Highlights of Last Year's Business

Summary of the 1.09 Release of Cray Research, Inc. Software

New Feature — "Applications In-depth"

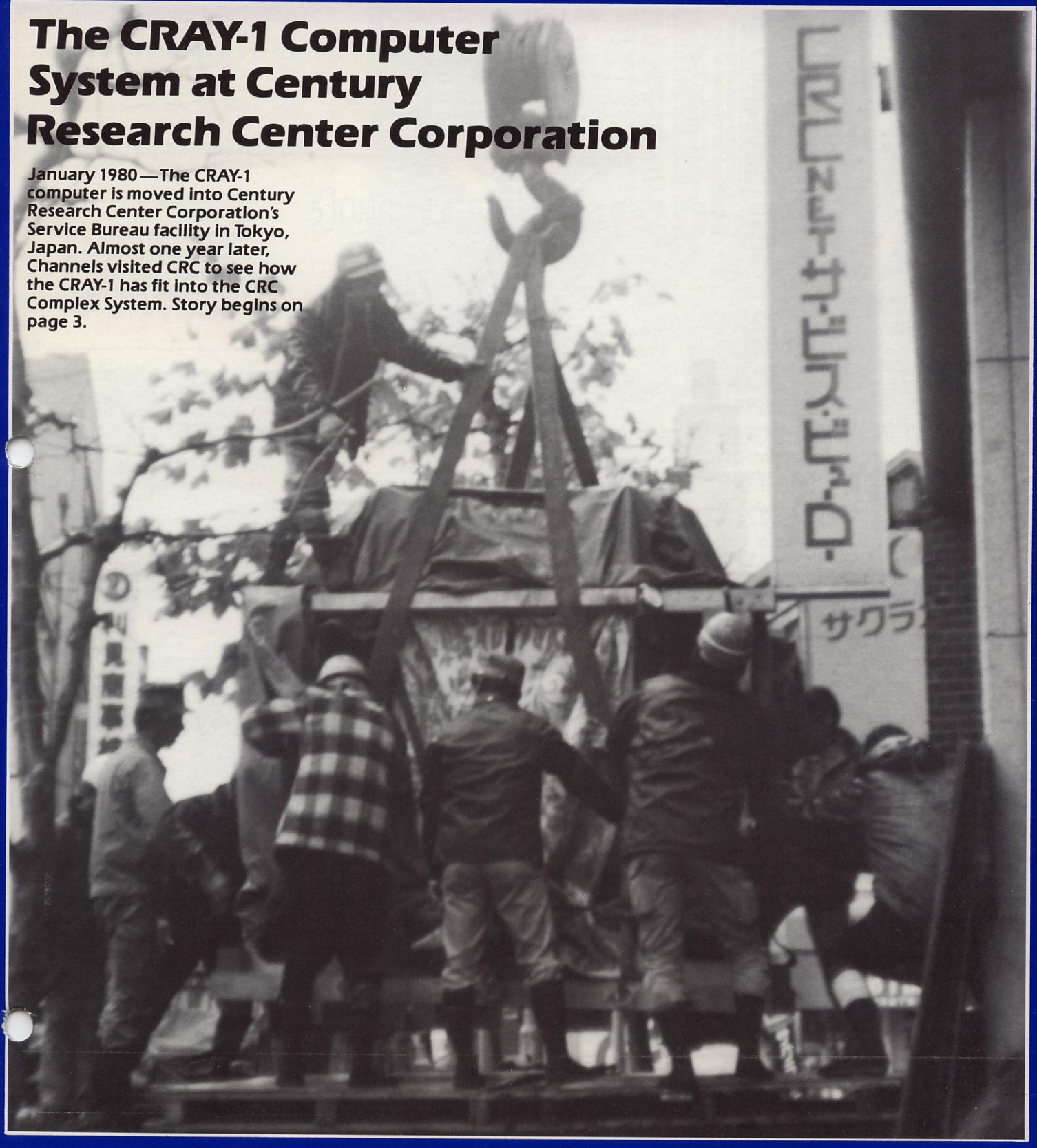
A Publication of Cray Research, Inc.

