



Congress and the supersonic transport, 1960-1971
by John Marion Bell

A thesis submitted in partial fulfillment of the requirements for the degree of MASTER OF ARTS in History
Montana State University
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Abstract:

Aviation state-of-the-art advances in the 1940's and 1950's paved the way for development of a commercial SST in the 1960's. Military aviation advances were translated directly into subsonic transports and it was felt that the next step in progress would be the SST.

Through military programs and basic research by NACA, the United States government aided the development of a commercial SST even before undertaking an active SST program in the 1960's. Foreign governments were also at work on SST's and when the British and French merged their development programs in 1962 the United States was spurred by their competition. President Kennedy announced an active program in June, 1963 a day following Pan Am's order of Anglo-French SST's. There was little opposition to the airplane at first; what little there was was based on the aircraft's unavoidable sonic boom.

A design competition was conducted by the FAA to select the best possible American design. Boeing was selected the winner in 1966 on the basis of a radical, swing-wing design. The program then entered a two-prototype development stage.

Boeing soon ran into development problems and in 1968 abandoned its swing-wing in favor of a conventional fixed-wing. The airplane's problems were also complicated by the great increase in cost of development as well as a growing opposition based on the possible negative environmental impact of the SST. The new environmental opposition questioned the need for an airplane which would possibly destroy solar radiation attenuating ozone in the stratosphere, possibly alter the earth's climate, and be excessively noisy on the ground.

After a decade of constant support for the airplane, Congress made an about face in 1970. The opposition began, to coalesce and the House narrowly passed the SST appropriation in May. During the remainder of 1970, an election year, the SST became a national political issue, and particularly an environmental issue. In December, the Senate cut all funds for the airplane. A compromise was reached between the two Houses funding the SST through March, 1971; there would be a separate vote on the SST before that time on whether or not to continue development.

During the first three months of 1971 the battle intensified.

The environmental issue was as strong as ever, but the fate of the airplane also hinged on economic factors. In March, the combined forces of economic and environmental opponents were able to complete the destruction of the SST program, after nearly a billion dollars had been spent but before any American SST had flown.

To more clearly assess the reasons for defeat, a retrospective study was undertaken. Nearly 400 Congressmen, particularly those who switched from support to opposition, were sent questionnaires soliciting their views on the program and on their votes. From questionnaire responses and from

contemporary reports, the conclusion was reached that neither economic nor environmental arguments and opponents alone were strong enough to shoot down the plane. Together, they were able to end a program which had been billed for over a decade as a necessary and inevitable form of progress.

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August 28, 1979

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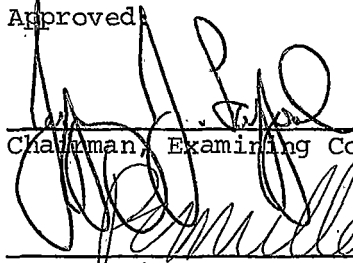
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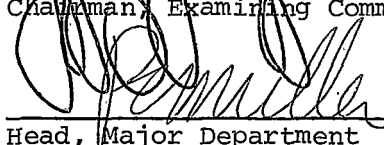
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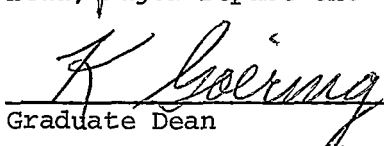
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It appears to be a truism that theses and similar projects always take longer than expected. And it appears that the writer is the last to realize this truism. Unfortunately, graduate student spouses are usually the first to understand this phenomena and are thereby subjected to even more stress and strain than the student. For her apparently futile, but loving, attempts at removing the veil of illusion, and for her untiring support and friendship over the past year while this thesis was in progress, I am forever and deeply indebted to my wife. And as a very meager token of gratitude for her constant support, love, and companionship under very trying conditions, I dedicate this thesis to my wife, Susan.

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ABSTRACT

Aviation state-of-the-art advances in the 1940's and 1950's paved the way for development of a commercial SST in the 1960's. Military aviation advances were translated directly into subsonic transports and it was felt that the next step in progress would be the SST. Through military programs and basic research by NACA, the United States government aided the development of a commercial SST even before undertaking an active SST program in the 1960's. Foreign governments were also at work on SST's and when the British and French merged their development programs in 1962 the United States was spurred by their competition. President Kennedy announced an active program in June, 1963 a day following Pan Am's order of Anglo-French SST's. There was little opposition to the airplane at first; what little there was was based on the aircraft's unavoidable sonic boom.

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Boeing soon ran into development problems and in 1968 abandoned its swing-wing in favor of a conventional fixed-wing. The airplane's problems were also complicated by the great increase in cost of development as well as a growing opposition based on the possible negative environmental impact of the SST. The new environmental opposition questioned the need for an airplane which would possibly destroy solar radiation attenuating ozone in the stratosphere, possibly alter the earth's climate, and be excessively noisy on the ground.

After a decade of constant support for the airplane, Congress made an about face in 1970. The opposition began to coalesce and the House narrowly passed the SST appropriation in May. During the remainder of 1970, an election year, the SST became a national political issue, and particularly an environmental issue. In December, the Senate cut all funds for the airplane. A compromise was reached between the two Houses funding the SST through March, 1971; there would be a separate vote on the SST before that time on whether or not to continue development.

During the first three months of 1971 the battle intensified. The environmental issue was as strong as ever, but the fate of the airplane also hinged on economic factors. In March, the combined forces of economic and environmental opponents were able to complete the destruction of the SST program, after nearly a billion dollars had been spent but before any American SST had flown.

To more clearly assess the reasons for defeat, a retrospective study was undertaken. Nearly 400 Congressmen, particularly those who switched from support to opposition, were sent questionnaires soliciting their views on the program and on their votes. From questionnaire responses and from contemporary reports, the conclusion was reached that neither economic nor environmental arguments and opponents alone were strong enough to shoot down the plane. Together, they were able to end a program which had been billed for over a decade as a necessary and inevitable form of progress.

INTRODUCTION

On December 3, 1970, the United States Senate voted to stop funding development of the American version of the Supersonic Transport (SST). Although there had been some opposition to the SST from the early 1960's this action represented the first time in a decade that opponents were able to halt the controversial SST program, a program that seemed to develop a life and justification of its own, regardless of its merits. During the 1960's the United States underwent tremendous changes, changes that had a great bearing on the success or failure of the SST program. At the beginning of that decade the SST represented just another step in the ongoing progress of mankind. By 1970, however, the nation had passed through a turbulent and eventful decade which resulted in the questioning of traditional values and concepts of progress. Instead of accepting any new development solely on the basis of its technological possibility, a significant body of Americans questioned programs such as the SST on the basis of what they would do to and for society.

The development of the jet engine in the 1930's paved the way for supersonic flight in the post-World War II era and by the early 1950's aviation state-of-the-art was sufficiently advanced to make civil supersonic flight a possibility during the 1960's. In addition to more powerful jet engines, new materials and materials fabrication techniques would allow flight at speeds greater than three times the speed of sound. Military aviation developments contributed directly to

civilian subsonic aviation and also led to the use of aluminum alloy and titanium airframes for supersonic flight.

Achievement of supersonic flight capabilities represented a continuation of the historic trend of shortening travel time. In the past, any mode of transportation which promised to shorten the time required to travel from one place to another has invariably been received favorably by the traveling public. Thus the sailing ship gave way to the steamship; the horse and buggy gave way to the automobile; the stagecoach was supplanted by the railroad; and the railroad, steamship, and automobile were eclipsed by the airplane. Similarly, advancements in the speed capability of the airplane led to an ever-increasing use of air transportation. When pre-World War II transports such as the DC-3 were replaced by the four-engined piston transports of the post-war era, air travel sharply increased. When the first generation of jet transports became widely available in the early 1960's, air travel boomed. It was expected that the trend would be continued by the introduction of the SST in the 1970's.

In addition to aviation state-of-the-art advancements making supersonic flight possible in the 1950's and 1960's, international competition provided a strong impetus for SST development. Programs were initiated in Great Britain, France, the Soviet Union, and the United States in the 1950's. For all four countries an SST in its family of airplanes was thought to be a source of national prestige,

much as Sputnik for the Soviet Union and the Apollo moon vehicle for the United States. Both Great Britain and France suffered status declines following World War II and felt an SST would help reverse those trends. Furthermore, an economically viable SST would provide its nation a product for export, thus contributing to a favorable balance-of-trade, and in the process stimulating its domestic economy. Many people, such as President Kennedy in 1963, viewed the SST as a "logical next step" in aviation, as well as a manifestation of progress, a view that was subsequently continued by Lyndon Johnson and Richard Nixon when they entered the White House. In the rush to reap the benefits of progress, however, many of the potentially harmful side effects of the SST were overlooked or assumed to be readily capable of solution.

The SST represented more than just a continuation of the phenomena of reducing travel time; it represented the whole-scale intervention of the government, unique for the United States at least, into a civilian aviation project. Although government participation in military developments had directly aided civilian projects before, the SST program was the first such civilian program to be sponsored and directed by the government. From late 1963 through the end of 1966 the Federal Aviation Administration (FAA) conducted a competition among interested manufacturers to determine the best possible design for America's supersonic entry. Boeing was eventually picked as prime

contractor for the SST largely on the basis of a revolutionary swing-wing design, a design based on experimental work conducted by the National Aeronautics and Space Administration (NASA). But the development of the swing-wing proved to be more difficult than Boeing had envisioned, resulting in its abandonment in favor of a conventional fixed-wing design in 1968.

The SST was also unique in that it was one of the first major technological programs to be subjected to questions about its impact on the physical environment. From minor opposition in the early 1960's based primarily on the sonic boom, opposition broadened by the end of the decade to include charges that the aircraft represented an intolerable threat to the natural environment. Seemingly unavoidable side-effects of supersonic flight such as the sonic boom, atmospheric contamination, and excessive engine noise were cited by opponents as reasons for stopping development.

An SST is designed to operate in the rarefied region of the atmosphere known as the stratosphere, at higher altitudes than conventional airplanes. The stratosphere has relatively little vertical mixing and SST emissions would probably remain in the stratosphere for as long as several years. Thus the cumulative effect of emissions in the stratosphere would be more severe than at lower altitudes where there is extensive vertical mixing which results in a cleansing effect. Although initial opposition to the SST was based on its inevitable

sonic boom, opponents became more concerned about the longer term effects of supersonic flight in the stratosphere by the latter part of the 1960's. Among the questions raised were those concerning the depletion of ozone, a vital force in the attenuation of harmful ultraviolet radiation, and the interaction of SST exhaust with elements already present in the stratosphere, interactions which could have profound effects on the earth's climate and surface temperature. Further questions were raised about the effect of engine noise in the immediate airport vicinity and in take-off and landing corridors.

During the period of controversy over the SST, many diverse opinions were expressed concerning the airplane's impact on the environment. Experts on both sides of the issue lent their professional prestige to arguments for or against the airplane. Amateurs and special-interest groups on both sides added their own opinions. Many of the arguments put forward were "iffy" in nature and therefore difficult to prove one way or another. As a result, the controversy often degenerated into a sensationalized "shouting match" as the decade of the 60's closed. It was in this atmosphere, highly charged with emotionalism and loud claims by both sides, that the Congress finally took steps to terminate the program in 1970 and 1971. There appear to be two critical factors involved in the termination of the United States SST program: economics and environment opposition. Over the course of a decade of development the airplane became much more

expensive than originally envisioned, a characteristic common to most research and development projects which are conducted on the fringes of technological capabilities. The SST also elicited the opposition of the newly-powerful environmental movement in the latter part of the 1960's. Together, economics and the environment contributed to the downfall of the SST. It is doubtful if either factor was strong enough on its own, but in conjunction they were sufficiently powerful to terminate a program on which nearly a billion dollars had been expended, and in which thousands of jobs were at stake in an ailing economy.

CHAPTER I

BACKGROUND TO AMERICAN SUPERSONIC TRANSPORT DEVELOPMENT

From the end of World War II until the mid-1960's the United States maintained a commanding lead in commercial aviation. First its piston-powered transports and later its subsonic jet-powered transports captured the major share of the world's market. It was considered only logical that the development of a supersonic transport would follow. By the late 1950's aviation state-of-the-art advancements and military developments in jet flight made the development of an American SST even more probable. As a result the federal government undertook a series of low-keyed programs to aid in the eventual development of a commercial SST. By early 1963, however, this course of deliberate development was threatened by the decision of foreign manufacturers to build SST's using existing materials fabrication techniques and technology in order to be the first on the market. It was thus in an era of American aviation dominance that the United States undertook initial SST development, but it was not until the threat of foreign competition became serious that the United States undertook an active developmental program.

By the late 1950's visionaries in the aviation industry and the government had dreamed of commercial supersonic flight for some time. With the development of the jet engine in the late 1930's supersonic flight was within reach of aviation technology. In 1947, the rocket-powered Bell X-1 became the first airplane to "break the sound barrier,"

proving the feasibility of supersonic flight.¹ Clearly the airplanes of the post-World War II era had come a long way from the wood, wire, and fabric craft the Wright brothers first flew at Kitty Hawk in 1903. Lightweight aluminum and aluminum alloy airframes coupled with more powerful engines aided tremendously in the steadily increasing performance of airplanes. By the 1950's exotic alloys were developed which would allow flight at supersonic speeds greater than aluminum alone would permit.² The ultimate in supersonic capability was reached when titanium was perfected for use as the skin of supersonic aircraft. Although more expensive and more difficult to work with than aluminum, titanium offered the capability of flight in the Mach III range at close to 2,000 miles-per-hour, whereas aluminum-skinned aircraft were limited to 1,450 miles-per-hour or just slightly above Mach II.³

¹ Don Dwiggins, The SST: Here It Comes Ready or Not (New York: Doubleday & Co., 1968), 105.

² Examples of new alloys were Alcoa's aluminum-lithium alloy and Armco Steel's PH15-7 Mo alloy steel. Alcoa's product could be utilized by aircraft flying in the 1,600 miles-per-hour range. The advantages of this alloy were that it was lighter than previous aluminum alloys and reportedly adaptable to standard industry fabricating processes. New York Times, October 1, 1957, 52; Armco Steel's 2,700 miles-per-hour PH 15-7 Mo (15% chromium, 7% nickel, 2.5% molybdenum, phase hardened) alloy supposedly presented advantages of low cost (\$2,000-2,200/ton average for mill products compared to \$30,000/ton for titanium alloy products) and ease of fabrication with existing stainless steel processing equipment, New York Times, September 11, 1957, 45.

³ Dwiggins, The SST, 195.

The mainstay of most civilian airlines from the 1930's until after World War II was the DC-3, a sturdy and dependable airliner, but limited in range, capacity, and speed because of its size and its twin-engined power plant. Immediately following World War II airframe manufacturers who had produced powerful four-engined bombers during the war turned their bomber experience into the multi-engined commercial transports of the post-war era. Thus with the introduction of larger, faster, and more productive airliners such as the Douglas DC-6, the Lockheed Constellation, and the Boeing Stratocruiser, commercial aviation made great advances. The next obvious step in commercial aviation was the introduction of the jet transport.

Jet fighter development and more particularly jet bomber development led to the first generation of subsonic transports. The first civilian jet transport to be produced was the de Havilland Comet. This British aircraft became the first jet transport to enter commercial service on May 2, 1952. The Comet beat the Boeing 707 into airline service by over six years.⁴

The second and more successful jet transport to be developed was the Boeing 707. Boeing was the builder of the subsonic B-47 Stratojet and B-52 Stratofortress bombers, experience that was intimately tied in with development of their jet transport prototype now

⁴F. G. Swanborough, Turbine-engined Airliners of the World (London: Temple Press Books, 1962), 14 and 45.

known as the "Dash Eighty." Boeing commenced design work on the "Dash Eighty" in 1946 without a government contract for a military version. Even when Boeing announced publicly on August 30, 1952 its intention to build a prototype jet transport the U. S. Air Force had not yet defined its need for a high-performance jet tanker capable of refueling the B-47 and the B-52. Nevertheless, the Air Force publicly announced its intention to acquire a jet tanker less than a month after the "Dash Eighty" first flew on July 15, 1954. Development of the tanker version then took precedence, with the first KC-135 accepted by the Air Force on January 31, 1957, and the first delivery of a commercial 707 to Pan American World Airways on August 15, 1958. Many refinements that were subsequently incorporated into the commercial version were first tested and proven in the military model.⁵

The Douglas and Convair Aircraft Corporations followed Boeing's lead and produced similar jet transports with the Douglas DC-8 entering airline service with United Airlines and Delta Airlines on September 18, 1959, and the Convair 880 entering service with Delta Airlines in May 1960.⁶ Across the Atlantic, Sud-Aviation drew on its Mirage bomber experience and produced the medium range, rear-engined Caravelle. The

⁵For a discussion of the development of the KC-135 see F. G. Swanborough, Military Transports and Training Aircraft of the World (London: Temple Press Books, 1965).

⁶Swanborough, Turbine-engined Airliners, 37 and 55.

Caravelle entered airline service with Air France on May 12, 1959. The development of the French jet was subsidized by the government in an attempt to revitalize the French aircraft industry. The specific size and design was chosen so as to not compete head on with the longer range jet aircraft then under development in the United States.⁷

During this period the Russians were not marking time in jet transport development. But instead of using bomber technology to produce transports specifically designed for civilian service, the Russians simply modified existing jet bomber designs. Thus they were able to place jet transports into service by September, 1956, but because of their hybrid design, a lack of familiarity with, and questions about the reliability of Russian aircraft on the part of the world's airlines, none of their jets were utilized outside the Communist bloc.⁸

World-wide air travel boomed following the introduction of subsonic jets in the late 1950's. Although the subsonic transports went into service well ahead of many forecasts made in the early 50's, visionaries looked ahead to the SST as the next step in the progress of commercial aviation. It was widely expected in the United States in

⁷ Ibid., 85 and 87.

⁸ Ibid., 92. Russia's first jet transport, the TU-104, was a modification of the Badger TU-16 jet bomber. Although some attempts were made to sell the TU-104 outside the Soviet Union, only four of the aircraft were purchased by non-Russian airlines, and those by the Czechoslovakian state airline.

the 1950's and well into the 1960's that military development of supersonic bombers would provide the necessary technological background for a commercial supersonic transport. In the early 1950's the Air Force began to develop what was expected to be its next generation of manned bombers. The first replacement for the subsonic B-47 and B-52 was the supersonic dash bomber, the B-58 Hustler. The Hustler, however, was not designed for missions at sustained supersonic speeds but was expected to cruise subsonically to the vicinity of its target and then dash supersonically during its bombing run.⁹ When the government began thinking seriously about building an SST in 1960, the builder of the Hustler, Convair Aircraft Corporation, proposed to modify their airplane to convert it into a medium-range, moderate capacity, interim supersonic transport. Before a House Committee in 1960 Convair's Vice President for Engineering argued that such a course would utilize existing technology and a proven basic design, and would therefore enable the United States to enter the commercial supersonic field years ahead of any potential competitors. The advantages gained in time required to develop an operational SST would be in addition to savings over the cost of developing a Mach III SST directly, without the benefit

⁹ Diggins, The SST, 108.

of an interim development such as a modified Hustler.¹⁰ Nevertheless, Convair was not able to gain government backing for this proposal and did not attempt to secure private financing for its "instant commercial SST."

North American Aviation's B-70 Valkyrie, capable of sustained supersonic flight at Mach III, was expected to be the Air Force's ultimate replacement for its subsonic bombers as well as for the limited performance Hustler. Because the B-70 would utilize titanium for its airframe in order to be able to withstand the temperatures generated at Mach III, it was widely expected during the late 1950's and early 1960's that it would provide a technological base for a Mach III transport. In 1960 the House Science and Astronautics Committee recognized the importance of B-70 technology to a commercial SST and recommended continuing development of the B-70. By this time, however, the Eisenhower Administration had made a decision to cut back on develop-

¹⁰U. S., Congress, House, Committee on Science and Astronautics, Supersonic Air Transports, Hearings, before a Special Investigating Subcommittee of the Committee on Science and Astronautics, 86th Cong., 2d Sess., 1960, 117-122. Convair proposed building a dozen B-58's modified as commercial SST's and powered with J-58 engines which would give them a top speed of Mach 2.4. By taking this approach valuable hours of supersonic flight time would be built up rather quickly and this would provide supersonic experience comparable to the 25,000 hours of jet bomber experience accumulated prior to the development of the 707. In pushing this proposal Convair noted that even their B-58 had only accumulated 500 hours of flight time above Mach 1.5 (out of a total 10,000 hours) between 1956 and 1961, a very small number of hours on which to base a full-scale SST development program.

ment of the supersonic bomber in response to the budgetary demands of the growing missile force. The B-70 subsequently became a victim of the missile age and only two prototypes were built. The House Committee Report in 1960 was in part an attempt to forestall this development, claiming that the B-70 could be justified on the basis of national security, maintaining in addition that the program was "so closely tied in with the possible future development of a supersonic commercial transport that it [development of the B-70] appears to be the most satisfactory way to accomplish it."¹¹

In response to the serious overcrowding of the nation's airways in the late 1950's the Federal Aviation Administration (FAA) was established on August 23, 1958. At this time airlines had made orders for many of the subsonic jets that would be coming off the Boeing, Douglas, and Convair assembly lines in the next several years. But the four-engined piston transports had already made the airways unsafe due to overcrowding a system designed for the slow (less than 200 miles-per-hour) DC-3. A number of tragic mid-air crashes from 1956 to 1958 prompted Senator Mike Monroney of Oklahoma to introduce a bill to establish the FAA and make it primarily responsible for developing a

¹¹U. S., Congress, House, Committee on Science and Astronautics, Special Investigating Subcommittee, Supersonic Air Transports, H. Rpt. 2041, 86th Cong., 2d Sess., 1960, 23-24.

safe airway system.¹² In addition, the FAA was given the responsibility to "encourage and foster the development of civil aeronautics and air commerce in the United States and abroad. . . ."¹³ When the Department of Transportation was established in 1966, various functions of the FAA were transferred to it. The authorizing act vested in the Department the responsibility for "development and construction of a civil supersonic aircraft."¹⁴

In carrying out its charter obligations, the FAA began active governmental support for a commercial SST in 1959 with the establishment of an SST study group.¹⁵ The first Congressional hearings on the SST were held by the above-mentioned House Committee on Science and Astronautics in May, 1960. In addition to strongly recommending continuation of the B-70 bomber program and the establishment of a commercial SST program, the House Committee recommended placing any SST

¹² Dwiggins, The SST, 41-43. On June 30, 1956 a TWA Super Constellation and a United DC-7 crashed while circling the Grand Canyon in partly cloudy skies. One hundred twenty-eight people lost their lives in that collision. In early 1958 three major disasters occurred within a period of 3 1/2 months. On May 20, 1958, a day prior to the introduction of Senator Monroney's FAA bill, a civilian jet trainer collided with a civilian transport above Brunswick, Maryland, killing twelve persons.

