NATIONAL ACADEMY OF SCIENCES

CLARENCE LEONARD (KELLY) JOHNSON

1910—1990

A Biographical Memoir by

BEN R. RICH

Biographical Memoir

Courtesy of the Lockheed Advanced Development Co., Palmdale, Calif.

C. L. "Kelly" Johnson

CLARENCE LEONARD (KELLY) JOHNSON

February 27, 1910–December 21, 1990

BY BEN R. RICH

Be quick, be quiet, be on time.

That was the credo of Clarence L. (Kelly) Johnson, the aeronautical innovator who founded Lockheed's supersecret "Skunk Works" where he designed the world's fastest and highest-flying aircraft—the SR-71 Blackbird.

Johnson played a leading role in the design of more than forty aircraft and set up a Skunk Works-type operation to develop a Lockheed satellite—the Agena-D—that became the nation's workhorse in space. His achievements over almost six decades captured every major aviation design award and the highest civilian honors of the U.S. government and made him an aerospace legend. He was elected to the National Academy of Sciences in 1965 and enshrined in the National Aviation Hall of Fame in 1974 and was honored by many other prestigious institutions and organizations for his work.

Johnson achieved international recognition for the highly successful Skunk Works operation—"a concentration of a few good people . . . applying the simplest, most straightforward methods possible to develop and produce new products" with minimum overhead and outside oversight—and for his unparalleled management style. For someone whose inauspicious beginnings were in a small iron-ore mining town in the upper peninsula of Michigan, the seventh of nine children of impoverished Swedish immigrants, the Kelly Johnson story was in the fabled American Horatio Alger tradition of success. But with Kelly Johnson the story was all true.

Born in the upper peninsula town of Ishpeming, Michigan, on February 27, 1910, Clarence Johnson received his Irish nickname of Kelly in elementary school from a song of that day, "Kelly from the Emerald Isle," following a schoolyard fight. His classmates figured that someone who had licked the school bully should be known by a somewhat more pugilistic name. The nickname stayed with him from that point on—he was known as "Kelly" ever since. And he won the reputation in his career of never backing away from controversy on aircraft design, materials, and production techniques.

From the time he was twelve years old, Johnson knew what he wanted to do in life—design airplanes. "My whole life from that time was aimed at preparing for that goal," Johnson wrote in his autobiography, *More than My Share of It All.*

Before he reached his teen years, Johnson designed his first aircraft—called the Merlin battle plane—named for the magician of King Arthur's court. A model of his Merlin won a prize in a contest sponsored by a service organization. Pursuing his goal, Johnson entered Flint (Michigan) Junior College after graduating from high school to take engineering, mathematics, physics, and calculus. To support himself he worked in construction and on the Buick Motor Car Company production assembly line during vacations, weekends, and summers. And in Flint, Johnson had his first airplane flight—$5 for three minutes in an old biplane that got up to 700 feet before the engine failed and the aircraft had to make a forced landing. But it didn't dampen Johnson's enthusiasm for aircraft. By that time he had graduated from Flint Junior College and had accumulated $300. He was prepared to spend all his savings on flying lessons at an airport in Flint instead of continuing his education at a university.

After talking to Johnson, the instructor pilot advised Johnson: "Kelly, you don't want to start off your career by giving me $300 to learn to fly. That won't get you far enough. You have good grades and you'll go a lot farther if you go on to the university. I won't take your money." Johnson eventually learned to fly, after he joined Lockheed, but he first heeded the instructor pilot's advice and enrolled at the University of Michigan at Ann Arbor in 1929.

There was virtually no construction work in Ann Arbor at the onset of the Great Depression, so Johnson worked his way through college washing dishes in fraternity houses until becoming a student assistant to the head of the aeronautical engineering department at the university. The head of the engineering department also operated the university's wind tunnel, and Johnson became involved in the testing programs, which included not only aircraft but the design of a Union Pacific streamlined train, a smoke-removal project for the city of Chicago, and an early proposal for generating energy with a smoke machine.