CHANNELS

Vol. 2, No. 3

The CRAY-1 Computer System at Century Research Center Corporation

January 1980—The CRAY-1 computer is moved into Century Research Center Corporation's Service Bureau facility in Tokyo, Japan. Almost one year later, Channels visited CRC to see how the CRAY-1 has fit into the CRC Complex System. Story begins on page 3.



letter from the editor

With this issue, we are adding a new feature that we feel will be a prime source on applications news for CRAY-1 users and potential users. "Applications In-depth" will provide news on Cray Research, Inc. applications developments, user tips, details on applications programs available on the CRAY-1, information about newly-available documentation, and more. We hope that you will find this addition to **Channels** interesting and helpful.

The new "Applications In-depth" section is just the start of the changes in store for **Channels.** Soon, **Channels** will have a different look and a redefined purpose. Our new emphasis is on providing you with technical news—user information, feature articles written by your fellow users, product news, and even stories about "recreational" uses of the CRAY-1. These changes to **Channels** have been made with the hope of better meeting our readers' informational needs. You'll be receiving your first issue of the new **Channels** later this year—look for it!

—T.M.B.

input/output

Our environment has changed through the years at an unprecedented scale and speed in every phase of society, economy and industry. Together with these changes, problems in our daily lives have become more diversified and complex than ever before. The needs of society for an information processing center have grown with the development of the informationalized society. An interdisciplinary approach combining our knowledge, techniques, and other resources in a wide range of fields is needed in order to solve our problems.

Particularly in the world of science and engineering, high-speed and large-scale computers are in constant demand. While large-scale, complex problems stimulate the development of high-performance computer systems, so do these powerful computers aid in discovering answers to hitherto unknown or obscure problems. Thus, a pattern in technical development through mutual influence is perpetuated.

CRC installed a CRAY-1 supercomputer in January 1980, in response to our customers' data processing needs for the 1980's. Our CRAY-1 has been operating satisfactorily since its installation, providing testimony to our timely decision on its acquisition.

CRAY-1 users worldwide are preeminent in their respective fields. Therefore, CRC is honored to be a CRAY-1 user. We take great pleasure in introducing ourselves to such a distinguished group in this issue of **Channels.**

—Y.T.

Yuzo Tsukamoto,
President of Century Research Center Corporation

Maintaining a reputation for leadership in computing services:

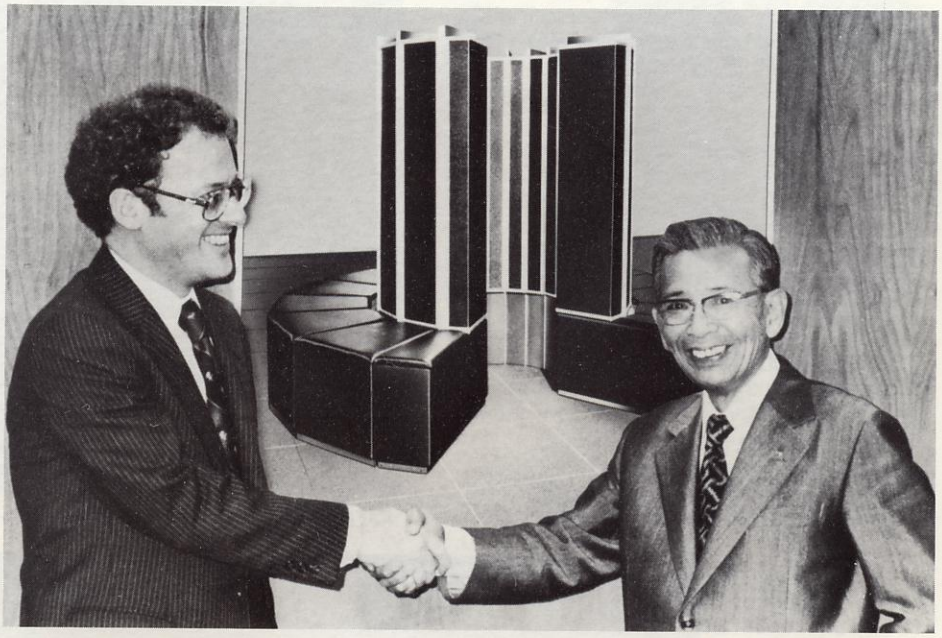
The CRAY-1 at Century Research Center Corporation

