1980 Elmer A. Sperry Award

FOR ADVANCING THE ART OF TRANSPORTATION

Presentation of

THE ELMER A. SPERRY AWARD FOR 1980

To

William M. Allen

Malcolm T. Stamper

Joseph F. Sutter

Everette L. Webb

for their leadership in the development, successful introduction and acceptance of wide-body jet aircraft for commercial service.

With Citation to

the employees of the Boeing Commercial Airplane Company for their contributions toward the development, successful introduction and acceptance of wide-body jet aircraft for commercial service.

By The Board of Award under the sponsorship of

The American Society of Mechanical Engineers
Institute of Electrical and Electronics Engineers
Society of Automotive Engineers
The Society of Naval Architects and Marine Engineers
American Institute of Aeronautics and Astronautics

At the Awards Luncheon of the Aircraft Systems Meeting of the American Institute of Aeronautics and Astronautics

Wednesday, August 12, 1981, Stouffer's Dayton Plaza Hotel, Dayton, Ohio

ELMER AMBROSE SPERRY 1860-1930

The Elmer A. Sperry Award commemorates the life and achievements of Dr. Elmer A. Sperry (1860-1930) by seeking to encourage progress in the engineering of transportation. Much of the great scope of the inventiveness of Dr. Sperry contributed either directly or indirectly to advancement of the art of transportation. His contributions have been factors of improvement of movement of people and goods by land, sea and air.

The award was established in 1955 by Dr. Sperry's daughter, Mrs. Robert Brooke Lea, and his son, Elmer A. Sperry, Jr.

PURPOSE OF THE AWARD

The Elmer A. Sperry Award shall be given in recognition of a distinguished engineering contribution which, through application, proved in actual service, has advanced the art of transportation whether by land, sea or air.

In the words of Edmondo Quattrocchi, the sculptor of the Elmer A. Sperry Medal:

"This Sperry medal symbolizes the struggle of man's mind against the forces of nature. The horse represents the primitive state of uncontrolled power. This, as suggested by the clouds and celestial fragments, is essentially the same in all the elements. The Gyroscope, superimposed on these, represents the bringing of this power under control of man's purposes."

WILLIAM M. ALLEN
Honorary Chairman
The Boeing Company

William M. Allen completed a distinguished 47-year career with The Boeing Company in September 1972 when he retired as board chairman. He had been company president since 1945 and board chairman since 1968. Prior to accepting the company presidency, he had long been the Boeing legal counsel and served 15 years as a company director.

Allen's aim of achieving leadership in commercial aviation for Boeing was implemented in 1952 when he asked Boeing's directors to authorize company-funded development of America's first jet transport, the prototype of the Model 707. The action led to revolutionizing the world's transportation system and travel habits.

In a career noteworthy for high-risk decisions, Allen unhesitatingly directed Boeing to undertake the 747, the largest commercial aircraft ever to enter production. He oversaw the program from inception through its first 18 months of airline service.

Allen was born in 1900 in Lolo, Montana, and later was graduated from the Harvard Law School.

He has been widely honored for his business leadership and contributions to the aerospace industry. During his Boeing career he played a prominent role in the B-52 and 747 programs and twice was awarded aviation's highest award, the Collier Trophy. In 1975, Fortune Magazine named Allen one of the first 10 recipients of the Hall of Fame for Business Leadership, which honors outstanding business leaders in the United States since the country's founding.

MALCOLM T. STAMPER
President
The Boeing Company

Malcolm T. Stamper, president of The Boeing Company since 1972, was responsible for directing the huge 747 program from start-up to airline introduction.

Stamper was named the first vice president-general manager of the 747 Division in June 1966, one month prior to formal program go-ahead. Under his supervision, Boeing built the 747 manufacturing complex, which includes the largest building by volume in the world, and designed and began production of the world's largest jetliner. In all, only three and one-half years elapsed from go-ahead to airline introduction.

In April 1969, Stamper became vice president-general manager of Boeing's former Commercial Airplane Group, directing all activities involved in the production, sale and development of all the company's commercial airplanes. In 1971, when the 747 was successfully in service, he was named senior vice president-operations for the entire Boeing corporation.

