texas • Ohio • Florida • Arizona • California • Southeast Asia

If you have a B.S., M.S. or Ph.D. and you are experienced or interested in any of the following, contact us immediately for free career counseling and an objective analysis of your position in today's market.

PROGRAMMERS
• Management Info Systems
• Information Retrieval
• Command & Control
• Aerospace Applications
• Real Time/On Line
• Systems Simulation
• Software Development
• Communications
SYSTEMS ENGINEERS
• Reliability Analysis
• Digital Computer Systems
• Digital Logic Design
• Digital Circuit Design
• Digital Communications
• Systems Integration
• Soft Ware Analysis
• Oceanography

Salaries range from $8,200 to $25,000. Our client companies assume all fees. Forward resume in confidence, or call (collect): Mr. Martin E. Sheridan (Area Code 703) 524–7660.

SHERIDAN ASSOCIATES INC.
1901 North Fort Myer Dr., Suite 1010, Arlington, Virginia 22209
(Just over the Potomac from Washington, D. C.)
Personnel Consultants to the Computer Industry
Write for application and wage/salary survey.

For more information, circle No. 17 on the Reader Service Card

PROGRAMMER'S PROGRAMMERS WANTED FOR SOFTWARE MECHANIZATION

We are in the process of revolutionizing the Automatic Testing Industry through Software Mechanization. This is a concept whereby men, materials and computers are optimally combined to produce large quantities of programs for Automatic Test Systems.

Software Designers are required to develop advanced compilers, simulators and other software aids to allow test engineers to do their jobs without becoming programmers.

If you are an experienced compiler architect, teleprocessing software designer or systems simulation programmer or analyst, we have an outstanding technical challenge for you. We prefer an electrical engineering background with advanced degree in digital computer programming or equivalent, plus a minimum of six years pertinent experience.

We offer ground-floor opportunities in a newly formed Software Systems Engineering Laboratory of a leader in the new technology of automatic testing.

Please send your resume in confidence, including salary history, to:
J. L. Leath, Station 2192
EMERSON ELECTRIC COMPANY
Electronics and Space Division
8100 W. Florissant, St. Louis, Missouri 63136
An Equal Opportunity Employer

CHECKMATE

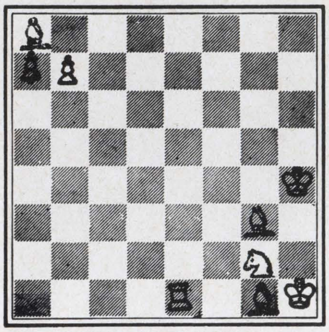
by

GEORGE N. VASSILAKIS

TRW SYSTEMS GROUP

Problem 3

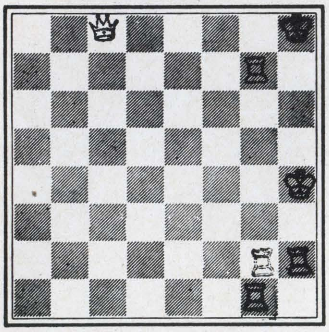
Samuel Loyd
Holyoke Transcript
1877



Mate in 3 Moves

Problem 4

Eric M. Hassberg
New York Post
1945



Mate in 2 Moves

Solutions:

Problem 1: Key Q–B5
If 1 . . . BxQ 2R–R7ch and mates the next move. If 1 . . . K–N1 2K–B7ch K–R2 3R–R8 mate; similar mate if King moves to K1.
Problem 2: Key Q–Q6

THE MINIGAME

This was the nineteenth game of the 1952 World Championship Tournament between Botvinnik and Smyslov.