Century Research Center Corporation (CRC) was established in November of 1958 as a pioneer in the service bureau business in Japan. In the years since its founding, CRC has regularly installed the most advanced computers available to serve the Japanese scientific and engineering communities and to maintain a leadership position in the service bureau business.

The order for the CRAY-1 was placed on November 8, 1978, coinciding with the twentieth anniversary of the founding of CRC.

Therefore, it is not surprising that CRC would want to obtain a CRAY-1 Computer System. And so they did—a CRAY-1 system was installed in January of 1980 at CRC's Service Bureau in Tokyo. The CRC system has two additional distinctions—it was the first supercomputer to be brought into Japan and the second CRAY-1 to be installed at a computing service company, the first being at United Computing Systems, Inc. (UCS) in Kansas City, Missouri.

CRC センチュリリサーチ センタ 株式会社



Yuzo Tsukamoto, President of CRC, and John A. Rollwagen, President of Cray Research, Inc., after CRC placed its order for a CRAY-1 Computer System.

CRC offers computing services and consulting to its customers, primarily in scientific applications. The company does business in computer timesharing, software development, system analyses, research and development, hardware development and maintenance, and facility management. CRC sees their customers as having three basic requirements: high speed and precision, large memory capabilities, and communication facilities. In particular, modeling simulations are commonly used by CRC customers, requiring extremely fast turnaround with high precision

Primary applications for the CRC CRAY-1 include structural analyses, nuclear, oil, and environmental science programs. CRC's wide selection of software packages is a combination of CRC-developed and commercially-obtained programs.

One area in which the CRAY-1 has proven to be very useful is structural analysis, because analysis programs are usually quite large and complex. CRC has made available commercial programs such as MSC/NASTRAN. Additionally, the company has developed a number of its own analysis programs in areas such as vibration analysis and civil engineering.