Stamper joined Boeing in 1962 after 14 years with General Motors. He was born in 1925 in Detroit, served as a naval officer during World War II, studied law at the University of Michigan, and was graduated with a degree in electrical engineering from Georgia Tech.

During his years in Seattle, Stamper has been active in numerous civic activities.

JOSEPH F. SUTTER
Vice President
Operations and Product Development
Boeing Commercial Airplane Company

Joseph F. Sutter was the key individual in the design and development of the 747. Beginning in late 1965 when he was named 747 Chief Engineer, all aspects of the 747 reflect Sutter's technical judgment and design expertise.

In recognition of his contribution, Sutter was awarded the American Institute of Aeronautics and Astronautics Aircraft Design Award in 1971 -- the first such award made by the Institute.

Since 1978, Sutter has been vice president-operations and product development for the Boeing Commercial Airplane Company, with responsibility for production management of the company's current airplane products, development of the new 757 and 767 jetliners, and future product offerings.

Sutter has had a distinguished technical management career during his 36 years at Boeing. He was aerodynamics unit chief on the Boeing jet prototype in the 1950s and then on the 707 program; chief of technology for the Model 727, and chief engineer-technology when the 737 and 747 were conceived. He is co-inventor of both the 737 and 747.

When the 747 received go-ahead status in July 1966, Sutter was named director of engineering. He thus had major technical responsibility for the program from concept through design, final configuration, flight testing and certification. It was during this period that 747 emerged as a family of airplanes, and Sutter has guided this effort throughout the program's 15-year history.

Sutter became vice president-general manager of the 747 Division in 1971. Beginning in 1976, he took over direction of Boeing's new family of jetliners for the 1980s and was responsible for bringing these design studies - now the 757 and 767 - to the point where they emerged as firm product offerings.

He is a native of Seattle, and a graduate of the University of Washington with a degree in aeronautical engineering.

EVERETTE L. WEBB
Director of Engineering
767 Division
Boeing Commercial Airplane Company

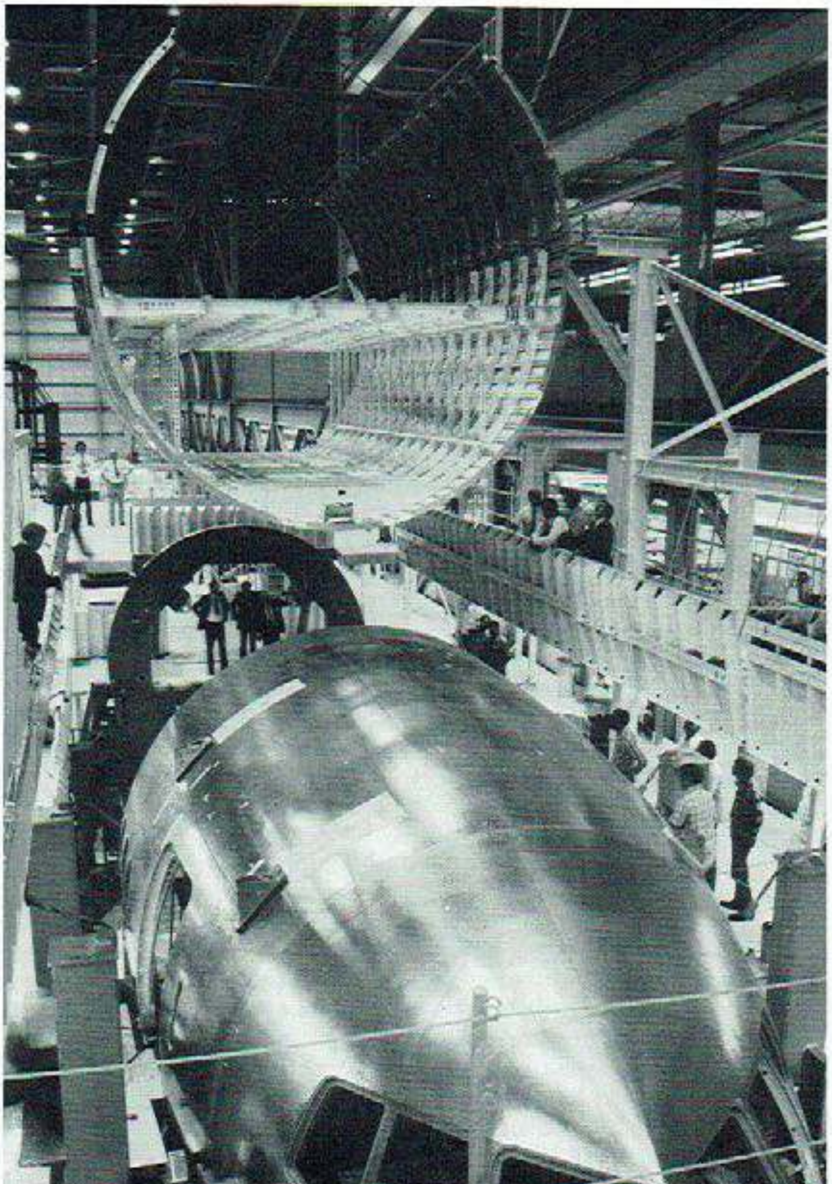
Everette L. Webb, currently director of engineering for Boeing's new 767 jetliner, spent seven years on the 747 program as chief of technology.