	Smyslov (White)	Botvinnik (Black)
1	P–K4	P–K3
2	P–Q4	P–Q4
3	N–Q2	P–QB4
4	KPxP	KPxP
5	B–N5ch	N–B3
6	Q–K2ch	Q–K2
7	PxP	QxQch
8	NxQ	BxP
9	N–QN3	B–N3
10	B–Q2	B–Q2
11	B–B3	P–B3
12	O–O	KN–K2
13	N(K2)–Q4	R–QB1
14	NxN	BxN
15	BxBch	PxB

Drawn

MASS TOURNAMENTS

Since Botvinnik won the world championship in 1948, only Russians have qualified as challengers. Grand masters from other lands have succeeded to enter the final eliminating event, the Challenger's Tournament, but this has always been won by a Russian. The U.S.S.R. has more than twice as many grand masters as there are in the U.S.A. and approximately one-third of all the grand masters in the world today. The popularity of chess in the Soviet Union is undoubtedly the best explanation one can give for their enormous success; and the best yardstick for measuring this popularity is found in the numbers of players that enter chess tournaments.

The first mass tournament was held in Leningrad in 1926 with 1500 participants. In 1936, the third championship of the All-Union Central Council of Trade Unions attracted 700,000 participants. New Year mass tournaments have become a regular event and attract close to one million participants each year.

By comparison, the biggest U.S.A. tournaments each year attract 100–200 participants.

WORLD CHAMPIONS

The title has been in use since 1870, when Steinitz claimed it on the basis of his many successes. The unofficial champions before Steinitz were: Staunton (1844–1851), Anderssen (1851–1858 and 1859–1866), and Morphy (1858–1859).

Howard Staunton (1810–1874)—An actor and a Shakespearean scholar, he learned chess at the age of thirty and three years later, in 1843, he became the best player in the world by defeating the Frenchman St. Amant. He wrote a number of books and also published a magazine called "The British Miscellany and Chess Player's Chronicle."

In 1851 Staunton organized the first international chess tournament which was held in London with Anderssen winning the top prize. Staunton's chess career virtually stopped after his defeat in London. An extremely aggressive person, Staunton loved a good argument in print. He attained the heights in both chess and literary criticism and a place in the Encyclopedia Britannica as a Shakespearean scholar who "showed the qualities of acuteness and caution which made him excel in chess."

THE PSYCHOLOGY OF A CHESS PLAYER

In his book, "The Psychology of a Chess Player," Reuben Fine quotes Dr. Milton Gurnitz, a prison psychologist, saying that:

> "In his experience those prisoners who learned chess during their incarceration were least likely to be recidivists. They evolve better ways of handling their aggression. The ego strength needed to play chess must also play a role here.
>
> "In a situation where two men are voluntarily together for hours at a time with no women present the homosexuality implications must necessarily be considered. Observation indicates that overt homosexuality is almost unknown among chess players. Among the chess masters of the present century I have heard of only one case. This is all the more striking in that artists, with whom chess masters like to compare themselves, are so frequently homosexual."

new products

Webster Computer Corporation, Danbury Connecticut has developed a **computer software package for IBM System/360-users** currently operating under DOS (Disk Operating System).

The software package, DOS MACHINE UTILIZATION REPORTING SYSTEM is a generalized record keeping system for IBM 360 users which provides complete time and cost analysis of all jobs, programs, projects and programmers operating on each computer system.

The efficiency of an IBM System/360 computer installation in terms of time and dollar cost is displayed by job, program, project and programmer with respect to production time, compilations, testing, rerun time, preventative maintenance and idle time.

Detail records provided through the use of DOS MACHINE UTILIZATION REPORTING SYSTEM may be retained, selected, sorted and summarized in many ways to provide analyses as required by an IBM System/360 installation.

For more information, circle No. 50
on the Reader Service Card

* * *

The Model 502 Telephone Data Coupler provides a low cost portable coupling means to interface digital data terminals such as the Teletype Models 33 and 35 with computer systems via telephone lines. Half or full duplex operation at up to 300 Baud for serial binary data is provided.

The Model 502 was designed by Specialized Communications Inc., and manufactured and distributed by ITI Electronics, Inc.

For more information, circle No. 51
on the Reader Service Card

* * *

DataMate Computer Systems, Big Spring, Texas, has announced their new **DataMate 16 digital computer.**

A two's complement, 16 bit arithmetic fully parallel processor, the DataMate has a 4096 word 1.0 microsecond memory modularly expandable to 32,724 words. Built in features include hardware multiply and divide; 8 I/O channels with priority interrupts; hardware index register and power failure protection. A flexible I/O bus accommodates up to 64 peripheral devices. Standard peripherals include a teletype; paper tape reader and punch; incremental magnetic tape; dual density IBM compatible magnetic tape system; CRT display; digital plotter; line printer and rotating mass storage. A simple plug in card is used to interface DataMate 16 with these peripherals.