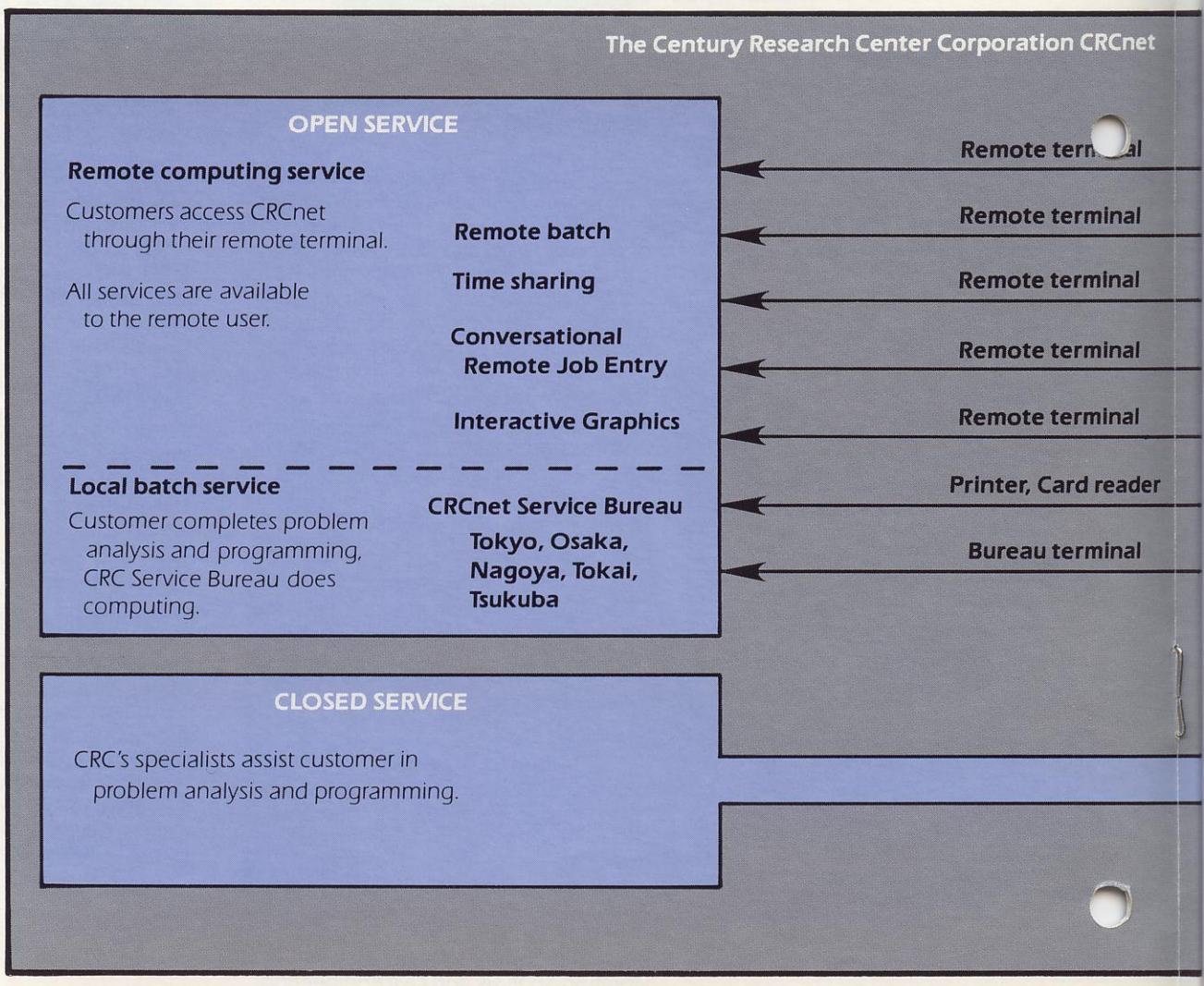
A second major area for the CRAY-1 at CRC has been nuclear research, including simulation problems for safety studies on new reactor systems. The CRAY-1's power has been used in environmental problems as well, in atmospheric and water pollution studies.

Other application areas in which the CRAY-1 holds great promise for CRC are in the design of rockets, optical systems, pioneering engineering work, chemical engineering, and operations. Still another promising applications area is CAD/CAM.

The CRC CRAY-1 arrived in Japan on January 4, 1980. Customs officials remarked that the system was the most expensive item to go through the customs office at Narita airport since its opening in 1977. Delivery day, January 13, was unusually snowy for Tokyo, prompting an observer to quip that the snow must have accompanied the computer system all the way from Chippewa Falls, Wisconsin (where the Cray Research, Inc. manufacturing facility is located).

