LEW ALLEN, JR.

1925–2010

Elected in 1978

"For pioneering work in combining technologies of space and information processing to strengthen the nation."

BY JOHN R. CASANI

LEW ALLEN, JR.—a towering figure in all respects—died on January 4, 2010, at his home in Potomac Falls, Virginia. He devoted 36 years of service to the nation in the U.S. Air Force, becoming a four-star general and the tenth U.S. Air Force chief of staff. When he retired from the Air Force in 1982, he agreed to become director of the National Aeronautics and Space Administration's (NASA) Jet Propulsion Laboratory (JPL). In 1990 he left JPL and served as chairman of the board of the Charles Stark Draper Laboratory in Boston. Throughout his long and productive life, Lew Allen, Jr., was recognized and honored not only for his technical knowledge but also for his wide-ranging intelligence, great integrity, and profound vision. He possessed strong, engaging leadership qualities—a "steady steel hand in a velvet glove," as one colleague put it.

Lew Allen was born in Miami, Florida, on September 30, 1925, and grew up in Gainesville, Texas. He entered the U.S. Military Academy at West Point in 1943, graduating in 1946 with a bachelor of science degree, a commission as a second lieutenant, and pilot wings. After completing multiengine flight training, he was assigned to Strategic Air Command's 7th Bombardment Group at Fort Worth Army Airfield (later renamed Carswell Air Force Base), where he flew B-29s and B-36s and served in positions related to nuclear weaponry. In

1950 he entered the University of Illinois for graduate training in nuclear physics and was awarded a master of science degree in 1952 and a Ph.D. in physics in 1954. His thesis was on high-energy photonuclear reactions.

Allen's Air Force career was characterized by a focus on technology, science, and steadily higher levels of assignments. At Los Alamos National Laboratory, he measured the cross section of neutrons coming out of nuclear explosions. At Kirtland Air Force Base, New Mexico, he was science advisor to the Physics Division of the Air Force Special Weapons Center from 1957 to 1961. The Van Allen belts had been discovered by the nation's first satellite, *Explorer 1,* and there was concern that nuclear weapons exploded in space might blank out civilian and military communications. Lew Allen defined a program to measure this effect, directing an experiment that flew a series of high-altitude rockets to measure electrons trapped in the geomagnetic field after an exoatmospheric nuclear blast. In December 1961 he moved to the Office of the Secretary of Defense, Space Technology Office, in the Directorate of Research and Engineering, in Washington, D.C. He spent 1965 to 1973 in service to the Office of the Secretary of the Air Force, first in Los Angeles and then at the Pentagon as deputy director of space systems, becoming director in June 1969. In 1970–1971 he was back in Los Angeles as assistant to the director of special projects and then director. He then served as chief of staff for the Air Force Systems Command at Andrews Air Force Base in Maryland.

No doubt in recognition of his leadership abilities and reputation of integrity, Lt. Gen. Allen was appointed deputy to the director of central intelligence for the intelligence community in Washington, D.C., in 1973. During a memorial tribute at JPL on April 7, 2010, Albert Wheelon, retired chief executive officer of Hughes Aircraft Corporation and a life trustee on Caltech's Board of Trustees, remarked that Allen was "a straight shooter. Many thought of him as the straightest of the straight shooters. . . . [He] made an enormous contribution to reconnaissance and general intelligence." In August 1973, Allen was named director of the National Security Agency

(NSA) and chief of the Central Security Service at Fort George G. Meade, in Maryland, by President Richard M. Nixon. According to Albert Wheelon, "his job was to bring that organization to heel and to calm the concern that Congress had about it. He was remarkably successful in this difficult assignment." Lew Allen was to become the first NSA director to testify before a U.S. House of Representatives, and then a U.S. Senate, committee, in open session, in 1975. When he departed the NSA in 1977, he was named commander of the Air Force Systems Command. He received his fourth star on August 1, 1977.

Starting in April 1978, Allen served as vice chief of staff of the Air Force, becoming chief of staff in July of the same year. He was then responsible for the entire U.S. Air Force. According to a statement on Allen's passing by the Secretary of Air Force Public Affairs, General Allen "left an indelible mark on the Air Force." Honoring tradition, Allen made *The U.S. Air Force* (popularly known as "Off We Go into the Wild Blue Yonder") the service's official song (courtesy of the copyright holder). Encouraging education, Allen created Project Warrior, a professional development program for airmen, calling for "the continuing study of military history, combat leadership, the principles of war, and the applications of air power."