¹³ Federal Aviation Act of 1958.

¹⁴ U. S. Code, Vol. XLIX, Section 1655, Subsection C.

¹⁵ "Federal Steps to Date on SST Development," Congressional Digest, December, 1970, 292.

program under the control of NASA, an agency over which the Science and Astronautics Committee exercised legislative oversight.¹⁶

Soon after taking office President Kennedy established an SST steering group composed of the FAA Administrator, the Assistant Secretary of the Air Force for Research and Development, and the NASA Director of Aeronautical Research. The steering group proposed that a Supersonic Transport Authority be established to coordinate development.¹⁷ Simultaneously, the President's Task Force on National Aviation Goals produced a study entitled "Project Horizon" in 1961 in which it noted that it was "no longer possible for civil aviation to progress mainly by reliance on the by-products of military-related research and development programs." It was further observed that aeronautics was "running a poor second to space technology in the time, talents, facilities, and funds expended on it within NASA," and recommended upgrading the national commitment to a program which would result in the continuation of world aviation leadership by the United States.¹⁸

¹⁶U. S., Congress, House, Committee on Science and Astronautics, Supersonic Air Transports, Report, 23-24.

¹⁷"Federal Steps," 292.

¹⁸U. S., Task Force on National Aviation Goals, "Project Horizon," Report of the Federal Aviation Agency, September, 1961, 48-49.

The first Congressional appropriation specifically for the SST was passed in 1961 when the FAA received \$11 million for development during fiscal 1962.¹⁹ An SST Program Management Office was opened at Wright-Patterson AFB in Ohio and in November, 1961 Initial Requests for Proposals (RFP) for research contracts were issued.²⁰ Congress appropriated \$20 million for SST research in 1962.²¹ In January, 1963, President Kennedy established a cabinet-level committee under the chairmanship of Vice President Johnson to coordinate development of the SST.²² From the above discussion of governmental support for the SST it is obvious that the United States government was committed early to SST development. But this commitment did not lead to development decisions reached in a vacuum; rather, competition from abroad played a significant role in pushing the United States into full-scale development earlier than it perhaps otherwise would have without any outside pressures.

¹⁹ SST development funds for fiscal 1962 were included in the FAA appropriation in PL 87-141.

²⁰ "Federal Steps," 292.

²¹ SST development funds for fiscal 1963 were included in the FAA appropriation in PL 87-741.

²² "Federal Steps," 292.

Great Britain and France began SST development independently in 1959. Great Britain intended to build a commanding lead in supersonic jet development, thus accomplishing a feat similar to that which had almost been accomplished with its first generation subsonic jet, the Comet I. Unfortunately, the early Comet was plagued by problems and after several spectacular, and at first inexplicable, crashes it was taken out of airline service.²³ By the time the Comet's problems were solved, the 707, and later the Douglas DC-8 and Convair 880, came on the scene. From then on United States airframe manufacturers have dominated the supply of commercial aircraft to the non-Communist world. As of 1971, 84 per cent of the free world's commercial aircraft were made in America.²⁴

²³ On the Comet see Swanborough, Turbine-engined Airliners, 45-50. The early Comet I was susceptible to structural failure where the wings joined the fuselage. After four similar crashes in less than a year and a half, the entire fleet of Comets was grounded in April 1954 and an exhaustive investigation undertaken. When the cause of failure was determined Comets were subsequently modified for use as British military transports; but it was not until October 4, 1968 that updated Comet 4's were put into commercial service, becoming the first jet airliners to provide commercial service across the Atlantic.

²⁴ New York Times, July 20, 1970, 53.

An aspect of France's entry in the supersonic race was Charles de Gaulle's attempt to restore French grandeur.²⁵ By 1962, however, Britain and France sought the advantages of pooling their resources and signed an agreement to jointly develop the SST now known as the Concorde.²⁶ The Anglo-French SST was to be built of aluminum using existing aviation technology, a decision which limited its top speed to just over Mach II. The Concorde's range was to be slightly in excess of 4,000 miles with a passenger capacity of 128.²⁷ During the same period the Soviet Union was engaged in developing the TU-144, an SST

²⁵ On aspects of French grandeur see especially W. W. Kulski, De Gaulle and the World (Syracuse, New York: Syracuse University Press, 1966), 25-27 and 79-92. See also Robert Aron, An Explanation of De Gaulle (New York: Harper & Row, 1966), and Alexander Werth, De Gaulle: A Political Biography (New York: Simon and Schuster, 1965). The France in which de Gaulle was returned to power in 1958 suffered under the cumulative burden of its past two centuries of history, but particularly the two world wars, the loss of Indo-China, the great turmoil in French Algeria, and constant domestic political strife. When de Gaulle established the Fifth Republic, one objective, in addition to creating stability, was to restore Gallic pride and grandeur. The nascent SST program was felt to be admirably suited to such a task.

²⁶ New York Times, November 30, 1963, 65. This historic agreement to jointly undertake such a major technological development came at a time when Britain was negotiating with France and the other members of the European Common Market for British entry into the market. Because of misunderstanding and obstinance on both sides, however, Britain's bid for entry was not successful. Less than two months after the two nations agreed to jointly produce the Concorde, de Gaulle announced to a January 14, 1963 press conference his veto of British entry.

²⁷ Diggins, The SST, 195.

strikingly similar to the Concorde with nearly identical range, speed, and capacity.²⁸ In opting to build a first-generation SST, the British, French, and Russians hoped to capture the initial market for supersonic commercial aircraft and later develop a more advanced airplane to capture the second-generation market.

The approach eventually taken by the United States was entirely different. Instead of using aluminum for the airframe, the American SST was to be built with a skin of titanium which could withstand significantly higher temperatures than either the Concorde or the TU-144 and which would subsequently be able to fly at close to Mach III, or greater than 1,800 miles-per-hour. It was to have a range of 4,000 miles and a passenger capacity of 298, more than double that of its foreign competitors. While it was understood that the Concorde would be the first on the market, American backers of the SST fully expected to eventually capture the lion's share of the market on the basis of a superior design, just as the subsonic Boeing 707 proved to be superior even to the rebuilt Comet.²⁹

²⁸"Comparison of U. S. and Foreign SST's," Congressional Digest, December, 1970, 294.

²⁹Dwiggins, The SST, 195. Titanium technology was relatively new but by the time a commercial SST became a reality it had already been proven in the building of military craft such as the Lockheed SR-71, capable of Mach III, and the experimental X-15 rocket plane built by North American.

When Concorde development was fully underway in 1963, airlines from the United States felt that in order to maintain a competitive position vis-à-vis foreign airlines which were expected to utilize the Concorde and TU-144 they would have to purchase foreign SST's, since availability of the United States version was obviously a number of years in the future. Thus on June 4, 1963 Pan American World Airways ordered six Concorde.³⁰ At the Air Force Academy Commencement the following day, President Kennedy announced the intention of the United States to build the "prototype of a commercially successful supersonic transport superior to that being built in any other country of the world."³¹ Not only did this announcement follow Pan Am's order of Concorde, it preceded by five days his American University détente speech and took place during a period of delicate negotiations and maneuvering which eventually resulted in the signing of the Nuclear Test Ban Treaty.³² In the spirit of the Apollo space project just then gaining momentum, JFK proposed the SST as a multi-purpose vehicle

³⁰ New York Times, June 5, 1963, 41.

³¹ U. S., President, Public Papers of the Presidents of the United States, 1963 (Washington, D. C.: Government Printing Office, 1964), 440-441.

³² On the June 10 American University speech in which President Kennedy proposed working with the Russians for peace in order to "make the world safe for diversity" see Theodore C. Sorensen, Kennedy (New York: Harper & Row, 1965). On the subject of the atmospheric Nuclear Test Ban Treaty see Sorensen, Kennedy, and Pierre Salinger, With Kennedy (New York: Doubleday & Co., 1966).

"essential to a strong and forward-looking Nation."³³ By building an SST, the United States would be able to maintain aviation technological leadership, demonstrate what could be accomplished under a democracy with free enterprise, expand international trade, and provide employment.³⁴

President Kennedy proposed the creation of a government/industry partnership to produce a superior SST, an aircraft viewed as aviation's "logical next development." The project, however, was not to be open-ended. Manufacturers were to provide 25 per cent of development funds and the government's share was not to exceed \$750 million. In addition, if the resultant aircraft should not prove to be commercially viable, the program would be halted.³⁵ Few people expected this to happen, however, and there was little opposition to the SST when it was first proposed. For it was then viewed by President Kennedy and many other Americans as a form of progress and a necessary and inevitable technological development in addition to the national prestige it was expected to bring to the nation developing a superior SST.

³³ Public Papers, 1963, 441.

³⁴ Ibid., 476.

³⁵ Ibid.

By the time of President Kennedy's announcement in 1963, the United States was well-prepared to undertake active development of an SST. Technological knowledge gained through the production of jet bombers, including supersonic bombers such as the B-58 Hustler and the proposed B-70 Valkyrie, was expected to aid immeasurably in the development of a commercial SST. Basic research into the problems of supersonic flight had taken place within various agencies of the federal government since at least the 1950's and state-of-the-art advancements in jet engines and airframes made Mach III flight a reality by the beginning of the 1960's. In addition, foreign competition posed serious threats to the continued domination of commercial aviation by American airframe manufacturers. Thus the United States government made the not too surprising decision to begin active development of an SST in 1963. The first phase in that development was a design competition to decide which airframe and engine manufacturers would receive the final contracts to build the proposed SST.

CHAPTER II

DESIGN COMPETITION AND PROTOTYPE DEVELOPMENT, 1963-1970

In order to select the best possible design for America's supersonic sweepstakes entry, the Federal Aviation Administration sponsored a design competition beginning in August, 1963 among the various airframe and engine manufacturers interested in developing an SST. In the early phases of the competition the FAA hoped to speed up development and catch up with the Concorde; such haste on a major technological development was due in large part to the head start that foreign competitors enjoyed. As the competition progressed without resulting in a clearly superior design by mid-1964, and as Concorde and TU-144 development neared the prototype stage, it became obvious that the United States would not be able to beat the Europeans into the air. Thus in 1964 President Johnson committed the United States to the development of an SST capable of outperforming its foreign opposition.

On the basis of a radically new, swing-wing design Boeing was selected in December, 1966 to build the American SST. In payload and speed the American craft would be clearly superior to both the Concorde and the TU-144. And even though delivery to the airlines was at best expected to be two to three years after the foreign airplanes would be in commercial service, backers of the Boeing aircraft expected it to capture the bulk of the market. However, the Boeing SST ran into serious design problems in 1967 resulting in the abandonment of the swing-wing the following year. The slow-down in development necessi-

tated by the significant design change also coincided with growing opposition to the aircraft from the Congress and the public on financial and environmental grounds. As the SST became more and more expensive, and as serious environmental questions were raised, the successful completion of the program became less and less assured as the decade of the 60's came to a close. By the end of the decade the completion of Boeing's prototypes was near, but by then the opposition coalesced with sufficient strength to bring about the defeat of the SST in 1970 and 1971. The selection of a radical and unproven airplane in the design competition played no small part in the ultimate demise of the SST.

I

Two months following President Kennedy's Air Force Academy announcement of an American SST program, the FAA issued a Request for Proposals (RFP) for SST designs. Interested airframe and engine manufacturers were expected to reply to the RFP by January 15, 1964.¹ Although expecting the American SST to be superior to foreign designs (in the manner that the 707 proved to be superior to foreign opposition in the subsonic jet field), at the time it issued the RFP the FAA did not envision a final design radically different from that of the Concorde. Its range would be 4,000 statute miles, sufficient to fly

¹ Diggins, The SST, 130-131.

non-stop from New York to Paris with a margin of reserve fuel to allow continuation to Rome if necessary. Capacity would be 125-160 passengers in addition to 2.5 tons of cargo and mail. The aircraft would cruise at Mach 2.2 and would be expected to be as quiet as subsonic jets when in the vicinity of airports. The FAA also set sonic boom overpressure limits of 2 pounds per square foot during acceleration and 1.5 pounds when cruising supersonically.²

A day prior to the issuance of the Request for Proposals, President Kennedy appointed former World Bank director Eugene R. Black and Olin Mathieson Company chairman Stanley de J. Osborne as special financial advisors to the President on the SST.³ Before Black and Osborne had an opportunity to complete a study of the SST Kennedy was assassinated in Dallas, Texas on November 22, 1963. Thus the special advisors presented their report to the new President, Lyndon Baines Johnson, on December 12, 1963. The SST program did not suffer under the new Administration. Being from Texas, a state with a large aerospace industry (General Dynamics and NASA, for example), President Johnson had long been an enthusiastic supporter of aviation and space.

² New York Times, August 17, 1963, 46. Manufacturers were then expected to bear 25 per cent of an estimated \$1 billion in prototype development costs. See also Dwiggins, The SST, 131.

³ New York Times, August 15, 1963, 58.

programs. Johnson had also chaired a cabinet-level committee formed by Kennedy in January, 1963 to coordinate SST development. As chairman, Johnson favored greater government participation in financing the SST but was not able to convince the other members of the cabinet-level committee to go along. In particular Secretary of Defense McNamara, Chairman of the President's Council of Economic Advisors Walter Heller, and Budget Bureau Director Kermit Gordon would not agree to increased government financing. Although McNamara was adamantly against spending Pentagon money for the civilian project since he did not expect the military to have any need for the SST, Johnson insisted that the high risk involved would inhibit private investment.⁴ Johnson thus came to his new job with a history of interest in and support for the SST and continued that support while in office.

In his State of the Union message on January 12, 1966 President Johnson listed three roads along which he claimed his Great Society Program led: growth and justice and liberation. "First is growth--the national prosperity which supports the well-being of our people and

⁴ Rowland Evans and Robert Novak, Lyndon B. Johnson: The Exercise of Power (New York: The New American Library, 1966), 20-21. In his memoirs, The Vantage Point: Perspectives of the Presidency, 1963-1969 (New York: Holt, Rinehart and Winston, 1971), Johnson devotes a full chapter to his space program activities but does not mention his role with the SST. It is possible that the success of the space program and the demise of the SST program prompted the omission, since as Senator, Vice President, and President, Johnson played an influential role in the development of the SST.

which provides the tools of our progress." The road to liberation utilizes "our success [growth] for the fulfillment of our lives. A great nation is one which builds a great people. A great people flow not from wealth and power, but from a society which spurs them to the fullness of their genius. That alone is a Great Society."⁵ Johnson viewed the SST as one of many means of achieving the Great Society as well as maintaining leadership in aircraft design and manufacture.⁶

In his Air Force Academy speech President Kennedy had limited government support for SST development to \$750 million, and in his message to Congressional leaders on June 14, 1963 he proposed that manufacturers be required to supply 25 per cent of prototype development costs.⁷ The Black and Osborne report presented to President Johnson on December 19 recommended government financing of 90 per cent and manufacturer financing of 10 per cent of prototype development costs rather than the 75-25 split envisioned by President Kennedy. Given the high cost of developing an SST the aviation industry was not happy about investing a quarter of a billion dollars in such a massive undertaking that was not assured of a favorable return. Black and Osborne

⁵ U. S., President, Public Papers of the Presidents of the United States, 1966 (Washington, D.C.: Government Printing Office, 1967), 4 and 6.

⁶ Ibid., 260.

⁷ Public Papers, 1963, 476.

were sympathetic to the industry's concerns and recommended the higher percentage of government funding, noting that even 10 per cent of a billion dollars was still a very significant sum. Even while conceding the risk involved in producing an SST Black and Osborne also recommended recovering the government's investment through some form of royalties on each airplane eventually sold, should the SST reach the production stage. The specifics recovering the government's investment were to be left to the future.⁸

In addition to their financial recommendations, Black and Osborne seriously questioned the approach that was being taken by the FAA on SST development. Arguing that it would not make sense to build a Mach 2.2 SST similar to, and certainly no more than slightly better than, the Concorde, Black and Osborne recommended following a more deliberate course that would result in a truly superior SST rather than tying the United States' effort to the Concorde.⁹

When engine and airframe manufacturers submitted design proposals in January, 1964, a Supersonic Transport Evaluation Group (STEG) was established and directed to commence evaluation of the proposals. STEG was composed of 210 members drawn from FAA, NASA, Civil Aeronautics Board, U. S. Air Force, U. S. Navy and the Department of

⁸ Newsweek, February 17, 1964, 77. See also New York Times, February 22, 1964, 1 and 9; March 12, 1964, 28.

⁹ Dwiggins, The SST, 139.

Commerce. Subsequently, representatives from ten airlines also conducted their own independent evaluation. Representatives of the government and airlines teams reviewed their findings in March. The airlines group then independently issued a statement recommending further design work on "at least two different airframes and engines."¹⁰

While the airlines group's recommendation for further study was in part based on a conviction that further design study was necessary, it also expressed a lukewarm attitude toward the proposed airplane on the part of some of the nation's airlines. At this time the airlines had just recently recovered from their massive investment in subsonic jets. Not until 1962 had most of the American airlines managed to amortize their investments to a point where they were making a profit.¹¹ It is understandable that they would be reluctant to be forced to invest heavily in a supersonic transport before their subsonic jet investment was fully returned. Most airlines did not want to repeat their experience with subsonic jets in which perfectly serviceable, and in many cases nearly new, DC-7's and Constellations were made obsolete almost overnight. But not all American airlines were so hesitant about going ahead with SST development. The optimistic group was represented

¹⁰"Federal Steps," 293.

¹¹"Evolution of U. S. Commercial Aviation," Congressional Digest, December, 1970, 291.

by Pan Am and Trans World Airlines (TWA), both of which would be forced to compete directly with foreign SST's on long, primarily overseas, routes.¹² It would be to their distinct advantage for the United States to push ahead with a superior SST which could give them an edge in the potentially lucrative international SST trade.

At the LBJ Ranch in Texas on March 28, 1964, President Johnson noted that "substantial progress" had been made on the SST and that the government had received a number of orders. The President further observed that "we believe the technical challenge of the supersonic transport is manageable. We think the main problem lies in the financial area. We believe that Government and industry participating is the key issue and we have to work that out."¹³ To help him with the impending decision on how to conduct further development, President Johnson established even another study group on April 1, 1964, the President's Advisory Committee on Supersonic Transport. The Committee was composed of the Secretary of Defense (who was also the chairman), Secretary of Commerce, NASA Administrator, and FAA Administrator. The Committee was enjoined to study and then advise the President on all

¹² New York Times, October 15, 1963, 1. When the FAA began taking orders for delivery positions for the American SST, TWA and Pan Am placed orders for six and fifteen SST's respectively, at a cost of \$100,000 per nonexistent aircraft.

¹³ U. S., President, Public Papers of the Presidents of the United States, 1963-64 (Washington, D.C.: Government Printing Office, 1965), 428.

aspects of the SST program, and to "devote particular attention to the financial aspects of the program. . . ." ¹⁴ At this point the chief concerns had been financial and technical; could the airplane be economically developed, and could the technical problems of supersonic flight be readily solved? As of 1964 there was little, if any, concern with possible environmental problems associated with the SST other than the question of public acceptance of the sonic boom.

The American SST program was at a critical junction. President Johnson was faced with a choice between a crash program to overtake the Concorde (the Black and Osborne report warned that such a course was not in the best interests of the nation and probably impossible anyway), and a more deliberate program to develop a clearly superior SST. In May the President directed the FAA to award design contracts to the two engine and two airframe manufacturers deemed best in the evaluation. ¹⁵ Noting that STEG found that none of the proposals met the requirements laid down in the RFP, Johnson nevertheless remained "convinced that it will be possible to develop an American supersonic transport which will be economic to operate, will find a substantial market among the airlines of the world, and will help to maintain

¹⁴ U. S., President, Proclamation, "Establishing the President's Advisory Committee on Supersonic Transport," Federal Register, XXIX, April 3, 1964, 4765.

¹⁵ New York Times, June 3, 1964, 16.

American leadership in the air."¹⁶ By taking this course of action President Johnson acknowledged that the French and British would get the first SST on the market; but committed the United States to building a model that would be clearly superior to the Concorde.

In June, 1964, Boeing and Lockheed were awarded six-month airframe design contracts; General Electric and Pratt & Whitney were awarded six-month engine design contracts.¹⁷ The loser in the airframe contest was North American, the unlucky builder of the B-70. North American's design was little more than a civilian version of the B-70 whereas the Boeing and Lockheed designs were not directly related to any military aircraft. Lockheed elected to use a design somewhat similar to the Concorde with a fixed double delta-shaped wing. Boeing's entry was more revolutionary than either the North American or the Lockheed designs. Instead of a fixed wing, Boeing opted for a variable or swing-wing which could be pivoted in flight to obtain the best lift-drag configuration for any given flight condition.¹⁸ Thus by mid-1964 the design competition was reduced to a contest between a conventional but proven design, and a radical, revolutionary, and

¹⁶ Public Papers, 1963-64, 551.