The DataMate 16 uses the latest digital design techniques—IC's and MSI devices throughout. The computer has byte, word, and double word processing capability with multi-level indirect addressing. Over 80 powerful commands are built into DataMate.

For more information, circle No. 52
on the Reader Service Card

* * *

The new P5P **Accodata Data Processing Binder** is designed with deluxe features for executive presentation. Constructed of 35-point heavy duty Accohide, it utilizes the newest concept in binding—the Accodata full-slide vinyl fastener—which assures luxurious appearance as well as trouble-free performance. Styled in contrasting shades of office grays, the fastener slides on smoothly to conceal the entire cable mechanism.

Top and bottom loading provides easy addition or removal of data forms subject to constant referral. Ten-inch Dataflex posts allow up to 8-inch capacity; multipost spacing permits one binder to accept various form sizes. Double-scored hinges and turned-over stubs provide smooth, unencumbered top and bottom covers for low profiles and compact storage.

For more information, circle No. 53
on the Reader Service Card

* * *

Linnell Electronics, Inc.—a member of the Comstock–Keystone Computer Group—has entered the peripheral field with the introduction of a **magnetic disc drive** which uses a removeable storage medium such as the IBM 1316 disk pack.

The new unit, the Linnell Model 1100 Disc Drive, is intended specifically for System 360 users and has been designed to meet all their requirements—program, interface, styling, maintenance and reliability. In achieving this, Linnell has parallelled the design of the IBM Model 2311 considerably beyond the usual plug-for-plug compatibility conventionally claimed for other drives. In appearance the two units are almost identical, having the same contours, colors and dimensions. Mechanically, they are part-for-part interchangeable in essential componets. Electrically, they employ the same logic. And they both use the same procedure-for-procedure maintenance.

The chief feature of the Model 1100 is the extremely reliable hydraulic head actuator. This component, which is directly interchangeable with the 2311 hydraulic actuator, eliminates the thermal, magnetic and drift problems inherent in electronic actuators. It also minimizes periodic adustment and maintenance requirements.

For more information, circle No. 54
on the Reader Service Card

* * *

Called the COMMUNITYPE 850 Magnetic Tape Transmission System, the equipment is capable of sending and receiving computer data in high-speed (tape-to-tape) transmissions over ordinary telephone company direct-dial circuits, such as between computer centers.

The 850 unit was designed primarily for use with Communitype's 100SR Data Communication System, an input/output source data terminal featuring a standard-keyboard IBM Selectric® typewriter.

A single 850 unit placed at the corporate computer center can serve scores of widely-dispersed 100SR installations, regardless of distances involved. Leased or private lines are not necessary, and the traditional electronic data processing steps of punch card preparation and verification are eliminated.

As the 850 system receives the data from the 100SR units, it transforms the data instantly and automatically to computer code recorded on magnetic tape compatible with IBM-360 type computers using series 2400 9-track tape drives. The data is recorded at 800 bpi (bits per inch) density.

The 850 system can also transmit computer-prepared data to remotely-located 100SR units by reading the data block-by-block into a 160-character (or larger) MOSFET buffer memory unit.

For more information, circle No. 55
on the Reader Service Card

* * *

A proprietary program called ANALYZE has been developed for general use by programmers, DP Managers, and computer facilities to **interface between the users program and the IBM-360 DOS/TOS supervisor.**

The ANALYZE Program is designed to stop premature cancellation of computer programs because of defects in data, or programming errors. The ANALYZE Routine automatically intercepts program checks or operator interrupts and transfers control to the operator, who may select any of several actions to correct the error and resume processing if desired.

It is advantageous as a method of machine console debugging during program testing and production shakedown runs when the data may be unpredictable and/or the program itself may be of a complex nature. It also allows the operator to interrupt program processing at will in order to perform data or instruction set modification, obtain core-memory displays, etc.