Webb's assignment to the 747 began in 1965 and continued through 1972. The technology designed into the airplane and the ultimate technical integrity of the world's first wide-body commercial airplane were Webb's responsibility. He was acknowledged as the leader in developing analysis and testing techniques to study the structural dynamics of transports with large, flexible structures. Webb led the technology effort required for the design of new nacelles with which to meet more stringent noise regulations, and oversaw technical aspects of the 747-200, -200B and 747SR (Short Range) derivatives.

For several years prior to the 747 program, Webb was chief of structures technology for product development, which involved him in development of the 707-320C, Model 727 and preliminary design studies of transport configurations for the transonic and supersonic speed regimes. He was chief of technology for Boeing's C5A design team in the mid-1960s, which led directly to his transfer to the 747.

As a result of his contribution to the 747 program, Webb was named director of technology for the Boeing Commercial Airplane Company, managing all technology and commercial research programs. In 1975, he became director of engineering on the 7X7, which later became the 767.

Webb's Boeing career spans 39 years.



Sixteen years ago this month, Joe Sutter was vacationing at his summer cabin on Hood Canal, an idyllic spot west of Seattle. He was awakened from a nap on the beach by a neighbor with a message to call Dick Rouzie, director of engineering for the Boeing's Transport Division, as quickly as possible.

Sutter called the plant, and was told by Rouzie that Boeing management had decided to proceed with serious study of a commercial derivative of the C-5A military transport. Rouzie wanted Sutter to head the project, but would give him time to think about it. Sutter didn't think long; he accepted before hanging up.

On Sutter's first Monday back at work the outcome of a day-long meeting was formation of a preliminary design group, with the assignment to develop a design proposal for a big commercial jet that could be shown to the world's major airlines.

As Sutter recalls, the 747 program was born that day. Three months later the same Dick Rouzie and four of his Boeing executive associates were honored with the 1965 Elmer A. Sperry Award for their "dedicated effort and essential contribution to the concept, design, development, production and practical application of the family of jet transports exemplified by the 707, 720 and 727."

While this team was being deservedly honored, the airplane that was emerging from Sutter's design group would dwarf everything which had preceded it by every conceivable measure.

The 747 was to be two and one-half times as large as Boeing's 707 Intercontinental; the program represented the largest commercial venture ever undertaken and financed by private capital in aviation history; the facilities, subcontracting team, and test programs were of a magnitude never before attempted in the industry.