¹⁷ New York Times, June 3, 1964, 16.

¹⁸ Ibid., January 1, 1967, 38.

largely unproven design. The Air Force's swing-wing F-111 was then under development but its first flight did not take place until December, 1964.¹⁹

The four manufacturers submitted design proposals to the FAA in November, 1964. Again STEG and an independent airlines group studied the proposals while the manufacturers continued design work.²⁰ Following review by STEG and the airlines, the President's Advisory Committee began a study of the designs in March, 1965; in July President Johnson directed the FAA to award additional 18-month design contracts.²¹

In July, 1966, a Request for Proposals for construction of two prototypes and initial flight testing was issued to the four manufacturers still involved in the design competition. In September the government evaluation team and an enlarged airlines team composed of 28 domestic and foreign airlines began independent evaluation of the proposals.²² On December 31, 1966, the selection of Boeing and General

¹⁹ John W. R. Taylor, ed., Jane's All the World's Aircraft (London: Sampson Low, Marston & Co., 1972), 321. The contract to build the swing-wing fighter-bomber was awarded to General Dynamics on November 24, 1962. The first flight of the F-111 took place on December 21, 1964 with wings locked in a partially swept-back position. The second flight took place on January 6, 1965 with full sweep action accomplished.

²⁰ "Federal Steps," 293.

²¹ New York Times, June 3, 1964, 16; "Federal Steps," 293.

²² "Federal Steps," 293.

Electric as prime contractors for construction of the prototype airframes and engines was announced by the FAA Administrator.²³

The Boeing design won largely on the basis of its revolutionary swing-wing concept. Because an SST would operate under a wide variety of both subsonic and supersonic flight conditions, Boeing claimed that no single wing configuration would be optimum for all situations. For example, the high lift required at take-off would be best provided by a relatively large wing protruding from the fuselage in the manner of a conventional subsonic aircraft wing. But when traveling at supersonic speeds an SST relies more on thrust than on its wings for lift, thus a sharply swept-back wing would be best for supersonic flight. Boeing therefore proposed to utilize a wing which could be pivoted in flight to provide the optimum configuration for any given flight condition. Thus the Boeing design won over Lockheed largely on the basis of an advanced technological concept. Even though Boeing's proposal necessitated development taking place on the frontiers of technological capability (only the controversial Air Force F-111 had been designed and operated with a swing-wing, and that fighter-bomber was considerably smaller than the proposed SST and therefore less of a technological challenge), design evaluators from the government and from the airlines felt that the radical Boeing design would provide more stability and

²³ New York Times, January 1, 1967, 1.

less engine noise at take-off and landing speeds. They also felt that the Boeing design would provide better operating economics should the aircraft be forced to fly subsonically on lengthy overland flights. The Lockheed fixed-wing double-delta design was necessarily a compromise between optimum configurations and it was felt that the increased power required at take-off and landing speeds to supply needed lift would result in less fuel economy as well as greater airport noise.²⁴

II

By opting for a larger and faster SST than those of foreign competitors, the United States gambled on capturing the bulk of the world market even while conceding the initial market to the Concorde (and to the TU-144 if the Russians could persuade foreign airlines to purchase their aircraft). This course would possibly have been a wise one in the absence of an attempt to build a revolutionary, swing-wing SST. But by attempting such a feat, Boeing was forced to solve complex technological problems as development progressed. Unlike the Concorde and TU-144 which were built using existing technology and materials and which even at that experienced significant problems, the success of the American SST was dependent upon continued breakthroughs on the frontiers of technological and technical capability. This was precisely

²⁴Ibid., 38.

what President Kennedy's other major nation-building project required. But in making good Kennedy's pledge to land Americans on the moon by 1970 and to return them safely, the Apollo program relied on a continuous parade of technological achievements from Commander Alan Shepard's sub-orbital flight on May 5, 1961, to the historic landing on the moon by Neil Armstrong and Edwin Aldrin on July 20, 1969. The major difference was that the Apollo program enjoyed a nearly unlimited source of funds from a Congress intent on ensuring the success of the popular, prestige-laden moon landing program. The SST program never enjoyed the unlimited Congressional backing that would have enabled Boeing to successfully produce a swing-wing SST. In addition, the American SST was in a race with the foreign SST's even though the United States conceded the initial phases of the race to its opposition. If the American program were to be successful it would have to result in a superior model before the builders of the Concorde and the TU-144 had the opportunity to parlay their experience with first generation SST's into second generation craft able to compete effectively with an SST such as the proposed Boeing aircraft. Because the American SST did not enjoy unlimited support in a manner similar to the Apollo program, and because the requirements of a race demanded production of a workable SST as soon as possible, Boeing's attempt to develop a swing-wing airplane was in trouble from the time the company won the airframe design competition in December, 1966.

After two years of prototype development Boeing recommended a delay in February, 1968 in construction of its two prototypes. At that point Boeing proposed the delay in order to incorporate design "improvements."²⁵ The "improvements" envisioned by Boeing eventually amounted to a wholesale revision of the aircraft, from a swing-wing to a fixed-wing design. A major problem with providing the SST with a swing-wing was weight.²⁶ Instead of a conventional and relatively simple wing design a swing-wing required stronger structural components in the wing and in the area where the wing joined the fuselage. The necessity of a large bearing assembly at the wing's pivot point also required further strengthening of the wing structure which added even more weight to the aircraft. Thus, while the use of a swing-wing would possibly have resulted in better low speed handling characteristics it would have resulted also in a substantial increase in the weight of the SST.²⁷ By 1968 Boeing designers were at an impasse; a steadily

²⁵"Federal Steps," 293.

²⁶Fortune, October, 1968, 129.

²⁷Dwiggins, The SST, 206. Lockheed's double-delta wing design was used in its Mach III reconnaissance aircraft, the SR-71. By double-delta it is meant that a smaller, long, narrow delta wing extension is placed on the fuselage forward of the main triangular, or delta, shaped wing. The double-delta has the advantage of providing extra lift at subsonic speeds. In addition, the large wing area (three times the area of a subsonic jet on Lockheed's SST) provides a "ground effect" cushion to make landings softer and easier than with the swing-wing Boeing SST. The Concorde Ogee wing, so named for the similar curve of the medieval ogive arch, is very similar to the Lockheed double-delta and the final Boeing design.

increasing gross weight threatened to reduce the payload of the SST to uneconomical proportions. In addition to weight problems Boeing designers had not perfected a fool-proof bearing and pivot assembly by 1968. Since in flight the whole weight of the airplane would be supported by the single bearing and pivot assembly in each wing, it was imperative to develop a completely reliable pivot system. General Dynamics had perfected a swing-wing for its F-111 fighter bomber, a contract that Boeing had bid on and lost in November, 1962.²⁸ But the technical challenge with an aircraft as large as the SST was on the order of several magnitudes greater than with the F-111. In addition to the greater challenge it must be remembered that SST passengers would not have the advantages of an ejection seat and parachute as do the crew members of the F-111. Also, should an F-111 fail in flight and the crew forced to bail out, the effect of the crash would certainly not be as great as the crash of an aircraft nearly as long as a football field.

When Boeing made its announcement of prototype development slow-down on February 10, 1968, aviation spokesmen tended to blame politics, rather than technical problems, for the slowdown.²⁹ 1968 was an election year and President Johnson had not announced his intention to reject

²⁸ Life, October 28, 1966, 81; Dwiggins, The SST, 173.

²⁹ Time, March 1, 1968, 76; New York Times, February 21, 1968, 1.

another term at the time of Boeing's decision. The Vietnam war had resulted in a severe domestic crisis with growing anti-war sentiment by 1968. At the same time many people began to question governmental priorities. President Johnson had attempted to wage a war in Asia while continuing his Great Society program at home. As a result, the federal budget was greatly out of balance by 1968 and some critics of the SST program attacked it on the basis of misplaced priorities.³⁰

By the first of May, 1968, Boeing admitted it was experiencing problems with its design, but the company still claimed to be putting most of its efforts into the swing-wing design. At the same time Boeing also admitted that it was considering a NASA fixed-wing design but refused to characterize the NASA design as a delta or triangular shaped wing (the type of wing Lockheed had proposed). The new wing design under study was described as "conventional but sharply swept back."³¹ By September it became clear that Boeing had all but abandoned the swing-wing design that had been so instrumental in gaining the prototype contract for the Seattle company.³² On September 18, 1968, President William M. Allen of Boeing explained that his company was experiencing severe problems in keeping down the weight of the SST. By this time

³⁰ New York Times, February 21, 1968, 1.

³¹ Ibid., May 1, 1968, 94.

³² Ibid., September 14, 1968, 11.

the consensus among aviation experts was that unless breakthroughs were achieved soon, the swing-wing was dead.³³ The breakthroughs were not forthcoming, however, and Boeing presented to the FAA on January 15, 1969 a proposal for a fixed-wing SST.³⁴

The American SST program was at its second critical junction. The first was in 1964 when President Johnson committed the United States to building a Mach III airliner. But after four years of attempting to develop a clearly superior airplane the United States program was in serious trouble. Boeing's design problems experienced in attempting to develop a swing-wing SST resulted in postponing the target date for completion of the prototype until 1972 while across the Atlantic the TU-144 and Concorde achieved flight status in early 1969.³⁵ In fairness to the American attempt to produce an SST it should be noted that the foreign builders of SST's also experienced design problems and tremendous cost overruns. But the builders of the TU-144 and the Concorde were not attempting to solve such massive technological problems as were the Americans. The Europeans relied for the most part on

³³Ibid., September 19, 1968, 93.

³⁴"Federal Steps," 293.

³⁵New York Times, March 3, 1969, 1. The first flight of the Concorde prototype took place in March, 1969; Aviation Week and Space Technology, June 9, 1969, 64. The first known flight of the TU-144 prototype took place in May, 1969.

established state-of-the-art practices in developing their airplanes, a course of action which did not preclude the need for design breakthroughs but which made such breakthroughs easier to obtain than was the case with the Boeing development. Thus by 1968 the American SST was at a point where a complete reappraisal was in order. It would be up to newly-inaugurated President Nixon to determine the future course of action for the American SST.

On February 27, 1969 President Nixon appointed an Interdepartmental Government Ad Hoc Committee headed by Under Secretary of Transportation James Beggs to study the SST program and make recommendations for future action.³⁶ During the same period another ad hoc committee was established, this one by the President's Office of Science and Technology to provide an independent assessment of the program. Although both ad hoc committee reports were adverse regarding continuation of the program, President Nixon announced on September 29, 1969 the continuation of the prototype program saying that his decision was the result of months of "spirited debate" within his Administration. Noting the United States' lead in transport, Nixon pledged to continue that lead. "The supersonic transport is going to be built," claimed the President, "the question is whether in the years ahead the people

³⁶ New York Times, February 28, 1969, 77.

of the world will be flying in American supersonic transports or in the transports of other nations."³⁷

A summary of the Interdepartmental Ad Hoc Committee report was compiled by Under Secretary Beggs from individual reports submitted by working groups within the committee. But Begg's summary was in such conflict with the views presented by the working groups, and particularly the panel on environmental and sociological impact, that individual members expressed dismay. Dr. Lee DuBridge, President Nixon's science advisor, even complained publicly.³⁸ And in a letter to Beggs, Dr. DuBridge wrote: "It is my view that the report in its present form is not acceptable since it does not adequately reflect the range of uncertainties and general negative character of the panel reports and committee discussions as I understand them."³⁹ Dr. Henry Houthakker of the President's Council of Economic Advisors also wrote Beggs that the summary did not properly reflect the views of the committee. He felt that the summary "contains primarily the most favorable material, interspersed with editorial comments, and thus distorts the implications and tenor of the reports. . . . With budget needs so great, I cannot see

³⁷ U. S., President, Public Papers of the Presidents of the United States, 1969 (Washington, D. C.: Government Printing Office, 1970), 737.

³⁸ "Never Mind the Experts," Nation, December 8, 1969, 620.

³⁹ U. S., Congressional Record, 91st Cong., 1st Sess., October 31, 1969, 32609.

how this program can be justified at the present time. . . ."⁴⁰ While Beggs later explained that the Ad Hoc Committee report was the least definitive and most outdated of all those furnished President Nixon by the Department of Transportation (DOT), it seems apparent that the Nixon Administration had determined to forge ahead regardless of the reservations developing in the scientific community.⁴¹

The independent study conducted at the same time as Begg's study provided another example. Known as the "Garwin Report," for physicist Richard L. Garwin who headed the panel of scientists making the review, this review was even more negative in its assessment of the SST program than the Interdepartmental Ad Hoc study, and even went so far as to outline the various options the government would have if it should decide to terminate the program.⁴² But this report was also ignored. Indeed, the President would not even release the Garwin Report until pressured by a lawsuit in 1971. Upon learning of the report, Congressman Henry Reuss of Wisconsin asked for a copy. When the Congressman was turned down by the Administration he then invoked Section 2954 of Title 5, U. S. Code which states: "An Executive agency,

⁴⁰Ibid., 32608.

⁴¹"Never Mind the Experts," Ibid.

⁴²U. S., Congressional Record, 92d Cong., 1st Sess., September 16, 1971, 32125.

on request of the Committee on Government Operations in the House of Representatives, or of any seven members thereof, or on request of the Committee on Government Operations of the Senate, or any five members thereof, shall submit any information requested of it relating to any matter within the jurisdiction of the committee." As a member of the Committee on Government Operations and chairman of the Conservation and Natural Resources Subcommittee, Representative Reuss felt that the law was clear on his right to obtain the requested information. Thus, with six other members of the Government Operations Committee, Reuss wrote the Office of Science and Technology, requesting a copy of the report. A reply was received from Presidential Counselor for Domestic Affairs, John Ehrlichman, in which the request was denied on the grounds that the "report constitutes an internal government memorandum of a confidential nature which cannot be released."⁴³

The Administration was reluctant to release the Garwin Report because of its adverse conclusion regarding continuation of the project. The report recommended against continuing government support of the SST at that time because of environmental and financial questions. The report concluded that in the absence of private financial enthusiasm

⁴³ Paul N. McCloskey, Jr., Truth and Untruth: Political Deceit in America (New York: Simon and Schuster, 1972), 76-77.

for the airplane it was not appropriate for the government to continue financing an aircraft whose pre-production cost could eventually be \$3 to \$5 billion over the cost of developing the prototypes; all of this for an airplane whose operating costs, as well as range and payload characteristics, would possibly not be able to meet design expectations.⁴⁴ In light of the Administration's decision to continue development of the SST it is understandable that it would suppress such an adverse report. It was not until August 21, 1971 that the Garwin Report was finally made public. By this time the SST had been terminated by the Congress and the Nixon Administration had no further need to keep the report's contents secret.

In addition to establishing the Ad Hoc Committee and receiving the Garwin Report in 1969, President Nixon solicited advice from cabinet members in 1970, including Secretary of the Interior Walter Hickel. Secretary Hickel was a self-made millionaire and Governor of Alaska when tapped by President Nixon to head up the Interior Department. Hickel's appointment alarmed many conservationists and his confirmation by the Senate was stretched out until January 23, 1969, three days after President Nixon was inaugurated. Contrary to the worse fears of conservationists, Secretary Hickel did not turn the keys of the Interior Department over to business interests whose only desire

⁴⁴U. S., Congressional Record, 92d Cong., 1st Sess., September 16, 1971, 32127.

was to take as much as possible from the public domain administered by Interior. While not becoming a conservationist on the model of a David Brower (former head of the Sierra Club and later founder of the Friends of the Earth), Hickel did show an environmental concern to a much greater degree than opponents of his nomination predicted.

As opposition to the SST heightened in 1970, President Nixon on July 23 requested Secretary Hickel's views on the SST, particularly as they "relate to the responsibilities of [his] own Department."⁴⁵ The President noted that the Administration had conducted a "searching review" of the program in 1969 and on the basis of that review he concluded that the "national interest required us to go forward with the program."⁴⁶ On July 31, Secretary Hickel replied to the President's request and expressed concern about the possible environmental effects of the SST, but noted that he agreed with the Council on Environmental Quality that two prototypes posed no threat to the environment. But he felt that satisfactory solutions to environmental problems should be solved before making a commitment to commercial production. Hickel then turned to the question of balance of payments, saying that he did not have complete faith in the economics of the SST and that the air-

⁴⁵ Walter J. Hickel, Who Owns America? (New York: Paperback Library, 1971), 179.

⁴⁶ Ibid.

plane could have a negative effect on the balance of payments. In addition, he questioned the efficacy of government financing of the SST, suggesting instead a quasi-governmental corporation on the model of COMSAT as a means of allowing the government to share with industry both the uncertainties and the revenues.⁴⁷

When Hickel's letter was received at the White House it created a "sonic boom" of its own, according to the Secretary. Hickel was soon informed that his reply was not what the White House had in mind. The letter was returned with the paragraphs on balance of payments and the ability of private industry to finance the SST red-lined for deletion.⁴⁸ The Secretary complied, but this episode, and the Administration's refusal to release the adverse Garwin Report, makes it clear that a decision was made in 1969 to continue development of the SST regardless of the environmental or economic questions that were not satisfactorily answered. While touring the Atomic Energy Commission's Hanford Atomic facilities in Washington State in September, 1971, President Nixon observed that "if a people are to be a great people, we must always explore the unknown. We must never be afraid of it; that is why we should have built the SST."⁴⁹

⁴⁷ Ibid., 180-181.

⁴⁸ Ibid., 181.

⁴⁹ U. S., President, Public Papers of the Presidents of the United States, 1971 (Washington, D. C.: Government Printing Office, 1972), 1001.

By mid-1970 the Boeing SST neared prototype flight status.

To enable Boeing to achieve that goal the Congress was asked to appropriate nearly \$290 million for fiscal 1971, a sum which would allow the SST to be ready for flight sometime in 1972, according to optimistic estimates. But even as the SST prototype program neared completion, serious opposition based on the airplane's environmental impact developed, leading in 1971 to the final demise of the American SST.

CHAPTER III

THE GATHERING STORM: ENVIRONMENTAL OPPOSITION DEVELOPS

Strong environmental opposition to the SST did not develop until the latter part of the 1960's. During the initial years of SST development there was very little opposition of any kind, and virtually no concern voiced about the aircraft's impact on the environment. Indeed, the earliest concerns about the environment were not from the standpoint of what the SST would do to the environment, but on what effect the environment would have on the operation of the SST. For example, at the International Air Transport Association's 14th Technical Conference held in Montreal, Canada during the week of April 17, 1961, serious concerns were voiced about the effect of cosmic radiation on passengers and crew, and the effect of Clear Air Turbulence (CAT) at the 60-70,000 foot operating altitude of the SST. Officials at the conference assumed that the SST was inevitable; their only concerns were that the aircraft be economical to operate and be acceptable to their customers, fare-paying passengers.¹

As the decade of the 60's unfolded, questions about the environmental impact of the SST were raised. Initially, opposition was based on the aircraft's unavoidable sonic boom. Unfortunately for the SST

¹Aviation Week, April 24, 1961, 26-27; Dwiggins, The SST, 21-22.

program, the observation of Project Director Maxwell that "in time [people] will come to accept the sonic boom as they have the rather unpleasant side effects which have accompanied other advances in transportation" was not heeded.² Instead of accepting the sonic boom, many people began to question the need for an SST at all, and even began to base their opposition on what could be termed the "rather unpleasant side effects" of the SST, in particular noise (in addition to the sonic boom) and possible atmospheric pollution. Instead of accepting the SST as an inevitable rung in the ladder of progress, opposition was based in part on the possible negative impact of the airplane on the environment. At times the arguments for and against the SST were sensationalized and "iffy" in nature. But the very fact that such a project was subjected to intensive questioning on environmental grounds indicates the very serious nature of the possible impact of the SST on the environment. The controversy over whether or not the SST would adversely affect the environment is not yet settled, because no prototypes were built; but many of the more serious questions, such as that of depletion of ozone in the stratosphere, could not be adequately answered without the long-term operation of a fleet of SST's. Should

²U. S., Congressional Record, 90th Cong., 2d Sess., June 10, 1968, 16423.

the predictions of environmental doom be proven correct through the implementation of a fleet of SST's, the opportunity to protect the environment would be lost.