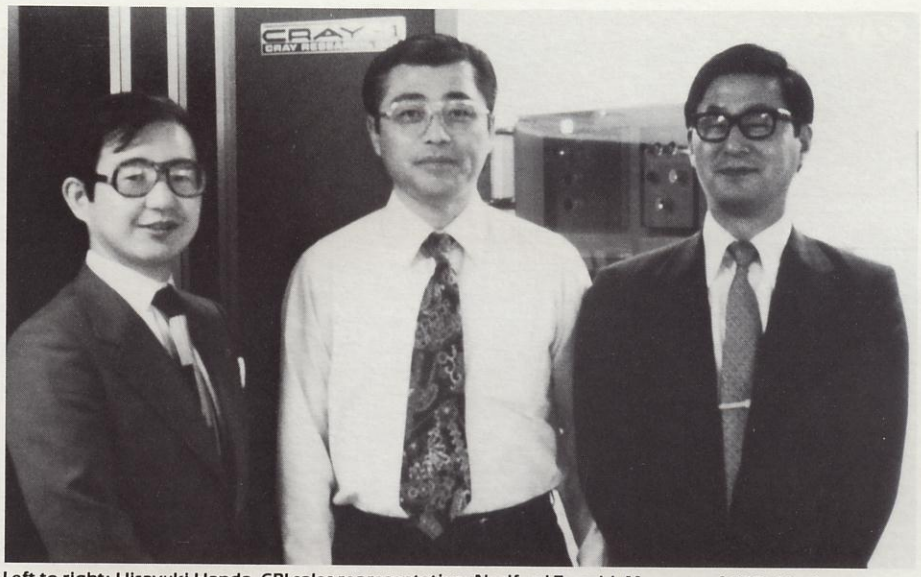
The story behind the CRC acquisition is an interesting one. In early 1978, CRC heard of United Computing Systems' decision to order a CRAY-1. Prior to that time, CRC had considered the CRAY-1 to be a special-purpose machine, inappropriate for their needs. However, the UCS decision changed CRC's impressions, and the CRAY-1 became a serious candidate for purchase by CRC. After learning more about the CRAY-1's capabilities, a group of CRC representatives headed by Director Mitsuru Maruyama visited CRAY-1 customer sites in the United States and made a comparison between the CRAY-1 and its competition. The group's findings culminated in the company placing an order for a CRAY-1 Computer System on November 8, 1978, coinciding with the twentieth anniversary of the founding of CRC.

The CRAY-1 is centrally located in the CRCnet Service Bureau computer center.



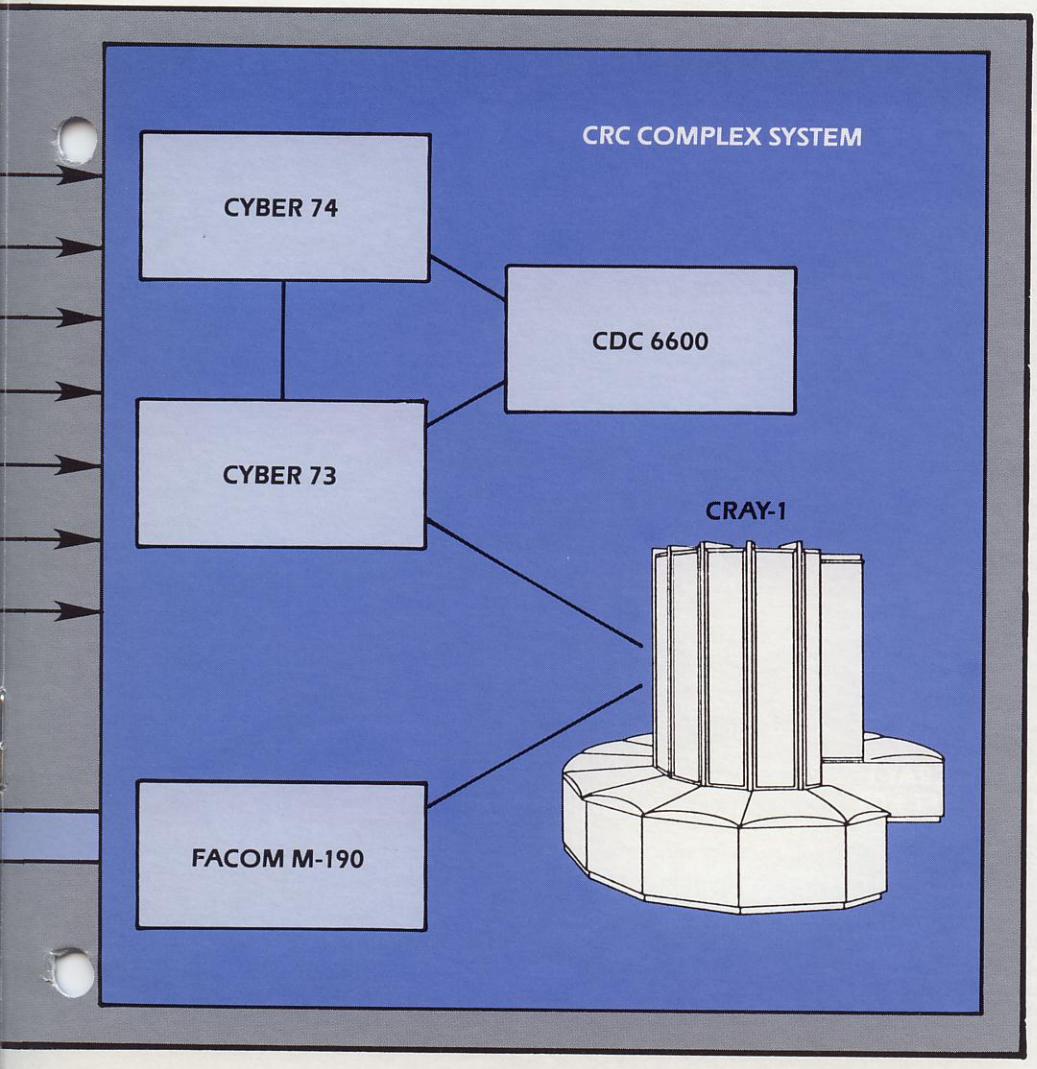
Traditionally, CRC has installed the most advanced computers available to serve the Japanese scientific and engineering communities.