For more information, circle No. 56
on the Reader Service Card

* * *

The development of a data input system to **utilize a direct keyboard-to-magnetic disc storage file** has been announced by Logic Corporation, Haddonfield, N. J. The LC-720-Disc Data Entry System consists of standard keyboard input terminals, a central processor, which will accept data from as many as 120 keyboards simultaneously, and an IBM 2311 disc pack drive.

The LC-720-Disc System offers simultaneous entry and verification of data by two different operators. Record size is from 1 to 240 characters long. A large library of up to 30 programs may be stored in the system and each is available simultaneously to all operators.

The keyboard is a standard 64 character IBM 029 keyboard layout. An alphanumeric display panel shows the operator in English the program number, the last character entered and column number, job number, record number, data availability, verification status, and the terminal operating mode.

For more information, circle No. 57
on the Reader Service Card

TROUBLE-TRAN
PRESENTS
XTRAN'S ADVENTURES IN FORTRAN

By GEORGE N. VASSILAKIS

Send your ANSWER to the problems posed here in each issue to:

TROUBLE-TRAN EDITOR
software age
P. O. Box 2076
2211 Fordem Ave., Madison, Wis. 53701

You can also profit by submitting PROBLEMS for this feature. If your problem is FORTRAN programming is selected for use in this feature, you will receive ___________ **$25.00**

TROUBLE-TRAN's Objectives:

1. To have fun.
2. To promote USA Standard FORTRAN by pointing out differences and inconsistencies of existing FORTRAN Compilers.
3. To alert programmers to the physical limitations of hardware.

Contest Rules:

1. The best answer (best explanation) bearing the earliest postmark wins __ **$25.00**
2. The second best answer with the earliest postmark will net the reader submitting it ______________________ **$15.00**

PROBLEM OF THE MONTH

Here is a problem that has not violated any of the USA Standard FORTRAN rules, however, not all third generation computers will give the same answer.

```
C   SUBMITTED BY F.M. OLIVA
    A=2                            SUBROUTINE XTRAN  (A,B)
    CALL XTRAN(A,A)                A=A+B**3
    WRITE  (6,100) A               IF(A.LT.SQRT(B))  B=3.14
100 FORMAT(F10.2)                  RETURN
    STOP                           END
    END
```

The problem is to determine which of the following systems will print a different answer for A and why?

CDC-6600, UNIVAC 1108, IBM 7094, GE-635, IBM System/360, SDS Sigma 7, Spectra 70, B5500.

ANSWER TO LAST MONTH'S PROBLEM

The purpose of this problem was to emphasize the importance of thinking before coding. Programmers who do not like to be called coders should always be on guard and never write a single line of code without thinking about the constraints of the problem or the physical limitations of the equipment that is used to solve the problem.

You may recall that our young engineers John and Tom had coded the following program to compute a table of factorials:

```
    F=1.                           100 FORMAT(I10,E15.8)
    DO 10  J=1,100                  10 CONTINUE
    X=J                                STOP
    F=F*X                              END
    WRITE(1,100) J,F
```

It is obvious that John and Tom had not violated any FORTRAN rules. Then, why did XTRAN insist that something was wrong? The answer of course is found in the word factorial. Anyone who has used factorials before knows that a 100! is a very very large number, and outside the range of floating point numbers most computers would allow. Indeed 100! equals 9.33×10^{157} and only the CDC computers would accept such a large number. Most first and second generation computers use -38 to $+38$ as the range of exponents for real numbers. The magnitude of the largest real number allowed by IBM System/360 is 16^{63} (7.2×10^{75} approx.). SDS computers use -77 to $+77$ as the range of exponents.

Perhaps the simplest method of computing large numbers and still keeping track of the exponents is to pick a large constant such as 10^{30} and use it to divide the number that is being computed each time it exceeds this constant, then set a counter to count multiples of 10^{30}.

P. S. Many readers have sent me new material recently and, since it is rather difficult to answer each one individually, I would like to take this opportunity to express my gratitude to all of you and assure you that your problems will be carefully considered.