General Lew Allen retired from the Air Force in July 1982. That year JPL was searching for its eighth director. A division of Caltech and a principal center for robotic planetary exploration for NASA, JPL had had a string of brilliant deep-space mission successes under William Pickering (director, 1954–1976); but NASA's planetary budget was cut in 1981, and JPL faced considerably reduced funding. NASA Administrator James M. Beggs even proposed terminating the nation's planetary exploration program altogether, making JPL "surplus to our needs."

Caltech began seeking other sources of funds, considering the addition of defense work to JPL's tasks. Nominated as JPL director, with a concurrent position as vice president of Caltech, Allen brought to JPL his extensive experience with military space missions and technology. This was seen as a

great boon for developing JPL's defense work, and so it was. But Dr. Allen, as he was known at JPL and Caltech, brought much more than this to his new position. As Larry Dumas, JPL's deputy director from 1992 to 2001, remembers him, Lew Allen was "an unassuming and soft-spoken gentleman with the knack of asking deceptively simple questions that could absolutely confound the brightest scientist or engineer. It takes a deep understanding of the subject to be able to do that."

Dr. Allen was a new-technology enthusiast. Terry Cole, appointed JPL's chief technologist in 1980, was also a research associate in chemistry at Caltech. Cole and Allen collaborated on initiating, nourishing, and finally instantiating JPL's Microdevices Laboratory (MDL), which grew into a research, development, and fabrication facility for highly capable, miniaturized devices for space missions. Cole described the beginnings of MDL in a 1996 interview for the Oral History Project of the Caltech Archives. At a meeting of the Caltech Trustees JPL committee with Burton I. Edelson, NASA associate administrator for space sciences, Edelson discussed a letter he had received from Caltech Trustee Mary Scranton in which she asked if there was any new role that JPL could play in addition to its work in solar system exploration. Edelson proposed that JPL become a microelectronics center of excellence for all of NASA.

Dr. Allen asked Cole to investigate the possibility and report on what kind of hiring and investment would be needed and to come up with a plan. The approach was to define an area or areas where JPL would be unique. "It was clear," Cole said, "that we couldn't compete with industry in producing computer chips or memory chips. . . . It was senseless to do that because we were forbidden, since we're a government-sponsored lab, to compete with industry. And the Defense Department was investing billions of dollars in improving conventional electronics."

Cole and the colleagues he consulted identified four areas of interest. First, they discerned that there were areas of the electromagnetic spectrum where detectors that would be useful in remote sensing were inadequate or nonexistent. They

discussed the idea of fabricating custom microchips (very large-scale integrated circuits) that would move technology from academic research into reality in a "silicon foundry." A third area was photonics: using lasers for remote sensing and eventually interplanetary communication. The fourth area was collective computational behavior: neural nets and parallel computing. Allen pointed out that the NASA Office of Space Science did not have a charter within NASA to develop technology, so while Edelson might support the idea, JPL would have to sell the rest of NASA on it. According to Cole, when he and Allen finally did make their presentation at NASA headquarters, the deputy administrator (Dale D. Myers) "turned to Lew Allen and said, 'Lew, do we really need this?' And Lew said, 'Yes, we really need this. It's important for NASA.' And he said 'Done.' . . . Lew Allen carried a tremendous reputation with him when he became director of the laboratory. And he was so well known in Washington that his word was really solid platinum."

In 1984, Terry Cole recruited Carl Kukkonen from the Ford Research Laboratory in Dearborn, Michigan, to be director of an advanced microelectronics program. Work in parallel computer architecture was growing at Caltech and, said Kukkonen, "Dr. Allen wanted JPL to work closely with [the Caltech] campus on this new computing technology." The Strategic Defense Initiative, begun around this time, was to use advanced technology to track and intercept Soviet missiles. Tracking objects simultaneously was a perfect task for parallel computing. JPL scientists and engineers also wanted access to a supercomputer. Allen agreed to find funding for a used Cray XMP, and eventually supercomputing became a widely used tool at JPL. As Kukkonen said, "As the technology advanced, parallel computing and supercomputing merged into a single organization—all started by Dr. Allen." NASA saw the value and became a prime sponsor of advanced computing and eventually also provided research and development (R&D) funding for advanced infrared, submillimeter, ultraviolet, and visible sensors for imaging; advanced lasers for sensing; and technology to miniaturize spacecraft. The Strategic Defense