The new CRAY-1 is at the core of the CRC Complex System located in Tokyo. Beginning in April 1980, CRC users were able to access the CRAY-1 through a Control Data Corporation front-end computer system. In October 1980, the CRC CRAY-1 also became available to IBM-oriented users, when a FACOM M-190 front-end was linked to the CRAY-1. CRC has conducted training seminars on the CRAY-1 for over 400 users to date.



Left to right: Hisayuki Handa, CRI sales representative; Norifumi Tsuzaki, Manager of CRC's Hardware Service Department; and Hiroshi Uda, Manager of the Software System Department at CRC.

The CRC Complex System in Tokyo is connected to CRCnet Service Bureaus in Osaka, Nagoya, and other major Japanese cities. It is also connected to remote batch and interactive terminals at customer sites via communications lines.



CRC sees their customers as having three basic requirements: high speed and precision, large memory capabilities, and communication facilities.

The CRAY-1 acquisition is particularly exciting for CRC, because the company feels that it can now broaden its business field as well as expanding its business volume. The company also sees the new system as a way to increase CRC's competitiveness and strength in the field of scientific and technical computation. The merits of a service bureau are greatest, says CRC, when the available computer power is an order of magnitude higher than the user's own. CRC is pleased with its decision to order a CRAY-1 and looks forward to future Cray Research, Inc. products. ■

Cray Research graphics project gains momentum

Based on the encouraging conclusions of a six-month study conducted in the first half of 1980, Cray Research announced its decision to embark on a significant computer graphics development effort. The newly formed graphics group is headed by Richard Weinberg, a graphics specialist who previously worked on high performance computer graphics for the Space Shuttle Engineering Simulator at NASA, and most recently, on a Ph.D. dissertation in computer science at the University of Minnesota. Weinberg has been joined by software engineer Tim Hoel, recently of Sperry Univac and a past manager of the academic computer center at St. Olaf College in Minnesota. By the end of 1981, the group is expected to have a staff of four, with further expansion anticipated in '82 and '83.