XTRAN

TROUBLE-TRAN WINNERS

SEPTEMBER

1st—R. Reichert, Murray Hill, N. J.
2nd—W. J. Reduchel, Cambridge, Mass.

OCTOBER

1st—S. W. Herrold, St. Laurent, Canada
2nd—V. F. Jennemann, Tulsa, Okla.

NOVEMBER

1st—V. F. Latvis, West Haven, Conn.
2nd—R. Bressler, Brookline, Mass.

HELP WANTED

PROGRAMMER

Immediate opening for experienced COBOL, S/360 DOS, Programmer to work on medical projects in new Data Processing facility with an S/360-30.

EXCELLENT SALARY AND BENEFIT PROGRAM

Submit resume with salary requirement to:

Director of Personnel
AUGUSTANA HOSPITAL
411 West Dickens, Chicago, Illinois 60614

PART TIME PROGRAMMERS/ANALYSTS with COBOL experience in such areas as management information systems, inventory control, accounting, personnel, or general manufacturing or information retrieval applications. Degree not necessary. All work will be corresponded through the mail on high contract rates. Send brief resume to Box SA-201, Software Age, P. O. Box 2076, 2211 Fordem Ave., Madison, Wis. 53701.

COMPUTER OPERATOR

One year experience required on S/360-30 or larger, under DOS. Must have the ability to develop into LEAD COMPUTER OPERATOR position with responsibility for all computer operations and production.

EXCELLENT SALARY AND BENEFIT PROGRAM

Call or apply to:

Personnel
AUGUSTANA HOSPITAL
348–1000
411 West Dickens, Chicago, Illinois 60614

EMPLOYMENT AND SEARCH CO'S

DATA PROCESSING POSITIONS
IN THE SOUTHWEST
Contact:
DATA PROCESSING CAREERS
Richard Kemmerly, Suite 1109, Stemmons Towers West, Dallas, Texas 75207. 214/637–6360.

PROFESSIONALS WANTED

by the 190 major corporations and private companies using our services. For consideration: forward resume, current and desired salary, location preference to: AEROSPACE & OCEANOGRAPHY Personnel Placement, Box 398, Melbourne Beach, Florida 32951.

PROFESSIONAL SERVICES

CONSULTANT: Excellent experience designing, programming, debugging and documenting commercial applications. Hourly or job basis. Box 11-H, 272 First Ave., N.Y.C. 10009.

COMPUTER SERVICES: Scientific analysis and programming wanted, hourly or job lot, Fortran, work done by mathematician and electrical engineer with graduate degrees from ivy league school. Dept. 202, P. O. Box 2076, 2211 Fordem Ave., Madison, Wis. 53701.

CONTRACT PROGRAMMING in Fortran, Algol, Basic, PL/1. Certification, documentation service. Milton E. Boyd Associates, P.O. 275, Saxonville, Mass. 01701. (617) 877–6827.

market place where you can reach 110,000 programmers, mathematicians, analysts and EDP managers.

CLASSIFIED ADS in software age

CLASSIFIED ADVERTISING

Non-Display Classified: For firms or individuals offering commercial products or services, 75¢ per word (including name and address). Minimum order $7.50. For Blind Ad Service, an additional $10.00. For "Positions Wanted" Ads, 55¢ per word (including name and address). No minimum. **Payment must accompany copy** except when ads are placed by accredited advertising agencies. Frequency discounts: 5% for 6 months; 10% for 12 months paid in advance.

Display Classified: One inch by one column, $70.00. Column width 2¼". Photographs accepted for an additional $20.00. Advertiser to supply all photo, art, cuts, or camera ready copy.

General Information: One inch display Help Wanted and Employment Services ads **will be** accepted in the classified section. Employment ads ⅛ page or more will appear run of book, will be keyed to the resume form in back of publication, and will qualify to free daily resume service.

Closing Date: 1st of preceding month (for example, May issue closes April 1st).

Send order and remittance to: Classified Dept., SOFTWARE AGE, P. O. Box 2076, 2211 Fordem Avenue, Madison, Wisconsin 53701.

software age
P. O. Box 2076 • 2211 Fordem Ave. • Madison, Wis. 53701

CLASSIFIED ADVERTISING ORDER FORM

Please refer to the above information for complete data concerning terms, frequency discounts, closing dates, etc. Cash with order.