Initiative's Innovative Science and Technology Office sponsored unclassified, high-risk, high-payoff R&D at both JPL and Caltech. NASA supported the Center of Excellence at JPL by providing funds for a building to provide a state-of-the-art R&D facility. Groundbreaking for what became the MDL at JPL was on January 21, 1987, and the facility became fully operational in 1990. At the memorial tribute at JPL in April 2010, Charles Elachi, director of JPL, called the MDL a major contribution by Lew Allen: "He really had the vision, 20, 25 years ago, that this was going to be a very important field for JPL." Elachi went on to cite a new European mission—Herschel/Planck—looking at the origin of the universe using MDL-developed focal plane submillimeter detectors, "which would have been unthinkable 10 years ago."

Elachi described another major contribution by Allen: his support for new research and the technology to enable it. In 1984 two astronomers, following up on data from the Infrared Astronomical Satellite that revealed unusual amounts of infrared radiation from Beta Pictoris (implying the existence of orbiting solid material), obtained an image of a circumstellar disc using a ground-based telescope. Though it was not clear if there actually were planets around the star, the disc was the first ever clearly seen in astronomical photographs. Recalled Elachi, "Dr. Allen said, 'This is going to be a great field in the future and I want JPL to be the leader. I'm going to invest our internal money into making that happen.'" Allen directed a substantial portion of discretionary funds toward further study of extrasolar planets.

During Lew Allen's tenure as JPL director, he oversaw the launch of the *Galileo* mission to Jupiter, which provided the first observations of an asteroid with a moon and imaged a comet colliding with Jupiter; *Magellan* to Venus, which used synthetic aperture radar to map the planet and its gravity field; the *Voyager 2* flybys of Uranus and Neptune; and the Infrared Astronomy Satellite, the first space-based telescope to survey the universe in infrared. He gracefully handled the concerns at JPL and at the campus about a retired general running a civilian space laboratory and quickly won over

both populations. He helped JPL obtain defense-related work that bolstered both technical work and morale at a time when NASA's planetary exploration program was declining. When the program started to rebound, he helped JPL respond with vigor and new levels of expertise. Eventually JPL even ended up turning away more defense work as the laboratory bumped up against infrastructure limitations.

Mention should be made of Lew Allen's interest in and support of students. The Summer Undergraduate Research Fellowship (SURF) program at Caltech was created in 1979. SURF is modeled on the grant-seeking process: Undergraduates collaborate with mentors to define a project prior to writing a research proposal; a faculty committee reviews the proposals and recommends awards. Students then work on their projects over 10 weeks in the summer, submit technical papers, and give oral presentations. Allen thought it was a great idea for JPL, too, and with participation of JPL Chief Technologist Terry Cole, a companion SURF program was initiated at the laboratory. After Allen retired from JPL, he continued as a member of the SURF board for three years and chaired it for a year. He and his wife Barbara provided money each year to fund a SURF student summer stipend and continued this after moving to the East Coast. Such direct encouragement of graduate students would not have been a surprise to his children. In the eulogy given by James (Jimmy) Allen, the youngest of five offspring, at Arlington National Cemetery, emphasis was placed on how the children were imbued by their father with "an endless thirst for knowledge. . . . One of [Dad's] proudest accomplishments was to be named outstanding graduate of every academic institution he attended: It was recognition for a life of learning."

Throughout his life, Lew Allen undertook concurrent assignments and tasks. In 1987 he chaired the Committee on Science, Engineering, and Public Policy, a joint unit of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. The committee's report, *Balancing the National Interest: U.S. National Security Export Controls and Global Economic Competition,* caused a stir

with its conclusion: that export control laws had impeded U.S. trade in high-technology products while making an unclear and variable contribution to national security. The report was later seen as a major contribution to a dialogue that led to removal of some export restrictions and to improvement of the U.S. position in export control collaboration with NATO allies and other friendly nations.