The group has already begun to "feel the pulse of the user" with site trips to Lawrence Livermore Laboratory, Sandia (Livermore) Corp., and Lawrence Berkeley Laboratory. Further user visits are planned in the near future, with the object of determining graphics methods and requirements at some twenty to thirty major installations. Data gathered in this way will be taken into account when producing the preliminary product definition at the end of March, 1981.

A dedicated graphics front-end, a DEC VAX-11/780, is scheduled to arrive in April. The first priority will be implementation of communications software and of a "standard" library of graphics routines. It is possible that the routine library will be assembled from Cray graphics software already running at our various sites.

MSC/NASTRAN—CRAY-1 version released

MacNeal-Schwendler Corporation released the CRAY-1 version of NASTRAN, originally developed as the NASA STRuctural ANalysis system, to United Computing Systems on December 15, 1980. The 15-month conversion of source code—including over 400,000 lines of FORTRAN and 1,500 lines in CRAY Assembly Language (CAL)—was made possible by the donation of CRAY-1 computer time by UCS.

CRAY NASTRAN now runs all static and normal mode problems. Soon, the post-processor graphics routines will be implemented, and all remaining problem types will be solvable.

A one-megaword CRAY-1 will enable in-core NASTRAN solutions featuring up to 200,000 degrees of freedom. A four-megaword configuration extends the problem range up to 300,000 degrees of freedom.

MSC follows quality assurance procedures involving 740 separate test data cases. UCS has run additional independent benchmark tests using data provided by General Motors Corporation. Across the board, CRAY NASTRAN has shown CPU performance increases over the CYBER 176. UCS reports increases of 4.5:1 and 4.2:1 for static and dynamic problems, respectively.

CRAY NASTRAN is now available for installation at other CRAY sites. Further information may be obtained directly from:

MacNeal-Schwendler
7442 N. Figueroa St.
Los Angeles, CA 90041
Telephone: (213) 254-3456

Applications In-depth

ANSYS—Enhanced performance under COS 1.09

The powerful finite element system, ANSYS, has been available for the CRAY-1 since August 1978. Over the last two years, Swanson Analysis Systems Inc., developer and vendor of ANSYS, has made several important extensions to the code, including nonlinear and large deflection capabilities, and, most recently, the interactive PREP facility. When ANSYS first became available, it was run under COS Release 1.05. To date, ANSYS has been installed at nine CRAY sites, with several more installations planned for 1981.

Mike Wheeler, consultant engineer at SASI, has reported significant performance improvements under COS 1.09. He attributes the latest improvements primarily to new vector reduction capabilities in CRAY FORTRAN that reduce CPU time spent in the Frontal Equation Solver. Benchmark results for two data cases exemplifying the performance increase are shown below, with times shown in CPU seconds.

Example 1—A flat plate (128 type STIF46 elements, 144 master degrees of freedom)

	CDC 7600	CRAY-1 CFT 1.07	CRAY-1 CFT 1.09
Stiffness matrix formulation	4.0	1.6 (x 2.5)	1.2 (x 3.3)
Eigenvalue Extraction	93	13 (x 7.2)	9 (x 10.3)
Total CPU time	123	22 (x 5.6)	14.5 (x 8.5)

Example 2—A joined pipe

	CDC 7600	CRAY-1 CFT 1.07	CRAY-1 CFT 1.09
Equation solution	46	25 (x 1.8)	20 (x 2.3)
Element formation	64	64 (x 1.0)	44 (x 1.5)
Total CPU time	118	96 (x 1.2)	68 (x 1.7)

Cray Research gains ITAB observer status

Realizing the importance of large-scale industry-standard CAD/CAM developments in the future of many of its current and potential customers, Cray Research has sought and gained observer status on the Industry Technical Advisory Board (ITAB). ITAB is comprised of representatives from a number of aerospace and non-aerospace companies and computer vendors. The Board works with Boeing, prime contractors to NASA for development of the IPAD (Integrated Programs for Aerospace-Vehicle Design) system, in setting goals and direction for IPAD. The aim of IPAD is to increase U.S. aerospace industry productivity through the use of computers in the 1980's. The group places strong emphasis on the planning, data definition, and control of an integrated engineering design process.