The wind tunnel also provided additional money for Johnson. The university permitted him and a friend to rent the wind tunnel when it was not in use for $35 an hour. Among their customers was the Studebaker Motor Company, which was designing a streamlined automobile and wanted the most efficient configuration possible to fully utilize the power of the engine. And the student operators of the wind tunnel did just that for Studebaker.

In his spare time, Johnson tutored other students in calculus. He graduated in 1932 with a bachelor's degree in aeronautical engineering and started looking for an engineering position at aircraft firms on the east coast. But there were no jobs for even the most talented young engineers at companies struggling just to survive in the depths of the Depression. Johnson decided to join the U.S. Army Air Corps to become an aviation cadet. The Air Corps turned Johnson down when he failed the eye examination. Once again he sought work as an engineer at aircraft companies, this time on the west coast via a borrowed car. The only encouragement he received was at the small Lockheed Aircraft Corporation in Burbank, California, where the company had just been reorganized from bankruptcy.

"There were no jobs then at Lockheed in 1932, but engineering executive Richard von Hake at the plant suggested, 'Why don't you go back to school and come out again next year? I think we'll have something for you.'"

Johnson returned to the University of Michigan for a year of graduate study to obtain a master's degree, his expenses paid by the grant of a $500 fellowship. He studied supercharging of engines, to get high power at high altitude, and boundary layer control. He also went back to the wind tunnel, where among the projects was the design testing of cars that would race at the Indianapolis 500 race.

And then in the wind tunnel program there was a model of a proposed two-engine Electra passenger transport being planned by Lockheed. The aircraft had stability problems, but the university professors and Lockheed executives felt they were acceptable. Johnson didn't.

He left college in 1933 with a master's of science degree, a used car, and plans to return to Lockheed and the promised job in California. Lockheed executive Cyril Chappellet and Chief Engineer Hall Hibbard hired the young Johnson as an $83 a month tool designer until there was an opening in engineering.

What did Johnson think of the upcoming new Lockheed Electra, the aircraft the newly reorganized company was banking its future on? Although he was a young engineer with a fresh degree and just starting his first aircraft company job, the outspoken Johnson didn't hesitate to voice a strong opinion. "Practically the first thing I told Chappellet and Hibbard was that their plane was unstable and that I did not agree with the university's wind-tunnel report," Johnson recalled in his autobiography.

Hibbard sent Johnson back to the University of Michigan wind tunnel with the Electra model "and see if you can do better with the airplane." Johnson did just that. It took seventy-two tunnel runs before he found the answer to the stability problem. He came up with the idea of putting controllable plates on the horizontal tail to increase its effectiveness and get more directional stability. He then added a twin vertical tail and removed the main center tail. The solution worked fine.

When he returned to Burbank, Johnson was a full-fledged member of Lockheed engineering, the sixth in the department. Assigned to the Model 10 Electra, Johnson also flew as a flight test engineer on the aircraft. It was the first of many Lockheed planes on which Johnson served as a flight test engineer—finally accumulating 2,300 hours in this job.

Working on the Model 14 Electra, Johnson developed the Fowler wing flap for braking safety and for added speed in flight when retracted. In 1937 the Institute of Aeronautical Sciences presented the Lawrence Sperry Award to Johnson for "important improvements of aeronautical design of high speed commercial aircraft" for development of the Fowler flap on the Model 14. The Sperry award was given annually "for outstanding achievements in aeronautics by young men."

Johnson was then twenty-seven. It was the first of more than fifty honors and awards—most of them national—he was to receive during his life.

Sparked by the success of its family of commercial aircraft, Lockheed was growing rapidly. However, it was military aircraft and the looming dark clouds of World War II that made Lockheed one of the giant aircraft firms and Johnson one of the industry's leading aeronautical designers.