From 1989 to 1995, Allen was a member of the President's Foreign Intelligence Advisory Board and the Intelligence Oversight Board, and as former U.S. Air Force chief of staff, he continued to be active in the military intelligence community, serving as a member of the National Security Agency Advisory Board. He was a member of the National Academy of Sciences Committee on International Security and Arms Control. He served on the Keck Foundation's board at the request of Howard Keck and on the California Association for Research in Astronomy board that oversaw construction of (and now operates) the Keck Observatory on Mauna Kea in Hawaii. He participated in meetings in 1986–1987 on possible U.S.–Soviet cooperation in space missions. Allen served on the Council on Foreign Relations. In 1988 he became chairman of the Board of Directors for the Charles Stark Draper Laboratory and was a member of the Board of Trustees for Aerospace Corporation. In 1989 he joined the Scientific Advisory Committee of General Motors. Also in 1989 he was elected to the National Academy of Engineering and served on a number of its committees. In 1990 he became a member of the Secretary of Energy's Advisory Board. Allen also served as regional chairman of United Way for several years. He held the position of senior faculty associate at Caltech until 1997.

Before retiring from JPL at the end of 1990, Allen made another major contribution to the nation's space program. As is well known now, the Hubble Space Telescope was launched with a flaw in its primary mirror that prevented proper focusing. Lew Allen was asked by NASA to lead the Optical Systems Failure Review Board. James Breckinridge, technical advisor to Dr. Allen, recalled that "Dr. Allen's technical knowledge of optical engineering was far greater

than any one of us imagined. He . . . fully understood both the engineering implications and the impact to the astronomical sciences community. . . . During our meetings, Dr. Allen took no notes but relied on his excellent memory to recall in-depth details during discussions. He identified all ambiguities in the presentations by the contractor, listened intently to the board members, and resolved issues in real time." The report was issued in November 1990, the board having identified precisely the errors that led to the flawed optics. The finding enabled fabrication of corrective optics in JPL's Wide-Field and Planetary Camera 2, which was installed during an astronaut-servicing mission in 1993. Finally, Hubble was able to perform as wonderfully as space scientists had hoped it would.

Dr. Allen was the recipient of numerous awards, decorations, and medals. He wore the Command Pilot Badge (more than 4,000 flying hours) and the Master Missile Badge. He was awarded the Air Force Legion of Merit in 1957, 1968, and 1971; the U.S. Department of Defense (DoD) Joint Service Commendation Medal in 1965; the U.S. Air Force Distinguished Service Medal in 1973 and 1982; and the DoD Distinguished Service Medal in 1977, 1979, and 1982. He was awarded the National Intelligence Distinguished Service Medal for service on the President's Foreign Intelligence Advisory Board, 1993–1995. In 1990, Dr. Allen was honored with the George W. Goddard Award from the Society of Photo-Optical Instrumentation Engineers/International Society for Optical Engineering; the Rotary National Space Trophy; the Robert H. Goddard Memorial Trophy from the National Space Club; and the William Oliver Baker Award from the Security Affairs Support Association (now the Intelligence and National Security Association). In 1999 he received the Distinguished Graduate Award from the West Point Association of Graduates.

Dr. Allen was inducted into the Air Force Space and Missile Pioneers Hall of Fame on August 8, 2007, at Peterson Air Force Base in Colorado. Additional honors included the University of Illinois Alumni Achievement Award, the National Geographic Society/General Thomas D. White Trophy, the American Institute of Aeronautics and Astronautics von

Kármán Lectureship in Astronautics in 1987 and the Goddard Astronautics Award in 1995, the American Astronautical Society Military Astronautics Award, the Distinguished Graduate Award of the Air Force Institute of Technology/Association of Graduates of the U.S. Air Force Academy, and the NASA Distinguished Service Medal.

Two awards are named in his honor. The U.S. Air Force's General Lew Allen, Jr., Trophy is awarded annually to recognize sustained job performance, job knowledge, direct sortie involvement, and military qualities. The annual Lew Allen Award for Excellence presented by JPL recognizes significant accomplishments and leadership in scientific research or technological innovation.

To his colleagues and friends, Lew Allen was an unfailing source of encouragement, support, wisdom, and knowledge. Stories abound of his personal warmth, humility, commanding presence, expectations of excellence, and creative vision. Of the many remembrances, there is one that may especially capture his qualities: "He was quiet, considerate, and extremely intelligent. He listened a lot and asked a lot of questions. He did not say much, but what he did say was very important."

Dr. Allen was laid to rest at Arlington National Cemetery on March 22, 2010. He is survived by his wife of 60 years, the former Barbara Frink Hatch; two sons, Lew III and James; three daughters, Barbara, Marjorie, and Christie; 13 grandchildren; and 11 great-grandchildren.