Current trends in CAD/CAM include a significant shift towards the use of distributed processing systems composed of many geographically dispersed "satellite" systems (typically minicomputer-based) networked with large, central mainframe complexes. Cray Research perceives its products, the CRAY-1 and future generation supercomputers, as playing a potentially major role in large-scale CAD/CAM developments. Through observation of ITAB, Cray Research will be in a better position to understand the long-range goals for the use of computers in design and manufacturing.■

software release **summary**

This article summarizes major changes made in the 1.09 version of Cray Research software, released in November, 1980. Major changes were made to the CRAY-1 Operating System (COS) and to the CRAY-1 FORTRAN Compiler (CFT). The SKOL programming language is also described.

COS

A major feature of COS 1.09, released in November 1980, is **I/O subsystem support,** which is provided for the CRAY-1 S Series Models S/1200 through S/4400. A CRAY-1 S Series Model S/1200 and up consists of a CPU, an I/O Subsystem acting as the MCU and/or mass storage subsystem. The I/O Subsystem consists of from two to four I/O processors and one-half million or one million words of common memory. Deadstart for these models is performed at the I/O Subsystem. Mass storage on Models S-1200 through S-4400 consists of two to forty-eight DD-29 DSUs, depending on the number of I/O processors in the I/O subsystem. The new ADSTAPE utility is provided for sites with an I/O Subsystem in place of the MCU so that a CRAY-1/S mainframe deadstart tape can be created.

An **ACCOUNT AND CHARGES facility** now exists. The ACCOUNT control statement validates the user's account number and optional password. Thus, a job is processed only if the account number and password (if specified) are valid. The CHARGES control statement allows the user to monitor a job's usage of computer resources up to a specified point in a job. Thus, CHARGES can be used for either partial or total resource accounting.

The user now has available the **ROLL macro,** which can be used to protect a job against system interruption. Rolling a job causes it to be written to disk so that the job at that point in time can be recovered in the event of system interruption. Once a job has been rolled, it remains recoverable unless it loses its recoverable status. If it loses this status, the user may request another ROLL to continue to protect the job against system interruption.

Execute-only datasets are now supported. These datasets are user permanent datasets which can be examined and modified only with proper authorization. An execute-only dataset cannot be dumped using PDSDUMP. The user can specify that a dataset be execute-only on the SAVE and MODIFY control statements.

Sites can now startup systems residing on CRAY-1 disk. A new PL (TOOLPL) has been released with 1.09; this PL contains several of the **Integration, Test, and Distribution tools** (MODSET, SPAWN, and STEP).

The SNAP, DUMP, INPUT and OUTPUT **macros can be made conditional** using the DEBUG label. The **INSFUN macro** allows the user to call any one of the installation-defined subfunctions defined in a subfunction table. Control is transferred to the indicated subfunction.

CFT

The CFT **PAUSE statement** is now supported in \$FTLIB. **Line numbers** and pagination are provided on CFT source listings. The **single precision EISPACK routines** have been added to \$SCILIB. CFT now produces informative messages indicating why DO-loops do not vectorize. The FORTRAN '77 support for **INQUIRE, OPEN, and CLOSE** is now provided in \$FTLIB. CFT integer multiply and divide have been speeded up.

SKOL

SKOL, a high-level programming language, offers a level of structured programming not possible with FORTRAN, while retaining the power of the CFT compiler. The seemingly incompatible goals of readability and efficient execution are achieved through a macro-based translation process, which changes the source SKOL code into FORTRAN. The FORTRAN is then compiled normally. ■

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Photographic contributions from Century Research Center Corporation.

Published quarterly by
Cray Research, Inc.
Marketing Publications

1440 Northland Drive
Mendota Heights, MN 55120
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Editor: Tina M. Bonetti
Graphics: Chad Jewett

CRAY RESEARCH, INC.