In 1937 Lockheed won a U.S. Army Air Corps competition for a swift two-engine fighter with the XP-38 prototype designed by Johnson. The twin-boomed aircraft was the forerunner of the legendary P-38 Lightning, with speeds of more than 400 mph. As the P-38 approached the speed of sound during its development, the aircraft encountered the problem of compressibility. Following wind tunnel tests, Johnson made design changes enabling the P-38 to cope with the problem that was still to face engineers and pilots in the future.

The P-38, the fastest and most maneuverable fighter of its day, fought on every front of World War II, and the two leading American aces won their victories flying Lightnings. Lockheed built almost 10,000 P-38s for the United States and Britain.

In 1938, with Hitler's Germany threatening war, Britain sent a purchasing commission to the United States to buy military aircraft—especially a coastal patrol bomber that could act as an antisubmarine plane. Visiting various American aircraft firms, the commission originally did not intend to come to Lockheed. However, there was a change in plans and Lockheed officials were informed that the purchasing commission would be there in five days.

Lockheed had only commercial transports in production at the time, but the Model 14 Electra could possibly be converted into a bomber. Lockheed engineers and shop personnel hurriedly designed and constructed a full-scale wooden mockup of a Model 14 converted to a medium reconnaissance bomber. It was ready when the British arrived five days after Lockheed first received word of the visit.

The enthusiasm and aggressiveness of the Lockheed people and the quality of their design so impressed the commission that the company was invited to send a team to England to confer with British Air Ministry, which would make the final decision on the proposed new bomber. On the team, led by high-level Lockheed executive Courtlandt Gross, was Kelly Johnson.

At the meeting with the Air Ministry, the British called for new specifications that required a major redesign. Working a straight seventy-two hours in a London hotel room over a three-day holiday, catnapping for brief periods, Johnson completed the engineering task in time for meetings with the Air Ministry. Following a week of additional discussions, the Air Ministry chief called Gross aside and said (as recalled by Courtlandt Gross later):

> Mr. Gross, we like your proposal very much, and we very much would like to deal with Lockheed. On the other hand, you must understand that we're very unused in this country to dealing—especially on transactions of such magnitude—on the technical say-so of a man as young as Mr. Johnson. And, therefore, I'll have to have your assurance . . . that if we do go forward, the aircraft resulting from the purchase will in every way live up to Mr. Johnson's specifications.

Gross assured the British air chief that Lockheed had "every confidence" in the twenty-eight-year-old Johnson and that the trust of the Air Ministry in Lockheed would not be misplaced. On June 23, 1938, the British Air Ministry signed a contract with Lockheed for 200 airplanes plus as many more that could be delivered by December 1939 up to a maximum of 250 at a total cost of $25 million. It was the largest single order ever received by any American aircraft manufacturer to that date. And so the famed Hudson bomber of World War II was born. In 1938 the twenty-eight-year-old Johnson became chief research engineer at Lockheed.

The origin of what was soon nicknamed the Skunk Works was in the World War II year of 1943 when the U.S. Army Air Corps asked Lockheed to hurriedly design a fighter around a British DeHavilland jet engine in the wake of disturbing reports that the Nazis had flown their own high-speed jet fighter in the skies over Europe.

Under an agreement negotiated by Johnson, Lockheed was to deliver a prototype jet aircraft within only ninety days. With the approval of Lockheed President Robert E. Gross, Johnson pirated personnel from other projects. He forged a team of twenty-three engineers and 103 shop mechanics working in a small assembly shed at Lockheed in Burbank. Lockheed top management gave Johnson a free hand in the shaping of the team and the aircraft they developed.

This Advanced Development Projects organization completed the prototype Johnson-designed XP-80 jet aircraft in 143 days—37 days under schedule. The aircraft made its first flight on January 8, 1944, at Muroc Dry Lake, California. It was the forerunner of the F-80 Shooting Star, the first U.S. fighter to exceed 500 mph and America's first operational jet fighter. Johnson's Skunk Works and the way it operated were firmly established at Lockheed.