I

The sonic boom generated by an aircraft as it passes through the atmosphere faster than the speed of sound (slightly less than 700 miles-per-hour at sea level) is for practical purposes unavoidable. The characteristics of the boom can be changed through the modification of an airplane's fuselage shape and wing configuration but it is not possible to eliminate the boom.³ A boom is produced by a supersonic airplane because it travels too fast to "quietly" move the air out of its way. Since the aircraft flies at faster than the speed of sound, the molecules receive no warning which causes them to slide around the aircraft without creating an overpressure. Instead, the molecules remain at rest until the aircraft is less than an inch away. They must then move aside in a few millionths of a second. This sets up shock waves which are radiated behind the aircraft in a conical pattern. These shock waves create momentary overpressures and are accompanied by

³ Karl D. Kryter, "Sonic Booms from Supersonic Transport," Science, January 24, 1969, 361. One possibility for reducing or eliminating the sonic boom would be to build a ballistic transport. But such a development is far in the future.

an audible boom. As with any other sound wave the intensity of a sonic boom decreases with distance from the generator of the boom. Thus an SST flying at 70,000 feet normally produces a less noticeable boom on the ground than would the same aircraft flying at the same speed at 50,000 feet. But of importance to the development of an SST is the fact that boom intensity varies directly with the size and weight of an airplane. Thus an SST the size of the proposed Boeing model, weighing nearly 700,000 pounds and having a length nearly that of a football field, would produce a greater boom than the military aircraft which have until recently been the sole source of sonic booms.⁴

Also of importance to the development of an SST is the production of superbooms under certain atmospheric conditions and maneuvering situations. When an airplane goes transsonic, or passes through Mach I, a momentary but particularly intense boom is produced. Although the total affected area is limited, the overpressure is significant. And since such booms would normally be generated early in an SST's flight path, and since there are relatively few corridors through which aircraft can depart any given airport, it follows that specific areas adjacent to the airports handling supersonic transports would be subjected more or less continuously to superbooms. And once the airplane

⁴William A. Shurcliff, S/S/T and Sonic Boom Handbook (New York: Ballantine Books, 1970), 21-25.

is at cruise altitude and speed the possibilities for superbooms continue. Temperature variations and wind patterns in the air through which a sonic boom overpressure travels can create a focusing effect resulting in a superboom. Also, smooth surfaces such as city streets can reflect sonic booms, thus intensifying the booms. Finally, routine maneuvers of an SST result in focusing effects; drastic maneuvers and speed changes could result in local superbooms.⁵

The government recognized early that the sonic boom would lead to opposition to the SST, largely because of adverse reactions to booms caused by military jets. And since it would be difficult to convince the public that commercial SST booms should be accepted for patriotic reasons, the government conducted a series of sonic boom tests during the 1960's to gauge how much the public would accept.⁶

Sonic boom tests were conducted by the government over St. Louis in 1961 and 1962. That city was subjected to 150 supersonic flights, resulting in 5,000 complaints, 1,624 damage claims and \$58,648 in payments for damage.⁷ Oklahoma City was the next to receive supersonic

⁵ Ibid., 26-27.

⁶ Dwiggins, The SST, 63. The U. S. Air Force made available a pamphlet in 1963 entitled, "Sonic Booms--They Do Occur," which listed the procedures a civilian should follow if affected by sonic booms. In 1966 the Strategic Air Command, whose B-58 Hustlers caused numerous sonic booms, attempted to place the booms in a patriotic context, saying the booms were caused by "the only free world bomber capable of flying at twice the speed of sound."

⁷ Kryter, "Sonic Booms," 365-366; Shurcliff, S/S/T, 32.

treatment, becoming the subject of the most intensive boom test ever in 1964. For a period of five months the city's residents experienced booms every hour on the hour during daylight. Boom intensity was carefully monitored and gradually increased from month to month. By the end of the five-month test there had been 1,254 supersonic overflights, resulting in 15,452 complaints, 4,901 damage claims, and damage payments totalling \$123,070 as November, 1969, with an additional \$128,788 in claims still pending.⁸ Since the overflights of Operation Bongo occurred at regularly scheduled times, and were conducted by military fighter jets whose sonic booms were not as severe as those expected from commercial SST's, the annoyance and damage that could be expected from regular commercial flights would be increased correspondingly. Regardless of the comparison to possible future SST booms, most residents of Oklahoma City were relieved when the test was completed in July. The Oklahoma City Times headline on July 30, read: "SILENCE IS DEAFENING."⁹

Boom tests were conducted in 1965 over Chicago, Milwaukee, and Pittsburg. None of the tests were as extensive as those over Oklahoma City but the results were similar; complaints, damage claims, and damage awards followed the tests. In 1966-67 the residents of Edwards Air

⁸ Kryter, "Sonic Booms," 365-366; Shurcliff, S/S/T, 32-33.

⁹ Dwiggin, The SST, 73.

Force Base in California were subjected to 367 boom-producing flights. Even for a military base whose inhabitants could be expected to be familiar with booms the results were little different from results in the civilian community tests.¹⁰

Not all sonic boom tests were deliberate. A number of incidents occurred with military jets during the 1960's which showed the tremendous power of the sonic boom. In January, 1965, Gordon Bains, then director of the SST program, was at the White Sands Missile Range in New Mexico explaining to newsmen that many damage claims resulting from sonic boom tests were spurious. An Air Force F-104 fighter jet then broke the sound barrier at an altitude of 500 feet; the resulting boom knocked out windows right where Bains was speaking.¹¹ In a similar incident at the Air Force Academy in June, 1968, a low-flying F-105 fighter made a supersonic pass at 500 feet above graduation ceremonies. As a result fifteen persons were injured and \$50,000 worth of windows were broken.¹² The above instances of sonic boom damage would not likely be repeated by a commercial SST except in an extreme emergency situation. But the potential is present for a multi-million dollar

¹⁰Shurcliff, S/S/T, 34.

¹¹Ibid., 30.

¹²Ibid., 29-30.

sonic boom-induced incident should a commercial SST be flown supersonically at too low an altitude above a city.

In August, 1966 the National Park Service discovered the sonic boom's potential, not from a low-flying aircraft but from a normal supersonic flight by a military jet high above the Canyon de Chelly National Monument in Arizona. The Monument is the site of pre-historic cliff dwellings and Navajo strongholds against Spanish attack, as well as rugged and beautiful scenery. On August 11, 1966, however, the supersonic age intruded into the park, according to rangers. A military aircraft produced a sonic boom which loosened an estimated 80 tons of rock, causing it to fall on ancient Indian cliff-dwellings, resulting in irreversible damage. There was also speculation that damage was caused elsewhere in the Monument.¹³ Mesa Verde National Park was the scene of sonic-boom induced rockslides on February 21, 1968. On that day jets from the Strategic Air Command produced booms resulting in approximately 66,000 tons of rock falling, blocking a tourist road and damaging Indian caves in the area.¹⁴

The effect of continuous sonic booms such as would occur if commercial SST's were allowed to fly supersonically over land is not

¹³ Bruce L. Welch, "SST: Coming Threat to Wilderness," National Parks Magazine, March, 1968, 9; Connie Foley, "Boom," American Forests, March, 1967, 4 and 58.

¹⁴ Shurcliff, S/S/T, 35.

limited to annoyance. The damage claims resulting from sonic boom tests as well as from military booms presents a graphic illustration of the adverse economic potential of the SST in relation to buildings and structures. Calculations based on damages awarded as a result of sonic boom tests indicate that \$400 to \$700 in damage payments were made per million man-booms.¹⁵ It is clear that a fleet of SST's operating regularly over land would cause a significant amount of damage simply as a result of sonic booms.

If the boom tests did nothing more, they proved to the government that the American people would not readily accept the constant booming that would take place as a result of widescale commercial SST service over land. The tests also indicated the extent of physical damage that could be expected if SST's flew regular routes over populated areas; the damage from normal overpressures would be significant and the possible damage from inadvertent superbooms would be tremendous. As a result of the adverse reaction to the boom test the FAA eventually banned supersonic flight over land areas of the United States.

¹⁵Shurcliff, S/S/T, 34; "Congress Facing Decision on Future of American SST," Congressional Quarterly, May 29, 1970, 1455. A million man-booms results when one million people are subjected to one sonic boom. Thus one supersonic overflight of a city of one million would produce a million man-booms; it would take ten such flights to equal a million man-booms for a city of 100,000.

Europeans as well as Americans have had sonic boom experiences. And just as in the United States their experience has been both inadvertent and deliberate. The most serious inadvertent boom incident occurred at Mauran, France on August 2, 1967, when part of a barn roof collapsed as a result of a sonic boom, killing three farm workers.¹⁶ Military booms also caused extensive damage to the Chateau de Landal at Broualan Village, resulting in a court order to the French government to pay \$11,550 in damages.¹⁷ Damage to other historic buildings in France has been outlined in an illustrated article in Les Monuments Historiques de la France.¹⁸ The historic treasures of France were not alone in their danger from sonic booms. The eighteenth century abbey church at Neresheim, Germany has been closed due to sonic boom-related damage to roof timbers, which were in danger of collapse.¹⁹ It has also been alleged that avalanches have been caused by sonic booms and that a herd of prize cattle stampeded over a cliff in Switzerland when startled by the same phenomena.²⁰

¹⁶Welch, "SST: Coming Threat to Wilderness," 11; Shurcliff, S/S/T, 37.

¹⁷Shurcliff, S/S/T, 36-37.

¹⁸M. Parent, "Effets des vols supersoniques," Les Monuments Historiques de la France, 1968, 5-21.

¹⁹Shurcliff, S/S/T, 37.

²⁰Welch, "SST: Coming Threat to Wilderness," 11; Shurcliff, S/S/T, 37.

Deliberate boom demonstrations and tests have also taken place in Europe but not on as wide a scale as in the United States. Bristol and London were boomed eleven times in 1967 in a test by the British government. And even though the boom overpressures were about half those expected from commercial SST's, 515 damage claims resulted in awards totalling \$9,981.²¹ The United Kingdom also conducted boom tests on military personnel and barracks with military jets, and simulated booms were produced in Project Yellow Hammer by tethered booms setting off explosive charges.²²

Sonic boom opposition developed in the mid-1960's when existing groups such as the Sierra Club and the Wilderness Society went on record opposing the boom. Leading the fight was the Citizens League Against the Sonic Boom, which was founded in 1967.²³ Also in 1967, the City Council of Santa Barbara, California passed an ordinance banning supersonic flight over that city, calling booms an "unlawful public nuisance."²⁴ Although of dubious legality, the sentiment expressed in the ordinance was a portent of the developing opposition to the SST.

²¹ Shurcliff, S/S/T, 35.

²² Kryter, "Sonic Booms," 362.

²³ Shurcliff, S/S/T, 106.

²⁴ Dwiggin, The SST, 82; Shurcliff, S/S/T, 107.

As a result of adverse reaction to sonic booms, and the extensive damage produced, the FAA announced on April 16, 1970 its intention to prohibit non-military supersonic flight over the United States.²⁵

But opponents to the SST such as Representative Henry Reuss of Wisconsin were concerned that such administrative action might be reversed in the future should the economic profitability of the SST require overland flights. To prevent reversal of sonic boom restrictions Reuss introduced a bill which would ban supersonic flights over the United States unless the Secretary of Health, Education and Welfare certified to Congress that such flights would not harm people subjected to the sonic boom.²⁶

The SST opposition was partially successful in that proponents were forced to admit the harmful nature of the sonic boom, and therefore measures were taken to minimize the impact of the boom on people and fragile land environments. But the boom was not an overly controversial subject, although there were disagreements over how much annoyance and damage the public would accept in return for the ability to fly cross-country in two hours instead of six. The various boom tests indicated that extensive damage would occur with normal sonic

²⁵ U. S., Federal Aviation Administration, Notice of Proposed Rulemaking, "Civil Aircraft Sonic Boom," Federal Register, XXXV, April 10, 1970, 6189.

²⁶ "Congress Facing Decision," 1458.

boom overpressures. The Internal Revenue Service recognized that fact some years previously when in 1959 it ruled that sonic booms were "inevitably sudden, unexpected and unusual," and therefore damage from such booms were tax deductible.²⁷ Although the sonic boom was sudden and inevitable, other forms of possible environmental problems associated with the SST were not so readily discernible, and were therefore considerably more controversial than the sonic boom. Thus questions of possible atmospheric modification and airport vicinity noise became the focus for debate in the latter part of the 60's.

II

By the late 1960's the increase in noise levels in all aspects of modern life was of such proportions that public health and safety were endangered. Greater noise levels were noted in diverse environments from the household kitchen, with its blenders and dishwashers, to the farmers' fields, where powerful, mechanized machinery helped produce food and fiber. Thus the aviation industry was not alone in experiencing greatly increased noise. With the introduction of subsonic jets in the 1960's, and with greatly increased patronage of air travel, the problems of noise in and around airports became severe. The first generation of subsonic jets were significantly noisier than

²⁷ New York Times, October 22, 1959, 11.

the piston-engined transports they replaced, and more importantly, the noise produced by the subsonic jets was higher in frequency and therefore more annoying. Concerted efforts on behalf of the manufacturers and airlines helped reduce noise generated by subsonic jets, mainly through the use of accoustical sound suppressors and the introduction of fan-jet engines, but increased air travel nevertheless led to greater overall noise problems.²⁸

Acknowledging the increasing impact that commercial aviation had on communities surrounding airports, and in particular the inhabitants below the flight paths of incoming and outgoing aircraft, the United States Supreme Court ruled in 1962 in Griggs v. County of Allegheny that airports are liable to property owners for overflight easements under the 14th Amendment's due process clause. Individual airports, concerned with the great increase in noise and public nuisance, have established noise limits for airplanes using their facilities. John F. Kennedy International Airport in New York has a noise limit of 112 PNdB (Perceived Noise-level in decibels), established in 1951. But expanded use of JFK has kept the limit from being effective in lowering total noise to the surrounding community. Los Angeles

²⁸ For a comprehensive discussion of noise and its impact on modern society, see Editors of Fortune, The Environment: A National Mission for the Seventies (New York: Harper & Row, 1970), Chapter VII.

International Airport, faced with lawsuits totalling in the millions of dollars as a result of excessive noise, has threatened to prevent SST's from operating out of Los Angeles.²⁹ But individual airports are largely powerless in limiting noise, it is up to the designers of transport aircraft to produce airplanes that meet reasonable noise standards.

Noise is nothing more than energy, in the form of pressure waves, generated by a noise-producing device such as the human voice or the jet aircraft engine. Noise is measured in decibels on a logarithmic scale, but it was realized by the middle of this century that not all noise at a given decibel level produces an identical effect on the ears of a listener. Thus the measurement known as the Perceived Noise-level in decibels (PNdB) was developed in 1959 by Dr. Karl Kryter of the Stanford Research Institute. Sound pressure as well as frequency was measured, resulting in noise and annoyance being considered in sound measurements. It was soon realized that the high whine of some noise generators, such as jet engines, could not be accurately measured by Kryter's PNdB. In 1966 the Aircraft Exterior Noise Committee of the Society of Automotive Engineers created a new noise standard known as the Effective Perceived Noise-level in Decibels (EPNdB). The FAA has

²⁹ Dwiggin, The SST, 253.

adopted EPNdB for all of its subsonic aircraft noise measurements in order to be able to include annoyance factors.³⁰

SST noise was a crucial issue by the late 1960's, and the problems that GE and Boeing experienced in making the airplane quieter were important factors in the decision of Congress to terminate the program in 1971. The above mentioned report of the President's Ad Hoc Committee in 1969 contained a section on airport noise in which it was observed that according to Boeing estimates the SST engines would be substantially noisier than subsonic engines. The potential noise problem would be meliorated, however, by the steeper climb rate the SST was expected to maintain on takeoff. Thus the noise levels directly below the flight path at one mile from the end of a runway were expected to be 111 PNdB for the SST and 125 PNdB for a 707. At a mile from the end of the runway on a landing approach the noise levels were expected to be 109 and 123 PNdB, respectively.³¹ On the ground, however, the SST was expected to be considerably noisier than subsonic jets. Side-line noise was estimated to be 124 PNdB for the SST whereas the subsonic jets had a noise level of 108 PNdB.³² Since airplanes spend more time

³⁰ Saturday Review, August 15, 1970, 15.

³¹ U. S., Congressional Record, 91st Cong., 1st Sess., October 31, 1969, 32602. Prolonged exposure to a noise level of 85 PNdB is sufficient to cause permanent hearing damage; a level of 120 PNdB is the threshold of pain for the human ear.

³² Saturday Review, August 15, 1970, 15.

on the runways and taxiways of an airport than they do in landings and approaches, the greater sideline airport noise of the SST was potentially more serious from the standpoint of overall community noise than the greater noise during takeoff and landing of subsonic jets. Another factor which made the comparison between subsonics and SST's less promising for the SST was that manufacturers were able to reduce noise levels of their subsonics. Proponents of the SST claimed that Boeing and GE possessed the technology to lower SST noise. But sound specialist Dr. Leo L. Beranek, a proponent of the SST and chairman of the DOT advisory committee on community noise, noted that to achieve meaningful reductions in sideline noise the manufacturers would have to increase the gross weight of the production SST from 750,000 pounds to nearly 800,000 pounds.³³ But since the payload of the SST was estimated to be in the range of 50,000 pounds it appeared that noise reduction could be accomplished only at the cost of reducing range and/or payload.

³³U. S., Congress, House, Committee on Appropriations, Civil Supersonic Aircraft Development (SST) Hearings, before a subcommittee of the Committee on Appropriations, House of Representatives, 92d Cong., 1st Sess., 1971, 58; New York Times, March 1, 1971, 17. The two prototypes would not be "silenced," and were still expected to weigh approximately 635,000 pounds. If the production version should weigh 800,000 pounds, that increase in weight would lead to a more severe sonic boom pressure.

In reacting to the extremely high noise levels an SST would produce in the airport vicinity, opponents such as Dr. Richard Garwin, chief author of the above mentioned Garwin Report, likened the noise of one SST taking off to fifty subsonic jets taking off simultaneously. Technically Dr. Garwin was correct; since sound is measured on a logarithmic scale, an increase of ten decibels represents a doubling of sound intensity. Thus in terms of sound energy produced, a single SST producing 124 PNdB would equal 50 subsonic jets producing 108 PNdB. But Dr. Garwin was challenged for being misleading in his estimate. Garwin's critics noted that loudness and sound could not be directly equated. Dr. John Powers of the FAA concluded that Garwin's contention was unreal since even if fifty jets were able to take off together some of the noise generated would be cancelled out. Perception, unlike noise generation, does not occur on a logarithmic scale. Harvey Hubbard of NASA used the example of a four-engined airplane with one engine running. With starting a second engine there would be twice as much accoustical power (sound) generated, but a person would not perceive a doubling of noise. Similarly, with all four engines running, the resulting sound would not be four times as loud.³⁴ Dr. Karl Kryter, creator of the PNdB scale, observed that both Garwin and his opponents

³⁴ Saturday Review, August 15, 1970, 15.

were technically correct, but he felt that Garwin resorted to overkill in his example. Kryter observed that "three hundred to four hundred per cent increase in noisiness to something that is already intolerable to some people is beyond acceptable limits."³⁵

Overstatement or not, the argument against the SST on the basis of noise was telling. President Nixon's Ad Hoc Committee concluded that with widescale use of SST's "significant numbers of people will file complaints and resort to legal action, and that a very high percentage of the exposed population will find the noise intolerable and the apparent cause of a wide variety of adverse effects."³⁶ The panel also noted that research could lead to some reduction in noise levels, but land use planning in areas surrounding airports offered the only satisfactory solution to the noise problem. If such a course of action were required for all SST airports the nation would possibly be faced with more examples of Everglades-type jet-ports. In that attempt to remove the annoyance factors of an airport from the Miami, Florida metropolitan area, the solution was to create a modern airport in the middle of the Everglades, with the result of further disrupting the critical balance of nature that has sustained Everglades ecology for so

³⁵ Ibid., 15-16.

³⁶ U. S., Congressional Record, October 31, 1969.

long. Since some metropolitan airports could not easily segregate SST's, unless regional SST-ports were established in very remote locations, and serviced by short-haul transports, the solution to noise problems seems to be reduction in noise (very difficult for the SST) and/or sanitizing the areas surrounding the existing airports. The sanitization process in which housing in critical noise areas was purchased and removed, has been attempted by Los Angeles International at a cost of many millions of dollars, but with the noise levels generated by the proposed Boeing SST much of the Los Angeles basin would have to be cleared of housing because the objectionable level of side noise from an SST producing 124 PNdB would span an area miles from the airplane.³⁷

III

Environmental opposition by the end of the 60's encompassed concerns about the impact of the SST on the atmosphere. Proponents had a difficult time refuting charges that the sonic boom would be annoying and harmful, and were not able to make a strong case for the ability of Boeing and GE to significantly reduce airport noise levels. But when the dispute shifted to what the long-term effects of SST operations on the atmosphere would be, SST opponents found it very difficult to make a telling case. Since the atmospheric impact of the SST was almost

³⁷ Ibid.

completely unknown, the arguments on both sides generally rested on "iffy" propositions. The debate over atmospheric pollution revolved around the effects that the SST would have on carbon dioxide (CO^2) addition, water vapor addition, and ozone depletion in the stratosphere.

SST's are designed to fly at approximately 20 km (65,000 feet) which puts them in the relatively inactive portion of the atmosphere known as the stratosphere. The stratosphere is a rarefied region with very little vertical mixing. Particles and gases released into that region by SST exhaust will likely remain for a period of one to three years. Because normal concentrations of particles and gases are low, and because stay times for foreign material are relatively long, the impact of a fleet of SST's could possibly be significant.³⁸

The primary by-products of combustion in a jet engine are carbon dioxide and water vapor. Since CO^2 is also a product of any fossil fuel combustion there has been a steady rise in world-wide CO^2 concentration for a number of years. As a result there has been a concern that the increased concentration would eventually cause the temperature of the earth to increase because of a "greenhouse effect." As

³⁸ Massachusetts Institute of Technology, Report of the Study of Critical Environmental Problems (SCEP), Man's Impact on the Global Environment: Assessment and Recommendations for Action (Cambridge, Mass.: MIT Press, 1970), 15.

CO² concentration increases there is a corresponding warming of the planet because atmospheric CO² reflects back to the earth part of the radiated energy that would otherwise be passed back into space. The 1970 MIT-sponsored Study of Critical Environmental Problems (SCEP) offered the conclusion that the climatic change resulting from increased CO² in this century will be small; it was nevertheless concluded that the longer-term effect might be more significant. In regarding the impact of the SST on CO² concentration, SCEP participants observed that the amount of CO² injected into the atmosphere by the SST would be small compared to other sources, mainly electrical generating plants and automobiles, and would therefore not be an immediate danger to the atmosphere. The report was critical about the overall effect of CO², and recommended a systematic study of CO² changes.³⁹ Dr. Fred Singer, Deputy Assistant Secretary for Scientific Programs of the Department of the Interior, told the House Appropriations Committee on March 4, 1971, that CO² would not be a problem because the "contribution is minor compared to the carbon dioxide which is contributed by many other sources in the earth's atmosphere."⁴⁰

³⁹Ibid., 11-12 and 68.