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25
26	27	28	29	30
31	32	33	34	35

________Words { @ 55¢ (Reader Rate) / @ 75¢ (Commercial Rate) } = $________

________Include Photograph @ $20.00 additional (**Display Ads Only**)

☐ Run Ad Blind $10.00 Insert________time(s) Total Enclosed $________

NAME________

ADDRESS________

CITY________ STATE________ ZIP________

Signature________

WORD COUNT: Include name and address. Name of city (Des Moines) or of state (New York) counts as one word each. Zone or Zip Code numbers not counted. (Publisher reserves right to omit Zip Code if space does not permit.) Count each abbreviation, initial, single figure or group of figures or letters as a word. Symbols such as 35mm, COD, PO, AC, etc., count as one word. Hyphenated words count as two words.

Programmers and Systems Analysts:

Come to IBM and help solve tomorrow's programming problems.

Many people talk about tomorrow. At IBM's Federal Systems Division, we work on it.

We need creative programmers that think ahead of the state-of-the-art. Our present projects are geared to help solve problems in the 1970's.

Wide range of projects.

Right now we're researching missile systems to cover the needs of the next decade. We're out to help monitor air traffic while en route. Looking for ways to simplify mail handling in tomorrow's Post Office. Retrieving delicate seismological data. And becoming even more involved in America's space program.

In this work, of course, we use the latest computers and peripheral equipment. Much of the work is in real-time... involving multiple-access concepts.

How about you?

We need programmers and analysts with experience in one of two basic areas: information-handling systems or scientific engineering programming. You should have a Bachelor's degree in Mathematics, Physics, Engineering, Economics, or Statistics with at least one year's experience.

Can you solve problems?

Today's major growth industry is information handling and control. And IBM is a leader in that field. This growth environment can bring out the best of your talents and abilities. Because in a growth company like IBM you must work constantly toward greater achievement. This means more opportunities to achieve distinction and personal recognition.

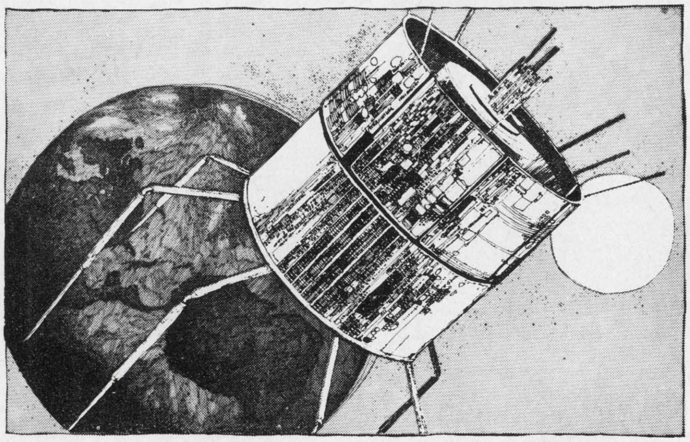
So if you're a problem-solver who wants a personal sense of achievement and recognition for your hard work in an exciting growth company, consider IBM.

Call or write.

Learn more about the opportunities for you at IBM. Immediate openings exist in the Northern New Jersey area; and in metropolitan Washington, D.C. Call Jim Dunn at (301) 921-7724. Or send a brief letter or resume to him at IBM Corporation, Federal Systems Division Headquarters, Dept. CB1023, 18100 Frederick Pike, Gaithersburg, Maryland 20760.