What was the origin of the Lockheed-registered Skunk Works name? It came from Al Capp's "Li'l Abner" comic strip, which featured the "skonk works" where Appalachian hillbillies threw in skunks, old shoes, and other odd ingredients to brew a fearsome drink called Kickapoo Joy Juice.

Working in wartime secrecy, especially on the XP-80 project, engineers identified the assembly shed as the Skunk Works where Kelly was stirring up some kind of potent brew. Although World War II ended before the P-80 could see combat in it, the aircraft proved itself during the Korean War in 1950 when the Shooting Star won history's first all-jet battle.

Among Johnson's military aircraft from the Skunk Works following the Shooting Star were the T-33 trainer, the aerial "schoolroom" responsible for teaching more pilots to fly jets than any other plane; the record-setting 1,300-mph F-104 Starfighter, the first operational airplane to fly twice the speed of sound in level flight; and the P2V Neptune antisubmarine patrol plane, which established a nonstop distance record of 11,235 miles in 1946.

Johnson also played a major role in the development of the Constellation, which started out as a commercial airliner design, then was taken over by the military during World War II as a transport, and once again was a pacesetting commercial airliner after the war in addition to a number of military versions produced by Lockheed. But far bigger challenges were in store for the Skunk Works and Johnson, who became Lockheed's chief engineer in 1952, vice president for research and development in 1958, and vice president for Advanced Development Projects in 1958.

In urgent need for a reconnaissance aircraft that could safely fly high over the Soviet Union to photograph missile and other military operations and return with the valuable data, the U.S. government again turned to Johnson and the Skunk Works. Out of the Skunk Works in 1955 came the long-winged U-2 jet, which could fly above 70,000 feet with a range of 4,000 miles on its U.S. Air Force missions. The U-2 was also a money saver. Johnson returned to the U.S. government approximately $2 million saved on the $20 million U-2 contract, producing an extra six planes for the same money intended to cover twenty aircraft.

Nor was this the first time. Johnson was known for his hard adherence to principles. On several occasions he turned back development contracts to the U.S. Department of Defense after initial work indicated the proposed aircraft would not be effective, no matter how much money the DoD was willing to provide.

Advanced U-2 versions, including the Air Force TR-1 and the NASA ER-2 high-altitude research aircraft, were developed. With improvements to the U-2 reaching their limit, radically new reconnaissance aircraft were on Kelly Johnson's drawing boards in the late 1950s: the family of titanium Blackbirds, culminating a few years later in the SR-71.

In January 1960 the U.S. Air Force gave the Skunk Works the go-ahead for the design, manufacture, and testing of twelve A-12s. "The aircraft that were to become the Blackbirds were the first to use the 'stealth' technology we developed for radar avoidance," Johnson said.

High speed was another prime objective for the Blackbirds. As Johnson said:

> The idea of attaining and staying at Mach 3.2 (more than three times the speed of sound) over long flights was the toughest job the Skunk Works ever had and the most difficult of my career.
>
> Aircraft operating at those speeds would require development of special fuels, structural materials, manufacturing tools and techniques, hydraulic fluid, fuel tank sealants, paints, plastics, wiring, and connecting plugs. Everything about the aircraft had to be invented.

But it all came together. Technologically ahead of their time, Johnson's Blackbirds were in the skies in the early 1960s: the A-12's first flight was in 1962; the YF-12A in 1963; and the SR-71 in 1964. With in-flight refueling, the SR-71 attained global range.

SR-71 Blackbirds went on in the 1970s to chalk up records for speed (2,193 mph), altitude (85,069 feet), a trans-Atlantic mark of one hour, fifty-four minutes, on a 3,470-mile flight from New York to London; and a world speed record of three hours, forty-seven minutes on a 5,463-mile flight from London to Los Angeles. In March 1990, the year the Air Force retired the Blackbirds from service, an SR-71 streaked across the United States in a record sixty-eight minutes on the 2,400-mile flight coast to coast.

When Clarence L. (Kelly) Johnson died in 1990, his SR-71 Blackbird, which first flew almost thirty years before, was still the world's fastest and highest-flying aircraft.