Boeing's studies for a big airplane had actually begun in mid-1962, and from this activity evolved a transport weighing as much as 700,000 pounds to meet emerging military requirements. The idea at first was shelved by the military, but in the next two years a very large logistics transport became more appealing. At the same time, Boeing planners were viewing with apprehension how then available commercial transports would cope with airline passenger and cargo growth being predicted for the 1970s. With airways and airports becoming more crowded and passenger volume increasing 15 percent annually, a second generation commercial jet was becoming an absolute requirement.

The U.S. Air Force transport program became known as the C-5A in the mid-1960s and a 500-man engineering team was at work on Boeing's proposal. Then, in the early fall of 1965, it was announced Boeing had lost its C-5A bid, and the company's emphasis shifted to pursuing the need it visualized for a super-sized commercial transport.

Events moved fast in the fall of 1965 under Sutter's direction. By this time some 50 different variations of double-deck concepts had been studied and discarded by Sutter's preliminary design group. What emerged was a wholly new design. With a circular cross-section 19 feet, 5 inches wide and a height of 8 feet, 4 inches, the main deck was designed to provide unparalleled passenger comfort as well as the capability to carry cargo containers side-by-side the full length of the fuselage. Below the main cabin floor was the cargo area large enough by itself to carry the full capacity of a 707 freighter. The flight deck was on the second level along with a lounge area reached by a spiral staircase from the main cabin.

The airplane incorporated a low wing which was swept much like that of the 707. Vastly improved engines, with noise and emission characteristics markedly better than previous powerplants and rated at 43,000 pounds thrust each, were under development by Pratt & Whitney. Early wind tunnel testing showed that the 747 would comfortably cruise at 35,000 feet at a speed of more than 600 miles an hour, and with a range of up to 6,000 miles.

This was the design which Boeing salesmen took on the road in January, 1966, and the response was positive. There was a feeling that potential customers were getting ready to order.

In March, 1966 Boeing Chairman William M. Allen reviewed the program's status with the company's board of directors, recommending they vote to proceed with the massive endeavor. In typical fashion, Allen conceded that the financial risks were greater than anything ever faced by Boeing, but at the same time the potential rewards would exceed that of any previous company program.

The Board approved the program on a tentative basis, reserving a final commitment until airline orders were forthcoming. Nonetheless, the 747 had achieved formal project status, and a full-scale engineering group was formed.

One month later Pan American, under the leadership of its founder Juan Trippe, announced it was ordering 25 Model 747s valued at $525 million. It was the largest single order for one type aircraft in aviation history. Pan Am's announcement said that it was "pioneering a whole new era in air transporation, introducing the spacious age." Indeed, the prospect of an airplane carrying from 350 to 450 passengers in first-time-ever twin-aisle, wide-body comfort captured the imagination of the traveling public, and Pan American's historic decision ricocheted through the industry. Within a short time, Lufthansa, Japan Air Lines and British Airways placed initial orders. On July 25, 1966, the Boeing board of directors gave full go-ahead status to the 747 program.

However, even before that decision took place, momentum on the program was beginning to build. The company purchased 780 acres of scrub timberland adjacent to Paine Field at Everett, Washington, approximately 35 miles north of Seattle. Malcolm Stamper, a Boeing vice president, was named to head the Everett Branch (later to become the 747 Division), with the awesome responsibility of overseeing the program during its most critical early days. The team that Stamper assembled to meet the December, 1969 delivery commitment to Pan American became aptly known as the "Incredibles."

Construction on the 747 site and production of the first airplane proceeded concurrently during the first two and one-half years of the program. Three quarters of a billion dollars were required during this time for basic engineering design, development and capital facilities, a sum about equal to the entire net worth of Boeing in 1967.

Building of the 747 facility was a monumental feat in itself. A three-mile rail spur (with the second steepest grade in the U.S.) was built in just months, then was utilized to haul structural steel to the site for building construction. A 15-million-gallon reservoir was dug to handle site water runoff. In July, 1967--one year after formal go-ahead--the major assembly bay was essentially completed. It was (and still is) the world's largest cubic volume building, with 200 million cubic feet, or, measured another way, with 52 acres under one continuous roof. Today, 15 years later, the 747 factory, now expanded by 85 million cubic feet to house Boeing's new 767 program, is still one of the largest tourist attractions in Washington State.