⁴⁰U. S., Congress, House, Civil Supersonic Aircraft Hearings, 1971, 619.

Questions were raised concerning the effect of water vapor in depleting ozone. Ozone, comprised of three oxygen molecules, is present in the stratosphere and absorbs much of the ultraviolet radiation impinging on the earth from the sun. This process protects people and other living things on earth from what would otherwise be lethal radiation. Even a small reduction could lead to an increase in skin cancer. In the natural cycle ozone is broken down by ultraviolet radiation and in doing so the intensity of that radiation is reduced. Then the ozone is reconstituted by a catalyst. But the presence of large quantities of SST exhaust would alter the natural cycle and lead to at least a partial depletion of stratospheric ozone. Instead of the steady-state cycle of absorption-attenuation-reconstitution, the presence of nitric acid and water vapor would intrude into the cycle at the point of reconstitution and result in the formation of oxygen gas (two molecules of oxygen) rather than ozone.⁴¹

Some atmospheric scientists were concerned that the amount of ozone reduction would be significant. Dr. Harold Johnston of the University of California at Berkeley predicted that a fleet of 500 SST's operating seven hours per day (predicted for 1985) would reduce the ozone by one-half in one year. As a result, all animals, including man, would be blinded if they lived outside during the daytime. Some of

⁴¹ New York Times, May 30, 1971, 7.

Dr. Johnston's associates further believed that all plants, except those under water, would be killed.⁴²

Chairman Russell Train of the Council on Environmental Quality (CEQ) testified before the Joint Economic Committee in August, 1970, that he was concerned about the possible effects on the ozone layer by SST flights. Atmospheric physicist and CEQ member, Dr. James E. McDonald, also voiced concern, but like Train he reiterated the "iffyness" of arguments concerning ozone depletion. Nevertheless, Dr. McDonald said that he would not want to take the risk of tinkering with the upper atmosphere without more information.⁴³

Dr. McDonald also testified before the House Appropriations Committee in March, 1971, and at that time estimated that with wide-scale use of the SST the ozone concentration would be reduced sufficiently to cause an increase of 10,000 cases of skin cancer per year in the United States.⁴⁴ In a statement presented to the Senate Appropriations Committee on March 10, 1971, Dr. Reginald E. Newell of MIT's Department of Meteorology warned against the introduction of water

⁴²Ibid.

⁴³Saturday Review, August 15, 1970, 43

⁴⁴U. S., Congress, House, Civil Supersonic Aircraft Hearings, 1971, 307-310.

vapor into the stratosphere, stressing the dangers inherent in upsetting the natural balance, particularly in regards to ozone.⁴⁵

Dr. William W. Kellogg, Associate Director of the National Center for Atmospheric Research in Boulder, Colorado testified on behalf of SST development before the Senate Committee on the day following Dr. Newell's appearance. Dr. Kellogg noted that natural influences on the climate and natural climatic variations were historically of greater magnitude than any changes that might result from SST operations. Using that assertion he then attempted to place Dr. McDonald's skin cancer figures in a better light in relation to SST development. Dr. Kellogg used the illustration of traveling from sea level at Washington, D. C., to approximately a mile above sea level at Boulder, Colorado. During such a trip a traveler would experience a reduction of approximately 2 per cent of the ozone present in Washington, D. C., or about the amount of ozone decrease that was conservatively estimated to be caused by SST operations. Dr. Kellogg did concede that the extra cases of skin cancer, regardless of the absolute number, should not be considered trivial. But he suggested turning the figures around and instead of saying there would be 10,000 new cases of skin cancer per year as a result of SST operations, saying that the

⁴⁵ U. S., Congress, Senate, Committee on Appropriations, Civil Supersonic Aircraft Development (SST) Hearings, before the Committee on Appropriations, 92d Cong., 1st Sess., 1971, 146.

"fraction of people affected would be one in 20,000."⁴⁶ Dr. Kellogg did not say that the one person in 20,000 should feel that a case of skin cancer was a worthwhile trade-off for the ability to fly cross-country in two hours.

Dr. Kellogg was a participant in the SCEP program in 1970 which urged that a monitoring program be set up to measure baseline levels of particulates and water vapor in the stratosphere so that any changes in the future would be traceable. SCEP tended to discount the possible destruction of ozone but also noted that without adequate data the future effects of SST flights would be difficult to predict.⁴⁷

By the time the SST issue reached its zenith in Congress in 1970 and 1971 there was ample testimony concerning the SST's environmental impact. But in most cases, and particularly in the cases of ozone depletion and CO² addition, the full impact of a fleet of SST's was impossible to accurately assess, thus both sides were forced to stress the "iffyness" of the possibilities. Even though the environmental issues were not completely resolved in the many hours of testimony and debate before the Congress, the very possibility that the SST would result in adverse impacts on the environment served to strengthen

⁴⁶ Ibid., 426-427.

⁴⁷ U. S., Congressional Record, 91st Cong., 2d Sess., August 5, 1970, 27385; Report of the Study of Critical Environmental Problems (SCEP), Man's Impact, 17-18.

the opposition since the proponents of the SST could not categorically deny any adverse environmental effect.

CHAPTER IV

THE GROWTH AND SUCCESS OF CONGRESSIONAL OPPOSITION

From 1961, when Congress passed its first appropriation specifically for the SST, until well into the decade, there was little effective opposition to the program. The early opposition that existed was based largely on the airplane's sonic boom. But the Congressional love affair with the airplane became endangered in the last half of the 1960's when opposition both inside and outside the Congress broadened in its concerns to include questions about possible environmental degradation from widescale use of the SST. And contributing to the erosion of support, the program became increasingly more expensive, threatening to cost far more than President Kennedy envisioned in 1963. The final break with the SST occurred in 1970 and 1971 when the problems of cost and environmental impact coalesced to end governmental support for the SST program.

I

A Representative from a Congressional district directly to the east of Chicago's O'Hare Field, Roman C. Pucinski, provided the first measure of opposition to the SST in Congress when in 1963, shortly after President Kennedy's Air Force Academy speech, he introduced a bill in the House which in effect would have banned supersonic flight through any navigable airspace of the United States. Pucinski said of his measure: "This legislation is designed to put the whole airplane industry on notice that the people of the United States do not intend to

perpetuate the folly of permitting air transport to be developed with no consideration to noise abatement." Saying that expecting people to "learn to live" with booms is "unadulterated bunk," the Representative questioned the justification for "exposing millions of Americans to tremendous discomfort and annoyance and even possible bodily harm, just to save a couple of hours on coast-to-coast flights."¹ The Chicagoan thus took a stand against the SST some two years before his city was subjected to a nerve-rattling and destructive sonic boom test program. Pucinski had few supporters, however, and his bill died a boomless death in the House Committee on Interstate and Foreign Commerce.²

Pucinski also made the first direct Congressional challenge to the SST in 1963. On October 10 the Illinois Representative offered an amendment to the \$60 million appropriation for the SST which would have deleted all but a half million dollars. Pucinski noted the annoyance to which his district was then subjected by subsonic airplanes using O'Hare Field, the largest airfield in the world. But enough of his fellow Representatives were unimpressed with his concern for future SST annoyance and defeated his amendment on a division vote of 70 to 125.³

¹Dwiggins, The SST, 177-178.

²U. S., Congressional Record, 88th Cong., 1st Sess., August 15, 1963, 15104.

³Ibid., October 10, 1963, 19267-19269.

Senator William Proxmire of Wisconsin attempted to delete all \$60 million in SST appropriations in November, 1963. Proxmire noted that the government had not yet received a report from Black and Osborne, who had been appointed by President Kennedy just three months before to study the SST program, yet the Administration proposed to move ahead at full speed. Proxmire warned against the "nationalization" of a major segment of American business when he opposed the SST appropriation measure on November 20. Stating that he did not want to go in the direction that the British and French had, Proxmire contended that "if we pay the whole bill as though we were buying an airplane to be provided by the Government . . . then we have gone a long step toward reaching right down into the engineering department, the production department, and the treasury department of each of these companies and telling them in detail about everything they should do."⁴ This subtle nationalization of segments of the aviation industry was made even more repugnant to Proxmire when in 1964 the new Johnson Administration agreed to the Black and Osborne recommendation to increase government participation from 75 percent to development costs to 90 percent.

NASA had aided the SST program for many years by conducting design work on supersonic airframes and engines which would have civilian applications. During the 1950's wind-tunnel tests on several variable

⁴Ibid., November 20, 1963, 22433.

geometry airframes laid the groundwork for Boeing's competition-winning swing-wing design in 1966.⁵ Representative Henry S. Reuss of Wisconsin made an attack on such indirect SST support when in 1964 he attempted to eliminate \$24.7 million from a NASA appropriation earmarked for basic SST research. That attempt was defeated on a standing vote of 26 to 109.⁶

The last phase of design competition was halfway to completion in 1965 and no opposition developed to that year's \$140 million appropriation. But in 1966, an election year, opposition again erupted. On May 10 Representative Clark MacGregor of Minnesota attempted to delete all funds for the SST. That move to strike a \$280 million appropriation for prototype development in fiscal 1967 was defeated on a voice vote. During floor debate MacGregor noted that the more than a quarter-billion dollars represented a lavish outlay on a project that at best rested on the speculation that the Concorde would be successful. The Minnesota Representative declared that he was not at all persuaded by the available evidence that the Concorde would be successful.⁷

In August of the same year the Senate had the first roll-call vote on the SST when on August 10 Senator Proxmire's attempt to cut SST

⁵Dwiggins, The SST, ibid.

⁶U. S., Congressional Record, 88th Cong., 2d Sess., March 23, 1964, 6319.

⁷Ibid., 89th Cong., 2d Sess., May 10, 1966, 9744.

funding from \$280 million to \$80 million was defeated by a margin of 31 to 58.⁸ This was the closest the anti-SST forces in the Senate would be to victory until late in 1970. The 1966 appropriation was also the largest to be requested from Congress until 1970, when \$290 million was sought to continue the project. Following the award of prototype design contracts to Boeing and GE at the end of 1966, there was a period of several years in which progress was slower than was anticipated when the program received \$280 million for fiscal 1967. The need for further large appropriations did not again occur until Boeing finally settled on a fixed-wing design in 1969 and was ready to proceed at full development speed in 1970. Thus the annual SST appropriations were passed with little difficulty until 1969 and 1970 when the economic and environmental questions merged to defeat the SST.

The program did face periodic sniping, however, in 1967 and 1968. On July 18, 1967 Representative MacGregor again attempted to delete funds for the SST but was defeated by a 30 to 89 standing vote. During debate the Minnesotan made it clear that he did not oppose the aircraft on its technical merits, rather he was concerned about the potential federal budget deficit of \$20 billion incurred in President Johnson's attempt to pursue a guns and butter policy of war against

⁸ Ibid., August 9, 1966, 18699.

Communism abroad and war against poverty at home. MacGregor took pains to describe his attempt to cut funding of the SST as a deferment of spending since he was persuaded that the "proposed aircraft is aerodynamically sound." But he was not convinced, any more than he had been in 1966, of the economic feasibility of the SST. MacGregor closed his argument against government funding at that time by declaring that he would not support the development of a commercial product that would be used by less than 5 percent of the citizens of the country.⁹

Senator Proxmire again provided Senate opposition to the SST in 1967 when on October 5 he attempted to reduce the requested \$142 million appropriation to \$1 million. Proxmire's amendment was handily defeated on a roll call by a vote of 19 to 54.¹⁰

Boeing was in the process of changing its design from a swing-wing to a fixed-wing during the course of 1968, and Congress responded to the reduced need for funding by rescinding \$30 million of previously appropriated but unspent funds. There was no opposition to the SST measure in the Senate that year but on July 3 opposition did surface in the House when Representatives Sidney R. Yates of Illinois and H. R. Gross of Iowa attempted to rescind even more than \$30 million. Out of a previously unexpended \$216 million, Gross would have cut allowable

⁹ Ibid., 90th Cong., 1st Sess., July 18, 1967, 19260-19261 and 19264.

¹⁰ Ibid., October 5, 1967, 28073-28074.

funding for fiscal 1969 to \$60 million, in effect rescinding \$154 million.¹¹ Expressing doubts about the efficacy of governmental participation in the SST program, Representative Gross suggested letting the British and French take the risks involved in producing an experimental airplane. And if the Concorde should prove to be successful, Gross suggested copying the design. In conclusion, the Iowa Congressman wondered to whom overseas the United States could sell a successful, expensive Boeing SST and get paid for it.¹²

The Yates amendment to the fiscal 1969 appropriation would have rescinded all but \$86 million of the previously unexpended funds. Yates contended that his amendment would provide sufficient funds for Boeing to meet contract obligations. If it did not, and Boeing's switch to a fixed-wing SST was viewed by Yates as a violation of the terms of the prototype development contract, then the final resolution of the issue should be made by the new President and new Congress taking office in early 1969. Yates' amendment was rejected, however, and the Illinois Representative demanded a division. His motion was then turned back by a count of 22 to 47.¹³

¹¹Ibid., 90th Cong., 2d Sess., July 3, 1968, 19471.

¹²Ibid., 19967.

¹³Ibid., 19996.

In 1969 the Congress appropriated \$11 million less than the \$96 million requested by the Administration. The full request was passed by the House in November, surviving an attempt by Yates to cut the entire \$96 million appropriation. Again insisting that the program had entered a new phase with Boeing's switch to a fixed-wing aircraft, Yates concluded that it was a logical time to terminate development. Yates' amendment was defeated on a voice vote and then by a standing vote of 64 to 126 upon his request for a division.¹⁴ When the measure went to the Senate the Appropriations Committee recommended cutting nearly \$16 million from the requested \$96 million. The Committee noted that its action was not intended to slow SST development but was taken because it felt that \$80 million was all that could be effectively spent in the remaining half of the fiscal year.¹⁵ When the issue reached the Senate floor in December, Proxmire attempted to cut all funds for the supersonic aircraft but was defeated on a roll-call vote of 22 to 58.¹⁶ Since the measures passed by the House and Senate conflicted, the issue then went to a conference committee where a final appropriation of \$85 million was agreed to. Both Houses then accepted the

¹⁴ Ibid., 91st Cong., 1st Sess., November 18, 1969, 34661 and 34672.

¹⁵ U. S., Congress, Senate, Committee on Appropriations, Department of Transportation and Related Agencies, S. Rept. 611, 91st Cong., 1st Sess., 1969.

¹⁶ U. S., Congressional Record, 91st Cong., 1st Sess., December 17, 1969, 39588.

conference report on voice votes, approving a cut of \$11 million from the Administration's request.¹⁷

The conflict over continuing SST development greatly intensified in 1970. But by the end of the year, after much heated debate and involved parliamentary maneuvering, the issue was still unresolved. 1970 was an important election year, one in which President Nixon tried very hard to reverse the normal off-Presidential year Congressional election pattern in which the President's party usually loses seats. And during that time the environmental movement increased greatly in power, as evidenced by the passage of major environmental legislation such as the National Environmental Protection Act in 1969 and the Clean Air Act in 1970, as well as the observance of "Earth Day" on April 22, 1970. Earth Day was a nationwide environmental teach-in that focused attention on environmental issues, including the SST. Taking place during the course of many Primary election contests, Earth Day had the effect of making many of the Representatives and Senators who were seeking re-election more aware of the growing sentiment against the airplane on environmental grounds.

Another factor influencing the dramatic turnabout in SST support was Boeing's newly invigorated development effort, back in gear by 1970 following the hiatus brought on by major design changes. As a result,

¹⁷Ibid., December 19, 1969, 40211 and 40225.

the Administration requested nearly \$290 million to continue prototype development. But by 1970 there was growing discontent throughout the nation as a result of the inability of the Nixon Administration to bring about the promised end to the Vietnam War, as well as discontent based on the tremendous financial outlay required to continue the war that was by then increasingly unpopular. These factors contributed greatly to the near-reversal of SST fortunes in 1970.

The Administration's request for further SST funding ran into immediate and surprisingly strong opposition in May when Representative Yates attempted to delete all \$290 million. Two votes were taken on the SST at that time. On a teller vote Yates' amendment was rejected by 86 to 102. Representative John J. Rhodes of Arizona then offered a standard motion to recommit the amendment. At that point Representative Edward P. Boland of Massachusetts "moved the previous question," a parliamentary maneuver that cuts off further debate. Boland's motion carried by 176 to 162. This parliamentary tactic thus prevented a direct roll call vote on the SST; but in general proponents of the airplane voted for the Boland motion, and opponents voted against it.¹⁸

During the lame-duck session of Congress following the November elections, the SST opposition achieved its first major victory when on December 3 the Senate accepted a Proxmire amendment by a margin of 52

¹⁸ Ibid., 91st Cong., 2d Sess., May 27, 1970, 17320 and 17327-17328.

to 41 deleting all of the requested \$290 million.¹⁹ But even though the opposition won in the Senate, the two Houses still had to iron out their differences on the DOT appropriations bill which included the SST funding measure. Thus the issue went to a conference committee. But prior to sending the bill to conference, Yates tried to get the House to instruct its conferees to agree to the Senate version, a move which if successful would have resulted in the defeat of the SST at that point. But Yates' move failed on December 8 on a roll-call vote of 174 to 213.²⁰ The conferees met on December 10 and agreed upon a funding level of \$210 million.²¹ SST opponents in the Senate felt that they had been sold out since the conference figure represented a cut of only \$80 million from the House figure.

When the conference report was considered in the House on December 16, Representative Mark Andrews of North Dakota moved to recommit the report, in effect calling for the rejection of the conference committee compromise. As he had done in May, Representative Boland moved the previous question and again prevented a direct roll-call vote on the issue. Boland's motion carried by 205 to 185.²²

¹⁹ Ibid., December 3, 1970, 39798.

²⁰ Ibid., December 8, 1970, 40271.

²¹ U. S., Congress, House, Making Appropriations for the Department of Transportation and Other Agencies, 1971, H. Rept. 1730 to accompany H.R. 17755, 91st Cong., 2d Sess., December 11, 1970.

²² U. S., Congressional Record, May 22, 1970, 40288.

The Senate took up the conference report on the day following House action and opponents began a filibuster on the DOT appropriation measure. The implications for the Department were serious since the term of the 91st Congress ended on January 3, 1971. Thus any legislation not enacted by that date would expire with the Congress. If that had been allowed to happen the Department of Transportation, and not just the SST program, would have been legally out of funds after that date. The only way to end a filibuster in the Senate was to invoke cloture. Attempts were made to do that on December 19 and 22 with both failing by a wide margin to gain the necessary two-thirds of those voting.²³ Finally, on December 29 with time running out, a compromise was reached and the Senate tabled the conference report.²⁴ On New Year's Eve the House passed a continuing resolution authorizing DOT funding through the third quarter of fiscal 1971, thereby including funding for the SST through March 30, 1971 at the rate of \$210 million per year.²⁵ On January 2, 1971 the Senate approved the House action by a voice vote, setting the stage for the final SST battle in early 1971.²⁶

²³Ibid., December 19, 1970, 42712; December 22, 1970, 43176. The cloture moves failed by votes of 43-48 and 42-44, respectively.

²⁴Ibid., December 29, 1970, 43878.

²⁵Ibid., December 31, 1970, 44301.

²⁶Ibid., January 2, 1971, 44562.

II

With the increased power of anti-SST forces, and the increased concern about environmental matters, it became obvious that the SST program was in for trouble in the latter half of 1970. The upcoming vote in the Senate was expected to be close and during the summer and fall of 1970 both sides rolled out their big guns in expanded efforts to make their respective cases stronger. And when the SST opposition won its Senate victory at the end of the year the battle was joined in earnest between SST advocates and opponents.

The battle in 1970 was primarily over the possible environmental impact of the SST. Proponents of the airplane were generally on the defensive in attempting to rebut arguments of ecological doom and were unable to convincingly allay fears about the airplane's impact. The environmental debate was undiminished in 1971, but there was also an increase in debate over the economic aspects of SST development. This was brought about principally by the proponents' attempts to place the development program in the best light possible. Thus proponents attempted to make a case for continuation of the SST program by stressing the creation of jobs at a time of high unemployment (particularly in the aerospace industry), and by stressing the possible enhancement of the nation's balance of payments that would result from the production of a successful SST. It was also asserted that the government would

recover its investment through royalties. Although soft-pedaled somewhat in the final debate, there was the standard issue of national prestige looming in the background. Finally, when the issue came to a head in March, 1971, in attempting to allay fears about possible environmental degradation, the proponents argued that the immediate issue was the building of two prototypes which in themselves would pose no threat to the environment.

The possible creation of several hundred thousand jobs enlisted the support of much of organized labor. The lead-off pro-SST witness at Senate hearings in March, 1971 was George Meany, head of the AFL-CIO. Labor joined with industry in the "American Labor and Industry for the SST" pressure group in 1971 and purchased full page ads in major newspapers across the country calling for continuation of the American SST. Half of the ad featured a picture of the TU-144 with the caption: "Announcing International SST Service--the best that rubles could buy."²⁷ It also noted that the American SST would provide jobs for 150,000 American workers all over the country. That figure was low compared to other estimates which claimed that up to 400,000 jobs, both directly and through a multiplier effect, would be created eventually by the program.²⁸ Critics of the SST pointed out, however, that peak job employment would

²⁷ New York Times, March 8, 1971, 22.