The secret of Kelly Johnson's success was really no secret. He was not only one of the world's foremost designers, but he was an innovative manager who gave people who worked for him challenges to constantly create better products.

Many of us in the Skunk Works turned down promotions to other Lockheed organizations to stay with Kelly. And uppermost for Kelly was to stay with the Skunk Works. He was offered a company presidency at Lockheed three times—and three times he declined it. "To me," said Kelly, "there was no better job within the corporation than head of Advanced Development Projects—the Skunk Works."

Even when he retired from Lockheed as a corporate senior vice president in 1975, Johnson continued at the Skunk Works as a senior advisor. His influence continues in the Skunk Works. "Our aim," he said, "is to get results cheaper, sooner, and better through application of common sense to tough problems. If it works, don't fix it."

"Reduce reports and other paperwork to a minimum."

"Keep it simple, stupid—KISS—is our constant reminder."

Johnson instinctively knew how to select people for his organization. He knew how to get the most out of the fewest people and how to get the job done—well. He let his managers run their programs with a minimum of interference. He not only gave you the authority but also the responsibility.

As a man of high integrity himself, Johnson expected complete honesty from the people of the Skunk Works. Mistakes were allowed, but they were to be brought to his attention immediately. And Kelly also expected recommendations to correct mistakes.

He was firmly convinced of the importance of being honest with people, not just telling them what they wanted to hear. He emphasized the necessity of good communication, urging us always to ask a lot of questions.

One of Kelly's challenges to employees was a standing 25-cent bet against anyone who wanted to differ with him. It was not the quarter, of course, but the distinction of winning it from the boss, Kelly said. "It's another incentive. And I've lost a few quarters, too," he admitted. But not often, it must be noted.

Said President Lyndon Johnson when he presented the National Medal of Science to Johnson at the White House in 1966:

> Kelly Johnson and the products of his famous Skunk Works epitomize the highest and finest goal of our society—the goal of excellence. His record of design achievement in aviation is both incomparable and virtually incredible. Any one of his many airplane designs would have honored any individual's career.

Clarence L. (Kelly) Johnson died on December 21, 1990. He was married to the former Nancy Powers Horrigan. His first wife, Althea Louise Young Johnson, died in 1970. His second wife, MaryEllen Meade Johnson, died in 1980.

REFERENCES

Clarence L. (Kelly) Johnson and Maggie Smith. *Kelly—More Than My Share of It All.* Washington, D.C.: Smithsonian Institution Press, 1985.

Philip L. Juergens. "Of Men and Stars." Lockheed history, 1957.

Sol London. "This is Lockheed Advanced Development Company." LADC (Skunk Works) information brochure, 1991.
J. Wayne Pryor. "Lockheed's Family Tree." History of the company's early aircraft, 1978.
Sol London. "A Farewell to Lockheed's Great Kelly Johnson." Lockheed Advanced Development Company Star, employee newspaper, January 24, 1991.
"A Letter to Kelly Johnson." Video, 1989.
"Kelly Johnson—A Man and His Machines." Video tribute by the American Institute of Aeronautics and Astronautics, 1978.
"The Tradition Continues—the ADP (Lockheed Advanced Development Projects) Way." Video, 1987.

TECHNICAL PAPERS AND REPORTS

The majority of Clarence L. (Kelly) Johnson's reports were classified and most of them still are.

HONORS AND AWARDS

1937

Lawrence Sperry Award, presented by the Institute of Aeronautical Sciences (now the American Institute of Aeronautics and Astronautics) for "important improvements of aeronautical design of high speed commercial aircraft" for development of the Fowler flap on Model 14. Presented annually "for outstanding achievement in aeronautics by young men."

1941

The Wright Brothers Medal, presented by the Society of Automotive Engineers for work on control problems of four-engine airplanes.

1956

The Sylvanus Albert Reed Award, presented by the Institute of Aeronautical Sciences, for "design and rapid development of high-performance subsonic and supersonic aircraft."