In the months after go-ahead, Sutter's engineering team was discovering that what appeared feasible in early paper designs was proving more difficult to translate to a final configuration. Because of its size, structural problems became a reality. Dozens (even hundreds) of technical unknowns had to be unscrambled. The most extensive laboratory and wind tunnel testing plan ever undertaken by Boeing was established. Throughout this critical period, Everette Webb, chief of 747 technology, shouldered the responsibility for making sure that the airplane's design was valid.

In all, 13,000 hours of wind tunnel testing went into the final 747 design--five times as much as on any previous Boeing jet. Only after that great expenditure of time and money, did the 747 final design fall into place. There were many changes from what had been originally presented to the airlines: engines moved farther outboard on the wings; engine-to-wing struts changed; flaps redesigned; new landing gear; rudder and elevator controls changed, and the tail reconfigured to decrease drag.

A major engineering crisis developed in early 1967 as airplane weight moved dangerously above specification. As a result, the development testing program was stepped up, and the company pulled in experienced engineers from other programs to look at the problem. The airplane's wing was redefined again for a savings of hundreds of pounds; new uses were found for lightweight materials; titanium was selected for the main landing gear beams, and the 747 structure was reviewed almost inch-by-inch to obtain maximum efficiency for minimum weight. The result was a more aerodynamically efficient airplane built to weight specification.

With the engineering team working day and night, other aspects of the program were taking shape. The largest subcontracting team in commercial aircraft history was assembled. It was comprised of approximately 1,500 prime suppliers and 15,000 secondary suppliers located in 49 states and eight foreign countries. About 65 per cent of the weight (50 per cent by dollar volume) of each 747 was assigned to the subcontractor team.

To support 747 production, the company created a new Fabrication and Services Division on a 260-acre site at Auburn, Washington, south of Seattle. Built at a cost of $150 million, it remains the most modern and mechanized fabrication facility in the free world.

Concurrently, the 747 program required design and fabrication of 270,000 tools, of which two-thirds were produced by suppliers and the remainder by Boeing.

Actual assembly of the first 747 began in September, 1967 when nose section components arrived at Everett from Boeing's Wichita facility. A major milestone occurred in March, 1968 when the first wing was removed from the assembly jig. Noteworthy was the fact that at this point the first Pratt & Whitney JT9D high-bypass-ratio turbofan engine designed for the 747 was still three months away from being test flown for the first time. That testing started in mid-June, 1968 aboard a leased Air Force B-52.

The pace of the program was feverish in mid-1968 as the first airplane came together in final assembly. Then, on September 20, the first 747 made its world debut in a rollout ceremony attended by aviation luminaries from around the world. By January, 1969 the airplane's major systems had been activated and its major components, such as landing gear and flight controls, had been operationally tested. On February 9, 1969 Boeing test pilot Jack Waddell was at the controls as the 747 flew for the first time. He said afterwards, "The plane is a pilot's dream."

The 747 test program which followed was the most extensive ever undertaken, involving five airplanes, 10 months and 1,500 test hours. The culmination came on December 30, 1969 when the Federal Aviation Agency certified the world's first wide-body transport for passenger service. As if this event wasn't proof enough of the 747's design, two months later, in a static test facility, a 747 wing was deflected 29 feet from its normal attitude and intentionally destroyed when the ultimate load was reached at 116.7 percent of design criteria.