²⁸ Dwiggins, The SST, 222.

take full production of the transport to generate more than a few thousand jobs. Professor Wassily Leontif of Harvard estimated that less than 3,000 new jobs would be created in the near future and that it would take 10 to 15 years to produce 200,000 jobs.²⁹ The job issue was brought into sharper focus immediately following the Senate vote against the SST in December, 1970, when a Boeing spokesman noted that there were only 4,800 SST-related jobs in Seattle at that time. Seattle did have an unemployment level more than double that of the rest of the nation, but it was not the SST that caused the problem, rather it was the inability of the airlines to purchase the Boeing 747 jumbo jet and other Boeing products. Employment at Boeing's Seattle plants had dropped from a high of 101,000 in 1968 to 55,000 by the end of 1970.³⁰

Balance of payments was another issue which received full play by SST proponents. In testimony before the Senate Appropriations Committee in March, 1971, Secretary of the Treasury John Connally asserted that an American SST would provide up to a \$22 billion gain in foreign trade over the following 20 years.³¹ During the previous summer, the director of SST development William Magruder had claimed that an American SST would generate at least \$17 billion dollars in foreign

²⁹ New York Times, March 17, 1971, 45.

³⁰ Ibid., December 6, 1970, 44.

³¹ U. S., Congress, Senate, Civil Supersonic Aircraft, 63-64.

trade over the next 20 years.³² Opponents of the SST, including reputable economists, challenged the claim of a positive balance of payments as a result of sales of an American SST abroad. Professor Milton Friedman of the University of Chicago accused the government of using arguments that were "demonstrable fallacies," and Richard R. Nelson of Yale called Magruder's arguments "an intellectual scandal."³³ Magruder neglected to consider the effect of American passengers flying on an SST, whether the airplane was foreign or American. According to opponents the picture would have been more complete had the spending of American dollars by American passengers overseas been included in the figures on balance of payments.³⁴ It was partly for this reason that the Interdepartmental Ad Hoc Committee had had serious doubts about the economic aspects of an American SST in its 1969 study.³⁵ Even some members of the Treasury Department were not as bullish on the balance of payments question as were Magruder and Secretary Connally. In a letter to Senator Proxmire on May 1, 1970, Undersecretary for Monetary

³² New York Times, July 20, 1970, 53.

³³ Ibid., March 17, 1971, 45.

³⁴ Ibid.

³⁵ For the complete Ad Hoc Committee report, including correspondence between various committee members and Undersecretary Beggs, see U. S., Congressional Record, 91st Cong., 1st Sess., October 31, 1969, 32599-32613.

Affairs Paul Volcher took the position that a U. S. supersonic transport would unfavorably alter the balance of payments. The Undersecretary qualified his position, however, by observing that a viable foreign commercial SST in the near future would change his assessment.³⁶

The concern for national prestige lost some of its force by 1970 but it nevertheless remained an issue. Astronaut and moon-walker Neil Armstrong toured the Soviet Union in the spring of 1970, during which time he had an opportunity to inspect the TU-144. In November the astronaut spoke to a luncheon meeting of the Aero Club and the Aviation-Space Writers Association in New York, and reported that the TU-144 was a "fine looking aircraft--as good as the best kind of products we're putting out."³⁷

Also related to national prestige as well as balance of payments was the assertion by Magruder's office that the United States' share of the free world jet transport market would fall 15 percent if the Europeans were successful in producing a family of aircraft headed by the Concorde. Included in that family would be the subsonic A-300 airbus (similar to the new American wide-body transports such as the Lockheed L-1011 and the Douglas DC-10) and the French Mercure short-

³⁶ Saturday Review, August 15, 1970, 37.

³⁷ New York Times, November 11, 1970, 88. See also U. S., Congress, Senate, Civil Supersonic Aircraft, 243, for Armstrong's testimony before that committee.

haul jet.³⁸ But opponents of the airplane were able to point out that a 15 percent drop in market share would still give the United States 69 percent of the commercial aviation market, and in addition there was no assurance that the Concorde would be successful and no assurance that the European subsonic jets would compete effectively with the American subsonics. Nevertheless, Stanford Professor of Transportation Karl Ruppenthal, former senior pilot with TWA, pointed out that Americans faced abdication of important markets if resources were concentrated on the SST. The professor felt that the real demand was for comfortable, efficient short-haul aircraft. In addition, Ruppenthal felt that at a cost of up to \$60 million per SST, the airlines as well as the airplane companies building the aircraft would go bankrupt.³⁹

The question of cost was a crucial one in the SST debate. Even though the program grew more expensive each year, proponents claimed that the government would recover its investment with the sale of 300 airplanes, and would receive a return on its investment of \$1 billion with the sale of 500 airplanes.⁴⁰ But Nobel Prize-winning

³⁸ New York Times, July 20, 1970, 53.

³⁹ U. S., Congress, Senate, Civil Supersonic Aircraft, 224.

⁴⁰ U. S. Congress, Senate, Committee on Appropriations, Department of Transportation and Related Agencies Appropriation for Fiscal Year 1971, Hearings, before a subcommittee of the Committee on Appropriations, on H.R. 17755, 91st Cong., 2d Sess., 1970, 1360.

economist Paul Samuelson told the Senate Appropriations Committee in 1971 that by applying sound investment rules he concluded not only that the Concorde was a lemon, but that the American SST was not a good, long-term investment; there were better ways for the government to stimulate the economy than by putting over a billion dollars into a venture in which there was no assurance of return. In commenting on the justification for continuing the SST on the basis of not throwing away the several hundred million dollars already spent, Samuelson noted that "if the argument is made that \$800 million thrown down the drain is a good reason for carrying on, think of how much more powerful the argument is going to be when \$1800 million has been spent." Professor Samuelson concluded his testimony by observing that the most important decision making lesson was to cut losses.⁴¹

The issue which created the most intense debate was the environmental impact of the SST. As outlined in the previous chapter the debate often hinged on "iffy" propositions, particularly when concerned with the SST's impact on the stratosphere. By the time of the final vote in 1971 proponents of the aircraft attempted to de-couple the prototype program from production. By doing so, the proponents were able to claim that two prototypes were absolutely no threat to the environment.

⁴¹U. S., Congress, Senate, Civil Supersonic Aircraft, 212.

In addition, by their projected 100-hour flight test program the prototypes would be able to answer many of the questions about environmental impact and improvements could be designed into the production models to protect the environment, according to proponents. In agreeing to this viewpoint, Secretary of Transportation John Volpe contended in Senate hearings that the prototypes were necessary to answer environmental questions.⁴²

When the Senate and the House reached the final votes on the SST in March, 1971, they were faced with conflicting testimony as noted above, particularly regarding the environment. On the issue of prototypes being able to answer environmental questions, it is unlikely that two airplanes, particularly with only a 100-hour test program would be able to do so. And if that proved to be the case, then the fact that the prototypes were de-coupled from production would turn out to be a dead letter since the decision to go into production would not be based on satisfactory conclusions of environmental reservations. In addition, the prototype-only argument of the proponents in March, 1971 was weak in the face of their contention that the government would recover its investment through royalties on each airplane sold. If the program faced a substantial chance of termination as a result of an unsuccessful prototype test program, then the possibility for government recovery of its investment was at best marginal.

⁴²Ibid., 124.

The issues discussed above came to a head in the House of Representatives on March 18, 1971 when a Yates amendment was adopted by a margin of 217 to 203 deleting all funds for the SST.⁴³ There had been some change in House members since the last vote in December, 1970 but it was also significant that the tally was recorded by teller vote, a new procedure in the House mandated by the Congressional Reform Act of 1970. Prior to the 92d Congress the House practice of using teller votes on amendments provided a means of accurately counting votes without wasting considerable time on roll-call votes. But this practice also led to abuses such as voting to cripple a bill through amendments decided by teller votes and then voting in favor of an emasculated bill on final passage which was usually by roll call. Recognizing this weakness of the teller vote, the House in the 91st Congress established the "recorded" teller vote which was then used in the first successful House vote against the SST in March, 1971.⁴⁴ Thus when Yates demanded a "recorded" teller vote on his amendment, Congressmen knew that their votes would be on public record and they could not quietly vote for the SST while maintaining a posture of opposition or neutrality.

On March 24, 1971 the Senate completed the process of terminating the SST when it refused to agree to an amendment submitted by its

⁴³U. S., Congressional Record, 92d Cong., 1st Sess., March 18, 1971, 7024.

⁴⁴McCloskey, Truth and Untruth, 103-104.

Appropriations Committee restoring the funds cut by the House.⁴⁵ The SST was dead and no conference was necessary since both Houses were in agreement. House proponents found the decision difficult to accept, however, and an attempt was made on May 12, 1971 to revive the SST program. When considering an appropriation measure for the Department of Transportation which included \$85 million in termination costs for the SST, the House accepted a Boland amendment to use the funds for continued development, rather than termination.⁴⁶ A week later, however, the Senate refused to go along with the House by a vote of 58 to 37 and the Senate version was then accepted by both Houses.⁴⁷ So after more than a decade of development, the American SST was finally put to rest. But it required a unique coalition of Congressmen and a unique set of events occurring in 1970 and 1971 to bring about the termination.

⁴⁵U. S., Congressional Record, March 24, 1971, 7829.

⁴⁶Ibid., May 12, 1971, 14584-14585 and 14590-14591.

⁴⁷Ibid.

CHAPTER V

THE VOTES IN CONGRESS: A RETROSPECTIVE ACCOUNT

In order to more accurately assess the reasons for the SST's defeat, the controversy was examined retrospectively by soliciting the views of Congressmen who participated in the various SST votes. Because of the environmental importance attached to the SST votes in 1970 and 1971 it is important to study the reasons for Congressmen consistently supporting or opposing the airplane, and the reasons for switching positions, in particular switching from support to opposition. If the consistent opponents and those who switched to opposition did so primarily for environmental reasons then it can be concluded that the demise of the SST was a significant environmental victory. But on the other hand, if there were other significant factors involved, the defeat of the SST cannot be considered an unqualified victory for the environmental movement.

By following the Congressional debates and testimony given to committees of the Congress, it is clear that there were numerous factors at play in the SST decision. But few Congressmen participated actively in debate (those who did were generally members of the committee that had jurisdiction over a given measure, plus a handful of others who were intensely interested in the issue), and even fewer took an active part in hearings. Thus by gaining retrospective views on their SST votes from Congressmen, particularly those who switched positions, a more valid assessment can be made regarding the reasons

for defeat of the SST than would be the case if the proceedings in Congress and the contemporary press accounts are the sole source of information. There are drawbacks to this approach, of course. The passage of four years has dimmed the recollections of some participants, particularly those who were not vitally interested in the issue, and there was the problem of gaining sufficient significant response on which to base an assessment. But by combining a study of debates, hearings, and contemporary accounts of the controversy with the retrospective accounts of participants, a clearer picture of the relative importance of the environmental opposition can be gained.

To secure the retrospective views of sufficient Congressmen to validate such a study of the SST, the author corresponded with a large number of Senators and Representatives, some of whom were no longer in the Congress. Congressmen were rated according to their position on a select number of recorded votes, and on the basis of those ratings questionnaires were sent to nearly 400 Congressmen in February and early March, 1974.¹ All Senators who participated in two or more of the votes

¹The accurate ranking of Congressmen was difficult in that there were few clear-cut votes on the SST, particularly in the House. Prior to 1970 most of the House votes were by voice or by division, thus no record exists of the positions taken by individual members on such votes. The votes used in ranking House members were: the roll call on Representative Boland's motion for the "previous question" on May 27, 1970; a similar Boland motion on December 8, 1970; and a pair of votes taken on March 18 1971: a recorded teller vote which deleted SST funds, and a roll call on reconsideration of the recorded teller vote. The Senate had a history of more roll call votes taken over a slightly

received questionnaires. All members of the House who changed positions on the SST received questionnaires, as did a geographically and politically balanced sample of House members who were consistently pro-SST or consistently anti-SST. The initial questionnaire consisted of ten questions (see Appendix A) but the response was disappointing. A few Congressmen attempted to fully answer all ten questions but the majority of the initial returns indicated a reluctance to take the time necessary to go through such a detailed set of questions. A number of responses also stated that it was standard policy to refuse such requests unless from constituents. In late March a shortened questionnaire (see Appendix B) was sent to all Senators who had not responded, and to all House members who switched positions and who had not yet responded. The shortened questionnaire generated a much greater response, and in many instances a more detailed response (see Appendix C). Overall, the quantity and quality of responses were greater from the Senate than from the House, although a number of House members were kind enough to return very thoroughly completed questionnaires. Several

longer period of time. Three such votes were utilized to rank Senators, and because they represented a greater numerical spread between support and opposition than did the House votes, the process of ranking Senators was correspondingly more accurate. The votes were: the December 17, 1969 roll call on Senator Proxmire's attempt to delete all SST funds; the successful December 3, 1970 Proxmire amendment deleting all requested funds; and the March 24, 1971 vote in which the whole Senate refused to agree to its Appropriations Committee amendment restoring SST funds.

Congressmen sent excerpts from the Congressional Record, committee hearing proceedings, various publications (Representative McCloskey sent a copy of his book Truth and Untruth), or copies of newsletters dealing with the SST that they had posted to constituents. In the case of newsletters, many of them proved to be at least as valuable as full responses to the questionnaires would have been since they provided a good indication of how the Congressmen felt on the subject at the time it was an active issue.²

Relatively large groups of Congressmen in both Houses were consistent in support of, or opposition to, the SST. In the Senate the forces supporting the SST were led by the two powerful Senators from Washington state, Warren G. Magnuson and Henry S. Jackson. Through their chairmanships of the important Senate Committees on Commerce and Interior, the Senators from "Boeing country" were in a position to extend favors or exact retribution in return for support for their own measures, including the SST. Their chief adversary in the Senate was

²Several of the responses merit special notice. Three questionnaires were returned fully answered but with no means of identifying the respondents. All three were mailed in plain, un-franked envelopes (a rare practice in the Congress) with no return address. Senator Strom Thurmond's office replied with a form postcard acknowledging receipt of "your communication," and thanking "you for presenting your views, which will have my attention." It is not known to what extent the South Carolina Senator gave his attention to the "views" expressed in the questionnaire he received. And finally, Representative John W. Wydler of New York replied that he had referred the questionnaire to the Honorable Dick Shoup [Representative from Montana's First Congressional District] . . . in order that [he] may have the privilege of serving his own constituency."

William Proxmire of Wisconsin, a long-time advocate of unsuccessful causes who was not as powerful as his Washington state colleagues. But Proxmire was able to call upon the support of influential Senators such as Edward Kennedy of Massachusetts and Edmund Muskie of Maine. In the House of Representatives the pro-SST forces were led by Massachusetts Representative Edward Boland and the opposition by Henry Reuss of Wisconsin and Sidney Yates of Illinois.

The consistently pro-SST groups in each House displayed strong similarities as well as some striking differences. There was a general agreement that the SST represented the "next logical step" in aviation, or was the "plane of the future," according to Senator Milton R. Young of North Dakota, carrying on a theme put forward by President Kennedy in 1963.³ There was also a belief that the United States needed to develop its own SST in order to maintain leadership in commercial aviation. Observing that "people have always been interested in speed in transportation," Representative Boland viewed the SST as the next step forward in aviation, continuing the trend of "faster horses, faster trains, faster ships, faster automobiles, and faster aircraft."⁴ By developing the plane of the future it was felt that the United States

³ Copy of March 19, 1971 Radio-TV text, "Plane of the Future," by Senator Milton R. Young of North Dakota, received March 11, 1974.

⁴ Letter from Representative Edward P. Boland, April 1, 1974.

would maintain its leadership in commercial aviation. Senator Charles McC. Mathias of Maryland detected an historical determinism which created "imperatives that the United States cannot ignore."⁵ Representative Chet Holifield of California viewed development of the SST as a "quantum advance in aeronautical science and engineering," as well as creating jobs for a sick aerospace industry.⁶ And when the SST was terminated, Senator John Tower of Texas called it a "black day for America's aerospace technological superiority."⁷

Enhancement of the nation's balance of payments and a return on the government's investment were justifications frequently used for the SST. In addition, it was argued that since two-thirds of the projected federal funding had already been expended, it would be a waste of the more than \$800 million already applied to discontinue the program in 1971, according to Senator Young of North Dakota.⁸ Representative Jackson Edwards Betts of Ohio was impressed by the argument that the United States would be forced to purchase foreign SST's and thus suffer

⁵ Copy of December 3, 1970 News Release by Senator Charles McC. Mathias, Jr., of Maryland, received May 7, 1974.

⁶ Letter from Representative Chet Holifield of California, April 1, 1974.

⁷ Copy of March 24, 1971 News Release by Senator John G. Tower of Texas, received March 12, 1974.

⁸ Senator Milton R. Young, "Plane of the Future."

a balance of payments deficit if an American SST were not built.⁹ Senator Robert Taft of Ohio, who voted for the SST as a member of the House and then the Senate, contended that if the SST proved to be successful, then the taxpayers' investment would be repaid.¹⁰ Voicing a common theme among supporters of the SST, Senator Howard Cannon of Nevada viewed the SST as unstoppable; the only question was who would build it? If the United States failed to do so there would be a loss of American jobs and an adverse balance of payments situation, according to the Nevada Senator.¹¹

Some supporters of the airplane stressed the SST's impact on local economies as reasons for their support. Maryland Representative Goodloe E. Byron favored SST development because it directly affected the economy and employment in a section of his district which experienced chronic unemployment.¹² Representative Barry Goldwater, Jr. of California noted the 8 per cent unemployment in his district in 1970 as one of the reasons for supporting the airplane.¹³ And Washington

⁹ Letter from former Representative Jackson Edward Betts of Ohio, April 15, 1974.

¹⁰ Letter from Senator Robert Taft of Ohio, April 8, 1974.

¹¹ Letter from Senator Howard W. Cannon of Nevada, April 8, 1974.

¹² Letter from Representative Goodloe E. Byron of Maryland, March 25, 1974.

¹³ Letter from Representative Barry M. Goldwater, Jr. of California, March 25, 1974.

Representative Mike McCormack, whose district did not include Boeing, reluctantly supported the prototype program because it was a "Boeing Project" and because his constituents wanted it.¹⁴ Observing that he would rather pay construction workers to produce something than to pay out welfare to those who did not produce, Louisiana's John R. Rarick also supported the SST program.¹⁵

In attempting to answer environmental criticism of the supersonic airplane, some proponents asserted that environmental problems could be solved. Senator Howard H. Baker of Tennessee maintained that environmental questions could be resolved through technological improvement before the program reached the production stage.¹⁶ Representative Julia Butler Hansen of Washington felt that a working model, or prototype, would have been able to provide answers to environmental questions, and Louisiana Representative R. Edward Hébert believed that "we could overcome any problems in this area."¹⁷ Carrying the attack against environmental opposition further, several pro-SST Congressmen advocated building an American SST in order to ensure the protection of the environment. Although he did not feel it was imperative to maintain

¹⁴Letter from Representative Mike McCormack of Washington, March 12, 1974.

¹⁵Letter from Representative John R. Rarick of Louisiana, March 22, 1974.

¹⁶Letter from Senator Howard H. Baker of Tennessee, April 12, 1974.

¹⁷Letters from Representative Julia Butler Hansen of Washington, March 22, 1974, and from Representative R. Edward Hébert of Louisiana, May 7, 1974.

technological superiority in every field, Senator James A. McClure of Idaho (a member of the House when the SST was an issue) reluctantly supported the SST as a means of ensuring adequate concern for environmental problems since other countries building SST's "do not share the concern for environmental problems created by the SST that America does, and they are unlikely to do anything about those problems."¹⁸ Senator Taft echoed those sentiments when he observed that prototypes would help resolve environmental questions, and that it was important to keep development in American hands since foreign SST's might not be as environmentally sound.¹⁹ Senator Mathias went a step further in his support of the SST by contending that the United States could do a positive service by "developing an American model which is of superlative quality, which meets the most rigorous standards of environmental protection, which offers the world the best pattern of protection from pollution, and which will advance the science of aviation in harmony with the environment and not at its expense."²⁰

In assessing the defeat of the SST, proponents generally gave a great deal of credit to the environmental opposition. In addition, the rising cost of the airplane was blamed by a number of them for the

¹⁸ Letter from Senator James A. McClure of Idaho, May 15, 1974.

¹⁹ Senator Robert Taft, op cit.

²⁰ Senator Charles McC. Mathias, op cit.

demise of the SST. Senator J. Caleb Boggs of Delaware felt that the airplane was a good investment and would ultimately have repaid the government, but the project was terminated because the "environmental opposition was very strong," in addition to other objections such as costs.²¹ Similarly, Senate Minority Leader Hugh Scott of Pennsylvania felt that environmental opposition was crucial "since once certain concessions were made to allay environmental complaints then the economics of the situation deteriorated."²²

A number of Congressmen went further than their colleagues above in assessing environmental opposition as the main cause of defeat. Representative Olin E. Teague of Texas observed that there was "no question but what the arguments and the job done by the environmental groups had a tremendous effect on the Congress and resulted in our abandonment of the program."²³ Teague's Texas colleague, Representative Earle Cabell, felt that the environmental opposition had a more disproportionate influence than the facts warranted, claiming that "a few self-appointed messiahs developed frenzy among many well-intentioned but badly mis-informed people with information that was, in the main, refuted accurately."²⁴ Cabell further contended that opposition arose

²¹ Letter from former Senator J. Caleb Boggs of Delaware, March 27, 1974.

²² Letter from Senator Hugh Scott of Pennsylvania, April 8, 1974.

²³ Letter from Representative Olin E. Teague of Texas, March 26, 1974.