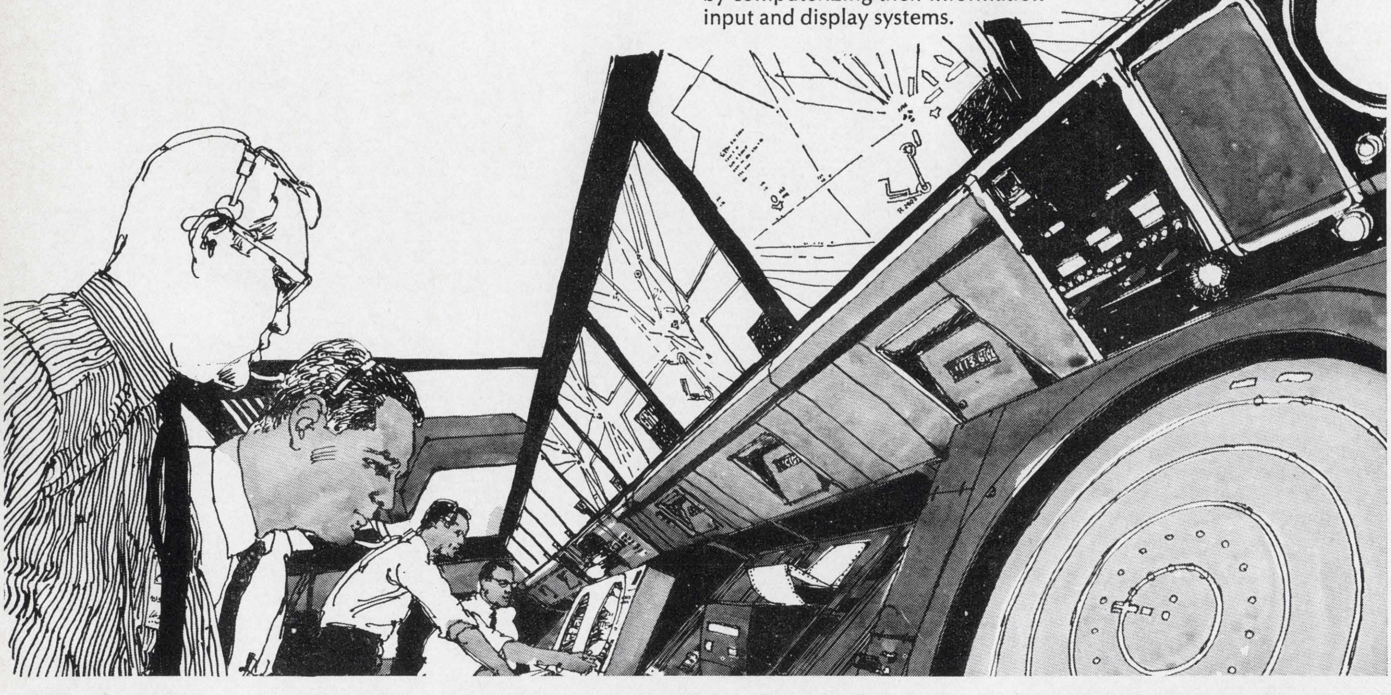
An Equal Opportunity Employer

IBM®



IBM works with NASA's Goddard Space Flight Center to help control and maneuver satellites like ATS (Applications Technology Satellite).

IBM is helping air traffic controllers by computerizing their information input and display systems.



software age

THIS INQUIRY IS IN
DIRECT RESPONSE TO
YOUR ADVERTISEMENT
IN
SOFTWARE AGE
MAGAZINE

CONFIDENTIAL INQUIRY

Your original copy of this form will be retained at the offices of SOFTWARE AGE and will be used for no other purpose than to notify the specific firms which you have checked (on the reverse side) of your interest.

TYPE OR PRINT CLEARLY FOR PHOTO REPRODUCTION

JOB DESIRED:

List computer hardware knowledge (names of systems, tape, disk, terminals, etc.):

Programming specialties and years of experience (commercial, scientific, theoretical, experimental, analog, etc.):

Systems programming on which you have had development experience (compilers, assemblers, executives, monitors, O.S., etc. Indicate for what computer):

Programming languages used and extent of experience (COBOL, FORTRAN, etc.):

Applications programmed (aerospace, banking, insurance, math subroutines, compilers, etc.):

Systems analysis experience (card design, flow charting, operation analysis, etc.):

EDP management experience (include years and number of people reporting to you):

SALARY: (current) (desired) **DATE OF AVAILABILITY:**

EDUCATION: Indicate major as well as degree unless self-explanatory.