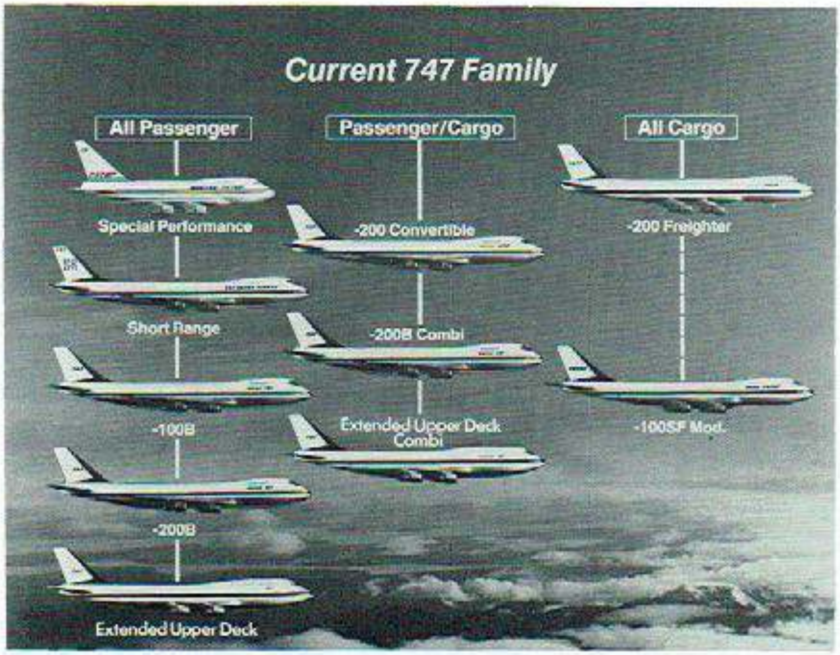
Boeing had expended 10 million engineering man-hours on the airplane to reach the point of first delivery to Pan American in December, 1969 so the airline could begin route proving and crew training. On January 21, 1970, Pan American introduced 747 commercial service on its New York-London route. The Age of the Superjet had arrived.

There were introduction problems, the most serious with the engine which "ovalized" 50/1000ths of an inch at full thrust causing a decrease in fuel efficiency. Early deliveries were delayed.

Nonetheless, program employment was peaking at 27,000 employees in late 1979 as production reached a maximum of seven airplanes a month to meet initial delivery requirements. At the end of 1970, ninety-six airplanes were turned over to 15 airlines and, then, more than six million passengers had flown aboard the 747, and the fleet was serving 33 cities in 16 countries. Passenger preference for the airplane was exceeding all expectations.

The design concept of the airplane was proving itself in other ways. During 1970, 747 gross weight was increased to 735,000 pounds to give airlines greater payload or range capability. By the end of 1970, the 747-200B series was certified at a gross weight of 775,000 pounds. Thus, at the same time that airlines were taking delivery of initial airplanes, the design process of improving the 747 and broadening the program into a "family" of airplanes to meet a broad range of airline requirements was well underway.

Between 1970 and 1975 five commercial versions of the 747 had been delivered. In addition to the original 747-100 model and longer-range 747-200, they were the 747C convertible passenger-cargo version, the 747F hinged-nose freighter, the 500-passenger 747SR (Short Range) airliner, and a derivative for the U.S. Air Force. Later, the shortened 747SP (Special Performance) very-long-range model, and the 747-100B were introduced.



These were some of the 747 milestones during the 1970's: 100th airplane delivered, February, 1971; fleet logs 1 million flight hours, September, 1972; 100 millionth passenger carried, October, 1975; 300 millionth passenger, October, 1980; and 500th airplane delivered, March, 1981. The 747 was in service with 66 operators in early 1981.

In 1983 a new version of the 747, with an extended upper deck, will be delivered. This option, which will allow the seating of 69 passengers, typifies the flexibility inherent in the original 747 design. When first delivered, eight passengers could use the upper deck, but not on takeoff or landings. Two years hence, the capacity will be two-thirds that of Boeing's 737 twinjet.

Fifteen years have passed since the 747 go-ahead was formally authorized. The 747--from the day it entered service--has been the most recognizable flying machine in the air. With continued incorporation of new technology, the 747 will continue to be a major force in air transportation well into the 21st Century.

PREVIOUS ELMER A. SPERRY AWARDS

1955 to William Francis Gibbs and his Associates for development of the S.S. United States.

1956 to Donald W. Douglas and his Associates for the DC series of air transport planes.

1957 to Harold L. Hamilton, Richard M. Dilworth and Eugene W. Kettering and Citation to their Associates for the diesel-electric locomotive.