²⁴ Letter from ~~Former~~ Representative Earle Cabell of Texas, April 4, 1974.

when many young people became opposed to any governmental assistance, except to the poor for housing and minimum income. Representative John J. McFall of California, chairman of the Transportation Subcommittee of the House Appropriations Committee, observed that the SST became a symbol, although a false one, of the need to protect the environment. The Californian maintained that "many people believed that anything that might even be a potential problem, albeit unproven, should be defeated, otherwise the impression would be given that we were moving backwards in our attempts to improve the environment."²⁵

Representatives Betts of Ohio and Tim Lee Carter of Kentucky assessed the economic aspect of development as more crucial to termination.²⁶ California's Holifield believed that the environmental argument was successfully refuted and even though environmental groups claimed success, Holifield contended that most members voted against the airplane for other reasons, including high cost. The California Representative also contended that environmental groups "must claim success from time to time or they will lose their constituencies and their contributors."²⁷

²⁵ Letter from Representative John J. McFall of California, April 16, 1974.

²⁶ Representative Jackson Edwards Betts, op cit.; letter from Representative Tim Lee Carter of Kentucky, March 25, 1974.

²⁷ Representative Chet Holifield, op cit.

In justifying his support for the SST, New Hampshire Representative Louis C. Wyman called the vote against the airplane a mistake since foreign SST's were flying and because Boeing was "one heck-of-a-good airplane manufacturer." A prototype was necessary to answer environmental questions and to find out if there were insurmountable problems. Wyman noted that both the government and industry had a stake in the airplane's success, and that if it did not prove successful, "we will have at least maintained a competitive position with the British, French and Soviets."²⁸ That was precisely what some of the project's opponents had been saying for some time, but with different emphasis, of course.

II

In general, the consistent opponents of the SST based their case against the airplane on environmental and economic grounds in addition to a concern for misplaced priorities. The majority believed the SST to be a "bad" project for one or more of the above reasons. But it took a long time for the opposition to build sufficient power to defeat the program. Former Senator Eugene McCarthy of Minnesota offered an explanation of why it is so difficult to terminate a "bad" project like the SST. If there is only one good reason to oppose a project which has

²⁸ Copy of News Release for week of May 24, 1971 by Representative Louis C. Wyman of New Hampshire, received April 1, 1974.

enjoyed strong support and on which millions have been expended, there is little chance for successful opposition. The chances of stopping such a project are only fair if there are two good reasons to oppose it. But the Senator asserts that if there are three good reasons the project is in for trouble. McCarthy contended that three good reasons for opposing the SST existed in 1971: technological difficulties, poor economics of production and operation, and environmental degradation. Senator McCarthy concluded that the defeat of the SST "marked the achievement of a new level of national maturity. Congressmen accepted that the United States need not do everything it can do simply to prove it can do it. They seemed to realize that a first-class power may be distinguished by the things it does not do and does not have to do."²⁹

McCarthy touched on all of the consistent themes that motivated the consistent opponents of the SST. But there were other reasons for opposing the airplane as well as those outlined by the former Minnesota Senator. California Representative Thomas M. Rees had serious reservations about the economic and environmental aspects of the SST, but he was more against the program because it would have given Boeing a monopoly over advanced aviation technology. Rees preferred to have a

²⁹ Letter from former Senator Eugene McCarthy of Minnesota, March 25, 1974.

consortium of aircraft companies build the SST if it had to be built.³⁰ Another California Representative, Paul N. McCloskey, Jr., had environmental and economic reservations, but was also particularly upset with the Nixon Administration for its excessive and self-serving secrecy in conducting the program. McCloskey was very critical of the Administration's handling of the Interdepartment Ad Hoc Committee report and the Garwin Report.³¹ Still another reason for opposing the SST was held by Representative Silvio Conte of Massachusetts. Conte was the ranking member on the Transportation Subcommittee and was generally against government subsidies. The SST needed subsidies to get it operational and would probably need additional subsidies to keep it operational.³² Finally, Conte's Massachusetts colleague, Representative Michael J. Harrington, opposed the SST on environmental and economic grounds but also viewed the program as "technology in search of a utilization, with the public bearing a very high price tag for the benefit of a very narrow base of the population."³³

³⁰ Letter from Representative Thomas M. Rees of California, April 12, 1974.

³¹ Letter from Representative Paul N. McCloskey, Jr. of California, March 14, 1974.

³² Letter from Representative Silvio O. Conte of Massachusetts, March 22, 1974.

³³ Letter from Representative Michael J. Harrington of Massachusetts, April 1, 1974.

Environmental reasons were given by a majority of the consistent SST opponents as a main reason for their opposition. New York Representative Mario Biaggi was concerned with the SST's environmental impact on New York City, particularly the noise that would be generated by the aircraft.³⁴ Representative Spark M. Matsunaga of Hawaii was also concerned about noise in his state, since "existing aircraft noise is bad enough."³⁵ The cautionary tone of the SCEP report fortified the environmental reservations that California Representative Edward R. Roybal had concerning the SST. Roybal also did not believe that two prototypes would answer all the environmental questions the aircraft raised.³⁶ The possibility of ozone depletion in the stratosphere was cause for concern to Representative John F. Seiberling of Ohio. He even went so far as to introduce a resolution in the House which, if it had passed, would have authorized the President to call an international conference to consider environmental problems and to suspend SST development until such problems could be worked out.³⁷

³⁴ Letter from Representative Mario Biaggi of New York, March 22, 1974.

³⁵ Letter from Representative Spark M. Matsunaga of Hawaii, March 29, 1974.

³⁶ Letter from Representative Edward R. Roybal of California, March 12, 1974.

³⁷ Letter from Representative John F. Seiberling of Ohio, April 2, 1974.

Senator Edward W. Brooke of Massachusetts viewed the SST as an "unacceptable risk to our environment," and did not favor spending tax monies on such a controversial project.³⁸ Senators William Spong of Virginia and Harrison Williams of New Jersey opposed the SST on environmental grounds since serious questions remained. Williams noted that there was no way to judge whether the "worst fears of the environmentalists would be realized, but they raised very serious questions which have never been satisfactorily answered."³⁹ In a similar fashion, Spong "resolved that if the pro and anti SST arguments were inconclusive, [he] would lean toward the environmentalists until they were proven wrong."⁴⁰

In addition to a concern with the environmental impact of the SST, opponents also considered the airplane to be an expensive "boondoggle" and a case of misplaced priorities. South Dakota Senator James Abourezk, who was in the House in 1971, viewed the SST as an expensive transportation system for a few "wealthy international jet-setters" while his constituents in South Dakota had to "struggle along with

³⁸ Letter from Senator Edward W. Brooke of Massachusetts, May 29, 1974.

³⁹ Letter from Senator Harrison Williams, Jr. of New Jersey, April 15, 1974.

⁴⁰ Letter from former Senator William Spong of Virginia, April 4, 1974.

inadequate rail and bus transportation."⁴¹ Senator Philip A. Hart of Michigan felt that the money spent on the SST could have been better used in more socially beneficial programs, and Representative Peter H.B. Freylinghuysen of New Jersey recommended that taxpayers' money be spent on other transportation needs, such as mass transit.⁴² Bella S. Abzug, Representative from New York, viewed the SST as a waste of taxpayers' money and as profits for the few. Abzug said "we must declare that we consider the needs of the people of this country to be more important than the profits of the corporations."⁴³ Senator George McGovern of South Dakota equated the SST with "snob appeal." The Senator felt that the needs of the poor and the hungry were more immediate and more compelling than the need for a Mach III transport.⁴⁴

Representative McCloskey found the environmental arguments put forward by the proponents of the airplane less than convincing, and Representative Freylinghuysen contended that if the SST were truly

⁴¹Letter from Senator James Abourezk of South Dakota, April 12, 1974.

⁴²Letters from Senator Philip A. Hart of Michigan, April 23, 1974, and Representative Peter H.B. Freylinghuysen of New Jersey, March 29, 1974.

⁴³Letter from Representative Bella S. Abzug of New York, March 15, 1974.

⁴⁴Copy of March 28, 1971 News Release by Senator George McGovern of South Dakota, received April 16, 1974.

inevitable, then it should stand the test of the market place and not require government subsidies.⁴⁵ Senator John Sherman Cooper of Kentucky was concerned with the potentially high costs of the SST and upon being assured that the military had no use for the airplane (because of limited payload capability and high fuel consumption) he decided to oppose development of the civilian transport.⁴⁶ Wyoming Representative Teno Roncalio considered the money spent on the SST to be wasted and was also concerned that SST flights would be routed over sparsely populated areas such as Wyoming so as to not be a "booming nuisance" to more populated areas.⁴⁷

Consistent opponents of the SST credited environmental opposition with being instrumental in stopping the program. In this they were not much different from the consistent supporters of the program except insofar as opponents generally viewed the environmental opposition as good, whereas supporters of the SST were likely to view it as dilletantish. And also much like consistent supporters of the Boeing airplane, the opposition concluded that economic considerations played an important role, but the opponents disagreed among themselves as to

⁴⁵ Representative Paul N. McCloskey, Jr., op cit., and Representative Peter H.B. Freylinhuysen, op cit.

⁴⁶ Letter from former Senator John Sherman Cooper of Kentucky, April 22, 1974.

⁴⁷ Letter from Representative Teno Roncalio of Wyoming, April 8, 1974.

which one was the most important. Senator Abourezk viewed the environmental opposition as crucial since the right questions were raised by people and groups who worked hard to make their position and concerns known. The South Dakotan felt that the proponents tended to be "slicker" in their presentations but they never really rebutted the environmental arguments.⁴⁸ Representative Emmanuel Celler of New York agreed with Abourezk in that environmental opposition was crucial in terminating the program, but Senator Walter F. Mondale of Minnesota believed that the "economic arguments were probably more telling than the environmental ones."⁴⁹ But in addition the Senator felt that the anti-SST environmental arguments had more credibility than did the pro-SST environmental defenses. Expressing a somewhat different viewpoint was Representative John S. Monagan of Connecticut who opposed the program because it represented a misallocation of national resources. Noting that at the beginning of the controversy environmental arguments had some force, they were not strong factors in the end and did not stand up since "as usual, they were overstated."⁵⁰

⁴⁸ Senator James Abourezk, op cit.

⁴⁹ Letters from former Representative Emmanuel Celler of New York, April 15, 1974, and Senator Walter F. Mondale of Minnesota, May 20, 1974.

⁵⁰ Letter from former Representative John S. Monagan of Connecticut, April 11, 1974.

Some of the consistent opposition believed that both environmental and economic factors were instrumental in terminating the SST program. Representative Howard W. Robison of New York felt that a reluctance to spend tax money on a purely commercial aircraft, and strong reservations about the environmental effects of the SST, brought about its defeat.⁵¹ Michigan Representative Guy Vander Jagt considered the high cost of the airplane and the possible environmental damage as crucial reasons for termination of the program.⁵² Arizona Representative and environmentalist Morris K. Udall considered "the environmental revolution in its heyday" and the "general feeling that this was an excessive boondoggle being developed principally for the benefit of one company and one section of the country" to be the determining factors in the defeat of the SST.⁵³

III

If the contention was correct of the consistent supporters and opponents that environmental opposition played a critical, and perhaps supreme, role in defeating the SST, then it should follow that a

⁵¹ Letter from Representative Howard W. Robison of New York, March 22, 1974.

⁵² Letter from Representative Guy Vander Jagt of Michigan, March 15, 1974.

⁵³ Letter from Representative Morris K. Udall of Arizona, March 22, 1974.

significant number of these who switched their positions, particularly those who switched to opposition, did so for environmental reasons. We now turn to a discussion of the two groups of switchers to see if the above proposition holds up. If so, the defeat of the SST can be viewed as a clear-cut environmental victory; if not, an explanation must be found elsewhere.

There were striking similarities between the switching groups. Members of both tended to be generally in favor of the concept of the SST but many also had doubts about the role of the government in developing the airplane. The anti-to-pro group could not support the project at first, but as the government's investment increased, that group could not stand to let the investment be "wasted." Conversely, even though the pro-to-anti group in general favored development of the airplane, they were concerned with the growing cost of development and could not justify throwing "good money after bad." There was a strikingly limited concern about the environmental aspects of the SST on the part of the switchers, ranging from a contention that there was no problem, to a feeling that any problems could be solved; but for a minority of switchers there was a concern about the possible adverse environmental impact of the SST.

Representative Samuel Stratton of New York, who switched to support of the airplane, echoed a theme of the consistent supporters when he declared that the solution of environmental questions required

the development of an American SST.⁵⁴ California Representative Robert Leggett also switched for reasons similar to those held by some consistent supporters. Leggett viewed the project as a source of jobs for California, even though his district did not encompass aerospace interests.⁵⁵

The general consensus among the anti-to-pro group of Congressmen, however, was that the economic situation required the development of an SST. Representative Ray Blanton of Tennessee felt that the government was too involved financially to pull out in 1970.⁵⁶ G. William Whitehurst, a Representative from Virginia, felt that since the government had gone four-fifths of the way toward developing an SST, it would be foolish to discontinue the program. Whitehurst was also convinced that the American aircraft would be able to capture the market by virtue of being superior to the European models.⁵⁷ Senator Marlow W. Cook of Kentucky made his decision to switch because he believed that the funds

⁵⁴U. S., Congressional Record, 92d Cong., 1st Sess., May 12, 1971, 14575-14576.

⁵⁵Letter from Representative Robert L. Leggett of California, April 18, 1974.

⁵⁶Letter from Representative Leonard Ray Blanton of Tennessee, April 9, 1974.

⁵⁷Letter from Representative G. William Whitehurst of Virginia, March 4, 1974.

necessary to continue prototype development were minimal compared to what had already been spent.⁵⁸

The contention that someone would build an SST prompted certain Congressmen to switch to support of the American airplane. John J. Flynt, a Georgia Representative, made his switch because of the Concorde competition, even though he still maintained doubts about the project.⁵⁹ Similarly, Representative Robert A. Roe of New Jersey felt that United States airlines would be forced to purchase foreign SST's, an eventuality which made production of an American transport imperative.⁶⁰ Representative Jim Wright of Texas also subscribed to the inevitability of American purchases abroad and contended that since "someone was going to build it" the United States might as well enhance its own balance-of-payments rather than enhance some other nation's.⁶¹

Anti-to-pro switchers tended to give the same assessment for defeat of the SST as did consistent supporters; environmental opposition. Representative Blanton concluded that the Sierra Club and other environmental groups killed the program, and Representative Wright believed

⁵⁸ Letter from Senator Marlow W. Cook of Kentucky, April 10, 1974.

⁵⁹ U. S., Congressional Record, May 12, 1971, 14573.

⁶⁰ Letter from Representative Robert A. Roe of New Jersey, April 19, 1974.

⁶¹ Letter from Representative Jim Wright of Texas, April 17, 1974.

environmental concerns were major considerations with some members, even though in his judgment they represented "feeling rather than thinking" responses.⁶² Virginia's Whitehurst blamed the Administration for not getting into high gear soon enough to head off the opposition in 1970. Whitehurst contended that the "fate of the plane unfortunately coincided with the high point of environmental concern," even though the environmental arguments were "insignificant compared to advantages of building the plane."⁶³ The critical questions about the airplane were economic rather than environmental for Representative Leggett, but he also contended that the environmental opposition was crucial.⁶⁴

It is not surprising that anti-to-pro Congressmen exhibited similarities with the consistently pro-SST group. But the members of Congress who switched from support to opposition also showed more similarities with the consistent supporters than with the consistent opponents, although there was more environmental concern in evidence. Senator Birch Bayh of Indiana concluded that possible pollution, the boom, noise, and misplaced priorities dictated a change in position.⁶⁵

⁶² Representative Leonard Ray Blanton, op cit., and Representative Jim Wright, ibid.

⁶³ Representative G. William Whitehurst, op cit.

⁶⁴ Representative Robert L. Leggett, op cit.

⁶⁵ Letter from Senator Birch Bayh of Indiana, July 16, 1974.

Wyoming Senator Clifford F. Hansen switched for similar reasons in addition to the high cost of the development program.⁶⁶ Representative James J. Hastings of New York made his decision to switch on the basis of environmental concerns as did Senator Richard S. Schweiker of Pennsylvania. Schweiker contended that "we cannot afford to continue a government program which threatens our environment and places an additional strain on all of our taxpayers for the benefit of a relatively small number of air travellers."⁶⁷

Except for the environmental reasons given above for switching to opposition, the majority of responses indicated a philosophical agreement with the concept of the airplane overcome by a reluctance to proceed with development on the grounds of the airplane's high cost or misplaced priorities. Senator George D. Aiken of Vermont was not opposed to research on high altitude and high speed airplanes, but was more interested in developing adequate transportation between Vermont and the rest of the United States before building an SST. Aiken wanted to put "first things first" and when that was done, he would look more favorably on the request for the funds to continue the research and

⁶⁶ Letter from Senator Clifford P. Hansen of Wyoming, April 8, 1974.

⁶⁷ Letter from Senator Richard S. Schweiker of Pennsylvania, March 8, 1974.

development work on the SST.⁶⁸ Similarly, Representative James M. Hanley of New York viewed the SST as the "plane of the future" but priorities existed in the transportation field, particularly in mass surface transit, that required funding first.⁶⁹ Senator Robert W. Packwood of Oregon echoed the sentiments of both Aiken and Hanley by recommending the expenditure of tax monies on mass transit projects such as a high speed train which would link Oregon's capital city of Salem with Portland, the state's major metropolitan area.⁷⁰ John W. Davis, Representative from a Georgia district in which Lockheed has a major plant, did not oppose the concept of the SST but did feel that transportation priorities required the funding of surface mass transit before funding of a supersonic transport.⁷¹

Several House members who switched to opposition before the votes of March, 1971 switched back to support when proponents of the SST attempted to revive the airplane in May, 1971. Representative John T. Myers of Indiana cited the problems of balance of payments and the Concorde opposition as reasons for his switch back to support. At

⁶⁸ Letter from Senator George D. Aiken of Vermont, April 8, 1974.

⁶⁹ Letter from Representative James M. Hanley of New York, April 15, 1974.

⁷⁰ Copy of March 23, 1971 News Release by Senator Robert W. Packwood of Oregon, received April 12, 1974.

⁷¹ U. S., Congressional Record, March 22, 1971, 7314-7315.

that time he viewed the success of the Concorde as an impetus for building an American SST.⁷²

A number of pro-to-anti switchers did so mainly because of the high cost of building the SST. Thus Representative Patrick T. Caffery switched because it required "too much money for something we didn't need."⁷³ Senator Len Jordan of Idaho opposed the program on the grounds that it would far exceed the \$750 million limit imposed by President Kennedy in 1963. The Senator also felt that if the airplane had economic merit, then private industry would have built it, a sentiment adhered to by Senator Packwood.⁷⁴ Representative James A. Haley of Florida similarly felt that the government should cease pouring millions into a project in which there was no assurance of recovering its investment. The Florida Representative suggested creating a COMSAT-like quasi-governmental corporation to develop the SST.⁷⁵

Noting that the country could not afford deficit spending, California Representative Burt L. Talcott opposed the SST "solely on the

⁷² Ibid., May 12, 1971, 14573.

⁷³ Letter from former Representative Patrick T. Caffery of Louisiana, April 2, 1974.

⁷⁴ Letters from former Senator Len Jordan of Idaho, March 25, 1974, and Senator Robert W. Packwood, op cit.

⁷⁵ Letter from Representative James A. Haley of Florida, April 15, 1974.

basis of better allocating Federal resources."⁷⁶ Talcott believed that the project was sound and technically feasible and he hoped the plane would be developed soon since "we cannot stop man in his quest for speed and progress," but budgetary considerations caused the Californian to turn from support to opposition. Arizona Representative and House Minority Whip John J. Rhodes switched for reasons similar to Talcott's. Like Talcott, Rhodes saw an SST in the future and regretted that financial considerations prompted his vote against the SST since he hoped and believed that the United States would eventually build one.⁷⁷

Just as with many consistently pro-SST Congressmen, several of the switchers felt that any environmental problems could be solved. Rhodes, even though convinced that questions raised by environmentalists required answers, was convinced that these could be found, either in laboratories or by the use of Mach III military craft.⁷⁸ Senator Lee Metcalf of Montana believed that "determined research could find the means to overcome the environmental hazards associated with the supersonic transport, given time and money."⁷⁹ Metcalf thus opposed the airplane because he feared that economically it would not "pay out."

⁷⁶U. S., Congressional Record, 91st Cong., 2d Sess., May 27, 1970, 17320.

⁷⁷Copy of April 7, 1971 News Release by Representative John J. Rhodes of Arizona, received March 1, 1974.

⁷⁸Ibid.

⁷⁹Letter from Senator Lee Metcal of Montana, April 15, 1974.

Senate Majority Leader Mike Mansfield opposed the SST when it became apparent that the nation's resources were being strained by involvement in Vietnam. The Montanan further felt that the program was terminated because the Congress determined in 1971 that the SST did not meet the criteria of meeting the greatest needs in society.⁸⁰ Other switchers gave more credit to the environmental opposition, even though they may not have felt that such concerns prompted them to switch. Although it was only one of several criteria for opposing the SST, Representative Daniel D. Rostenkowski of Illinois felt that for the Congress as a whole, the environmental opposition was crucial.⁸¹ Senator Hansen of Wyoming concluded that environmental opposition was decisive, and Senator Jordan of Idaho believed that the environmental opposition was critical to the defeat of the SST because proponents were never fully able to remove apprehensions about the airplane's environmental impact.⁸²

On balance, the two groups of switchers had much in common with each other, and more in common with consistent SST supporters than with

⁸⁰Letter from Senator Mike Mansfield of Montana, March 22, 1974.

⁸¹Letter from Representative Daniel D. Rostenkowski of Illinois, April 15, 1974.

⁸²Senator Clifford P. Hansen, op cit., and former Senator Len Jordan, op cit.

consistent SST opponents. It thus appears that even though the defeat of the SST in 1970 and 1971 was due in large measure to the environmental opposition, the program would most likely have been continued had there not existed a significant body of opposition based on the cost of the airplane or based on a reluctance to have the government involved in such a commercial enterprise.

