

IBM Scientific Centers

Data Processing Division, Cambridge Scientific Center, Massachusetts

Not long after its inception in 1964, the Cambridge Scientific Center developed a plan for designing and implementing a virtual machine system to measure the performance of different operating systems by isolating them within separate virtual machines. Both a control program to create and manage virtual machines and an interactive monitor system (CMS) were developed. Time-sharing and virtual machine design and architecture have continued to be major areas of interest. Another major thrust was the development of methodology for measuring, predicting, and improving system performance: for example, the design of resource management algorithms. Current work at Cambridge involves primarily distributed processing, terminal intelligence, operating system technology, and system performance and operations research.

Data Processing Division, Los Angeles Scientific Center, California

The original application specialties of the center, which was established in 1964, included space technology, medical modeling, industrial education, and geophysical modeling. Special joint application projects were established in shipboard scientific computing (Scripps Institute of Oceanography), in higher education (University of California at Irvine), in advanced numeric control (University of California at Los Angeles (UCLA), Engineering Department), and in medical treatment diagnostics (UCLA Medical Center). Though applications work continued during the 1970s, the center's focus shifted more toward larger, internally developed and systems-oriented projects, such as virtual storage operating systems, general purpose emulators, and application development systems. Current work includes distributed high-function graphics support systems, distributed interactive processing, mixed text and line art graphics input systems, clustered small systems architecture, systems security, and energy optimization in office building design.

Data Processing Division, Palo Alto Scientific Center, California

The Palo Alto Scientific Center, since its inception in 1964, has maintained an interest in understanding the concerns of the computer user in the fields of physics and engineering, in particular the effectiveness of the computer as a tool for experimentation or simulation. Research projects have included basic physical processes, model formulation, numeric analysis, programming and graphic display techniques, and verification of models by means of measured data. Work has been carried out in the areas of high energy, reactor, atmospheric, and plasma physics; in geophysics; and in aeronautical, chemical, and power engineering. Other interests include problems of on-line data acquisition and ease of communication between the user and the computer. In this respect, high level programming languages have been investigated. Subsequent work has focused on improving APL performance and availability.

IBM Germany, Heidelberg Scientific Center

Established in 1968, the scientific center originally carried out applications-oriented research in high energy physics and medicine in conjunction with the University of Heidelberg and the German Cancer Research Center. Principal projects included automatic evaluation of bubble chamber pictures, image enhancement in radio-scintigraphy for early cancer detection, and radiation treatment planning for cancer therapy. Since 1973, the center has been investigating new, user-friendly interfaces to computer-stored data and applications programs. Present areas of research include application program development tools, problem solving and decision making tools, and information management and retrieval.

IBM Israel, Haifa Scientific Center

Research efforts at the center are presently concentrated in three major fields: the development of new, socially significant computer applications in medicine, agriculture, and economics; computer sciences; and applied mathematics in computer applications. These projects have generally been carried out in conjunction with educational and industrial institutions and government agencies. Medical projects have included computer-assisted diagnosis of endocrine disorders, studies of heart muscle contractility, and estimation of cardiac output and blood gas using noninvasive techniques such as ultrasonic

processing. In the field of economics, the center is working on an econometric system for national budget planning. Agricultural projects have involved operational problems such as irrigation and water supply management; optimization of livestock husbandry, machine use, and transportation; computer design and control of greenhouses; and the development of models for predicting salinity processes in aquifers.

IBM Italy, Bari Scientific Center

Since 1969 the scientific center, in collaboration with the Center for Studies and Application of Advanced Technology, has been studying the use of computers in education. APL was chosen as the language suitable for teaching and computer interaction in the fields of computer science, applied mathematics and statistics at the high school and university level; in addition, the query language AQL has been developed. Bari is at present engaged in studies in connection with the University of Utrecht and the artificial intelligence group of Edinburgh University. Also in progress are joint studies on systems of differential equations with the Institutes of Mathematics of the Universities of Bari, Florence, and Naples.

IBM Italy, Pisa Scientific Center

Though the Pisa Scientific Center officially opened in 1969, it actually commenced its activity in 1965, in close collaboration with the National Computing Center for Electronic Calculus, CNUCE. The first research projects involved models of macroeconomics and the hydrology of river basins. Joint studies on stochastic simulation were initiated in conjunction with the University of Pennsylvania's Wharton School of Economics. In addition, work on rainfall-runoff and flood routing is being carried out with the University of Pavia's Institute of Hydraulics. More recently, a computer network project was developed to study distributed systems; proposed research includes analysis of distributed data base systems.

IBM Italy, Venice Scientific Center

Activity at the Venice Scientific Center first began in 1969, and has focused on various aspects of hydrodynamic modeling. Projects concerned with large bodies of water, such as seas, have included mathematical mod-

els of tidal waves and flooding. In addition, there are research efforts focused on the effects of ground water on soil subsidence and stability that may be useful in the control of erosion. Experience gained from these projects has stimulated research in the modeling of air pollution, particularly with respect to sulfur dioxide. Mathematical models of convection and diffusion have been developed for use in real-time forecasting and for the detailed simulation of diffusion phenomena.

IBM Japan, Tokyo Scientific Center

The Tokyo Scientific Center was established in 1970. Four principal areas of research on which work has focused include image processing, environmental science, computer-aided design, and computational linguistics. Specific image processing applications projects have included medicine (cell images, scintigrams), metallography (test qualities of alloyed metals), and remote sensing (crop recognition, marine weather, environmental analysis). Projects in the environmental sciences have involved predictions of air pollution and a computer-assisted regional planning system. In the area of computer-aided design, studies have included interactive ship design, three-dimensional design, and an integrated designer activity support system. Finally, in computational linguistics, a project has been developed for data base query using natural Japanese sentence structure. Recently, an interdisciplinary group was organized to help solve social problems in environmental and medical areas.

IBM Mexico, Latin American Scientific Center, Mexico City

Created in 1971, the center owes its name to the fact that it is the only scientific center in Latin America. Early work was in the field of computer use in education, and in the study of pollution models. In 1975, the center took a new direction, with most of its resources oriented toward digital image processing and natural resources. Satellite and aircraft images are currently being used to analyze and remedy agricultural problems such as erosion. The center is now entering the area of geographic information systems. Plans include the use of meteorological and statistical information to create a data base for the simulation and modeling of agricultural problems.

IBM Spain, Madrid Scientific Center

The Madrid Scientific Center was established in 1972 under an agreement between the Universidad Autonoma of Madrid and IBM Spain. Its past activities have focused on environmental and computer sciences. Currently, the main emphasis is on image processing and its applications. Several joint projects are being conducted in the area of earth resources surveying by remote-sensing techniques. These projects are related to land use, cartography, geology, and agricultural studies using satellite images. A microprocessor system for simple image processing operations is being built to further improve current capabilities, which include color, graphic, and microdensitometer displays. Recently, the center has expanded its interests to petrology, virology, and new computer applications to agriculture. For example, computer control of greenhouses is being used to study the effects of greenhouse environment and nutri-

tional conditions on crop productivity. New operations research techniques are also being developed to facilitate the analysis of large systems typical of agricultural planning problems. Other areas of research include "portable software" and decision support systems.

IBM United Kingdom, Peterlee Scientific Center

Established in 1969, the center has pursued two major work directions. The first involves relational data base research, with particular emphasis on the interactive query environment. Many of the important results of this research have been incorporated into a prototype system called PRTV (Peterlee Relational Test Vehicle), and current research is directed toward evaluating the relational data model as embodied in PRTV. The center's second major area of research is in advanced management science, with special reference to modeling applications in economic planning and public sector decision making.