1959

Corecipient of the Collier Trophy as designer of the airframe of the F-104 Starfighter, sharing the honor with General Electric (engine) and U.S. Air Force (flight records). The F-104 was designated the previous year's "greatest achievement in aviation in America."

1960

The General Hap Arnold Gold Medal, presented by the Veterans of Foreign Wars for design of the U-2 high-altitude research plane.

1963

The Theodore von Karman Award, presented by the Air Force Association for designing and directing development of the U-2, "thus providing the Free World with one of its most valuable instruments in the defense of freedom."

1964

The Medal of Freedom, presented by President Lyndon B. Johnson in ceremonies at the White House. The highest civilian honor the President can bestow, this medal recognizes "significant contributions to the quality of American life." Kelly Johnson was cited for his advancement of aeronautics.
The Award of Achievement, presented by the National Aviation Club of Washington, D.C., for "outstanding achievement in airplane design and development over many years, including such models as the Constellation, P-80, F-104, JetStar, the U-2 and climaxed by the metallurgical and performance breakthroughs of the A-11 (YF-12A)."
The Collier Trophy (his second), following his work on the 2,000-mph YF-12A interceptor. Johnson's achievement for the previous year was called the greatest in American aviation.
The Theodore von Karman Award (his second), presented by the Air Force Association for his work with the A-11 (YF-12A) interceptor.
Honorary degree of doctor of engineering, University of Michigan.
Honorary degree of doctor of science, University of Southern California.
Honorary degree of doctor of laws, University of California at Los Angeles.

1965

San Fernando Valley Engineer of the Year, so designated by the San Fernando, California, Valley Engineers' Council.
Elected a member of the National Academy of Engineering.
Elected a member of the National Academy of Sciences.

1966

The Sylvanus Albert Reed Award (his second), given by the American Institute of Aeronautics and Astronautics "in recognition of notable contributions to the aerospace sciences resulting from experimental or theoretical investigations."
National Medal of Science, presented by President Lyndon B. Johnson at the White House.
The Thomas D. White National Defense Award, presented by the U.S. Air Force Academy in Colorado Springs, Colorado.

1967

Elected an honorary fellow of the American Institute of Aeronautics and Astronautics.

1968

Elected a fellow of the Royal Aeronautical Society.

1969

The General William Mitchell Memorial Award, presented by the Aviators Post 743 of the American Legion at Biltmore Hotel, Wings Club, February 14.

1970

The Spirit of St. Louis Medal by the American Society of Mechanical Engineers.

On behalf of Lockheed's Advanced Development Projects facility, which Johnson directed until his retirement in 1975, he accepted the first Engineering Materials Achievement Award of the American Society of Metals. Lockheed's ADP program "took titanium out of the development phase into full production for aircraft application."

The Engineering Merit Award presented by the Institute for the Advancement of Engineering, Beverly Hills, California.

Honored by the Air Force Association, Washington, D.C., for Johnson's design of the P-38 Lightning.

1971

The Sixth Annual Founders Medal of the National Academy of Engineering in recognition of his fundamental contributions to engineering.

1972

The Sliver Knight Award by the Lockheed Management Club of California for his contributions to Lockheed's success.

The first "Clarence L. Johnson Award" by the Society of Flight Test Engineers for his contributions to aviation and flight test engineering.

1973

Civilian Kitty Hawk Memorial Award by the Los Angeles Area Chamber of Commerce for outstanding contributions to the field of aviation.

1974

The Air Force Exceptional Service Award for his many outstanding contributions to the U.S. Air Force from 1933 to 1974. Presented by Secretary of the Air Force John McLucas.

Enshrined in the National Aviation Hall of Fame in Dayton, Ohio, for his outstanding contributions to aviation.

1975

Awarded the Wright Brothers Memorial Trophy for vital and enduring contributions over a period of forty years to the design and development of military and commercial aircraft.