CHAPTER VI

CONCLUSION

When first proposed in the late 1950's, the SST was viewed as a continuation of progress in transportation, a progress which contained both quantitative and qualitative elements. But supersonic progress would likely be more quantitative since subsonic aviation offered as much, if not more, in the way of amenities.¹ The House Committee on Science and Astronautics' report on the SST in 1960 underscored the view that a supersonic transport would represent progress: in terms of speed and general performance, according to the committee, "a supersonic transport would represent the greatest advance ever contemplated in a single step . . . , it would be greater than the combined advances made since the beginning of aviation history."² In announcing the inauguration of an American SST program at the Air Force Academy in 1963, President Kennedy also noted the dynamic character of civilian aviation by pointing ahead to the "challenging new frontier in commercial aviation . . . a frontier already crossed

¹The Boeing Stratocruiser of the immediate post-World War II era offered plush and luxurious double-deck accommodations, including sleeping quarters. And the latest Boeing subsonic jet, the 747, is also a double-decker, offering first-class accommodations and a piano bar on the upper level of the airplane. No such amenities are envisioned for SST's.

²U. S., Congress, House, Supersonic Air Transports, 1960, 2.

by the military--supersonic flight."³ As would his successors in the White House, the President expressed a faith in the ability of American industry to produce a "superior SST" and urged the government to participate in the program to an unprecedented degree.⁴

At the end of the decade of the 1960's there was still sentiment in the Congress that the SST represented progress. The House Appropriations Committee approved continued funding for the SST in May, 1970, and in its report stated that the "supersonic transport is the next logical step forward in commercial aviation. People have always bought speed in transportation. This was the case of subsonic jet aircraft and it will be true in the case of supersonic jet aircraft."⁵

During the course of most of the SST development program Congress was quite sympathetic to the needs of the program. Until 1969, SST appropriations were easily passed by the Congress and attempts to cut down or eliminate expenditures on the airplane were handily brushed aside. Many of the members supporting the SST agreed with Senators Moss and Scott that the SST was the "next logical step" in commercial aviation, and likewise agreed to the view of

³Public Papers, 1963, 440.

⁴Ibid., 441.

⁵U. S., Congress, Senate, Department of Transportation and Related Agencies, 1970, 1229.

Representative William L. Springer of Illinois that the SST was the "air transport of the future."⁶

There was much sentiment for the SST based on expressions of inevitability and logical next step, but the immediate impetus for development was foreign competition. If it had not been for the active development programs conducted by Britain, France, and Russia during the late 1950's and early 1960's American supporters of the concept of supersonic flight might still have viewed an SST as inevitable, but the future would not have been so near or urgent. But foreign competition, and particularly the combining of efforts in the Concorde by Britain and France in 1962, spurred the United States into a developmental program in which an extensive financial commitment as well as substantial technological breakthroughs were required. And once the competition got underway, it seemed that the various national efforts assumed lives of their own, regardless of any justifications put forward for discontinuation. For example, the historic and largely unprecedented co-development of the Concorde by Britain and France had a stormy history. As project costs mounted astronomically in the 1960's Britain in particular soured on continuing the project.

⁶ Letter from Federal Power Commissioner and former Representative from Illinois William L. Springer, April 12, 1974.

Business editor Mary Goldring of the Economist of London testified to the Congressional Joint Economic Committee in 1970 that Britain would have dropped out of the Concorde program years before on any cost-effective basis. But the difficulties of getting out of an international treaty, loss of face, and the loss of 60,000 jobs ensured Britain's continuation in the project.⁷

Although many SST proponents, and even some opponents, argued that the airplane was inevitable, the Economist editor probably came close to putting a finger on the essential part of that proposition by noting the "loss of face" aspect of Britain extricating itself from the Concorde project. The problems associated with loss of face are seemingly so serious for a nation that almost any action is acceptable, no matter how difficult, dangerous, or self-defeating. One only has to look at the record of the United States in Southeast Asia to understand what a powerful force loss of face represents.

Coupled with loss of face as a reason for continuing supersonic transport development programs in the United States and abroad was the widespread belief in a technological imperative. Biologist and ecologist Garrett Hardin sensed such an imperative as an article of faith in the idea of progress. According to Hardin, the first article,

⁷U. S., Congress, Joint Economic Committee, Economy in Government Hearings, 91st Cong., 2d Sess., 1970, 922.

"the Dogma of Aladdin's Lamp," holds that "if we can dream of it, we can invent it." The second article then holds that "when we invent it, we are required to use it."⁸ But some opponents of the SST were iconoclastic when it came to the technological imperative, believing as did Massachusetts Representative Harrington that the SST was a technology in search of a utilization, and opposed it on the grounds that every technological possibility does not have to be developed. Even some supporters of the program felt that just because it was possible to build the SST, it did not follow that that would be the best possible course of action. Representative McCormack of Washington state reluctantly supported the SST but believed that "society has [to draw a line] between what is technologically possible and what is a reasonable social goal."⁹

Change, and particularly quantitative change, has occurred so rapidly in the Twentieth Century that one development or new product is hardly accepted before another is developed to take its place. Aviation provides a case in point.¹⁰ Advances in commercial aviation

⁸ Garrett Hardin, Exploring New Ethics for Survival: The Voyage of the Spaceship Beagle (Baltimore, Maryland: Penguin Books, Inc., 1972), 141.

⁹ Letter from Representative Mike McCormack of Washington, March 12, 1974.

¹⁰ U. S., Congress, House, Committee on Science and Astronautics, Technical Information for Congress: Report to the Subcommittee on Science, Research and Development of the Committee on Science and Astronautics, 92nd Cong., 1st Sess., 1971, 705-708.

since World War II have been extraordinary. Four-engined piston airliners such as the DC-6 and Constellation which supplanted the DC-3 in commercial service following the war had by no means served out their usefulness when the 707's and DC-8's took their places in the early 1960's. But increased payload and speed capabilities of the first generation subsonic transports dictated the replacement almost overnight of the piston airliners. Similarly, the advent of the 747 jumbo jet and other wide-body transports occurred long before DC-8's and 707's were obsolete. But again, gains in potential productivity caused the airlines to purchase the new jets even though they did not particularly need the increased capability. And even though the future of supersonic transportation is by no means clear, the possibility exists that when the Concorde is perfected there will be a snowball effect on the world's airlines in which the use of the Anglo-French jet by BOAC and Air France (the national airlines of Britain and France) will "force" competing airlines to purchase the supersonic airline, regardless of their need for it.

The fuel economy of the supersonic transport is one aspect that makes it different from former advances in commercial aviation. There is no questioning the capability of an SST to move people two to three times faster than the speediest subsonic jet. And it is quite possible for an airliner similar to the now-discarded American model to be developed. Transporting nearly 300 passengers at 1,800 miles-per-hour,

such an aircraft would be extremely productive on the basis of passenger-miles per time period. But increased speed and passenger-mile capability can be achieved only at great sacrifice in fuel economy, reversing the pattern which has been prevalent in most previous commercial aviation developments. The tremendous energy required to push an airplane past the sound barrier and keep it going supersonically thus offsets gains in speed capability. A comparison of fuel consumption in pounds per hour and in pounds per passenger mile for various modes of transportation underscores one of the trade-offs required for supersonic flight. A jet airplane such as the 707 with a capacity of 110 passengers consumes 1,000 pounds of fuel per hour at a rate of 0.17 pounds per passenger-mile (assuming the aircraft is fully loaded). A Boeing 747 jumbo jet with 400 passengers consumes 22,400 pounds per hour at a rate of 0.09 pounds per passenger-mile. But the Concorde, carrying 112 passengers, expends 75,000 pounds per hour at a rate of 0.58 pounds per passenger-mile. Thus the price paid for supersonic flight at just over Mach II is substantial, nearly three and a half times greater fuel consumption on a passenger-mile basis than a 707 and more than six times the fuel consumption of the 747. The Concorde consumes as much fuel per hour as an ocean liner transporting 2,000 people at 38 miles-per-hour, and consumes fuel at

the rate of a Cadillac conveying a single person at 65 miles-per-hour.¹¹ With the world facing finite and rapidly diminishing fossil fuel reserves, and with the development of alternative energy sources for aircraft many years away, the excessive fuel requirements for saving three hours on a trans-Atlantic flight may not be worth the trade-off. Based on the operation of a fleet of 500 SST's by 1990, it was estimated in 1971 that the equivalent of the entire production of Alaska's North Slope oil fields would be required to fuel the SST's.¹²

The mixed blessings to be gained by commercial supersonic flight and the great technical difficulties standing in the way of successful SST development became more apparent as the decade of the 60's closed. And as the American airplane became more expensive, the environmental movement grew in strength. Coinciding with and drawing inspiration from other activist movements of the 60's (Civil Rights and Anti-War movements), as well as reacting to the increasingly obvious degradation of the natural environment, the environmental movement reached a peak in 1970, the year that the SST commenced its death throes. The Congress passed the National Environmental Protection Act (NEPA) in 1969 and President Nixon signed the measure into law on

¹¹ Ralph E. Lapp, The Logarithmic Century (Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1973), 46.

¹² U. S., Congress, House, Civil Supersonic Aircraft Development, 119.

January 1, 1970. Under NEPA's provisions the Environmental Protection Agency was established, ushering in a whole new concept of governmental action in protecting the environment. This was clearly a major victory for environmentalists and provided a powerful tool for protecting the environment. Continuing to show concern for the environment, the Congress passed the Clean Air Act of 1970 empowering the Environmental Protection Agency to set standards for air pollution levels; another victory for the environmentalists.

The phenomena called "Earth Day" epitomized the environmental movement in 1970. Copying somewhat the techniques used by anti-war activists, the organizers of Earth Day celebrations conducted teach-ins on campuses and other locations all over the country on April 22. That happening did not immediately usher in the environmental millenia, but it did bring into focus the growing dissatisfaction that many people had toward the direction the nation was taking on the environment. Traditional concepts of growth and progress were called into question, and the SST was but one of many projects and practices that came in for criticism on environmental grounds. To environmentalists, the SST required too many trade-offs, all of which were potentially harmful to the environment. Thus the SST, begun in days far more congenial to such developments, found itself on a collision course in 1970 with the growing environmental movement and the budgetary crunch brought about by the United States' tragic involvement in

Vietnam and President Johnson's attempts to provide guns and butter at the same time.

During the course of the American SST development, several critical decision points were passed, but of those, two stand out as the most critical. The first occurred in 1964 when President Johnson and his advisors decided to pursue development of a Mach III airliner, rather than build an airliner similar in capabilities to the Concorde. The second took place in 1969 when President Nixon, in the face of increasing opposition and conflicting recommendations, decided to go ahead with SST development. Each of the decisions held great implications for the success or failure of the SST program.

By heeding the recommendation of special advisors Black and Osborne to proceed with development of a Mach III airliner, President Johnson ensured that a successful American SST would be clearly superior, in both payload and speed, to the Concorde. But his decision also meant that development of the aircraft would not rely primarily on existing aviation state-of-the-art but would be forced to take place on the frontiers of aviation technology. The Concorde was built with an aluminum fuselage but even so experienced many delays and setbacks in its development. With the cancellation of the Air Force's B-70 bomber program by the Eisenhower Administration, the future SST program had no comparable military development to provide breakthroughs. And compounding the adverse implications of Johnson's decision even further

was the selection of Boeing's swing-wing design at the end of 1966. By opting for a variable geometry Mach III transport, and by not having a comparable military project to provide breakthroughs, the civilian program faced severe developmental problems, not so severe as to cause termination in themselves, but severe enough that with the advent of other problems the program would be in deep trouble.

By 1969, when President Nixon conducted a "thorough survey" of the SST program and then after "spirited debate" within the Administration which recommended continuation of the project, opposition to the SST had developed significantly. The program was at a point where it could have been halted since Boeing had not begun the metal-cutting stage for the prototype. Any further delay would have been at the price of increased development costs, according to industry spokesmen.¹³ But President Nixon decided to continue development, thus setting the stage for the intense confrontation that occurred in 1970 and ultimately led to the downfall of the SST in 1971.

The combined effects of Johnson's and Nixon's decisions put the SST program in a position of requiring a vast outlay of prototype funds at a time when the federal budget was overtaxed and at a time when the environmental movement was perhaps at its strongest. Thus

¹³ U. S., Congress, Senate, Civil Supersonic Aircraft Development.

the coalition that developed to defeat the SST was diverse. Although some members of Congress were probably disposed to vote as they did purely on party considerations, the coalition in Congress was remarkably bi-partisan. In the Senate, the crucial vote of December, 1970 in which the SST was first winged, 18 Republicans (up from 5 in 1969) and 34 Democrats (up from 17) voted against the airplane. There was a similar bi-partisanship in the House when on March 18, 1971, the first vote in the House against the SST, 84 Republicans voted against the project (compared to 62 in 1970), and 131 Democrats voted against funding (compared to 113 in 1970). Support for the airplane was likewise bi-partisan.

In addition to the bi-partisan character of the opposition, the coalition included conservatives and liberals, rural and urban Congressmen, big state and small state Congressmen. Thus a fiscal conservative such as Senator Harry F. Byrd of Virginia could team up with liberal environmental activists such as Senator Edmund Muskie of Maine and Senator William Proxmire of Wisconsin to defeat the SST in the Senate. Likewise, members of the President's party such as Idaho's Len Jordan and Wyoming's Clifford Hansen brought themselves to oppose the President they usually supported. In the House, Republican Whip John J. Rhodes of Arizona, generally a supporter of Administration policies, would add his opposing vote to that of Democratic maverick and constant supporter of environmental measures, Morris K. Udall,

also of Arizona. And a Representative such as James M. Hanley of New York could switch to opposition on economic grounds while still viewing the airplane as the plane of the future.

Contemporary accounts of the SST defeat tended to stress the mixed character of factors leading to that defeat. Newsweek concluded that the defeat was the result of a balancing of "economic and ecological vices and virtues."¹⁴ The New York Times, which had editorialized against the SST, observed that the airplane had never been able to meet the market test and that as the project continued the American public became increasingly aware of the negative environmental aspects of the airplane as well as the financial risks involved in continuing development.¹⁵ And in espousing a theme put forward by former Senator McCarthy of Minnesota, the New York Times also concluded that the anti-SST votes were not a manifestation of an anti-technological bias in America, but a "new technological sophistication of the American people and their representatives in Congress," as well as an indication of an awareness that technology exists to serve man, not the reverse.¹⁶

¹⁴ Newsweek, March 29, 1971, 23.

¹⁵ New York Times, March 25, 1971, 38.

¹⁶ Ibid., March 28, 1971, iv, 14.

The Wall Street Journal compared the reasons for the SST defeat to the 1971 decision of the Du Pont company to discontinue production of Corfam, its synthetic shoe leather. When Du Pont introduced Corfam in the late 1960's it hoped to copy its fabulous success with its synthetic product, nylon. But the public was not ready for Corfam and in 1971 Du Pont quietly discontinued its production. The Journal did not want research on supersonic flight to be discontinued but preferred to have private industry make the decision to build or not to build an SST, much as the forces of the market place led to Du Pont's decision. Allowing the market place to determine the future of the program "might delay matters but it also might make it less likely that the supersonic transport would crash like Corfam," according to the Journal.¹⁷ The New York financial newspaper viewed the SST defeat as the "first great collision, in contemporary terms, between technology and ecology, as well as between the concepts of economic growth and social purpose."¹⁸

Aviation Week & Space Technology editor Robert Hotz viewed the defeat of the plane as the result of aerospace industry and Administration slowness to respond to the "hysterical" ecological opposition. Hotz also agreed with Senator Magnuson's assessment of the anti-SST

¹⁷ Wall Street Journal, March 22, 1971, 10.

¹⁸ Ibid., March 26, 1971, 10.

votes as being anti-technological and leading to a "technological Appalachia that will create a third-rate nation."¹⁹ But the Sierra Club, an environmental organization that was strongly against the SST, did not accept the view that the votes were anti-technological, but it also did not agree with an assessment that the votes were statements of national ecological concerns. Sierra Club Bulletin editor James Ramsey considered the economic opposition and a concern for re-ordering priorities to be the most significant factors leading to the defeat of the airplane. But Ramsey also claimed credit for the environmental movement for a "sustained and courageous effort in combatting the SST," contending that without the environmental opposition, the SST could not have been stopped.²⁰

Because of the great diversity displayed by members who opposed the SST it cannot be said that any one faction could claim a clear-cut victory. Without the presence of economic opponents the environmental opponents would not have been able to defeat the airplane. And conversely, without the environmental opposition, those who opposed for economic reasons would not have been strong enough to stop funding of the SST. Of those who switched to opposition, more gave economic reasons than gave environmental reasons. Indeed, a significant body

¹⁹ Aviation Week & Space Technology, December 14, 1970, 11; March 29, 1971, 9.

²⁰ Sierra Club Bulletin, April, 1971, 2.

of switchers, including people such as Senator Hansen and Representative Rhodes, wanted the airplane to be built but did not feel that the federal government should be involved, at least at that time. But this does not diminish the importance of the environmental opposition since even supporters of the airplane credited the environmental position with bringing about the defeat of the airplane. And the longer-range importance of the SST vote and the environmental movement's participation in it was that the controversy was one of the first in which environmental reservations were so strongly voiced, and one of the first major technological developments which was subjected to such intense questioning on the grounds of possible environmental damages and on the grounds of priorities. The vote against the SST in 1971 was in large part a vote to bring consideration of the environment into major technological developments, and was a strong indication that such developments could no longer count on being approved simply because they represented outdated modes of quantitative progress.

APPENDICES

APPENDIX A

SUPERSONIC TRANSPORT PROGRAM QUESTIONNAIRE¹

John M. Bell--Montana State University

From your voting record on the SST it appears that you consistently supported the program. In answering the questions below please do not feel limited in your answers. Any additional insights or references to key personal staff members, committee staff, or other contacts would be most helpful and greatly appreciated.

1. What were your chief reasons for supporting the SST? Did they involve economics (jobs, balance-of-payments, etc.), "national prestige," or environmental concerns? Others?
2. What is your opinion of the environmental arguments used in opposition to the SST (sonic booms, greenhouse effect, sideline noise, etc.)? Do you feel those concerns were justified or did they contain an element of sensationalism?
3. Did you find the pro-SST arguments, by the industry and the Administration for example, to be effective from a scientific and technological standpoint? If so, in what ways.
4. What type of contacts did you receive from pro- and/or anti-SST groups? (Names of groups or individuals would be very helpful here.) Were these contacts your chief source of detailed information or were there others?

¹ A cover letter explaining the thesis topic and a request for the Congressman's indulgence accompanied each questionnaire. There were four different sets of initial questionnaires, each one containing the same questions but tailored stylistically to the group in which the recipient was ranked. Thus the above is a sample of the questionnaires sent to consistent supporters of the SST. The only differences in the other three versions (consistently opposed, switched from pro-to-anti, and switched from anti-to-pro) were stylistic. For example, in the introduction to the questionnaire, a consistent opponent would read: "it appears that you consistently opposed the program" and switchers would read: "it appears that you switched from opposition to support" or "support to opposition." The various questions were also treated in the same manner.

5. Did you favor the two-prototype test program before making a decision on production, or did you favor going ahead with production plans while testing the prototypes? Why or why not?
6. Has the present "energy crisis" had any effect on your support for the SST? If so, in what way?
7. Do you feel that the money spent by the government on initial development was "wasted" because the program was terminated early?
8. Would you favor private rather than government financing of an American SST?
9. In your opinion, is there any chance that the program will be renewed? And if given the opportunity would you vote for the SST today? Why or why not?
10. Aside from your personal reasons for supporting the SST what do you consider to be the primary factors which resulted in SST development being halted by Congress in 1971?

APPENDIX B

SUPERSONIC TRANSPORT QUESTIONNAIRE

John M. Bell--Montana State University

In answering the questions below please feel free to use the spaces provided, or use additional sheets if that would be more convenient. Any references to key personal staff, or other contacts, would be most helpful and greatly appreciated.

1. What were your chief reasons for voting the way you did on the SST?
2. How critical was environmental opposition in terminating development, and how would you rate the veracity of pro- and anti-SST environmental arguments?
3. Please comment on any other aspect of the American SST program you feel is important.

APPENDIX C

TABLE C-1. RESPONSES TO QUESTIONNAIRES.

	Number Sent Out	Replies Received	Substantive Responses ^a	% Substantive Responses ^b
<u>Senate:</u>				
Pro-SST	38	21	18	45.0
Anti-SST	31	21	16	52.0
Pro-to-Anti	19	12	16	52.0
Anti-to-Pro	<u>1</u>	<u>1</u>	<u>1</u>	<u>100.0</u>
Subtotal	89	55	45	51.0
<u>House:</u>				
Pro-SST	125	33	30	24.0
Anti-SST	118	29	25	21.0
Pro-to-Anti	32	11	9	28.0
Anti-to-Pro	<u>31</u>	<u>6</u>	<u>5</u>	<u>16.0</u>
Subtotal	306	79	69	22.5
TOTAL BOTH	395	134	114	28.0

^aIncludes replies which stated it was the Congressman's policy to not reply to questionnaires, etc.

^bQuestionnaires answered or material sent to the author on which an assessment of the Congressman could be made. Although the number of substantive responses was relatively small, particularly from House members, the closeness of the votes and the use of the Congressional Record to corroborate ratings make the returns more valid. The members who switched positions were less likely to speak on the issue during debate than were consistent supporters or opponents. But those who responded to the author's questionnaires and also spoke during debate were consistent. And those who spoke during debate but did not respond to the questionnaires were categorized correctly and in all cases of pro-to-anti switchers, the reasons given during debate were economic rather than environmental.

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