Degrees			
Years			
Schools			

EMPLOYMENT: Indicate present employment and previous jobs below.

Employer			
City			
Years	to	to	to
Title or Function			

Name Age

Home Address Home Phone

(city) (state) (ZIP code) U.S. Citizen?

Security Clearance Location Preference

Marital Status

Military Status

BE SURE YOU HAVE CHECKED ON REVERSE SIDE THE COMPANIES YOU WANT TO SEE THIS INQUIRY. PUT FORM IN STAMPED ENVELOPE AND MAIL TO:

software age
MAGAZINE
P. O. BOX 2076
2211 FORDEM AVE., MADISON, WIS. 53701

AFTER APRIL 10, THIS FORM WILL NOT BE PROCESSED
WRITE ADVERTISERS DIRECTLY OR WRITE US FOR CURRENT S/A ISSUE

check your interests here

Fill in the confidential inquiry form on the other side of this sheet. This form provides all the information advertisers require to screen applicants. If further information is desired, you will hear from the advertiser direct. Then, check below the boxes of those companies to which you want copies of your form sent. Mail to Software Age, P.O. Box 2076, 2211 Fordem Avenue, Madison, Wisconsin 53701. **(Please do not send us your own resume. We will only process this form. A new form must be filled out for each issue in which you are answering ads.)**

			Page
☐	1.	Ann Arbor Computer Corp.	37
☐	2.	Blue Cross–Blue Shield	33
☐	3.	Collins Radio Co.	11
☐	4.	Conductron Corp.	22
☐	5.	Control Data Corp.	8 & 9
☐	6.	Emerson Electric Co.	39
☐	7.	A. Epstein & Sons, Inc.	26
☐	8.	ESSO Mathematics & Systems, Inc.	23
☐	9.	Hamilton Standard Div. of UAC	24
☐	10.	Honeywell, Inc., Electronic Data Processing Div.	5
☐	11.	Hughes Aircraft Co., Aerospace Div.	3rd Cover
☐	12.	Hughes Aircraft Co., Fullerton	20
☐	13.	IBM Corp.	44
☐	14.	Lockheed Electronics Co.	2nd Cover
☐	15.	Mohawk Data Sciences Corp.	37
☐	16.	National Cash Register Co., Electronics Div.	4th Cover
☐	17.	Pratt & Whitney Aircraft	4
☐	18.	RCA, Information Systems Div.	19
☐	19.	Sikorsky Aircraft	15
☐	20.	Univac Corp.	16 & 17
☐	21.	Xerox Corp.	3

EMPLOYMENT AND SEARCH AGENCIES

			Page
☐	22.	American Computer Personnel Inc.	13
☐	23.	Callahan Center for Computer Personnel	24
☐	24.	Computer Careers, Inc.	12
☐	25.	Data Management Services, Inc.	34
☐	26.	Electronic Systems Personnel	21
☐	27.	Ferguson Personnel	39
☐	28.	Robert Half Personnel Agencies	35
☐	29.	Input, Inc.	24
☐	30.	Insta-Search International	25
☐	31.	Everett Kelley Associates, Inc.	31
☐	32.	LaSalle Associates	28
☐	33.	Lawrence Personnel	14
☐	34.	Management Scientists, Inc.	31
☐	35.	National Manpower Register	29
☐	36.	National Personnel Consultants	31
☐	37.	Parker–Finch Associates, Inc.	37
☐	38.	RSVP Services	31
☐	39.	Sheridan Associates	39
☐	40.	Source EDP	26
☐	41.	WCP Information Systems Personnel	10

PRODUCTS AND SERVICES

(Use Reader Service Card)

North American Institute of Systems & Procedures	14
Software Age Resume Center	27

☐ **I do not now receive S/A. Please enter my FREE subscription.**

Name .... Street Address ....

City .... State .... Zip Code ....

Prime Experience in What Industry .... / My Specialty ....

☐ Technical Degree ☐ Non-Technical Degree ☐ No Degree

Year Born .... ☐ I Have Analog/Hybrid Experience

software age

P. O. Box 2076
2211 Fordem Avenue
Madison, Wisconsin 53701