



*Keith W Chao*

## KEITH W. UNCAPHER

1922–2002

Elected in 1998

*“For information technology on the national level.”*

BY ANITA JONES

**K**EITH WILLIAM UNCAPHER, founder and Executive Director Emeritus of Information Sciences Institute, Associate Dean for Information Sciences Emeritus of the University of Southern California, and senior vice president of the Corporation for National Research Initiatives, died at the age of 80 on October 10, 2002. He died in mid-air while returning to the West Coast after attending an NAE meeting.

Keith was born in Denver, Colorado, on April 1, 1922, one of three children of Wayne Samuel and Alice Clague Uncapher; the family moved to California when he was six months old. After high school graduation in Glendale, California, he joined the Navy and became a radar technician. Although he was prone to seasickness, he never hesitated when he had to climb the mast of his ship to fix the radar. When he left the service in 1946, Keith studied electronics and mathematics at Glendale College. In 1950, he graduated from the California Polytechnic Institute with a B.S. in mathematics and electrical engineering.

At the recommendation of one of his professors, Keith applied for a job at the RAND Corporation in Santa Monica, California, which was a fairly new organization at the time. He was readily accepted at RAND and soon began to conduct fundamental research on digital-memory technology (before the time of core memory). His talent for managing research was evident early on, and he was soon put in charge of the Computer Engi-

neering Group, where he led the development of a digital-memory subsystem for the Johnniac computer, based on the use of Selectron tubes. This system broke the previous world record for reliability, running for 10 hours without an error.

Keith also participated in the development of several early interactive computing systems, including JOSS, Grail, and the RAND Tablet. Under his leadership, RAND conducted pioneering research on survivable communications, which introduced a concept that eventually became known as packet switching, a fundamental technique that was used in the Advanced Research Projects Agency Network (ARPANET) only a few years later. Packet switching was later widely adopted by the telecommunications industry and remains a key element of the Internet to this day.

In 1972, Keith left the RAND Corporation to found the Information Sciences Institute (ISI), which he hoped would have close university connections. After one California university told him it would take many months to get approval to establish the institute, he contacted the provost of the University of Southern California (USC), who welcomed the idea and rapidly established ISI as part of the university. Keith located ISI on the beautiful marina of Marina del Rey and served as executive director until 1988. Under his leadership, the institute flourished and grew to have a staff of several hundred.

During the 1970s, when the relevancy of university research was being questioned by the U.S. Department of Defense (DoD), he showed that university computer-science research could be directly relevant to military needs. The Military Message Experiment, for example, demonstrated the first use of interactive computing, electronic mail, and networks for military communications. Other projects included reliable, network-based time-sharing services and rapid turnaround fabrication of very-large-scale integration (VLSI) designs using an online brokerage service called MOSIS (metal-oxide semiconductor implementation service). MOSIS provided a vehicle for the fast, low-cost fabrication of semiconductor designs for university students and faculty; researchers in government and not-for-profit laboratories; as well as for researchers in large and small corporations. By making

hands-on experimentation with early VLSI design, implementation, and testing widely accessible, MOSIS was an important factor in establishing and maintaining the U.S. lead in microelectronics.

For decades, Keith served as a trusted advisor to senior government officials, especially officials in DoD and the Defense Advanced Research Projects Agency (DARPA). Keith exerted a profound influence by encouraging reliance on digital communications and information systems. He personally sought out excellent researchers, broadened their horizons, and, in some cases, convinced them to move for a period of time from their research laboratories into key government staff positions (e.g., to act as DARPA program officers to initiate programs in critical areas of research). He was untiring in his determination to ensure that these positions be filled by individuals who were knowledgeable in state-of-the-art hardware and software—at a time when the information technology field was expanding and changing rapidly—to ensure that DoD-funded research would be creative and effective.

After 15 years as head of ISI, Keith became Executive Director Emeritus so he could focus on two other activities. In 1980, he had become the Associate Dean of Engineering for information sciences at USC. He now had time to help USC discover applications of information technology and how it could be used to improve the university's academic research programs, as well as its administrative processes. In 1993, he became Associate Dean Emeritus. Keith was also a founder and senior vice president of the Corporation for National Research Initiatives (CNRI), a not-for-profit corporation he and Robert Kahn established in 1986. CNRI determines priorities for critical applications of information technology and fosters research and development on information infrastructure on a national scale.

Microelectromechanical systems (MEMS) is one example of a technology Keith recognized early on as important to U.S. economic leadership and national security. He recognized that MEMS, which combine sensors, actuators, and some computational capability, could lead to the development of low-cost, small devices that could be mass produced for myriad applications. In

the 1990s, Keith worked directly with the university research community to stimulate interest in solving technical problems related to the design and manufacture of MEMS devices. He also championed DARPA's efforts to develop a MEMS-focused brokerage service modeled on the MOSIS approach, so that researchers and developers in universities, laboratories, and small companies could have their designs fabricated rapidly and affordably. The service gave thousands of designers working in many scientific and engineering disciplines access to MEMS fabrication resources. Thanks to Keith's leadership, investment by DoD in MEMS research was doubled, and the United States rapidly developed military applications for MEMS devices. In addition, for a time at least, U.S. industry had a technical lead thanks to the availability of students trained in this technology in university research laboratories.

Keith also served the technical community in other ways. He helped orchestrate a merger between the American Institute of Electrical Engineers and the Institute of Radio Engineers to create the Institute of Electrical and Electronic Engineers (IEEE). He facilitated the emergence of a single national computer-engineering professional society in the United States, the IEEE Computer Group, and in 1964, was its first chair. The Computer Group became the IEEE Computer Society in 1971. In 1970, Keith was elected president of the American Federation of Information Processing Societies (AFIPS). He was also a member of the Air Force Science Advisory Board for 15 years.

Keith Uncapher's contributions have been recognized and celebrated many times over. In 1979, he was awarded the AFIPS Distinguished Service Award. The Air Force granted him the Air Force Meritorious Civilian Service Award in 1981. In 1983, he received the IEEE Centennial Award. And in 1998, he was elected a member of the National Academy of Engineering.

Keith was a man of high integrity with a sunny disposition, a genuine love of humanity, an engaging sense of humor, and a taste for fine food, travel, and natty clothes. He had an uncanny ability to identify promising areas of technology and to facilitate the rapid advancement of those technologies at a national level. Thus, he influenced the pattern and pace of research in univer-

sities, government laboratories, and industry. He ensured that a broad community would have access to semiconductor fabrication and to interactive, time-shared computing so that researchers could explore these technologies. He identified individuals with the vision and knowledge to advance a technology and was instrumental in putting them into key roles where they could advance that technology. His efforts changed the face of technology, and his insights, wisdom, and dedication to his nation inspired everyone who had the privilege of working with him.

Keith is survived by his wife Doris Uncapher and two sons, Jeffrey Keith Uncapher and William Bradley Uncapher. His two sisters predeceased him.