1958 to Ferdinand Porsche (in memoriam) and Heinz Nordhoff and Citation to their Associates for development of the Volkswagen automobile.

1959 to Sir Geoffrey De Havilland, Major Frank B. Halford (in memoriam) and Charles C. Walker and Citation to their Associates for the first jet-powered aircraft and engines.

1960 to Frederick Darcy Braddon and Citation to the Engineering Department of the Marine Division, Sperry Gyroscope Company, for the three-axis gyroscopic navigational reference.

1961 to Robert Gilmore Letourneau and Citation to the Research and Development Division, Firestone Tire and Rubber Company, for high speed, large capacity, earth moving equipment and giant size tires.

1962 to Lloyd J. Hibbard for application of the ingitron rectifier to railroad motive power.

1963 to Earl A. Thompson and Citation to his Associates for design and development of the first notably successful automobile transmission.

1964 to Igor Sikorsky and Michael E. Gluhareff and Citation to the Engineering Department of the Sikorsky Aircraft Division, United Aircraft Corporation, for the invention and development of the high-lift helicopter leading to the Skycrane.

1965 to Maynard L. Pennell, Richard L. Rouzie, John E. Steiner, William H. Cook and Richard L. Loesch, Jr. and Citation to the Commercial Airplane Division, The Boeing Company, for the concept, design, development, production and practical application of the family of jet transports exemplified by the 707, 720, and 727.

1966 to Hideo Shima, Matsutaro Fujii and Shigenari Oishi and Citation to the Japanese National Railways for the design, development and construction of the New Tokaido Line with its many important advances in railroad transportation.

1967 to Edward R. Dye (in memoriam), Hugh DeHaven and Robert A. Wolf and Citation to the research engineers of Cornell Aeronautical Laboratory and the staff of the Crash Injury Research projects of the Cornell University Medical College.

1968 to Christopher S. Cockerell and Richard Stanton-Jones and Citation to the men and women of the British Hovercraft Corporation for the design, construction and application of a family of commercially useful Hovercraft.

1969 to Douglas C. MacMillan, M. Neilsen and Edward L. Teale, Jr. and Citations to Wilbert C. Gumprich and the organizations of George G. Sharp, Inc., Babcock and Wilcox Company, and the New York Shipbuilding Corporation, for the design and construction of the N.S. Savannah, the first nuclear ship with reactor, to be operated for commercial purposes.

1970 to Charles Stark Draper and Citations to the personnel of the MIT Instrumentation Laboratories: Delco Electronics Division, General Motors Corporation, and Aero Products Division, Litton Systems, for the successful application of inertial guidance systems to commercial air navigation.

1971 to Sedgwick N. Wight (in memoriam),and George W. Baughman and Citations to William D. Hailes, Lloyd V. Lewis, Clarence S. Snavely, Herbert A. Wallace, and the employees of General Railway Signal Company, and the Signal & Communications Division, Westinghouse Air Brake Company, for development of Centralized Traffic Control on railways.

1972 to Leonard S. Hobbs and Perry W. Pratt and the dedicated engineers of the Pratt & Whitney Aircraft Division of United Aircraft Corporation for the design and development of the JT-3 turbo jet engine.

1975 to Jerome L. Goldman, Frank A. Nemec and James J. Henry and Citations to the naval architects and marine engineers of Friede and Goldman, Inc., and Alfred W. Schwendtner for revolutionizing marine cargo transport through the design and development of barge carrying general cargo vessels.

1977 to Clifford L. Eastburg and Harley J. Urbach and Citations to the Railroad Engineering Department of The Timken Company for the development, subsequent improvement, manufacture and application of tapered roller bearings for railroad and industrial uses.

1978 to Robert Puiseux and Citations to the employees of the Manufacture Francais des Pneumatiques Michelin for the design, development and application of the radial tire.

1979 to Leslie J. Clark for his contributions to the conceptualization and initial development of the sea transport of liquefied natural gas.

THE 1980 ELMER A. SPERRY BOARD OF AWARD

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