1978

Sponsored by the American Institute of Aeronautics and Astronautics, "A Salute to Kelly Johnson" night—an hour-long multimedia presentation of his career highlights.

1980

Bernt Balchen Trophy, the highest award of the New York State Air Force Association, presented annually to "an individual of national prominence whose contribution to the field of aviation has been unique, extensive or of great significance."

1981

The Department of Defense Medal for Distinguished Public Service, presented by Defense Secretary Harold Brown.

Elected a fellow of the Society of Automotive Engineers for "his abilities to motivate a small staff to work within a tight time frame and budget in creating revolutionary aircraft designs."

The "Kelly Johnson Blackbird Achievement Trophy" was created by the USAF to "recognize the individual or group who has made the most significant contribution to the U-2, SR-71 or TR-1 program since the previous annual reunion."

The Daniel Guggenheim Medal "for his brilliant design of a wide range of pacesetting, commercial, combat and reconnaissance aircraft, and for his innovative management techniques that developed these aircraft in record time at minimum cost."

1982

Meritorious Service to Aviation Award from the National Business Aircraft Association, recognizing his designs of more than forty aircraft, including the world's first business jet, the JetStar.

1983

The Howard Hughes Memorial Award for 1982, presented by the Aero Club of Southern California in joint sponsorship with the Marina City Club. Recipient is recognized as a leader in aviation who has devoted a major portion of his life to the pursuit of aviation as a science and an art.

The National Security Medal, presented by President Ronald Reagan for exceptional meritorious service in a position of high responsibility and for outstanding contribution to the national security of the nation.

1984

Appointed Royal Designer for Industry, an honor originally established in 1936 by the British Royal Society of Arts recognizing designers who have attained eminence, efficiency, and visual excellence in creative design for industry. Limited to 100 recipients, Johnson was the seventy-second to receive the appointment. Diplomas are issued under the authority of the Council of the Royal Society of Arts.

1985

Honored by the Smithsonian's Air and Space Museum with an exhibit recognizing him as one of the founding fathers of the jet age. The exhibit ran for one year and was viewed by an estimated 16 million people.

Installed in the American Institute of Aeronautics's "1985 Aerospace Pioneer Hall of Fame," honoring him for his distinguished career in aerospace.

1986

Recognized by titanium producers association for the "earliest large-scale use of titanium in an aircraft primary structure."

1987

The Lord Medal for "Leadership in Wealth Creation," for "contributions to the development of products that add to the civilized aspects of human societies."

1988

The National Medal of Technology for "outstanding achievements in the design of a series of commercial, military and reconnaissance aircraft that have incorporated a wide range of technological advancements."

Inducted into the Michigan Aviation Hall of Fame in recognition of his many outstanding contributions to the field of aviation.

1990

National Air and Space Museum Trophy from the Smithsonian Institution "in recognition of extraordinary service in aviation, space science, and technology" and for the SR-71, a "past achievement that has contributed significantly to advancing aerospace activities."

1991

National Management Association Hall of Fame.

PATENTS

Kelly Johnson received forty-four U.S. patents. Some of the more important ones are listed below.

1939	Design for Airplane Model 27 (D-116,094).
1940	Design for Airplane Model P-38 (D-119,714).
1943	Anti-Icing Duct for Model 12 and P-38 (2,320,870).
1946	Design for Airplane Model P-80 (D-143,822).
1947	Auxiliary Fuel Tank for Model P-80 (2,421,699).
1954	Airplane Design for Model C-130 (D-172,969).
1956	Afterburning Means for Turbo-Jet Engines (2,771,740).
	Airplane Design for Model F-104 (D-179,348).
1957	Airplane with Variable Swept Wings (2,794,608).
	Landing Drag Flap and Lift Spoiler (2,791,385).
1958	Jet Utility Transport (D-183,657).
1959	Turbine Engine Blow-Out Preventer (2,870,684).
1960	Aircraft Propulsion Systems (Jet Flap) (2,928,627).
1961	Airplane Design for Model JetStar (D-191,243).